Evidence Synthesis

Number 120

Screening for Speech and Language Delay and Disorders in Children Age 5 Years or Younger: A Systematic Evidence Review for the U.S. Preventive Services Task Force

Prepared for:
Agency for Healthcare Research and Quality
U.S. Department of Health and Human Services
540 Gaither Road
Rockville, MD 20850
www.ahrq.gov

Contract No. HHSA-290-2012-0001-5I, Task Order No. 2

Prepared by:
RTI International–University of North Carolina Evidence-based Practice Center
Research Triangle Park, NC

Investigators:
Nancy D. Berkman, PhD
Ina Wallace, PhD
Linda Watson, EdD
Tamera Coyne-Beasley, MD, MPH
Katie Cullen, BA
Charles Wood, MD
Kathleen N. Lohr, PhD

AHRQ Publication No. 13-05197-EF-1
November 2014

This report is based on research conducted by the RTI International–University of North Carolina Evidence-based Practice Center (EPC) under contract to the Agency for Healthcare Research and Quality (AHRQ), Rockville, MD (Contract No. HHSA-290-2012-0001-5I, TO2). The findings and conclusions in this document are those of the authors, who are responsible for its contents, and do not necessarily represent the views of AHRQ. Therefore, no statement in this report should be construed as an official position of AHRQ or of the U.S. Department of Health and Human Services.

The information in this report is intended to help health care decisionmakers—patients and clinicians, health system leaders, and policymakers, among others—make well-informed decisions and thereby improve the quality of health care services. This report is not intended to be a substitute for the application of clinical judgment. Anyone who makes decisions concerning the provision of clinical care should consider this report in the same way as any medical reference and in conjunction with all other pertinent information (i.e., in the context of available resources and circumstances presented by individual patients).

Persons using assistive technology may not be able to fully access information in this report. For assistance, contact http://www.uspreventiveservicestaskforce.org/Page/Name/contact-us.

None of the investigators report any affiliations or financial involvement that conflicts with the material presented in this report.

Acknowledgments

The authors acknowledge the following individuals for their contributions to this project: Karen Lee, MD, MPH, AHRQ Medical Officer; current and former members of the U.S. Preventive Services Task Force who contributed to topic deliberations; Evelyn Whitlock, MD, MPH, Kaiser Permanente Research Affiliates EPC Director; Tracy Beil, MS, Kaiser Permanente Research Affiliates EPC; and the following RTI–UNC EPC staff: Carol Woodell, BSPH, Project Manager, Meera Viswanathan, PhD, EPC Director, Lynn Whitener, DrPH, MSLS, librarian, Manny Coker-Schwimmer, MPH, research assistant, Laura Small, BA, editor, and Loraine Monroe and Judith Cannada, publication specialists.

Structured Abstract

Purpose: To evaluate the evidence on screening and treating children for speech and language delay or disorders for the U.S. Preventive Services Task Force (USPSTF).

Data Sources: PubMed/MEDLINE, the Cochrane Library, PsychInfo, ClinicalTrials.gov, HSRProj, the World Health Organization International Clinical Trials Registry Platform, and reference lists of published literature (through July 2014).

Study Selection: Two investigators independently selected studies reporting on benefits and harms of screening; accuracy of screening tools compared with diagnostic evaluations; and benefits or harms of treatment of speech and language delay or disorders compared with placebo, watchful waiting, or waitlist interventions. To provide context for evaluating our Key Questions, we also included studies describing screening instruments and risk factors for speech and language delay or disorder.

Data Extraction: One reviewer extracted data and a second checked accuracy. Two independent reviewers assigned quality ratings using predefined criteria.

Data Synthesis: No included studies examined the impact of screening on speech and language or other functional outcomes. We included 23 studies evaluating the accuracy of speech and language screening in primary care settings to identify children for diagnostic evaluations and interventions. Among instruments in 13 studies in which parents rated their children's skills, sensitivity ranged between 50 and 94 percent, and specificity ranged between 45 and 96 percent. Of 3 instruments widely used in the United States, the MacArthur Communication Development Inventory (CDI) and the Language Development Survey (LDS) outperformed the Ages and Stages Questionnaire (ASQ) Communication domain, especially in terms of their specificity, correctly identifying on average 82 percent (CDI) and 91 percent (LDS), compared with 58 percent (ASQ). The ASQ and CDI have versions for infants, toddlers, and preschool-age children, with the CDI being more robust across age groups. The accuracy of professionally or paraprofessionally administered instruments was more variable across studies and many did not perform as well as parent-rated instruments. Because few studies examined the same instrument with different populations or with different ages, it is unclear how multiage professionally or paraprofessionally administered instruments fare more broadly or whether there is an optimal age for screening. We found no studies addressing adverse effects of screening, such as deleterious consequences of false conclusions from screening. We also found no studies concerning the role of enhanced surveillance by a primary care provider.

We included 13 studies examining treatment for speech and language delay or disorders. Although the treatment approaches sometimes may overlap, we organized our findings by outcomes: language (including expressive and receptive language, and more specific aspects of language such as vocabulary, syntax/morphology, and narratives), speech sounds (including articulation, phonology, and speech intelligibility), and fluency (stuttering). Although results were mixed, the majority of studies found treatment to be effective. Characteristics of effective studies include higher intensity, treating children with more severe delays, and individualizing

treatment to the child. We found little evidence concerning other functional outcomes or adverse effects of treatment.

Risk factors that were generally associated with speech and language delay or disorders in multivariate analyses of cohort populations included being male, a family history of speech and language concerns, and lower levels of parental educational achievement.

Limitations: As in the earlier review, we did not find any well-conducted trials that could address our overarching question of whether screening leads to improved outcomes. Many screening studies do not include unselected samples from the population but rather participants with and without language delays. Intervention studies did not consistently control for additional community services that children may have been receiving and varied greatly in treatment approach and outcome measurement. Also, because young children with disabilities are entitled to treatment, it may not be possible for future studies in the United States to examine treatment versus no treatment.

Conclusion: This synthesis yields evidence that two parent-rated screeners, the CDI and LDS, can accurately identify children for diagnostic evaluations and interventions and likely can be interpreted with little difficulty in the primary care setting. Some treatments for young children identified with speech and language delays and disorders may be effective.

Table of Contents

Chapter 1. Introduction

Overview and Objective

This systematic review provided evidence to be used to update U.S. Preventive Services Task Force (USPSTF) recommendations released in 2006 concerning screening preschool children (i.e., children 5 years of age or younger) for language delays (and disorders) in primary care settings. The 2006 USPSTF recommendation and conclusions, which are described below, provide the context and rationale for the current update. The rest of the Introduction includes a description of speech and language delays and disorders in children 5 years of age or younger; an overview of the epidemiology of the condition; a description of screening, intervention, and current clinical practice; and a discussion and justification of the changes in scope of the current review. The Methods section describes the Key Questions (KQs), contextual questions, and analytic framework that guided this update review, as well as the search strategy, study selection, data abstraction, quality rating, and data analyses. The Results section presents findings organized by KQ. The Discussion section summarizes the findings and comments on the applicability and context of the findings, any limitations, gaps and future research needs, and conclusions.

Previous USPSTF Recommendation

In 2006, the USPSTF concluded that the evidence was insufficient to recommend for or against routine use of brief, formal screening instruments in primary care to detect speech and language delay in children up to 5 years of age (I statement).

Previous USPSTF Conclusions

Importance

The USPSTF noted that speech and language delays affect up to 8 percent of preschool-age children and, if untreated, often persist into the school years. Such delays may be associated with diminished school achievement and behavioral problems.

Detection

The USPSTF concluded that there was insufficient evidence that brief instruments suitable for use in primary care can accurately identify speech and language delays in preschool-age children. Although there is extensive literature evaluating the reliability and validity of many instruments, the optimal method of screening for speech and language delay or disorders has not been identified.

Benefits of Detection and Early Intervention

Whereas the USPSTF did not find evidence that screening for speech and language delay is beneficial for identifying children who would profit from further assessment and intervention, the USPSTF found fair evidence that speech and language interventions can improve outcomes in the short term. However, the USPSTF noted that no studies evaluated whether brief screening yields any benefits beyond those that are found by addressing clinical or parent concerns.

Harms of Detection and Early Intervention

The USPSTF indicated that no studies addressed the harms of either screening or intervention for speech and language delays and, thus, they were unable to determine the benefit-harm ratio of using brief, formal screening instruments to screen for these delays in the primary care setting.

Risk Factors and Prevalence Rates

The USPSTF was unable to develop a list of specific risk factors to guide primary care providers in selective screening. The most consistently reported risk factors included a family history of speech and language delay, male gender, and perinatal factors, such as prematurity and low birth weight. In studies that evaluated speech and language delay for preschool children 2 to 4.5 years of age, the prevalence of speech and language delay ranged between 5 and 8 percent, whereas studies of only language delay reported rates of 2.3 percent to 19 percent.

Condition Definition

A speech or language delay implies that the child is developing speech or language in the correct sequence but at a slower rate than expected, whereas a speech or language disorder suggests that the child's speech or language ability is qualitatively different from typical development.

The distinction between the two is complicated because screening instruments are unable to distinguish between a child who has a delay (i.e., a child with late emerging language during the first 2 years of life) that subsequently resolves and one who will go on to display a speech and language disorder (i.e., a child who goes on to receive a formal diagnosis of specific language impairment). Some researchers report that many children with language delays, particularly in expressive language, score in the normal range by 4 or 5 years of age, but that their performance is often weaker than children without delays.[1-4] Because children with delays often test in the normal range by school age, the ability of screeners to make long-term predictions based solely on preschool screening findings is limited.[1]

Other terms used to describe speech and language delay or disorders are speech and language disabilities and impairment. In the remainder of the report, we will use interchangeably the terms speech and language delay, speech and language disorder, speech and language impairment, and speech and language disabilities.

The Individuals with Disabilities Education Act (IDEA) defines a speech and language disability

as "a communication disorder, such as stuttering, impaired articulation, a language impairment, or a voice impairment, that adversely affects a child's educational performance."[5] Children with speech and language disorders are functioning well below the norm for their age in one or more aspects of speech or language.

A defining feature of these disorders is whether the impairment is considered primary or secondary. In some cases, children have other developmental, sensory, or physical problems that "explain" their speech and language difficulties, such as intellectual disabilities, autism spectrum disorders, hearing loss, structural abnormalities (such as cleft lip or palate), an impairment of motor function (such as cerebral palsy), or some combination of these factors; such children are categorized as having a secondary speech and language disorder. In other cases, no specific explanation for the speech and language delay or disorder is ever identified; these children are diagnosed as having a primary language disorder. Another term for primary language disorder is specific language impairment (SLI).

Although it is likely to be useful to distinguish between primary and secondary language disorders in determining appropriate treatment, in the context of screening, it may not be possible. Early screening may flag symptoms of speech and language disorders later determined to be associated with another developmental disorder in which speech and language delays are prominent. At the time of the screening, the primary care provider will be blind to the eventual diagnostic outcome. For example, the most common early concern reported by parents prior to their children's eventual diagnoses of autism spectrum disorder is related to speech and language development.[6,7]

Another way of thinking about speech and language disorders is to consider their etiology. Speech and language disorders may be acquired or developmental. In acquired cases, the language disorder is the result of an injury that occurred sometime after birth (e.g., focal lesion; acquired aphasia secondary to a seizure disorder; brain damage after tumors, infections, or radiation; and traumatic brain injury). Developmental language disorders present themselves as development unfolds, but are thought to be present at birth and often for no apparent reason. When no other condition exists that explains the language difficulty, it is labeled a primary speech or language disorder.

The focus of this review is on primary speech or language disorders whose etiology is developmental and is limited to children who have not been previously identified with another disorder or disability; eliminating those with acquired, focal causes of speech and language delay, and appreciating that some of these children will receive a primary diagnosis for a disorder such as autism or mental retardation subsequent to the screening. This may be considered an additional outcome of screening.

Other classifications of speech and language disorders consider symptoms. For example, the International Classification of Disease (ICD)-10 lists specific speech and language developmental disorders; these include specific speech expressive disorder, expressive language disorder (difficulty getting a message across to others), and receptive language disorder (difficulty in understanding messages from other people). The use of the modifier "specific" in the ICD-10 indicates that the disorder is not a symptom of another disorder, such as intellectual

disability, hearing loss, or autism spectrum disorder. The American Speech-Language-Hearing Association (ASHA) guidelines[8] describe a speech disorder as an impairment of the articulation of speech sounds, fluency, or voice, and a language disorder as impaired comprehension or use of spoken, written, or other symbol systems. ASHA further states that the disorder may involve the form of language (phonology, morphology, syntax), the content of language (semantics), and the function of language in communication (pragmatics) in any combination. Prelinguistic communication behaviors (e.g., gestures, babbling, joint attention) are important precursors of language ability; they have been found to predict language development in typically developing children[9] as well subsequent language delays.[10-12] For these reasons, this review considers screenings for both verbal and preverbal communication skills.

Prevalence

Speech and language delays and disorders are common problems in pediatric populations. A systematic review conducted by Law and colleagues (2000)[13] estimated the prevalence of speech and/or language delays in children 2 to 5 years of age to be between 5 percent and 12 percent, with a median of 6 percent.[13] This estimate was based on data in six studies on either speech or language delays among children in the United Kingdom. More specifically, the prevalence of primary language delays (not including speech) has been estimated to be between 3 percent and 16 percent, with a median prevalence of 7 percent. This estimate was based on eight studies of preschoolers in the United Kingdom, Canada, New Zealand, the United States, and Hong Kong. Other studies of single populations provide similar prevalence estimates. In a population-based study in Utah of children 8 years of age, the prevalence of communication disorders (speech or language), based on special education or ICD-9 classifications, was 63.4 per 1,000.[14] Removing all cases identified with communication disorders that also met diagnostic criteria for autism spectrum disorder or intellectual disability, the prevalence dropped to 59.1 per 1,000. This was the only prevalence study conducted in the United States; no U.S. prevalence studies of preschool children have been conducted.

A population study in a large town in Finland reported a prevalence of 10 per 1,000 for SLI (not a component of another primary diagnosis) in children 6 years of age and younger.[15] In a nationally representative sample of children 4 and 5 years of age in Australia, 13 percent of their parents reported being “a little concerned” and 12 reported being “concerned” about some aspect of how their child talked and made speech sounds, and 5 percent were “a little concerned” and 4 percent were “concerned” about how their child understood language.[16]

Approximately 2.6 percent of children (298,274 children) 3 to 5 years of age were served under IDEA in 2007 for speech and language disabilities in the United States.[17]

The usefulness of language screening in the primary care setting is best measured by how well it identifies those children who are not already flagged as having potential speech or language delays. Therefore, specific groups of children who would have been identified as at higher-than-average risk, such as children diagnosed with hearing deficits, intellectual disability or craniofacial abnormalities, would not be considered in determining the value of screening.

Burden

ASHA (2011)[18] estimates that speech sound disorders affect 10 percent of children, the prevalence of language difficulty in preschool children is between 2 percent to 19 percent, and specific language impairment affects 7 percent of children. As adults, those children who had speech and language disorders, especially when language is affected, may hold lower skilled jobs and are more likely to be unemployed than unaffected children.[19] According to one study detailing the economic impact of communication disorders,[20] the rate of unemployment among individuals with communication impairments is 43 percent. Further, these researchers found that 44 percent of individuals whose speech makes it difficult for them to be understood are in the lowest income strata, compared with 17 percent of those free of disabilities. Finally, they estimated that in 1999 dollars, the total economic impact of communication disorders, including costs of unemployment, underemployment, rehabilitation, and special education services, was approximately $154 billion, approximately 2.5 percent of total gross domestic product.

Course, Comorbidity, and Sequelae

Etiology and Natural History

In contrast to acquired speech and language disorders, developmental speech and language disorders, that are not secondary to another condition, are often of unknown origin. Still, many speech and language disorders originating in childhood are known to cluster in families.[21-23] Recent twin studies have shown a strong concordance for language impairment in monozygotic twins.[24-27] The Twins Early Development Study[26,27] found concordance increases at the more extreme ends of the language impairment distribution, with genetic influences similar for males and females. Moreover, genetic linkage studies have identified a number of candidate genes associated with stuttering, speech sound disorders and other SLIs.[22,23,28,29] Although only a small proportion of childhood speech and language disorders can be explained by genetic findings to date, the increasing sophistication of genetic approaches is likely to yield a better understanding of the role of genetics in these disorders in the not very distant future.[22,23,28,29]

Sequelae

Childhood speech and language disorders include a broad set of disorders with heterogeneous outcomes. Evidence from studies of children identified with these disorders followed into early school years, adolescence, and adulthood is accumulating to provide outcomes for this population. Although few of these studies account for participants' treatment histories, it is unlikely that most individuals were completely untreated for their speech and language disorders. Thus, a true picture of the natural history of language delays and disorders is limited. Followup studies report that when young children have speech and language delays, they are at increased risk for learning disabilities once they reach school age,[30] and children with both speech sound disorders and language impairment are at greatest risk for language-based learning disabilities.[31, 32] These children may have difficulty reading in elementary school[33-36] and have difficulty with written language.[37] These issues may lead to overall academic underachievement[38] and, in some

cases, lower IQ scores[39] that may persist into adulthood.[40] Estimates of the increased risk for poor reading outcomes in second and fourth grades, according to the findings of one research group, are seven to eight times greater for children with nonspecific language impairment (i.e., language impairment accompanied by low IQ) and about five times greater for children with SLI.[33,41,42] These estimates are in line with the findings from a study of children referred as preschoolers for speech and language assessments who were subsequently prioritized for an intervention based on the assessment results; they were significantly more likely to exhibit language and literacy impairments in elementary school than children never referred for speech and language assessments.[43]

The risk for poor outcomes is greater for children whose disorders persist past the early childhood years and for those who have both lower IQ scores and language impairments rather than only speech impairments.[44] Estimates of the proportion of children with early speech and language delay whose disorders persist into the school years vary, and may depend to some extent on the inclusion criteria for children based on their early characteristics. In one large study using a database of children who received preschool services in Florida under IDEA Part B, Delgado[45] found that 54 percent of 2,045 children classified as having a speech or language delay for preschool service eligibility were classified as having an educational disability when they were in fourth grade.[45] A study in England[43] followed up with 196 of 350 children 7 to 9 years of age who were initially referred to community clinics for speech and language concerns prior to 3.5 years of age. The researchers found that 36 percent of the group prioritized for intervention after their early assessment showed significant language and literacy impairments (at least 2 standard deviations below the mean on one or more assessments) at followup, compared with 16 percent of the referred nonprioritized group and 8 percent of the control group. In addition to persisting speech- and language-related underachievement (verbal, reading, spelling), language-delayed children have also shown more behavior problems and impaired psychosocial adjustment, and the psychosocial problems can persist into adulthood.[46-48]

Current Clinical Practice in the United States

Identification of Speech and Language Delays and Disorders in Primary Care Settings

Screening for speech and language disorders has been defined as using standardized tools to detect the risk of a delay, which can be corroborated by a full-scale diagnostic evaluation. Screening for speech and language disorders in clinical practice most often occurs in pediatric outpatient clinics in the context of routine developmental surveillance and screening. By surveillance we mean the informal checks about developmental progress that occur during routine well-checkups; surveillance is also known as monitoring.

In 2006, the American Academy of Pediatrics (AAP) published clinical guidelines for developmental screening and surveillance in the primary care setting.[49] These guidelines recommend that pediatric health care providers perform surveillience at every well-child visit for children less than 36 months of age, and if any concerns arise, to screen using standardized developmental tools. Irrespective of concerns, the guidelines identify 9, 18, and 30 (or 24)

months as the specific ages when developmental screening should be done. The AAP also developed the Bright Futures Guidelines for Health Supervision of Infants, Children, and Adolescents[50] that offer primary care providers a set of processes and tools for surveillance, documentation of findings, and talking with parents about health, global development, and concerns. Bright Futures Guidelines recommend screening for developmental concerns including speech and language at regular intervals as part of well-child checkups. Irrespective of the procedures used, when a child fails a screen, the primary care provider should make a referral for further evaluation and treatment.

A variety of tools have been used to screen for speech and language delays; many are part of a broader screening for developmental delay. Some screening tools are designed to be administered to the child; others are checklists that are designed to be completed by a parent or teacher. Often primary care providers use broad-band instruments that screen for a variety of developmental issues. One such instrument is the Parents' Evaluation of Developmental Status (PEDS) questionnaire;[51] it asks parents about concerns they may have about their child's development using one question on each of several different developmental domains, including expressive and receptive language. The PEDS indicates the need for further screening or referral. Alternatively, other broad-band instruments such as the Denver II[52] and Ages and Stages Questionnaire-3[53] have separate scales that probe for more detailed information about the different developmental domains (e.g., language, motor, adaptive, social-emotional skills). Whereas the Denver II directly assesses the child, the Ages and Stages-3 asks parents about their child's development. In contrast to broad-band screeners, narrow-band screeners are designed to screen only for speech and language skills. Some narrow-band screeners for speech and language include the Language Development Survey[54] and the MacArthur-Bates Communicative Development Inventory (CDI);[55] the parent completes these screeners but they can be scored by a primary care provider.

The rationale for identifying speech and language problems during the years prior to formal schooling is so that early intervention services may be initiated before these problems interfere with school learning. Yet individual clinicians lack specific pediatric organizational or governmental policy recommendations concerning the effectiveness of speech and language screening outside of more global developmental screening recommendations. Additionally, because a variety of screens are available, practitioners may be confused about which tools are best at which times. Screening may be considered a low priority because administering the instruments is time consuming and the reimbursement level may be considered low. Further complicating the motivation for speech and language screening is the lack of a universal system for referral and management once abnormalities are detected through screening.

Interventions and Treatment

Once a child is diagnosed with a speech-language disorder, he or she is typically referred for therapy. Therapies and treatment plans for childhood speech and language disorders are highly variable and are commonly individualized to the patterns of symptoms exhibited by a particular child.[56] Treatments are designed to adapt to the child's interests, personality, and learning style and to address the priorities of the child, parents, or teachers based on the functional impact of the child's disorder in different settings.

The content of therapy sessions will depend on the child's identified needs (e.g., for a child with an articulation disorder, the speech-language pathologist may model the production of problematic sounds, cue the child on placement of the articulators, and provide multiple opportunities for practice). When the speech sound disorders are determined to follow rule-based error patterns (phonological disorders), the therapy will address the disorder using systematic presentation of speech sound stimuli to help the child learn the phonological rules of the language.[57,58] Similarly, for children with language disorders, therapy will be designed to address the symptoms, guided by knowledge of what is developmentally appropriate and by assessment information identifying the specific weaknesses of the child in expressive or receptive language related to vocabulary, syntax, or pragmatics or some combination. Strategies include environmental adaptations and a rich exposure of the child to vocabulary, language structures, and varied language interactions or a more focused program of modeling, prompting, and practicing specific language targets that are appropriate next steps based on the child's current developmental level.[59-61]

For children who have severe communication impairments that include limited or no ability to speak intelligibly, an augmentative and alternative communication system might be designed in conjunction with their speech-language therapy. These systems are sometimes built around "high tech" speech-generating devices; in other cases, the systems are "low tech" and involve the use of picture communication boards or books, sometimes combined with gestures. Many assistive technology options are now available to support individuals with speech and language disorders in their daily functioning.[62,63]

Therapy may take place in various settings such as speech and language specialty clinics, home, schools, or classrooms. Therapy may be administered to an individual or group. Therapists may be speech-language pathologists, parents, or teachers and may be child-centered or include peer and family components. The duration and intensity of the intervention varies depending on the severity of the speech or language disorder and the child's progress in meeting therapy goals.

Rationale for Changes to Scope Since 2006 Review

The USPSTF used this report to update its 2006 recommendations on brief, formal screening for speech and language delays and disorders for children 5 years of age and younger in primary care settings.

This review summarizes the evidence to date for the benefits and harms of screening and the accuracy of screening tests for children 5 years of age and younger, and the benefits and harms of treating speech and language delays and disorders using accepted techniques among children who were identified by 6 years of age.

The updated review generally adhered to the scope of the previous review, with rigorous attention to only including studies of children who were not previously identified with hearing impairments; developmental disorders such as Down syndrome, fragile X syndrome, or autism; craniofacial anomalies; or neurological/neurogenetic impairments. Studies including these populations of children, some of which were included in the previous review, are not useful

because they detail populations who have already been diagnosed with conditions that are marked by deficits in speech and language. The updated review also does not include studies of children older than 5 years of age in screening if separate data are not available for preschool-aged children; some of these studies were included in the previous review as well. Although the previous review included some studies in which screening occurred in school settings, the review did not address questions concerning the effectiveness of screening in settings such as preschools or kindergartens and the role of primary care providers vis-à-vis these other screening programs. We have included this as a contextual question.

Chapter 2. Methods

Key Questions and Analytic Framework

The investigators, USPSTF members, and Agency for Healthcare Research and Quality (AHRQ) Medical Officers developed the scope, Key Questions (KQs), and analytic framework (Figure 1) that guided the literature search and review.

Key Questions

1. Does screening for speech and language delay or disorders lead to improved speech and language outcomes, as well as improved outcomes in domains other than speech and language?
2. Do screening evaluations in the primary care setting accurately identify children for diagnostic evaluations and interventions?
    a. What is the accuracy of these screening techniques and does it vary by age, cultural/linguistic background, whether the screening is conducted in a child's native language, or by how the screening is administered (i.e., parent report, parent interview, direct assessment of child by professional)?
    b. What are the optimal ages and frequency for screening?
    c. Is selective screening based on risk factors more effective than unselected, general population screening?
    d. Does the accuracy of selective screening vary based on risk factors? Is the accuracy of screening different for children with an inherent language disorder compared with children whose language delay is due to environmental factors?
3. What are the adverse effects of screening for speech and language delay or disorders?
4. Does surveillance (active monitoring) by primary care clinicians play a role in accurately identifying children for diagnostic evaluations and interventions?
5. Do interventions for speech and language delay or disorders improve speech and language outcomes?
6. Do interventions for speech and language delay or disorders improve other outcomes, such as academic achievement, behavioral competence, or socioemotional development, or health outcomes, such as quality of life?
7. What are the adverse effects of interventions for speech and language delay or disorders (e.g., time, stress, and stigma)?

We include three contextual questions to help inform the report. We do not show these questions in the analytic framework because they were not analyzed using the same rigorous systematic review methodology as the studies that met the report's inclusion criteria. At the title and abstract and full-text article review stages, reviewers categorized studies not included to answer KQs that related to the specific contextual questions.

Contextual Questions

We addressed techniques of screening, risk factors for speech and language delay or disorders, and the role for primary care providers if screening is conducted in other venues via the following contextual questions:

1. What are the techniques for screening for speech and language delay or disorders and do they differ by the child's age or cultural background?
2. What risk factors are associated with speech and language delay or disorders?
3. What is the role of primary care providers in screening children age 5 years or younger that is performed in other venues (such as Head Start or preschool)?

Search Strategies

We searched PubMed/MEDLINE, the Cochrane Library, PsychInfo, and CINAHL for English-language articles published from January 1, 2004 through July 20, 2014. We used Medical Subject Headings as search terms when available and keywords when appropriate, focusing on terms to describe relevant populations, screening tests, interventions, outcomes, and study designs. Appendix A describes the complete search strategies. We conducted targeted searches for unpublished literature by searching ClinicalTrials.gov. To supplement electronic searches, we reviewed the reference lists of pertinent review articles and studies meeting our inclusion criteria and added all previously unidentified relevant articles.

Study Selection

Newly Identified Studies

We selected studies on the basis of inclusion and exclusion criteria developed for each KQ based on the PICOTS approach for identifying populations, interventions, comparators, outcomes, timing, settings, and study designs (Appendix A). Appendix B lists the excluded studies. We imported all citations identified through searches and other sources into EndNote X7. Two investigators independently reviewed titles and abstracts. We dually and independently reviewed the full text of abstracts marked for potential inclusion by either reviewer. Two experienced team members then resolved disagreements.

Population

We included studies that focused on the screening of children 5 years of age or younger. Also, all children who failed a screening had to receive diagnostic assessments for speech or language delays or disorders by 6 years of age. Treatment studies had to focus on the treatment of children who were screened or diagnosed according to our age criteria. If studies included a mix of ages where only some children met our age requirements, the studies were included only if evidence was available for subgroups of children who met our inclusion criteria.

Interventions

For KQs 1 through 3, we searched for studies that examined screening instruments specific to speech and language conditions, and more general developmental screening tools with speech and language modules, that clinicians could use to identify speech and language delays and disorders. All tools needed to be feasible for primary care settings (i.e., could be administered or interpreted by primary care providers). For KQ 4, we searched for studies that examined processes of monitoring speech and language rather than use of formal screening instruments. For KQs 5 through 7, we searched for studies that examined treatment interventions for children diagnosed with specific speech and language delays or disorders. We searched for interventions designed to improve speech or language in children, as long as diagnosis occurred at 6 years of age or younger.

Comparators

For KQs 1 and 3, we included studies that compared screened with unscreened groups. For KQ 2, we included studies that compared screening outcomes with those of a reference standard. For subparts of KQ 2, we included studies that compared screening accuracy in different subpopulations and for KQ 4, we included studies examining surveillance versus other approaches to referral for diagnosis. For KQs 5, 6, and 7, we included studies that compared an intervention with no intervention, delayed treatment, or watchful waiting.

Outcomes and Timing

We searched for studies on improvements in all aspects of speech and language functioning as well as improvements in other types of functioning, such as emergent academic skills, academic achievement (e.g., reading, writing, spelling, arithmetic), behavior competence, socioemotional functioning, quality of life, and parental satisfaction. Additionally, we excluded any screening study that did not provide test accuracy because it would prevent us from calculating sensitivity and specificity of the screeners.

Settings

Screening studies had to be conducted within a primary care setting or screeners had to be interpretable in a primary care setting (KQs 1 through 4). Treatment studies were not limited by location and could be conducted in speech and language clinics, schools, or homes (KQs 5 through 7). For all KQs, we limited our search to studies conducted in the United States or in countries with high Human Development Indexes.

Study Designs

For KQs 1 through 4, we included randomized controlled trials (RCTs), cohort studies, and systematic reviews. For KQs 5 through 7, we included RCTs and systematic reviews of RCTs. We systematically searched for studies for all questions from 2004 forward and we hand-searched the references from included systematic reviews. Studies identified from the hand

search could have been published at any time.

Studies in the 2006 Review

We applied, dually and independently, the inclusion and exclusion criteria described above to all studies included in the 2006 review.[64] We resolved disagreements by discussion and consensus; if necessary, we sought adjudication of conflicts from other experienced team members. We also conducted a check of the quality rating to ensure that studies met our current quality rating criteria. If the reviewer did not agree with this earlier assessment, we re-rated the quality of the study through dual review. Among included studies from the 2006 report, one reviewer checked for errors in previously generated abstraction tables and updated them as needed.

Newly Identified Studies

We abstracted pertinent information from each newly included study; details included methods and patient PICOTS. A second investigator checked all data abstractions for completeness and accuracy. Using predefined criteria developed by the USPSTF and others, two investigators independently assessed the quality of each study as good, fair, or poor. Appendix C describes the quality rating criteria.[65] Disagreements were resolved by discussion and consensus. Studies with fatal flaws were rated as poor quality. For KQ 2, fatal flaws that could result in poor-quality ratings included use of an inappropriate reference standard (i.e., a reference standard that was not one typically used by speech-language pathologists for diagnosis of speech and language disorders), improper administration of the screening test, biased ascertainment of reference standard, very small sample size, or a very narrowly selected spectrum of patients. For KQs 5 and 6, fatal flaws that could result in poor-quality ratings included groups assembled initially not being comparable or maintained throughout the study, use of unreliable or invalid measurement instruments or instruments not applied equally across groups (including not masking outcome assessment), the lack of intention-to-treat analysis, a very high rate of loss to followup, or important differential loss to followup.

Data Synthesis and Analysis

In the results chapter, we first summarize the newly identified included studies. We then describe the previously identified studies that continue to meet current inclusion and quality criteria. Finally, we present a qualitative synthesis of previous and current findings.

The discussion chapter summarizes conclusions from the previous review, the 2006 USPSTF recommendation, and the implications of the new synthesis for previous conclusions. In addition, we assess the overall summary of the body of evidence for each KQ using methods developed by the USPSTF, based on the number, quality, and size of studies; consistency of results among studies (similar magnitude and direction of effect); and applicability of the results to the population of interest.

Expert Review and Public Comment

A draft report was reviewed by outside content experts, USPSTF members, and AHRQ Medical Officers, and was revised based on comments.

USPSTF Involvement

This review was funded by AHRQ. AHRQ staff and USPSTF members participated in developing the scope of the work and reviewed draft manuscripts, but the authors are solely responsible for the content.

Chapter 3. Results

This chapter provides a comprehensive presentation of the evidence from the 2006 report and our updated searches. The KQs in this update are similar to the questions in the 2006 report, and we have added three descriptive contextual questions. The contextual questions describe techniques used for speech and language screening, risk factors associated with speech and language delays, and the role of the primary care provider in screening when the screening occurs in other venues, such as daycare. The inclusion criteria across the two reviews are generally the same. Exceptions include the type of screening studies allowed, where we limited the length of the screener that would be used by a primary care provider; only including studies with a broad range of children's ages if there were separate data for children 5 years of age or younger; excluding studies of children with known conditions such as cleft palate; and requiring reference standards to be instruments known to be used by speech and language practitioners to diagnose speech and language delay or disorders in either research or clinical venues (Table 1). We limited treatment studies to RCTs and only to those with no treatment comparisons because "usual care" would always imply a treatment arm. To be comparable to the United States, we required the setting to be in countries with a very high Human Development Index.

We first report on the yields from our literature searches. The results presented below first summarize and then describe new studies identified by the updated search. Next, we summarize studies from the 2006 report that continue to meet inclusion and quality criteria. In relation to screening, we included 16 good- or fair-quality screening studies (in 26 publications) of the 35 studies included in the prior report, and in relation to treatment, we included 7 good- or fair-quality studies of 14 earlier included studies. Table 2 lists all studies included for analysis in this review. Reasons for study exclusion are detailed below. We follow with a synthesis of the overall (new then old) evidence, noting results for subgroups when such data are available. Appendix D contains full evidence tables for each KQ.

Literature Search

Figure 2 illustrates the yield at each stage of the review process for the update search. We reviewed 1,497 titles and abstracts dually and independently, and identified 555 studies for full-text review. Evidence to answer KQs was obtained from 38 studies (in 40 articles) and 2 systematic reviews. Fifty-five additional studies were used solely to answer contextual questions. More specifically, of the 52 fair- or good- quality studies on screening or intervention included in the previous review, 27 studies (28 articles) met the inclusion criteria for this review. Four studies originally rated as good or fair in the earlier review were newly rated as poor quality and were not included in our analysis.[66-69] Eight new screening studies (in 9 publications) and 6 new treatment studies met our inclusion and quality eligibility criteria following dual independent review.

Key Question 1. Does Screening for Speech and Language Delay or Disorders Lead to Improved Speech and Language Outcomes, as Well as Improved Outcomes in Domains Other Than Speech and Language?

Although one new study met our inclusion criteria,[70,71] it was rated as poor quality, resulting in no evidence being available to answer this KQ. The study randomized a large sample of children in the Netherlands who attended regularly scheduled visits at child health centers. Children were randomized at 15 months to receive screening/no screening at 18 and 24 months and then followed to 8 years of age. The study found no significant differences between the two arms in language performance at 36 months of age. At 8 years of age, children in the screening arm were less likely to be in a special school but not less likely to have repeated a grade because of language problems. A comparison of children screened versus not screened found that children who were screened were less likely to be in the lowest 10th percentile for oral language testing. Of primary concern in this study was a large attrition rate. Of 6,485 children randomized to the screening group, 3,776 were fully screened. The study obtained outcomes for 3,118 children in this arm; only 1,980 of the children who had been fully screened. Of 4,955 children randomized to the control arm, outcome measures were obtained for 2,288 children.

Breaking the randomization, cohort analyses were conducted comparing children who were screened (a subgroup of the intervention arm) versus not screened (obtained from the intervention and control arms). This analysis did not control for other possible differences between children in the two groups that could result in poorer outcomes, such as autism spectrum disorder or hearing, developmental, and emotional problems that may have arisen following the initial screening.

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

Key Question 2a. What Is the Accuracy of These Screening Techniques and Does it Vary by Age, Cultural/Linguistic Background, Whether the Screening Is Conducted in a Child's Native Language, or by How the Screening Is Administered?

Summary of Newly Identified Evidence on Accuracy of Screening

Fourteen new studies (15 articles) met our inclusion criteria since the prior review on the accuracy of screening instruments.[72-85] In addition, we found 3 older studies and a systematic review through hand searches/peer reviewer recommendation that were not included in the previous review.[86-89] We used both the Law et al. (1998) systematic review[89] and the previous

USPSTF review[90] to hand-search for relevant studies. Of the 14 newly identified studies, we rated eight as poor quality (Appendix C): two because the reference test was not independent of the screener,[79,80] three because the reference test was inappropriate (i.e., either another screener or a measure of cognitive ability),[81-83] two because an inappropriate reference standard was used and the reference was not independent of the screener,[84,85] and one because no information was given on the reference standard and there was limited information on the screener.[87]

Study Characteristics of Newly Identified Evidence on Accuracy of Screening

Characteristics of the eight newly identified studies rated fair or good quality are shown in Table 3. Of these, only Sachse and Von Suchodoletz[76] was rated as good quality. Three studies[72-74] examined the accuracy of the Ages and Stages Questionnaire (ASQ), including a Spanish translation of the instrument. Five studies[73-76,78] examined different versions of the MacArthur-Bates Child Development Inventory (CDI), including translations in Spanish, German, and Swedish and shortened versions; two of these studies[73,74] also examined the ASQ. One of the studies[72] that reported on the ASQ also examined the accuracy of the Battelle Developmental Inventory Screening Test communication domain, the Brigance Preschool Screen, and the Early Screening Profiles. One study[86] reported on a trial of a Speech Screening Test. Another reported on the Infant-Toddler Checklist (ITC), a component of the Communication and Symbolic Behavior Scales—developmental Profile (CSBS-DP).[88] As part of these studies, children 18 months of age,[78] 2 years of age,[74-76] 3 to 5 years of age,[73] and 4.5 years of age were screened.[72,86] Five of the studies were conducted in the United States; the remaining three were located in Canada, the United Kingdom, and Sweden. Recruitment techniques and venues included advertisements, birth registries, early childhood programs, medical practices, and university research programs. Venues for the studies included primary care practices, early childhood centers, health centers, hospitals, and university research labs.

Description of Previously Identified Studies on Screening That Continue to Meet Current Inclusion and Quality Criteria

We examined all 42 studies (in 43 articles) identified in the 2006 review. Of these 42 studies, 23 continued to meet the inclusion criteria for this update.[54,66-68,91-108] Nineteen studies were excluded at the full-text level. One study[109] was not original research but rather a letter to an editor, and another[110] examined the accuracy of a diagnostic test rather than a screener. Eight studies[111-118] included children with either a prior diagnosis or who were older than our age criteria and did not include an analysis by subgroups that met our inclusion criteria. Six studies included screeners that did not focus on speech or language, did not have a speech and language component, or could not be administered or interpreted in the required time frame. Three studies[119-121] did not include accuracy information about their screener. We rated 7 of the remaining 23 studies[66-68,96,101,107] as poor quality. Reasons for these ratings may be found in Appendix C.

Characteristics of the 16 good- or fair-quality studies included in our analysis are shown in Table 3. Three studies (in four articles)[54,98,102,122] examined the accuracy of the Language Development

Survey (LDS). Two studies[95,104] examined the General Language Screen (GLS, formerly known as the Parent Language Checklist). Two studies[92,105] examined the Fluharty Preschool Speech and Language Screening Test (FPSLST) and its earlier version, the Fluharty Preschool Screening Test. Two studies reported on the Structured Screening Test[99] and its previous version, the Hackney Early Language Screening Test.[100] No other screeners were examined in more than one study. Nine studies examined one or more instruments that were not assessed in any other study; many have not been published or used widely outside of the study that reported its use, or were older versions of a currently used instrument. These include the Davis Observation Checklist for Texas,[91] the Northwestern Syntax Screening Test,[92] the Screening Kit of Language Development,[93] the Denver Developmental Screening Test,[94] the Denver Articulation Screening Exam,[97] the Developmental Nurse Screen and the Parent Questionnaire,[103] the Sentence Repetition Screening Test,[106] and Ward's unnamed screening tool.[108]

The ages of the children screened in these studies varied; the majority focused on children 2 and 3 years of age. One study focused on children 9 months of age,[108] and four were limited to those 4 and 5 years of age.[91,105,106] Nine of the studies were conducted in the United States, and the remaining seven in other English-speaking countries including the United Kingdom, Canada, and Australia. Recruitment techniques and venues included advertisements, birth registries, early childhood programs, university research programs, medical practices, and school registration and entrance medical examinations.

Detailed Synthesis of Evidence on Screening

Table 4 provides a description of each screener included in addressing KQ 2. We present the skills screened, the summary scores, time to complete, appropriate ages for administration, the source of the screening information, and when available, reliability data. In some cases, we obtained the reliability information from test manuals. We review the evidence on the accuracy of screening by considering who does the screening and whether demographics such as age, race, and ethnicity and risk factors facilitate screening. Table 5 provides accuracy statistics separately for parent rated screeners, and Table 6 provides statistics for trained examiners. We report sensitivity, specificity, prevalence, positive and negative predictive value, positive and negative likelihood ratios (LRs), as well as 95% confidence intervals (CIs) for sensitivity and specificity. However, we caution that the positive and negative predictive values are virtually meaningless in studies where the prevalence exceeded 10 percent, because investigators chose a random sample from among children with negative screens to complete the reference measures. As such, we do not discuss them in the text. When accuracy statistics were not provided by the author, we calculated them ourselves using an online calculator[123] (Appendix E).

We calculated median test statistics across all parent rated and trained examiner screeners separately. In some cases, a study calculated separate statistics for each reference measure; we calculated the median accuracy statistics across all measurements across all studies. We calculated the median rather than the mean because the accuracy statistics were somewhat skewed. When more than one study examined the accuracy of an instrument, we determined the median of the accuracy statistics for that instrument and discuss it separately in the text. We report the accuracy statistics by age when there is variation by age at screening.

Parent-Rated Screeners

Fourteen studies (in 16 articles)[54,72-78,88,95,98,102-104,108,122] examined the accuracy of screening instruments in which parents rated their child's speech and language skills (Table 5). The instruments included are the ASQ, the CDI, GLS (formerly known as the Parent Language Checklist), the Infant-toddler Checklist (ITC) from the CSBS-DP, LDS, Parent Questionnaire, and Ward's screening tool. Most children in these studies were 2 or 3 years of age (toddlers). Cutoff scores for positive screening, when provided, varied as a function of the instrument but were usually the scores recommended by the developer.

Sensitivity for detecting a true speech and language delay or disorder using parent-report screeners ranged between 50 percent and 94 percent, with a median of 80 percent, based on data from 19 measurements of accuracy that include 12 different reference standards in the 14 studies. Data from one study[98] were not included as they concerned the same sample with a different cut point. The specificity of the screening test for detecting a child without a speech and language delay or disorder ranged between 45 percent and 96 percent, with a median of 81 percent. Based on the Michigan State University[124] criteria for interpreting LRs (Appendix E), we found a positive LR in at least one study investigating the ASQ, CDI, LDS, Parent Questionnaire, and Ward's screening tool. These results indicate that there was at least a moderate increase in the likelihood of a language delay using the results of each of these screeners. Inspection of the negative LRs suggests that in at least one study examining the CDI, ITC, and LDS, there was at least a moderate decrease in the likelihood of language delay.

Figures 3a and 3b present CIs for sensitivity and specificity of the parent-rated screeners, individually by study. As Figure 3a demonstrates, the CIs for sensitivity of the different screeners overlap, suggesting no clear difference in sensitivity between the screeners. In contrast, Figure 3b shows that the Parent Language Questionnaire CI for specificity does not overlap with other screeners, suggesting that this measure is less able to detect children without language delays than the other screeners.

Accuracy data for all screeners is found in Tables 5 and 6. In addition, when there was more than one study that assessed a screener, we provide results below.

Ages and Stages Questionnaire (ASQ). Children in the three studies[72-74] evaluating the ASQ ranged between 24 and 54 months of age. We found that the median sensitivity of the ASQ was 63 percent and the median across the different studies was 84 percent. In the two studies using the Spanish version of the ASQ,[73,74] the positive LR indicates moderate to large increases in the likelihood of a language delay for those screened positive.

MacArthur-Bates CDI. Five studies (6 articles)[73-78] examined the accuracy of the CDI. This screener has versions for infants, toddlers, and preschool children. Parents report their child's use of words and sentences in the toddler and preschool versions. All but one of the studies in this review[73] used the toddler version; children ranged from 18 to 62 months of age. In addition to the original English-language version of the CDI, studies included translated versions in Spanish, German, and Swedish. The median sensitivity of the CDI across studies was 82 percent and the median specificity was 86 percent. The positive and negative LRs in the German version of the

CDI[76,77] indicate a moderate increase in the likelihood of a language delay for those who failed the screener and a large decrease in the likelihood of language delay for those passing the screener. The CDI Words and Sentences[75] and the short form of the Spanish version of the CDI[74] also had moderately positive LRs; the Spanish short form version also had a moderate negative LR.

GLS/Parent Language Checklist. The Parent Language Checklist was an earlier version of the GLS, but is essentially the same. Children in two studies[95,104] evaluating this instrument were 36 months of age. The median sensitivity of the GLS/Parent Language Questionnaire across three measurements was 75 percent and the median specificity was 68 percent. The CI for specificity of the Parent Language Checklist did not overlap with other parent rated screeners, indicating that its specificity is lower than other parent-rated screeners.

Language Development Survey (LDS). Three studies (4 articles)[54,98,102,122] reported on the LDS, a screener in which parents indicate which of 310 words their child produces as well as whether the child produces 2-word and longer sentences. Children in these studies ranged between 24 and 34 months of age. The median sensitivity of the LDS was 91 percent, based on data from three measurements; data from Klee et al., 1998[98] were not included as they concerned the same sample with a different cut point. The median specificity across three measurements is 86 percent. In one study of the LDS,[122] the positive LR was 24.1, indicating that children who screened positive are very likely to have a language delay. In addition, in each of the studies that investigated the LDS, the negative LRs were moderate to strong, indicating that children who passed the LDS are highly likely not to have a language delay.

Accuracy by Age of Children

ASQ. Inspection of the CIs of the ASQ by age, for older children (4.5 years of age) in the Frisk et al., 2009 study[72] compared with children 2 to 3 years of age in two other studies[73,74] suggests that there were few differences in sensitivity as a function of age. However, as the CIs indicate, the specificity is higher for the Spanish ASQ for younger children; the median specificity for detecting the absence of speech and language delays or disorders in the children 2 to 3 years of age was 94 percent compared with the median specificity of 74 percent for children 4.5 years of age. Moreover, the positive LRs indicated at least a moderate increase in the likelihood of a language delay relative to children who screened negative in the studies with the children 2 to 3 years of age, with only a small increase in the likelihood of disease for the older children. The negative LRs were small and equivalent for both younger and older samples.

CDI. Four of the five studies (5 articles)[74-78] that examined the accuracy of the toddler version of the CDI included children who were 18 to 36 months of age. One study[73] used the preschool version with children 36 to 62 months of age. Comparison of the accuracy of the toddler version with the preschool version indicates they were fairly comparable. The median of the sensitivity of the toddler version is 84 percent compared with 82 percent for the preschool version; the median specificity is 87 percent for the toddler version versus 81 percent for the preschool version. However, as the sensitivity graphs show, sensitivity in one study[78] of toddlers was lower than all the others.

ITC. The one study of the ITC[88] included separate accuracy statistics for children in two age groups; younger toddlers (12 to17 months of age) and older toddlers (18 to 24 months of age). Accuracy results were similar as is shown in the CI graphs. Sensitivity for the younger toddlers was 89 percent, and it was 86 percent for the older toddlers. Specificity was 74 percent for the younger toddlers, and 77 percent for the older toddlers. In both samples, negative LRs indicate a moderate decrease in the likelihood of language delay in those who passed the screener.

Accuracy by Racial/Ethnic Characteristics of Children

No studies provided evidence for accuracy as a function of racial/ethnic characteristics.

Accuracy of Longer Prediction

Two studies in four articles[76,77,98,122] examined the accuracy of screeners for predicting future language delay or disorder. In both studies, the accuracy of the screener administered at 2 years of age was examined in relation to the reference standard at both 2 years and 3 years of age, allowing a comparison of longer term versus more immediate sensitivity and specificity. In a study (1 of 2 articles)[122] that examined the LDS, sensitivity for detecting a language delay or disorder at 3 years of age was 67 percent compared with 91 percent at 2 years of age. Specificity for detecting typical language at 3 years of age was 93 percent compared with 96 percent at 2 years of age. In a second study that examined the Elternfragebogen fur die Fruberkennung von Riskokindern (ELFRA-2), the German version of the CDI, sensitivity for detecting a language delay or disorder at 3 years of age was 94 percent compared with 93 percent at 2 years of age. Specificity for detecting typical language at 3 years of age was 61 percent compared with 88 percent at 2 years of age.

Trained Examiner–Rated Screeners

Twelve studies[72,86,91-94,97,99,100,103,105,106] examined the accuracy of screening tests designed to be completed by trained examiners, including nurses, primary care providers, teachers, and paraprofessionals (Table 6). Evidence includes data on the following instruments: Brigance Preschool Screen (BPS), Battelle Developmental Inventory Screening Test (BDIST) Communication Domain, Davis Observation Checklist for Texas (DOCT), Denver Articulation Screening Exam (DASE), Denver Developmental Screening Test (DDST), Language, Developmental Nurse Screen (DNS), Early Screening Profiles (ESP), Fluharty Preschool Speech and Language Screening Test (FPSLST), Northwestern Syntax Screening Test (NSST), Sentence Repetition Screening Test (SRST), Screening Kit of Language Development (SKOLD), Structured Screening Test (SST, previously named the Hackney Early Language Screening Test), and Rigby's Trial Speech Screening Test. Several studies included more than one screening instrument. All but two of the instruments (the DNS[103] and DOCT[91]) require at least some direct testing of the child, whereas these two instruments are ratings made after observing the child. In comparison with the studies of parent-rater instruments, these studies tended to focus on older preschool-age children but ranged from 18 to 72 months of age. Three studies[99, 100,103] were focused on children 2 to 3 years of age; one study[92] included children 3 to 4 years of age; five studies[72,86,91,105,106] included children who were 4 to 5 years of age; and three studies[93, 94,97] included children across the age span.

Four instruments include at least a component to screen for articulation delays or disorders (i.e., FPSLST, DASE, SRST, and the Trial Speech Screening Test). Four screeners include separate components for language expression and language comprehension (i.e., SKOLD, BDIST Communication domain, BPS, and SST). Two screeners measure grammar (i.e., NSST and SRST). One instrument assesses vocabulary knowledge (i.e., ESP). Two instruments measure global speech and language skills (i.e., DOCT, DDST Language). The DNS includes a single question about the child's communication that is answered after a period of observation.

Many studies included either multiple screeners or examined accuracy in relation to more than one reference test; we include all of these measurements in our analysis. Based on 27 measurements (in the 11 studies using accuracy from all reference tests), sensitivity of a screening test administered by a trained examiner for detecting a true speech and language delay or disorder ranged between 17 percent and 100 percent (median of 74 percent), and specificity for detecting typical speech and language development ranged between 46 percent and 100 percent (median of 91 percent). In studies of the BDIST,[72] DOCT,[91] SKOLD,[93] SRST,[106] SST,[99] and the trial speech screening test,[86] positive LRs indicated at least moderate increase in the likelihood of language delay for those who screened positive; the studies of the BPS,[72] DOCT,[91] ESP,[72] NSST,[92] SKOLD,[93] and HELST[100] indicated at least a moderate decrease in the likelihood of language delay for those who screened negative. Screener-specific accuracy results for instruments that appeared in more than one study are presented below.

Figure 4a displays the 95% CI graphs for sensitivity, and Figure 4b provides the 95% CI graphs for specificity for the trained examiner screeners. The CIs for sensitivity indicate great variability among the instruments. Still, the CIs for the Standard English version of the SKOLD and the HELST did not overlap with several of other screeners (the BDST Receptive, BDST Expressive BPS Receptive, DDST, FPST, SRST, SST, and the Trial Speech Screening Test); indicating that these latter screeners are less sensitive that the SKOLD and HELST for detecting language delays. The graphs also show that the DDST was less sensitive than several of the other screeners. CIs around the specificity point estimates of the screeners were somewhat tighter. Some screeners demonstrated better ability to detect typical speech or language compared with others; namely, the SE version of the SKOLD30, DOCT, DSST, the Sentence Repetition Screening Test (for typical articulation), the SST and the Trial Speech Screening Test demonstrated better ability to detect typical speech or language compared with the BDST (for typical receptive language), BPS, ESP (for typical receptive language), NSST, and HELST.

Fluharty Preschool Speech and Language Screening Test (FPSLST). Two studies[92,105] examined the accuracy of the FPSLST and its precursor, the Fluharty Preschool Screening Test, with children who were 3 and 4 to 5 years of age. Based on administration by a trained examiner, the FPSLST provides separate scores for articulation and language and an overall composite. Across the five measurements (all reference tests included) in these two studies, the sensitivity ranged between 17 percent and 74 percent with a median of 43 percent; the specificity ranged between 81 percent and 97 percent, with a median of 93 percent.

Structured Screening Test (SST). Two studies evaluated the SST and its precursor, the Hackney Early Language Screen,[99,100] each with children 30 months of age. Designed for health visitors to administer during routine developmental assessments, this instrument includes items measuring

language expression and comprehension. In the two studies, sensitivity was 66 and 98 percent (median 82 percent) and specificity was 89 and 69 percent (median 79 percent) for the SST and HELST, respectively. It should be noted that the SST maximized the specificity in contrast to the sensitivity.

Accuracy by Age of Children and Language Dialect

Screening Kit of Language Development (SKOLD). One study[93] assessed the SKOLD with children 30 to 48 months of age. The SKOLD measures both language comprehension and expression, and includes separate subtests for different ages and for speakers of African American dialect and Standard English (SE). Because the instrument has separate subtests by age and linguistic background, we could examine accuracy as a function of these two characteristics. Across the two dialect versions, the median sensitivity was 94, 94, and 97 percent for children 30 to 36 months, 37 to 42 months, and 43 to 48 months of age, respectively; the median specificity was 92, 88, and 85 percent.

Across the three age levels, the median sensitivity for SE subtests was 100 percent compared with 88 percent for African American dialect, and the median specificity for SE was 93 percent compared with 86 percent for African American dialect. As noted above in the comparison of CIs, the SE version of the SKOLD displays higher sensitivity for detecting language delays than several other measures.

Except for African American children screened at 43 to 48 months of age, positive LRs indicate a large increase in the likelihood of a language delay among children who failed the screen in any age/dialect group. Across all ages and both versions, negative LRs indicate a large decrease in the likelihood of a language delay for those who passed the screen.

No other screening instrument provided separate data by racial/age groups.

Key Question 2b. What Are the Optimal Ages and Frequency for Screening?

There is no evidence to answer this question.

Key Question 2c. Is Selective Screening Based on Risk Factors More Effective Than Unselected, General Population Screening?

There is no evidence to answer this question.

Key Question 2d. Does the Accuracy of Selective Screening Vary Based on Risk Factors? Is the Accuracy of Screening Different for Children With an Inherent Language Disorder Compared With Children Whose Language Delay Is Due to Environmental Factors?

There is no evidence to answer this question.

Key Question 3. What Are the Adverse Effects of Screening for Speech and Language Delay or Disorders?

There is no evidence to answer this question.

Key Question 4. Does Surveillance (Active Monitoring) by Primary Care Clinicians Play a Role in Accurately Identifying Children for Diagnostic Evaluations and Interventions?

There is no evidence to answer this question.

Key Question 5. Do Interventions for Speech and Language Delay or Disorders Improve Speech and Language Outcomes?

In this review, we organize our summary of treatment evidence around three broad outcome categories: language (including expressive and receptive language, and more specific aspects of language such as vocabulary, syntax/morphology, and narratives), speech sounds (including articulation, phonology, phonological awareness, and speech intelligibility), and fluency (stuttering). Among both the newly identified and the previously identified evidence, some studies report outcomes in more than one of these three broad categories.

Summary of Newly Identified Evidence on Treatment

We include in our analysis six trials testing treatment for speech and language delays or disorders that met the inclusion criteria and were not included in the previous review.[125-130] Also, we identified one systematic review of the literature on treatment of childhood apraxia of speech.[131]

We identified two additional studies that we rated as poor quality (Appendix C). One study did not state how the groups were randomized, whether the researchers used any procedures to

address missing data and intention to treat, and presented no participant characteristics beyond pretest scores;[132] the other study did not state how study assignments were made and did not include baseline characteristics or independent measure of the outcome.[133]

Study Characteristics of Newly Identified Evidence on Treatment

The newly identified evidence includes one good-quality cluster RCT[128] and five fair-quality parallel RCTs[125-127,129,130] (Table 7). The systematic review of the literature on treatment of childhood apraxia of speech found no studies that met the researchers' inclusion criteria. Among the six newly identified trials, four examined language outcomes,[125,128-130] including three that also examined aspects of speech sound outcomes.[125,129,130] The other two newly identified studies focused on fluency outcomes (Table 8).[126,127]

Description of Previously Identified Studies on Treatment That Continue to Meet Current Inclusion and Quality Criteria

Of 14 fair- or good-quality trials identified in the previous review (two of which we concluded were one study), seven trials reported in eight publications met the inclusion criteria for this update[134-141] (Table 7). One of these was evaluated as being good quality.[135]

We excluded five treatment studies that were included in the 2006 review because we considered them to be comparative effectiveness studies.[142-146] One additional article from the previous review was excluded because it was irretrievable.[147]

New Studies Reporting Language Outcomes

Wake et al. (2011)[128] tested the impact of a modified Hanen Parent Program called "You Make the Difference"[148] for children served by maternal and child health centers in Melbourne, Australia. Child eligibility at 18 months of age was based on a score at or below the 20th percentile on a parent-completed vocabulary checklist; 301 children were randomized by the maternal and child health center in which they were served. Treatment was provided by three professionals trained in the intervention model (one speech-language pathologist and two psychologists) through six weekly 2-hour parent group sessions; for the first 1.5 hours, the group leader facilitated a review of the previous week's home practice, followed by a participatory presentation on optimizing responsive interactions and providing a rich language environment for young children. For the last 30 minutes, parents were videotaped practicing new strategies with their children, with coaching as needed from the group leader. The report does not state if any children received speech/language services in the community. Outcomes were measured at 2 and 3 years of age, and included broad measures of expressive and receptive language (the Preschool Language Scale expressive communication and auditory comprehension subscales) and the Expressive Vocabulary Test.

Fricke and colleagues[125] recruited 180 children (mean of 4 years of age) from nursery school programs in Yorkshire, England with the lowest scores on a composite measure of expressive language. For children in the treatment group, teaching assistants provided a 30-week

manualized oral language program modified from a previous intervention study.[149] This program was compiled from a variety of sources and has not been widely disseminated nor evaluated as a specific treatment package outside of the studies conducted by this group of researchers, thereby limiting the immediate applicability to other settings. Lessons covered vocabulary and narratives, as well as the emergent literacy skills of letter sounds and phonological awareness during the last 10 weeks of the program. The children participated in three 15-minute small group sessions per week for 10 weeks in nursery school classrooms (for children 3 and 4 years of age) and three 30-minute small group sessions and two 15-minute individual sessions per week for 20 weeks in reception classrooms (in which children are enrolled the year they turn 5). A large number of individual language outcome measures were gathered, and through latent variable analysis, the researchers identified four constructs (Language, Narrative, Phoneme Awareness, Literacy) for which effects were examined at immediate post-test and at a maintenance followup 6 months after the end of the intervention. No information was provided regarding whether any children received speech/language treatment in the community.

Wake and colleagues[130] recruited 200 children at 4 years of age from the greater Melbourne, Australia area. Eligible children had receptive and/or expressive language scores at least 1.25 standard deviations below the mean on the Clinical Evaluation of Language Fundamentals–Preschool, second edition; children were excluded if they had known intellectual disability, major medical conditions, autism spectrum disorder, hearing loss greater than 40 dB in the better ear, or parents with insufficient English to participate. Children were randomized to an intervention (n = 99) or control (n = 101) group. The intervention was planned to comprise 18 one-hour sessions, occurring in 3 blocks of 6 one-hour sessions across 6 weeks with a 6-week break between session blocks. The intervention was adapted from a manualized program developed for an earlier RCT by a different team of investigators.[150] Trained language assistants provided the intervention, which included phonological awareness activities and storybook reading targeting print awareness, initial phoneme isolation, and letter knowledge for all children, and also included specific language targets selected for each child individually, based on the child's language profile. Examples of individualized targets included vocabulary expansion, sentence structure, and comprehension and use of morphological markers (e.g., plurals, possessives, past tense verb endings). The intervention manual supported implementation of the intervention by the language assistants, and they were trained and had ongoing guidance from a supervising speech pathologist. Parents of children in the control group were informed by mail of group allocation and the availability of local speech pathology services. However, no data were reported on local speech pathology services actually received by the control group, or on community speech pathology services received by the experimental group, if any.

Yoder and colleagues[129] recruited 52 preschool children with specific speech and language impairments (mean of 43.8 months of age). Included children had nonverbal intelligence quotients above 80, and scores at least 1.3 standard deviations below the mean on either a mean length of utterance measure or the expressive subscale of the Preschool Language Scale-third edition,[151] and a score of at least 1.3 standard deviations below the mean on the Arizona Articulation Proficiency Profile.[152] The intervention consisted of broad target recasting, a strategy characterized by an interventionist providing additional information when a child uses an immature form of speech or language. Interventionists provided speech recasts (providing an

appropriately articulated repetition of an utterance the child used with immature articulation, but without adding additional grammatical structure) or sentence-length recasts (expanding a syntactically immature structure used by the child to a syntactically complete sentence). Individualized treatment was conducted 3 times per week for 30 minutes per session for 6 months. Intervention effects were examined at immediate post-treatment, and 8 months after the treatment ended. All study participants were free to participate in community interventions. The treatment and control groups did not differ in amount of speech and language treatment they received in the community, but the control group participated in more treatments targeting areas other than speech and language.

Studies From the Previous Review Reporting Language Outcomes

All seven previously identified trials included in this update report language outcomes.[134-137,139-141]

One trial by Glogowska and colleagues examined children under 42 months of age (N = 159) who were identified with a delay in general language, in expressive language, or in phonological development at any of 16 clinics in Bristol, England.[135] Treatment consisted of immediate speech and language therapy services, usually provided by the clinic. Some children in both arms did not fulfill the protocol. In the therapy group, 3 of 71 children failed to attend any therapy sessions; in the control group, 1 of 88 families requested therapy within 1 month of randomization, and 17 requested therapy at the end of 6 months. Intervention treatment services were provided for an average of 8.4 months (range 0.9 to 12), for 8.1 contacts (range 0 to 17), and for 6.2 total hours (range 0 to 15). Outcome measures were collected at 6 and 12 months after randomization.

Robertson and Ellis Weismer[139] examined the impact of a clinician-delivered intervention on the expressive and receptive language skills of toddlers (21 to 30 months of age) who were identified as late talkers (based on scores on parent-reported expressive vocabulary below the 10th percentile) (N = 21). Speech-language pathologists directed therapy in small groups of no more than 4 children, for 150 minutes per week for 12 weeks. Aspects of the intervention included establishing routines, using theme-based materials, increasing the salience of linguistic input through modifications of stress vocabulary and pitch, modeling language, and providing interaction opportunities and feedback. Three key strategies used for language modeling were a) parallel talk, or providing a verbal description of the child's actions in the absence of a child verbalization; b) expansion/expatiation, or repeating a child's utterance with the addition of content that extends the child; and c) recast, defined here as repeating a child's utterance with modification of syntactic elements of modality or voice.

One earlier included Canadian trial also evaluated the effects of the Hanen Parent Program parent training on language outcomes[137] among children 23 to 33 months of age with expressive language delays (i.e., at no higher than the 1-word stage). The Hanen Parent Program comprises 8 parent group sessions of 2.5 hours each and 3 home visits. Parents were taught to provide linguistic input to their children contingent on their children's interests. For this study, the usual Hanen Parent Program was modified to coach parents on focused stimulation of 10 target words; replacing acquired words with new, parent-identified target words; and modeling 2-word

utterances.

Gibbard et al.[136] also evaluated a parent training program for parents of toddlers 26 to 39 months of age with limited expressive vocabulary (30 words or less) but without evidence of global developmental delays. Parents attended sessions for 60 to 75 minutes every other week for 11 weeks. The primary objective for parents was to increase their child's language development to where the child was producing 3- to 4-word utterances. During the parent group meetings, the group leader emphasized games and activities that could be used to help the children meet these objectives, and how to transfer the language skills achieved during the games to daily life activities.

A second trial conducted by Robertson and Ellis Weismer[140] randomized 20 children with specific language impairment, 44 thru 61 months of age, to a peer model group or control. All children were enrolled in a language-based early childhood classroom throughout the study. Children in the peer model group played house in their classroom with language-typical peers at least 4 times for 15 minutes per play session over a 3-week period. Children in the control group were monitored to ensure they played in the house area at least 60 minutes during the same 3-week interval, but without language-typical peer models. Language measures were all tied to the playing house scripts and included gain scores in a) the number of words included in a script describing how to play house, b) the number of different words in the script, c) the number of play-theme related acts described in the script, and d) the number of linguistic markers used in the script. Group comparisons were made on these content and structural indices of playing house scripts at immediate post-test and at 3-week followup. No comparisons were made on language measures apart from those in the playing house scripts that were tied to the specific context in which the experimental group interacted with language-typical peer models.

Finally, two studies that focused on treating children with speech sound disorders also included language outcome measures.[134,141] These studies are described in more detail in the speech sound outcomes section. Almost and Rosenbaum[134] included mean length of utterance as an outcome measure of expressive language. Shelton and colleagues[141] included the Northwestern Syntax Screening Test[153] and the Auditory Association Subtest of the Illinois Test of Psycholinguistic Abilities as language outcome measures.

New Studies Reporting Speech Sound Outcomes

Three of the above described new studies of language outcomes included speech sound outcome measures as well.[125,129,130] In their study of broad target recast treatment, Yoder and colleagues[129] evaluated speech intelligibility measured as acceptable ("intelligible") word approximations in a 20-minute speech sample. Two other new studies examined outcomes related to phonological awareness.[125,130] Phonological awareness is the ability to recognize the variety of sound units that make up spoken words. Slow development of phonological awareness often occurs in children with other speech and language delays or disorders, and is associated with difficulty in the development of early literacy skills.[154,155]

Studies From the Previous Review Reporting Speech Sound Outcomes

Three of the trials described in detail above among studies with language outcomes also reported speech sound outcomes. Glogowska and colleagues[135] included a phonology error rate[156] to measure the impact of usual speech and language therapy services on speech sounds. Girolametto and colleagues[138] evaluated the effects of the Hanen Parent Program adapted to include focused stimulation of language targets on three measures related to speech sounds: syllable structure level, consonant inventory, and percentage of consonants correct. Robertson and Ellis Weismer[139] included a measure of percentage of intelligible utterances in their study of small group language therapy for late-talking toddlers.

Two additional trials focus primarily on speech sound outcomes,[134,141] although both included measures of language outcomes as well. Almost and Rosenbaum[134] evaluated the efficacy of a modified cycles approach to phonological therapy,[157] wherein rule-based errors in the child's speech sound production are treated through recursive cycles of therapy targeting particular rules (also known as phonological processes). In a trial of 26 children with severe phonological disorders, outcomes were measured for those randomized to the intervention group following 4 months of treatment. Speech sound outcome measures included the Assessment of Phonological Processing-Revised,[158] the Goldman-Fristoe Test of Articulation,[159] and percentage of consonants correct.

Shelton and colleagues[141] identified 45 preschoolers (mean of 47 months of age) through articulation screening, matched trios of children on a measure of receptive vocabulary, and then randomly assigned each member of the trio to 1 of 3 groups: a listening intervention that focused on speech sound discrimination activities, a reading and talking intervention that focused on storybook interactions, or control. Parents conducted activities with their children in the 2 active treatment groups for 57 days, for 5 minutes per day in the listening group, and 15 minutes per day in the reading and talking group. Speech sound outcomes included measures of speech sound discrimination in quiet and in noise, speech sound error recognition, and articulation.

New Studies Reporting Fluency Outcomes

Two newly identified studies focused only on fluency outcomes.[126,127] Both of these studies examined the Lidcombe Program of Early Stuttering Intervention.[160] The manual for the Lidcombe program can be downloaded from the Web site of the Australian Stuttering Research Centre (www.fhs.usyd.edu.au/asrc). In this program, parents are trained to provide differential verbal contingencies for stutter-free speech and for unambiguously stuttered speech for prescribed periods each day. In the original version of the program, the parent and child attend sessions with a speech and language pathologist for up to 1 hour per week during Stage 1 of the treatment while the parent learns and practices the contingencies, and learns to rate the severity of the child's stuttering. The speech-language pathologist also evaluates the child's stuttering during each weekly visit, using a measure of percentage of syllables stuttered. When the child is stuttering on less than 1 percent of all syllables uttered, the treatment progresses to Stage 2. During Stage 2, the parent gradually withdraws the contingencies, and clinic visits decrease in

frequency over a period of at least 1 year. If the child's percentage of syllable stuttered is above 1 percent for two consecutive visits, then the treatment returns to Stage 1 until stuttering again decreases to the criterion level.

Jones and colleagues[126] evaluated the Lidcombe program in New Zealand based on a trial that recruited 54 children between 36 and 72 months of age. The control group parents were told they would receive the Lidcombe intervention at the end of the trial should it prove to be efficacious and their children were still stuttering; they were also free to seek other treatment for their children during the trial, provided it was not the Lidcombe program. In violation of the protocol, 4 of the 25 children in the control group received some Lidcombe treatment; 3 others received alternative treatments for stuttering. Outcomes were measured at 9 months after randomization. The second study of the Lidcombe program was conducted in Australia, and involved telehealth delivery of the treatment.[127] The 22 included children were 36 to 54 months of age, with a history of stuttering for longer than 6 months, and no previous or current treatment for stuttering. Adaptations for telehealth delivery of the intervention included regularly scheduled telephone consultations in place of weekly clinic visits, videotaped demonstrations of the use of contingent feedback, parent training in rating stuttering severity via audiotaped speech samples and telephone conversations, audio recorded parent-child interactions mailed to the speech-language pathologist for evaluation of parent implementation, and audio recorded speech samples of the child mailed to the speech-language pathologist for computation of the percentage of syllables stuttered. Although parents of children in the control group were offered the Lidcombe program after the post-test, unlike in the Jones study, we do not know whether any families sought other treatment during the trial.

Studies From the Previous Review Reporting Fluency Outcomes

There were no included previously identified trials that measured fluency outcomes.

Detailed Synthesis of Prior Evidence With New Findings on Treatment

In synthesizing the evidence across studies, we first organized the trials based on the type(s) of outcomes reported—language, speech sounds, or fluency. Within each group of studies reporting the same type of outcomes, we considered treatment heterogeneity, including the agent (teacher/clinician, parent, peer), strategies, and dosage/intensity. We also considered the characteristics of the children, including age range, and their speech and language abilities and disabilities.

In our synthesis, we refer descriptively to the types of outcomes but in general do not name each specific outcome, to aid in readability. Details for results of specific outcome measures are given in Table 8. In addition, we characterize outcomes as statistically significant or nonsignificant, and we use Cohen's (1988)[161] conventions for referring to effect sizes as small, medium, or large, based on the variance explained by treatment group assignment. For Cohen's d, representing the distance in standard deviation units between two means, the conventions we used are small = 0.2 to <0.5, medium = 0.5 to <0.8, and large = 0.8 or larger. For odds ratios giving the differential likelihood of a dichotomous outcome, the conventions we used are small =

1.44 to <2.47, medium = 2.47 to <4.25, and large = 4.25 or larger. Although we use Cohen's conventions for characterizing effect sizes as small, medium, or large, we acknowledge and agree with the caution that these conventions may not be equated with the clinical significance of the differences.[162] When standardized effect sizes were provided in the publications, we used the reported effect size. For trials not reporting standardized effect sizes, we computed effect sizes when the published data permitted these computations.

Table 7 provides information on specific ages of children in the included trials. In the text, we use "toddlers" to refer to children under 3 years of age, and "preschoolers" to refer to children from 3 to 6 years of age.

Studies Reporting Language Outcomes

Eleven trials report on language outcomes (Table 8). Among these, 4 used parents as the primary intervention agent.[128,136,137,141] Two trials tested the impact of variations of the Hanen Parent Program[128,137] on outcomes of toddlers with language delays, with divergent findings of moderate to large effects favoring the treatment group on 5 of 6 expressive language outcome measures in the Girolametto et al. trial[137] (N = 25), contrasted with no significant differences and negligible effect sizes on 3 expressive language measures and 1 receptive language measure in the Wake et al. trial[128] (N = 301). Relative to Girolametto et al., the Wake et al. (2011) trial[128] provided a lower dosage of parent training (720 vs. >1,200 minutes), enrolled younger children (18 vs. 23 to 33 months of age) who were selected based on less stringent criteria for language delay (lowest 20th vs. lowest 5th percentile for expressive vocabulary), and did not include any home visits for coaching purposes, but did include some individual parent coaching at the end of the parent group meetings. In Girolametto et al., the parent group facilitators made 3 home visits. The differences in eligibility criteria for the 2 studies may be relevant to the divergent findings. Whereas Wake et al. consider the possibility that the tested treatment was not sufficiently intensive to produce an effect, they concluded that the null findings in their study were more likely due to natural resolution of the initial symptoms of delayed language, based on finding that the mean language scores were in the normal range (and very close to the standardized mean scores) for children in both groups at 3 years of age. Children in Girolametto et al., selected based on expressive vocabulary in the lowest 5th percentile, may have been less likely to experience a natural resolution of their language delays compared with those in the Wake et al. trial.

In a small trial involving parent training (N = 36), Gibbard et al.[136] tested group training for parents of toddlers (27 to 39 months of age) with limited expressive language. The total intensity of the intervention was relatively low, similar to Wake et al.[128] (780 to 975 minutes), although the parent group meetings in the Gibbard et al. trial were scheduled over a 6-month period, compared with a 6-week period in the Wake et al. (2011)[128] trial. The content of the training was focused on activities parents could do with their children to promote specific language objectives, an approach that seemed more similar to the Girolametto et al.[137] adaptation of the Hanen Parent Program than the Wake et al.[128] trial, which focused on more general language stimulation strategies. However, we could not fully assess the comparability of the content of the Gibbard et al. intervention to that of either adaptation of the Hanen Parent Program from information available in the publication or online. Similar to the results of Girolametto et al. and

in contrast to Wake et al., Gibbard et al. reported large effects across 7 language outcome measures, including 6 measures of expressive language and 1 of receptive language.

Shelton et al.[141] also had parents provide interventions for their children (27 to 55 months of age) in a small trial (n = 45 in 3 groups). They were primarily interested in the treatment of children with speech sound disorders; however, in addition to a Listening treatment group exposed to speech discrimination activities designed to target speech sound outcomes, they included a second Reading and Talking treatment group in which parents read and talked about storybooks with their children, a treatment that might be expected to positively impact children's language outcomes. No significant effects were found for either treatment group compared with the control group on expressive syntax (small effect sizes favoring the control group compared with the Listening group, and favoring the Reading and Talking group compared with the control group). Also, no significant effects were found on an auditory association measure tapping children's semantic knowledge (medium effect sizes in favor of the Listening group compared with the control group, as well as for the Reading and Talking group compared with the control group).

Two trials tested treatments primarily or exclusively delivered in a small group format with toddlers[140] and preschoolers[125] with speech and language delays or disorders. In addition to small group intervention, the Fricke et al. trial included two 15-minute individual treatment sessions per week during the last 20 weeks of the 30-week program. The intensity of both interventions was relatively high, 2,850 total minutes in the Fricke et al. trial[125] and 1,800 minutes in the Robertson and Ellis Weismer trial.[139] In both studies, the researchers specified the components of the intervention and trained the interventionists (teaching assistants in Fricke et al., and speech-language pathologists in Robertson & Ellis Weismer) to implement the program. Both trials reported significant and large effects on measures of language skills. Fricke et al. also reported a significant but small effect for a construct measuring narrative language.

Four trials reporting language outcomes tested treatments provided to children on an individual basis by research staff or speech-language pathologists,[129,135] but are not otherwise very comparable to one another. Glogowska et al.[135] examined the effects of providing young children (18 to 42 months of age) with clinically significant delays in language or phonological development immediate access to usual speech-language therapy services in the community. Over the 12 months of the trial, children received an average of 372 minutes of treatment and showed significant but small gains relative to the control group in receptive language, with a small effect size (d = 0.3), but did not differ at the end of treatment on expressive language measures, for which effect sizes were negligible. Wake et al. (2013)[130] tested a manualized intervention for 4-year-olds with specific language impairments that included a focus on phonological awareness, print awareness, and letter knowledge for all children but also addressed individualized language goals based on the children's respective profiles of language impairments. Children received an average of 1,020 minutes of treatment over a 30-week period (approximately 7 months). The intervention had no significant effect on the primary outcomes of expressive or receptive language, or on the secondary outcome of pragmatic language, with small to negligible effect sizes for all three variables. Yoder et al.[129] tested the effects of an intervention strategy called recasting (repeating what is said by a child, but with correct articulation or with a grammatical expansion of the child's utterance). The total amount of

treatment was 2,340 minutes, provided over 6 months. The intervention had no significant effect on the outcome measure of language (mean length of utterance); the publication did not report data sufficient to allow for the computation of an effect size. Yoder et al. reported an interaction between the treatment group and the pretreatment articulation skills of the child, with a significant treatment effect on mean length of utterance at post-test and at followup for children with the lowest baseline articulation skills. Almost et al.[134] tested whether an individualized treatment for children with speech sound disorders had an impact on the language outcome measure of mean length of utterance, but found no significant language effect (small effect size). More information about this study is provided in the following section.

Finally, the trial in which preschoolers with language impairments play with peers with age-appropriate language skills in the house play area of the preschool classroom at least four times over a 3-week period found large and significant effects on four measures of expressive language taken from samples in which the children were asked to specifically talk about playing house.[140]

Studies Reporting Speech Sound Outcomes

We included eight trials that reported outcomes related to speech sounds (measures of articulation, phonology, phonological/phonemic awareness or intelligibility)[125,129,130,134,135,138,139,141] (Table 8). All of these trials also reported language outcomes.

For 2 trials, the treatment was parent-mediated. Giralometto et al.,[138] examined speech sound outcomes in addition to language outcomes for toddlers whose parents participated in the modified Hanen Parent Program. They reported significant effects on consonant inventory and syllable structure for the treatment group compared with the control group, and the effect sizes were large in both cases. Although parent-mediated, the approach examined by Shelton et al.[141] was quite different in content. The primary research question in their study was whether children (27 to 55 months of age) would benefit from a Listening treatment in which parents focused the child's attention on consonant sounds in syllables and words and engaged the child in activities directed at discrimination of sounds, including correctly and incorrectly articulated sounds. The total intensity of the treatment was 1,425 minutes, delivered 5 minutes per day 5 days per week for a total of 57 sessions. One significant difference emerged in comparing the Listening treatment with a control condition: children in the control condition made more improvements in auditory discrimination in noise. Although effects on articulation were nonsignificant, there was a medium-sized effect in favor of the Listening group on one articulation measure (Templin-Darley Articulation Screening Test), but only a small effect on a second articulation measure (McDonald Screening Deep Test of Articulation). Shelton et al. also reported results on articulation measures for the Reading and Listening treatment described under language outcomes; this group did not differ significantly from the control group on articulation outcomes, with small effects for both measures. Further, the effect favored the control group for one measure (McDonald Screening Deep Test of Articulation).

Robertson and Ellis Weismer[139] evaluated a speech sound outcome (i.e., the percentage of intelligible utterances) for toddlers who participated in their small group speech and language program provided by speech-language pathologists. They found a significant effect of large magnitude in favor of the treated children compared with controls.

Two studies examined effects on speech sounds for children treated individually by speech-language pathologists. Almost et al.[134] examined the effects of a now well-known "cycles" approach to phonological therapy for preschoolers with severe phonological disorders. The treatment was provided by speech-language pathologists in 30-minute sessions twice a week across 4 months (total of 1,040 minutes of treatment). There were significant effects with large effect sizes on three speech sound outcome measures including two standardized tests as well as the percentage of consonants correct during a speech sample. Glogowska et al.[135] found no improvement in phonology error rate for young children randomized to get usual community speech-language pathology services for a year; however, after 12 months, treated children were 2.7 times more likely than control children to no longer exhibit the criterion severity of speech sound problems used to initially select children eligible for the trial, a significant effect of medium size. As mentioned above, the total average amount of treatment time in that trial was less than 7 hours.

The Yoder et al. individual treatment trial[129] with preschoolers included a strategy called a "speech recast," which involved repeating a child's incorrect speech production with correct articulation. There were no main effects of treatment on child intelligibility; however, there was an interaction between treatment and the pretreatment articulation skills of the child, with a significant treatment effect on intelligibility at followup for children with the lowest baseline articulation skills.

Two studies that focused primarily on language outcomes examined the impact of speech and language interventions on phonological/phonemic awareness skills as secondary outcomes for preschoolers.[125,130] The study by Fricke and colleagues,[125] in which preschoolers participated in small group and individual speech and language lessons delivered by teaching assistants, found significant effects with a small to medium effect size both in the immediate posttests as well as at a 6-month followup for a construct representing measures of phonemic awareness. Phonological awareness also was measured in the study by Wake et al.[130] (2013) in which language assistants provided individual home-based intervention focusing on language and emergent literacy skills to preschoolers with language impairments, with findings of a significant effect of moderate size on this outcome.

Studies Reporting Fluency Outcomes

Two trials focused only on fluency outcomes[126,127] (Table 8), examining the Lidcombe Program of Early Stuttering Intervention.[160]

Jones and colleagues,[126] who delivered the treatment to parents and their children 3 to 6 years of age in a clinic setting, found the Lidcombe group showed a greater decrease in the percentage of syllables stuttered than the control group after 9 months; children in the Lidcombe group were almost 8 times more likely to have reached the criterion of stuttering on less than 1 percent of syllables. The odds ratio for this finding is large, with children in the Lidcombe program 7.7 times more likely than those in the control group to stutter on less than 1 percent of syllables after 9 months.

The Lewis et al. trial[127] using telehealth delivery of the Lidcombe program to parents and their

preschool children found the treatment group showed a significantly greater reduction in the percentage of syllables stuttered, 69 percent less than in the control group (95% CI, 13 to 89).

Key Question 6. Do Interventions for Speech and Language Delay or Disorders Improve Other Outcomes?

Summary of Newly Identified Evidence on Other Outcomes

We identified three trials that met the inclusion criteria, contribute evidence relevant to this KQ, and were not included in the previous review.[125,128,130] All three trials examined speech or language measures as primary outcomes and thus they were included in the synthesis of evidence related to KQ 5 above (Table 7).

Study Characteristics of Newly Identified Evidence on Other Outcomes

Two newly identified trials, both rated fair quality, measured outcomes related to literacy.[125,130] One of these trials also included a secondary measure of health-related quality of life.[130] That trial and one other,[128] included outcomes related to child problem behaviors.

Description of Previously Identified Studies on Other Outcomes That Continue to Meet Current Inclusion and Quality Criteria

Two previously identified studies met inclusion criteria for the current review[135,139] and provide evidence relevant to this KQ. Both also measured speech or language outcomes and thus were included in the results for KQ 5 above. Glogowska et al.[135] measured well-being, attention level, play level, and adaptive socialization skills as secondary outcomes. Robertson and Ellis Weismer[139] measured adaptive socialization skills and parental stress as outcomes.

Detailed Synthesis of Prior Evidence With New Findings on Other Outcomes

Two trials examined the effects of language treatments on socialization, either among children receiving community-based speech-language pathology services,[135] or among language-delayed toddlers receiving small group therapy.[139] The former trial produced no significant differences between treated and control children in socialization outcomes, whereas the latter produced significant differences in favor of the treated children, with large effect sizes.

Of the two trials reporting outcomes related to child behavior problems, one was a low-intensity parent group program for parents of slow-to-talk toddlers,[128] and the other provided up to 18 one-hour in-home speech and language treatment sessions for preschoolers with specific language impairment, with the sessions conducted by a language assistant.[130] Neither found treatment to have a significant effect on children's problem behaviors, with very small effect sizes. Similarly,

two trials, reporting secondary outcome measures of well-being (with toddlers)[135] and health-related quality of life (with preschoolers),[130] reported nonsignificant effects of treatment and very small effect sizes in both cases.

Contrasting with these null findings, two trials measured outcomes related to emergent literacy skills for speech and language treatments conducted with preschoolers,[125,130] and found significant improvement in letter knowledge in both cases, with small effect sizes. Although one of these studies failed to find a significant treatment effect for a broader construct of literacy,[125] the researchers did find a significant treatment effect of moderate size on a measure of reading comprehension first administered at a 6-month followup. Further, these differences were mediated by differences in oral language associated with being in the treatment group. Several other outcomes were examined only in single trials. Glogowska et al.[135] found no significant advantages in favor of toddlers randomized to receive speech-language pathology services versus those in the control condition on measures of well-being, attention level, or play. Robertson and Ellis Weismer[139] found that parents of language-delayed toddlers randomized to participate in small group language therapy reported significantly greater improvements in parental stress than parents of toddlers in the control condition; the effect size for this finding was large.

Key Question 7. What Are the Adverse Effects of Interventions for Speech and Language Delay or Disorders?

Three studies examined potential adverse effects of interventions.[135,139] The small group intervention study conducted by Robertson and Ellis Weismer found greater improvement in parent stress, as measured by the Parental Stress Index in the intervention group. Glogowska et al. found no differences in well-being between a group receiving individual treatment and controls,[135] and Wake et al.[130] found no differences in health-related quality of life.

Chapter 4. Discussion

Below, we summarize the findings of the 2006 report[64] about screening preschool children for speech and language delay. We note the 2006 USPSTF recommendations and comment on the implications of this new synthesis for previous conclusions. Then we discuss the context for these updated results, applicability, limitations of the review and the literature, research gaps, and conclusions.

Overall, the USPSTF issued an I statement following the 2006 review, concluding that "the evidence is insufficient to recommend for or against routine use of brief, formal screening instruments in primary care to detect speech and language delay in children up to 5 years of age."

Speech and language delay affects 5 to 8 percent of preschool children, often persists into the school years, and may be associated with lowered school performance and psychosocial problems. The USPSTF found insufficient evidence that brief, formal screening instruments that are suitable for use in primary care for assessing speech and language development can accurately identify children who would benefit from further evaluation and intervention. Fair evidence suggests that interventions can improve the results of short-term assessments of speech and language skills; however, no studies have assessed long-term outcomes. Furthermore, no studies have assessed any additional benefits that may be gained by treating children identified through brief, formal screening who would not be identified by addressing clinical or parental concerns. No studies have addressed the potential harms of screening or interventions for speech and language delays, such as labeling, parental anxiety, or unnecessary evaluation and intervention. Thus, the USPSTF could not determine the balance of benefits and harms of using brief, formal screening instruments to screen for speech and language delay in the primary care setting.

Summary of Review Findings

Key Question 1

The 2006 report found no studies that met the inclusion criteria to answer this question. Although one new RCT met our inclusion criteria[70,71] by randomizing a large national sample of children who received regularly scheduled care at child health centers to early screening and measuring outcomes in both groups at 8 years of age, the study was not included in our analysis because it was rated as poor quality due to various flaws. The most serious is the large attrition, with fewer than 60 percent who were fully screened and about half of the fully screened group who contributed outcomes. The study obtained outcomes on an even smaller percentage of children in the control group. Other flaws included not using a standard instrument for measuring speech and language at the endpoint but rather a more indirect measure based on self-report and then not conducting an analysis that considered other possible diagnoses that may have occurred unevenly in the two groups over the long followup influencing the findings, including autism spectrum disorder and other developmental or emotional delays or disorders. Nevertheless, we acknowledge the difficulty in conducting and maintaining a study of this kind (Table 9).

Key Question 2

The 2006 review examined several aspects of the question of whether screening evaluations in the primary care setting accurately identify children for diagnostic evaluations and interventions. The first was whether identification of risk factors improves screening. The 2006 review found 16 studies that met their inclusion criteria, and concluded that a small number of characteristics such as male sex, family history, and parental education were linked to language delay. We discuss these and other risk factors as part of Contextual Question 2. However, we found no studies that used these risk factors to improve accuracy. Nor did we find any studies that examined the role of child race and ethnicity on the accuracy of speech-language screening results.

The second and third subquestions addressed screening techniques, how screening differed by age, screening accuracy, and how accuracy differed by age. The 2006 review evaluated the performance characteristics of instruments to screen for speech and language delay. This review included studies of instruments that took 30 minutes or less to administer. The included studies were generally focused on children 5 years of age and younger who did not have a previously diagnosed condition such as autism, mental retardation, or orofacial malformations.

The 2006 review included a total of 43 studies that described 32 instruments taking no more than 30 minutes to administer (the 2006 review counted a study[90] with two sub-studies as two separate studies; we count it as one study). In the good or fair studies of instruments, sensitivity for detecting a speech or language delay ranged from 17 to 100 percent and specificity for detecting typical language ranged from 45 to 100 percent. The previous review further identified the Early Language Milestone Scale, Clinical Linguistic and Auditory Milestone Scale, Language Development Survey, SKOLD, and Levett-Muir Language Screening Test as the 5 instruments with the highest sensitivity and specificity. However, the reviewers concluded that the best methods and ages for screening could not be determined from the studies included in the review due to a number of factors (e.g., instruments were not designed for screening or lacked comparisons across populations, venues were outside the primary care setting, speech and language delay has no gold standard reference).

The fourth subquestion examined the optimal ages and frequency for screening. No studies addressed this question.

The USPSTF found insufficient evidence that brief, formal screening instruments that are suitable for use in primary care for assessing speech and language skills can accurately identify children who would benefit from further evaluation and intervention.

Implications of the New Synthesis on Prior Conclusions on Screening

Of the 42 studies (43 articles) identified in the 2006 review, 16 studies (17 articles) continued to meet the inclusion criteria for this update and were determined to be of good or fair quality.[54,91-95,97-100,102-106,108,122] We only included studies that provided accuracy statistics or data that allowed us to calculate it. We were stricter in determining whether a study met the population inclusion criteria. We excluded any studies where some children in the studies were outside the

age range or had a previously diagnosed condition and the study did not stratify for age and condition. We also used the most recent USPSTF criteria for determining quality of studies. To these 16 studies, we added an additional 8 newly found studies (9 articles). In doing so, we were able to address one identified limitation of the previous review, namely, the lack of studies comparing the same instrument in different populations. We also examined the studies in our review by considering parent-rated screeners separately from screeners that are administered by trained examiner, including those in primary care. The current review also included one study that examined screening of preverbal language[88] (Table 10).

Altogether there were 14 studies (in 16 articles)[54,72-78,88,95,98,102-104,108,122] that examined the accuracy of screening instruments in which parents rated their young children's speech and language skills. Sensitivity ranged between 50 and 94 percent, and specificity ranged between 45 and 96 percent.

Nine of the parent-rated screener studies (11 articles) examined 3 instruments widely used in the United States—the ASQ Communication domain, the CDI, and the LDS. Several of these screeners exhibited LRs, suggesting that there is a moderate to large increase in the likelihood of language delays in children who screened positive or a moderate to large decrease in the likelihood of language delays in children who screened negative. Although the LRs tended not to be consistent across all studies that included a particular screener, both the positive and negative LRs were moderate to large, in 2 studies examining the CDI.[74,76,77] Another parent report screener, the ITC, is also used in the United States but with a somewhat younger population (i.e., 6 to 24 months of age).

Because the ASQ and CDI have versions for infants, toddlers, and preschool-age children, we were able to examine the accuracy of the instrument at different ages. Studies examining the ASQ with children 2 years of age,[74] 3.5 years of age,[73] and 4.5 years of age[72] reported comparably low sensitivity at all 3 ages (ranging between 50 and 59 percent), and better specificity for the 2- and 3.5-year-old samples (95 and 92 percent) compared with the older sample (79 and 83 percent). These results suggest that use of the ASQ for screening for language delays, especially in preschool-aged children may result in many false negatives. Comparisons indicated that sensitivity and specificity of the toddler and preschool CDI versions were fairly close, suggesting that the CDI is robust in its ability to detect a language delay across the toddler and preschool years. The study examining the ITC subdivided the sample into two age groupings—younger and older toddlers. Sensitivity, specificity, and LRs were nearly identical in the 2 age groupings.

However, it is also the case that accuracy over time diminishes somewhat. Two studies (in four articles)[76,77,98,122] examined the accuracy of the parent-report screeners completed by parents of children 2 years of age in relation to language assessments administered to the children at both 2 and 3 years of age. In one study[122] that evaluated the LDS, sensitivity was reduced after a year, but specificity remained the same at 2 and 3 years of age. In the second study[76,77] that evaluated the ELFRA-2, the German version of the CDI, sensitivity was about the same at 2 and 3 years of age, but specificity was reduced at 3 years. Forty-four percent of the children who had been classified as having a language delay at 2 years of age had typical language at 3 years of age. The reduction in specificity over time illustrates the finding that some children with language delays

will "catch up" and display more typical language skills with development.[3]

We reviewed 12 studies[72,86,91-94,97,99,100,103,105,106] that examined the accuracy of screening tests administered by trained examiners, all but 2 of which require direct testing of the child. The variability in accuracy across these instruments was greater than for the parent-rated instruments; sensitivity ranged between 17 and 100 percent and specificity ranged between 48 and 100 percent. Several of the trained examiner screeners also had moderate or large likelihood ratios indicating increase in the likelihood of a language delay for those who screened positive or a decrease in the likelihood of a language delay for those who screened negative. Many of the screening instruments performed as well as the parent-rated instruments, but aside from the DDST (now known as the Denver II), most are not used in primary care offices and would require a dedicated, trained professional or paraprofessional to directly test the child. The study of the DDST, with the original version of the instrument, found excellent specificity (100 percent) but poor sensitivity (46 percent); no studies provided information on the accuracy of the language component of the current version.

Because few studies of screening instruments administered by trained examiners examined the same instrument with different populations or with different ages, it is unclear how multiage instruments fare more broadly or whether there is an optimal age for screening. We were only able to examine cross-age accuracy with two instruments that are published and used in the United States. Two studies[92,105] examined the FPSLST with children 3 years of age and children 4 to 5 years of age. Whereas specificity was greater in the study[105] with older children (ranging from 85 to 95 percent in two samples with two reference measures each), compared with the study of the younger children[92] (81 percent), sensitivity was generally low in both studies (ranging from 17 to 74 percent in the older cohort and 60 percent in the younger group).

A second study[93] that reports on an instrument (the SKOLD) designed for children 2 to 5 years of age provided separate accuracy statistics for each three age groups (2.5 to 3, 3 to 3.5, and 3.5 to 4 years of age), and separately for speakers of African American dialect and standard English, generally found excellent sensitivity and specificity for each age and linguistic group. Although the accuracy of this instrument suggests that it is a good candidate for screening children 2.5 to 4 years of age, particularly with speakers of African American dialect, its widespread utility may be limited by the necessary training. The developers of the instrument[93] caution that, "For successful administration and scoring, screeners need an understanding of normal and impaired language development, Black English, and familiarity with administration and scoring procedures of SKOLD. Ideally, paraprofessionals should be trained by speech-language pathologists in the above areas."

The 2006 review concluded that despite the availability of brief screeners, screening for speech and language delay has serious limitations (e.g., optimal screening methods had not been established, an accepted gold reference standard was lacking, data comparing a screener across different populations and different ages were limited, and sensitivity and specificity varied). With the addition of 8 newly identified studies and the exclusion of 14 of the 35 studies from the 2006 review, the evidence in this review differs somewhat. We identified several studies that speak to accuracy of the CDI and LDS in multiple populations and multiple ages. Although there is no gold standard for speech and language assessment, the reference standards used in these

studies are well-regarded instruments that speech-language pathologists routinely use. The sensitivity and specificity of these instruments are acceptable,[163] and because parents complete these screeners, adopting them in a screening program should not burden a primary care practice with training someone in test administration. The findings related to the CDI and LDS point to the importance of involving parents in identifying young children with speech and language delays and disorders. In addition, each of these instruments focus on language, and the more extensive information that parents provide specifically related to their children's language skills may help explain the fact that the CDI and LDS are more accurate in identifying children with speech and language delays or disorders than broad-based screeners that include fewer items to screen for speech and language problems. In summary, this synthesis yields evidence that two parent-rated screeners, the CDI and LDS, would likely be interpreted with little difficulty in the primary care setting and can accurately identify children for diagnostic evaluations and interventions.

Key Question 3

The 2006 review found that no studies addressed the question of adverse effects of screening. The authors suggested potential adverse effects such as false positive and false negative results, which would have deleterious consequences such as erroneously labelling a child with typical speech and language as having a delay or disorder, or missing a child with a true speech and language impairment who fails to benefit from timely intervention services. We found no studies addressing this question either and thus have no evidence.

Key Question 4

The 2006 study found no studies examining the role of enhanced surveillance by a primary care clinician once a child demonstrates clinical concern for speech and language delay. We asked a related question, "Does surveillance (active monitoring) by primary care clinicians play a role in accurately identifying children for diagnostic evaluations and interventions?" and found no evidence to answer this question.

Key Question 5

Prior Review Findings and USPSTF Recommendations on Speech and Language Outcomes of Treatment

In the 2006 review, studies evaluated the effects of individual or group interventions that were directed by clinicians or parents focusing on specific speech and language domains. These domains included expressive and receptive language, articulation, phonology, and syntax. Interventions were short-term, commonly lasting from 3 to 6 months, and took place in speech and language specialty clinics, community clinics, homes, and schools. Outcomes were measured by subjective reports from parents and by scores on standardized instruments.

Eight fair- or good-quality studies focusing on the treatment of children 3 years of age or younger found mixed results, with 5 studies reporting improvement on a variety of speech and

language domains, including clinician-directed treatment to improve expressive and receptive language delay, parent-directed therapy to improve expressive delay, and clinician-directed therapy to improve receptive auditory comprehension. Results were also mixed among 7 fair-quality studies focusing on children from 3 to 5 years of age; 5 found significant improvement and 2 reported no differences.

Implications of the New Synthesis on Prior Conclusions on Treatment

The previous evidence synthesis reported significant effects of treatment on speech and language outcomes across the age range of 2 to 5 years, although significant findings were not universal across included trials. We did not include 6 of the earlier included studies in the new synthesis because we considered them to be comparative, examining the relative merit of a new intervention to treatment as usual. One newly identified trial was unique in examining the treatment of children who were all below 2 years of age;[128] no significant effects on language outcomes were detected, but it is not possible to evaluate whether this finding was related to the young age of the children or other factors.

The evidence of maintained benefits of a school-based language treatment program for preschoolers with low language scores[125] is an important addition to this updated synthesis. This new synthesis also adds evidence from two small trials for the potential effectiveness of treating preschool children who stutter, with both trials testing the same treatment, the Lidcombe Program of Early Stuttering Intervention.[126,127] Thus, there is some cumulative evidence for benefits of targeting outcomes in the areas of language (6 of 11 trials reporting significant positive results), speech sounds (6 of 8 trials reporting significant positive results), and fluency (2 of 2 trials reporting significant positive results) among toddlers and preschoolers with speech and language delays or disorders.

The addition of new evidence to the prior synthesis related to the treatment of speech and language concerns in children does little to bring clarity to the question of the characteristics of effective treatments. Two of the three largest trials included in this synthesis, and the only two of good quality, reported limited to no benefits associated with treatment.[128,135] A potential explanation for these results is that the trials examined the lowest-intensity treatments evaluated in any of the studies included in this synthesis (around 6 hours of individual speech and language therapy in one case, and 12 hours of parent group meetings in the other case). The addition of findings from a second trial of low-intensity treatment after the previous synthesis provides additional reasons to question the benefits of such low-intensity treatments for young children with speech and language delays. However, because the heterogeneity across the included studies related to many factors in addition to intensity, it is not possible to be certain that treatment intensity explains the null findings. In fact, one trial of parent groups treatment entailing only 13 to 16 hours of parent group meetings produced large effects on language outcomes,[136] and another study that provided the second most intense treatment of any of these trials (as individual treatment) found no main effects on child language or intelligibility.[129] Thus, intensity alone cannot account for either positive or null findings among these trials.

This synthesis also includes a study that identified an interaction between a baseline characteristic of children and the response of children to a particular treatment strategy (i.e.,

recasting).[129] Although the generalizability of this specific finding is limited, it is the only evidence related to the benefits of matching treatments to individual child characteristics. Given the improbability that a treatment for any condition will benefit everyone with the condition, there is a need for such evidence.

In this synthesis, we grouped outcome measures into the broad categories of language, speech sounds, and fluency. Although we generally would anticipate correlations of at least moderate size among different measures within one of these broad categories (e.g., children who are slow to acquire vocabulary generally will also have relatively short mean lengths of utterances; children who make many errors on consonant sounds generally will be less intelligible than children who make few errors), the strength of these correlations for any given subpopulation of children with speech or language disorders is an empirical question. That is, we cannot assume that one measure within a category such as language will be equivalent to another measure in that category, or that the effects of a treatment on one measure will be generalizable to other measures within the outcome category. Across the trials that report outcomes within the categories of language and speech sounds, diverse outcome measures are used, with no single measure used in a majority of trials. For example, among the trials that report on language outcomes, the measure used the most is mean length of utterance, an index of expressive language structural complexity; however, this measure is used in only 4 of 10 trials reporting language outcomes.

The trials also vary in the way outcomes are reported; for example, most trials omitted information about effect sizes, and some did not report the statistics needed to compute effect sizes. In a few cases, outcome measures are reported that speak directly to clinical significance, such as the relative number of children in treatment versus control who reduced stuttering to less than 1 percent of syllables,[126] or improvement on the clinical criteria used for study entry.[135] In most cases, however, outcomes are not reported in terms that are easily interpreted with respect to their clinical or functional impact.

In summary, the majority of the 13 trials that met inclusion criteria for this synthesis offer evidence supporting the effectiveness of treating speech and language delays and disorders in young children. Positive findings have emerged from studies examining various service delivery models, including individual and small group treatment, and various intervention agents, including parents supported/trained by professionals, speech-language pathologists, and trained teaching or therapy assistants. Null findings are also reported for some included trials reporting language outcomes and speech sound outcomes. Confident interpretation of this body of evidence on the treatment of speech and language is limited by multiple factors, including a) the small size of many of the trials, which constrains the examination of moderators and mediators of treatment effectiveness; b) the lack of replicated positive findings for any treatment approach except the Lidcombe program for stuttering; c) the wide variability across trials in the age of children treated, intervention agents (e.g., speech-language pathologists, teaching assistants, parents, research staff), intensity, content, and strategies; d) the relatively small number of trials that have examined manualized treatments or otherwise provide enough details of the treatment approach to permit replication; e) a corresponding lack of reporting of treatment fidelity in many trials; and f) the lack of common outcome measures and the inconsistency in how results are reported across trials. Due to these constraints, the current body of evidence does not lend itself

to meta-analysis and offers little guidance related to the specific factors associated with effective treatments for young children with speech and language delays or disorders.

Key Question 6

Prior Review Findings and USPSTF Recommendations on Other Non-Speech and Language Outcomes of Treatment

In the 2006 review, four good- or fair-quality studies included functional outcomes other than speech or language. However, the interventions and outcomes varied across the studies and lacked appropriate comparison cohorts. The 2006 review also examined "additional" outcomes and cost-effectiveness issues but did not find any studies that addressed these questions.

Implications of the New Synthesis on Prior Conclusions on Other Outcomes

As in the previous synthesis, few trials have examined other outcomes of speech and language treatment of children (i.e., outcomes beyond speech and language). One new trial provided evidence supporting the contributions of oral language to proficiency in early reading comprehension.[125] Although this is widely assumed to be the case based on prior longitudinal correlational research, the trial provides better evidence for a causal relationship. The other outcomes measured in the four trials including nonspeech and nonlanguage outcomes are disparate, and thus allow no synthesis of findings across studies.

Key Question 7

Prior Review Findings and USPSTF Recommendations on Adverse Effects of Interventions for Speech and Language Delay or Disorders

The 2006 review found no studies that addressed this question. The update found insufficient evidence to address this question (one outcome in each of two studies).

Applicability of Findings

The included studies have mixed applicability for primary care settings. In a few studies, screening occurred in primary care settings,[78,86,99,100,103] and in two cases, primary care providers administered the screening to the children.[86,103] It should be noted that none of these studies occurred in the United States, and the extent to which conclusions reached from screening in primary care settings in Sweden, Australia, and the United Kingdom is transferable to primary care settings is the United States is not known.

Other settings for screenings included early child care centers, preschools, and elementary schools; developmental evaluation centers; university research labs; and hospitals. Whether it is realistic for screening to occur in another setting and to have the results sent to a primary care provider is not known, although with training and supervision, a staff member in the primary

care setting could administer some of the screeners. In some studies, parent-rated screeners were completed at home and mailed or brought to the investigator, and in other cases, they were completed when the child was seen for the administration of the reference test. Either of these settings appears to be applicable to the primary care setting. However, aside from the ASQ, which is used in the primary care setting, the other parent-rated screeners have not been widely adopted in the United States.

Most of the intervention trials (8 of 12) were conducted in countries other than the United States: three in the United Kingdom,[125,135,136] two in Australia,[127,128,134,137,138] and one in New Zealand.[126] As with the screening studies, whether conclusions reached from trials conducted in countries with different medical, health insurance, and school systems is an open question.

Many screening studies only examined accuracy on a subset of children—those who failed the screener and either a random selection of children who passed or a separate cohort of children with typical language. The applicability to an unselected group of children in a primary care setting is not known; however, it is highly likely that the positive predictive value and the negative predictive value that we calculated are inaccurate due to an incorrect prevalence estimate. An important next step is to conduct screening studies with a general population of preschoolers, whereby the prevalence of language delay is closer to the 8 percent found in prevalence studies.

There is also mixed applicability for the interventions in community settings. One study explicitly tested the effectiveness of immediately referring young children identified with speech or language delays/disorders to usual community speech-language therapy services against a control condition (watchful waiting).[135] This test is valuable in providing information on whether it likely is to be helpful for a primary care provider to refer children with speech and language delays or disorders for speech-language pathology treatment. However, the question this study answers is similar to asking, “Is it effective for a person with symptoms of illness to go to a physician?” Speech-language pathology services entail a diversity of treatments that are individualized to a child’s symptoms and ability to participate in different types of intervention, and also will be influenced by the training, experiences, and preferences of the speech-language pathologist serving the child. The rigor of an RCT is unlikely to be relevant to clinical treatment, where it is important to recognize the individual’s needs.

Some trials have evaluated manualized programs for which resources and training are available (e.g., Lidcombe, Hanen, the cycles approach to phonological therapy tested in Almost). Using Hanen requires certification, which is relatively expensive (Appendix F). The treatments used in most trials would be difficult to replicate in the community due to insufficient published information on the program, as well as the difficulty that community practitioners have in accessing information in many peer-reviewed journals.

Context of Findings

Techniques for Screening for Speech and Language Delay or Disorders and Differences by Age and Cultural Background

In the 2006 review, the question concerning techniques for speech and language screening was examined as part of addressing accuracy in KQ 2. The 2006 review, which considered all techniques taking 30 minutes or less to complete as having potential for screening, found 43 papers describing the characteristics of 51 speech and language screeners. The conclusion was that there was no gold standard, and that studies using these instruments provided limited details of participants.

In the current review, we limited our focus to instruments that either take no more than 10 minutes to administer in the primary care facility or could be interpreted in 10 minutes or less, if administered outside the primary care practice. We also limited it to instruments that we used to address KQ 2. We found 20 studies that described instruments that met criteria for addressing KQ 2. Descriptions of the screening instruments are found in Table 4. Both parent-rated and trained examiner tools are included, with the latter appropriate for children who are somewhat older.

Risk Factors Associated With Speech and Language Delay or Disorders

We searched the evidence for consistent, reliable, and valid risk factors that clinicians could use to identify children at highest risk for speech and language delay (Tables10 and 11). The ability to stratify children reliably by risk could promote efficiencies in screening activities, ideally assisting in earlier identification of children with speech and language disorders that would translate into earlier intervention and improved speech and language outcomes. Predicting those at high risk for speech and language disorders is complicated, however, by the many types of speech and language disorders, heterogeneity in populations across studies, inconsistent identification of potential risk factors across studies, and inconsistent adjustment for potential confounders (other characteristics that may simultaneously be related to the risk of a child having a speech and language problem). To adjust for confounders, all but six studies[165-170] included multivariate analyses of cohorts or a case control design. We limit our report of cohort studies to their multivariate findings, where available.

Evidence for valid risk factors is also limited by lack of discussion of causal links describing how an associated risk factor may lead to a speech or language delay. For example, male gender is listed as a risk factor for speech and language delay in a number of studies, but it is unclear how and why male gender may contribute to speech and language delay. We aimed to update the evidence on risk stratification.

Our review includes 38 studies conducted in 28 cohorts and 1 review of studies on characteristics of late-talking toddlers.[171] Twenty-one of the cohorts were English-speaking and 7 were non-English-speaking.

Among studies in English-speaking populations, sample sizes ranged from 60[165] to 11,383[172] subjects. Most studies evaluated outcomes measuring language delay with or without speech delay; speech and language outcome domains included expressive and receptive language and vocabulary, number of words, early language and communication difficulty, stuttering, and parental report of speech and language impairment. Male sex was a significant risk factor in 11

of the 14 studies examining it.[83,167,173-181] Only in one large cohort study of children 5 years of age in Britain did male sex decrease the probability of both specific language impairment and nonspecific language impairment.[46] In these multivariate analyses, proximal factors such as overcrowding, the child being in preschool, and the parent being a poor reader were found to be significant risk factors for poorer outcomes. Family history of speech and language impairment was also a consistent risk factor, significantly associated with delay in 7 of 9 studies.[166,168,173,175,176,178,182] However, family history was generally measured by self-report and described nonspecifically as members who were late talking or had language disorders and speech problems. Family history was not found to be a risk factor for stuttering onset in one cohort, measured at 3 and 4 years of age.[177,181] Parental education had an inconsistent association with speech and language delay. Nine of 15 studies reported a significant association between lower parental education level (either mother or father) and speech and/or language delay.[46,167,168,172,173,179,182,183] The study of risk factors related to stuttering onset found that stuttering was associated with the mother having a higher level of education.[177,181] Other risk factors identified in 2 or more studies among English-speaking populations included lower socioeconomic status, earlier identified speech and language delays, poorer parenting practices, greater parental stress, and poorer maternal mental health. Minority race was significant in 2 of the 5 studies that examined it.[180,184]

Four studies examining speech and language delay in preterm birth cohorts, measured at between ages 18 months and 4 years of age; studies mostly examined nonoverlapping sets of risk factors.[83,180,184,185] However, two of the studies found that males were at higher risk for poor outcomes.[83,180] Perinatal risk factors were inconsistently measured across other cohorts and included prematurity, low birth weight, born late in the family birth order, less breastfeeding, alcohol consumption during pregnancy, and younger maternal age at birth. Perinatal factors determined to be risk factors in at least one study that measured them were binge drinking, prematurity, low birth weight, and maternal age.

The 13 studies assessing risk in non-English-speaking populations, conducted in 8 cohorts, included sample sizes from 24 to 42,107 and evaluated various types of delay including vocabulary, communication, word production, speech, stuttering, and expressive and receptive language. Significant associations were reported in 5 studies in 4 cohorts evaluating risk associated with male sex[57,58,186,187] and 2 studies evaluating family history of speech and language concerns.[187,188] Perinatal risk factors were examined in a Netherlands study comparing a preterm and term cohort; the study found prematurity to be associated with communication delays at 4 years of age.[186,189-191] Several studies, including one based on a large Finnish cohort (N = 8,276) found that low birth weight was also associated with poorer speech and language outcomes.[58,192,193] Other associated risk factors reported less consistently included parental education level, and family factors such as size and overcrowding. These studies did not find associations with mother's stuttering or speaking style or rate, mother's age, or child temperament.

A review of late-talking toddlers 18 to 34 months of age found a statistically significant association with family history of language disorders, socioeconomic status, and parental stress but no association with parents' education level.[171] The review identified some of the challenges inherent in identifying risk factors for speech and language disorders. First, some studies are

limited to children with an expressive vocabulary delay, excluding children with receptive language deficits, even though many children 2 years of age present with deficits of both comprehension and expression.[171] Also, the instruments used to measure expressive vocabulary across studies are inconsistent. The review author concluded that future research should take into account the lack of homogeneity observed within the population of children with a vocabulary delay at 2 years of age and consider a multifactorial perspective of child development to further understand this phenomenon.

Although more recent studies examine more proximal risk factors such as social determinants of health rather than distal risk factors such as race, speech and language studies continue to have dissimilar inclusion and exclusion criteria and assess dissimilarly measured risk factors and outcomes. Due to these dissimilarities, understanding which of these more proximal factors may be the attributable factor for the speech and language disorder is difficult to determine.

Role of Primary Care Providers in Screening in Children Age 5 Years or Younger That Is Performed in Other Venues

The 2006 review did not address the role of primary care providers in screening in children 5 years of age or younger that is performed in other venues (such as Head Start or preschool). We found two studies[91,194] that examined screening in preschool venues; however, neither discussed the role of the medical provider. Thus, we have no evidence for the interface between this aspect of the screening process and primary care providers.

Limitations of the Review

The 2006 review identified a number of limitations of the literature base, including a lack of studies specific to screening; inconsistencies in terminology across studies; assessment instruments and interventions addressing the specific aspects of language development rather than a global indicator of speech or language common to the screener; and difficulties evaluating the impact of complex interventions, especially related to screening. Many of these issues continue to plague the field.

We found additional limitations. One difficulty in drawing conclusions about whether screening for speech and language delay or disorders leads to improved outcomes is the lack of well-designed studies that address this overarching question. The ideal study would randomize children to screening and no screening; follow up those who are screened, both positives and negatives; and at some later point, assess all children, while collecting enough data to understand what occurred during the intervening time. Although de Koning and colleagues[70] designed a randomized trial of screening versus no screening, their study had a large attrition, and they did not use a uniform method of assessing language outcomes. Thus, this trial did not provide evidence about screening.

We are beginning to answer the question of whether screening can accurately identify children, and have identified some candidate measures. Yet many studies included in the review are less than ideal because they include selected groups of children; that is, many studies include a

sample with and without language delays. Use of such predetermined samples makes it difficult to examine whether screening is accurate in unselected samples, the likely target for such activities. In addition, because they tend to have a greater number of children with language delays or disorders, estimates of prevalence are skewed, leading to inaccurate estimates of positive and negative predictive values. Only a few studies examined how well screeners detected speech and language disorders over the long term. Such studies are critical in calculating the real benefit of early detection. Examining long-term outcomes may identify those with a language impairment rather than a transient language delay, enabling us to target intervention resources to those who have a greater need.

We also encountered studies that purported to screen for speech and language delays but used screeners that were not specific to linguistic skills, instead screening for developmental delay. Other studies validated screeners by examining their accuracy in relation to other screeners, not to recognized reference standards. The issue is not that the screeners were deficient; rather, it is the study designs that were deficient.

One limitation of the included intervention trials was that the studies often do not include information on whether the children were receiving community services for their speech and language symptoms outside of the study. Exceptions[126,129,135] provided information about community speech and language services. Understanding what services children in both arms of the intervention receive is critical to interpreting treatment impacts, or lack of them.

It is challenging, at least in the United States, to conduct an RCT comparing speech and language treatment to no treatment for children with severe enough symptoms to be identified as having speech and language delays or disorders. Under IDEA, children from birth to 5 years of age with special needs are entitled to services through the early intervention programs in their states. States have some latitude in setting eligibility criteria for these services, and as funding has become tighter, the trend is to limit eligibility, requiring children to present with more severe problems. The result of this law and the associated policies in the United States is that children with more significant problems will likely be receiving public early intervention/preschool services, making it unlikely that researchers can compare children receiving a speech-language treatment with children not receiving any speech-language treatment in an RCT. Whereas it may be possible to conduct such trials with children who have milder symptoms that do not qualify them for public services, such trials would not be representative of the full population of children with speech and language delays and disorders, and would largely exclude the children with the greatest needs.

Across the included trials, control groups in the majority of trials were children who were offered intervention on a delayed schedule. This condition likely would make parents more willing to consent to their child being in an RCT, but constrains our ability to look at long-range outcomes for treated versus untreated children.

Future Research Needs

In order to sufficiently answer the question “Does screening for speech and language delay or

disorders lead to improved speech and language outcomes as well as improved outcomes in domains other than speech and language?", studies need to be specifically designed and executed for this purpose. Neither the current review nor the 2006 review could answer this question directly; rather, both reviews addressed the question by considering subquestions. This research gap presents an opportunity for a large study to test the efficacy of systematic routine screening for speech and language delays and disorders compared with not implementing routine screening in primary care. In tandem with this, the field would benefit from a study to examine the feasibility of speech and language-specific screening as part of the more general developmental screening that is already recommended.[49] Better designed studies of risk factors, including child background factors, would also facilitate clinicians' ability to identify children at highest risk for speech and language delay.

Given Federal mandates under IDEA that all children with a documented speech or language delay receive early intervention, going forward it may be difficult to conduct RCTs to examine the efficacy of interventions. Future research protocols may adopt quasiexperimental designs of sufficient rigor to answer intervention questions. For instance, regression discontinuity designs (RDDs) seem applicable to addressing treatment efficacy because these designs can be used when there is a cutoff in a continuous measure that is used to identify children who are eligible for the treatment. The effect size is evaluated at the point of discontinuity dividing those who met/did not meet eligibility criteria. Well-designed and implemented RDDs can now meet standards for rigor without reservation for the Institute of Education Sciences-sponsored evaluations of evidence.

We recommend that stakeholders with an interest in screening develop research agendas and funding targeted to answer the important questions that could not be addressed in this review. To build the necessary evidence that screening children for speech and language delays and disorders can lead to improved outcomes, it will be necessary to design and conduct studies that can specifically address that question.

Conclusion

We found no evidence to answer the overarching question of whether screening for speech and language delay or disorders leads to improved speech and language outcomes. However, this should not be interpreted to mean that screening for speech and language delay is not beneficial; rather, we do not know whether there is a benefit due to the lack of evidence to answer this question. The studies from the 2006 review as well as the newly identified studies suggest that some screening instruments for detecting speech and language delays and disorders are accurate. Although these parent-rated instruments require only that the primary care provider interpret the findings, studies have not examined how receptive providers are to doing so. As in the 2006 review, we found no studies that addressed the harms of screening for speech and language delays. Nor did we find any evidence about the role of enhanced surveillance by a primary care clinician once a child elicits clinical concern for speech and language delay. Building on the studies identified in the 2006 review, we found evidence supporting the effectiveness of treating speech and language delays and disorders in children. However, the body of evidence does not provide guidance regarding the specific factors associated with effective treatments for young

children with speech and language delays or disorders. Finally, this review found no evidence relating to the harms of treating speech and language delays or disorders.

References

1. Ellis EM, Thal DJ. Early language delay and risk for language impairment. Perspectives on Language Learning and Education. 2008;15(3):93-100.
2. Girolametto L, Wiigs M, Smyth R, et al. Children with a history of expressive vocabulary delay: Outcomes at 5 years of age. Am J Speech Lang Pathol. 2001;10:358-69.
3. Rescorla L. Late talkers: do good predictors of outcome exist? Dev Disabil Res Rev. 2011 Nov;17(2):141-50. Epub: 2011/11/01. PMID: 23362033.
4. Rice ML, Taylor CL, Zubrick SR. Language outcomes of 7-year old children with or without a history of late language emergence at 24 months. J Speech Lang Hear Res. 2008;51:394-407.
5. Speech and Language Impairments. Washington, DC: National Dissemination Center for Children with Disabilities; 2011 April 2013. Accessed May 13 2013.
6. Chawarska K, Paul R, Klin A, et al. Parental recognition of developmental problems in toddlers with autism spectrum disorders. J Autism Dev Disord. 2007 Jan;37(1):62-72. Epub: 2007/01/02. PMID: 17195921.
7. Guinchat V, Chamak B, Bonniau B, et al. Very early signs of autism reported by parents include many concerns not specific to autism criteria. Res Autism Spectr Disord. 2012;6(2):589-601.
8. American Speech-Language-Hearing Association. Definitions of communication disorders and variations [Relevant Paper]. 1993.
9. Rowe ML, Goldin-Meadow S. Early gesture selectively predicts later language learning. Dev Sci. 2009 Jan;12(1):182-7. PMID: 19120426.
10. Crais ER, Watson LR, Baranek GT. Use of gesture development in profiling children's prelinguistic communication skills. Am J Speech Lang Pathol. 2009 Feb;18(1):95-108. PMID: 19029535.
11. Thal DJ, Tobias S. Communicative gestures in children with delayed onset of oral expressive vocabulary. J Speech Hear Res. 1992 Dec;35(6):1281-9. PMID: 1494275.
12. Whitehurst GJ, Smith M, Fischel JE, et al. The continuity of babble and speech in children with specific expressive language delay. J Speech Hear Res. 1991 Oct;34(5):1121-9. PMID: 1749242.
13. Law J, Boyle J, Harris F, et al. Prevalence and natural history of primary speech and language delay: findings from a systematic review of the literature. Int J Lang Commun Disord. 2000 Apr-Jun;35(2):165-88. Epub: 2000/07/27. PMID: 10912250.
14. Pinborough-Zimmerman J, Satterfield R, Miller J, et al. Communication disorders: prevalence and comorbid intellectual disability, autism, and emotional/behavioral disorders. Am J Speech Lang Pathol. 2007 Nov;16(4):359-67. Epub: 2007/11/01. PMID: 17971495.
15. Hannus S, Kauppila T, Launonen K. Increasing prevalence of specific language impairment (SLI) in primary healthcare of a Finnish town, 1989-99. Int J Lang Commun Disord. 2009 Jan-Feb;44(1):79-97. Epub: 2008/07/09. PMID: 18608605.
16. McLeod S, Harrison LJ. Epidemiology of speech and language impairment in a nationally representative sample of 4- to 5-year-old children. J Speech Lang Hear Res. 2009 Oct;52(5):1213-29. Epub: 2009/05/01. PMID: 19403947.

17. U.S. Department of Education, Office of Special Education and Rehabilitative Serivces, Office of Special Education Programs. 31st Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act. Washington, DC: 2009.
18. American Speech-Language-Hearing Association. The Speech-Language Pathology Medical Review Guidelines. 2011 http://www.asha.org/uploadedFiles/SLP-Medical-Review-Guidelines.pdf. Accessed October 12 2014.
19. Felsenfeld S, Broen PA, McGue M. A 28-year follow-up of adults with a history of moderate phonological disorder: educational and occupational results. J Speech Hear Res. 1994 Dec;37(6):1341-53. Epub: 1994/12/01. PMID: 7877292.
20. Ruben RJ. Redefining the survival of the fittest: communication disorders in the 21st century. Laryngoscope. 2000 Feb;110(2 Pt 1):241-5. Epub: 2000/02/19. PMID: 10680923.
21. Conti-Ramsden G, Falcaro M, Simkin Z, et al. Familial loading in specific language impairment: Patterns of differences across proband characteristics, gender and relative types. Genes, Brain and Behavior. 2007;6:216-28.
22. Newbury DF, Monaco AP. Genetic advances in the study of speech and language disorders. Neuron. 2010 Oct 21;68(2):309-20. PMID: 20955937.
23. Rice ML, Smith SD, Gayan J. Convergent genetic linkage and associations to language, speech and reading measures in families of probands with Specific Language Impairment. J Neurodev Disord. 2009 Dec;1(4):264-82. PMID: 19997522.
24. DeThorne LS, Hart SA, Petrill SA, et al. Children's history of speech-language difficulties: genetic influences and associations with reading-related measures. J Speech Lang Hear Res. 2006 Dec;49(6):1280-93. PMID: 17197496.
25. Kovas Y, Hayiou-Thomas ME, Oliver B, et al. Genetic influences in different aspects of language development: the etiology of language skills in 4.5-year-old twins. Child Dev. 2005 May-Jun;76(3):632-51. PMID: 15892783.
26. Oliver BR, Plomin R. Twins' Early Development Study (TEDS): A multivariate, longitudinal genetic investigation of language, cognition and behavior problems from childhood through adolescence. Twin Research and Human Genetics. 2007;10:95-105.
27. Viding E, Spinath FM, Price TS, et al. Genetic and environmental influence on language impairment in 4-year-old same-sex and opposite-sex twins. J Child Psychol Psychiatry. 2004 Feb;45(2):315-25. PMID: 14982245.
28. Kang C, Drayna D. Genetics of speech and language disorders. Annu Rev Genomics Hum Genet. 2011 Sep 22;12:145-64. Epub: 2011/06/15. PMID: 21663442.
29. Grigorenko EL. Speaking genes or genes for speaking? Deciphering the genetics of speech and language. J Child Psychol Psychiatry. 2009 Jan;50(1-2):116-25. PMID: 19220595.
30. Bashir AS, Scavuzzo A. Children with language disorders: natural history and academic success. J Learn Disabil. 1992 Jan;25(1):53-65; discussion 6-70. Epub: 1992/01/01. PMID: 1740638.
31. Raitano NA, Pennington BF, Tunick RA, et al. Pre-literacy skills of subgroups of children with speech sound disorders. J Child Psychol Psychiatry. 2004 May;45(4):821-35. PMID: 15056313.

32. Peterson RL, Pennington BF, Shriberg LD, et al. What influences literacy outcome in children with speech sound disorder? J Speech Lang Hear Res. 2009 Oct;52(5):1175-88. Epub: 2009/05/01. PMID: 19403946.
33. Catts HW, Fey ME, Tomblin JB, et al. A longitudinal investigation of reading outcomes in children with language impairments. J Speech Lang Hear Res. 2002 Dec;45(6):1142-57. Epub: 2003/01/28. PMID: 12546484.
34. Scarborough HS, Dobrich W. Development of children with early language delay. J Speech Hear Res. 1990 Mar;33(1):70-83. Epub: 1990/03/01. PMID: 2314086.
35. Richman N, Stevenson J, Graham PJ. Pre-school to school: A behavioural study In: R S, ed. In: Behavioural Development: A Series of Monographs. Vol. 228. London, United Kingdom: Academic; 1982.
36. Silva PA, Williams S, McGee R. A longitudinal study of children with developmental language delay at age three: later intelligence, reading and behaviour problems. Dev Med Child Neurol. 1987 Oct;29(5):630-40. Epub: 1987/10/01. PMID: 2444484.
37. Bishop DV, Clarkson B. Written language as a window into residual language deficits: a study of children with persistent and residual speech and language impairments. Cortex. 2003 Apr;39(2):215-37. Epub: 2003/06/06. PMID: 12784886.
38. Stern LM, Connell TM, Lee M, et al. The Adelaide preschool language unit: results of follow-up. J Paediatr Child Health. 1995 Jun;31(3):207-12. Epub: 1995/06/01. PMID: 7669381.
39. Silva PA, McGee R, Williams SM. Developmental language delay from three to seven years and its significance for low intelligence and reading difficulties at age seven. Dev Med Child Neurol. 1983 Dec;25(6):783-93. Epub: 1983/12/01. PMID: 6653911.
40. Young AR, Beitchman JH, Johnson C, et al. Young adult academic outcomes in a longitudinal sample of early identified language impaired and control children. J Child Psychol Psychiatry. 2002 Jul;43(5):635-45. Epub: 2002/07/18. PMID: 12120859.
41. Catts H, Fey M, Zhang X, et al. Estimating the risk of future reading difficulties in kindergarten children: a research-based model and its clinical implementation. Lang Speech Hear Serv Sch. 2001;32:38-50.
42. Tomblin JB, Zhang X, Buckwalter P, et al. The association of reading disability, behavioral disorders, and language impairment among second-grade children. J Child Psychol Psychiatry. 2000 May;41(4):473-82. Epub: 2000/06/03. PMID: 10836677.
43. Glogowska M, Roulstone S, Peters TJ, et al. Early speech- and language-impaired children: linguistic, literacy, and social outcomes. Dev Med Child Neurol. 2006 Jun;48(6):489-94. Epub: 2006/05/17. PMID: 16700942.
44. Snowling MJ, Bishop DV, Stothard SE, et al. Psychosocial outcomes at 15 years of children with a preschool history of speech-language impairment. J Child Psychol Psychiatry. 2006 Aug;47(8):759-65. Epub: 2006/08/11. PMID: 16898989.
45. Delgado CEF. Fourth grade outcomes of children with a preschool history of developmental disability. Educat Train Dev Dis. 2009;44(4):573-9.
46. Law J, Rush R, Schoon I, et al. Modeling developmental language difficulties from school entry into adulthood: literacy, mental health, and employment outcomes. J Speech Lang Hear Res. 2009 Dec;52(6):1401-16. Epub: 2009/12/03. PMID: 19951922.
47. Cohen NJ, Barwick MA, Horodezky NB, et al. Language, achievement, and cognitive processing in psychiatrically disturbed children with previously identified and

unsuspected language impairments. J Child Psychol Psychiatry. 1998 Sep;39(6):865-77. Epub: 1998/10/03. PMID: 9758195.
48. Cohen NJ, Menna R, Vallance DD, et al. Language, social cognitive processing, and behavioral characteristics of psychiatrically disturbed children with previously identified and unsuspected language impairments. J Child Psychol Psychiatry. 1998 Sep;39(6):853-64. Epub: 1998/10/03. PMID: 9758194.
49. Council on Children with Disabilities. Identifying infants and young children with developmental disorders in the medical home: an algorithm for developmental surveillance and screening. Pediatrics. 2006 Jul;118(1):405-20. Epub: 2006/07/05. PMID: 16818591.
50. American Academy of Pediatrics. Bright Futures. Elk Grove Village, IL: American Academy of Pediatrics; 1990 http://brightfutures.aap.org/index.html. Accessed May 14, 2013.
51. Glascoe FP, Shouse H, Woods SK, et al. Parents' Evaluation of Developmental Status (PEDS). PEDStest.com, LLC; 2013 http://www.pedstest.com/LearnAboutPEDS/IntroductiontoPEDS.aspx. Accessed May 14, 2013.
52. Frankenburg WK, Dodds J, Archer P, et al. The Denver II: a major revision and restandardization of the Denver Developmental Screening Test. Pediatrics. 1992 Jan;89(1):91-7. Epub: 1992/01/01. PMID: 1370185.
53. Squires J, Bricker D. Ages & Stages Questionnaires (ASQ-3). 3rd ed., Baltimore, MD: Paul H. Brookes Publishing; 2009.
54. Rescorla L. The Language Development Survey: a screening tool for delayed language in toddlers. J Speech Hear Disord. 1989 Nov;54(4):587-99. Epub: 1989/11/01. PMID: 2811339.
55. Fenson L, Marchman VA, Thal DJ, et al. The MacArthur-Bates Communicative Development Inventories User's Guide and Technical Manual. 2nd ed., Baltimore: Brookes; 2006.
56. American Speech-Language-Hearing Association. Home Page. Washington, DC: American Speech-Language-Hearing Association; 1997-2013 http://www.asha.org/. Accessed May 14, 2013.
57. Baker E, McLeod S. Evidence-based practice for children with speech sound disorders: part 2 application to clinical practice. Lang Speech Hear Serv Sch. 2011 Apr;42(2):140-51. Epub: 2010/09/17. PMID: 20844271.
58. Kamhi AG, Pollock KE, eds. Phonological disorders in children: Clinical decision making in assessment and intervention. Baltimore, MD: Paul H. Brookes Publishing; 2005.
59. Pickstone C, Goldbart J, Marshall J, et al. A systematic review of environmental interventions to improve child language outcomes for children with or at risk of primary language impairment. J Res Spec Educat Needs. 2009;9(2):66-79.
60. Snowling MJ, Hulme C. Interventions for children's language and literacy difficulties. Int J Lang Commun Disord. 2012 Jan-Feb;47(1):27-34. Epub: 2012/01/25. PMID: 22268899.
61. Boyle J, McCartney E, O'Hare A, et al. Intervention for mixed receptive-expressive language impairment: a review. Dev Med Child Neurol. 2010 Nov;52(11):994-9. Epub: 2010/09/04. PMID: 20813021.

62. Burne B, Knafelc V, Melonis M, et al. The use and application of assistive technology to promote literacy in early childhood: a systematic review. Disabil Rehabil Assist Technol. 2011;6(3):207-13. Epub: 2010/10/07. PMID: 20923322.
63. Desch LW, Gaebler-Spira D. Prescribing assistive-technology systems: focus on children with impaired communication. Pediatrics. 2008 Jun;121(6):1271-80. Epub: 2008/06/04. PMID: 18519500.
64. Nelson HD, Nygren P, Walker M, et al. Screening for speech and language delay in preschool children: systematic evidence review for the US Preventive Services Task Force. Pediatrics. 2006 Feb;117(2):e298-319. Epub: 2006/02/03. PMID: 16452337.
65. Harris RP, Helfand M, Woolf SH, et al. Current methods of the US Preventive Services Task Force: a review of the process. Am J Prev Med. 2001 Apr;20(3 Suppl):21-35. Epub: 2001/04/18. PMID: 11306229.
66. Clark JG, Jorgensen SK, Blondeau R. Investigating the validity of the Clinical Linguistic Auditory Milestone Scale. Int J Pediatr Otorhinolaryngol. 1995 Jan;31(1):63-75. Epub: 1995/01/01. PMID: 7537257.
67. Levett L, Muir J. Which three year olds need speech therapy? Uses of the Levett-Muir language screening test. Health Visit. 1983 Dec;56(12):454-6. Epub: 1983/12/01. PMID: 6559779.
68. Sherman T, Shulman BB, Trimm RF, et al. PLASTER: predicting communication impairments in a NICU follow-up population—Pediatric Language Acquisition Screening Tool for Early Referral. Infant Toddler Interv Transdisciplinary J. 1996;6(3):183-95.
69. Rescorla L, Hadicke-Wiley M, Escarce E. Epidemiological investigation of expressive language delay at age two. First Lang. 1993;13(37):5-22.
70. de Koning HJ, de Ridr-Sluiter JG, van Agt HME, et al. A cluster-randomised trial of screening for language disorders in toddlers. J Med Screen. 2004;11(3):109-16. PMID: 15333268.
71. van Agt HM, van der Stege HA, de Ridder-Sluiter H, et al. A cluster-randomized trial of screening for language delay in toddlers: effects on school performance and language development at age 8. Pediatrics. 2007 Dec;120(6):1317-25. Epub: 2007/12/07. PMID: 18055682.
72. Frisk V, Montgomery L, Boychyn E, et al. Why screening Canadian preschoolers for language delays is more difficult than it should be. Infants Young Child. 2009;22(4):290-308.
73. Guiberson M, Rodriguez BL. Measurement properties and classification accuracy of two Spanish parent surveys of language development for preschool-age children. Am J Speech Lang Pathol. 2010 Aug;19(3):225-37. Epub: 2010/05/21. PMID: 20484705.
74. Guiberson M, Rodriguez BL, Dale PS. Classification accuracy of brief parent report measures of language development in Spanish-speaking toddlers. Lang Speech Hear Serv Sch. 2011 Oct;42(4):536-49. Epub: 2011/08/17. PMID: 21844403.
75. Heilmann J, Weismer SE, Evans J, et al. Utility of the MacArthur-Bates Communicative Development Inventory in identifying language abilities of late-talking and typically developing toddlers. Am J Speech Lang Pathol. 2005;14(1):40-51.
76. Sachse S, Von Suchodoletz W. Early identification of language delay by direct language assessment or parent report? J Dev Behav Pediatr. 2008 Feb;29(1):34-41. Epub: 2008/02/28. PMID: 18300723.

77. Sachse S, Von Suchodoletz W. Untitled response. J Dev Behav Pediatr. 2009;30(2):176.
78. Westerlund M, Berglund E, Eriksson M. Can severely language delayed 3-year-olds be identified at 18 months? Evaluation of a screening version of the MacArthur-Bates Communicative Development Inventories. J Speech Lang Hear Res. 2006 Apr;49(2):237-47. Epub: 2006/05/05. PMID: 16671841.
79. Elbaum B, Gattamorta KA, Penfield RD. Evaluation of the Battelle Developmental Inventory, 2nd Edition, Screening Test for use in states' child outcomes measurement systems under the Individuals with Disabilities Education Act. J Early Interv. 2010;32(4):255-73.
80. Skarakis-Doyle E, Campbell W, Dempsey L. Identification of children with language impairment: investigating the classification accuracy of the MacArthur-Bates Communicative Development Inventories, Level III. Am J Speech Lang Pathol. 2009 Aug;18(3):277-88. Epub: 2009/04/01. PMID: 19332526.
81. Henrichs J, Rescorla L, Schenk JJ, et al. Examining continuity of early expressive vocabulary development: the generation R study. J Speech Lang Hear Res. 2011 Jun;54(3):854-69. Epub: 2010/10/23. PMID: 20966386.
82. Heo KH, Squires J, Yovanoff P. Cross-cultural adaptation of a pre-school screening instrument: Comparison of Korean and US populations. J Intellect Disabil Res. 2008;52(3):195-206.
83. Mossabeb R, Wade KC, Finnegan K, et al. Language development survey provides a useful screening tool for language delay in preterm infants. Clin Pediatr (Phila). 2012 Jul;51(7):638-44. Epub: 2012/03/09. PMID: 22399570.
84. Sices L, Stancin T, Kirchner HL, et al. PEDS and ASQ developmental screening tests may not identify the same children. Pediatrics. 2009;124(4):e640-7. PMID: 19736268.
85. van Agt HM, van der Stege HA, de Ridder-Sluiter JG, et al. Detecting language problems: accuracy of five language screening instruments in preschool children. Dev Med Child Neurol. 2007 Feb;49(2):117-22; discussion 84. Epub: 2007/01/27. PMID: 17253998.
86. Rigby MJ, Chesham I. A trial speech screening test for school entrants. Br Med J (Clin Res Ed). 1981 Feb 7;282(6262):449-51. Epub: 1981/02/07. PMID: 6780069.
87. Coulter L, Gallagher C. Piloting new ways of working: evaluation of the WILSTAAR Programme. Int J Lang Commun Disord. 2001;36 Suppl:270-5. Epub: 2001/05/09. PMID: 11340795.
88. Wetherby AM, Goldstein H, Clearly J, et al. Early identification of children with communication disorders: Concurrent and predictive validity of the CSBS Developmental Profile. Infants Young Child. 2003;16:161-74.
89. Law J, Boyle J, Harris F, et al. Screening for speech and language delay: a systematic review of the literature. Health Technol Assess. 1998;2(9):1-184. Epub: 1998/09/05. PMID: 9728296.
90. Nelson HD, Nygren P, Walker M, et al. Screening for Speech and Language Delay in Preschool Children. Prepared by Oregon Health and Science University Evidence-based Practice Center under Contract No. 290-02-0024, Task No. 2 for the U.S. Preventive Services Task Force Systematic Evidence Review Number 41. Rockville, MD: Agency for Healthcare Research and Quality; February 2006.
91. Alberts FM, Davis BL, Prentice L. Validity of an observation screening instrument in a multicultural population. J Early Interv. 1995;19(2):168-77.

92. Allen DV, Bliss LS. Concurrent validity of two language screening tests. J Commun Disord. 1987 Aug;20(4):305-17. Epub: 1987/08/01. PMID: 3624526.
93. Bliss LS, Allen DV. Screening Kit of Language Development: a preschool language screening instrument. J Commun Disord. 1984 Apr;17(2):133-41. Epub: 1984/04/01. PMID: 6725626.
94. Borowitz KC, Glascoe FP. Sensitivity of the Denver Developmental Screening Test in speech and language screening. Pediatrics. 1986 Dec;78(6):1075-8. Epub: 1986/12/01. PMID: 3786032.
95. Burden V, Stott CM, Forge J, et al. The Cambridge Language and Speech Project (CLASP). I. Detection of language difficulties at 36 to 39 months. Dev Med Child Neurol. 1996 Jul;38(7):613-31. Epub: 1996/07/01. PMID: 8674912.
96. Dixon J, Kot A, Law J. Early language screening in City and Hackney: work in progress. Child Care Health Dev. 1988 May-Jun;14(3):213-29. Epub: 1988/05/01. PMID: 3208420.
97. Drumwright A, Van Natta P, Camp B, et al. The Denver articulation screening exam. J Speech Hear Disord. 1973 Feb;38(1):3-14. Epub: 1973/02/01. PMID: 4698385.
98. Klee T, Carson DK, Gavin WJ, et al. Concurrent and predictive validity of an early language screening program. J Speech Lang Hear Res. 1998 Jun;41(3):627-41. Epub: 1998/06/25. PMID: 9638927.
99. Laing GJ, Law J, Levin A, et al. Evaluation of a structured test and a parent led method for screening for speech and language problems: prospective population based study. BMJ. 2002 Nov 16;325(7373):1152. Epub: 2002/11/16. PMID: 12433766.
100. Law J. Early language screening in city and Hackney: the concurrent validity of a measure designed for use with 2 1/2-year-olds. Child Care Health Dev. 1994 Sep-Oct;20(5):295-308. Epub: 1994/09/01. PMID: 7988000.
101. McGinty C. An investigation into aspects of the Mayo early language screening test. Child Care Health Dev. 2000 Mar;26(2):111-28. Epub: 2000/04/12. PMID: 10759751.
102. Rescorla L, Alley A. Validation of the language development survey (LDS): a parent report tool for identifying language delay in toddlers. J Speech Lang Hear Res. 2001 Apr;44(2):434-45. Epub: 2001/04/28. PMID: 11324663.
103. Stokes SF. Secondary prevention of paediatric language disability: a comparison of parents and nurses as screening agents. Eur J Disord Commun. 1997;32(2 Spec No):139-58. Epub: 1997/01/01. PMID: 9279431.
104. Stott CM, Merricks MJ, Bolton PF, et al. Screening for speech and language disorders: the reliability, validity and accuracy of the General Language Screen. Int J Lang Commun Disord. 2002 Apr-Jun;37(2):133-51. Epub: 2002/05/16. PMID: 12012612.
105. Sturner RA, Heller JH, Funk SG, et al. The Fluharty Preschool Speech and Language Screening Test: a population-based validation study using sample-independent decision rules. J Speech Hear Res. 1993 Aug;36(4):738-45. Epub: 1993/08/01. PMID: 8377486.
106. Sturner RA, Funk SG, Green JA. Preschool speech and language screening: further validation of the sentence repetition screening test. J Dev Behav Pediatr. 1996 Dec;17(6):405-13. Epub: 1996/12/01. PMID: 8960570.
107. Walker D, Gugenheim S, Downs MP, et al. Early Language Milestone Scale and language screening of young children. Pediatrics. 1989 Feb;83(2):284-8. Epub: 1989/02/01. PMID: 2643801.

108. Ward S. Detecting abnormal auditory behaviours in infancy: the relationship between such behaviours and linguistic development. Br J Disord Commun. 1984 Dec;19(3):237-51. Epub: 1984/12/01. PMID: 6508994.
109. Oakenfull S, McGregor T, Ramtin F, et al. Re: WILSTAAR. Int J Lang Commun Disord. 2001 Jan-Mar;36(1):135-8. Epub: 2001/02/28. PMID: 11221430.
110. Merrell AW, Plante E. Norm-referenced test interpretation in the diagnostic process. Lang Speech Hear Ser Schools. 1997;28(1):50-8.
111. Black MM, Gerson LF, Freeland CA, et al. Language screening for infants prone to otitis media. J Pediatr Psychol. 1988 Sep;13(3):423-33. Epub: 1988/09/01. PMID: 3199297.
112. Blaxley L, Clinker M, Warr-Leeper GA. Two language screening tests compared with developmental sentence scoring. Lang Speech Hear Ser Schools. 1983;14:38-46.
113. Chaffee CA, Cunningham CE, Secord-Gilbert M, et al. Screening effectiveness of the Minnesota Child Development Inventory Expressive and Receptive Language Scales: sensitivity, specificity, and predictive value. Psychol Assess. 1990;2(1):80-5.
114. Dodge GR. A comparison of language screening methods. Lang Speech Hear Ser Schools. 1980;11(4):214-7.
115. Glascoe FP. Can clinical judgment detect children with speech-language problems? Pediatrics. 1991 Mar;87(3):317-22. Epub: 1991/03/01. PMID: 2000271.
116. Plante E, Vance R. Diagnostic accuracy of two tests of preschool language. Am J Speech Lang Pathol. 1995;4(2):70-6.
117. Scherer NJ, D'Antonio LL. Parent questionnaire for screening early language development in children with cleft palate. Cleft Palate Craniofac J. 1995 Jan;32(1):7-13. Epub: 1995/01/01. PMID: 7727490.
118. Wilcox LD, Anderson RT. Distinguishing between phonological difference and disorder in children who speak African-American vernacular English: an experimental testing instrument. J Commun Disord. 1998;31(4):315-35.
119. Feeney J, Bernthal J. The efficiency of the revised Denver Developmental Screening Test as a language screening tool. Lang Speech Hear Ser Schools. 1996;27(4):330-2.
120. German ML, Williams E, Herzfeld J, et al. Utility of the Revised Denver Developmental Screening Test and the Developmental Profile II in identifying preschool children with cognitive, language, and motor problems. Educ Train Mental Retard. 1982;17(4):319-24.
121. Rescorla L, Achenbach TM. Use of the language development survey (LDS) in a national probability sample of children 18 to 35 months old. J Speech Lang Hear Res. 2002 Aug;45(4):733-43. Epub: 2002/08/30. PMID: 12199403.
122. Klee T, Pearce K, Carson DK. Improving the positive predictive value of screening for developmental language disorder. J Speech Lang Hear Res. 2000 Aug;43(4):821-33. Epub: 2001/06/02. PMID: 11386471.
123. Hamm RM. Clinical Decision Making Calculators. Oklahoma City: Department of Family and Preventive Medicine The University of Oklahoma Health Sciences Center; 2004 http://www.fammed.ouhsc.edu/robhamm/cdmcalc.htm2014.
124. Ebell M, Barry H. Likelihood Ratios Part 1: Introduction. Lansing, MI: Office of Medial Education Research and Development, College of Human Medicine, Michigan State University; 2008 http://omerad.msu.edu/ebm/index.html2014.
125. Fricke S, Bowyer-Crane C, Haley AJ, et al. Efficacy of language intervention in the early years. J Child Psychol Psychiatry. 2013 Mar;54(3):280-90. Epub: 2012/11/28. PMID: 23176547.

126. Jones M, Onslow M, Packman A, et al. Randomised controlled trial of the Lidcombe programme of early stuttering intervention. BMJ. 2005 Sep 24;331(7518):659. Epub: 2005/08/13. PMID: 16096286.
127. Lewis C, Packman A, Onslow M, et al. A phase II trial of telehealth delivery of the Lidcombe Program of Early Stuttering Intervention. Am J Speech Lang Pathol. 2008 May;17(2):139-49. Epub: 2008/05/02. PMID: 18448601.
128. Wake M, Tobin S, Girolametto L, et al. Outcomes of population based language promotion for slow to talk toddlers at ages 2 and 3 years: Let's Learn Language cluster randomised controlled trial. BMJ. 2011;343:d4741. Epub: 2011/08/20. PMID: 21852344.
129. Yoder P, Camarata M, Gardner E. Treatment effects on speech intelligibility and length of utterance in children with specific language and intelligibility impairments. J Early Interv. 2005;28(1):34-49.
130. Wake M, Tobin S, Levickis P, et al. Randomized trial of a population-based, home-delivered intervention for preschool language delay. Pediatrics. 2013 Oct;132(4):e895-904. Epub: 2013/09/18. PMID: 24043276.
131. Morgan AT, Vogel AP. A Cochrane review of treatment for childhood apraxia of speech. Eur J Phys Rehabil Med. 2009 Mar;45(1):103-10. Epub: 2009/01/22. PMID: 19156019.
132. Denne M, Langdown N, Pring T, et al. Treating children with expressive phonological disorders: does phonological awareness therapy work in the clinic? Int J Lang Commun Disord. 2005 Oct-Dec;40(4):493-504. Epub: 2005/10/01. PMID: 16195202.
133. Grogan-Johnson S, Alvares R, Rowan L, et al. A pilot study comparing the effectiveness of speech language therapy provided by telemedicine with conventional on-site therapy. J Telemed Telecare. 2010;16(3):134-9. Epub: 2010/03/04. PMID: 20197354.
134. Almost D, Rosenbaum P. Effectiveness of speech intervention for phonological disorders: a randomized controlled trial. Dev Med Child Neurol. 1998 May;40(5):319-25. Epub: 1998/06/18. PMID: 9630259.
135. Glogowska M, Roulstone S, Enderby P, et al. Randomised controlled trial of community based speech and language therapy in preschool children. BMJ. 2000 Oct 14;321(7266):923-6. Epub: 2000/10/13. PMID: 11030677.
136. Gibbard D. Parental-based intervention with pre-school language-delayed children. Eur J Disord Commun. 1994;29(2):131-50. Epub: 1994/01/01. PMID: 7865920.
137. Girolametto L, Pearce PS, Weitzman E. Interactive focused stimulation for toddlers with expressive vocabulary delays. J Speech Hear Res. 1996 Dec;39(6):1274-83. Epub: 1996/12/01. PMID: 8959612.
138. Girolametto L, Pearce PS, Weitzman E. Effects of lexical intervention on the phonology of late talkers. J Speech Lang Hear Res. 1997 Apr;40(2):338-48. Epub: 1997/04/01. PMID: 9130202.
139. Robertson SB, Ellis Weismer S. Effects of treatment on linguistic and social skills in toddlers with delayed language development. J Speech Lang Hear Res. 1999 Oct;42(5):1234-48. Epub: 1999/10/09. PMID: 10515518.
140. Robertson SB, Ellis Weismer S. The influence of peer models on the play scripts of children with specific language impairment. J Speech Lang Hear Res. 1997 Feb;40(1):49-61. Epub: 1997/02/01. PMID: 9113858.
141. Shelton RL, Johnson AF, Ruscello DM, et al. Assessment of parent-administered listening training for preschool children with articulation deficits. J Speech Hear Disord. 1978 May;43(2):242-54. Epub: 1978/05/01. PMID: 661262.

142. Barratt J, Littlejohns P, Thompson J. Trial of intensive compared with weekly speech therapy in preschool children. Arch Dis Child. 1992 Jan;67(1):106-8. Epub: 1992/01/01. PMID: 1739321.
143. Cole KN, Dale PS. Direct language instruction and interactive language instruction with language delayed preschool children: a comparison study. J Speech Hear Res. 1986 Jun;29(2):206-17. Epub: 1986/06/01. PMID: 3724113.
144. Courtright JA, Courtright IC. Imitative modeling as a language intervention strategy: the effects of two mediating variables. J Speech Hear Res. 1979 Jun;22(2):389-402. Epub: 1979/06/01. PMID: 491564.
145. Rvachew S, Nowak M. The effect of target-selection strategy on phonological learning. J Speech Lang Hear Res. 2001 Jun;44(3):610-23. Epub: 2001/06/16. PMID: 11407566.
146. Wilcox MJ, Kouri TA, Caswell SB. Early language intervention: a comparison of classroom and individual treatment. Am J Speech-Lang Path. 1991;1(1):49-61.
147. Law J, Kot A, Barnett G. A comparison of two methods for providing intervention to three year old children with expressive/receptive language impairment. London: Department of Language and Communication Science, City University; 1999.
148. Manolson HA, Ward B, Doddington N. You make the difference in helping your child learn. The Hanen Centre; 1995.
149. Bowyer-Crane C, Snowling MJ, Duff FJ, et al. Improving early language and literacy skills: differential effects of an oral language versus a phonology with reading intervention. J Child Psychol Psychiatry. 2008 Apr;49(4):422-32. Epub: 2007/12/18. PMID: 18081756.
150. Boyle J, McCartney E, Forbes J, et al. A randomised controlled trial and economic evaluation of direct versus indirect and individual versus group modes of speech and language therapy for children with primary language impairment. Health Technol Assess. 2007 Jul;11(25):iii-iv, xi-xii, 1-139. Epub: 2007/07/06. PMID: 17610807.
151. Zimmerman I, Steiner B, Pond R. Preschool Language Scale. 3rd ed., San Antonio: Psychological Corporation; 1992.
152. Fudala J, Reynolds W. Arizona Articulation Proficiency Scale. 2nd ed., Los Angeles: Western Psychological Services; 1986.
153. Lee LL. Northwestern Syntax Screening Test. Evanston: Northwestern University Press; 1971.
154. Bird J, Bishop DV, Freeman NH. Phonological awareness and literacy development in children with expressive phonological impairments. J Speech Hear Res. 1995 Apr;38(2):446-62. PMID: 7596110.
155. Catts HW. The relationship between speech-language impairments and reading disabilities. J Speech Hear Res. 1993 Oct;36(5):948-58. PMID: 8246483.
156. Pagel Paden E, Novak MA, Beiter AL. Predictors of phonologic inadequacy in young children prone to otitis media. J Speech Hear Disord. 1987;52:232-42.
157. Hodson B, E. P. Targetiirg Intelligible Speech: A Phonological Approach to Remediation. Austin, TX: Pro-Ed; 1991.
158. Hodson B. The Assessment of Phonological Processes-Revised. Danville, IL: Interstate Printen and Publishers; 1986.
159. Goldman H, Fristoe M. Goldman-Fristoe Test of Articulation. Circle Pines, MN: American Guidance Service; 1969.

160. Onslow M, Packman A, Harrison E, eds. The Lidcombe Program of Early Stuttering Intervention: A Clinician's Guide. Austin, TX: Pro-Ed; 2003.
161. Cohen J. Statistical Power Analysis for the Behavioral Sciences. 2nd ed., Hillsdale: Lawrence Erlbaum; 1988.
162. Ferguson CJ. An effect size primer: a guide for clinicians and researchers. Prof Psychol. 2009;40(5):532-8.
163. Macias MM. Developmental Screening Tools, D-PIP Training Workshop. American Academy of Pediatrics; 2006.
164. Sturner RA, Kunze L, Funk SG, et al. Elicited imitation: its effectiveness for speech and language screening. Dev Med Child Neurol. 1993 Aug;35(8):715-26. Epub: 1993/08/01. PMID: 8335161.
165. Alston E, St James-Roberts I. Home environments of 10-month-old infants selected by the WILSTAAR screen for pre-language difficulties. Int J Lang Commun Disord. 2005;40(2):123-36. PMID: 16101270.
166. Pruitt SL, Garrity AW, Oetting JB. Family history of speech and language impairment in African American children: implications for assessment. Topics Lang Disord. 2010;30(2):154-64.
167. Tomblin JB, Hardy JC, Hein HA. Predicting poor-communication status in preschool children using risk factors present at birth. J Speech Hear Res. 1991 Oct;34(5):1096-105. Epub: 1991/10/01. PMID: 1749241.
168. Tomblin JB, Smith E, Zhang X. Epidemiology of specific language impairment: prenatal and perinatal risk factors. J Commun Disord. 1997 Jul-Aug;30(4):325-43; quiz 43-4. Epub: 1997/07/01. PMID: 9208366.
169. Whitehurst GJ, Arnold DS, Smith M, et al. Family history in developmental expressive language delay. J Speech Hear Res. 1991 Oct;34(5):1150-7. Epub: 1991/10/01. PMID: 1749245.
170. Weindrich D, Jennen-Steinmetz C, Laucht M, et al. Epidemiology and prognosis of specific disorders of language and scholastic skills. Eur Child Adolesc Psychiatry. 2000 Sep;9(3):186-94. Epub: 2000/11/30. PMID: 11095041.
171. Desmarais C, Sylvestre A, Meyer F, et al. Systematic review of the literature on characteristics of late-talking toddlers. Int J Lang Commun Disord. 2008 Jul-Aug;43(4):361-89. Epub: 2007/09/22. PMID: 17885825.
172. Law J, Rush R, Anandan C, et al. Predicting language change between 3 and 5 years and its implications for early identification. Pediatrics. 2012 Jul;130(1):e132-7. Epub: 2012/06/13. PMID: 22689865.
173. Campbell TF, Dollaghan CA, Rockette HE, et al. Risk factors for speech delay of unknown origin in 3-year-old children. Child Dev. 2003 Mar-Apr;74(2):346-57. Epub: 2003/04/23. PMID: 12705559.
174. Hammer CS, Farkas G, Maczuga S. The language and literacy development of Head Start children: a study using the Family and Child Experiences Survey Database. Lang Speech Hear Ser Schools. 2010;41(1):70-83.
175. Choudhury N, Benasich AA. A family aggregation study: the influence of family history and other risk factors on language development. J Speech Lang Hear Res. 2003 Apr;46(2):261-72. Epub: 2004/01/01. PMID: 14700370.
176. Zubrick SR, Taylor CL, Rice ML, et al. Late language emergence at 24 months: an epidemiological study of prevalence, predictors, and covariates. J Speech Lang Hear Res.

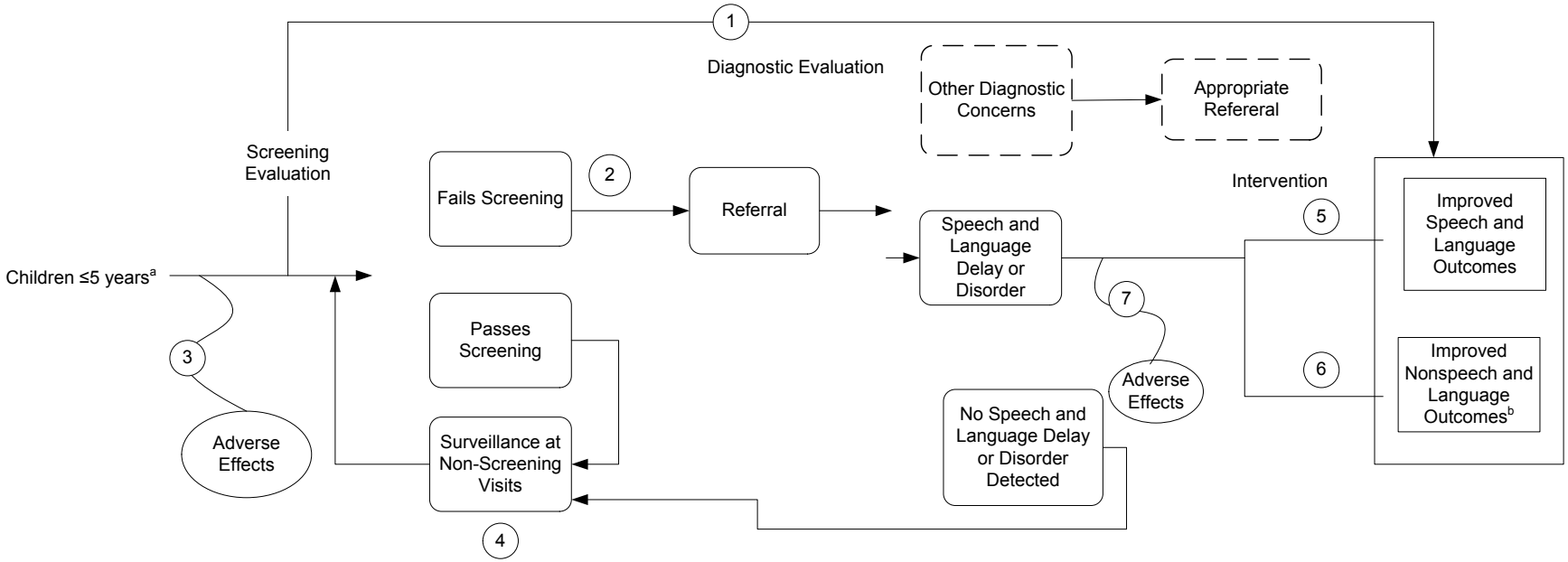
2007;50(6):1562-92. PMID: 2009731670. Language: English. Entry Date: 20080411. Revision Date: 20091218. Publication Type: journal article.
177. Reilly S, Onslow M, Packman A, et al. Predicting stuttering onset by the age of 3 years: a prospective, community cohort study. Pediatrics. 2009 Jan;123(1):270-7. Epub: 2009/01/02. PMID: 19117892.
178. Reilly S, Wake M, Bavin EL, et al. Predicting language at 2 years of age: a prospective community study. Pediatrics. 2007 Dec;120(6):e1441-9. Epub: 2007/12/07. PMID: 18055662.
179. Harrison LJ, McLeod S. Risk and protective factors associated with speech and language impairment in a nationally representative sample of 4- to 5-year-old children. J Speech Lang Hear Res. 2010 Apr;53(2):508-29. Epub: 2009/09/30. PMID: 19786704.
180. Adams-Chapman I, Bann CM, Vaucher YE, et al. Association between feeding difficulties and language delay in preterm infants using Bayley Scales of Infant Development-Third Edition. J Pediatr. 2013 Sep;163(3):680-5 e1-3. Epub: 2013/04/16. PMID: 23582139.
181. Reilly S, Onslow M, Packman A, et al. Natural history of stuttering to 4 years of age: a prospective community-based study. Pediatrics. 2013 Sep;132(3):460-7. Epub: 2013/08/28. PMID: 23979093.
182. Tallal P, Ross R, Curtiss S. Familial aggregation in specific language impairment. J Speech Hear Disord. 1989 May;54(2):167-73. Epub: 1989/05/01. PMID: 2709834.
183. Pena ED, Gillam RB, Bedore LM, et al. Risk for poor performance on a language screening measure for bilingual preschoolers and kindergarteners. Am J Speech Lang Pathol. 2011 Nov;20(4):302-14. Epub: 2011/08/09. PMID: 21821821.
184. Singer LT, Siegel AC, Lewis B, et al. Preschool language outcomes of children with history of bronchopulmonary dysplasia and very low birth weight. J Dev Behav Pediatr. 2001 Feb;22(1):19-26. Epub: 2001/03/27. PMID: 11265919.
185. Foster-Cohen SH, Friesen MD, Champion PR, et al. High prevalence/low severity language delay in preschool children born very preterm. J Dev Behav Pediatr. 2010 Oct;31(8):658-67. Epub: 2010/07/09. PMID: 20613625.
186. Kerstjens JM, Bos AF, ten Vergert EMJ, et al. Support for the global feasibility of the Ages and Stages Questionnaire as developmental screener. Early Hum Dev. 2009;85(7):443-7. PMID: 19356866.
187. Zambrana IM, Pons F, Eadie P, et al. Trajectories of language delay from age 3 to 5: persistence, recovery and late onset. Int J Lang Commun Disord. 2014 May-Jun;49(3):304-16. Epub: 2014/01/03. PMID: 24382196.
188. Fox AV, Dodd B, Howard D. Risk factors for speech disorders in children. Int J Lang Commun Disord. 2002 Apr-Jun;37(2):117-31. Epub: 2002/05/16. PMID: 12012611.
189. Kerstjens JM, de Winter AF, Bocca-Tjeertes IF, et al. Developmental delay in moderately preterm-born children at school entry. J Pediatr. 2011;159(1):92-8. PMID: 21324481.
190. Kerstjens JM, de Winter AF, Bocca-Tjeertes IF, et al. Risk of developmental delay increases exponentially as gestational age of preterm infants decreases: A cohort study at age 4 years. Dev Med Child Neurol. 2012;54(12):1096-101. PMID: 23020259.
191. Potijk MR, Kerstjens JM, Bos AF, et al. Developmental delay in moderately preterm-born children with low socioeconomic status: risks multiply. J Pediatr. 2013 Nov;163(5):1289-95. Epub: 2013/08/24. PMID: 23968750.

192. Schjolberg S, Eadie P, Zachrisson HD, et al. Predicting language development at age 18 months: data from the Norwegian Mother and Child Cohort Study. J Dev Behav Pediatr. 2011 Jun;32(5):375-83. Epub: 2011/05/07. PMID: 21546853.
193. Van Lierde KM, Roeyers H, Boerjan S, et al. Expressive and receptive language characteristics in three-year-old preterm children with extremely low birth weight. Folia Phoniatrica et Logopaedica. 2009;61(5):296-9.
194. Williams C. Teacher judgements of the language skills of children in the early years of schooling. Child Lang Teach Ther. 2006;22(2):135-54.
195. Whitehouse AJ, Robinson M, Zubrick SR. Late talking and the risk for psychosocial problems during childhood and adolescence. Pediatrics. 2011 Aug;128(2):e324-32. Epub: 2011/07/06. PMID: 21727106.
196. Conti-Ramsden G. Processing and linguistic markers in young children with specific language impairment (SLI). J Speech Lang Hear Res. 2003 Oct;46(5):1029-37. Epub: 2003/10/25. PMID: 14575341.
197. Coplan J, Gleason JR, Ryan R, et al. Validation of an early language milestone scale in a high-risk population. Pediatrics. 1982 Nov;70(5):677-83. Epub: 1982/11/01. PMID: 7133817.
198. Glascoe FP, Byrne KE. The accuracy of three developmental screening tests. J Early Interv. 1993;17(4):368-79.
199. Leppert ML, Shank TP, Shapiro BK, et al. The capute scales: CAT/CLAMS-A pediatric assessment tool for the early detection of mental retardation and communicative disorders. Ment Retard Dev Disabil Res Rev. 1998;4(1):14-9.
200. Macias MM, Saylor CF, Greer MK, et al. Infant screening: the usefulness of the Bayley Infant Neurodevelopmental Screener and the Clinical Adaptive Test/Clinical Linguistic Auditory Milestone Scale. J Dev Behav Pediatr. 1998 Jun;19(3):155-61. Epub: 1998/07/02. PMID: 9648040.
201. Law J, Garrett Z, Nye C. Speech and language therapy interventions for children with primary speech and language delay or disorder. Cochrane Database Syst Rev. 2003(3)PMID: CD004110.
202. Alvik A, Groholt B. Examination of the cut-off scores determined by the Ages and Stages Questionnaire in a population-based sample of 6 month-old Norwegian infants. BMC Pediatr. 2011;11:117. Epub: 2011/12/21. PMID: 22182217.
203. Dionne C, Squires J, Leclerc D, et al. Cross-cultural comparison of a French Canadian and U.S. developmental screening test. Dev Disabil Bull. 2006;34(1-2):43-56.
204. Fenson L, Marchman VA, Thal DJ, et al. MacArthur-Bates Communicative Development Inventories: Users guide and technical manual. Baltimore, MD: Brookes; 2007.
205. Fluharty NB. The design and standardization of a speech and language screening test for use with preschool children. J Speech Hear Disord. 1974 Feb;39(1):75-88. Epub: 1974/02/01. PMID: 4814827.
206. Jackson-Maldonado D, Marchman VA, Fernald LCH. Short-form versions of the Spanish MacArthur–Bates Communicative Development Inventories. Appl Psycholinguist. 2013 July 2013;34(4):837-68.
207. Rescorla L, Ratner NB, Jusczyk P, et al. Concurrent validity of the language development survey: associations with the MacArthur-Bates communicative development inventories: words and sentences. Am J Speech Lang Pathol. 2005 May;14(2):156-63. Epub: 2005/07/02. PMID: 15989390.

208. Squires J, Potter L, Bricker D. Ages and Stages Questionnaire user's guide. Baltimore, MD: Brookes; 1999.
209. Sturner RS, Layton TL, Evans AW, et al. Preschool speech and language screening: A review of currently available tests. Am J Speech Lang Pathol. 1994;2:25-36.
210. Vach W, Bleses D, Jorgensen R. Construction of a Danish CDI short form for language screening at the age of 36 months: methodological considerations and results. Clin Linguist Phon. 2010 Aug;24(8):602-21. Epub: 2010/06/08. PMID: 20524850.
211. Westerlund M, Eriksson M, Berglund E. A short-term follow-up of children with poor word production at the age of 18 months. Acta Paediatr. 2004 May;93(5):702-6. Epub: 2004/06/04. PMID: 15174798.
212. Wetherby AM, Allen L, Cleary J, et al. Validity and reliability of the Communication and Symbolic Behavior Scales Developmental Profile with very young children. J Speech Lang Hear Res. 2002;45:1202-18.
213. Brookhouser PE, Hixson PK, Matkin ND. Early childhood language delay: the otolaryngologist's perspective. Laryngoscope. 1979 Dec;89(12):1898-913. Epub: 1979/12/01. PMID: 513912.
214. Cantwell DP, Baker L. Psychiatric and learning disorders in children with speech and language disorders: a descriptive analysis. Adv in Learning & Behav Disabilities. 1985;4Epub: Original Search 1-23-04
215. Everitt A, Hannaford P, Conti-Ramsden G. Markers for persistent specific expressive language delay in 3-4-year-olds. Int J Lang Commun Disord. 2013 Sep-Oct;48(5):534-53. Epub: 2013/09/17. PMID: 24033652.
216. Glascoe FP, Leew S. Parenting behaviors, perceptions, and psychosocial risk: impacts on young children's development. Pediatrics. 2010 Feb;125(2):313-9. Epub: 2010/01/27. PMID: 20100743.
217. Klein PS, Tzuriel D. Preschoolers type of temperament as predictor of potential difficulties in cognitive functioning. Isr J Psychiatry Relat Sci. 1986;23(1):49-61. Epub: 1986/01/01. PMID: 3759393.
218. Kloth S, Janssen P, Kraaimaat F, et al. Communicative behavior of mothers of stuttering and nonstuttering high-risk children prior to the onset of stuttering. J Fluency Disord. 1995;20(4):365-77.
219. Lyytinen H, Ahonen T, Eklund K, et al. Developmental pathways of children with and without familial risk for dyslexia during the first years of life. Dev Neuropsychol. 2001;20(2):535-54. Epub: 2002/03/15. PMID: 11892951.
220. O'Leary C, Zubrick SR, Taylor CL, et al. Prenatal alcohol exposure and language delay in 2-year-old children: The importance of dose and timing on risk. Pediatrics. 2009;123(2):547-54. PMID: 19171621.
221. Peters SA, Grievink EH, van Bon WH, et al. The contribution of risk factors to the effect of early otitis media with effusion on later language, reading, and spelling. Dev Med Child Neurol. 1997 Jan;39(1):31-9. Epub: 1997/01/01. PMID: 9003727.
222. Roth C, Magnus P, Schjolberg S, et al. Folic acid supplements in pregnancy and severe language delay in children. JAMA. 2011 Oct 12;306(14):1566-73. Epub: 2011/10/13. PMID: 21990300.
223. van Batenburg-Eddes T, Henrichs J, Schenk JJ, et al. Early Infant Neuromotor Assessment is Associated with Language and Nonverbal Cognitive Function in Toddlers:

The Generation R Study. J Dev Behav Pediatr. 2013 Jun;34(5):326-34. Epub: 2013/05/28.
224. Yliherva A, Olsen P, Maki-Torkko E, et al. Linguistic and motor abilities of low-birthweight children as assessed by parents and teachers at 8 years of age. Acta Paediatr. 2001 Dec;90(12):1440-9. Epub: 2002/02/21. PMID: 11853344.
225. Zubrick SR, Taylor CL, Rice ML, et al. Late language emergence at 24 months: an epidemiological study of prevalence, predictors, and covariates. J Speech Lang Hear Res. 2007 Dec;50(6):1562-92. Epub: 2007/12/07. PMID: 18055773.
226. Fey ME, Cleave PL, Long SH, et al. Two approaches to the facilitation of grammar in children with language impairment: an experimental evaluation. J Speech Hear Res. 1993 Feb;36(1):141-57. Epub: 1993/02/01. PMID: 7680731.
227. Fey ME, Cleave PL, Ravida AI, et al. Effects of grammar facilitation on the phonological performance of children with speech and language impairments. J Speech Hear Res. 1994 Jun;37(3):594-607. Epub: 1994/06/01. PMID: 8084191.
228. Fey ME, Cleave PL, Long SH. Two models of grammar facilitation in children with language impairments: phase 2. J Speech Lang Hear Res. 1997 Feb;40(1):5-19. Epub: 1997/02/01. PMID: 9113855.
229. Girolametto L, Pearce PS, Weitzman E. The effects of focused stimulation for promoting vocabulary in young children with delays: a pilot study. J Child Commun Dev. 1996;17(2):39-49.
230. Glogowska M, Campbell R, Peters TJ, et al. A multimethod approach to the evaluation of community preschool speech and language therapy provision. Child Care Health Dev. 2002 Nov;28(6):513-21. Epub: 2003/02/06. PMID: 12568481.
231. Mulac A, Tomlinson CN. Generalization of an operant remediation program for syntax with language delayed children. J Commun Disord. 1977 Sep;10(3):231-43. Epub: 1977/09/01. PMID: 903408.
232. Rvachew S. Speech perception training can facilitate sound production learning. J Speech Hear Res. 1994 Apr;37(2):347-57. Epub: 1994/04/01. PMID: 8028316.
233. Schwartz RG, Chapman K, Terrell BY, et al. Facilitating word combination in language-impaired children through discourse structure. J Speech Hear Disord. 1985 Feb;50(1):31-9. Epub: 1985/02/01. PMID: 3974209.

Figure 1. Analytic Framework



[a]Excluding children with diagnosed disorders including autism, mental retardation, Fragile X, hearing loss, degenerative and other neurologic conditions.
[b]School performance, behavioral competence, socioemotional development, quality of life, and others.

Figure 2. Preferred Reporting of Systematic Reviews and Meta-Analysis (PRISMA) Tree

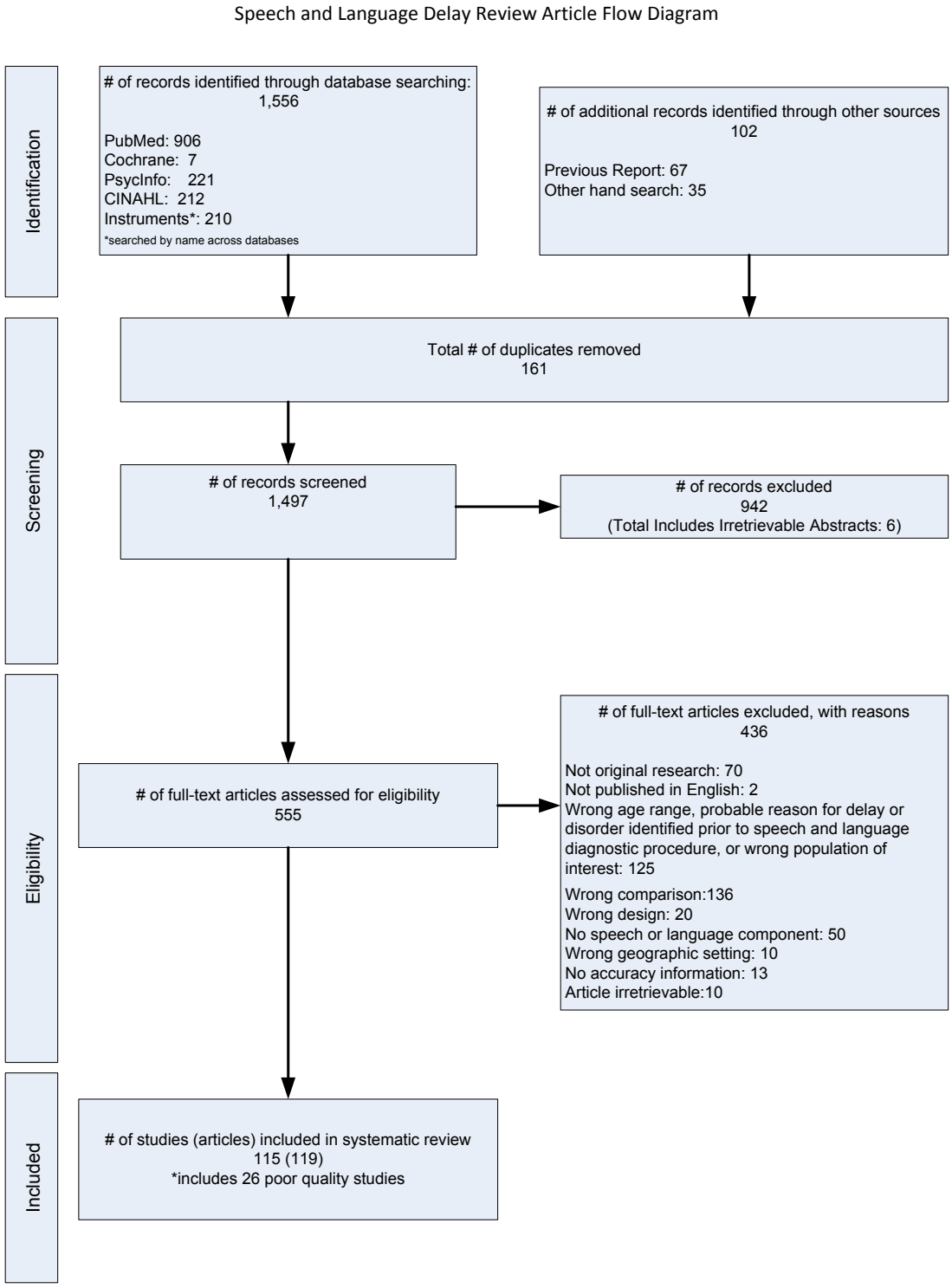


Figure 3a. Parent-Report Screeners: Sensitivity Values

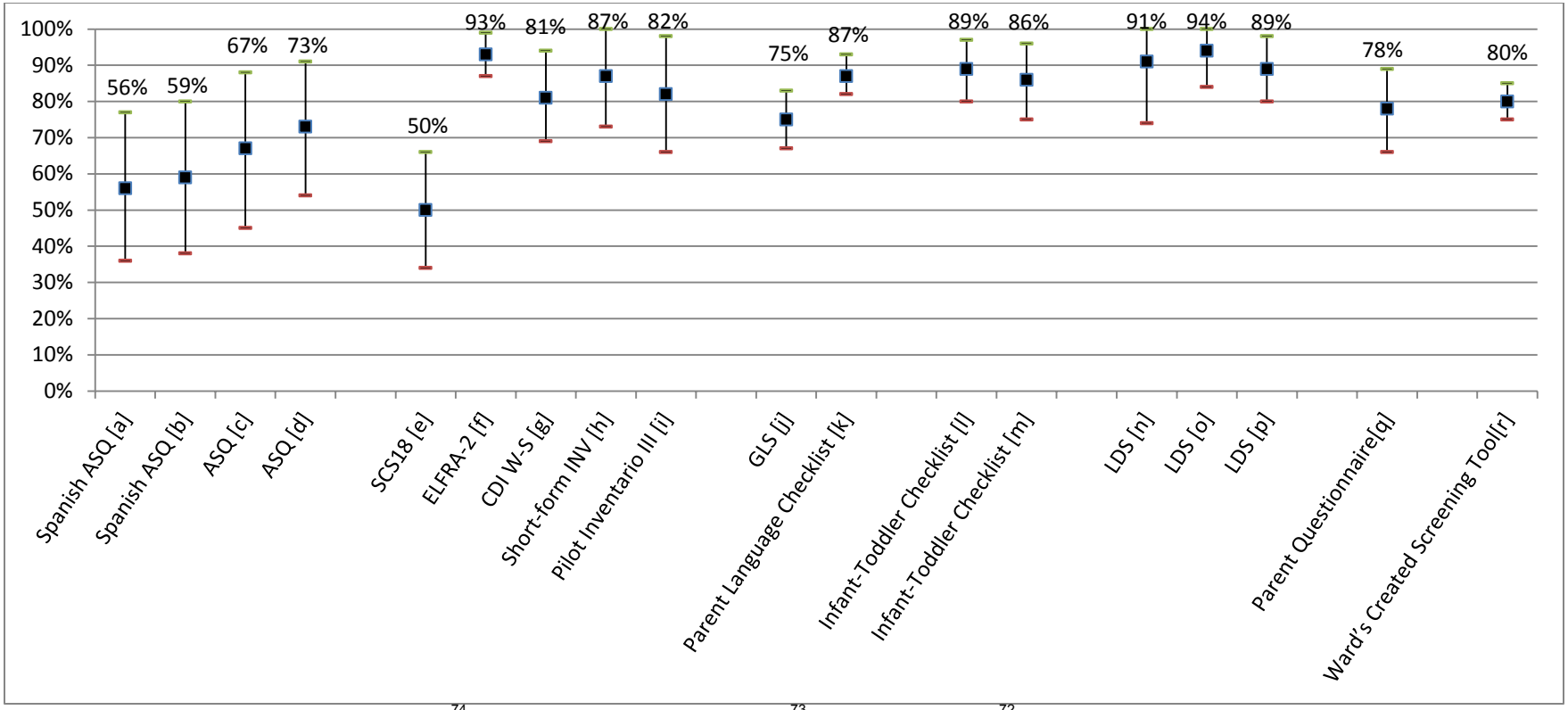


Figure Legend Notes: [a] Guiberson et al, 2011[74]; [b] Guiberson & Rodriguez, 2010[73]; [c] Frisk et al, 2009[72], with reference measure PLS-4, Comprehension; [d] Frisk et al, 2009[72], with reference measure PLS-4, Expression; [e] Swedish CDI Words and Sentences, Westerlund et al, 2006[78]; [f] German CDI Words and Sentences, Sachse & Von Suchodoletz, 2008[76]; 2009,[77]; [g] CDI Words and Sentences, Heilmann et al, 2005[75]; [h] Spanish CDI (Words and Sentences). Guiberson et al, 2011[74]; [i] Spanish CDI III, Guiberson & Rodriguez, 2010[73]; [j] Stott et al, 2002[104]; [k] Earlier version of GLS, Burden, 1986[95]; [l] Wetherby et al, 2003[88], ages 12-17 months; [m] Wetherby et al, 2003[88], ages 18-24 months; [n] Klee et al, 2000[122]; [o] Rescorla & Alley, 2001[102]; [p] Rescorla, 1989[54]; [q] Stokes, 1997[103]; [r] Ward, 1984[108].

ASQ = Ages & Stages Questionnaire; BPVS = British Picture Vocabulary Scales; CDI = Communicative Development Inventory; CI = confidence interval; EAT = Edinburgh Articulation Test; ELFRA = Elternfragebogen fur die Fruberkennung von Riskokindern; GLS = General Language Screen; INV = Inventario; LDS = Language Development Survey; RDLS = Reynell Developmental Language Scale; PLS = Preschool Language Scale; SCS18 = Swedish Communication Screening at 18 months of age; W-S = Words and Sentences.

Figure 3b. Parent-Report Screeners: Specificity Values

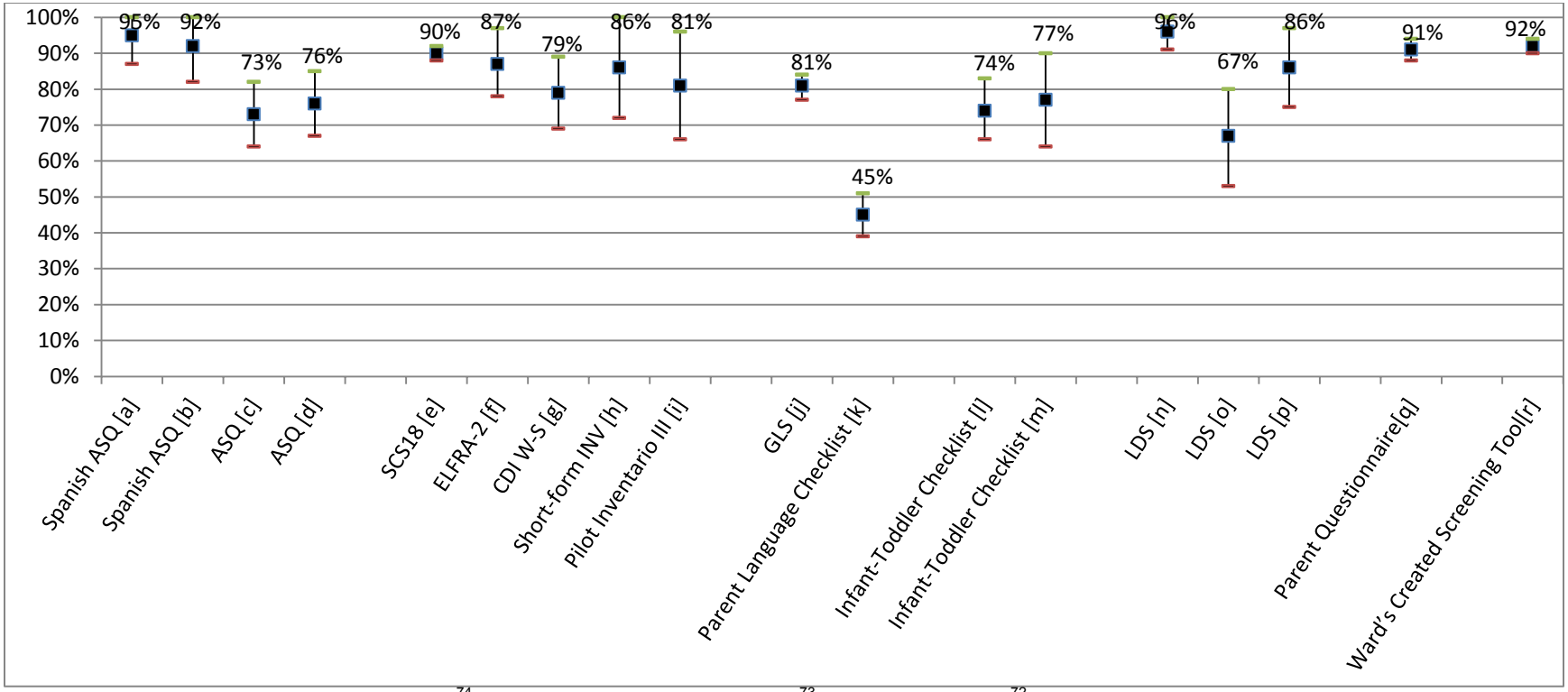


Figure Legend Notes: [a] Guiberson et al, 2011[74]; [b] Guiberson & Rodriguez, 2010[73]; [c] Frisk et al, 2009[72], with reference measure PLS-4, Comprehension; [d] Frisk et al, 2009[72], with reference measure PLS-4, Expression; [e] Swedish CDI Words and Sentences, Westerlund et al, 2006[78]; [f] German CDI Words and Sentences, Sachse & Von Suchodoletz, 2008[76]; 2009[77]; [g] CDI Words and Sentences, Heilmann et al, 2005[75]; [h] Spanish CDI (Words and Sentences), Guiberson et al, 2011[74]; [i] Spanish CDI III, Guiberson & Rodriguez, 2010[73]; [j] Stott et al, 2002[104]; [k] Earlier version of GLS, Burden, 1986[95]; [l] Wetherby et al, 2003[88], ages 12-17 months; [m] Wetherby et al, 2003[88], ages 18-24 months; [n] Klee et al, 2000[122]; [o] Rescorla & Alley, 2001[102]; [p] Rescorla, 1989[54]; [q] Stokes, 1997[103]; [r] Ward, 1984[108].

ASQ = Ages & Stages Questionnaire; BPVS = British Picture Vocabulary Scales; CDI = Communicative Development Inventory; CI = confidence interval; EAT = Edinburgh Articulation Test; ELFRA = Elternfragebogen fur die Fruberkennung von Riskokindern; GLS = General Language Screen; INV = Inventario; LDS = Language Development Survey; RDLS = Reynell Developmental Language Scale; PLS = Preschool Language Scale; SCS18 = Swedish Communication Screening at 18 months of age; W-S = Words and Sentences.

Figure 4a. Trained Examiner Screeners: Sensitivity Values

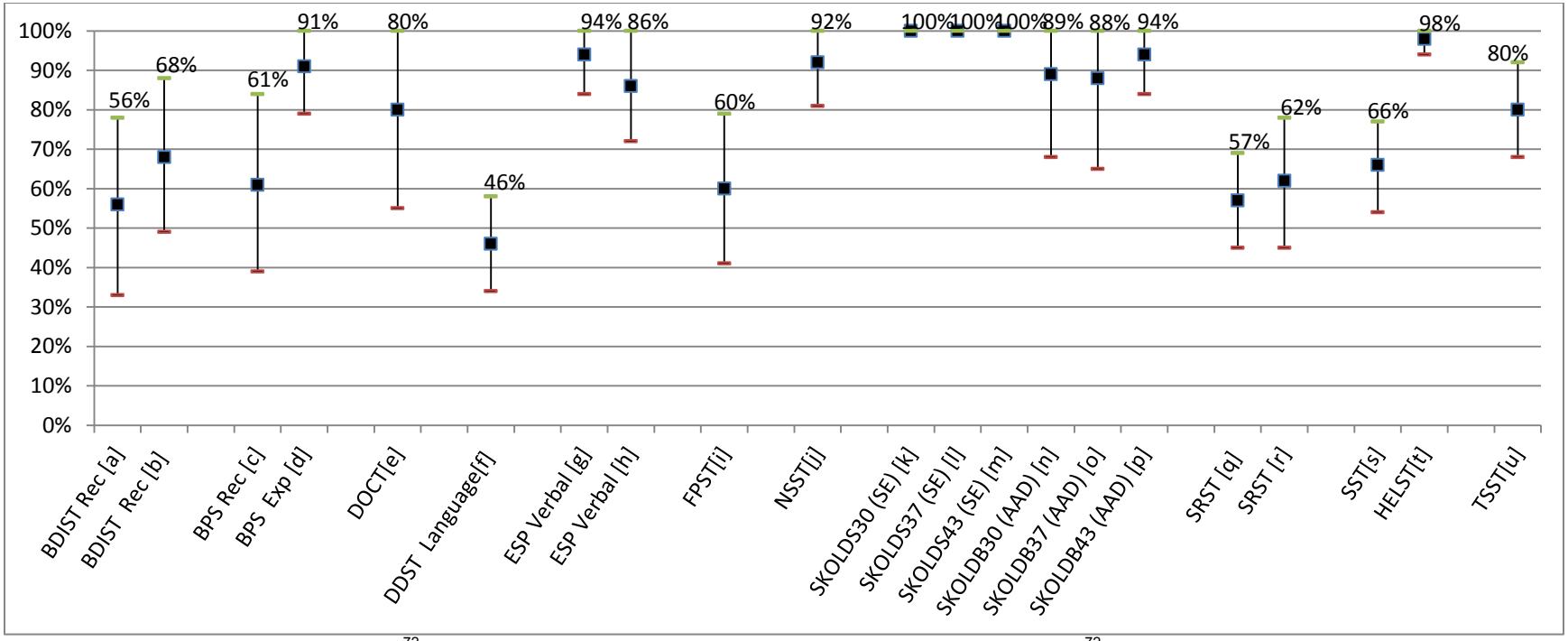


Figure Legend Notes: [a] Frisk et al, 2009[72], with reference measure PLS-4, Comprehension; [b] Frisk et al, 2009[72], with reference measure PLS-4, Expression; [c] Frisk et al, 2009[72], with reference measure PLS-4, Receptive; [d] Frisk et al, 2009[72], with reference measure PLS-4, Expressive; [e] Alberts et al, 1995[91]; [f] Borowitz & Glascoe, 1986[94]; [g] Frisk et al, 2009[72], with reference measure PLS-4, Comprehension; [h] Frisk et al, 2009[72], with reference measure PLS-4, Expression; [i] Allen & Bliss, 1987[92]; [j] Allen & Bliss, 1987[92]; [k] Bliss & Allen, 1984[93], ages 30-36 months; [l] Bliss & Allen, 1984[93], ages 37-42 months; [m] Bliss & Allen, 1984[93], ages 43-48 months; [n] Bliss & Allen, 1984[93], ages 30-36 months; [o] Bliss & Allen, 1984[93], ages 37-42 months; [p] Bliss & Allen, 1984[93], ages 43-48 months; [q] Sturner et al, 1996[106], with reference measure AAPS-R; [r] Sturner et al, 1996[106], with reference measure ITPA, Bankson; [s] Laing et al, 2002[99]; [t] Law, 1994[100]; [u] Rigby & Chesham, 1981[86].

AAD = African American dialect; BDIST = Battelle Developmental Inventory Screening Test; BPS = Brigance Preschool Screening; CI = confidence interval; DDST = Denver Developmental Screening Test; DOCT = Davis Observation Checklist for Texas; ESP = Early Screening Profile; FPSLST = Fluharty Preschool Speech and Language Screening Test; FPST = Fluharty Preschool Screening Test; HELST = Hackney Early Language Screening Test; ITPA = Illinois Test of Psycholinguistic Abilities; NSST = Northwestern Syntax Screening Test; PLS = Preschool Language Scale; SE = standard English; SKOLD = Screening Kit of Language Development; SRST = Sentence Repetition Screening Test; SST = Structured Screening Test; TSST = Trial Speech Screening Test.

Figure 4b. Professional/Paraprofessional Report Screeners: Specificity Values

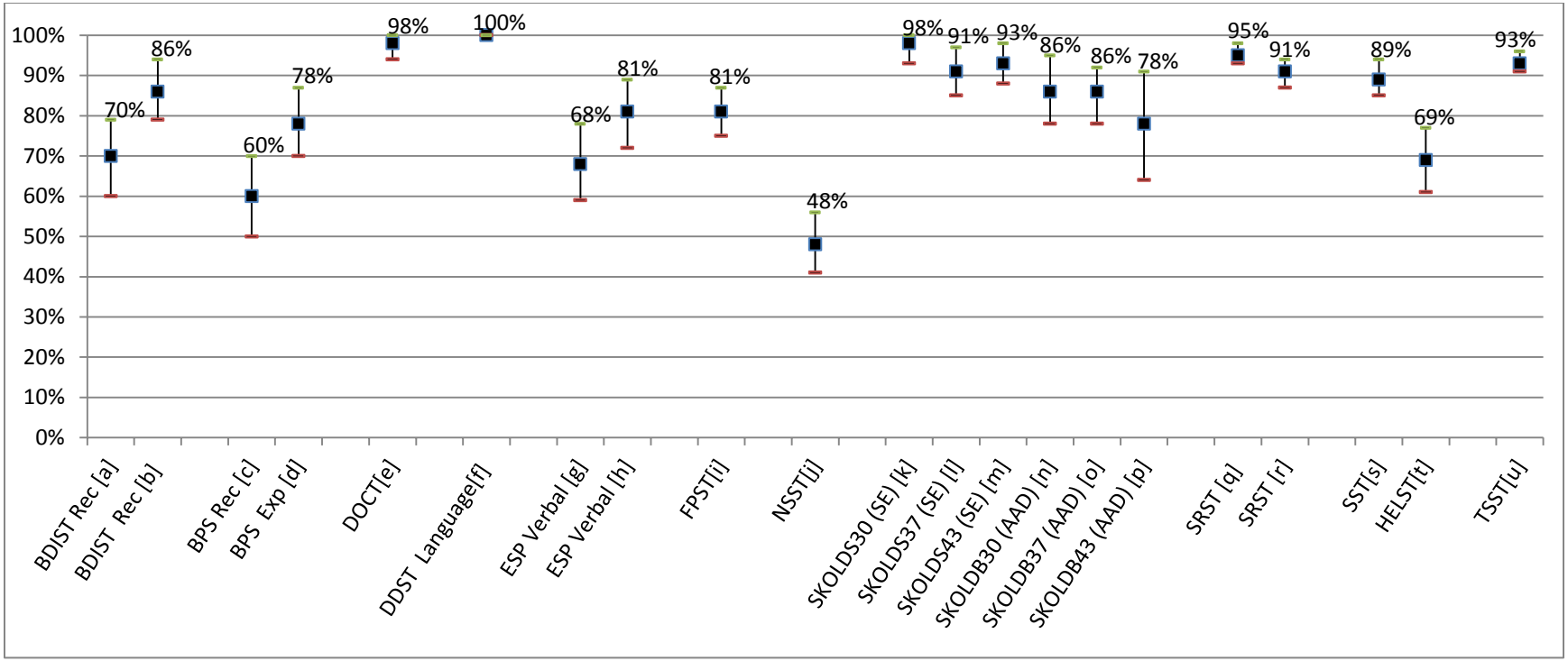


Figure Legend Notes: [a] Frisk et al, 2009[72], with reference measure PLS-4, Comprehension; [b] Frisk et al, 2009[72], with reference measure PLS-4, Expression; [c] Frisk et al, 2009[72], with reference measure PLS-4, Receptive; [d] Frisk et al, 2009[72], with reference measure PLS-4, Expressive; [e] Alberts et al, 1995[91]; [f] Borowitz & Glascoe, 1986[94]; [g] Frisk et al, 2009[72], with reference measure PLS-4, Comprehension; [h] Frisk et al, 2009[72], with reference measure PLS-4, Expression; [i] Allen & Bliss, 1987[92]; [j] Allen & Bliss, 1987[92]; [k] Bliss & Allen, 1984[93], ages 30-36 months; [l] Bliss & Allen, 1984[93], ages 37-42 months; [m] Bliss & Allen, 1984[93], ages 43-48 months; [n] Bliss & Allen, 1984[93], ages 30-36 months; [o] Bliss & Allen, 1984[93], ages 37-42 months; [p] Bliss & Allen, 1984[93], ages 43-48 months; [q] Sturner et al, 1996[106], with reference measure AAPS-R; [r] Sturner et al, 1996[106], with reference measure ITPA, Bankson; [s] Laing et al, 2002[99]; [t] Law, 1994[100]; [u] Rigby & Chesham, 1981[86].

AAD = African American dialect; BDIST = Battelle Developmental Inventory Screening Test; BPS = Brigance Preschool Screening; CI = confidence interval; DDST = Denver Developmental Screening Test; DOCT = Davis Observation Checklist for Texas; ESP = Early Screening Profile; FPSLST = Fluharty Preschool Speech and Language Screening Test; FPST = Fluharty Preschool Screening Test; HELST = Hackney Early Language Screening Test; ITPA = Illinois Test of Psycholinguistic Abilities; NSST = Northwestern Syntax Screening Test; PLS = Preschool Language Scale; SE = standard English; SKOLD = Screening Kit of Language Development; SRST = Sentence Repetition Screening Test; SST = Structured Screening Test; TSST = Trial Speech Screening Test.

Table 1. Differences in Included Studies in the 2006 and Current Review

2006 Review	Current Review
• ***Screening Studies*** o Screeners reviewed could be ≤ 30 minutes. o Studies included some children older than 6 years of age. o Studies included some children with known conditions (e.g., cleft palate). o Acceptable reference standards included other screeners or items extracted from measures of cognitive ability. • ***Treatment Studies*** o RCTs included no treatment as well as treatment comparisons such as usual care.	• ***Screening Studies*** o Screeners could be > 10 minutes if administered outside primary care office and interpreted only by clinician. o If studies included children older than 6 years of age, data needed to be available on the sample who were younger than 6 years of age. o Studies were excluded if they included children with known conditions (e.g., cleft palate). o Reference standards had to be instruments used by speech and language practitioners to diagnose speech and language delay or disorders in either research or clinical venues. • ***Treatment Studies*** o Treatment studies were limited to RCTs with treatment comparisons limited to unspecified usual care or care in the community.

RCT = randomized controlled trial.

Table 2. Comparison of Studies Meeting Inclusion and Key Question Quality Criteria in the 2006 and Current Review

Key Question/Contextual Question	Study	2006	Current
KQ 1. Improved outcomes from screening	NA		
KQ 2. Accuracy of screening instruments	Alberts 1995[91]	X	X
	Allen 1987[92]	X	X
	Blaxley 1983[112]	X	
	Bliss 1984[93]	X	X
	Borowitz 1986[94]	X	X
	Burden 1996[95]	X	X
	Chaffee 1990[113]	X	
	Clark 1995[66]	X	
	Conti-Ramsden 2003[196]	X	
	Coplan 1982[197]	X	
	Dodge 1980[114]	X	
	Drumwright 1973[97]	X	X
	Feeney 1996[119]	X	
	Frisk 2009[72]		X
	German 1982[120]	X	
	Glascoe 1991[115]	X	
	Glascoe 1993[198]	X	
	Guiberson 2010[73]		X
	Guiberson 2011[74]		X
	Heilmann 2005[75]		X
	Klee 1998[98]	X	X
	Klee 2000[122b]	X	X
	Laing 2002[99]	X	X
	Law 1994[100]	X	X
	Law 1998[89] (SR)	X	
	Leppert 1998[199]	X	
	Levett 1983[67]	X	
	Macias 1998[200]	X	
	Nelson 2006[64] (SR)[c]		X
	Nelson 2006[90] (SR)		X
	Rescorla 1989[54]	X	X
	Rescorla 1993[69]	X	
	Rescorla 2001[102]	X	X
	Rigby 1981[86]		X
	Sachse 2008[76]		X
	Sachse 2009[77a]		X
	Scherer 1995[117]	X	
	Sherman 1996[68]	X	
	Stokes 1997[103]	X	X
	Stott 2002[104]	X	X
	Sturner 1993[105]	X	X
	Sturner 1996[106]	X	X
	Ward 1984[108]	X	X
	Westerlund 2006[78]		X
	Wetherby 2003[88]		X
KQ 3. Harms of screening	NA		
KQ 4. Surveillance	NA		
KQ 5. Benefits of treatment	Almost 1998[134]	X	X
	Barratt 1992[142]	X	
	Cole 1986[143]	X	
	Courtright 1979[144]	X	
	Fricke 2013[125]		X
	Gibbard 1994[136]	X	X
	Girolametto 1996[137]	X	X
	Girolametto 1997[138]	X	X
	Glogowska 2000[135]	X	X
	Jones 2005[126]		X

Table 2. Comparison of Studies Meeting Inclusion and Key Question Quality Criteria in the 2006 and Current Review

Key Question/Contextual Question	Study	2006	Current
	Law 1998[89] (SR)	X	
	Law 1999[147]	X	
	Law 2003[201] (SR)	X	
	Lewis 2008[127]		X
	Morgan 2009[131] (SR)		X
	Nelson 2006[64] (SR)[c]		X
	Nelson 2006[90] (SR)		X
	Robertson 1997[140]	X	X
	Robertson 1999[139]	X	X
	Rvachew 2001[145]	X	
	Shelton 1978[141]	X	X
	Wake 2011[128]		X
	Wake 2013[130]		X
	Wilcox 1991[146]	X	
	Yoder 2005[129]		X
KQ 6. Non-speech and language benefits of treatment	Fricke 2013[125]		X
	Girolametto 1996[137]	X	
	Glogowska 2000[135]	X	
	Law 1998[89] (SR)	X	
	Law 1999[147]	X	
	Nelson 2006[64] (SR)[c]		X
	Nelson 2006[90] (SR)		X
	Robertson 1999[139]	X	X
	Rvachew 2001[145]	X	
	Wake 2011[128]		X
	Wake 2013[130]		X
KQ 7. Harms of treatment	Glogowska 2000[135]	X	X
	Robertson 1999[139]	X	X
	Wake 2013[130]		X
CQ 1. Techniques of screening	Alvik 2011[202]		X
	Dionne 2006[203]		X
	Drumwright 1973[97]	X	X
	Fenson 2007[204]		X
	Fluharty 1974[205]	X	X
	Frankenburg 1992[52]	X	X
	Guiberson 2010[73]		X
	Guiberson 2011[74]		X
	Heo 2008[82]		X
	Jackson-Maldonado 2013[206]		X
	Kerstjens 2009[186]		X
	Rescorla 1989[54]	X	X
	Rescorla 2002[121]	X	X
	Rescorla 2005[207]		X
	Sices 2009[84]		X
	Squires 1999[208]		X
	Sturner 1993[105]		X
	Sturner 1994[106]		X
	Vach 2010[210]		X
	van Agt 2007[85]		X
	Westerlund 2004[211]		X
	Wetherby 2002[212]		X
CQ 2. Risk factors	Adams-Chapman 2013[180]		X
	Alston 2005[165]		X
	Brookhouser 1979[213]	X	
	Campbell 2003[173]	X	X
	Cantwell 1985[214]	X	
	Choudhury 2003[175]	X	X
	Desmarais 2008[171]		X

Table 2. Comparison of Studies Meeting Inclusion and Key Question Quality Criteria in the 2006 and Current Review

Key Question/Contextual Question	Study	2006	Current
	Everitt 2013[215]		X
	Foster-Cohen 2010[185]		X
	Fox 2002[188]	X	X
	Glascoe 2010[216]		X
	Hammer 2010[174]		X
	Harrison 2010[179]		X
	Henrichs 2011[81]		X
	Kerstjens 2009[186]		X
	Kerstjens 2011[189]		X
	Kerstjens 2012[190]		X
	Klein 1986[217]	X	
	Kloth 1995[218]	X	
	Law 2009[46]		X
	Law 2012[172]		X
	Lyytinen 2001[219]	X	
	Mossabeb 2012[83]		X
	O'Leary 2009[220]		X
	Pena 2011[183]		X
	Peters 1997[221]	X	
	Potijk 2353[191]		X
	Pruitt 2010[166]		X
	Reilly 2007[178]		X
	Reilly 2009[177]		X
	Reilly 2013[181]		X
	Roth 2011[222]		X
	Schjolberg 2011[192]		X
	Singer 2001[184]	X	X
	Tallal 1989[182]	X	X
	Tomblin 1991[167]	X	X
	Tomblin 1997[168]	X	X
	van Batenburg-Eddes 2013[223]		X
	Van Lierde 2009[193]		X
	Weindrich 2000[170]	X	X
	Whitehurst 1991[169]	X	X
	Yliherva 2001[224]	X	X
	Zambrana 2014[187]		X
	Zubrick 2007[225]		X
CQ 3. Role of providers	None		

[a] Companion to Sachse 2008.
[b] Companion to Klee 1998.
[c] Companion to Nelson et al, 2006.

CQ = contextual question; KQ = key question; SR = systematic review; USPSTF = U.S. Preventive Services Task Force.

Table 3. Screening Accuracy Studies From the 2006 and Current Review

Study reference Quality rating Source	Screening tool Screening source	Country Recruitment setting	Sample description Recruitment method Inclusion/exclusion criteria Sampling for reference measure
Alberts et al, 1995[91] Fair 2006 review	Davis Observation Checklist for Texas Trained examiner	USA Head Start centers in central Texas	Children 52-67 months of age No description of recruitment methods Eligibility included normal hearing and English-language dominance No sampling for reference measure
Allen and Bliss, 1987[92] Fair 2006 review	Fluharty Preschool Screening Test Northwestern Syntax Screening Test Trained examiner	USA Child care centers in suburban Detroit	Preschool-age children 36-47 months of age No description of recruitment methods No inclusion/exclusion criteria provided No sampling for reference measure
Bliss and Allen, 1984[93] Fair 2006 review	Screening Kit of Language Development Trained examiner	USA Child care centers in metropolitan Detroit	Preschool-age children 30-48 months of age No description of recruitment methods No inclusion/exclusion criteria provided No sampling for reference measure
Borowitz and Glascoe, 1986[94] Fair 2006 review	Denver Developmental Screening Test Trained examiner	USA Developmental evaluation center in middle Tennessee	Children 18-66 months of age Children were referred by Head Start centers, day care and preschool centers, public schools, public health agencies, the Department of Human Services, and private physicians Children were referred because of their home environment, medical problems, and suspected delays No sampling for reference measure
Burden et al, 1996[95] Good 2006 review	Parent Language Checklist Parent report	UK Community sample within Cambridge Health Authority	Children 36 months of age Same sample as described by Stott et al, 2002,[104] but differs in terms of who was followed and analyzed. Families residing within the Cambridge Health Authority with a child born during a 9-month period were invited by mail to complete the screening when the child was 36 months. 1,936 of the 2,590 screeners were returned. Of the 472 net-positive children, 277 proceeded to the screening. From the pool of randomly selected net-negative children, 226 were randomly selected and 148 proceeded to the screening. A total of 425 children were included. Children were eligible if they were not a product of a multiple birth, had a listed medical condition (not described), lived in a multilingual home, or were eliminated on the telephone interview. All children failing and not excluded and matched sample of children passing
Drumwright et al, 1973[97] Fair 2006 review	Denver Articulation Screening Exam Trained examiner	USA Head Start, public and private child care centers, schools, pediatric clinics in Denver	Children 2.5-6 years of age No description of recruitment methods Children from economically disadvantaged homes No sampling for reference measure

Table 3. Screening Accuracy Studies From the 2006 and Current Review

Study reference Quality rating Source	Screening tool Screening source	Country Recruitment setting	Sample description Recruitment method Inclusion/exclusion criteria Sampling for reference measure
Frisk et al, 2009[72] Fair New	Ages and Stages Questionnaire Communication domain Parent report Battelle Developmental Inventory Screening Test communication domain Brigance Preschool Screen Early Screening Profiles Trained examiner	Canada Child Development Programs (programs that provide early intervention services to young children at risk for developmental disabilities) in Ontario	Parents of children 4.5 years of age No description of recruitment methods Children were eligible if they were not legally blind, profoundly hearing impaired, untestable because of global delay, diagnosed with autism spectrum disorder, or used English as a second language with less than 19 months daily exposure to English Of the 131 children initially screened, data were available for only 111 children No sampling for reference measure
Guiberson and Rodriguez, 2010[73] Fair New	Spanish Ages and Stages Questionnaire Communication domain Pilot Inventario-III (Spanish Communicative Development Inventory) Parent report	USA Head Start centers, early childhood program, medical clinic in 2 western states	Parents of children 32-62 months of age Recruitment included sending flyers home to families with children enrolled in preschool programs, posting flyers in early childhood centers and medical clinics, and attending preschool family nights and Head Start community health fairs Eligible families spoke only or mostly Spanish; eligible children had normal hearing, no known neurological impairment, no severe phonological impairment, and spoke only or mostly Spanish Predetermined that approximately half of sample would have language delays and half without
Guiberson et al, 2011[74] Fair New	Spanish Ages and Stages Questionnaire Communication domain Short-form Inventarios del desarrollo de habilidades comunicativas: palabras y enunciados (Spanish CDI) Parent report	USA Early Head Start center, early intervention programs in 2 western states	Parents of toddlers 24-35 of age Study flyers sent to Early Head Start family members and service coordinators; interested parents of children in these programs who met inclusion criteria were invited Eligible families spoke only or mostly Spanish; eligible children had normal hearing, no known neurological impairment, and spoke only or mostly Spanish; children with both typical language development and expressive language delays were included Predetermined that approximately half of sample would have language delays and half without
Heilmann et al, 2005[75] Study 2 Fair New	MacArthur-Bates Communicative Development Inventory: Words & Sentences Parent report	USA University research center	Parents of children who were 24 months of age Children were part of a larger longitudinal study of language delay who were recruited via birth registry, newspapers, flyers, posters at health fairs, and referrals from birth-to-3 providers Eligible children were from a monolingual English-speaking home, scored within the normal range on Denver II for general development, had normal hearing, and normal oral and speech motor abilities Included 38 late talkers and 62 children part of the larger study who had typical language

Table 3. Screening Accuracy Studies From the 2006 and Current Review

Study reference Quality rating Source	Screening tool Screening source	Country Recruitment setting	Sample description Recruitment method Inclusion/exclusion criteria Sampling for reference measure
Klee et al, 1998[98] Fair 2006 review Klee et al, 2000[122] Fair	Language Development Survey Parent report	USA Community in Wyoming	Parents of children 24-26 months of age Families recruited by mail from 2 cities No inclusion/exclusion criteria provided All children who screened positive in an earlier study and a sample of those who screened negative were invited to participate in a comprehensive evaluation Same sample as in Klee et al, 1998,[98] with a different analysis
Laing et al, 2002[99] Good 2006 review	Structured Screening Test Trained examiner	UK Health center in section of London	Children 30 months of age Health visitors invited parents of all children who attended their child's 30-month developmental checkup to participate Children were eligible whether or not they had a previously diagnosed developmental disability No sampling for reference measure
Law, 1984[100] Good 2006 review	Hackney Early Language Screening Test Trained examiner	UK Pediatric practice in section of London	Children 30 months of age All children attending a routine developmental checkup at 30 months of age in a London suburb were screened No description of inclusion/exclusion criteria All who tested positive and a sample of those passed were seen for a diagnostic evaluation, provided their first language was English
Rescorla, 1989[54] Study 3 Fair 2006 review	Language Development Survey Parent report	USA University research center	Parents of children 23-34 months of age Parents recruited in response to a telephone inquiry following a notice in the paper and pediatricians' offices about a study of delayed language (delayed language sample) and through lists of participants in a previous study or whose pediatrician recommended them (typical language sample) Children recruited for study of language delay and the typical language comparison group
Rescorla and Alley, 2001[102] Study 2 Fair 2006 review	Language Development Survey Parent report	USA University research center	Parents of children 23-34 months of age Sample of parents of children who were recruited for an epidemiological study of language delay in response a letter sent to all families of children 2 years of age in 4 townships in a suburban Philadelphia county. The set who failed the LDS and a matched group who passed the LDS were invited to participate in Study 2. No inclusion/exclusion criteria described for epidemiological study other than age; for Study 2, sample of typical language children were matched to group with language delays on age, gender and SES All children who failed the LDS in the epidemiological study and a matched sample who passed the LDS

Table 3. Screening Accuracy Studies From the 2006 and Current Review

Study reference Quality rating Source	Screening tool Screening source	Country Recruitment setting	Sample description Recruitment method Inclusion/exclusion criteria Sampling for reference measure
Rigby and Chesham, 1981[86] Fair New	Trial Speech Screening Test Trained examiner	UK Primary care practice	Children 4.5 years of age Total population of children attending the school entrant medical examination Children were excluded if they were already receiving speech therapy No sampling for reference measure
Sachse and Von Suchodoletz, 2008[76] Sachse and Von Suchodoletz, 2009[77] Good New	ELFRA-2 (German version of MacArthur CDI: Toddler form) Parent report	Germany Community	Parents of children 2 years of age Parents recruited via birth announcements in a newspaper in Germany Children were eligible if they were from a monolingual German-speaking home and did not have poor vision, a hearing impairment, an abnormal result on a hearing screening, or missing subtests on the reference standard due to poor cooperation All children classified as late talkers based on the screening and a random sample of children with typical language development
Stokes, 1997[103] Good 2006 review	Developmental Nurse Screen Trained examiner Parent Questionnaire Parent	Australia Child Health Centers in metropolitan Perth	Parents of children 34-40 months of age Letters were sent inviting parents along with a questionnaire Children were eligible if they had no developmental disability and English was their primary language Of the 1,500 parents invited, 409 consented, and 398 were included (11 were removed because of a developmental disability or non-English language) No sampling for reference measure
Stott et al, 2002[104] Fair 2006 review	General Language Screen (formerly Parent Language Checklist) Parent report	UK Community within Cambridge Health authority	Children 36 months of age Families with a child born during a 9-month period were invited by mail to complete the screening 1,936 of the 2,590 screeners were returned, and 75 were excluded based on predefined (but unstated) criteria Selection of both passes and fails: 596 of 636 parents were interviewed at 37 months and 419 of the children were assessed at 39 months; 254 of 279 families who were invited were followed up at 45 months
Sturner et al, 1993[105] Fair 2006 review Study 1	Fluharty Preschool Speech and Language Screening Test (Revision of Fluharty Preschool Screening Test) Trained examiner	USA School in a rural county in North Carolina	Children 53-68 months of age Parents recruited during kindergarten registration to bring their children back for screening; of the 378 who registered, 279 came for screening All kindergarten registrants Stratified samples of children completing the screening invited to return for testing; all positive and sample of borderline and negative screens
Sturner et al, 1993[105] Fair 2006 review Study 2	Fluharty Preschool Speech and Language Screening Test (Revision of Fluharty Preschool Screening Test) Trained examiner	School in a rural county in North Carolina	Children 55-69 months of age Parents recruited during kindergarten registration to bring their children back for screening; of the 533 who registered, 421 came for screening All kindergarten registrants Stratified samples of children completing the screening invited to return for diagnostic testing; all positive screens and sample of borderline and negative screens

Table 3. Screening Accuracy Studies From the 2006 and Current Review

Study reference Quality rating Source	Screening tool Screening source	Country Recruitment setting	Sample description Recruitment method Inclusion/exclusion criteria Sampling for reference measure
Sturner et al, 1996[106] Fair 2006 review	Sentence Repetition Screening Test Trained examiner	USA School in a rural county in North Carolina	Children 54-66 months of age Parents recruited during kindergarten registration to bring their children back for screening All kindergarten registrants Followup of all positive screens and sample of borderline and negative screens
Ward, 1984[108] Fair 2006 review	Ward screening tool (author-created) Trained examiner	UK Community in one district in Manchester	Children 7-23 months of age All parents in district were invited to a local clinic for a hearing test between the ages of 7 and 9 months (screening occurred between 7 and 23 months). Children were ineligible if their caregivers had limited English No sampling for reference measure
Westerlund et al, 2006[78] Fair 2006 review	Swedish Communication Screening -18 (derived from Swedish MacArthur-Bates CDI) Parent report	Sweden Community sample invited to all child health centers in one county	Parents of children 18 months old All parents of 18-month-old children invited to come to child health care centers based on the national population register of the region All had Swedish as their primary language No sampling for reference measure
Wetherby et al, 2003[88] Fair New	Infant-Toddler Checklist from the Communication and Symbolic Behavior Scales Parent report	USA Research sample recruited from the community for a longitudinal study	Parents of children 6-24 months old Parents recruited from public announcements, community family events, health care providers, child care providers, public agency that provides services infants and toddlers under Part C of the Individuals with Disabilities Education Act Sample was drawn from 2434 parents who completed the Infant-Toddler Checklist and the subset of 392 children 12-24 months old whose parents also completed a Behavior Sample Inclusion criteria included completion of Behavior Sample within 2 months of the Infant Toddler Checklist All children who failed the screen and samples of those scored between the mean and 1 SD below the mean and those who scored at or above the mean

LDS = Language Development Survey; SD = standard deviation; UK = United Kingdom; USA = United States of America.

Table 4. Screening Tools for Speech and Language Delay and Disorders in Children Age 5 Years and Younger

Screening tool	Domain(s) or skills screened	Summary scores	Number of items Time to complete	Appropriate ages	Reliability	Screening source
Ages and Stages Questionnaire Communication domain, 2nd edition[72,208]	Broad communication skills	Communication	6 (at each of 19 age levels) NR	4-60 months	Coefficient alpha = 0.63-0.75	Parent report
Spanish version of Ages and Stages Questionnaire Communication domain[73]	Broad communication skills in Spanish	Communication	6 (at each of 19 age levels) NR	4-60 months	NR	Parent report
Battelle Developmental Inventory Screening Test Communication domain[72]	Receptive and expressive language skills	Receptive Expressive	9 9 NR	12-96 months	NR	Trained examiner
Brigance Preschool Screen[72]	Receptive and expressive language skills	Understanding reading (receptive language) Expressive language	2 4 NR	45-56 months	NR	Trained examiner
Davis Observation Checklist for Texas[91]	Speaking, understanding Speech fluency, voice, and hearing	Communication	2-5 behaviors (in each of 6 areas) NR	4-5 years	NR	Trained examiner
Denver Articulation Screening Exam[97]	Articulation	Articulation	34 sound elements NR	2.5-7 years	Test-retest = 0.95	Trained examiner
Denver Developmental Screening Test Language Sector[94]	Broad language skills	Global language	NR NR	1 month-6 years	NR	Trained examiner
Developmental Nurse Screen[103]	Broad language	Global language	1 NR	34-40 months	NR	Trained examiner
Early Screening Profiles[72]	Word comprehension and production	Verbal concepts	25 NR	2.0-6.11 years	NR	Trained examiner
Fluharty Preschool Screening Test/Fluharty Preschool Speech and Language Screening Test[105,209]	Articulation, expressive, and receptive language skills	Articulation Language	35 6-10 minutes	2-6 years	Test-retest = 0.96-0.98	Trained examiner
General Language Screen (GLS)/ Parent Language Checklist[95,104]	Comprehension, expression, articulation, pragmatics	Global language	11 NR	36 months	Coefficient alpha = 0.74	Parent report
Infant-Toddler Checklist[88]	Emotion and use of eye gaze, communication, gestures, sound use word use, word understanding, object use	Social composite Speech composite Symbolic composite Total score	24 5-10 minutes (entire screener)	6-24 months	Test-retest Total = 0.86 Social = 0.70 Speech = 0.73 Symbolic = 0.79	Parent report
Language Development Survey[54,102]	Expressive vocabulary and word combinations	Expressive language	310 words, word combinations NR	18-35 months	Coefficient alpha = 0.99 Test-retest = 0.86 to 0.99 for categories	Parent report
MacArthur-Bates Communicative Development Inventory (CDI): Words and Sentences (W-S)[75,204]	Expressive vocabulary, morphology, and grammar	Productive vocabulary	798 words, morphological markers, Sentences 20–40 minutes	16-30 months	Test-retest Complexity = 0.96 Vocabulary = 0.95	Parent report

Table 4. Screening Tools for Speech and Language Delay and Disorders in Children Age 5 Years and Younger

Screening tool	Domain(s) or skills screened	Summary scores	Number of items Time to complete	Appropriate ages	Reliability	Screening source
ELFRA-2, German version of MacArthur CDI: Toddler (now CDI: Words and Sentences)[76]	German expressive vocabulary, morphology, and grammar	Global language (using all components)	260 vocabulary 25 syntax 11 morphology NR	16-30 months	NR	Parent report
Pilot Inventario-III (Spanish version of CDI-III)[73]	Expressive vocabulary, grammar, usage	Expressive language	100 vocabulary 12 sentence usage 12 language use NR	30-37 months	Coefficient alpha Vocabulary = 0.92 Sentences = 0.95 Usage = 0.94	Parent report
Short Form of Inventarios del desarrolo de habilidades comunicativas: palabras y enuciados (Spanish version of CDI-WS)[74,206]	Spanish expressive vocabulary, morphology, and grammar	Expressive language	100 words, word combinations 15 minutes	16-30 months	NR	Parent report
Swedish Communication Screening (SCS-18) (derived from Swedish CDI)[78]	Swedish expressive and receptive vocabulary, morphology, grammar	Word production	90 words 13 gestures NR	18 months	Coefficient alpha Word production= 0.97 Word comprehension = 0.96 Test–retest Word production = 0.97 Word comprehension = 0.89	Parent report
Northwestern Syntax Screening Test[92]	Expressive and receptive knowledge of syntactic forms	Syntactic expression Syntactic comprehension	40-20 expressive and 20 receptive NR	3-8 years	NR	Trained examiner
Parent Questionnaire[103]	Sentence use Comprehension Articulation Problems	Global language	4 2 minutes	34-40 months	NR	Parent report
Screening Kit of Language Development[93]	Vocabulary comprehension, story completion, sentence completion, paired sentence repetition, individual sentence repetition with and without pictures, comprehension of commands	Global language	38-50 items per subtest 10 minutes	30-60 months	NR	Trained examiner
Sentence Repetition Screening Test[106,164]	Expressive morphology and articulation	Global language Articulation	15 NR	54-66 months	Coefficient alpha Language = 0.83 Articulation = 0.88	Trained examiner
Trial Speech Screening Test[86]	Articulation Grammar	Language	12 NR	54 months	NR	Trained examiner
Ward screening tool (author-created)[108]	Attention to auditory and language stimuli, prelanguage expression	Prelinguistic behaviors	10 NR	7-9 months	NR	Parent report

NR = not reported

Table 5. Accuracy of Screening Instruments for Speech and Language Delays and Disorders: Parent-Rated Screeners

Instrument and version (Decision cutoff point)	Author, Year, USPSTF quality	Age	N	Reference instrument	Sensitivity 95% CI	Specificity 95% CI[a]	Prevalence[a]	PPV[a,b] NPV[a,b]	PLR[a] NLR[a]
Ages and Stages Questionnaire, 2nd ed. ("recommended cutoff")	Frisk et al, 2009[72] Fair	4.5 years	110	PLS-4 Comprehension PLS-4 Expression	67% 45%-88% 73% 54%-91%	73% 64%-82% 76% 67%-85%	16% 20%	32% 92% 43% 92%	2.4 0.46 3.0 0.36
Ages and Stages Questionnaire Spanish version (NR)	Guiberson et al, 2011[74] Fair	24-35 months	45	PLS-4 Expression, Spanish edition	56% 36%-77%	95% 87%-100%	51%	92%[c] 67%[c]	12.4 0.46
Ages and Stage Questionnaire Spanish version (NR)	Guiberson and Rodriguez, 2010[73] Fair	32-36 months	48	PLS-4 Expression, Spanish edition	59% 38%-80%	92% 82%-100%	46%	87% 73%	7.7 0.44[c]
SCS18: Swedish CDI Words and Sentences (<8 words)	Westerlund et al, 2006[78] Fair	18 months	891	Language Observation– 3 years	50% 34%-66%	90% 88%-92%	4%	18%[c] 89%[c]	4.8[c] 0.56
Communicative Development Inventories (CDI): Words and Sentences (<19th percentile)	Heilmann et al, 2005[75] Fair	24 months	100	PLS-3 Expression	81% 69%-94%	79% 69%-89%	38%	70%[c] 89%[c]	3.9 0.23
ELFRA-2: German CDI Words and Sentences (<50 or 50-80 words and grammatical scores below cutoff)	Sachse and Von Suchodoletz, 2008, 2009[76,77] Good	24-26 months	117	SETK-2	93% 87%-99%	87% 78%-97%	59%	91%[c] 89%[c]	7.3 0.08
Short Form Inventarios del Desarrollo de Habilidades Comunicativas: Spanish CDI Words and Sentences (NR)	Guiberson et al, 2011[74] Fair	24-35 months	45	PLS-4 Expression, Spanish edition	87% 73%-100%	86% 72%-100%	51%	87%[c] 86%[c]	6.4 0.15
Pilot Inventario–III: Spanish CDI III (NR)	Guiberson and Rodriguez, 2010[73] Fair	32-36 months	48	PLS-4 Expression, Spanish edition	82% 66%-98%	81% 66%-96%	46%	78% 84%	4.2[c] 0.22[c]
General Language Screen (≥2 of 11 items endorsed)	Stott et al, 2002[104] Fair	36 months	596	DPII (37 months) EAT, RDLS, BPVS (45 months)	75% 67%-83% 67% ---[d]	81% 77%-84% 68% ---[d]	8%[c] 4%[c]	47% 94% 31% 91%	3.9[c] 0.31[c] ---[d] ---[d]
Parent Language Checklist: Previous version of the General Language Screen (1 failed item)	Burden et al, 1996[95] Good	36 months	425	Renfrew Action Picture Test, Bus Story, study-derived tests of phonology and comprehension	87% 82%-93%	45% 39%-51%	32%	42% 89%	1.6 0.28

Table 5. Accuracy of Screening Instruments for Speech and Language Delays and Disorders: Parent-Rated Screeners

Instrument and version (Decision cutoff point)	Author, Year, USPSTF quality	Age	N	Reference instrument	Sensitivity 95% CI	Specificity 95% CI[a]	Prevalence[a]	PPV[a,b] NPV[a,b]	PLR[a] NLR[a]
Infant-Toddler Checklist (NR)	Wetherby et al, 2003[88] Fair	12-17 months 18-24 months	151 81	CSBS Behavior Sample	89% 80%-97% 86% 75%-96%	74% 66%-83% 77% 64%-90%	35% 52%	65%[c] 92%[c] 80%[c] 83%[c]	3.5 0.15 3.7 0.19
Language Development Survey (<50 or no word combinations) (≥28 screening score)	Klee et al, 1998[98] Fair Klee et al, 2000[e122] Fair	24-26 months 24-26 months	64 64	Clinical judgment on infant MSEL language scales, MLU	91% 74%-100% 91% 74%-100%	87% 78%-96% 96% 91%-100%	17% 17%	59% 98% 83% 98%	6.9 0.10 24.1 0.09
Language Development Survey, Study 2 (<50 or no word combinations)	Rescorla and Alley, 2001[102] Fair	25.4 months	66	RLDS Expressive	94% 84%-100%	67% 53%-80%	27%	52%[c] 97%[c]	2.8 0.08
Language Development Survey, Study 3 (<50 or no word combinations)	Rescorla, 1989[54] Fair	24-34 months	81	RLDS Expressive	89% 80%-98%	86% 75%-97%	56%	89% 86%	6.4 0.13
Parent Questionnaire (NR)	Stokes, 1997[103] Fair	34-40 months	381	SLP rating using language sample, RDLS Comprehension	78% 66%-89%	91% 88%-94%	13%	56%[c] 96%[c]	8.3 0.24
Ward's Created Screening Tool (≥1 item)	Ward, 1984[108] Fair	7-23 months	1,070	REEL	80% 75%-85%	92% 90%-94%	24%[c]	75% 94%	9.6 0.22

[a] Calculated by EPC authors unless otherwise noted that study investigators provided data. Prevalence values were not estimated or weighted to reflect sampling.
[b] Predictive values may be questionable for studies in which prevalence exceeded 10%; the problem arises when investigators choose a random sample of children with negative screens to complete the reference measures.
[c] Study investigators provided data.
[d] Could not calculate because of lack of data in article.
[e] Same data using a different decision rule for failing screener.

BPVS = British Picture Vocabulary Scale; CDI = Communicative Development Inventory; CDI WS = Communicative Development Inventory Words and Sentences; CSBS = Communication and Symbolic Behavior Scale; DPII = Developmental Profile II; EAT = Edinburgh Articulation Test; ELFRA = Elternfragebogen fur die Fruberkennung von Riskokindern; MLU = mean length of utterance; MSEL = Mullen Scale of Early Learning; N = number; NR = not reported; NLR = negative likelihood ratio; NPV = negative predictive value; PLS = Preschool Language Scale; PLR = positive likelihood ratio; PPV = positive predictive value; REEL = Receptive Expressive Emergence of Language; RDLS = Reynell Developmental Language Scale; SCS18 = Swedish Communication Screening at 18 months of age; SETK-2 = Sprachentwicklungstest fur sweijahrige slindes; SETK-3/5 = Sprachentwicklungstest fur dreibis funfjahrige kinder; SICD = Sequenced Inventory of Communication Development; SLP = speech-language pathologist.

Table 6. Accuracy of Screening Instruments for Speech and Language Delays and Disorders: Professional/Paraprofessional-Administered Screeners

Instrument and version (Decision cutoff point)	Author, Year, USPSTF quality	Age	N	Reference instrument	Sensitivity 95% CI	Specificity 95% CI[a]	Prevalence[a]	PPV[a,b] NPV[a,b]	PLR[a] NLR[a]
Battelle Developmental Inventory Screening Test–Receptive (<1 SD)	Frisk et al, 2009[72] Fair	45 years	110	PLS-4 Comprehension PLS-4 Expression	56% 33%-78% 68% 49%-88%	70% 60%-79% 86% 79%-94%	16% 20%	26% 89% 56% 92%	1.8 0.89 5.0 0.37
Brigance Preschool Screen Receptive (<1 SD) Expressive (<1 SD)	Frisk et al, 2009[72] Fair Frisk et al, 2009[72] Fair	45 years 45 years	110 110	PLS-4 Comprehension PLS-4 Expression	61% 39%-84% 91% 79%-100%	60% 50%-70% 78% 70%-87%	16% 20%	23% 89% 51% 97%	4.2 1.5 0.12 0.65
Davis Observation Checklist for Texas (NR)	Alberts et al, 1995[91] Fair	52-67 months	59	MSCA, GFTA, informal language sample	80% 55%-100%	98% 94%-100%	17%	89% 96%	39.2 0.20
Denver Articulation Screening Test (<15th percentile)	Drumwright et al, 1973[97] Fair	30-72 months	150	Henja Articulation Test	92% ----[d]	97% ----[d]	----[d]	----[d]	----[d]
Denver Developmental Screening Test, Language Sector (NR)	Borowitz and Glascoe, 1986[94] Fair	18-66 months	71	PLS	46% 34%-58%	100% 100%-100%	92%	100% 15%	---[e] 0.53
Developmental Nurse Screen	Stokes, 1997[103] Fair	34-40 months	378	SLP rating using language sample, RDLS Comprehension	76% ----[d]	96% ----[d]	----[d]	80% 96%	----[d] ----[d]
Early Screening Profile Verbal Concepts (<1 SD)	Frisk et al, 2009[72] Fair	45 years	110	PLS-4 Comprehension PLS-4 Expression	94% 84%-100% 86% 72%-100%	68% 59%-78% 81% 72%-89%	16% 20%	40% 98% 53% 96%	3.0 0.08 4.5 0.17
Fluharty Preschool Screening Test (Failure ≥1 subtests)	Allen and Bliss, 1987[92] Fair	36-47 months	182	SICD	60% 41%-79%	81% 75%-87%	14%	33% 93%	3.1 0.49
Fluharty Preschool Speech and Language Screening Test (FPSLST) Articulation (NR)	Sturner et al, 1993[105] Study 1 Fair	53-68 months	51	AAPS-R	74% ----[d]	96% ----[d]	4%[c]	50% ----[d]	----[d] ----[d]
FPSLST Language (NR)	Sturner et al, 1993[105] Study 1 Fair	53-68 months	51	TACL-R	38% ----[d]	85% ----[d]	17%[c]	42% ----[d]	----[d] ----[d]

Table 6. Accuracy of Screening Instruments for Speech and Language Delays and Disorders: Professional/Paraprofessional-Administered Screeners

Instrument and version (Decision cutoff point)	Author, Year, USPSTF quality	Age	N	Reference instrument	Sensitivity 95% CI	Specificity 95% CI[a]	Prevalence[a]	PPV[a,b] NPV[a,b]	PLR[a] NLR[a]
FPSLST Articulation (NR)	Sturner et al, 1993[105] Study 2 Fair	55-69 months	147	TD	43% ----[d]	93% ----[d]	5%[c]	26% ----[c]	----[d] ----[d]
FPSLST Language (NR)	Sturner et al, 1993[105] Study 2 Fair	55-69 months	147	TOLD-P	17% ----[d]	97% ----[d]	22%[c]	50% ---[-d]	----[d] ----[d]
Northwestern Syntax Screening Test (Failure ≥1 subtests)	Allen and Bliss, 1987[92] Fair	36-47 months	182	SICD	92% 81%-100%	48% 41%-56%	14%	22% 97%	1.8 0.16
Screening Kit of Language Development (SKOLD) SKOLDS30 (<11) SKOLDS37 (<10) SKOLDS43 (<19) SKOLDB30 (<9) SKOLDB37 (<14) SKOLDB43 (<19)	Bliss and Allen, 1984[93] Fair	30-36 months 37-42 months 43-48 months 30-36 months 37-42 months 43-48 months	47 93 100 75 91 54	SICD SICD SICD SICD SICD SICD	*Standard English* 100% 100%-100% 100% 100%-100% 100% 100%-100% *AA Dialect* 89% 68%-100% 88% 65%-100% 94% 84%-100%	98% 93%-100% 91% 85%-97% 93% 88%-98% 86% 78%-95% 86% 78%-92% 78% 64%-91%	6% 11% 9% 12% 9% 33%	75% 100% 33% 100% 60% 100% 47% 98% 37% 99% 68% 97%	44.0 0 11.1 0 15.2 0 6.5 0.13 6.0 0.15 4.2 0.07
Sentence Repetition Screening Test (<20th percentile)	Sturner et al, 1996[106] Fair	54-66 months	323	AAPS-R ITPA, Bankson	57% 45%-69% 62% 45%-78%	95% 93%-98% 91% 87%-94%	19%[c] 11%[c]	12.5 6.6	0.45 0.42
Structured Screening Test (<10)	Laing et al, 2002[99] Good	30 months	282	RDLS	66% 54%-77%	89% 85%-94%	23%	65% 90%	6.2[c] 0.38[c]
Hackney Early Language Screening Test, earlier version (≤10)	Law, 1994[100] Good	30 months	189	RDLS	98% 94%-100%	69% 61%-77%	26%	53% 99%	3.17 0.03

Table 6. Accuracy of Screening Instruments for Speech and Language Delays and Disorders: Professional/Paraprofessional-Administered Screeners

Instrument and version (Decision cutoff point)	Author, Year, USPSTF quality	Age	N	Reference instrument	Sensitivity 95% CI	Specificity 95% CI[a]	Prevalence[a]	PPV[a,b] NPV[a,b]	PLR[a] NLR[a]
Trial Speech Screening Test (<12 elements)	Rigby and Chesham, 1981[86] Fair	54 months	438	SLP evaluation of Renfrew, RDLS, Edinburgh Articulation	80% 68%-92%	93% 91%-96%	10%	58% 98%	12.1 0.21

[a] Calculated by EPC authors unless otherwise noted that study investigators provided data. Prevalence values were not estimated or weighted to reflect sampling.
[b] Predictive values may be questionable for studies in which prevalence exceeded 10%; the problem arises when investigators choose a random sample of children with negative screens to complete the reference measures.
[c] Study investigators provided data.
[d] Could not calculate because of lack of data in article.
[e] Calculated as infinity.

AAPS-R = Arizona Articulation Proficiency Scale-Revised; AA = African American; GFTA = Goldman-Fristoe Test of Articulation; ITPA = Illinois Test of Psycholinguistic Abilities; MSCA = McCarthy Scale of Children's Abilities; NR = not reported; PLS = Preschool Language Scale; RLDS = Reynell Developmental Language Scale; SICD = Sequenced Inventory of Communication Development; SLP = speech language pathologist; TACL-R = Test for Auditory Comprehension of Language-Revised; TD = Templin-Darley Test of Articulation, Consonant Singles Subtest; TOLD-P = Test of Language Development Primary.

Table 7. Characteristics of Randomized Controlled Trials of Speech and Language Interventions

Study, Country, Risk of bias	Speech and language domains	Intervention	Length of intervention Timing of outcome assessment	Inclusion/exclusion criteria	Age at baseline (months)	N Patients randomized
Almost et al, 1998[134] Canada Fair	Speech sounds (phonology) Language (expressive)	G1: Clinician-directed individualized therapy G2: Delayed tx	Two 30-minute sessions per week for 4 months (1,040 minutes total). Outcome assessment at 4 months	Inclusion: severe phonological disorder, normal receptive language, hearing, oral structures and function, and sufficient attention span	G1: 42.5 (range, 33-61) G2: 42.5 (range, 33-55)	Overall: 26 G1: 13 G2: 13
Fricke et al, 2013[125] United Kingdom Fair	Language (expressive and receptive) Speech sounds (phonological awareness)	G1: Oral language group intervention to teach skills related to vocabulary, expressive vocabulary and grammatical competence, to encourage active listening and build confidence in independent speaking G2: Usual nursery/primary school activities	Three 15-minute group sessions per week for 10 weeks, increasing to 5 sessions per week (three 30-minute group sessions plus two 15-minute individual sessions) for 20 weeks (2,850 minutes total). Outcome assessment at end of tx (30 weeks) and at 6 month followup	Inclusion: 12 children in each of 15 nursery schools with the lowest mean verbal composite scores	G1: 48 G2: 48 (screening occurred at 48 months)	Overall: 180 G1: 90 G2: 90
Gibbard, 1994[136] United Kingdom Fair	Language (expressive and receptive)	G1: Parent group S&L training, mix of approaches focusing on activities for parent to use with children, many from the Derbyshire Language Scheme G2: Wait list	60-75 minutess every other week for 6 months (780-975 minutes total). Outcome assessment at 6 months	Inclusion: Ages 27-39 months, little or no expressive language, no general developmental delay, no medical condition indicative of a language delay, no previous S&L therapy	G1: 35 (range, 29-39) G2: 32 (range, 27-39)	Overall: 36 G1: 18 G2: 18
Girolametto et al, 1996[137] Companion: Girolametto et al, 1997[138] Canada Fair	Language (expressive) Speech sounds (phonology)	G1: Hanen Program for Parents training program modified to be consistent with a focused stimulation on children's language G2: Wait list	Eight 150-minute parent group sessions (1,200 minutes total) and three home visits over 11 weeks. Outcome assessment 3 weeks following end of tx	Inclusion: Expressive language delay, single-word stage of language development, only English spoken in home Exclusion: Major sensory impairment, oral motor problems, neurological problems, ASD	G1: 28.7 (range, 25-35) G2: 28.6 (range, 23-34)	Overall: 25 G1: 12 G2: 13
Glogowska et al, 2000[135] United Kingdom Good	Language (expressive and receptive) Speech sounds (phonology)	G1: Individually-tailored, "routine" S&L therapy by a therapist G2: Wait list "watchful waiting"	Average of 6.2 hours of therapy over 12 months (372 minutes total). Outcome assessment at 12 months	Inclusion: Preschoolers in S&L therapy based on general or expressive language group scores on preschool language scale or phonology group scores	G1: 34.2 (range, 18-42) G2: 34.2 (range, 24-42)	Overall: 159 G1: 71 G2: 88 (18 crossed over before study end)
Jones et al, 2005[126] New Zealand Fair	Fluency	G1: Lidcombe Program of Early Stuttering according to the manual G2: Delayed tx	Conducted in two stages. Stage 1: Parent-conducted program each day and speech pathologist once per week. Outcome assessment at 9 months	Inclusion: Ages 3-6 years, diagnosed stuttering with ≥2% of syllables stuttered, English-speaking Exclusion: Tx for stuttering in previous 12 months, onset	G1: 56.4 G2: 46.8 (Range: 36-72)	Overall: 54 G1: 29 G2: 25

Table 7. Characteristics of Randomized Controlled Trials of Speech and Language Interventions

Study, Country, Risk of bias	Speech and language domains	Intervention	Length of intervention Timing of outcome assessment	Inclusion/exclusion criteria	Age at baseline (months)	N Patients randomized
				within 6 months before recruitment		
Lewis et al, 2008[127] Australia Fair	Fluency	G1: Lidcombe Program of Early Stuttering, a manualized intervention delivered through telehealth (phone, video and audio recordings) G2: Delayed tx	Typically at least one weekly phone consultation; video demonstrations, phone and mail support. Outcome assessment at 9 months	Inclusion: Stuttering for longer than 6 months, no current or previous tx, all other development normal, parent and child English-speaking	Mean: NR (range, 36-54)	Overall: 22 G1: 9 G2: 13
Morgan and Vogel, 2009[131] Australia Systematic review Fair	Childhood apraxia of speech	RCT tx studies of interventions delivered by S&L therapists	No studies met inclusion criteria	Inclusion: Ages 3-16 years	NA	NA
Robertson et al, 1997[140] United States Fair	Language (expressive and receptive)	G1: Unstructured play sessions in "house" area with normal peers G2: No play sessions with normal peers	At least four 15- to 20-minute sessions over 3 weeks (minimum of 60 minutes). Outcome assessment at 3 weeks following end of tx	Inclusion: Language impairment and in language-based early childhood classroom; WISC-R score ≥85; poor receptive and expressive language; no motor, emotional, or physical handicaps; no hearing or vision problems; monolingual English	G1: 49.8 G2: 49.6 (overall range, 44-61)	Overall: 20 G1: 10 G2: 10
Robertson et al, 1999[139] United States Fair	Language (expressive and receptive) Speech sounds (intelligibility)	G1:Speech-language pathologist directed small group therapy of no more than four children G2: Wait list	150 minutes per week for 12 weeks (1,800 minutes total). Outcome assessment at end of tx	Inclusion: Normal hearing, oral and speech motor abilities, no frank neurological impairment, monolingual, English-speaking homes, CDI vocabulary scores <10th percentile, no other delays, no prior S&L therapy	G1: 25.6 (range, 21-30) G2: 24.6 (range, 21-28)	Overall: 21 G1: 11 G2: 10
Shelton et al, 1978[141] United States Fair	Speech sounds (phonology, articulation) Language (expressive and receptive)	G1: Parent-directed speech sound listening/ discrimination activities (listening group) G2: Parent-child storybook interaction (reading and talking group) G3: Control group	G1: 5 minutes per day, 5 days per week for 57 days (1,425 minutes total) G2: 15 minutes per day, 5 days per week for 57 days (4,275 minutes total). Outcome assessment at end of tx	Inclusion: Below cut-off score on Templin-Darley Articulation Screening Test, pass audiometric screening	G1: 47 G2: 49 G3: 39 (overall range, 27-55)	Overall: 45 G1: 15 G2: 15 G3: 15
Wake et al, 2011[128] Clustered randomized trial Australia Good	Language (expressive and receptive)	G1: Modified "You Make the Difference" (Hanen Parent Training Program): low-intensity version of parent-delivered toddler language promotion program for	120 minutes per week for 6 weeks (720 minutes total). Outcome assessment when child age 2 years (12-14 weeks following program completion) and 3 years	Inclusion: At or below 20th percentile in expressive vocabulary at 18 months Exclusion: Cognitive delay, major medical conditions, or suspected ASD; parents with	G1: 18.1 (SD, 0.7) G2: 18.1 (SD, 0.8)	Overall: 301 G1: 158 G2: 143

Table 7. Characteristics of Randomized Controlled Trials of Speech and Language Interventions

Study, Country, Risk of bias	Speech and language domains	Intervention	Length of intervention Timing of outcome assessment	Inclusion/exclusion criteria	Age at baseline (months)	N Patients randomized
		toddlers identified as slow to talk on universal screening G2: Usual care (not defined)		insufficient English		
Wake et al, 2013[130] Australia Fair	Language (expressive and receptive) Speech sounds (phonological awareness)	G1: 18 1-hour home-based therapy sessions conducted by a "language assistant" G2: No intervention control; "free to participate in community-based tx"	18 in-home 1-hour targeted sessions in three blocks of weekly sessions for 6 weeks starting every 3 months	Inclusion: Expressive and/or receptive language scores >1.25 SD below normal Exclusion: Intellectual disability, major medical conditions, hearing loss >40 dB in the better ear, ASD, parents with insufficient English	G1: 50 G2: 49 (recruited at 48 months)	Overall: 200 G1: 99 G2: 101
Yoder et al, 2005[129] United States Fair	Language (expressive) Speech sounds (intelligibility)	G1: Broad target recasts intervention G2: No intervention control; "free to participate in community-based tx"	Three 30-minute tx sessions per week for 6 months (2,340 minutes total). Outcome assessment at end of tx and at followup (8 months later)	Inclusion: Specific language and speech accuracy impairments; nonverbal IQ >80; no hearing impairment; monolingual English, no oral motor disorders	G1: 44.3 (SD, 7.6) G2: 43.2 (SD, 9.6)	Overall: 52 G1: 26 G2: 26

ASD = autism spectrum disorder; CDI = MacArthur-Bates Communicative Development Inventory; G = group; N = number; NR = not reported; RCT = randomized controlled trial; SD = standard deviation; tx = treatment; WISC-R = Wechsler Intelligence Scale for Children.

Table 8. Outcomes of Randomized Controlled Trials of Speech and Language Interventions

Study, Country, Risk of bias	Speech and language domains	Speech and language (KQ 5) outcomes Non-speech and language (KQ 6) outcomes	Summary of findings
Almost et al, 1998[134] Canada Fair	Speech sounds (phonology) Language (expressive)	Difference measured through ANCOVA to adjust for baseline, tx, and time[a] **Speech and Language (KQ 5)** Phonological processes (APP-R): F=8.64, d=1.15 (p=0.007) Articulation (GFTA): F=8.92, d=1.17 (p=0.007) Consonants correct (PCC): F=8.06, d=1.11 (p=0.009) MLU: F=0.23, d=0.18 (p=0.638) **Non-Speech and Language (KQ 6)** None reported	S&L: More improvement in 3 of 4 measures of phonology Non-S&L: No measures reported
Fricke et al, 2013[125] United Kingdom Fair	Language (expressive and receptive) Speech sounds (phoneme awareness)	Difference measured through structural equation modeling to allow for missing data and clustering of children within schools **Speech and Language (KQ 5)** Language: end of tx: d=0.80 (p<0.01); followup: d=0.83 (p<0.001) Narrative: end of tx: d=0.39 (p=0.003); followup: d=0.30 (p=0.041) Phoneme awareness: end of tx: d=0.49 (p<0.031); followup: d=0.49 (p=0.01) **Non-Speech and Language (KQ 6)** Literacy: end of tx: d=0.31 (p=0.07); followup: d=0.14 (p=0.354) Letter knowledge: end of tx: d=0.41 (p<0.001) Difference in reading comprehension at followup: 0.97 (95% CI, 0.40-1.54), d=0.52 (p=0.001)	S&L: Better performance on language, narrative, and phoneme awareness at posttest and at 6-month followup Non-S&L: Better reading comprehension but no difference in reading accuracy at 6-month followup
Gibbard, 1994[136] Study 1 United Kingdom Fair	Language (expressive and receptive)	All differences measured through ANCOVA to adjust for baseline, tx, and time[a] **Speech and Language (KQ 5)** Reynell Expressive: F=64.89, d=2.69 (p<0.001) Reynell Comprehension: F=34.11, d=1.95 (p<0.001) Derbyshire One Word Scores: F=34.24, d=1.95 (p<0.001) Derbyshire Total Scores: F=31.94, d=1.88 (p<0.001) Renfrew Grammatical Ability: F=20.36, d=1.50 (p<0.001) Renfrew Information: F=32.0, d=1.89 (p<0.001) MLU: F=24.44, d=1.65 (p<0.001) **Non-Speech and Language (KQ 6)** None reported	S&L: More improved in all measures of S&L Non-S&L: No measures
Girolametto et al, 1996[137] Companion: Girolametto et al, 1997[138] Canada Fair	Language (expressive) Speech sounds (phonology)	Difference measured through MANCOVA to adjust for baseline, tx, and time[a] **Speech and Language (KQ 5)** Expressive vocabulary: Size: F=4.90, d=0.88 (p<0.01) Number of different words in interaction: F=7.96, d=1.13 (p<0.02) Number of learned control words: F=17.25, d=1.67 (p<0.01) Talkativeness: F=2.38, d=0.62 (p<0.06) Parent report on structural complexity: F=2.85, d=0.68 (p<0.04) Consonant inventory: F=4.34 (p<0.01) Early consonants: d=1.0; middle consonants: d=1.1; late consonants: d=0.6 Percent of consonants correct: d=-0.3 (p=NS) Number of vocalizations: p=NS Syllable structure level (Level 3 vocalizations): F=6.74, d=0.9 (p<0.01) **Non-Speech and Language (KQ 6)** None reported	S&L: More improved in measures of vocabulary size, use of more different words, more structurally complete and complex utterances, more multiword utterances, and larger inventory of consonants. No difference in number of vocalizations or rate of words per minute Non-S&L: No measures

Table 8. Outcomes of Randomized Controlled Trials of Speech and Language Interventions

Study, Country, Risk of bias	Speech and language domains	Speech and language (KQ 5) outcomes Non-speech and language (KQ 6) outcomes	Summary of findings
Glogowska et al, 2000[135] United Kingdom Good	Language (expressive and receptive) Speech sounds (phonology)	All differences measured through ANCOVA to adjust for baseline, tx, and time (95% CI)[a] **Speech and Language (KQ 5)** Auditory comprehension, average of differences at 6 and 12 months: 4.1 (0.5 to 7.6), d=~0.3 (p=0.025) Expressive language, average of difference at 6 and 12 months: 1.4 (-2.1 to 4.8) (p=0.44) Phonology error rate, average of difference at 6 and 12 months: -4.4 (-12.0 to 3.3) (p=0.26) Bristol Language Development Scale, average of difference at 6 and 12 months: 0.1 (-0.4 to 0.6) (p=0.73) Improvement by 12 months on clinical criteria used for study entry: OR=1.3 (0.67 to 2.4) (p=0.46) **Non-Speech and Language (KQ 6)** Well-being, average of difference at 6 and 12 months: 0.04 (-0.2 to 0.3) Attention level, average of difference at 6 and 12 months: 0.02 (-0.3 to 0.3) (p=0.91) Play level, average of difference at 6 and 12 months: 0.04 (-0.2 to 0.2) Vineland Socialization Scale, average of difference at 6 and 12 months: 0.6 (-3.1 to 4.2)	S&L: More improved auditory comprehension, no difference in expressive language, phonology error rate, language development Non-S&L: No difference in well-being, attention, play level, or socialization skills
Jones et al, 2005[126] New Zealand Fair	Fluency	Percent syllables stuttered: adjusted mean difference (95% CI)[a] **Speech and Language (KQ 5)** 2.3 (0.8 to 3.9) (p=0.003) Difference measured through logistic regression to adjust for baseline Odds of <1% of syllables stuttered: OR=0.13 (0.03 to 0.63) (p=0.011) **Non-Speech and Language (KQ 6)** None reported	S&L: Greater reduction in % of syllables stuttered and greater odds of stuttering <1% of syllables Non-S&L: No measures
Lewis et al, 2008[127] Australia Fair	Fluency	Difference measured through ANCOVA to adjust for baseline, tx, and time (95% CI) **Speech and Language (KQ 5)** Stuttering frequency: At 9 months: 69% (13% to 89%) (p=0.04) Adjusting for patient characteristics: 73% (25% to 90%) (p=0.02) **Non-Speech and Language (KQ 6)** None reported	S&L: Greater reduction in % of syllables stuttered during speech sample; more “responders” (i.e., decrease of >80% in stuttered syllables) Non-S&L: No measures
Robertson et al, 1999[139] United States Fair	Language (expressive and receptive) Speech sounds (intelligibility)	Difference measured through ANCOVA to adjust for baseline, tx, and time[a] **Speech and Language (KQ 5)** MLU: F=10.33, d=1.40 (p<0.003) Total number of words: F=46.83, d=2.99 (p<0.001) Number of different words: F=41.05, d=2.80 (p<0.001) Number of different words, controlling for number of words: F=24.03, d=2.14 (p<0.001) Lexical repertoire: F=46.86, d=2.99 (p<0.001) Percentage of intelligible utterances: F=24.44, d=2.16 (p<0.001) **Non-Speech and Language (KQ 6)** Vineland Socialization Scale: F=12.15, d=1.52 (p=0.003) Parental stress (child domain of the PSI): F=53.32, d=3.19 (p<0.001)	S&L: More improvement in MLU, number of words, vocabulary size, lexical diversity, and % of intelligible utterances Non-S&L: More improvement in socialization skills, greater reduction in parental stress
Robertson et al, 1997[140] United States Fair	Language (expressive and receptive)	Difference measured through ANCOVA to adjust for baseline, tx, and time[a] **Speech and Language (KQ 5)** Number of words: F=70.72 (p<0.01) Number of different words: F=73.79 (p<0.01) Play-theme-related acts: F=99.80 (p<0.01)	S&L: More words used; greater verbal productivity; more lexical diversity, reported play acts, and linguistic

Table 8. Outcomes of Randomized Controlled Trials of Speech and Language Interventions

Study, Country, Risk of bias	Speech and language domains	Speech and language (KQ 5) outcomes Non-speech and language (KQ 6) outcomes	Summary of findings
		Linguistic markers: F=73.51 (p<0.01) **Non-Speech and Language (KQ 6)** None reported	markers Non-S&L: No measures
Shelton et al, 1978[141] United States Fair	Speech sounds (phonology, articulation) Language (expressive and receptive)	Difference between the 3 groups measured through ANCOVA to adjust for baseline, tx, and time[a] (results always compared with control) **Speech and Language (KQ 5)** Test of Auditory Discrimination (Quiet): Listening: d= 0.17; Reading & Talking: d=-0.05 (p=0.90) Test of Auditory Discrimination (Noise): Listening: d=-0.41; Reading & Talking: d= 0.91 (p=0.03) (greatest improvement in controls) Northwestern Syntax Screening Test: Listening: d=-0.17; Reading & Talking: d=0.10 (p=0.72) Auditory Association Subtest of ITPA: Listening: d=0.50; Reading & Talking: d=0.51 (p=0.25) Discrimination Task: Listening: d=0; Reading & Talking: d=-0.05 (p=1.00) Error Recognition: Listening: d=0.17; Reading & Talking: d=0.40 (p=0.26) Templin-Darley Articulation Screening Test: Listening: d=0.65; Reading & Talking: d=0.02 (p=0.07) McDonald Screening Deep Test of Articulation: Listening: d=0.06; Reading & Talking: d= -0.38 (p=0.51) **Non-Speech and Language (KQ 6)** None reported	S&L: No difference in improvements between intervention groups and controls in relation to articulation, auditory discrimination, or auditory association Non-S&L: No measures
Wake et al, 2011[128] Australia Good	Language (expressive and receptive)	All differences measured through random-effects regression to adjust for clustering, potential confounders, and baseline measures (95% CI)[a] **Speech and Language (KQ 5)** MCDI vocabulary raw score At 2 years: 2.1 (-3.0 to 7.2), d=0.004 (p=0.42) At 3 years: 4.1 (-2.3 to 10.6), d=0.08 (p=0.21) PLS expressive communication standard score At 2 years: 1.2 (-1.6 to 4.0), d=0.02 (p=0.41) EVT expressive vocabulary standard score: At 3 years: -0.5 (-4.4 to 3.4), d=-0.08 (p=0.80) PLS auditory comprehension standard score At 2 years: 1.4 (-2.2 to 5.0), d=-0.01 (p=0.44) At 3 years: -0.3 (-4.2 to 3.7), d=-0.06 (p=0.90) **Non-Speech and Language (KQ 6)** CBCL externalizing behavior raw score At 2 years: -0.3 (-1.6 to 1.1), d=-0.04 (p=0.71) At 3 years: -0.1 (-1.6 to 1.4), d=-0.01 (p=0.86) CBCL internalizing behavior raw score At 2 years: 0.1 (-0.9 to 1.1), d=-0.06 (p=0.78) At 3 years: -0.1 (-1.3 to 1.2), d=-0.06 (p=0.92)	S&L: No difference in expressive or receptive language outcomes at 2 or 3 years of age Non-S&L: No difference in internalizing or externalizing problem behaviors at 2 or 3 years of age

Table 8. Outcomes of Randomized Controlled Trials of Speech and Language Interventions

Study, Country, Risk of bias	Speech and language domains	Speech and language (KQ 5) outcomes Non-speech and language (KQ 6) outcomes	Summary of findings
Wake et al, 2013[130] Australia Fair	Language (expressive and receptive) Speech sounds (phonological awareness)	Mean difference (95% CI) measured at age 5, adjusting for gender, mother's education, recruitment from "Let's Read" or "Let's Learn Language," baseline expressive and receptive language scores, and baseline measure of the outcome being considered, when available **Speech and Language (KQ 5)** Expressive language: 2.0 (-0.5 to 4.4), d=0.2 (p=0.12) Receptive language: 0.6 (-2.5 to 3.8), d=0.05 (p=0.69) Pragmatic language: -1.0 (-3.7 to 1.6), d=-0.1 (p=0.45) Phonological awareness: 5.0 (2.2 to 7.8), d=0.6 (p<0.001) **Non-Speech and Language (KQ 6)** Letter knowledge: 2.4 (0.3 to 4.5), d=0.3 (p=0.03) Number of behavior problems: -0.5 (-1.7 to 0.7), d=-0.1 (p=0.43) Health-related quality of life: -0.8 (-5.2 to 3.5), d=-0.05 (p=0.71)	S&L: No difference in expressive or receptive language outcomes; better phonological awareness Non-S&L: Better letter knowledge; no difference in behavior problems or health-related quality of life
Yoder et al, 2005[129] US Fair	Language (expressive) Speech sounds (intelligibility)	Difference measured through ANCOVA to adjust for baseline, tx, and time **Speech and Language (KQ 5)** At end of tx: (p=NS) 8 months after end of tx: (p=NS) Among children who began tx with lowest articulation scores, difference in MLU: At end of tx: (p=0.01) 8 months followup: (p=0.03) **Non-Speech and Language (KQ 6)** None reported	S&L: No difference between groups in change over time Non-S&L: No measures

[a] Cohen's d calculated by the review authors.

ANOVA = analysis of variance; APP-R = Assessment of Phonological Processes-Revised; CBCL = Child Behavior Checklist; CI = confidence interval; d = Cohen's d; EVT = Expressive Vocabulary Test; GFTA = Goldman-Fristoe Test of Articulation; ITPA = Illinois Test of Psycholinguistic Ability; MCDI = MacArthur-Bates Communicative Development Inventory; MLU = mean length of utterances; MANCOVA = multivariate analysis of variance; NA = not applicable; NS = not significant; OR = odds ratio; PCC = percentage consonants correct; PLS = Preschool Language Scale; PSI = Parental Stress Index; S&L = speech and language; tx = treatment; VABS = Vineland Adaptive Behavior Scale.

Table 9. Summary of Evidence

Key question	Intervention/ screening	Trials, *k* Observations, *n*	Major limitations	Consistency	Applicability	Quality ratings	Summary of findings
Key Question 1 (effect of screening on speech and language and other outcomes)	NA	k=0	NA	NA	NA	NA	No studies addressed the overarching key question
Key Question 2 (accuracy of screening)	Parent-rated speech and language screeners	k=13, n=3,994	Different reference measures, some studies had small sample sizes	Mixed	Many studies included children with language delays or disabilities and typical language development rather than unselected samples; some studies were in countries with different health care structures	2: Good 11: Fair	CDI and LDS have the highest sensitivity (median, 82% and 91%); specificity is comparable across the CDI, LDS, and ASQ (87, 86, and 87). Sensitivity and specificity are generally comparable across the toddler and preschool years; prediction over 1 year indicates some reduction in accuracy for the CDI and LDS
	Professional/ paraprofessional-administered speech and language screeners	k=12,[a] n=2,911	Few studies examined the same screener, different reference measures used, criteria for failure not always explicit	Mixed	Not clear how many of the instruments would actually be used today in the United States; would require some training of staff to administer to children	2: Good 9: Fair	Great variability in sensitivity and specificity; sensitivity ranged between 17% and 100% (median, 74%), specificity ranged between 31% and 100% (median, 91%)
Key Question 3 (adverse effects of screening)	NA	k=0	NA	NA	NA	NA	No studies addressed this question
Key Question 4 (role of surveillance in identifying children)	NA	k=0	NA	NA	NA	NA	No studies addressed this question
Key Question 5 (speech and language benefits of treatment)	Language	k=9, n=839	Small sample sizes, limited replication of positive treatment approaches, limited use of manualized approaches, lack of consistency in outcome measurement	Inconsistent	4 of 9 trials conducted in United States but all in English, 2 manualized programs evaluated, 1 of which is relatively expensive	2: Good 7: Fair	5 of 9 trials reported significant positive results

Table 9. Summary of Evidence

Key question	Intervention/ screening	Trials, *k* Observations, *n*	Major limitations	Consistency	Applicability	Quality ratings	Summary of findings
	Speech sounds	k=5, n=307	Limited replication of positive treatment approaches, limited use of manualized approaches	Inconsistent	Only 1 of the trials was conducted in the United States but all in English, 2 were delivered by parents, 1 individualized	1: Good 4: Fair	2 of 5 trials reported significant positive results
	Fluency	k=2, n=76	Only 1 approach evaluated in 1 fluency disorder (stuttering)	Consistent	2 trials of the same manualized treatment for stuttering, both conducted in English but outside the United States	2: Fair	The Lidcombe Program of Early Stuttering can reduce stuttering in children
Key Question 6 (other benefits of treatment than speech and language)	NA	k=4, n=661	Outcomes and comparisons vary across studies	Inconsistent	All outcomes measured are relevant to U.S. population, all studies conducted in English, 1 study in the United States	2: Good 2: Fair	A limited number of disparate outcomes were measured across a minority of studies
Key Question 7 (harms of treatment)	NA	k=2, n=180	Harms of treatment generally not measured in studies	Inconsistent	Only parent stress and child well-being measured	1: Good 1: Fair	Studies generally did not report on harms

[a] Two studies included both parent-rated and professional/paraprofessional-administered screeners.

ASQ = Ages & Stages Questionnaire; CDI = Communicative Development Inventory; LDS = Language Development Survey; NA = not applicable.

Table 10. Risk Factors: Earlier Speech and Language Concerns Through Parental Education

Author, Year Analysis approach[a]	Speech and language outcome	Population (N)	Age	Earlier speech and language concerns	Family history of language disorders	Male	SES	Maternal age	Parental education
Adams-Chapman et al, 2013[180] Multivariate	Language delay composite measure (expressive and receptive)	Preterm infants born ≤26 weeks included in U.S. Neonatal Research Network Follow-Up Study (N=1,477)	18-22 months	NR	NR	↑	NR	NR	Mother <high school: ↑
Alston and St. James-Roberts, 2005[165] Univariate	Language and communication difficulty	Infants who completed the WILSTAAR early language and communication screening assessment (N=60)	Mean age: Not at-risk: 9.4 months At-risk: 10.0 months	NR	NR	0	0	Dad age: ↑	NR
Campbell, 2003[173] Multivariate	Speech delay	Cohort of children being followed to study otitis media, Pittsburgh (N=639)	36 months	NR	↑	↑	NR	NR	Mother low: ↑
Choudhury and Benasich, 2003[175] Case control: univariate	Low language as measured by PLS-3: expressive, receptive, and total score; Stanford-Binet: verbal vocabulary, verbal comprehension; CELF-P: word structure, sentence structure	Cohort with family history of specific language impairment and matched controls, New York City area (N=92)	36 months	NR	All measures except CELF-P sentence structure: ↑	↑	NR	NR	NR
Desmarais et al, 2008[171] Analysis approach varies by study	Late talking	Review of 25 publications	18-39 months	NR	↑	NR	↑	NR	0
Everitt, Hannaford and Conti-Ramsden, 2013[215] Case control	Persistent expressive language delay vs. typical language development among children with specific expressive language delay 1 year earlier	Nursery school children in Scotland (N=94)	4-5 years	Specific expressive language delay: 0 Received S&L therapy: 0 Poorer performance on PLS-3 AC, PLS-3 EC, and Recalling Sentences subtest 1 year earlier	0	0	NR	NR	Mother: 0 Father: 0

Table 10. Risk Factors: Earlier Speech and Language Concerns Through Parental Education

Author, Year Analysis approach[a]	Speech and language outcome	Population (N)	Age	Earlier speech and language concerns	Family history of language disorders	Male	SES	Maternal age	Parental education
Foster-Cohen et al, 2010[185] Multivariate	Poorer receptive and expressive language ability	Very preterm cohort compared with full-term born in New Zealand (N=204)	4 years	NR	NR	NR	NR	NR	NR
Fox, Dodd, and Howard, 2002[188] Multivariate	Functional speech disorders	German cohort (N=113)	32-86 months	NR	↑	NR	NR	NR	NR
Glascoe and Leew, 2010[216] Multivariate	Delay in communication (expressive and receptive language)	U.S. nationally representative sample included in Brigance Infant and Toddler Screens study (N=382)	2 weeks to 24 months	NR	NR	NR	Employment: 0	NR	0
Hammer, 2010[174] Multivariate	Parent-reported speech-language impairment	Head Start Family and Child Experiences Survey cohort (N=1,015)	3-4 years (mean, 50 months)	NR	NR	↑	NR	NR	0
Harrison and McLeod, 2010[179] Multivariate	Expressive speech and language concern, receptive speech and language concern, low receptive vocabulary	Growing Up in Australia: The Longitudinal Study of Australian Children cohort (N=4,980)	51-67 months, 80% were 54-60 months	NR	NR	All 3 outcomes: ↑	Household income: Expressive and receptive: 0 Vocabulary: ↓ Financial hardship: All outcomes: 0	Expressive and receptive: 0 Vocabulary: ↓	Mother: Expressive and receptive: 0 Vocabulary: ↓ Father: All outcomes: 0
Henrichs et al, 2011[81] Multivariate	Expressive vocabulary delay (late bloomers, late onset, or persistent delay)	Generation R Study cohort, the Netherlands (N=3,759)	Mean, 31.6 months	Receptive delay at 18 months: ↑	NR	NR	0	Late bloomer: ↑ Late onset: ↓	Late onset: ↓ Persistent: ↓
Kerstjens et al, 2011[189] Multivariate	Ages and Stages communication domain delays	Community-based and preterm cohorts in the Netherlands (N=1,983)	43-49 months (4-year-old assessment)	NR	NR	Included in model but NR	NR	NR	In model but NR
Kerstjens et al, 2009[186] Multivariate	Ages and Stages communication domain delays	Community-based and preterm cohorts in the Netherlands (N=1,893)	43-49 months (4-year-old assessment)	NR	NR	↑	Low: ↑	NR	0
Kerstjens et al, 2012[190] Multivariate	Ages and Stages communication domain delays	Community-based and preterm cohorts in the Netherlands (N=1,983)	43-49 months (4-year-old assessment)	NR	NR	Included in model but NR	NR	NR	In model but NR

Table 10. Risk Factors: Earlier Speech and Language Concerns Through Parental Education

Author, Year Analysis approach[a]	Speech and language outcome	Population (N)	Age	Earlier speech and language concerns	Family history of language disorders	Male	SES	Maternal age	Parental education
Law et al, 2009[46] Multivariate	Specific language impairment (SLI); nonspecific language impairment (N-SLI)	British Cohort Study cohort (N=9,132)	5 years (60 months)	Ever seen speech and language therapist: SLI ↑ N-SLI ↑	NR	SLI: ↓ N-SLI: ↓	Overcrowding: SLI: ↑ N-SLI: ↑	NR	Mother: SLI: 0 N-SLI: ↓ Parent poor reader: SLI: ↑ N-SLI: ↑
Law et al, 2012[172] Multivariate	Nonspecific language impairment (N-SLI)	United Kingdom nationwide birth cohort (N=11,383)	60 months	Vocabulary at 3 years old	NR	NR	NR	NR	Mother: ↓
Mossabeb et al, 2012[83] Multivariate	Language delay measured through number of words	Born <34 weeks in Pennsylvania hospital (N=178)	26 months	NR	NR	↑	NR	NR	NR
O'Leary, 2009[220] Multivariate	Ages and Stages communication domain delays	Randomly ascertained sample of children born to moms in Western Australia Survey of Health (RASCAL) cohort (N=1,692)	24-month survey	NR	NR	NR	0	Young maternal age during pregnancy: ↑	0
Pena et al, 2011[183] Multivariate	Risk for language impairment	Latino bilingual pre-K in central Texas and northern Utah (N=1,029)	58-68 months Older age: ↓	NR	NR	NR	NR	NR	Mother: ↓
Potijk et al, 2013[191] Multivariate	Ages and Stages communication domain delays	Community-based sample of preterm and term children (Longitudinal Preterm Outcome Project), the Netherlands (N=1,470)	4 years	NR	NR	In model but NR	Lower SES: ↑	In model but NR	NR
Pruitt, 2010[166] Univariate	Specific language impairment	African American children in Louisiana (N=161)	25-100 months	NR	↑	NR	NR	NR	Mother: 0
Reilly et al, 2007[178] Multivariate	Poorer expressive language as measured by the Communication and Symbolic Behavior Scales (CSBS) and	Early Language in Victoria Study cohort, Australia (N=1,720)	24 months	NR	CSBS and CDI: ↑	CSBS and CDI: ↑	CSBS and CDI: 0	CSBS: ↑ CDI: 0	Mother, CSBS and CDI: 0

Table 10. Risk Factors: Earlier Speech and Language Concerns Through Parental Education

Author, Year Analysis approach[a]	Speech and language outcome	Population (N)	Age	Earlier speech and language concerns	Family history of language disorders	Male	SES	Maternal age	Parental education
	MacArthur-Bates Communication Development Inventory (CDI)								
Reilly, 2009[177] Multivariate	Stuttering onset by 3 years of age	Prospective community-ascertained cohort (the Early Language in Victoria Study), Melbourne, Australia (N=1,619)	24-36 months	Higher Communication and symbolic Behavior Scale scores at 2 years old: 0 Higher Communication Development Inventory raw vocabulary score at 2 years old: ↑	0	↑	0	NR	Mother: ↑
Reilly et al, 2013[181] Multivariate	Stuttering onset by 4 years of age	Prospective community-ascertained cohort (the Early Language in Victoria Study), Melbourne, Australia (N=1,619)	4 years	Higher Communication and Symbolic Behavior Scale scores at 2 years old: ↑	0	↑	0	NR	Mother higher: ↑
Roth, 2011[222] Multivariate	Severe or moderate language based on parent report	Norwegian mother and child cohort (N=35,135 or 36,136 depending on the analysis)	36-month followup	NR	NR	NR	NR	NR	Included in model but NR
Schjolberg, 2011[192] Multivariate	Slow language development	Norwegian mother and child cohort (N=42,107)	18 months	NR	NR	↑	Income: ↓	0	Mother: ↓ Father: 0
Singer et al, 2001[184] Multivariate	Speech-language development delay	Very low birthweight cohort, with and without bronchopulmonary dysplasia, and controls, Cleveland (N=246)	36 months	NR	NR	NR	↓	NR	NR

Table 10. Risk Factors: Earlier Speech and Language Concerns Through Parental Education

Author, Year Analysis approach[a]	Speech and language outcome	Population (N)	Age	Earlier speech and language concerns	Family history of language disorders	Male	SES	Maternal age	Parental education
Tallal, Ross, and Curtiss, 1989[182] Univariate	Specific language impairment	Cases and control from San Diego, longitudinal study (N=130)	48-59 months	NR	Mother: ↑ Father: ↑ Siblings: ↑	NR	NR	NR	Mother held back and history of learning problems: ↑ Father held back: ↑
Tomblin et al, 1991[167] Univariate	Poor communication skills	Longitudinal cohort in Iowa concerned with early identification of children with communication problems (N=662)	30-60 months	NR	NR	↑	NR	NR	Mother: 0 Father: ↓
Tomblin, Smith, and Zhang, 1997[168] Univariate	Specific language impairment	Monolingual English-speaking kindergarteners in Iowa and Illinois (N=1,102)	Kindergarten age	NR	Mother: 0 Father: ↑	NR	NR	NR	Mother:↓ Father: ↓
van Batenburg-Eddes, 2013[223] Multivariate	Receptive and expressive language delay at 1.5 years, expressive language delay at 2.5 years, expressive language delay across ages	Toddlers in the Generation R Study cohort with neuromotor development assessment at 9-15 weeks, the Netherlands (N=2,483)	Assessment at mean age 1.5 and 2.6 years	NR	NR	NR	Family income in model but NR	NR	In model but NR
Van Lierde, 2009[193] Case control: Univariate	Receptive and expressive language delay	ELBW children, matched with normal birthweight controls in Flanders, Belgium (N=24)	ELBW chronological age: 38-49 months; corrected age: 35-45 months Normal: 31-44 months	NR	NR	NR	NR	NR	NR
Weindrich et al, 2000[170] Univariate	Receptive and expressive language and articulation disorders	Mannheim Study of Risk Children cohort, Germany (N=320)	54 months	NR	NR	↑	NR	NR	NR

Table 10. Risk Factors: Earlier Speech and Language Concerns Through Parental Education

Author, Year Analysis approach[a]	Speech and language outcome	Population (N)	Age	Earlier speech and language concerns	Family history of language disorders	Male	SES	Maternal age	Parental education
Whitehurst, 1991[169] Univariate	Expressive language delay	Community cohort of children living in Long Island, NY (N=117)	24-38 months	NR	0	NR	NR	NR	NR
Yliherva et al, 2001[224] Multivariate	Problems in speech production, speech perception, linguistic concepts	Birth cohort, northern Finland (N=8,276)	96 months	NR	NR	All analyses: ↑	NR	0	Mother: 0
Zambrana et al, 2014[187] Multivariate	Analysis 1: late-onset language delays Analysis 2: transient language delays Analysis 3: persistent language delays	Prospective community-based sample (children included in Norwegian Mother and Child Cohort Study) (N=10,587)	5 years	Poorer actions and gestures composite at 1.5 years: Analysis 1: ↑ Analysis 2: ↑ Analysis 3: ↑ Poorer language comprehension composite at 1.5 years: Analysis 1: ↑ Analysis 2: ↑ Analysis 3: ↑	Late talker: Analysis 1: ↑ Analysis 2: ↑ Analysis 3: ↑ Writing and reading difficulties: Analysis 1: ↑ Analysis 2: 0 Analysis 3: ↑ Unintelligible speech: Analysis 1: 0 Analysis 2: ↑ Analysis 3: 0	Analysis 1: 0 Analysis 2: ↑ Analysis 3: ↑	Poverty Analysis 1: ↑ Analysis 2: 0 Analysis 3: 0	Mother ≤24 Analysis 1: 0 Analysis 2: ↑ Analysis 3: ↓ Father ≤25 Analysis 1: ↓ Analysis 2: ↓ Analysis 3: 0	Mother <5 years of college: Analysis 1: 0 Analysis 2: ↑ Analysis 3: 0 Father <5 years of college: Analysis 1: ↓ Analysis 2: 0 Analysis 3: ↓
Zubrick, 2007[225] Multivariate	Ages and Stages communication domain delays	RASCAL cohort (N=1,766)	24 months	NR	↑	↑	Family income: 0 SES for neighborhood: 0	0	0

[a] In each study identified as reporting multivariate results, the statistical significance of each risk factor is presented controlling for all of the other identified risk factors. Unless otherwise stated, risk factors reported as NR were not included in the model.

↓ = statistically significant decreased risk; ↑ = statistically significant increased risk; 0 = no statistically significant association.

AC = Auditory Comprehension; CSBS = Communication and Symbolic Behavior Scale; CELF-P = Clinical Evaluation of Language Fundamentals-Preschool; EC = Expressive Communication; ELBW = extremely low birth weight; G = group; N = number; N-SLI = nonspecific language impairment; NR = not reported; SES = socioeconomic status; SLI = specific language impairment; PLS-3 = Preschool Language Scale; RASCAL = Randomly Ascertained Sample of Children born to moms in western Australia; WILSTAAR = Ward Infant Language Screening Test Assessment Acceleration Remediation.

Table 11. Risk Factors: Low Birthweight Through Other Associations

Author, Year	Low birthweight	Birth order	Prematurity	Other perinatal factors	Parent stress	Parenting practices	Child medical conditions	Other associations
Adams-Chapman et al, 2013[180]	ELBW: 0	NR	NA: whole cohort is premature	1 month mechanical ventilation: ↑ Multiple birth: ↑	NR	NR	Cerebral palsy: ↑ Severe intraventricular hemorrhage: 0 Necrotizing enterocolitis: 0 Hearing impairment: ↑	Dysfunctional feeding: ↑ Non-English speaking: ↑ Steroid exposure: 0 Black race: ↑ Private insurance: ↓
Alston, 2005[165]	NR	0	NR	NR	NR	Mother-infant time interacting: ↓ Spontaneous maternal interaction: ↓	NR	Total television: ↓ Infant babbling: ↓
Campbell, 2003[173]	NR	NR	NR	NR	NR	NR	NR	Medicaid health insurance: 0 African American race: 0
Choudhury and Benasich, 2003[175]	NR	NR	NR	NR	NR	NR	Autoimmune disease: ↑ Asthma: 0	NR
Desmarais et al, 2008[171]	NR	NR	NR	NR	↑	History of otitis media: 0	Behavior: 0 Language stimulation: 0 Lexical acquisition: 0 Communicative intent: 0 Phonetic and phonological skills: 0	NR
Everitt, Hannaford and Conti-Ramsden, 2013[215]	NR	0	NR	Mild problems: 0	0	NR	Hearing concerns: 0 Ear infection: 0	Mother's occupation: 0 Father's occupation: 0
Foster-Cohen, et al, 2010[185]	NR	NR	Very preterm Receptive: ↑ Expressive: ↑	Severity of neonatal white matter abnormalities: 0	NR	Parent-child synchrony: ↓	NR	Social risk index: 0 Cognitive ability: ↓ Parent-child synchrony: ↓
Fox et al, 2002[188]	NR	NR	NR	Birth difficulties: ↑	NR	NR	Ear problems: 0	Sucking habits: ↑
Glascoe and Leew, 2010[216]	NR	NR	NR	NR	Elevated scores on depression screen: ↑ Anxiety: 0	Not talking to child in a special way: ↑ Not helping child learn by showing child things: ↑	NR	>3 siblings in home: ↑ ≥2 household moves in the past year: ↑ Limited English facility: ↑ Ethnicity: 0

Table 11. Risk Factors: Low Birthweight Through Other Associations

Author, Year	Low birthweight	Birth order	Prematurity	Other perinatal factors	Parent stress	Parenting practices	Child medical conditions	Other associations
Hammer, 2010[174]	NR	NR	NR	NR	NR	NR	NR	Child age: 0 2-parent household: 0 Race/ethnicity: 0
Harrison, 2010[179]	All outcomes: 0	Older siblings: Expressive: ↑ Receptive: ↓ Vocabulary: 0	All outcomes: 0	Neonatal intensive care: 0 Breastfed >9 months: all outcomes: 0	Mother distress/well-being: all outcomes: ↓	Support for children learning at home: Expressive and receptive: 0 vocabulary: ↓ Television watching: all outcomes: 0	Asthma: all outcomes: 0 Bronchiolitis: all outcomes: 0 Ear infections: expressive: ↑, receptive and vocabulary: 0 Ongoing hearing problems: expressive and receptive: ↑, vocabulary: 0 Social temperament: expressive and receptive: 0, vocabulary: ↓ Persistence temperament: all outcomes: ↓ Reactivity temperament: outcomes: ↑	Parents' language other than English status: expressive: ↓, receptive: 0 vocabulary: ↑ Parents' indigenous status: all outcomes: 0 Number of children in household: expressive and receptive: 0, vocabulary: ↑ Smoking in household: expressive and receptive: 0, vocabulary: ↑ Neighborhood disadvantaged: all outcomes: 0
Henrichs, et al, 2011[81]	0	NR	Late bloomers: ↑		Late onset: ↑	NR	NR	Marital status: 0 Ethnicity non-Western: late bloomers: ↓; late onset: ↑ Single motherhood: late bloomers: ↓
Kerstjens, 2011[189]	Included in model but NR	NR	Early preterm: ↑ Moderate preterm: 0	Multiple birth included in model but NR	NR	NR	NR	Non-Dutch birth included in model but NR
Kerstjens, 2009[186]	NR	NR	↑	NR	NR	NR	NR	1-parent family: ↓
Kerstjens, 2012[190]	Included in model but NR	NR	↑	Multiple birth included in model but NR	NR	NR	NR	Non-Dutch birth included in model but NR
Law, 2009[46]	SLI: 0 N-SLI: ↑	NR	NR	Mother smoked during pregnancy: SLI: 0, N-SLI: 0	NR	No reading to child: SLI: 0 N-SLI: ↑	Neurotic behaviors: SLI: 0, N-SLI: ↑ Antisocial behaviors: SLI: 0, N-SLI: ↑	No preschool: SLI ↑ Some preschool: N-SLI ↑ Single motherhood: SLI: 0, N-SLI: ↑
Law, 2012[172]	NR	NR	NR	Small for gestational age: 0	NR	NR	NR	Pattern Construction: ↑ Behavior: ↓ Language concerns: ↓

Table 11. Risk Factors: Low Birthweight Through Other Associations

Author, Year	Low birthweight	Birth order	Prematurity	Other perinatal factors	Parent stress	Parenting practices	Child medical conditions	Other associations
Mossabeb et al, 2012[83]	NR	Singleton: 0	NA	NR	NR	NR	NR	Public health insurance: ↑ Singleton gestation: 0 Small for gestational age: 0 Days on ventilator: 0 PDS ligation: 0 Culture + sepsis: 0 IVH grade 1-2: 0 IVH grade 3-4: 0
O'Leary, 2009[220]	NR	Parity: 0	NR	Binge drinking: Prepregnancy: 0 Trimester 1: 0 Trimester 2: ↑ Trimester 3: ↑	Maternal (mild): ↑	Poor parenting: ↑	NR	Marital status: 0 Parent smoking: 0 Parent drug use: 0
Pena et al, 2011[183]	NR	NR	NR	NR	NR	NR	NR	Bilingual: 0 Later first English exposure: ↑
Potijk et al, 2013[191]	NR	NR	Decreasing gestational age: ↑	NR	NR	NR	NR	Multiplicative effect of SES and gestational age decreased the individual additive effect of the 2 associations; number of siblings in model but NR
Pruitt 2010[166]	NR	NR	NR	NR	NR	NR	NR	NR
Reilly, 2007[178]	CSBS and CDI: 0	CSBS and CDI: 0	CSBS and CDI: 0	Twin: CSBS and CDI: 0	Mom mental health score: CSBS and CDI: 0	NR	NR	CSBS score at 12 months: ↓ Non-English-speaking background: CSBS: 0, CDI: ↑ Maternal vocabulary score: ↑
Reilly, 2009[177]	0	0	0	Twin: ↑	Mom mental health score: 0	NR	NR	Temperament: 0
Reilly et al, 2013[181]	0	Older siblings: 0	<36 weeks: 0	Twin birth: ↑	Mom mental health score: 0	NR	NR	Temperament: 0
Roth, 2011[222]	NR	NR	NR	Maternal use of folic acid supplements: Severe language delay: ↓ Moderate language delay: 0	NR	NR	NR	Maternal body mass index and marital status included in models but NR

Table 11. Risk Factors: Low Birthweight Through Other Associations

Author, Year	Low birthweight	Birth order	Prematurity	Other perinatal factors	Parent stress	Parenting practices	Child medical conditions	Other associations
Schjolberg et al, 2011[192]	↑	NR	↑	Apgar score: ↑ Multiple birth: ↑	↑		NR	Siblings: ↑ Fussy: 0 Gestational diabetes: 0 Smoking during pregnancy: 0 Alcohol consumption first trimester: ↑ Alcohol consumption last trimester: 0 Language other than Norwegian: ↑ Daycare before 18 months: 0
Singer et al, 2001[184]	0	NR	0	Multiple birth: 0	NR	NR	Higher neurologic risk: ↑ Patent ductus arteriosis: ↑ Necrotizing enterocolitis: 0 Septicemia: 0 Peak bilirubin: 0 Retinopathy of prematurity: 0	Minority race: ↑
Tallal et al, 1989[182]	NR	NR	NR	NR	NR	NR	NR	NR
Tomblin et al, 1991[167]	0	Later: ↑	NR	NR	NR	NR	NR	At-risk determination at birth (parental background, maternal health during pregnancy, birth characteristics, and health as infant): ↑
Tomblin et al, 1997[168]	0	NR	NR	C-section: 0 Duration of breastfeeding: ↓	NR	NR	NR	Parent exposure to diseases, tobacco, alcohol, and drugs: 0 Maternal occupational exposure: 0
van Batenburg-Eddes, 2013[223]	In model but NR	NR	Gestational age in model but NR	NR	NR	NR	NR	Neuromotor development: Receptive delay at 1.5 years: ↑ Receptive delay at 1.5 years: 0 Expressive delay at 2.5 years: ↑ Expressive delay across

Table 11. Risk Factors: Low Birthweight Through Other Associations

Author, Year	Low birthweight	Birth order	Prematurity	Other perinatal factors	Parent stress	Parenting practices	Child medical conditions	Other associations
								ages: ↑ Ethnicity in model but NR Marital status in model but NR
Van Lierde, 2009[193]	ELBW associated with poorer receptive language, expressive language (vocabulary, semantics, and morpho-syntaxis) and total score	NR	NR	NR	NR	NR	NR	NR
Weindrich et al, 2000[170]	NR	NR	NR	Composite measure of organic risk: ↑	NR	NR	NR	Composite measure of psychosocial risk: ↑
Whitehurst, 1991[169]	NR	NR	NR	NR	NR	NR	NR	NR
Yliherva et al, 2001[224]	Speech:↑ if low, not very low Concepts: ↑ if very low	Production: 0 Perceptions and concepts: ↑	NR	Composite measure of risk: 0	NR	NR	Hearing impaired (all analyses): ↑	Reconstructed family: Perception and concepts: ↑ Urban residence (all analyses): 0
Zambrana et al, 2014[187] Multivariate	NR	Older siblings: Analysis 1: 0 Analysis 2 (2+): ↑ Analysis 3: 0	NR	Multiple birth (all analyses): 0	NR	NR	NR	Parents with other mother tongue (all analyses): 0 Spoken to in another language (all analyses): 0 Mom partnership status (all analyses): 0

Table 11. Risk Factors: Low Birthweight Through Other Associations

Author, Year	Low birthweight	Birth order	Prematurity	Other perinatal factors	Parent stress	Parenting practices	Child medical conditions	Other associations
Zubrick, 2007[225]	↑	2 or more children in family: ↑	↑	Cigarette use during pregnancy: 0	Depression anxiety stress scale: 0	Parenting scale: 0 Family function: 0	NR	Paid employment: 0 Family type: 0 In daycare: 0 Other ASQ scales abnormal: gross motor: ↑ fine motor: ↑ Adaptive score: ↑ Personal-social: ↑ Child Behavior Checklist: 0 Dimension of Temperament scale: 0

↓ = decreased; ↑ = increased.

ASQ = Ages & Stages Questionnaire; CDI = MacArthur-Bates Communication Development Inventory; ELBW = extremely low birth weight; IVH = intraventricular hemorrhage; N = number; NA = not applicable; NR = not reported; N-SLI = nonspecific language impairment; PDS = polydioxanone; SES = socioeconomic status; SLI = specific language impairment.

Appendix A. Search Strategy

Speech Language Evidence 2004 Forward Searches

	Search String	Results
#1	Search (“Communication Disorders/classification”[Mesh] OR “Communication Disorders/diagnosis”[Mesh])	15523
#5	Search (“Communication Disorders/classification”[Mesh] OR “Communication Disorders/diagnosis”[Mesh]) Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	1246
	OVERARCHING EVIDENCE	
#6	Search (“Communication Disorders/classification”[Mesh] OR “Communication Disorders/diagnosis”[Mesh]) Filters: Review; Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	95
#16	Search (“Communication Disorders/classification”[Mesh] OR “Communication Disorders/diagnosis”[Mesh]) Filters: Controlled Clinical Trial; Guideline; Practice Guideline; Meta-Analysis; Multicenter Study; Randomized Controlled Trial; Publication date from 2004/01/01; English; Preschool Child: 2-5 years; Infant: birth-23 months	55
#23	Search ”Epidemiologic Studies”[Mesh] Filters: Publication date from 2004/01/01; English; Preschool Child: 2-5 years; Infant: birth-23 months	92332
#24	Search (#16 AND #23) Filters: Publication date from 2004/01/01; English; Preschool Child: 2-5 years; Infant: birth-23 months	24
	SCREENING	
#25	Search ((“Psychological Tests”[Mesh]) OR “Diagnostic Techniques and Procedures”[Mesh]) OR “Mass Screening”[Mesh] Filters: Publication date from 2004/01/01; English; Preschool Child: 2-5 years; Infant: birth-23 months	106030
#26	Search (#1 AND #25) Filters: Publication date from 2004/01/01; English; Preschool Child: 2-5 years; Infant: birth-23 months	797
#27	Search (#1 AND #25) Filters: Review; Publication date from 2004/01/01; English; Preschool Child: 2-5 years; Infant: birth-23 months	34
#28	Search (#1 AND #25) Filters: Review; Publication date from 2004/01/01; English; Infant: birth-23 months	18
#30	Search (#1 AND #25) Filters: Review; Publication date from 2004/01/01; English; Preschool Child: 2-5 years	31
#32	Search ”Risk”[Mesh] Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	37645
#33	Search (#5 AND #32) Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	165
#34	Search ((((“Primary Health Care”[Mesh]) OR “Physicians, Family”[Mesh]) OR “Pediatrics”[Mesh] OR primary care OR family physicians OR pediatrician) OR “Child Health Services”[Mesh]) OR “Preventive Health Services”[Mesh]Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	29572
#35	Search (#5 AND #34) Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	206
#39	Search ((“Sensitivity and Specificity”[Mesh]) OR “Diagnostic Errors”[Mesh]) OR “Diagnosis, Differential”[Mesh] Filters: English; Infant: birth-23 months; Preschool Child: 2-5 years	55512
#40	Search (#5 AND #39) Filters: English; Infant: birth-23 months; Preschool Child: 2-5 years	180
	ADVERSE EFFECTS	
#45	Search ”Communication Disorders”[Mesh] Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	2828
#50	Search (((((“Diagnostic Errors”[Mesh]) OR “Stress, Physiological”[Mesh]) OR “Life Change Events”[Mesh]) OR “Prejudice”[Mesh]) OR “Stereotyping”[Mesh]) OR “Self Concept”[Mesh] OR adverse effect OR harm OR stigma	529148
#55	Search (#45 AND #50) Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	115
#56	Search (#45 AND #50) Filters: Review; Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	8
#62	Search (#45 AND #50) Filters: Controlled Clinical Trial; Meta-Analysis; Multicenter Study; Randomized Controlled Trial; Guideline; Practice Guideline; Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	5
#63	Search (#56 OR #62) Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	12
#65	Search (#23 AND #51) Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	41

Appendix A. Search Strategy

	INTERVENTIONS/OUTCOMES	
#68	Search (“Communication Disorders/drug therapy”[Mesh] OR “Communication Disorders/nursing”[Mesh] OR “Communication Disorders/prevention and control”[Mesh] OR “Communication Disorders/rehabilitation”[Mesh] OR “Communication Disorders/surgery”[Mesh] OR “Communication Disorders/therapy”[Mesh]) Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	718
#69	Search (((((((“Cost of Illness”[Mesh]) OR “Quality of Life”[Mesh]) OR “Employment”[Mesh]) OR “Psychology, Industrial”[Mesh]) OR “Family Relations”[Mesh]) OR “Family”[Mesh]) OR “Interpersonal Relations”[Mesh]) OR (“Educational Status”[Mesh] OR “Educational Measurement”[Mesh])) OR “Motivation”[Mesh] Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	29636
#70	Search (#68 AND #69) Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	207
#71	Search (((“Outcome and Process Assessment (Health Care)”[Mesh]) OR “Comparative Study” [Publication Type]) OR (“Evaluation Studies” [Publication Type] OR “Evaluation Studies as Topic”[Mesh])) OR “Epidemiologic Studies”[Mesh] Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	132829
#72	Search (#68 AND #71) Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	399
#79	Search (#70 OR #72) Filters: Controlled Clinical Trial; Guideline; Meta-Analysis; Multicenter Study; Practice Guideline; Randomized Controlled Trial; Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	99
#85	Search (#70 OR #72) Filters: Review; Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	43
	COSTS	
#86	Search ((“Costs and Cost Analysis”[Mesh] OR “Economics”[Mesh])) Filters:Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	6647
#98	Search (#69 OR #86) Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	34506
#99	Search (#68 AND #98) Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	215
#105	Search (#68 AND #98) Filters: Controlled Clinical Trial; Guideline; Meta-Analysis; Multicenter Study; Practice Guideline; Randomized Controlled Trial; Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	35
#106	Search (#68 AND #98) Filters: Review; Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	24
#107	Search (#99 AND #23) Filters: Publication date from 2004/01/01; English; Infant: birth-23 months; Preschool Child: 2-5 years	69

Total Unduplicated PubMed = 740

Cochrane = 6 = 6 new
PsycInfo = 182 = 173 new
CINAHL = 142 = 136 new
Instruments = 147 = 137 new

Total Unduplicated Database = 1074

Search – July 20, 2013

	Search String	**Results**
#1	Search ((((((Ages and Stages Questionnaire[Title/Abstract])) OR Battelle Developmental Inventory Screening Test[Title/Abstract]) OR Clinical Adaptive Test[Title/Abstract]) OR (Clinical Linguistic and Auditory Milestone Scale[Title/Abstract])) OR Denver Developmental Screening Test[Title/Abstract]) OR Early Language Milestone Scale[Title/Abstract]	314
#2	Search ((((((Ages and Stages Questionnaire[Title/Abstract])) OR Battelle Developmental Inventory Screening Test[Title/Abstract]) OR Clinical Adaptive Test[Title/Abstract]) OR (Clinical Linguistic and Auditory Milestone Scale[Title/Abstract])) OR Denver Developmental Screening Test[Title/Abstract]) OR Early Language Milestone Scale[Title/Abstract] Filters: Publication date from 2013/03/01	11
#3	Search ((((((Ages and Stages Questionnaire[Title/Abstract])) OR Battelle Developmental Inventory Screening Test[Title/Abstract]) OR Clinical Adaptive Test[Title/Abstract]) OR (Clinical	10

Appendix A. Search Strategy

	Search String	Results
	Linguistic and Auditory Milestone Scale[Title/Abstract])) OR Denver Developmental Screening Test[Title/Abstract]) OR Early Language Milestone Scale[Title/Abstract] Filters: Publication date from 2013/04/01	
#4	Search ((((Fluharty Preschool Speech[Title/Abstract]) OR Infant-Toddler Checklist[Title/Abstract]) OR Language Development Survey[Title/Abstract]) OR McArthur-Bates Communicative Development Inventory[Title/Abstract]) OR WILSTAAR[Title/Abstract] Filters: Publication date from 2013/04/01	4
#5	Search ("Communication Disorders/classification"[Mesh] OR "Communication Disorders/diagnosis"[Mesh]) Filters: Publication date from 2013/04/01	10
#6	Search ("Communication Disorders/classification"[Mesh] OR "Communication Disorders/diagnosis"[Mesh]) Filters: Publication date from 2013/04/01; Infant: 1-23 months	2
#7	Search ("Communication Disorders/classification"[Mesh] OR "Communication Disorders/diagnosis"[Mesh]) Filters: Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	3
#8	Search ("Communication Disorders/classification"[Mesh] OR "Communication Disorders/diagnosis"[Mesh]) Filters: Review; Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	1
#9	Search (("Psychological Tests"[Mesh]) OR "Diagnostic Techniques and Procedures"[Mesh]) OR "Mass Screening"[Mesh] Filters: Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	227
#10	Search (#7 AND #9) Filters: Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	2
#11	Search "Risk"[Mesh] Filters: Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	116
#12	Search (#7 AND #11) Filters: Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	0
#13	Search (#7 AND #11) Schema: all Filters: Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	0
#14	Search ((((("Primary Health Care"[Mesh]) OR "Physicians, Family"[Mesh]) OR "Pediatrics"[Mesh] OR primary care OR family physicians OR pediatrician) OR "Child Health Services"[Mesh]) OR "Preventive Health Services"[Mesh] Filters:Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	87
#15	Search (#7 AND #14) Filters: Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	0
#16	Search (#7 AND #14) Schema: all Filters: Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	0
#17	Search (("Sensitivity and Specificity"[Mesh]) OR "Diagnostic Errors"[Mesh]) OR "Diagnosis, Differential"[Mesh] Filters: Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	46
#18	Search (#7 AND #17) Filters: Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	0
#19	Search (#7 AND #17) Schema: all Filters: Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	0
#20	Search "Communication Disorders"[Mesh] Filters: Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	7
#21	Search "Communication Disorders"[Mesh] Filters: Review; Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	1
#22	Search ("Communication Disorders/drug therapy"[Mesh] OR "Communication Disorders/nursing"[Mesh] OR "Communication Disorders/prevention and control"[Mesh] OR "Communication Disorders/rehabilitation"[Mesh] OR "Communication Disorders/surgery"[Mesh] OR "Communication Disorders/therapy"[Mesh]) Filters:Publication date from 2013/04/01; Infant: 1-23 months; Preschool Child: 2-5 years	3
#23	Search ("Communication Disorders/drug therapy"[Mesh] OR "Communication Disorders/nursing"[Mesh] OR "Communication Disorders/prevention and control"[Mesh] OR "Communication Disorders/rehabilitation"[Mesh] OR "Communication Disorders/surgery"[Mesh] OR "Communication Disorders/therapy"[Mesh]) Filters:Publication date from 2013/04/01; English; Infant: 1-23 months; Preschool Child: 2-5 years	3
#24	Search (("Costs and Cost Analysis"[Mesh] OR "Economics"[Mesh])) Filters:Publication date from 2013/04/01; English; Infant: 1-23 months; Preschool Child: 2-5 years	19
#25	Search (#23 AND #24) Filters: Publication date from 2013/04/01; English; Infant: 1-23 months; Preschool Child: 2-5 years	0

Appendix A. Search Strategy

	Search String	Results
#26	Search (#23 AND #24) Schema: all Filters: Publication date from 2013/04/01; English; Infant: 1-23 months; Preschool Child: 2-5 years	0

PubMed Total Citations = 19 = 11 new

Cochrane = 0
PsycInfo = 10 = 4 new
CINAHL = 11 = 1 new
Instruments = 9

Total NEW Database = 14

Instruments that were searched by name across databases:

- Ages and Stages Questionnaire—3rd Edition,
- Battelle Developmental Inventory Screening Test—2nd edition,
- Clinical Adaptive Test/Clinical Linguistic and Auditory Milestone Scale,
- Denver Developmental Screening Test II,
- Early Language Milestone Scale,
- Fluharty Preschool Speech and Language Screening Test,
- Infant-Toddler Checklist,
- The Language Development Survey,
- McArthur-Bates Communicative Development Inventory, and
- Ward Infant Language Screening Test, Assessment, Acceleration, and Remediation (WILSTAAR).

Search – July 2014

	Search String	Results
#1	Search ((((((Ages and Stages Questionnaire[Title/Abstract])) OR Battelle Developmental Inventory Screening Test[Title/Abstract]) OR Clinical Adaptive Test[Title/Abstract]) OR (Clinical Linguistic and Auditory Milestone Scale[Title/Abstract])) OR Denver Developmental Screening Test[Title/Abstract]) OR Early Language Milestone Scale[Title/Abstract]	345
#2	Search (((((Fluharty Preschool Speech[Title/Abstract]) OR Infant-Toddler Checklist[Title/Abstract]) OR Language Development Survey[Title/Abstract]) OR McArthur-Bates Communicative Development Inventory[Title/Abstract]) OR WILSTAAR[Title/Abstract]	53
#3	Search (#1 OR #2)	398
#4	Search (#1 OR #2) Filters: Publication date from 2013/04/01	53
#5	Search ("Communication Disorders/classification"[Mesh] OR "Communication Disorders/diagnosis"[Mesh]) Filters: Publication date from 2013/04/01	421
#6	Search ("Communication Disorders/classification"[Mesh] OR "Communication Disorders/diagnosis"[Mesh])	16177
#7	Search ("Communication Disorders/classification"[Mesh] OR "Communication Disorders/diagnosis"[Mesh]) Filters: Publication date from 2013/04/01; Infant: 1-23 months	35
#8	Search ("Communication Disorders/classification"[Mesh] OR "Communication Disorders/diagnosis"[Mesh]) Filters: Publication date from 2013/04/01; Infant: 1-23 months; Newborn: birth-1 month	39
#9	Search ("Communication Disorders/classification"[Mesh] OR "Communication Disorders/diagnosis"[Mesh]) Filters: Publication date from 2013/04/01; Infant: 1-23 months; Newborn: birth-1 month; Infant: birth-23 months	39
#10	Search ("Communication Disorders/classification"[Mesh] OR "Communication Disorders/diagnosis"[Mesh]) Filters: Publication date from 2013/04/01; Infant: 1-23 months; Newborn: birth-1 month; Infant: birth-23 months; Preschool Child: 2-5 years	102
#12	Search ((“Psychological Tests”[Mesh]) OR “Diagnostic Techniques and Procedures”[Mesh]) OR “Mass Screening”[Mesh]	5667363
#13	Search (#10 AND #12) Filters: Publication date from 2013/04/01; Infant: 1-23 months; Newborn: birth-1 month; Infant: birth-23 months; Preschool Child: 2-5 years	64
#14	Search (#10 AND #12)	64
#15	Search ("Communication Disorders/classification"[Mesh] OR "Communication Disorders/diagnosis"[Mesh]) Filters: Review; Publication date from 2013/04/01; Infant: 1-23 months; Newborn: birth-1 month; Infant: birth-23 months; Preschool Child: 2-5 years	9

Appendix A. Search Strategy

	Search String	Results
#16	Search “Risk”[Mesh] Filters: Review; Publication date from 2013/04/01; Infant: 1-23 months; Newborn: birth-1 month; Infant: birth-23 months; Preschool Child: 2-5 years	375
#17	Search “Risk”[Mesh]	820783
#18	Search (#10 AND #17) Filters: Review; Publication date from 2013/04/01; Infant: 1-23 months; Newborn: birth-1 month; Infant: birth-23 months; Preschool Child: 2-5 years	1
#19	Search (#10 AND #17)	16
#20	Search ((((“Primary Health Care”[Mesh]) OR “Physicians, Family”[Mesh]) OR “Pediatrics”[Mesh] OR primary care OR family physicians OR pediatrician) OR “Child Health Services”[Mesh]) OR “Preventive Health Services”[Mesh] Filters: Review; Publication date from 2013/04/01; Infant: 1-23 months; Newborn: birth-1 month; Infant: birth-23 months; Preschool Child: 2-5 years	419
#21	Search ((((“Primary Health Care”[Mesh]) OR “Physicians, Family”[Mesh]) OR “Pediatrics”[Mesh] OR primary care OR family physicians OR pediatrician) OR “Child Health Services”[Mesh]) OR “Preventive Health Services”[Mesh]	703870
#22	Search (#10 AND #21) Filters: Review; Publication date from 2013/04/01; Infant: 1-23 months; Newborn: birth-1 month; Infant: birth-23 months; Preschool Child: 2-5 years	0
#23	Search (#10 AND #21) Schema: all Filters: Review; Publication date from 2013/04/01; Infant: 1-23 months; Newborn: birth-1 month; Infant: birth-23 months; Preschool Child: 2-5 years	0
#24	Search (#10 AND #21)	14
#25	Search (((“Sensitivity and Specificity”[Mesh]) OR “Diagnostic Errors”[Mesh]) OR “Diagnosis, Differential”[Mesh])	837185
#26	Search (#10 AND #25)	23
#27	Search "Communication Disorders"[Mesh]	52319
#28	Search "Communication Disorders"[Mesh] Filters: Newborn: birth-1 month	1383
#29	Search "Communication Disorders"[Mesh] Filters: Newborn: birth-1 month; Infant: birth-23 months	3861
#30	Search "Communication Disorders"[Mesh] Filters: Newborn: birth-1 month; Infant: birth-23 months; Infant: 1-23 months	3861
#31	Search "Communication Disorders"[Mesh] Filters: Newborn: birth-1 month; Infant: birth-23 months; Infant: 1-23 months; Preschool Child: 2-5 years	10964
#32	Search "Communication Disorders"[Mesh] Filters: Publication date from 2013/04/01; Newborn: birth-1 month; Infant: birth-23 months; Infant: 1-23 months; Preschool Child: 2-5 years	263
#33	Search "Communication Disorders"[Mesh] Filters: Review; Publication date from 2013/04/01; Newborn: birth-1 month; Infant: birth-23 months; Infant: 1-23 months; Preschool Child: 2-5 years	18
#35	Search ("Communication Disorders/drug therapy"[Mesh] OR "Communication Disorders/nursing"[Mesh] OR "Communication Disorders/prevention and control"[Mesh] OR "Communication Disorders/rehabilitation"[Mesh] OR "Communication Disorders/surgery"[Mesh] OR "Communication Disorders/therapy"[Mesh])	13469
#36	Search (("Costs and Cost Analysis"[Mesh] OR "Economics"[Mesh])) Filters:Review; Publication date from 2013/04/01; Newborn: birth-1 month; Infant: birth-23 months; Infant: 1-23 months; Preschool Child: 2-5 years	54
#37	Search (("Costs and Cost Analysis"[Mesh] OR "Economics"[Mesh]))	487743
#38	Search (("Costs and Cost Analysis"[Mesh] OR "Economics"[Mesh])) Filters:Publication date from 2013/04/01; Newborn: birth-1 month; Infant: birth-23 months; Infant: 1-23 months; Preschool Child: 2-5 years	773
#39	Search (#35 AND #38) Filters: Publication date from 2013/04/01; Newborn: birth-1 month; Infant: birth-23 months; Infant: 1-23 months; Preschool Child: 2-5 years	0
#40	Search (#35 AND #38) Schema: all Filters: Publication date from 2013/04/01; Newborn: birth-1 month; Infant: birth-23 months; Infant: 1-23 months; Preschool Child: 2-5 years	0
#41	Search (#35 AND #38)	0

PubMed Total Citations = 147 = 135 New

Cochrane = 1
PsycInfo = 29= 23
CINAHL = 59 = 20 New
Instruments = 54 = 11 New

Total NEW Database = 190

Appendix A. Search Strategy

Instruments that were searched by name across databases:

- Ages and Stages Questionnaire—3rd Edition,
- Battelle Developmental Inventory Screening Test—2nd edition,
- Clinical Adaptive Test/Clinical Linguistic and Auditory Milestone Scale,
- Denver Developmental Screening Test II,
- Early Language Milestone Scale,
- Fluharty Preschool Speech and Language Screening Test,
- Infant-Toddler Checklist,
- The Language Development Survey,
- McArthur-Bates Communicative Development Inventory, and
- Ward Infant Language Screening Test, Assessment, Acceleration, and Remediation (WILSTAAR).

Grey Literature Searches

4/30/2013 ClinicalTrials.Gov
(communication OR language) AND (therapy OR development) | “communication disorders” | Child (76 records)

Communicative development inventory = 32

- Ages and Stages Questionnaire—3rd Edition = 0
- Battelle Developmental Inventory Screening Test—2nd edition = 0
- Clinical Adaptive Test/Clinical Linguistic and Auditory Milestone Scale = 0
- Denver Developmental Screening Test II = 3
- Early Language Milestone Scale = 0
- Fluharty Preschool Speech and Language Screening Test = 0
- Infant-Toddler Checklist = 0
- The Language Development Survey = 1
- McArthur-Bates Communicative Development Inventory = 0
- Ward Infant Language Screening Test, Assessment, Acceleration, and Remediation (WILSTAAR) = 0

7/20/2014 Clinical Trials.gov
(communication OR language) AND (therapy OR development) | "communication disorders" | Child (34 records)

Communicative development inventory = 10

- Ages and Stages Questionnaire—3rd Edition = 0
- Battelle Developmental Inventory Screening Test—2nd edition = 0
- Clinical Adaptive Test/Clinical Linguistic and Auditory Milestone Scale = 0
- Denver Developmental Screening Test II = 0
- Early Language Milestone Scale = 0
- Fluharty Preschool Speech and Language Screening Test = 0
- Infant-Toddler Checklist = 0
- The Language Development Survey = 0
- McArthur-Bates Communicative Development Inventory = 0
- Ward Infant Language Screening Test, Assessment, Acceleration, and Remediation (WILSTAAR) = 0

Appendix A Table 1. Inclusion/Exclusion Criteria

	Inclusion	Exclusion
Populations	**KQs 1–4:** Children age 5 years or younger who are representative of a population seen in a primary care setting **KQs 5-7:** Children age 6 years or younger who are representative of a population seen in a primary care or similar setting identified with speech or language delay or disorder. Treatment studies must focus on treatment of children who were screened and or diagnosed according to the specified age criteria.	Screening for or treatment of children with co-morbid developmental disorder (e.g., hearing impairment, developmental or neurological/neurogenetic impairment) identified prior to speech and language diagnostic procedure
Interventions: Screening	All instruments and procedures that are applicable for use in children age 5 years or younger: • ≤10 minutes to administer by a primary care provider or to be interpreted in a primary care setting • >10 minutes if completed by a parent or trained examiner and interpreted by the clinician • Instruments specifically for speech and language • General developmental instruments with a separate component for speech and/or language skills	• Instruments not designed for use in children age 5 years or younger • Tools that take >10 minutes to administer by a primary care provider • Tools that require a professional to administer, score, or interpret • General developmental screening instruments that do not have a separate component for speech and/or language skills
Interventions: Treatment	• All therapeutic interventions designed to improve speech or language in children delivered at any age, as long as diagnosis occurs when child is age 6 years or younger o Therapists may be speech-language pathologists or other clinicians, parents, or teachers • Therapeutic settings include group and individual sessions offered in a clinical locale, school, or home	Therapeutic interventions delivered to children who are diagnosed after age 6 years
Comparisons	**KQs 1, 3:** Screened vs. unscreened **KQ 2:** Different subpopulations (e.g., by age, risk factors) **KQ 4:** Screening vs. surveillance; surveillance vs. no activity **KQs 5-7:** Intervention vs. no intervention	• Single group design with no comparator (KQs 1, 3, 5-7) • Treatment or screening comparisons

Appendix B. Excluded Studies

X1	Not original research (nonsystematic review articles, commentaries, opinions, commentaries, editorials/letters to the editor and other publications with no primary data)
X2	Wrong language (study not published in English)
X3	Wrong age range, probable reason for delay or disorder identified prior to speech and language diagnostic procedure, or wrong population of interest (i.e., wrong condition).
X4	Wrong comparator (Comparison of screening or diagnostic instruments; treatment comparisons; single group designs with no comparator)
X5	Wrong study design based on key questions (e.g., case study, case series, cross-sectional study)
X6	Screening or diagnosis does not focus on speech and language or the instrument does not include a speech and language component
X7	Wrong geographic setting (countries without a high human development index)
X8	No accuracy information provided
X9	Full text article irretrievable

1. Screening for speech and language delay in preschool children: recommendation statement. Am Fam Physician. 2006 May 1;73(9):1605-10. PMID: 16719254. Exclusion Code: X1.
2. Narrative Ability of Children With Speech Sound Disorders and the Prediction of Later Literacy Skills. Lang Speech Hear Ser Schools. 2011;42(4):561-79. PMID: 21969531 Exclusion Code: X4.
3. Real-Word and Nonword Repetition in Italian-Speaking Children With Specific Language Impairment: A Study of Diagnostic Accuracy. J Speech Lang Hear Res. 2013;56(1):323-36. Exclusion Code: X4.
4. Tense Marking and Spontaneous Speech Measures in Spanish Specific Language Impairment: A Discriminant Function Analysis. J Speech Lang Hear Res. 2013;56(1):352-63. Exclusion Code: X4.
5. Aarnoudse-Moens CS, Weisglas-Kuperus N, van Goudoever JB, et al Meta-analysis of neurobehavioral outcomes in very preterm and/or very low birth weight children. Pediatrics. 2009 Aug;124(2):717-28. PMID: 19651588. Exclusion Code: X6.
6. Adams C, Lockton E, Freed J, et al The Social Communication Intervention Project: a randomized controlled trial of the effectiveness of speech and language therapy for school-age children who have pragmatic and social communication problems with or without autism spectrum disorder. Int J Lang Commun Disord. 2012 May-Jun;47(3):233-44. PMID: 22512510. Exclusion Code: X4.
7. Adams C, Lockton E, Gaile J, et al Implementation of a manualized communication intervention for school-aged children with pragmatic and social communication needs in a randomized controlled trial: the Social Communication Intervention Project. Int J Lang Commun Disord. 2012 May-Jun;47(3):245-56. PMID: 22512511. Exclusion Code: X4.
8. Adams-Chapman I. Insults to the developing brain and impact on neurodevelopmental outcome. J Commun Disord. 2009;42(4):256-62. PMID: 19423130. Exclusion Code: X1.
9. Allen CW, Silove N, Williams K, et al Validity of the Social Communication Questionnaire in assessing risk of autism in preschool children with developmental problems. J Autism Dev Disord. 2007;37(7):1272-8. PMID: 17080270. Exclusion Code: X3.
10. American Speech-Language-Hearing Association. Guidelines for Audiological Screening [Guidelines]. 1997. Exclusion Code: X1.
11. Amess P, Young T, Burley H, et al Developmental outcome of very preterm babies using an assessment tool deliverable by health visitors. Eur J Paediatr Neurol. 2010 May;14(3):219-23. PMID: 19615924. Exclusion Code: X4.
12. Andersson L. Determining the Adequacy of Tests of Children's Language. Commun Disord Q. 2005;26(4):207-25. Exclusion Code: X1.
13. Anthony JL, Aghara RG, Dunkelberger MJ, et al What factors place children with speech sound disorders at risk for reading problems? Am J Speech Lang Pathol. 2011 May;20(2):146-60. PMID: 21478282. Exclusion Code: X4.
14. Anthony JL, Aghara RG, Dunkelberger MJ, et al What Factors Place Children With Speech Sound Disorders at Risk for Reading Problems? Am J Speech Lang Pathol. 2011;20(2):146-60. Exclusion Code: X4.
15. Antoniazzi D, Snow P, Dickson-Swift V. Teacher identification of children at risk for language impairment in the first year of school.

Int J Speech Lang Pathol. 2010 Jun;12(3):244-52. PMID: 20433343. Exclusion Code: X3.

16. Antonio MCS, Fenick AM, Shabanova V, et al Developmental screening using the Ages and Stages Questionnaire: Standardized versus-real-world conditions. Infants Young Child. 2014;27(2):111-9. PMID: 2014-10475-003. Exclusion Code: X4.
17. Archibald LM, Joanisse MF. On the sensitivity and specificity of nonword repetition and sentence recall to language and memory impairments in children. J Speech Lang Hear Res. 2009 Aug;52(4):899-914. PMID: 19403945. Exclusion Code: X3.
18. Baatenburg de Jong RJ. Early Intervention in Very Preterm Children. Erasmus Medical Center; 2011. http://clinicaltrials.gov/ct2/show?term=speech+disorder+treatment&recr=Open&age=0&rank=14. Accessed on May 14, 2013. Exclusion Code: X9.
19. Bahr RH. Differential diagnosis of severe speech disorders using speech gestures. Topics Lang Disord. 2005;25(3):254. Exclusion Code: X3.
20. Bailet LL, Repper KK, Piasta SB, et al Emergent literacy intervention for prekindergarteners at risk for reading failure. J Learn Disabil. 2009 Jul-Aug;42(4):336-55. PMID: 19398614. Exclusion Code: X6.
21. Baker E, McLeod S. Evidence-based practice for children with speech sound disorders: part 2 application to clinical practice. Lang Speech Hear Serv Sch. 2011 Apr;42(2):140-51. PMID: 20844271. Exclusion Code: X4.
22. Ballantyne AO, Spilkin AM, Trauner DA. The revision decision: is change always good? A comparison of CELF--R and CELF--3 test scores in children with language impairment, focal brain damage, and typical development. Lang Speech Hear Ser Schools. 2007;38(3):182-9. Exclusion Code: X4.
23. Barbaro J, Dissanayake C. Prospective identification of autism spectrum disorders in infancy and toddlerhood using developmental surveillance: the social attention and communication study. J Dev Behav Pediatr. 2010 Jun;31(5):376-85. PMID: 20495475. Exclusion Code: X3.
24. Barratt J, Littlejohns P, Thompson J. Trial of intensive compared with weekly speech therapy in preschool children. Arch Dis Child. 1992 Jan;67(1):106-8. PMID: 1739321. Exclusion Code: X4.
25. Barrett S, Prior M, Manjiviona J. Children on the borderlands of autism: differential characteristics in social, imaginative, communicative and repetitive behaviour domains. Autism. 2004 Mar;8(1):61-87. PMID: 15070548. Exclusion Code: X3.
26. Becker DB, Grames LM, Pilgram T, et al The effect of timing of surgery for velopharyngeal dysfunction on speech. J Craniofac Surg. 2004 Sep;15(5):804-9. PMID: 15346022. Exclusion Code: X4.
27. Beitchman JH, Jiang H, Koyama E, et al Models and determinants of vocabulary growth from kindergarten to adulthood. J Child Psychol Psychiatry. 2008 Jun;49(6):626-34. PMID: 18341544. Exclusion Code: X4.
28. Berkoff MC, Leslie LK, Stahmer AC. Accuracy of caregiver identification of developmental delays among young children involved with child welfare. J Dev Behav Pediatr. 2006 Aug;27(4):310-8. PMID: 16906006. Exclusion Code: X6.
29. Bernard JY, De Agostini M, Forhan A, et al The dietary n6:n3 fatty acid ratio during pregnancy is inversely associated with child neurodevelopment in the EDEN mother-child cohort. J Nutr. 2013 Sep;143(9):1481-8. PMID: 23902952. Exclusion Code: X4.
30. Bernhardt B, Major E. Speech, language and literacy skills 3 years later: A follow-up study of early phonological and metaphonological intervention. Int J Lang Commun Disord. 2005;40(1):1-27. PMID: 15832523. Exclusion Code: X4.
31. Beverly BL, McGuinness TM, Blanton DJ. Communication and academic challenges in early adolescence for children who have been adopted from the former Soviet Union. Lang Speech Hear Serv Sch. 2008 Jul;39(3):303-13. PMID: 18596288. Exclusion Code: X3.
32. Bharti B, Bharti S. Parent-based language intervention for 2-year old children with specific expressive language delay: a randomised controlled trial with erroneous confidence (intervals). Arch Dis Child. 2010 Nov;95(11):953. PMID: 20880946. Exclusion Code: X5.
33. Bierman KL, Nix RL, Greenberg MT, et al Executive functions and school readiness intervention: impact, moderation, and mediation in the Head Start REDI program. Dev Psychopathol. 2008 Summer;20(3):821-43. PMID: 18606033. Exclusion Code: X3.
34. Bingham GE, Hall-Kenyon KM, Culatta B. Systematic and engaging early literacy: Examining the effects of paraeducator implemented early literacy instruction.

Commun Disord Q. 2010;32(1):38-49. Exclusion Code: X3.
35. Bishop DV, Baird G. Parent and teacher report of pragmatic aspects of communication: use of the children's communication checklist in a clinical setting. Dev Med Child Neurol. 2001 Dec;43(12):809-18. PMID: 11769267. Exclusion Code: X3.
36. Bishop DV, Hayiou-Thomas ME. Heritability of specific language impairment depends on diagnostic criteria. Genes Brain Behav. 2008 Apr;7(3):365-72. PMID: 17919296. Exclusion Code: X4.
37. Bishop DVM, Baird G. 'Parent and teacher report of pragmatic aspects of communication: Use of the Children's Communication Checklist in a clinical setting': Erratum. Dev Med Child Neurol. 2005;47(4). Exclusion Code: X1.
38. Black MM, Gerson LF, Freeland CA, et al Language screening for infants prone to otitis media. J Pediatr Psychol. 1988 Sep;13(3):423-33. PMID: 3199297. Exclusion Code: X3.
39. Blaxley L, Clinker M, Warr-Leeper GA. Two language screening tests compared with developmental sentence scoring. Lang Speech Hear Ser Schools. 1983;14:38-46. Exclusion Code: X3.
40. Bleses D, Vach W, Jorgensen RN, et al The internal validity and acceptability of the Danish SI-3: a language-screening instrument for 3-year-olds. J Speech Lang Hear Res. 2010 Apr;53(2):490-507. PMID: 20360468. Exclusion Code: X8.
41. Boets B, Vandermosten M, Poelmans H, et al Preschool impairments in auditory processing and speech perception uniquely predict future reading problems. Res Dev Disabil. 2011 Mar-Apr;32(2):560-70. PMID: 21236633. Exclusion Code: X4.
42. Bölte S, Westerwald E, Holtmann M, et al Autistic traits and autism spectrum disorders: The clinical validity of two measures presuming a continuum of social communication skills. J Autism Dev Disord. 2011;41(1):66-72. PMID: 20422277. Exclusion Code: X3.
43. Bolton PF, Golding J, Emond A, et al Autism spectrum disorder and autistic traits in the Avon Longitudinal Study of Parents and Children: precursors and early signs. J Am Acad Child Adolesc Psychiatry. 2012 Mar;51(3):249-60 e25. PMID: 22365461. Exclusion Code: X3.
44. Boris NW. Minding the transition to school. J Am Acad Child Adolesc Psychiatry. 2010 Jul;49(7):635-6. PMID: 20610132. Exclusion Code: X1.
45. Bornman J, Sevcik RA, Romski M, et al Successfully translating language and culture when adapting assessment measures. J Pol Pract Intell Disabil. 2010;7(2):111-8. Exclusion Code: X7.
46. Bortolini U, Arfe B, Caselli CM, et al Clinical markers for specific language impairment in Italian: The contribution of clitics and non-word repetition. Int J Lang Commun Disord. 2006 Nov-Dec;41(6):695-712. PMID: 17079223. Exclusion Code: X4.
47. Bothe AK, Davidow JH, Bramlett RE, et al Stuttering treatment research 1970-2005: I. Systematic review incorporating trial quality assessment of behavioral, cognitive, and related approaches. Am J Speech Lang Pathol. 2006 Nov;15(4):321-41. PMID: 17102144. Exclusion Code: X5.
48. Boudreau D. Use of a parent questionnaire in emergent and early literacy assessment of preschool children. Lang Speech Hear Ser Schools. 2005;36(1):33-47. Exclusion Code: X4.
49. Bowyer-Crane C, Snowling MJ, Duff FJ, et al Improving early language and literacy skills: differential effects of an oral language versus a phonology with reading intervention. J Child Psychol Psychiatry. 2008 Apr;49(4):422-32. PMID: 18081756. Exclusion Code: X3.
50. Boyle J, McCartney E, O'Hare A, et al Intervention for mixed receptive-expressive language impairment: a review. Dev Med Child Neurol. 2010 Nov;52(11):994-9. PMID: 20813021. Exclusion Code: X1.
51. Bozaykut A, Aksoy HU, Sezer RG, et al Evaluation of Clinical Course and Neurocognition in Children With Self-Limited Infantile Epilepsy in a Turkish Cohort Study. J Child Neurol. 2014 Jun 22. Exclusion Code: X3.
52. Braaten EB, Norman D. Intelligence (IQ) testing. Pediatr Rev. 2006 Nov;27(11):403-8. PMID: 17079505. Exclusion Code: X1.
53. Brackenbury T, Pye C. Semantic deficits in children with language impairments: issues for clinical assessment. Lang Speech Hear Serv Sch. 2005 Jan;36(1):5-16. PMID: 15801504. Exclusion Code: X1.
54. Brancalioni AR, Magnago KF, Keske-Soares M. Proposal for classifying the severity of speech disorder using a fuzzy model in accordance with the implicational model of feature complexity. Clin Linguist Phon. 2012;26(9):774-90. Exclusion Code: X3.
55. Briggs RD, Stettler EM, Silver EJ, et al Social-emotional screening for infants and toddlers in

primary care. Pediatrics. 2012;129(2):e377-e84. PMID: 22232304. Exclusion Code: X3.
56. Brookhouser PE, Hixson PK, Matkin ND. Early childhood language delay: the otolaryngologist's perspective. Laryngoscope. 1979 Dec;89(12):1898-913. PMID: 513912. Exclusion Code: X4.
57. Broomfield J, Dodd B. The nature of referred subtypes of primary speech disability. Child Lang Teach Ther. 2004;20(2):135-51. Exclusion Code: X4.
58. Brownlie EB, Beitchman JH, Escobar M, et al Early language impairment and young adult delinquent and aggressive behavior. J Abnorm Child Psychol. 2004 Aug;32(4):453-67. PMID: 15305549. Exclusion Code: X4.
59. Burne B, Knafelc V, Melonis M, et al The use and application of assistive technology to promote literacy in early childhood: a systematic review. Disabil Rehabil Assist Technol. 2011;6(3):207-13. PMID: 20923322. Exclusion Code: X3.
60. Busari JO, Weggelaar NM. How to investigate and manage the child who is slow to speak. BMJ. 2004 Jan 31;328(7434):272-6. PMID: 14751899. Exclusion Code: X1.
61. Buschmann A, Jooss B, Rupp A, et al Children with developmental language delay at 24 months of age: results of a diagnostic work-up. Dev Med Child Neurol. 2008 Mar;50(3):223-9. PMID: 18266869. Exclusion Code: X4.
62. Buschmann A, Jooss B, Rupp A, et al Parent based language intervention for 2-year-old children with specific expressive language delay: a randomised controlled trial. Arch Dis Child. 2009 Feb;94(2):110-6. PMID: 18703544. Exclusion Code: X5.
63. Butterworth B, Kovas Y. Understanding neurocognitive developmental disorders can improve education for all. Science. 2013 Apr 19;340(6130):300-5. Exclusion Code: X1.
64. Cabell SQ, Justice LM, Zucker TA, et al Validity of teacher report for assessing the emergent literacy skills of at-risk preschoolers. Lang Speech Hear Serv Sch. 2009 Apr;40(2):161-73. PMID: 19336834. Exclusion Code: X3.
65. Camilleri B, Botting N. Beyond static assessment of children's receptive vocabulary: the dynamic assessment of word learning (DAWL). Int J Lang Commun Disord. 2013 Sep-Oct;48(5):565-81. PMID: 24033654. Exclusion Code: X6.
66. Camilleri B, Law J. Assessing children referred to speech and language therapy: static and dynamic assessment of receptive vocabulary. Adv Speech Lang Pathol. 2007;9(4):312-22. Exclusion Code: X4.
67. Campisi L, Serbin LA, Stack DM, et al Precursors of language ability and academic performance: an inter-generational, longitudinal study of at-risk children. Infant Child Develop. 2009;18(5):377-403. Exclusion Code: X4.
68. Cantwell DP, Baker L. Psychiatric and learning disorders in children with speech and language disorders: a descriptive analysis. Adv in Learning & Behav Disabilities. 1985;4. Exclusion Code: X3.
69. Cappiello MM, Gahagan S. Early child development and developmental delay in indigenous communities. Pediatr Clin North Am. 2009 Dec;56(6):1501-17. PMID: 19962033. Exclusion Code: X1.
70. Capute AJ, Palmer FB, Shapiro BK, et al Clinical linguistic and auditory milestone scale: prediction of cognition in infancy. Dev Med Child Neurol. 1986 Dec;28(6):762-71. PMID: 3817315. Exclusion Code: X6.
71. Carr Swift M, O'Brian S, Hewat S, et al Investigating parent delivery of the Lidcombe Program. Int J Speech Lang Pathol. 2011 Aug;13(4):308-16. PMID: 21793776. Exclusion Code: X4.
72. Carter AS, Messinger DS, Stone WL, et al A randomized controlled trial of Hanen's 'More Than Words' in toddlers with early autism symptoms. J Child Psychol Psychiatry. 2011 Jul;52(7):741-52. PMID: 21418212. Exclusion Code: X3.
73. Caskey M, Vohr B. Assessing language and language environment of high-risk infants and children: a new approach. Acta Paediatr. 2013 May;102(5):451-61. PMID: 23397889. Exclusion Code: X1.
74. Cattani A, Bonifacio S, Fertz M, et al Communicative and linguistic development in preterm children: A longitudinal study from 12 to 24 months. Int J Lang Commun Disord. 2010;45(2):162-73. PMID: 22748029. Exclusion Code: X4.
75. Catts HW, Petscher Y, Schatschneider C, et al Floor effects associated with universal screening and their impact on the early identification of reading disabilities. J Learn Disabil. 2009 Mar-Apr;42(2):163-76. PMID: 19098274. Exclusion Code: X6.
76. Chaffee CA, Cunningham CE, Secord-Gilbert M, et al Screening effectiveness of the Minnesota Child Development Inventory Expressive and Receptive Language Scales: sensitivity, specificity, and predictive value.

Psychol Assess. 1990;2(1):80-5. Exclusion Code: X3.
77. Champion TB, Rosa-Lugo LI, Rivers KO, et al A preliminary investigation of second- and fourth-grade African American students' performance on the Gray Oral Reading Test—Fourth Edition. Topics Lang Disord. 2010;30(2):145-53. Exclusion Code: X3.
78. Chang SE, Zhu DC. Neural network connectivity differences in children who stutter. Brain. 2013 Dec;136(Pt 12):3709-26. PMID: 24131593. Exclusion Code: X4.
79. Chen CW, Li CY, Wang JK. Growth and development of children with congenital heart disease. J Adv Nurs. 2004 Aug;47(3):260-9. PMID: 15238120. Exclusion Code: X7.
80. Chiat S, Roy P. The preschool repetition test: an evaluation of performance in typically developing and clinically referred children. J Speech Lang Hear Res. 2007;50(2):429-43. Exclusion Code: X4.
81. Chiu S, DiMarco MA. A pilot study comparing two developmental screening tools for use with homeless children. Journal of Pediatric Healthcare. 2010;24(2):73-80. Exclusion Code: X4.
82. Choudhury N, Benasich AA. Maturation of auditory evoked potentials from 6 to 48 months: prediction to 3 and 4 year language and cognitive abilities. Clin Neurophysiol. 2011 Feb;122(2):320-38. PMID: 20685161. Exclusion Code: X4.
83. Christensen RV, Hansson K, Oetting J, et al The Use and Productivity of Past Tense Morphology in Specific Language Impairment: An Examination of Danish. J Speech Lang Hear Res. 2012;55(6):1671-89. Exclusion Code: X3.
84. Ciccia AH, Whitford B, Krumm M, et al Improving the access of young urban children to speech, language and hearing screening via telehealth. J Telemed Telecare. 2011;17(5):240-4. PMID: 21636686. Exclusion Code: X6.
85. Ciccone N, Hennessey N, Stokes SF. Community-based early intervention for language delay: A preliminary investigation. Int J Lang Commun Disord. 2012;47(4):467-70. PMID: 22788232. Exclusion Code: X5.
86. Ciolli L, Seymour HN. Dialect identification versus evaluation of risk in language screening. Semin Speech Lang. 2004 Feb;25(1):33-40. PMID: 15088231. Exclusion Code: X1.
87. Clegg J, Ansorge L, Stackhouse J, et al Developmental communication impairments in adults: Outcomes and life experiences of adults and their parents. Language, Speech, and Hearing Services in Schools. 2012;43(4):521-35. PMID: 22826372. Exclusion Code: X3.
88. Cole KN, Dale PS. Direct language instruction and interactive language instruction with language delayed preschool children: a comparison study. J Speech Hear Res. 1986 Jun;29(2):206-17. PMID: 3724113. Exclusion Code: X4.
89. Conti-Ramsden G. Processing and linguistic markers in young children with specific language impairment (SLI). J Speech Lang Hear Res. 2003 Oct;46(5):1029-37. PMID: 14575341. Exclusion Code: X6.
90. Coplan J, Gleason JR, Ryan R, et al Validation of an early language milestone scale in a high-risk population. Pediatrics. 1982 Nov;70(5):677-83. PMID: 7133817. Exclusion Code: X6.
91. Core C, Hoff E, Rumiche R, et al Total and conceptual vocabulary in Spanish-English bilinguals from 22 to 30 months: implications for assessment. J Speech Lang Hear Res. 2013 Oct;56(5):1637-49. PMID: 24023382. Exclusion Code: X8.
92. Council on Children with Disabilities. Identifying infants and young children with developmental disorders in the medical home: an algorithm for developmental surveillance and screening. Pediatrics. 2006 Jul;118(1):405-20. PMID: 16818591. Exclusion Code: X1.
93. Courtright JA, Courtright IC. Imitative modeling as a language intervention strategy: the effects of two mediating variables. J Speech Hear Res. 1979 Jun;22(2):389-402. PMID: 491564. Exclusion Code: X4.
94. Crais ER. Testing and beyond: strategies and tools for evaluating and assessing infants and toddlers. Lang Speech Hear Serv Sch. 2011 Jul;42(3):341-64. PMID: 20679409. Exclusion Code: X1.
95. Cummings AE, Barlow JA. A comparison of word lexicality in the treatment of speech sound disorders. Clin Linguist Phon. 2011 Apr;25(4):265-86. PMID: 21158502. Exclusion Code: X4.
96. de Lourdes Drachler M, de Castro Aerts DG, de Souza RM, et al Social inequalities in maternal opinion of child development in southern Brazil. Acta Paediatr. 2005 Aug;94(8):1137-9. PMID: 16188861. Exclusion Code: X3.
97. de Ridder H, van derStege H. Early detection of developmental language disorders. In: Verhoeven L, van Balkom H, eds. Classification of developmental language disorders: Theoretical issues and clinical implications. Mahwah, NJ US: Lawrence

Erlbaum Associates Publishers; 2004:349-66. Exclusion Code: X9.
98. Deave T, Heron J, Evans J, et al The impact of maternal depression in pregnancy on early child development. BJOG. 2008 Jul;115(8):1043-51. PMID: 18651886. Exclusion Code: X4.
99. Deevy P, Weil LW, Leonard LB, et al Extending use of the NRT to preschool-age children with and without specific language impairment. Lang Speech Hear Serv Sch. 2010 Jul;41(3):277-88. PMID: 20421612. Exclusion Code: X6.
100. Delgado CE, Vagi SJ, Scott KG. Tracking preschool children with developmental delay: third grade outcomes. Am J Ment Retard. 2006 Jul;111(4):299-306. PMID: 16792431. Exclusion Code: X3.
101. Dereu M, Roeyers H, Raymaekers R, et al How useful are screening instruments for toddlers to predict outcome at age 4? General development, language skills, and symptom severity in children with a false positive screen for autism spectrum disorder. Eur Child Adolesc Psychiatry. 2012 Oct;21(10):541-51. PMID: 22580987. Exclusion Code: X3.
102. Desch LW, Gaebler-Spira D. Prescribing assistive-technology systems: focus on children with impaired communication. Pediatrics. 2008 Jun;121(6):1271-80. PMID: 18519500. Exclusion Code: X1.
103. Dethorne LS, Johnson BW, Loeb JW. A closer look at MLU: what does it really measure? Clin Linguist Phon. 2005;19(8):635-48. Exclusion Code: X3.
104. Devescovi A, Caselli MC. Sentence repetition as a measure of early grammatical development in Italian. Int J Lang Commun Disord. 2007;42(2):187-208. Exclusion Code: X4.
105. Diepeveen FB, De Kroon ML, Dusseldorp E, et al Among perinatal factors, only the Apgar score is associated with specific language impairment. Dev Med Child Neurol. 2013 Jul;55(7):631-5. PMID: 23506460. Exclusion Code: X3.
106. Dietz C, Swinkels S, van Daalen E, et al Screening for autistic spectrum disorder in children aged 14-15 months. II: population screening with the Early Screening of Autistic Traits Questionnaire (ESAT). Design and general findings. J Autism Dev Disord. 2006 Aug;36(6):713-22. PMID: 16633887. Exclusion Code: X3.
107. Dockrell JE, Stuart M, King D. Supporting early oral language skills for English language learners in inner city preschool provision. Br J Educ Psychol. 2010 Dec;80(Pt 4):497-515. PMID: 20307374. Exclusion Code: X5.
108. Dodge GR. A comparison of language screening methods. Lang Speech Hear Ser Schools. 1980;11(4):214-7. Exclusion Code: X3.
109. D'Odorico L, Majorano M, Fasolo M, et al Characteristics of phonological development as a risk factor for language development in Italian-speaking pre-term children: A longitudinal study. Clin Linguist Phon. 2011 Jan;25(1):53-65. PMID: 21080829. Exclusion Code: X4.
110. Dohmen A, Vogt S. Late talker -- early intervention for children being at risk of language disorder [German]. Forum Logopadie. 2006;20(5):6-11. Exclusion Code: X2.
111. Dollaghan CA, Horner EA. Bilingual language assessment: a meta-analysis of diagnostic accuracy. J Speech Lang Hear Res. 2011 Aug;54(4):1077-88. PMID: 21106696. Exclusion Code: X6.
112. Duffner PK, Granger C, Lyon N, et al Developmental and functional outcomes in children with a positive newborn screen for Krabbe disease: A pilot study of a phone-based interview surveillance technique. J Pediatr. 2012;161(2):258-63. PMID: 22381022. Exclusion Code: X3.
113. Eadie PA, Ukoumunne O, Skeat J, et al Assessing early communication behaviours: structure and validity of the Communication and Symbolic Behaviour Scales-Developmental Profile (CSBS-DP) in 12-month-old infants. Int J Lang Commun Disord. 2010 Sep-Oct;45(5):572-85. PMID: 19886849. Exclusion Code: X8.
114. Earls MF, Andrews JE, Hay SS. A longitudinal study of developmental and behavioral screening and referral in North Carolina's Assuring Better Child Health and Development participating practices. Clin Pediatr (Phila). 2009;48(8):824-33. Exclusion Code: X4.
115. Ebbels SH, van der Lely HK, Dockrell JE. Intervention for verb argument structure in children with persistent SLI: a randomized control trial. J Speech Lang Hear Res. 2007 Oct;50(5):1330-49. PMID: 17905915. Exclusion Code: X5.
116. Edwards J, Beckman ME. Methodological questions in studying consonant acquisition. Clin Linguist Phon. 2008;22(12):937-56. Exclusion Code: X1.
117. Einarsdottir J, Ingham R. Accuracy of parent identification of stuttering occurrence. Int J Lang Commun Disord. 2009 Nov-

Dec;44(6):847-63. PMID: 19105072. Exclusion Code: X8.
118. Einarsdottir J, Ingham RJ. Have disfluency-type measures contributed to the understanding and treatment of developmental stuttering? Am J Speech Lang Pathol. 2005 Nov;14(4):260-73. PMID: 16396610. Exclusion Code: X1.
119. Eisenberg S. Clinical focus. When conversation is not enough: assessing infinitival complements through elicitation. Am J Speech Lang Pathol. 2005;14(2):92-106. Exclusion Code: X1.
120. Eisenberga SL, Ling-Yu G. Differentiating Children With and Without Language Impairment Based on Grammaticality. Lang Speech Hear Ser Schools. 2013;44(1):20-31. Exclusion Code: X4.
121. Ek U, Norrelgen F, Westerlund J, et al Teenage outcomes after speech and language impairment at preschool age. Neuropsychiatr Dis Treat. 2012;8:221-7. Exclusion Code: X4.
122. Elbro C, Dalby M, Maarbjerg S. Language-learning impairments: a 30-year follow-up of language-impaired children with and without psychiatric, neurological and cognitive difficulties. Int J Lang Commun Disord. 2011 Jul-Aug;46(4):437-48. PMID: 21771219. Exclusion Code: X5.
123. Ellis JM, Tan HK, Gilbert RE, et al Supplementation with antioxidants and folinic acid for children with Down's syndrome: randomised controlled trial. BMJ. 2008 Mar 15;336(7644):594-7. PMID: 18296460. Exclusion Code: X3.
124. Emanuel R, Chiat S, Roy P. Evaluation of the clinical decisions made for 2-year-olds referred for speech and language therapy: a follow-up study. Int J Lang Commun Disord. 2007 Mar;42 Suppl 1:1-15. PMID: 17454234. Exclusion Code: X4.
125. Engel S, Tronhjem KM, Hellgren LI, et al Docosahexaenoic acid status at 9 months is inversely associated with communicative skills in 3-year-old girls. Matern Child Nutr. 2013 Oct;9(4):499-510. PMID: 22642227. Exclusion Code: X4.
126. Eom S, Fisher B, Dezort C, et al Routine developmental, autism, behavioral, and psychological screening in epilepsy care settings. Dev Med Child Neurol. 2014 May 27PMID: 24861272. Exclusion Code: X3.
127. Erford BT, Luce CL. Reliability and validity of scores on the Slosson Auditory Perception Skills Screener. Percept Mot Skills. 2005 Dec;101(3):891-7. PMID: 16491694. Exclusion Code: X6.
128. Eriksson M, Westerlund M, Miniscalco C. Problems and limitations in studies on screening for language delay. Res Dev Disabil. 2010 Sep-Oct;31(5):943-50. PMID: 20483561. Exclusion Code: X1.
129. Farkas C. Inventario del Desarrollo de Habilidades Comunicativas McArthur-Bates (CDI): Propuesta de una versión abreviada. Universitas Psychologica. 2011;10(1):245-62. Exclusion Code: X2.
130. Farmer M, Oliver A. Assessment of pragmatic difficulties and socioemotional adjustment in practice. Int J Lang Commun Disord. 2005;40(4):403-29. PMID: 16195198. Exclusion Code: X3.
131. Farver JM, Nakamoto J, Lonigan CJ. Assessing preschoolers' emergent literacy skills in English and Spanish with the Get Ready to Read! screening tool. Ann Dyslexia. 2007 Dec;57(2):161-78. PMID: 18008165. Exclusion Code: X3.
132. Feeney J, Bernthal J. The efficiency of the revised Denver Developmental Screening Test as a language screening tool. Lang Speech Hear Ser Schools. 1996;27(4):330-2. Exclusion Code: X8.
133. Feldman HM. Evaluation and management of language and speech disorders in preschool children. Pediatr Rev. 2005 Apr;26(4):131-42. PMID: 15805236. Exclusion Code: X1.
134. Felsenfeld S, van Beijsterveldt CE, Boomsma DI. Attentional regulation in young twins with probable stuttering, high nonfluency, and typical fluency. J Speech Lang Hear Res. 2010 Oct;53(5):1147-66. PMID: 20643792. Exclusion Code: X4.
135. Fernald LCH, Kariger P, Hidrobo M, et al Socioeconomic gradients in child development in very young children: Evidence from India, Indonesia, Peru, and Senegal. PNAS Proceedings of the National Academy of Sciences of the United States of America. 2012;109(Suppl 2):17273-80. PMID: 23045688. Exclusion Code: X6.
136. Fernell E, Hedvall A, Westerlund J, et al Early intervention in 208 Swedish preschoolers with autism spectrum disorder. A prospective naturalistic study. Res Dev Disabil. 2011 Nov-Dec;32(6):2092-101. PMID: 21985993. Exclusion Code: X3.
137. Flax JF, Realpe-Bonilla T, Roesler C, et al Using early standardized language measures to predict later language and early reading outcomes in children at high risk for language-learning impairments. J Learn Disabil. 2009

Jan-Feb;42(1):61-75. PMID: 19011122. Exclusion Code: X4.
138. Flipsen P, Jr., Hammer JB, Yost KM. Measuring severity of involvement in speech delay: segmental and whole-word measures. Am J Speech Lang Pathol. 2005;14(4):298-312. Exclusion Code: X3.
139. Franken MC, Kielstra-Van der Schalk CJ, Boelens H. Experimental treatment of early stuttering: a preliminary study. J Fluency Disord. 2005;30(3):189-99. PMID: 16023710. Exclusion Code: X4.
140. Fulks MA, Harris SR. Predictive accuracy of the Miller assessment for preschoolers in children with prenatal drug exposure. Phys Occup Ther Pediatr. 2005;25(1-2):17-37. PMID: 15760822. Exclusion Code: X4.
141. Gallardo G, Guàrdia J, Villaseñor T, et al Psychometric data for the Revised Token Test in normally developing Mexican children ages 4–12 years. Arch Clin Neuropsychol. 2011;26(3):225-34. PMID: 21441259. Exclusion Code: X4.
142. Gamliel I, Yirmiya N, Jaffe DH, et al Developmental trajectories in siblings of children with autism: cognition and language from 4 months to 7 years. J Autism Dev Disord. 2009 Aug;39(8):1131-44. PMID: 19326200. Exclusion Code: X4.
143. Gardner H, Froud K, McClellan A, et al Development of the Grammar and Phonology Screening (GAPS) test to assess key markers of specific language and literacy difficulties in young children. Int J Lang Commun Disord. 2006;41(5):513-40. Exclusion Code: X8.
144. Gatt D, Grech H, Dodd B. Early lexical expression in typically developing Maltese children: implications for the identification of language delay. Clin Linguist Phon. 2013 Jul;27(6-7):459-71. PMID: 23621436. Exclusion Code: X6.
145. Gejao MG, Ferreira AT, Silva GK, et al Communicative and psycholinguistic abilities in children with phenylketonuria and congenital hypothyroidism. J Appl Oral Sci. 2009;17 Suppl:69-75. PMID: 21499658. Exclusion Code: X3.
146. Gerber S, Brice A, Capone N, et al Language use in social interactions of school-age children with language impairments: an evidence-based systematic review of treatment. Lang Speech Hear Serv Sch. 2012 Apr;43(2):235-49. PMID: 22052968. Exclusion Code: X3.
147. German ML, Williams E, Herzfeld J, et al Utility of the Revised Denver Developmental Screening Test and the Developmental Profile II in identifying preschool children with cognitive, language, and motor problems. Educ Train Mental Retard. 1982;17(4):319-24. Exclusion Code: X8.
148. Gernand KL, Moran MJ. Phonological awareness abilities of 6-year-old children with mild to moderate phonological impairments. Commun Disord Q. 2007;28(4):206-15. PMID: 2008-04464-002. First Author & Affiliation: Gernand, Keri Leigh. Exclusion Code: X3.
149. Gerrits E, de Bree E. Early language development of children at familial risk of dyslexia: Speech perception and production. J Commun Disord. 2009;42(3):180-94. PMID: 2009-06229-003. PMID: 19100994. First Author & Affiliation: Gerrits, Ellen. Exclusion Code: X4.
150. Geurts H, Embrechts M. Pragmatics in pre-schoolers with language impairments. Int J Lang Commun Disord. 2010 Jul-Aug;45(4):436-47. PMID: 19821791. Exclusion Code: X3.
151. Ghassabian A, Rescorla L, Henrichs J, et al Early lexical development and risk of verbal and nonverbal cognitive delay at school age. Acta Paediatr. 2014 Jan;103(1):70-80. PMID: 24117532. Exclusion Code: X3.
152. Gibson J, Adams C, Lockton E, et al Social communication disorder outside autism? A diagnostic classification approach to delineating pragmatic language impairment, high functioning autism and specific language impairment. Journal of Child Psychology and Psychiatry. 2013;54(11):1186-97. PMID: 2013-36361-004. Exclusion Code: X4.
153. Gildersleeve-Neumann CE, Kester ES, Davis BL, et al English speech sound development in preschool-aged children from bilingual English-Spanish environments. Lang Speech Hear Serv Sch. 2008 Jul;39(3):314-28. PMID: 18596289. Exclusion Code: X3.
154. Gillam RB, Loeb DF, Hoffman LM, et al The efficacy of Fast ForWord Language intervention in school-age children with language impairment: a randomized controlled trial. J Speech Lang Hear Res. 2008 Feb;51(1):97-119. PMID: 18230858. Exclusion Code: X4.
155. Gillon GT. Phonological Awareness Intervention: A Preventive Framework for Preschool Children with Specific Speech and Language Impairments. In: McCauley RJ, Fey ME, eds. Treatment of language disorders in children. Baltimore, MD US: Paul H Brookes Publishing; 2006:279-307. Exclusion Code: X9.

156. Gillon GT, Moran CA, Hamilton E, et al Phonological awareness treatment effects for children from low socioeconomic backgrounds. Asia Pacific Journal of Speech, Language, and Hearing. 2007;10(2):123-40. PMID: 2008-05074-005. First Author & Affiliation: Gillon, Gail T. Exclusion Code: X3.
157. Girolametto L, Weitzman E, Greenberg J. Facilitating emergent literacy: efficacy of a model that partners speech-language pathologists and educators. Am J Speech Lang Pathol. 2012 Feb;21(1):47-63. PMID: 22230181. Exclusion Code: X3.
158. Glascoe FP. Can clinical judgment detect children with speech-language problems? Pediatrics. 1991 Mar;87(3):317-22. PMID: 2000271. Exclusion Code: X3.
159. Glascoe FP, Byrne KE. The accuracy of three developmental screening tests. J Early Interv. 1993;17(4):368-79. Exclusion Code: X6.
160. Glaspey A, Stoel-Gammon C. A dynamic approach to phonological assessment. Adv Speech Lang Pathol. 2007;9(4):286-96. PMID: 2009694373. Language: English. Entry Date: 20080606. Revision Date: 20101231. Publication Type: journal article. Exclusion Code: X4.
161. Glaspey AM, Stoel-Gammon C. Dynamic assessment in phonological disorders: the Scaffolding Scale of Stimulability. Topics Lang Disord. 2005;25(3):220. PMID: 2009036045. Language: English. Entry Date: 20051202. Revision Date: 20110114. Publication Type: journal article. Exclusion Code: X4.
162. Glennen SL. Predicting language outcomes for internationally adopted children. J Speech Lang Hear Res. 2007 Apr;50(2):529-48. PMID: 17463245. Exclusion Code: X4.
163. Glogowska M, Roulstone S, Peters TJ, et al Early speech- and language-impaired children: linguistic, literacy, and social outcomes. Dev Med Child Neurol. 2006 Jun;48(6):489-94. PMID: 16700942. Exclusion Code: X4.
164. Goldberg CS, Lu M, Sleeper LA, et al Factors Associated with Neurodevelopment for Children with Single Ventricle Lesions. J Pediatr. 2014 Jun 19PMID: 24952712. Exclusion Code: X3.
165. Goldstein B, Kohnert K. Speech, language, and hearing in developing bilingual children: current findings and future directions. Lang Speech Hear Serv Sch. 2005 Jul;36(3):264-7. PMID: 16175889. Exclusion Code: X1.
166. Gollenberg AL, Lynch CD, Jackson LW, et al Concurrent validity of the parent-completed Ages and Stages Questionnaires, 2nd Ed. with the Bayley Scales of Infant Development II in a low-risk sample. Child Care Health Dev. 2010;36(4):485-90. PMID: 2010689737. Language: English. Entry Date: 20100806. Revision Date: 20100806. Publication Type: journal article. Exclusion Code: X6.
167. Gordon K, Pasco G, McElduff F, et al A communication-based intervention for nonverbal children with autism: what changes? Who benefits? J Consult Clin Psychol. 2011 Aug;79(4):447-57. PMID: 21787048. Exclusion Code: X3.
168. Gorman BK. Cross-linguistic universals in reading acquisition with applications to English-language learners with reading disabilities. Semin Speech Lang. 2009 Nov;30(4):246-60. PMID: 19851952. Exclusion Code: X1.
169. Gray S. Diagnostic accuracy and test-retest reliability of nonword repetition and digit span tasks administered to preschool children with specific language impairment. J Commun Disord. 2003 Mar-Apr;36(2):129-51. PMID: 12609578. Exclusion Code: X6.
170. Greenslade KJ, Plante E, Vance R. The diagnostic accuracy and construct validity of the structured photographic expressive language test--preschool: second edition. Lang Speech Hear Serv Sch. 2009 Apr;40(2):150-60. PMID: 18840676. Exclusion Code: X6.
171. Grizzle KL, Simms MD. Early language development and language learning disabilities. Pediatr Rev. 2005 Aug;26(8):274-83. PMID: 16061525. Exclusion Code: X1.
172. Guadarrama-Celaya F, Otero-Ojeda GA, Bernardo Pliego-Rivero F, et al Screening of neurodevelopmental delays in four communities of Mexico and Cuba. Public Health Nurs. 2012 Mar-Apr;29(2):105-15. PMID: 22372447. Exclusion Code: X4.
173. Guiberson M, Rodriguez BL. Classification accuracy of nonword repetition when used with preschool-age Spanish-speaking children. Lang Speech Hear Serv Sch. 2013 Apr;44(2):121-32. PMID: 23188260. Exclusion Code: X6.
174. Gutierrez-Clellen V, Simon-Cereijido G, Sweet M. Predictors of second language acquisition in Latino children with specific language impairment. Am J Speech Lang Pathol. 2012 Feb;21(1):64-77. PMID: 22230174. Exclusion Code: X4.
175. Haber J, Norris M. The Texas Preschool Screening Inventory: a simple screening device for language and learning disorders. Child Health Care. 1983;12(1):11-8. Exclusion Code: X6.

176. Hadley PA. Assessing the emergence of grammar in toddlers at risk for specific language impairment. Semin Speech Lang. 2006 Aug;27(3):173-86. PMID: 16941288. Exclusion Code: X1.
177. Hagberg BS, Miniscalco C, Gillberg C. Clinic attenders with autism or attention-deficit/hyperactivity disorder: cognitive profile at school age and its relationship to preschool indicators of language delay. Res Dev Disabil. 2010 Jan-Feb;31(1):1-8. PMID: 19713073. Exclusion Code: X3.
178. Hall AJ, Maw AR, Steer CD. Developmental outcomes in early compared with delayed surgery for glue ear up to age 7 years: a randomised controlled trial. Clin Otolaryngol. 2009 Feb;34(1):12-20. PMID: 19260880. Exclusion Code: X3.
179. Hall NE, Segarra VR. Predicting academic performance in children with language impairment: the role of parent report. J Commun Disord. 2007 Jan-Feb;40(1):82-95. PMID: 16876817. Exclusion Code: X4.
180. Hannus S, Kauppila T, Pitkäniemi J, et al Use of language tests when identifying specific language impairment in primary health care. Folia Phoniatrica et Logopaedica. 2013;65(1):40-6. PMID: 2013-36899-006. Exclusion Code: X3.
181. Harris MN, Voigt RG, Barbaresi WJ, et al ADHD and learning disabilities in former late preterm infants: a population-based birth cohort. Pediatrics. 2013 Sep;132(3):e630-6. PMID: 23979091. Exclusion Code: X6.
182. Harty M, Alant E, Uys CJ. Maternal self-efficacy and maternal perception of child language competence in pre-school children with a communication disability. Child Care Health Dev. 2007 Mar;33(2):144-54. PMID: 17291318. Exclusion Code: X4.
183. Hassink JM, Leonard LB. Within-treatment factors as predictors of outcomes following conversational recasting. Am J Speech Lang Pathol. 2010 Aug;19(3):213-24. PMID: 20308290. Exclusion Code: X4.
184. Hatcher PJ, Hulme C, Miles JN, et al Efficacy of small group reading intervention for beginning readers with reading-delay: a randomised controlled trial. J Child Psychol Psychiatry. 2006 Aug;47(8):820-7. PMID: 16898996. Exclusion Code: X3.
185. Hay I, Elias G, Fielding-Barnsley R, et al Language delays, reading delays, and learning difficulties: interactive elements requiring multidimensional programming. J Learn Disabil. 2007 Sep-Oct;40(5):400-9. PMID: 17915494. Exclusion Code: X3.
186. Helland T, Plante E, Hugdahl K. Predicting dyslexia at age 11 from a risk index questionnaire at age 5. Dyslexia. 2011 Aug;17(3):207-26. PMID: 21793119. Exclusion Code: X4.
187. Heo KH, Squires J. Cultural adaptation of a parent completed social emotional screening instrument for young children: Ages and stages questionnaire-social emotional. Early Hum Dev. 2012;88(3):151-8. PMID: 2012-04693-006. PMID: 21855237. First Author & Affiliation: Heo, Kay H. Exclusion Code: X6.
188. Hesketh A, Dima E, Nelson V. Teaching phoneme awareness to pre-literate children with speech disorder: a randomized controlled trial. Int J Lang Commun Disord. 2007 May-Jun;42(3):251-71. PMID: 17514541. Exclusion Code: X4.
189. Hetzroni OE. AAC and literacy. Disabil Rehabil. 2004 Nov 4-18;26(21-22):1305-12. PMID: 15513730. Exclusion Code: X1.
190. Hillen T, Gafson L. Statutory health assessments for pre-school foster children fail to screen accurately for mental health disorders. Clin Child Psychol Psychiatry. 2014;19(2):313-27. PMID: 2012502160. Language: English. Entry Date: 20140328. Revision Date: 20140328. Publication Type: journal article. Exclusion Code: X6.
191. Hix-Small H, Marks K, Squires J, et al Impact of implementing developmental screening at 12 and 24 months in a pediatric practice. Pediatrics. 2007;120(2):381-9. PMID: 2009643557. Language: English. Entry Date: 20071102. Revision Date: 20091218. Publication Type: journal article. Exclusion Code: X6.
192. Hodge T, Downie J. Together we are heard: effectiveness of daily 'language' groups in a community preschool. Nurs Health Sci. 2004 Jun;6(2):101-7. PMID: 15130095. Exclusion Code: X4.
193. Holm A, Farrier F, Dodd B. Phonological awareness, reading accuracy and spelling ability of children with inconsistent phonological disorder. Int J Lang Commun Disord. 2008;43(3):300-22. PMID: 2008-05840-006. PMID: 17852519. First Author & Affiliation: Holm, Alison. Exclusion Code: X3.
194. Hornman J, Kerstjens JM, de Winter AF, et al Validity and internal consistency of the Ages and Stages Questionnaire 60-month version and the effect of three scoring methods. Early Hum

Dev. 2013 Dec;89(12):1011-5. PMID: 24041814. Exclusion Code: X6.
195. Horowitz L, Jansson L, Ljungberg T, et al Interaction before conflict and conflict resolution in pre-school boys with language impairment. Int J Lang Commun Disord. 2006 Jul-Aug;41(4):441-66. PMID: 16815811. Exclusion Code: X4.
196. Howlin P. Augmentative and Alternative Communication Systems for Children with Autism. In: Charman T, Stone W, eds. Social & communication development in autism spectrum disorders: Early identification, diagnosis, & intervention. New York, NY US: Guilford Press; 2006:236-66. Exclusion Code: X9.
197. Hughes CW, Melson AG. Child and adolescent measures for diagnosis and screening. In: Rush AJ, Jr., First MB, Blacker D, eds. Handbook of psychiatric measures (2nd ed.). Arlington, VA US: American Psychiatric Publishing, Inc.; 2008:251-308. Exclusion Code: X9.
198. Hustad KC, Keppner K, Schanz A, et al Augmentative and alternative communication for preschool children: intervention goals and use of technology. Semin Speech Lang. 2008 May;29(2):83-91. PMID: 18645910. Exclusion Code: X4.
199. Hwa-Froelich DA, Matsuo H. Vietnamese children and language-based processing tasks. Lang Speech Hear Serv Sch. 2005 Jul;36(3):230-43. PMID: 16175886. Exclusion Code: X3.
200. Hyde ML. Newborn hearing screening programs: overview. J Otolaryngol. 2005 Aug;34 Suppl 2:S70-8. PMID: 16076420. Exclusion Code: X1.
201. Illerbrun D, Haines L, Greenough P. Language Identification Screening Test for Kindergarten: a comparison with four screening and three diagnostic language tests. Lang Speech Hear Serv Schools. 1985;16(4):280-92. Exclusion Code: X3.
202. Isotani SM, Azevedo MF, Chiari BM, et al Expressive language of two year-old pre-term and full-term children. Pro Fono. 2009 Apr-Jun;21(2):155-9. PMID: 19629327. Exclusion Code: X7.
203. Jackson J, Kornrich R, Safranek S. Clinical inquiries. How should you evaluate a toddler for speech delay? J Fam Pract. 2011 Apr;60(4):230-1. PMID: 21472154. Exclusion Code: X1.
204. Jee SH, Szilagyi M, Ovenshire C, et al Improved detection of developmental delays among young children in foster care. Pediatrics. 2010;125(2):282-9. PMID: 2011-14233-017. PMID: 20064864. First Author & Affiliation: Jee, Sandra H. Exclusion Code: X8.
205. Jessup B, Ward E, Cahill L, et al Teacher identification of speech and language impairment in kindergarten students using the Kindergarten Development Check. Int J Speech Lang Pathol. 2008;10(6):449-59. PMID: 2010169046. Language: English. Entry Date: 20090710. Revision Date: 20091218. Publication Type: journal article. Exclusion Code: X6.
206. Jimenez JE, Rodriguez C, Crespo P, et al Implementation of Response to Intervention (RtI) Model in Spain: an example of a collaboration between Canarian universities and the department of education of the Canary Islands. Psicothema. 2010 Nov;22(4):935-42. PMID: 21044535. Exclusion Code: X6.
207. Joffe VL, Black E. Social, emotional, and behavioral functioning of secondary school students with low academic and language performance: perspectives from students, teachers, and parents. Lang Speech Hear Serv Sch. 2012 Oct;43(4):461-73. Exclusion Code: X3.
208. Johnson CA, Weston AD, Bain BA. An objective and time-efficient method for determining severity of childhood speech delay. Am J Speech Lang Pathol. 2004;13(1):55-65. PMID: 2004184537. Language: English. Entry Date: 20041112. Revision Date: 20091218. Publication Type: journal article. Exclusion Code: X4.
209. Johnson CJ, Beitchman JH, Brownlie EB. Twenty-year follow-up of children with and without speech-language impairments: Family, educational, occupational, and quality of life outcomes. Am J Speech Lang Pathol. 2010;19(1):51-65. PMID: 2010-15690-005. PMID: 19644128. First Author & Affiliation: Johnson, Carla J. Exclusion Code: X3.
210. Jordan R. Managing autism and Asperger's syndrome in current educational provision. Pediatr Rehabil. 2005 Apr-Jun;8(2):104-12. PMID: 16089250. Exclusion Code: X1.
211. Justice LM, Bowles RP, Pence Turnbull KL, et al School readiness among children with varying histories of language difficulties. Dev Psychol. 2009 Mar;45(2):460-76. PMID: 19271831. Exclusion Code: X4.
212. Justice LM, Petscher Y, Schatschneider C, et al Peer effects in preschool classrooms: is children's language growth associated with their classmates' skills? Child Dev. 2011 Nov-

Dec;82(6):1768-77. PMID: 22026480. Exclusion Code: X4.
213. Justice LM, Skibbe LE, McGinty AS, et al Feasibility, efficacy, and social validity of home-based storybook reading intervention for children with language impairment. J Speech Lang Hear Res. 2011 Apr;54(2):523-38. PMID: 20719873. Exclusion Code: X4.
214. Kaderavek JN, Justice LM. Embedded-explicit emergent literacy intervention II: goal selection and implementation in the early childhood classroom. Lang Speech Hear Serv Sch. 2004 Jul;35(3):212-28. PMID: 15248792. Exclusion Code: X1.
215. Kapalková S, Polišenská K, Vicenová Z. Non-word repetition performance in Slovak-speaking children with and without SLI: novel scoring methods. Int J Lang Commun Disord. 2013;48(1):78-89. PMID: 2011887853. Language: English. Entry Date: 20130125. Revision Date: 20130222. Publication Type: journal article. Exclusion Code: X6.
216. Kapci EG, Kucuker S, Uslu RI. How applicable are Ages and Stages Questionnaires for use with Turkish children? Topics in Early Childhood Special Education. 2010;30(3):176-88. PMID: 2010-21103-005. First Author & Affiliation: Kapci, Emine Gul. Exclusion Code: X7.
217. Kasper J, Kreis J, Scheibler F, et al Population-based screening of children for specific speech and language impairment in Germany: a systematic review. Folia Phoniatr Logop. 2011;63(5):247-63. PMID: 21304231. Exclusion Code: X5.
218. Katz LA, Maag A, Fallon KA, et al What makes a caseload (un)manageable? School-based speech-language pathologists speak. Lang Speech Hear Serv Sch. 2010 Apr;41(2):139-51. PMID: 19755641. Exclusion Code: X3.
219. Keegstra AL, Knijff WA, Post WJ, et al Children with language problems in a speech and hearing clinic: background variables and extent of language problems. Int J Pediatr Otorhinolaryngol. 2007 May;71(5):815-21. PMID: 17353056. Exclusion Code: X3.
220. Kelley E, Paul JJ, Fein D, et al Residual language deficits in optimal outcome children with a history of autism. J Autism Dev Disord. 2006 Aug;36(6):807-28. PMID: 16897404. Exclusion Code: X3.
221. Ketelaars MP, Cuperus J, Jansonius K, et al Pragmatic language impairment and associated behavioural problems. Int J Lang Commun Disord. 2010;45(2):204-14. PMID: 22748032. Exclusion Code: X4.
222. Khan NZ, Muslima H, Shilpi AB, et al Validation of a home-based neurodevelopmental screening tool for under 2-year-old children in Bangladesh. Child Care Health Dev. 2013 Sep;39(5):643-50. PMID: 22676392. Exclusion Code: X7.
223. King S, Laplante DP. The effects of prenatal maternal stress on children's cognitive development: Project Ice Storm. Stress. 2005 Mar;8(1):35-45. PMID: 16019596. Exclusion Code: X4.
224. King TM, Rosenberg LA, Fuddy L, et al Prevalence and early identification of language delays among at-risk three year olds. J Dev Behav Pediatr. 2005 Aug;26(4):293-303. PMID: 16100502. Exclusion Code: X6.
225. Kirk C, Gillon GT. Longitudinal effects of phonological awareness intervention on morphological awareness in children with speech impairment. Lang Speech Hear Serv Sch. 2007 Oct;38(4):342-52. PMID: 17890514. Exclusion Code: X4.
226. Klein PS, Tzuriel D. Preschoolers type of temperament as predictor of potential difficulties in cognitive functioning. Isr J Psychiatry Relat Sci. 1986;23(1):49-61. PMID: 3759393. Exclusion Code: X6.
227. Klein-Tasman BP, Mervis CB, Lord C, et al Socio-communicative deficits in young children with Williams syndrome: Performance on the Autism Diagnostic Observation Schedule. Child Neuropsychol. 2007;13(5):444-67. PMID: 2007-13751-004. PMID: 17805996. First Author & Affiliation: Klein-Tasman, Bonita P. Exclusion Code: X3.
228. Kloth S, Janssen P, Kraaimaat F, et al Communicative behavior of mothers of stuttering and nonstuttering high-risk children prior to the onset of stuttering. J Fluency Disord. 1995;20(4):365-77. Exclusion Code: X5.
229. Koushik S, Hewat S, Shenker RC, et al North-American Lidcombe Program file audit: replication and meta-analysis. Int J Speech Lang Pathol. 2011 Aug;13(4):301-7. PMID: 21793775. Exclusion Code: X5.
230. Kucuker S, Kapci EG, Uslu RI. Evaluation of the Turkish version of the 'Ages and Stages Questionnaires: Social-Emotional' in identifying children with social-emotional problems. Infants Young Child. 2011;24(2):207-20. PMID: 2011-07380-007. First Author & Affiliation: Kucuker, Sevgi. Exclusion Code: X6.

231. Lamont J, Girolametto L, Johnson CJ, et al Emergent Literacy Skills of Preschoolers with Language Disorders: Monolingual English versus Dual Language Learners. Canadian Journal of Speech-Language Pathology & Audiology. 2011;35(4):286-98. PMID: 2011419136. Language: English. Entry Date: 20120217. Revision Date: 20130118. Publication Type: journal article. Exclusion Code: X4.
232. Laplante DP, Brunet A, Schmitz N, et al Project Ice Storm: prenatal maternal stress affects cognitive and linguistic functioning in 5 1/2-year-old children. J Am Acad Child Adolesc Psychiatry. 2008 Sep;47(9):1063-72. PMID: 18665002. Exclusion Code: X4.
233. Lattermann C, Euler HA, Neumann K. A randomized control trial to investigate the impact of the Lidcombe Program on early stuttering in German-speaking preschoolers. J Fluency Disord. 2008 Mar;33(1):52-65. PMID: 18280869. Exclusion Code: X5.
234. Law J, Boyle J, Harris F, et al Screening for primary speech and language delay: a systematic review of the literature. Int J Lang Commun Disord. 1998;33 Suppl:21-3. PMID: 10343657. Exclusion Code: X1.
235. Law J, Boyle J, Harris F, et al Screening for speech and language delay: a systematic review of the literature. Health Technol Assess. 1998;2(9):1-184. PMID: 9728296. Exclusion Code: X5.
236. Law J, Boyle J, Harris F, et al Prevalence and natural history of primary speech and language delay: findings from a systematic review of the literature. Int J Lang Commun Disord. 2000 Apr-Jun;35(2):165-88. PMID: 10912250. Exclusion Code: X4.
237. Law J, Dockrell J, Williams K, et al Comparing specialist early years provision for speech and language impaired children with mainstream nursery provision in the UK -- an application of the Early Childhood Environment Rating Scale (ECERS). Child Care Health Dev. 2004;30(2):177-84. PMID: 2005060006. Language: English. Entry Date: 20050408. Revision Date: 20091218. Publication Type: journal article. Exclusion Code: X4.
238. Law J, Garrett Z, Nye C. Speech and language therapy interventions for children with primary speech and language delay or disorder. Cochrane Database Syst Rev. 2003(3)PMID: CD004110. Exclusion Code: X3.
239. Law J, Kot A, Barnett G. A comparison of two methods for providing intervention to three year old children with expressive/receptive language impairment. London: Department of Language and Communication Science, City University; 1999. Exclusion Code: X9.
240. Laws G, Bates G, Feuerstein M, et al Peer acceptance of children with language and communication impairments in a mainstream primary school: Associations with type of language difficulty, problem behaviours and a change in placement organization. Child Lang Teach Ther. 2012;28(1):73-86. PMID: 2012-05820-006. First Author & Affiliation: Laws, Glynis. Exclusion Code: X4.
241. Leitão S, Fletcher J. Literacy outcomes for students with speech impairment: Long-term follow-up. Int J Lang Commun Disord. 2004;39(2):245-56. PMID: 2004-21006-006. PMID: 15204454. First Author & Affiliation: Leitão, Suze. Exclusion Code: X3.
242. Leonard LB, Deevy P, Fey ME, et al Sentence comprehension in specific language impairment: a task designed to distinguish between cognitive capacity and syntactic complexity. J Speech Lang Hear Res. 2013 Apr;56(2):577-89. PMID: 22988286. Exclusion Code: X4.
243. Leppert ML, Shank TP, Shapiro BK, et al The capute scales: CAT/CLAMS-A pediatric assessment tool for the early detection of mental retardation and communicative disorders. Ment Retard Dev Disabil Res Rev. 1998;4(1):14-9. Exclusion Code: X6.
244. Lerna A, Esposito D, Conson M, et al Social-communicative effects of the Picture Exchange Communication System (PECS) in autism spectrum disorders. Int J Lang Commun Disord. 2012 Sep-Oct;47(5):609-17. PMID: 22938071. Exclusion Code: X3.
245. Lewis BA, Kirchner HL, Short EJ, et al Prenatal cocaine and tobacco effects on children's language trajectories. Pediatrics. 2007 Jul;120(1):e78-85. PMID: 17606552. Exclusion Code: X4.
246. Limbos MM, Joyce DP. Comparison of the ASQ and PEDS in screening for developmental delay in children presenting for primary care. J Dev Behav Pediatr. 2011 Sep;32(7):499-511. PMID: 21760526. Exclusion Code: X6.
247. Linan-Thompson S. Response to instruction, English language learners and disproportionate representation: the role of assessment. Psicothema. 2010 Nov;22(4):970-4. PMID: 21044540. Exclusion Code: X1.
248. Lipka O, Siegel LS. The improvement of reading skills of L1 and ESL children using a Response to Intervention (RtI) Model.

Psicothema. 2010 Nov;22(4):963-9. PMID: 21044539. Exclusion Code: X3.
249. Lung FW, Shu BC, Chiang TL, et al Efficient developmental screening instrument for 6- and 18-month-old children in the Taiwan Birth Cohort Pilot Study. Acta Paediatr. 2008 Aug;97(8):1093-8. PMID: 18462464. Exclusion Code: X7.
250. Lunkenheimer ES, Dishion TJ, Shaw DS, et al Collateral benefits of the Family Check-Up on early childhood school readiness: indirect effects of parents' positive behavior support. Dev Psychol. 2008 Nov;44(6):1737-52. PMID: 18999335. Exclusion Code: X6.
251. Luu TM, Vohr BR, Allan W, et al Evidence for catch-up in cognition and receptive vocabulary among adolescents born very preterm. Pediatrics. 2011 Aug;128(2):313-22. PMID: 21768322. Exclusion Code: X3.
252. Lyytinen H, Ahonen T, Eklund K, et al Early development of children at familial risk for dyslexia--follow-up from birth to school age. Dyslexia. 2004 Aug;10(3):146-78. PMID: 15341196. Exclusion Code: X4.
253. Lyytinen H, Ahonen T, Eklund K, et al Developmental pathways of children with and without familial risk for dyslexia during the first years of life. Dev Neuropsychol. 2001;20(2):535-54. PMID: 11892951. Exclusion Code: X6.
254. Lyytinen H, Erskine J, Kujala J, et al In search of a science-based application: a learning tool for reading acquisition. Scand J Psychol. 2009 Dec;50(6):668-75. PMID: 19930268. Exclusion Code: X1.
255. Lyytinen P, Eklund K, Lyytinen H. Language development and literacy skills in late-talking toddlers with and without familial risk for dyslexia. Ann Dyslexia. 2005 Dec;55(2):166-92. PMID: 17849192. Exclusion Code: X4.
256. Macharey G, von Suchodoletz W. Perceived stigmatization of children with speech-language impairment and their parents. Folia Phoniatr Logop. 2008;60(5):256-63. PMID: 18765946. Exclusion Code: X4.
257. Macias MM, Saylor CF, Greer MK, et al Infant screening: the usefulness of the Bayley Infant Neurodevelopmental Screener and the Clinical Adaptive Test/Clinical Linguistic Auditory Milestone Scale. J Dev Behav Pediatr. 1998 Jun;19(3):155-61. PMID: 9648040. Exclusion Code: X6.
258. Magnusson M, Sundelin C, Westerlund M. Identification of health problems at 18 months of age--a task for physicians or child health nurses? Child Care Health Dev. 2006 Jan;32(1):47-54. PMID: 16398790. Exclusion Code: X4.
259. Marino BS, Lipkin PH, Newburger JW, et al Neurodevelopmental outcomes in children with congenital heart disease: evaluation and management: a scientific statement from the American Heart Association. Circulation. 2012 Aug 28;126(9):1143-72. Exclusion Code: X1.
260. Markiewicz K, Pachalska M. Diagnosis of severe developmental disorders in children under three years of age. Med Sci Monit. 2007 Feb;13(2):CR89-99. PMID: 17261988. Exclusion Code: X3.
261. Marks K, Hix-Small H, Clark K, et al Lowering developmental screening thresholds and raising quality improvement for preterm children. Pediatrics. 2009 Jun;123(6):1516-23. PMID: 19482762. Exclusion Code: X3.
262. Martin AJ, Darlow BA, Salt A, et al Performance of the Parent Report of Children's Abilities-Revised (PARCA-R) versus the Bayley Scales of Infant Development III. Arch Dis Child. 2013 Dec;98(12):955-8. PMID: 24030249. Exclusion Code: X3.
263. Martin-Ruiz ML, Duboy MA, de la Cruz IP. Deployment and validation of a smart system for screening of language disorders in primary care. Sensors (Basel). 2013;13(6):7522-45. PMID: 23752564. Exclusion Code: X3.
264. Massa J, Gomes H, Tartter V, et al Concordance rates between parent and teacher clinical evaluation of Language Fundamentals Observational Rating Scale. Int J Lang Commun Disord. 2008;43(1):99-110. PMID: 2008-00484-005. PMID: 17852530. First Author & Affiliation: Massa, Jacqueline. Exclusion Code: X3.
265. Matheny N, Panagos J. Comparing the effects of articulation and syntax programmes on syntax and articulation improvement. Language Speech and Hearing Services in Schools. 1978;9:50-6. Exclusion Code: X6.
266. Matthews-Somerville RC, Cress CJ. Parent Perceptions of Communication Behaviors at Formally Assessed Stage Transitions in Young Children at Risk for Being Nonspeaking. Commun Disord Q. 2005;26(3):164-77. PMID: 2006-02670-005. First Author & Affiliation: Matthews-Somerville, Rochelle C. Exclusion Code: X3.
267. McCormack J, Harrison LJ, McLeod S, et al A nationally representative study of the association between communication impairment at 4–5 years and children's life activities at 7–9 years. J Speech Lang Hear Res. 2011;54(5):1328-48. PMID: 2011-29720-009.

PMID: 21498580. First Author & Affiliation: McCormack, Jane. Exclusion Code: X4.

268. McIntosh B, Dodd BJ. Two-year-olds' phonological acquisition: normative data. Int J Speech Lang Pathol. 2008;10(6):460-9. PMID: 2010169047. Language: English. Entry Date: 20090710. Revision Date: 20091218. Publication Type: journal article. Exclusion Code: X4.
269. McKean K, Phillips B, Thompson A. A family-centred model of care in paediatric speech-language pathology. Int J Speech Lang Pathol. 2012 Jun;14(3):235-46. PMID: 21936758. Exclusion Code: X4.
270. McLeod S, Harrison LJ, McCormack J. The Intelligibility in Context Scale: Validity and Reliability of a Subjective Rating Measure. J Speech Lang Hear Res. 2012;55(2):648-56. PMID: 2011512856. Language: English. Entry Date: 20120427. Revision Date: 20130118. Publication Type: journal article. Exclusion Code: X8.
271. McLeod S, McCormack J. Application of the ICF and ICF-Children and Youth in children with speech impairment. Semin Speech Lang. 2007;28(4):254-64. PMID: 2009698970. Language: English. Entry Date: 20080307. Publication Type: journal article. Exclusion Code: X1.
272. McPhillips M, Jordan-Black JA. The effect of social disadvantage on motor development in young children: a comparative study. J Child Psychol Psychiatry. 2007 Dec;48(12):1214-22. PMID: 18093027. Exclusion Code: X4.
273. McQuiston S, Kloczko N. Speech and language development: monitoring process and problems. Pediatr Rev. 2011 Jun;32(6):230-8; quiz 9. PMID: 21632874. Exclusion Code: X1.
274. Merrell AW, Plante E. Norm-referenced test interpretation in the diagnostic process. Lang Speech Hear Ser Schools. 1997;28(1):50-8. Exclusion Code: X4.
275. Millard SK, Cook FM. Working with young children who stutter: raising our game. Semin Speech Lang. 2010 Nov;31(4):250-61. PMID: 21080297. Exclusion Code: X1.
276. Millard SK, Nicholas A, Cook FM. Is parent-child interaction therapy effective in reducing stuttering? J Speech Lang Hear Res. 2008 Jun;51(3):636-50. PMID: 18506041. Exclusion Code: X5.
277. Miniscalco C, Nygren G, Hagberg B, et al Neuropsychiatric and neurodevelopmental outcome of children at age 6 and 7 years who screened positive for language problems at 30 months. Dev Med Child Neurol. 2006;48(5):361-6. PMID: 2009178868. Language: English. Entry Date: 20070316. Revision Date: 20091218. Publication Type: journal article. Exclusion Code: X6.
278. Miniscalco C, Westerlund M, Lohmander A. Language skills at age 6 years in Swedish children screened for language delay at 2(1/2) years of age. Acta Paediatr. 2005 Dec;94(12):1798-806. PMID: 16421042. Exclusion Code: X8.
279. Mirrett PL, Bailey DB, Jr., Roberts JE, et al Developmental screening and detection of developmental delays in infants and toddlers with fragile X syndrome. J Dev Behav Pediatr. 2004 Feb;25(1):21-7. PMID: 14767352. Exclusion Code: X3.
280. Moats L. Relevance of neuroscience to effective education for students with reading and other learning disabilities. J Child Neurol. 2004 Oct;19(10):840-5. PMID: 15559901. Exclusion Code: X1.
281. Moricke E, Swinkels SH, Beuker KT, et al Predictive value of subclinical autistic traits at age 14-15 months for behavioural and cognitive problems at age 3-5 years. Eur Child Adolesc Psychiatry. 2010 Aug;19(8):659-68. PMID: 20390313. Exclusion Code: X3.
282. Morris SR. Clinical application of the mean babbling level and syllable structure level. Lang Speech Hear Serv Sch. 2010 Apr;41(2):223-30. PMID: 19755639. Exclusion Code: X1.
283. Mortimer J, Rvachew S. A longitudinal investigation of morpho-syntax in children with speech sound disorders. J Commun Disord. 2010;43(1):61-76. PMID: 2010-00513-004. PMID: 20004412. First Author & Affiliation: Mortimer, Jennifer. Exclusion Code: X4.
284. Mouridsen SE, Hauschild K. A longitudinal study of personality disorders in individuals with and without a history of developmental language disorder. Logopedics Phoniatrics Vocology. 2009;34(3):135-41. PMID: 2010436084. Language: English. Entry Date: 20091113. Revision Date: 20110527. Publication Type: journal article. Exclusion Code: X3.
285. Munsell KL. A screening battery for identifying at-risk infants: Prediction of outcome on Bayley Scales of Infant/Todder Development-III. US: ProQuest Information & Learning; 2007. Exclusion Code: X9.
286. Murray E, McCabe P, Ballard KJ. A comparison of two treatments for childhood apraxia of speech: methods and treatment protocol for a parallel group randomised control

trial. BMC Pediatr. 2012;12:112. PMID: 22863021. Exclusion Code: X1.
287. Nair MK, Nair GS, George B, et al Development and validation of Trivandrum Development Screening Chart for children aged 0-6 years [TDSC (0-6)]. Indian J Pediatr. 2013 Nov;80 Suppl 2:S248-55. PMID: 24014206. Exclusion Code: X7.
288. Nathani S, Oller DK, Neal AR. On the robustness of vocal development: an examination of infants with moderate-to-severe hearing loss and additional risk factors. J Speech Lang Hear Res. 2007 Dec;50(6):1425-44. PMID: 18055766. Exclusion Code: X3.
289. Nelson HD, Bougatsos C, Nygren P. Universal newborn hearing screening: systematic review to update the 2001 US Preventive Services Task Force Recommendation. Pediatrics. 2008 Jul;122(1):e266-76. PMID: 18595973. Exclusion Code: X3.
290. Noordenbos MW, Segers E, Serniclaes W, et al Allophonic mode of speech perception in Dutch children at risk for dyslexia: a longitudinal study. Res Dev Disabil. 2012 Sep-Oct;33(5):1469-83. PMID: 22522205. Exclusion Code: X3.
291. Oakenfull S, McGregor T, Ramtin F, et al Re: WILSTAAR. Int J Lang Commun Disord. 2001 Jan-Mar;36(1):135-8. PMID: 11221430. Exclusion Code: X1.
292. O'Brian S, Iverach L, Jones M, et al Effectiveness of the Lidcombe Program for early stuttering in Australian community clinics. Int J Speech Lang Pathol. 2013 Dec;15(6):593-603. PMID: 23691980. Exclusion Code: X5.
293. O'Connor M, Arnott W, McIntosh B, et al Phonological awareness and language intervention in preschoolers from low socio-economic backgrounds: a longitudinal investigation. Br J Dev Psychol. 2009 Nov;27(Pt 4):767-82. PMID: 19994478. Exclusion Code: X3.
294. Oetting JB, Cleveland LH. The clinical utility of nonword repetition for children living in the rural south of the US. Clin Linguist Phon. 2006 Sep-Oct;20(7-8):553-61. PMID: 17056486. Exclusion Code: X3.
295. Oetting JB, Newkirk BL, Hartfield LR, et al Index of productive syntax for children who speak African American English. Lang Speech Hear Ser Schools. 2010;41(3):328-39. PMID: 2010705712. Language: English. Entry Date: 20100903. Revision Date: 20110520. Publication Type: journal article. Exclusion Code: X3.
296. O'Hare AE. Wayward words and watchful waiting: should clinicians be more proactive for the preschooler with uncomplicated expressive language delay? Arch Dis Child. 2009 Feb;94(2):80-2. PMID: 19158135. Exclusion Code: X1.
297. Oliver B, Dale PS, Plomin R. Verbal and nonverbal predictors of early language problems: an analysis of twins in early childhood back to infancy. J Child Lang. 2004 Aug;31(3):609-31. PMID: 15612392. Exclusion Code: X4.
298. Onslow M, Yaruss JS. Differing perspectives on what to do with a stuttering preschooler and why. Am J Speech Lang Pathol. 2007 Feb;16(1):65-8. PMID: 17329676. Exclusion Code: X1.
299. Pankratz ME, Plante E, Vance R, et al The diagnostic and predictive validity of the Renfrew Bus Story. Lang Speech Hear Serv Sch. 2007 Oct;38(4):390-9. PMID: 17890518. Exclusion Code: X3.
300. Paradis J. Grammatical morphology in children learning English as a second language: implications of similarities with specific language impairment. Lang Speech Hear Serv Sch. 2005 Jul;36(3):172-87. PMID: 16175882. Exclusion Code: X3.
301. Patterson JL, Rodríguez BL, Dale PS. Response to Dynamic Language Tasks Among Typically Developing Latino Preschool Children With Bilingual Experience. Am J Speech Lang Pathol. 2013;22(1):103-12. PMID: 2012010263. Language: English. Entry Date: 20130315. Revision Date: 20130322. Publication Type: journal article. Exclusion Code: X3.
302. Paul R, Roth FP. Characterizing and predicting outcomes of communication delays in infants and toddlers: implications for clinical practice. Lang Speech Hear Serv Sch. 2011 Jul;42(3):331-40. PMID: 21106717. Exclusion Code: X1.
303. Peadon E, Rhys-Jones B, Bower C, et al Systematic review of interventions for children with Fetal Alcohol Spectrum Disorders. BMC Pediatr. 2009;9:35. PMID: 19463198. Exclusion Code: X3.
304. Pearce WM, James DG, McCormack PF. A comparison of oral narratives in children with specific language and non-specific language impairment. Clin Linguist Phon. 2010 Aug;24(8):622-45. PMID: 20462361. Exclusion Code: X4.
305. Pennington L. Measuring communication outcomes. Dev Med Child Neurol.

2010;52(1):7-8. PMID: 2010-00714-005. First Author & Affiliation: Pennington, Lindsay. Exclusion Code: X1.
306. Pennington L, Miller N, Robson S. Speech therapy for children with dysarthria acquired before three years of age. Cochrane Database Syst Rev. 2009(4)PMID: CD006937. Exclusion Code: X3.
307. Perona K, Plante E, Vance R. Diagnostic accuracy of the Structured Photographic Expressive Language Test: Third Edition (SPELT-3). Lang Speech Hear Ser Schools. 2005;36(2):103-15. PMID: 2009090425. Language: English. Entry Date: 20060303. Revision Date: 20091218. Publication Type: journal article. Exclusion Code: X4.
308. Pesco D, O'Neill DK. Predicting later language outcomes from the Language Use Inventory. J Speech Lang Hear Res. 2012 Apr;55(2):421-34. PMID: 22223891. Exclusion Code: X6.
309. Peter B, Button L, Stoel-Gammon C, et al Deficits in sequential processing manifest in motor and linguistic tasks in a multigenerational family with childhood apraxia of speech. Clin Linguist Phon. 2013;27(3):163-91. PMID: 2013-03801-001. Exclusion Code: X4.
310. Peters SA, Grievink EH, van Bon WH, et al The contribution of risk factors to the effect of early otitis media with effusion on later language, reading, and spelling. Dev Med Child Neurol. 1997 Jan;39(1):31-9. PMID: 9003727. Exclusion Code: X3.
311. Peterson RL, Pennington BF, Shriberg LD, et al What influences literacy outcome in children with speech sound disorder? J Speech Lang Hear Res. 2009 Oct;52(5):1175-88. PMID: 19403946. Exclusion Code: X4.
312. Phillips BM, Lonigan CJ, Wyatt MA. Predictive validity of the get ready to read! Screener: concurrent and long-term relations with reading-related skills. J Learn Disabil. 2009 Mar-Apr;42(2):133-47. PMID: 19074622. Exclusion Code: X3.
313. Pickett E, Pullara O, O'Grady J, et al Speech acquisition in older nonverbal individuals with autism: a review of features, methods, and prognosis. Cogn Behav Neurol. 2009 Mar;22(1):1-21. PMID: 19372766. Exclusion Code: X3.
314. Pickstone C, Goldbart J, Marshall J, et al A systematic review of environmental interventions to improve child language outcomes for children with or at risk of primary language impairment. J Res Spec Educat Needs. 2009;9(2):66-79. Exclusion Code: X1.
315. Pihko E, Mickos A, Kujala T, et al Group intervention changes brain activity in bilingual language-impaired children. Cereb Cortex. 2007 Apr;17(4):849-58. PMID: 16707736. Exclusion Code: X6.
316. Plante E, Vance R. Diagnostic accuracy of two tests of preschool language. Am J Speech Lang Pathol. 1995;4(2):70-6. Exclusion Code: X3.
317. Pollock KE, Price JR. Phonological skills of children adopted from China: implications for assessment. Semin Speech Lang. 2005 Feb;26(1):54-63. PMID: 15731970. Exclusion Code: X1.
318. Prathanee B, Purdy SC, Thinkhamrop B, et al Early language delay and predictive factors in children aged 2 years. J Med Assoc Thai. 2009 Jul;92(7):930-8. PMID: 19626813. Exclusion Code: X7.
319. Price J, Roberts J, Vandergrift N, et al Language comprehension in boys with fragile X syndrome and boys with Down syndrome. J Intellect Disabil Res. 2007;51(Part 4):318-26. PMID: 2009549032. Language: English. Entry Date: 20071116. Revision Date: 20091218. Publication Type: journal article. Exclusion Code: X3.
320. Puolakanaho A, Ahonen T, Aro M, et al Very early phonological and language skills: estimating individual risk of reading disability. J Child Psychol Psychiatry. 2007 Sep;48(9):923-31. PMID: 17714377. Exclusion Code: X4.
321. Puolakanaho A, Ahonen T, Aro M, et al Developmental links of very early phonological and language skills to second grade reading outcomes: strong to accuracy but only minor to fluency. J Learn Disabil. 2008 Jul-Aug;41(4):353-70. PMID: 18560022. Exclusion Code: X3.
322. Qi CH, Kaiser AP. Problem behaviors of low-income children with language delays: an observation study. J Speech Lang Hear Res. 2004 Jun;47(3):595-609. PMID: 15212571. Exclusion Code: X4.
323. Quigg TC, Mahajerin A, Sullivan PD, et al Ages and Stages Questionnaires-3 Developmental Screening of Infants and Young Children With Cancer. J Pediatr Oncol Nurs. 2013;30(5):235-41. PMID: 2012321180. Language: English. Entry Date: 20131025. Revision Date: 20131101. Publication Type: journal article. Exclusion Code: X3.
324. Quintero I, Hernández S, Verche E, et al Disfunción ejecutiva en el Trastorno Específico del Lenguaje. = Executive dysfunction in Specific Language Impairment. Revista de

Logopedia, Foniatría y Audiología. 2013;33(4):172-8. PMID: 2013-36352-004. Exclusion Code: X9.

325. Randall D, Reynell J, Curwen M. A study of language development in a sample of 3 year old children. Br J Disord Commun. 1974 Apr;9(1):3-16. PMID: 4433458. Exclusion Code: X4.
326. Rannard A, Lyons C, Glenn S. Parent concerns and professional responses: the case of specific language impairment. Br J Gen Pract. 2005 Sep;55(518):710-4. PMID: 16176739. Exclusion Code: X4.
327. Reading S, Richie C. Documenting changes in communication behaviours using a Structured Observation System. Child Lang Teach Ther. 2007;23(2):181-200. PMID: 2009625054. Language: English. Entry Date: 20070914. Revision Date: 20091218. Publication Type: journal article. Exclusion Code: X4.
328. Redmond SM. Differentiating SLI from ADHD using children's sentence recall and production of past tense morphology. Clin Linguist Phon. 2005 Mar;19(2):109-27. PMID: 15704501. Exclusion Code: X3.
329. Reid J, Donaldson ML. The effectiveness of therapy for child phonological disorder: the Metaphon approach. In: M A, ed Child Language. Clevedong, Avon: Multiligual Matters; 1996. Exclusion Code: X9.
330. Rescorla L. Age 13 language and reading outcomes in late-talking toddlers. J Speech Lang Hear Res. 2005 Apr;48(2):459-72. PMID: 15989404. Exclusion Code: X4.
331. Rescorla L. Age 17 language and reading outcomes in late-talking toddlers: support for a dimensional perspective on language delay. J Speech Lang Hear Res. 2009 Feb;52(1):16-30. PMID: 18723598. Exclusion Code: X4.
332. Rescorla L. Late talkers: do good predictors of outcome exist? Dev Disabil Res Rev. 2011 Nov;17(2):141-50. PMID: 23362033. Exclusion Code: X1.
333. Rescorla L, Ross GS, McClure S. Language delay and behavioral/emotional problems in toddlers: findings from two developmental clinics. J Speech Lang Hear Res. 2007 Aug;50(4):1063-78. PMID: 17675605. Exclusion Code: X4.
334. Roberts MY, Kaiser AP. The effectiveness of parent-implemented language interventions: a meta-analysis. Am J Speech Lang Pathol. 2011 Aug;20(3):180-99. PMID: 21478280. Exclusion Code: X5.
335. Romski M, Sevcik RA, Adamson LB, et al Randomized comparison of augmented and nonaugmented language interventions for toddlers with developmental delays and their parents. J Speech Lang Hear Res. 2010 Apr;53(2):350-64. PMID: 20360461. Exclusion Code: X4.
336. Ross B, Cress CJ. Comparison of standardized assessments for cognitive and receptive communication skills in young children with complex communication needs. AAC: Augmentative & Alternative Communication. 2006;22(2):100-11. PMID: 2009250965. Language: English. Entry Date: 20061027. Revision Date: 20091218. Publication Type: journal article. Exclusion Code: X3.
337. Rousseau I, Packman A, Onslow M, et al An investigation of language and phonological development and the responsiveness of preschool age children to the Lidcombe Program. J Commun Disord. 2007 Sep-Oct;40(5):382-97. PMID: 17118388. Exclusion Code: X5.
338. Ruscello DM, Cartwright LR, Haines KB, et al The use of different service delivery models for children with phonological disorders. J Commun Disord. 1993 Sep;26(3):193-203. PMID: 8227504. Exclusion Code: X4.
339. Russ S, Halfon N. Early identification of language delays--are we there yet? J Dev Behav Pediatr. 2005 Aug;26(4):304-6; discussion 7. PMID: 16100503. Exclusion Code: X1.
340. Rvachew S, Bernhardt BM. Clinical implications of dynamic systems theory for phonological development. Am J Speech Lang Pathol. 2010 Feb;19(1):34-50. PMID: 19644125. Exclusion Code: X4.
341. Rvachew S, Nowak M. The effect of target-selection strategy on phonological learning. J Speech Lang Hear Res. 2001 Jun;44(3):610-23. PMID: 11407566. Exclusion Code: X4.
342. Ryan-Krause P, Meadows-Oliver M, Sadler L, et al Developmental status of children of teen mothers: contrasting objective assessments with maternal reports. Journal of Pediatric Healthcare. 2009;23(5):303-9. PMID: 2010431231. Language: English. Entry Date: 20091204. Revision Date: 20110520. Publication Type: journal article. Exclusion Code: X4.
343. Saltuklaroglu T, Kalinowski J. How effective is therapy for childhood stuttering? Dissecting and reinterpreting the evidence in light of spontaneous recovery rates. Int J Lang Commun Disord. 2005 Jul-Sep;40(3):359-74. PMID: 16195194. Exclusion Code: X1.
344. Samson JF, Lesaux NK. Language-minority learners in special education: rates and

predictors of identification for services. J Learn Disabil. 2009 Mar-Apr;42(2):148-62. PMID: 19011121. Exclusion Code: X3.
345. Scheffler F, Vogel D, Astern R, et al Screening for communication and cognitive disorders in infants and toddlers. Pediatr Nurs. 2007 Nov-Dec;33(6):473-80. PMID: 18196710. Exclusion Code: X1.
346. Scherer NJ, D'Antonio LL. Parent questionnaire for screening early language development in children with cleft palate. Cleft Palate Craniofac J. 1995 Jan;32(1):7-13. PMID: 7727490. Exclusion Code: X3.
347. Schirmer CR, Portuguez MW, Nunes ML. Clinical assessment of language development in children at age 3 years that were born preterm. Arq Neuropsiquiatr. 2006 Dec;64(4):926-31. PMID: 17220997. Exclusion Code: X7.
348. Schlosser RW. Goal attainment scaling as a clinical measurement technique in communication disorders: A critical review. J Commun Disord. 2004;37(3):217-39. PMID: 2004-13526-002. PMID: 15063144. First Author & Affiliation: Schlosser, Ralf W. Exclusion Code: X1.
349. Schum RL. Language screening in the pediatric office setting. Pediatr Clin North Am. 2007 Jun;54(3):425-36, v. PMID: 17543903. Exclusion Code: X1.
350. Segers E, Verhoeven L. Computer-supported phonological awareness intervention for kindergarten children with specific language impairment. Lang Speech Hear Serv Sch. 2004 Jul;35(3):229-39. PMID: 15248793. Exclusion Code: X5.
351. Sevcik RA. Comprehension: An overlooked component in augmented language development. Disability and Rehabilitation: An International, Multidisciplinary Journal. 2006;28(3):159-67. PMID: 2006-02673-004. First Author & Affiliation: Sevcik, Rose A. Exclusion Code: X1.
352. Sevcik RA, Barton-Hulsey A, Romski M. Early intervention, AAC, and transition to school for young children with significant spoken communication disorders and their families. Semin Speech Lang. 2008 May;29(2):92-100. PMID: 18645911. Exclusion Code: X1.
353. Shafer VL, Sussman E. Predicting the future: ERP markers of language risk in infancy. Clin Neurophysiol. 2011 Feb;122(2):213-4. PMID: 20674485. Exclusion Code: X1.
354. Share DL. Orthographic learning, phonological recoding, and self-teaching. Adv Child Dev Behav. 2008;36:31-82. PMID: 18808041. Exclusion Code: X1.
355. Sheldrick RC, Neger EN, Perrin EC. Concerns about development, behavior, and learning among parents seeking pediatric care. J Dev Behav Pediatr. 2012;33(2):156-60. PMID: 2012-27825-007. PMID: 22183104. First Author & Affiliation: Sheldrick, R. Christopher. Exclusion Code: X5.
356. Shetty P. Speech and language delay in children: a review and the role of a pediatric dentist. J Indian Soc Pedod Prev Dent. 2012 Apr-Jun;30(2):103-8. PMID: 22918093. Exclusion Code: X1.
357. Shevell MI, Majnemer A, Webster RI, et al Outcomes at school age of preschool children with developmental language impairment. Pediatr Neurol. 2005 Apr;32(4):264-9. PMID: 15797183. Exclusion Code: X4.
358. Shong SY, Cheng ST. Development of a screening instrument for early language delay in Hong Kong Chinese: a preliminary study. J Genet Psychol. 2009 Sep;170(3):193-6. PMID: 19928313. Exclusion Code: X8.
359. Sices L, Stancin T, Kirchner HL, et al PEDS and ASQ developmental screening tests may not identify the same children. Pediatrics. 2009;124(4):e640-7. PMID: 19736268. Exclusion Code: X6.
360. Sices L, Taylor HG, Freebairn L, et al Relationship between speech-sound disorders and early literacy skills in preschool-age children: impact of comorbid language impairment. J Dev Behav Pediatr. 2007 Dec;28(6):438-47. PMID: 18091088. Exclusion Code: X4.
361. Sidhu M, Malhi P, Jerath J. Multiple risks and early language development. Indian J Pediatr. 2010 Apr;77(4):391-5. PMID: 20422325. Exclusion Code: X7.
362. Sigman M, McGovern CW. Improvement in cognitive and language skills from preschool to adolescence in autism. J Autism Dev Disord. 2005 Feb;35(1):15-23. PMID: 15796118. Exclusion Code: X3.
363. Simms MD. Language disorders in children: classification and clinical syndromes. Pediatr Clin North Am. 2007 Jun;54(3):437-67, v. PMID: 17543904. Exclusion Code: X1.
364. Singhania R, Sonksen P. The Indian picture puzzle test - a developmental test designed and standardised for Indian children. Indian J Pediatr. 2004 May;71(5):387-96. PMID: 15163865. Exclusion Code: X4.
365. Sittner Bridges M, Catts HW. The Use of a Dynamic Screening of Phonological Awareness to Predict Risk for Reading Disabilities in Kindergarten Children. J Learn Disabil.

2011;44(4):330-8. PMID: 2011305646. Language: English. Entry Date: 20111111. Revision Date: 20120907. Publication Type: journal article. Exclusion Code: X4.

366. Skovgaard AM, Olsen EM, Christiansen E, et al Predictors (0-10 months) of psychopathology at age 1 1/2 years--A general population study in the Copenhagen Child Cohort CCC 2000. Journal of Child Psychology and Psychiatry. 2008;49(5):553-62. PMID: 2008-04513-010. PMID: 18341552. First Author & Affiliation: Skovgaard, A. M. Exclusion Code: X4.
367. Slott M, Vach W, Bleses D. Evaluation of methods used to assess language development of 3-4-year-old Danish children. Logoped Phoniatr Vocol. 2008;33(4):190-207. PMID: 19031290. Exclusion Code: X1.
368. Smit-Glaude SW, van Strien JW, Licht R, et al Neuropsychological intervention in kindergarten children with subtyped risks of reading retardation. Ann Dyslexia. 2005 Dec;55(2):217-45. PMID: 17849194. Exclusion Code: X3.
369. Smith-Lock KM, Leitao S, Lambert L, et al Effective intervention for expressive grammar in children with specific language impairment. Int J Lang Commun Disord. 2013 May-Jun;48(3):265-82. PMID: 23650884. Exclusion Code: X5.
370. Snowling MJ, Bishop DV, Stothard SE, et al Psychosocial outcomes at 15 years of children with a preschool history of speech-language impairment. J Child Psychol Psychiatry. 2006 Aug;47(8):759-65. PMID: 16898989. Exclusion Code: X4.
371. Snowling MJ, Hulme C. Interventions for children's language and literacy difficulties. Int J Lang Commun Disord. 2012 Jan-Feb;47(1):27-34. PMID: 22268899. Exclusion Code: X1.
372. Sohr-Preston SL, Scaramella LV. Implications of timing of maternal depressive symptoms for early cognitive and language development. Clin Child Fam Psychol Rev. 2006 Mar;9(1):65-83. PMID: 16817009. Exclusion Code: X1.
373. Spaulding TJ, Hosmer S, Schechtman C. Investigating the interchangeability and diagnostic utility of the PPVT-III and PPVT-IV for children with and without SLI. Int J Speech Lang Pathol. 2013 Oct;15(5):453-62. PMID: 23374021. Exclusion Code: X6.
374. Spaulding TJ, Plante E, Farinella KA. Eligibility criteria for language impairment: is the low end of normal always appropriate? Lang Speech Hear Serv Sch. 2006 Jan;37(1):61-72. PMID: 16615750. Exclusion Code: X6.
375. Spek IL, Weisglas-Kuperus N. Language Functions in Preterm-Born Children: A Systematic Review and Meta-analysis. Pediatrics. 2012;129(4):745-54. PMID: 2011526037. Language: English. Entry Date: 20120504. Revision Date: 20130419. Publication Type: journal article. Exclusion Code: X4.
376. St James-Roberts I, Alston E. Attention development in 10-month-old infants selected by the WILSTAAR screen for pre-language difficulties. J Child Psychol Psychiatry. 2006 Jan;47(1):63-8. PMID: 16405642. Exclusion Code: X4.
377. St. Pourcain B, Mandy WP, Heron J, et al Links between co-occurring social-communication and hyperactive-inattentive trait trajectories. J Am Acad Child Adolesc Psychiatry. 2011;50(9):892-902. PMID: 2011-19545-011. PMID: 21871371. First Author & Affiliation: St. Pourcain, Beate. Exclusion Code: X3.
378. Stern LM, Connell TM, Lee M, et al The Adelaide preschool language unit: results of follow-up. J Paediatr Child Health. 1995 Jun;31(3):207-12. PMID: 7669381. Exclusion Code: X4.
379. Stevenson J, Richman N. The prevalence of language delay in a population of three-year-old children and its association with general retardation. Dev Med Child Neurol. 1976 Aug;18(4):431-41. PMID: 955307. Exclusion Code: X6.
380. Stock CD, Fisher PA. Language delays among foster children: implications for policy and practice. Child Welfare. 2006 May-Jun;85(3):445-61. PMID: 16999381. Exclusion Code: X1.
381. Stockman IJ. Toward validation of a minimal competence phonetic core for african american children. J Speech Lang Hear Res. 2008 Oct;51(5):1244-62. PMID: 18728112. Exclusion Code: X3.
382. Stoel-Gammon C, Williams AL. Early phonological development: creating an assessment test. Clin Linguist Phon. 2013 Apr;27(4):278-86. PMID: 23489340. Exclusion Code: X6.
383. Stokes SF, Klee T. The diagnostic accuracy of a new test of early nonword repetition for differentiating late talking and typically developing children. J Speech Lang Hear Res. 2009 Aug;52(4):872-82. PMID: 19641075. Exclusion Code: X6.

384. Suggate SP. Why what we teach depends on when: grade and reading intervention modality moderate effect size. Dev Psychol. 2010 Nov;46(6):1556-79. PMID: 20873927. Exclusion Code: X3.
385. Tervo RC. Identifying patterns of developmental delays can help diagnose neurodevelopmental disorders. Clin Pediatr (Phila). 2006 Jul;45(6):509-17. PMID: 16893855. Exclusion Code: X1.
386. Thomas-Stonell N, Oddson B, Robertson B, et al Predicted and observed outcomes in preschool children following speech and language treatment: parent and clinician perspectives. J Commun Disord. 2009 Jan-Feb;42(1):29-42. PMID: 18835607. Exclusion Code: X4.
387. Thomas-Stonell N, Oddson B, Robertson B, et al Validation of the Focus on the Outcomes of Communication under Six outcome measure. Dev Med Child Neurol. 2013 Jun;55(6):546-52. PMID: 23461266. Exclusion Code: X4.
388. Thomas-Stonell N, Oddson B, Robertson B, et al Validation of the Focus on the Outcomes of Communication under Six outcome measure. Dev Med Child Neurol. 2013 Jun;55(6):546-52. PMID: 23461266. Exclusion Code: X8.
389. Thordardottir E, Kehayia E, Mazer B, et al Sensitivity and specificity of French language and processing measures for the identification of primary language impairment at age 5. J Speech Lang Hear Res. 2011 Apr;54(2):580-97. PMID: 21081674. Exclusion Code: X6.
390. Tjus T, Heimann M, Nelson K. Reading acquisition by implementing a multimedia intervention strategy for fifty children with autism or other learning and communication disabilities. Journal of Cognitive and Behavioral Psychotherapies. 2004;4(2):203-21. PMID: 2005-07292-008. First Author & Affiliation: Tjus, Tomas. Exclusion Code: X3.
391. To T, Guttmann A, Dick PT, et al Risk markers for poor developmental attainment in young children: results from a longitudinal national survey. Arch Pediatr Adolesc Med. 2004 Jul;158(7):643-9. PMID: 15237063. Exclusion Code: X3.
392. Tomblin JB, Zhang X, Buckwalter P, et al The association of reading disability, behavioral disorders, and language impairment among second-grade children. J Child Psychol Psychiatry. 2000 May;41(4):473-82. PMID: 10836677. Exclusion Code: X3.
393. Toohill BJ, McLeod S, McCormack J. Effect of dialect on identification and severity of speech impairment in Indigenous Australian children. Clin Linguist Phon. 2012;26(2):101-19. PMID: 2011414943. Language: English. Entry Date: 20120127. Revision Date: 20120601. Publication Type: journal article. Exclusion Code: X4.
394. Toth K, Dawson G, Meltzoff AN, et al Early social, imitation, play, and language abilities of young non-autistic siblings of children with autism. J Autism Dev Disord. 2007 Jan;37(1):145-57. PMID: 17216560. Exclusion Code: X4.
395. Trajkovski N, Andrews C, Onslow M, et al A phase II trial of the Westmead Program: syllable-timed speech treatment for pre-school children who stutter. Int J Speech Lang Pathol. 2011 Dec;13(6):500-9. PMID: 22070727. Exclusion Code: X4.
396. Turnbull KP, Anthony AB, Justice L, et al Preschoolers' exposure to language stimulation in classrooms serving at-risk children: The contribution of group size and activity context. Early Education and Development. 2009;20(1):53-79. PMID: 2009-02541-003. First Author & Affiliation: Turnbull, Khara Pence. Other Publishers: Lawrence Erlbaum. Release Date: 20090713. Publication Type: Journal, (0100). Exclusion Code: X4.
397. Valtonen R, Ahonen T, Lyytinen P, et al Co-occurrence of developmental delays in a screening study of 4-year-old Finnish children. Dev Med Child Neurol. 2004 Jul;46(7):436-43. PMID: 15230455. Exclusion Code: X4.
398. van der Leij A, van Bergen E, van Zuijen T, et al Precursors of developmental dyslexia: an overview of the longitudinal Dutch Dyslexia Programme study. Dyslexia. 2013 Nov;19(4):191-213. PMID: 24133035. Exclusion Code: X1.
399. van der Lely HK, Payne E, McClelland A. An investigation to validate the grammar and phonology screening (GAPS) test to identify children with specific language impairment. PLoS One. 2011;6(7):e22432. PMID: 21829461. Exclusion Code: X3.
400. van Kleeck A, Vander Woude J, Hammett L. Fostering literal and inferential language skills in Head Start preschoolers with language impairment using scripted book-sharing discussions. Am J Speech Lang Pathol. 2006 Feb;15(1):85-95. PMID: 16533095. Exclusion Code: X5.
401. van Otterloo SG, van der Leij A. Dutch home-based pre-reading intervention with children at familial risk of dyslexia. Ann Dyslexia. 2009 Dec;59(2):169-95. PMID: 19898941. Exclusion Code: X3.

402. Vandereet J, Maes B, Lembrechts D, et al Predicting expressive vocabulary acquisition in children with intellectual disabilities: a 2-year longitudinal study. J Speech Lang Hear Res. 2010 Dec;53(6):1673-86. PMID: 20705745. Exclusion Code: X3.
403. Vandewalle E, Boets B, Ghesquiere P, et al Development of phonological processing skills in children with specific language impairment with and without literacy delay: a 3-year longitudinal study. J Speech Lang Hear Res. 2012 Aug;55(4):1053-67. PMID: 22232409. Exclusion Code: X3.
404. Venker CE, McDuffie A, Ellis Weismer S, et al Increasing verbal responsiveness in parents of children with autism:a pilot study. Autism. 2012 Nov;16(6):568-85. PMID: 21846665. Exclusion Code: X3.
405. Ventola P, Kleinman J, Pandey J, et al Differentiating between autism spectrum disorders and other developmental disabilities in children who failed a screening instrument for ASD. J Autism Dev Disord. 2007 Mar;37(3):425-36. PMID: 16897377. Exclusion Code: X3.
406. Voigt RG, Llorente AM, Jensen CL, et al Comparison of the validity of direct pediatric developmental evaluation versus developmental screening by parent report. Clin Pediatr (Phila). 2007 Jul;46(6):523-9. PMID: 17579105. Exclusion Code: X6.
407. Waite MC, Theodoros DG, Russell TG, et al Internet-based telehealth assessment of language using the CELF-4. Lang Speech Hear Serv Sch. 2010 Oct;41(4):445-58. PMID: 20421616. Exclusion Code: X3.
408. Waite MC, Theodoros DG, Russell TG, et al Assessing children's speech intelligibility and oral structures, and functions via an Internet-based telehealth system. J Telemed Telecare. 2012 Jun;18(4):198-203. PMID: 22604277. Exclusion Code: X3.
409. Wake M, Gerner B, Gallagher S. Does parents' evaluation of developmental status at school entry predict language, achievement, and quality of life 2 years later? Ambul Pediatr. 2005 May-Jun;5(3):143-9. PMID: 15913407. Exclusion Code: X3.
410. Wake M, Levickis P, Tobin S, et al Improving outcomes of preschool language delay in the community: protocol for the Language for Learning randomised controlled trial. BMC Pediatr. 2012;12:96. PMID: 22776103. Exclusion Code: X4.
411. Wankoff LS. Warning signs in the development of speech, language, and communication: when to refer to a speech-language pathologist. J Child Adolesc Psychiatr Nurs. 2011 Aug;24(3):175-84. PMID: 21810134. Exclusion Code: X1.
412. Washington JA, Craig HK. A language screening protocol for use with young African American children in urban settings. Am J Speech Lang Pathol. 2004 Nov;13(4):329-40. PMID: 15719899. Exclusion Code: X3.
413. Washington KN, Warr-Leeper G, Thomas-Stonell N. Exploring the outcomes of a novel computer-assisted treatment program targeting expressive-grammar deficits in preschoolers with SLI. J Commun Disord. 2011 May-Jun;44(3):315-30. PMID: 21288539. Exclusion Code: X4.
414. Webster RI, Majnemer A, Platt RW, et al The predictive value of a preschool diagnosis of developmental language impairment. Neurology. 2004 Dec 28;63(12):2327-31. PMID: 15623695. Exclusion Code: X4.
415. Weir E, Bianchet S. Developmental dysfluency: early intervention is key. CMAJ. 2004 Jun 8;170(12):1790-1. PMID: 15184330. Exclusion Code: X1.
416. Weiss AL. Why we should consider pragmatics when planning treatment for children who stutter. Lang Speech Hear Serv Sch. 2004 Jan;35(1):34-45. PMID: 15049418. Exclusion Code: X1.
417. Wellman RL, Lewis BA, Freebairn LA, et al Narrative ability of children with speech sound disorders and the prediction of later literacy skills. Lang Speech Hear Serv Sch. 2011 Oct;42(4):561-79. PMID: 21969531. Exclusion Code: X4.
418. Westerlund M. Identifying children at risk for language impairment: screening of communication at 18 months. Acta Paediatr. 2004 Apr;93(4):573-4; author reply 4-5. PMID: 15188994. Exclusion Code: X1.
419. Westerlund M, Lagerberg D. Expressive vocabulary in 18-month-old children in relation to demographic factors, mother and child characteristics, communication style and shared reading. Child Care Health Dev. 2008;34(2):257-66. PMID: 2008-01466-017. First Author & Affiliation: Westerlund, M. Exclusion Code: X4.
420. Westerveld MF, Gillon GT, Boyd L. Evaluating the clinical utility of the Profile of Oral Narrative Ability for 4-year-old children. Int J Speech Lang Pathol. 2012 Apr;14(2):130-40. PMID: 22204368. Exclusion Code: X6.
421. Whitehouse AJ, Robinson M, Zubrick SR. Late talking and the risk for psychosocial problems

during childhood and adolescence. Pediatrics. 2011 Aug;128(2):e324-32. PMID: 21727106. Exclusion Code: X4.
422. Whitworth A, Daves C, Stokes S, et al Identification of communication impairments in preschoolers: a comparison of parent and teachers success. Aust J Hum Commun Disord 1993;21(1):112-33. Exclusion Code: X8.
423. Wijedasa D. Developmental screening in context: Adaptation and standardization of the Denver Developmental Screening Test-II (DDST-II) for Sri Lankan children. Child Care Health Dev. 2012;38(6):889-99. PMID: 2012-27727-016. PMID: 22017516. First Author & Affiliation: Wijedasa, D. Exclusion Code: X4.
424. Wilcox LD, Anderson RT. Distinguishing between phonological difference and disorder in children who speak African-American vernacular English: an experimental testing instrument. J Commun Disord. 1998;31(4):315-35. Exclusion Code: X3.
425. Wilcox MJ, Kouri TA, Caswell SB. Early language intervention: a comparison of classroom and individual treatment. Am J Speech-Lang Path. 1991;1(1):49-61. Exclusion Code: X4.
426. Williams C. Teacher judgements of the language skills of children in the early years of schooling. Child Lang Teach Ther. 2006;22(2):135-54. Exclusion Code: X4.
427. Wilson SB, Lonigan CJ. An evaluation of two emergent literacy screening tools for preschool children. Ann Dyslexia. 2009 Dec;59(2):115-31. PMID: 19834812. Exclusion Code: X3.
428. Wilson SB, Lonigan CJ. Identifying preschool children at risk of later reading difficulties: evaluation of two emergent literacy screening tools. J Learn Disabil. 2010 Jan-Feb;43(1):62-76. PMID: 19822699. Exclusion Code: X3.
429. Wink M, Rosanowski F, Hoppe U, et al Subjective burden in mothers of speech-impaired children. Folia Phoniatr Logop. 2007;59(5):268-72. PMID: 17726330. Exclusion Code: X3.
430. Wong AM, Klee T, Stokes SF, et al Differentiating Cantonese-speaking preschool children with and without SLI using MLU and lexical diversity (D). J Speech Lang Hear Res. 2010 Jun;53(3):794-9. PMID: 20530389. Exclusion Code: X4.
431. Yoder PJ, Molfese D, Gardner E. Initial mean length of utterance predicts the relative efficacy of two grammatical treatments in preschoolers with specific language impairment. J Speech Lang Hear Res. 2011 Aug;54(4):1170-81. PMID: 21386042. Exclusion Code: X4.
432. Yoon G, Kramer J, Zanko A, et al Speech and language delay are early manifestations of juvenile-onset Huntington disease. Neurology. 2006;67(7):1265-7. PMID: 2009309165. Language: English. Entry Date: 20070907. Publication Type: journal article. Exclusion Code: X3.
433. Young AR, Beitchman JH, Johnson C, et al Young adult academic outcomes in a longitudinal sample of early identified language impaired and control children. J Child Psychol Psychiatry. 2002 Jul;43(5):635-45. PMID: 12120859. Exclusion Code: X4.
434. Yu JW, Buka SL, McCormick MC, et al Behavioral problems and the effects of early intervention on eight-year-old children with learning disabilities. Matern Child Health J. 2006 Jul;10(4):329-38. PMID: 16474990. Exclusion Code: X3.
435. Yurchak SH. The moderating influence of parental enculturation on the relationship between socioeconomic risk factors and outcomes for Native American preschool children. US: ProQuest Information & Learning; 2004. Exclusion Code: X9.
436. Zakopoulou V, Anagnostopoulou A, Christodoulides P, et al An interpretative model of early indicators of specific developmental dyslexia in preschool age: a comparative presentation of three studies in Greece. Res Dev Disabil. 2011 Nov-Dec;32(6):3003-16. PMID: 21612888. Exclusion Code: X6.

Appendix C Table 1. Quality Ratings of Studies of Screening Outcomes for Speech and Language Delay in Children Age 5 Years and Younger (KQ 1)

Author, Year	Are screening or treatment interventions and comparators described?	Study design	Were selection criteria clearly described?	Are the inclusion/exclusion criteria measured using valid and reliable measures, implemented across all study participants?	Was the delay or disorder status of subjects determined using valid and reliable methods?	Was method of randomization adequate?	Was allocation concealment adequate?
Van Agt et al, 2007[71]	G1: Screening G2: No screening (usual care)	RCT Cluster	Yes	Yes	Sometimes	Yes	NA

Author, Year	Did the strategy for recruiting participants differ across study groups?	Were baseline characteristics similar between groups? If not, did the analysis control for differences?	Were the outcome assessors blinded to the intervention status of participants?	Was intervention fidelity adequate?	Did variation from the study protocol compromise the conclusions of the study?	Overall attrition	Did the study have high attrition raising concern for bias?	Was the analysis conducted on an intention-to-treat basis?	Did the study have crossovers or contamination raising concern for bias?
Van Agt et al, 2007[71]	No	Not among those reported	Yes	No	No	Approximately 50% or more based on outcome	Yes	Yes, but attrition was very high and approach was not described	No

Author, Year	Were outcomes prespecified/defined and adequately described?	Were outcome measures valid and reliable?	Was the duration of followup adequate to assess the outcome?	Was an appropriate method used to handle missing data?	Did the study use acceptable statistical methods?	Quality rating	Comments
Van Agt et al, 2007[71]	Yes	Some	Yes	Unknown, but believe not	Yes	Poor	This study had a very high attrition rate so that the reader could not be confident that the results were comparing a comparable group of children screened to those not screened

Appendix C Table 2. Quality Ratings of Studies of Screening Accuracy for Speech and Language Delay in Children Age 5 Years and Younger (KQ 2)[a]

Author, Year	Was the screening test adequately described?	Were selection criteria clearly described?	Did the study use a credible reference standard?	Was the time period between the screening test and the comparator short enough?	Did the whole or a random selection of the sample receive screening test?
Alberts et al, 1995[91]	Yes	Yes	Yes	NR	Yes
Allen and Bliss, 1987[92]	Yes	No	Yes	Yes	Yes
Bliss and Allen, 1984[93]	Yes	No	Yes	NR	Yes
Borowitz and Blascoe, 1986[94]	Yes	Yes	Yes	Yes	Yes
Burden et al, 1996[95]	Yes	Yes	Yes	Yes	Yes
Clark et al, 1995[66]	Yes	No	Yes	Yes	Yes
Coulter and Gallagher, 2001[87]	Yes	Yes	Unclear	Unclear	Yes
Dixon et al, 1988[96]	Yes	No	Yes	Yes	Yes
Drumwright et al, 1973[97]	Yes	No	Yes	Yes	Yes
Elbaum et al, 2010[79]	Yes	Yes	Yes	Yes	Yes
Frisk et al, 2009[72]	Yes	Yes	Yes	Yes	Yes
Guiberson and Rodriguez, 2010[73]	Yes	Yes	Yes	Yes	Yes
Guiberson et al, 2011[74]	Yes	Yes	Yes	Yes	Yes
Heilman et al, 2005[75]	Yes	Yes	Yes	Yes	Yes
Henrichs et al, 2011[81]	Yes	Yes	No	No	Yes
Heo et al, 2008[82]	Yes	Yes	No	Yes	Yes
Klee et al, 1998[98]	Yes	No	Yes	Yes	Yes
Klee et al, 2000[122]	Yes	No	Yes	Yes	Yes
Laing et al, 2002[99]	Yes	Yes	Yes	Yes	Yes
Law, 1994[100]	Yes	Yes	Yes	Yes	Yes
Levett and Muir, 1983[67]	Yes	Yes	Yes	Yes	Yes
McGinty, 2000[101]	No	Yes	Yes	Yes	Yes
Mossabeb et al, 2012[83]	Yes	Yes	No	Unclear	Unclear
Rescorla, 1989[54]	Yes	Unclear	Yes	Yes	Yes
Rescorla et al, 1993[69]	Yes	Yes	No	Yes	Yes
Rescorla and Alley, 2001[102]					
Study 1	Yes	No	No	Yes	Yes
Study 2	Yes	No	Yes	Yes	Yes
Rigby and Chesham, 1981[86]	Yes	Yes	Yes	Unclear	Yes
Sachse and Von Suchodoletz, 2008[76] Sachse and Von Suchodoletz, 2009[77]	Yes	Yes	Yes	Yes	Yes
Sherman et al, 1995[68]	Yes	Yes	Yes	Yes	Yes
Sices et al, 2009[84]	Yes	Yes	No	Yes	Yes
Skarakis-Doyle and Campbell, 2009[80]	Yes	Yes	No	No	Yes
Stokes, 1997[103]	Yes	Yes	Yes	Yes	Yes
Stott et al, 2002[104]	Yes	No	Yes	Yes	Yes
Sturner et al, 1993[105]					
Study 1	Yes	No	Yes	Yes	Yes
Study 2	Yes	No	Yes	Yes	Yes
Sturner et al, 1996[106]	Yes	No	Yes	Yes	Yes

Appendix C Table 2. Quality Ratings of Studies of Screening Accuracy for Speech and Language Delay in Children Age 5 Years and Younger (KQ 2)[a]

Author, Year	Was the screening test adequately described?	Were selection criteria clearly described?	Did the study use a credible reference standard?	Was the time period between the screening test and the comparator short enough?	Did the whole or a random selection of the sample receive screening test?
Van Agt et al, 2007[85]	Yes	Yes	No	Unclear	Yes
Walker et al, 1989[107]	Yes	Yes	Yes	Yes	Yes
Ward, 1984[108]	Yes	Yes	Yes	Yes	Yes
Westerlund et al, 2006[78]	Yes	Yes	Yes	No	Yes
Wetherby et al, 2003[88]	Yes	Yes	Yes	Yes	Yes

Author, Year	Did patients receive the same reference regardless of test results?	Was the reference standard independent of the test?	Was the sample size adequate?	Quality rating	Comments
Alberts et al, 1995[91]	Yes	Yes	Yes, 59	Fair	Sample size is adequate but not good. Reference test is a combination of measures, including a cognitive measure. No information about the length of time between the two tests.
Allen and Bliss, 1987[92]	Yes	Unclear	Yes, 182	Fair	No description of eligibility or exclusionary criteria other than the children were in Head Start. It was not explicitly stated that the reference test and screening test were independently administered.
Bliss and Allen, 1984[93]	Yes	Yes	Yes, 602	Fair	No description of eligibility or exclusionary criteria other than the children were in Head Start. No indication of the time lag between screening and reference standard.
Borowitz and Glascoe, 1986[94]	Yes	Yes	Yes, 71	Fair	Sample size is adequate but not good.
Burden et al, 1996[95]	Yes	Yes	Yes, 425	Good	This is a large epidemiological sample that is well described. All criteria for a good rating were met.
Clark et al, 1995[66]	Yes	Unclear	Yes, 99	Poor	Eligibility and exclusionary criteria not described other than age. May not be independent assessment and screening.
Coulter and Gallagher, 2001[87]	Unclear	Unclear	Yes, 1174	Poor	No information is provided on the reference standard. Nor is there any information about the screening instrument, though there are references.
Dixon, 1988[96]	Yes	Yes	No, 40	Poor	It is unclear what the eligibility criteria were. Two separate samples were combined, and the sample size is small.
Drumwright et al, 1983[97]	Yes	Yes	Yes, 150	Fair	Little information regarding the sample other than their age and that they were economically disadvantaged.
Elbaum et al, 2010[79]	Yes	No	Yes, 100	Poor	Screening test, which is a subset of the full instrument, was validated against the full instrument; that is, the subset of items was extracted from the larger data set from the whole test, no separate administration.
Frisk et al, 2009[72]	Yes	Yes	Yes, 112	Fair	Somewhat restricted sample; 41% of sample were cognitively below average and 8% had global cognitive delay. Also, screening tests were not administered as separate instruments, but were intermingled.
Guiberson and Rodriguez, 2010[73]	Yes	Yes	No, 48	Fair	Meets all criteria except sample size.

Appendix C Table 2. Quality Ratings of Studies of Screening Accuracy for Speech and Language Delay in Children Age 5 Years and Younger (KQ 2)[a]

Author, Year	Did patients receive the same reference regardless of test results?	Was the reference standard independent of the test?	Was the sample size adequate?	Quality rating	Comments
Guiberson et al, 2011[74]	Yes	Yes	No, 45	Fair	Meets all criteria except sample size.
Heilmann et al, 2005[75] Study 2	Yes	Yes	Yes, 100	Fair	Meets all criteria; uses appropriate diagnostic procedure, interprets diagnostic separate from screening procedure, sample is 100 children comprised of late talking toddlers and typical language toddlers.
Henrichs et al, 2011[81]	Yes	Yes	Yes, 3759	Poor	Uses another screener as a reference test. The time lag between the screener and the reference is 1 year, which is too long for children this age.
Heo et al, 2008[82]	No	Yes	Yes, 404 (in validity analysis)	Poor	Reference test is screener, not diagnostic assessment.
Klee et al, 1998[98] Klee et al, 2000[122]	Yes	Yes	Yes, 64	Fair	Sample size is adequate but not good.
Laing et al, 2002[99] Good	Yes	Yes	Yes, 458	Good	This is a large epidemiological sample that is well described. All criteria for a good rating were met.
Law, 1994[100]	Yes	Yes	Yes, 189	Good	This is a large epidemiological sample that is well described. All criteria for a good rating were met.
Levett and Muir, 1983[67]	Yes	Yes	No, 14	Poor	Sample size for sensitivity and specificity evaluation is too small.
McGinty, 2000[101]	Yes	Yes	Yes, 200	Poor	Limited information is given about screening test.
Mossabeb et al, 2012[83]	Yes	Yes	Yes, 178	Poor	It is not clear when the children were screened in relation to receiving the Bayley Scale of Infant Development. The Bayley is a measure of cognitive development and not a reasonable reference measure.
Rescorla, 1989[54]	Yes	Yes	Yes, 81	Fair	Little information regarding exclusionary criteria. Sample size is adequate but not good.
Rescorla et al, 1993[69]	Yes	Yes	Yes, 108 and 92	Poor	The reference test (items from the Bayley Scale of Infant Development and the Stanford-Binet) is insufficient to determine language delay.
Rescorla and Alley, 2001[102] Study 1	Yes	Unclear	Yes, 422	Poor	Reference test is individual items from two measures of cognitive development. No information was provided about eligibility or exclusionary criteria other than the sample were 2-year-olds.
Rescorla and Alley, 2001[102] Study 2	Yes	Unclear	Yes, 66	Fair	Unlike Study 1, a credible reference standard is used. No information was provided about eligibility or exclusionary criteria other than the sample was comprised of 2-year-olds who failed the screening in Study 1 or who passed the screening test and were matched to an at-risk child.
Rigby and Chesham, 1981[86]	Yes	No	Yes, 438	Fair	This is a large epidemiological sample that is generally well carried out with some limitations. No indication of the time span between the screener and diagnostic test. All children received two of the diagnostic instruments; the third, an articulation test, was only given if the SLP felt it was necessary.
Sachse and Von Suchodoletz, 2008[76], 2009[77]	Yes	Yes	Yes, 117	Good	All criteria for a good rating were met.

Appendix C Table 2. Quality Ratings of Studies of Screening Accuracy for Speech and Language Delay in Children Age 5 Years and Younger (KQ 2)[a]

Author, Year	Did patients receive the same reference regardless of test results?	Was the reference standard independent of the test?	Was the sample size adequate?	Quality rating	Comments
Sherman et al, 1996[68]	Yes	No	Yes, 173	Poor	The reference standard was not independent of the screener because the same individual administered both during the same session.
Sices et al, 2009[84]	Yes	No	Yes, 60	Poor	The reference is only the provider's rating of a concern, not a diagnostic assessment, and the providers were present when the PEDS was completed.
Skarakis-Doyle et al, 2009[80]	No	No	Yes, 58	Poor	No independent reference test is provided, only classification status as LI/TLD prior to screener.
Stokes, 1997[103]	Yes	Yes	Yes, 398	Fair	This is a large epidemiological sample that is well described. All criteria for a good rating were met.
Stott et al, 2002[104]	Yes	Yes	Yes, 254	Fair	The sample is only described in terms of their age and how they were recruited, no exclusionary criteria provided.
Sturner et al, 1993[105] Study 1	Yes	Yes	Yes, 51	Fair	The sample is only described in terms of their age and how they were recruited, no exclusionary criteria provided. The sample size is adequate but not large.
Sturner et al, 1993[105] Study 2	Yes	Yes	Yes, 147	Fair	The sample is only described in terms of their age and how they were recruited, no exclusionary criteria provided.
Sturner et al, 1996[106]	Yes	Yes	Yes, 76	Fair	The sample is only described in terms of their age and how they were recruited, no exclusionary criteria provided. The sample size is adequate but not large.
van Agt et al, 2007[85]	No	No	Yes, 317	Poor	Inappropriate reference test. Two procedures used for validation were used for positive and negative screens; one a parent response to a question or a specialist report for children who were seen for suspected language problems. The reference test was not independent of the screening. Also, there was no information regarding the timing between the screening and the reference test.
Walker et al, 1989[107]	Yes	No	Yes, 77	Poor	The same individuals who administered the screening instrument administered the reference standard.
Ward, 1984[108]	Yes	Unclear	Yes, 1070	Fair	The report indicates that the author visited those…
Westerlund et al, 2006[78]	Yes	Yes	Yes, 891	Fair	18 months between screening and reference is long for an initial evaluation of the sensitivity and specificity of an instrument because of changes in development, but the authors state that no children received speech and language services.
Wetherby et al, 2003[88]	Yes	Unclear	Yes, 232	Fair	Not specified whether the two procedures were completely independent. A random selection of those who were screened had the behavior sampling, but the sample size was sufficient.

[a] All studies in previous review and newly found studies were rated for quality.

KQ = key question; LI/TLD = language impaired/typical language development; NR = not reported; SL = speech language; SLP = speech-language pathologist.

Appendix C Table 3. Quality Ratings of Included Randomized Controlled Trials of Interventions for Speech and Language Delay and Disorders

Author, Year	Were screening or treatment interventions and comparators described?	Study design	Were eligibility criteria described clearly?	Were inclusion/exclusion criteria measured using valid and reliable measures, implemented across all study participants?	Was the delay or disorder status of subjects determined using valid and reliable methods?	Was method of randomization adequate?	Was allocation concealment adequate?
Denne, 2005[132]	G1: Phonological awareness therapy G2: No treatment	RCT	Yes	Yes	Yes	NR	NR
Fricke, 2013[125]	G1: Oral language skill, phonological awareness, literacy skill intervention G2: Waiting control group	RCT cluster	Yes	Yes	Yes	NR	NR
Grogan-Johnson, 2010[133]	G1: Teletherapy G2: Conventional therapy	RCT crossover	Yes	No	Yes	NR	NR
Jones, 2005[126]	G1: Lidcombe Program for Stuttering G2: No treatment	Dynamically balanced randomization with stratification	Yes	Yes	Yes	Yes	Yes
Lewis, 2008[127]	G1: Telehealth of Lidcombe Stuttering intervention G2: No treatment	RCT	Yes	NR	Yes	NR	Yes
Wake, 2011[128]	G1: Parent-based languge program G2: Usual care	Block randomization	Yes	Yes	Yes	Yes	Yes
Wake, 2013[130]	G1: 18 in-home sessions by "language assistant" over 1 year G2: Parents contacted and given information on local speech pathology services	RCT	Yes	NR	Yes	Yes	Yes
Yoder, 2005[129]	G1: BTR	2-arm RCT	Yes	Yes	Yes	Yes	No

Author, Year	Did the recruiting strategy differ across study groups?	Were baseline characteristics similar between groups? If not, did the analysis control for differences?	Were the outcome assessors blinded to the intervention status of participants?	Was intervention fidelity adequate?	Did variation from the study protocol compromise the conclusions of the study?	Overall attrition	Did the study have high attrition raising concern for bias?	Was the analysis conducted on an intention-to-treat basis?	Did the study have crossovers or contamination raising concern for bias?	Were outcomes prespecified/ defined and adequately described?
Denne, 2005[132]	No	Yes, but no demographic information was included, only pretest information	NR	Yes	No	0.05	No	No	No	Yes
Fricke, 2013[125]	No	Yes	NR	Yes	No	0.09	No	NR	No	Yes

Appendix C Table 3. Quality Ratings of Included Randomized Controlled Trials of Interventions for Speech and Language Delay and Disorders

Author, Year	Did the recruiting strategy differ across study groups?	Were baseline characteristics similar between groups? If not, did the analysis control for differences?	Were the outcome assessors blinded to the intervention status of participants?	Was intervention fidelity adequate?	Did variation from the study protocol compromise the conclusions of the study?	Overall attrition	Did the study have high attrition raising concern for bias?	Was the analysis conducted on an intention-to-treat basis?	Did the study have crossovers or contamination raising concern for bias?	Were outcomes prespecified/ defined and adequately described?
Grogan-Johnson, 2010[133]	No	Not reported	NR	Yes	No	0.16	NR	NR	No	Yes
Jones, 2005[126]	No	Yes	Yes	Yes	No	0.13	No	Yes	No	Yes
Lewis, 2008[127]	No	No/Yes for baseline stuttering	NR	Yes	No	0.18	No	Yes	No	Yes
Wake, 2011[128]	No	Yes	Yes	Yes	No	5% at 2 years; 11% at 3 years	No	Yes	No	Yes
Wake, 2013[130]	No	Yes	Yes	NR	NR	8% for intervention; 13% for control	No	Yes	NR	Yes
Yoder, 2005[129]	No	Yes	Yes	Yes	No	0	No	NR	No	Yes

Author, Year	Were outcome measures valid and reliable?	Was duration of followup adequate to assess the outcome?	Was an appropriate method used to handle missing data?	Did the study use acceptable statistical methods?	Quality rating	Comments
Denne, 2005[132]	Yes	Yes; end of treatment	NR	Yes	Poor	No discussion of how the group was randomized or whether they used any procedures for missing data. No baseline data other than pretest scores were presented. Intention to treat is not addressed other than to say one intervention participant had to be excluded because s/he was unable to attend several therapy sessions.
Fricke, 2013[125]	Yes	Yes; 6 months	Yes	Yes	Fair	No discussion of how groups were randomized or whether analysis was conducted on an intention to treat basis. However, they did use appropriate techniques for missing data.
Grogan-Johnson, 2010[133]	Yes	Yes; every 3 months	NR	No	Poor	No mention of how the children were assigned. No baseline characteristics provided. Data for many variables are combined across conditions. Therapists who provided treatment rated children's progress; no independent measure of outcome.
Jones, 2005[126]	Yes	Yes; 9 months post randomization	Yes	Yes	Fair	Differential attrition (13%) is close to the limit, with somewhat more in the control group. No data after randomization were available for these participants. Five protocol violations occurred: four children in the control group received some Lidcombe treatment and one child in Tx group had only 3 weeks of treatment.

Appendix C Table 3. Quality Ratings of Included Randomized Controlled Trials of Interventions for Speech and Language Delay and Disorders

Author, Year	Were outcome measures valid and reliable?	Was duration of followup adequate to assess the outcome?	Was an appropriate method used to handle missing data?	Did the study use acceptable statistical methods?	Quality rating	Comments
Lewis, 2008[127]	Yes	9 months post randomization and 12 months after stage 1 (tx) and 18 months after randomization (control)	NR	Yes	Fair	No information on how missing data was handled. Attrition is at the lower end of acceptable. Some differences in baseline characteristics.
Wake, 2011[128]	Yes	3 months post program and 15 months post program	Yes	Yes	Good	Meets all criteria.
Wake, 2013[130]	Yes	Yes; 1 year	NR	NR	Fair	Intention to treat principles were used (outcomes were compared based on randomization without regard for adherence to protocol), but no information was provided about how missing outcome data were handled for attriters. No information was provided about handling missing data in general (e.g., w.r.t. entry assessments). Although there was training and ongoing consultation to help maintain fidelity of implementation, no fidelity measures were reported. No information is given on whether children in the experimental groups received other therapy, or what therapy children in the control group may have received. These factors represent potential confounders that were not addressed in the analyses.
Yoder, 2005[129]	Yes	Yes; 6 and 14 months	NR	Yes	Fair	This study does not appear to have any fatal flaws. However, the extent to which there was any loss through attrition is unclear and if it occurred, how it was handled.

BTR = broad target recasts; G = group; ITT = intention to treat; NR = not reported; RCT = randomized controlled trial; tx = treatment.

Appendix C Table 4. Quality Ratings of Included Randomized Controlled Trials of Interventions for Speech and Language Delay and Disorders From the 2006 Review

Study	Randomization	Blinding of assessors	Similarities at baseline	Explanation of withdrawals	Discounting in analysis of missing values	Degree of attrition	Intention to treat analysis	Power	Description of eligibility criteria	USPSTF quality rating
Almost et al, 1998[134]	A	A	A	A	A (last known scores used)	C (0.15)	A (I to T)	A	A	Fair
Fey et al, 1993[226]	B	A	C (mother's education)	A	C	A (0.03)	B	B	A	Poor
Fey et al, 1994[227]	B	C	A	A	A (none)	A (none)	B	B	A	Poor
Fey et al, 1997[228]	B	A	A	A	C	A (0.06)	B	B	A	Poor
Gibbard, 1994 Study 2[136]	B	B	A	A (none)	A (none)	A (none)	B	B	A	Poor
Gibbard, 1994 Study 1[136]	B	B	A	A (none)	A (none)	A (none)	B	B	A	Fair
Girolametto et al, 1996[137]	B	A	A	A (none)	A (none)	A (none)	B	B	A	Fair
Girolametto et al, 1996[229]	B	A	C (behavior)	A (none)	A (none)	A (none)	B	B	A	Poor
Girolametto et al, 1997[138]	B	A	A	A (none)	A (none)	A (none)	B	B	A	Fair
Glogowska et al, 2000[135]	A	A	A	A	C	A (0.03)	A (I to T)	C	A	Good
Glogowska et al, 2002[230]	A	B	B	C	B	B	B	B	C	Poor
Mulac et al, 1977[231]	B	A	B	B	B	B	B	B	B	Poor
Robertson et al, 1997[140]	A	B	A	A	B	A (none)	B	B	A	Fair
Robertson et al, 1999[139]	B	B	A	A	C	C (0.13)	B	B	A	Fair
Rvachew, 1994[232]	B	A	A	B	C	C (0.13)	B	B	A	Poor
Schwartz et al, 1985[233]	B	C	B	B	B	B	B	B	A	Poor
Shelton et al, 1978[141]	B	B	A	A	C	A (0.08)	B	B	A	Fair

Appendix D Table 1. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2)

Author, Year	Screener(s)	Goal	Inclusion criteria	Exclusion criteria	Study design	Study description	Study duration
Frisk et al, 2009[72]	ASQ communication domain; Battelle Developmental Inventory Screening Test; Brigance Preschool Screen; Early Screening Profiles	To determine how well four extensively used American-normed screening tests identify Ontario preschoolers with language delays	Children in infant and child care development programs who did not meet exclusion criteria	Legally blind; profoundly hearing impaired; severe global developmental delay; ESL with less than 19 months daily exposure to English; autism spectrum disorder diagnosis	Other	Prospective followup of screened group	Mean length = 9.9 months
Guiberson and Rodriguez, 2010[73]	Spanish ASQ communication domain; translated pilot version of the CDI-III (Pilot Inventario-III)	To determine the relationship between Spanish ASQ, Pilot INV-III, and PLS-4 and the accuracy of the Spanish ASQ Communication and Pilot INV-III for detecting expressive language delays	Families speaking only or mostly Spanish; normal hearing; no known neurological impairment; children speaking only or mostly Spanish; lack of severe phonological impairment	NR	Other	Prospective followup of screened group	7-10 days
Guiberson et al, 2011[74]	Spanish ASQ communication domain; Spanish adapatation of CDI Words and Sentences Short-form (Inventarios del desarrolo de habilidades comunicativas: palabras y enuciados [INV-II]), M3L; demographic and developmental questionnaire test (SPLS)	To determine if toddler-age Spanish-speaking children with expressive language delays can be accurately detected with parent-report screening tools	Families speaking only or mostly Spanish; normal hearing; no known neurological impairment; children speaking only or mostly Spanish; either TD or ELD	NR	Other	Cohort followup	7-10 days
Heilmann et al, 2005[75]	CDI-WS	To determine the validity of the CDI-WS in characterizing language skills of 30-month-old toddlers who were initially identified as late talkers at 24 months	Study 1 & 2: monolingual English-speaking home; score within normal range on Denver II for general development; exhibit normal hearing; demonstrate normal oral and speech motor abilities	NR	Other	2 studies: prospective followup	6 months

Appendix D Table 1. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2)

Author, Year	Screener(s)	Goal	Inclusion criteria	Exclusion criteria	Study design	Study description	Study duration
Rigby and Chesham, 1981[86]	Screen: Picture cards and spontaneous sentence Test: Renfrew and Reynell Test, Edinburgh Articulation Test	To analyze usefulness of screening for speech and language capabilities	Children attending school entrant medical examinations	Already attending a speech therapist	Other	Group screened then tested	NA
Sachse and Von Suchodoletz, 2008[76], 2009[77]	German version of the CDI toddler form called the ELFRA-2	To compare accuracy and diagnostic power of parent-report measure of language delay with that of direct assessment of language abilities. Both concurrent and predictive validity assessed	Monolingual German-speaking home; no evidence of autism or any general medical disorders	Poor vision; hearing impairment; abnormal result on hearing screening; missing subtests	Other	Prospective followup of screened group	Assessment following screening and 1 year later
Westerlund et al, 2006[78]	G1: SCS18, derived from MacArthur CDI G2: Traditional 18-month assessment: child's use of at least 8 words and understanding of more	To evaluate SCS18 (a parent-report measure based on the CDI) in accuracy of prediction of child's later performance at 3 years as well as in comparison with traditional 18-month method	Children invited to come to Child Health Care centers based on the national population register of the region. All had Swedish as their primary language	NR	RCT cluster	2 groups of practices, one in which the new screening instrument is used	18 months
Wetherby et al, 2003[88]	Infant-Toddler Checklist (from the CSBS)	To screen for prelinguistic delays	Children in a longitudinal study recruited from announcements, health care providers, and childcare providers; 3% were served by IDEA Part C. Demographically diverse and representative of the community.	NR	Other	Diagnostic validity	NA

Author, Year	Funding source	Diagnosis or objective of screening	Overall age	% Female	% Race/Ethnicity	Comments
Frisk et al, 2009[72]	Central West Region Ministry for Children and Youth; Infant and Child Development Services Durham	Language delays	Mean age at screening (SD): 54 months (0.6) Mean age at reference test (SD): 63.9 months (2.8)	32.10%	NR	NA
Guiberson and Rodriguez, 2010[73]	American Speech-Language-Hearing Association; University of Northern Colorado	ELD	Total: 29.42 months (SD, 3.70) G1: ELD G2: TD G1: 23 G2: 22	50% G1: 45.4% G2: 53.8%	All identified as Hispanic and Mexican	NA

Appendix D Table 1. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2)

Author, Year	Funding source	Diagnosis or objective of screening	Overall age	% Female	% Race/Ethnicity	Comments
Guiberson et al, 2011[74]	NR	Expressive language delay	Total: 29.42 months (SD, 3.70) G1: ELD G2: TD G1: 29 (3.61) G2: 29.86 (3.83)	G1: 39.1% G2: 63.6%	All identified as Hispanic and Mexican	
Heilmann et al, 2005[75]	NIDCD	Screening for late talkers	24 months at baseline; 30 months at followup	Study 1: 32% Study 2: NR	Study 1 White: 94.7% African American: 2.6% Biracial: 2.6% Study 2 White: 93% African American: 2% Asian: 1% Biracial: 4%	NA
Rigby and Chesham, 1981[86]	NR	Usefulness of screener	Mean age NR, but ~4.5 years	NR	NR	NR
Sachse and Von Suchodoletz, 2008[76], 2009[77]	NR	Screening study for late talking (language delay)	24 months (N=3) 25 months (N=95) 26 months (N=19)	Total: 33% G1: 26% G2: 43%	NR	Mean developmental age: about 1 month lower in LT group
Westerlund et al, 2006[78]	Origin of Man, Language and Languages Eurocores; Anna Ahlstrom and Ellen Terserus Foundation; Gillbergska Foundation; University of Gavle	Screening for children who will be “severely language disabled”	18 months at baseline; 3 years at followup	Total: 47.8% G1: 49% G2: 46.9%	NR	NA
Wetherby et al, 2003[88]	U.S. Department of Education, Office of Special Education and Rehabilitation and Institute of Education Sciences	To screen for prelinguistic delays	12 to 24 months; divided into a younger group (n=151) of 12 to 17 months (M, 14.0 [SD, 1.8]) and older group (n=81) of 18 to 24 months (M, 20.4 [SD, 1.8])	NR	66% Caucasian 28% African American 4% Other 5% Hispanic	NA

Appendix D Table 2. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2): Intervention Characteristics

Author, Year	Screening and comparators	Intervention between screening and diagnosis	Description of intervention/screening	Fidelity or adherence to treatment	Does the study examine modifying effects of any demographic or other patient characteristics?	Country	Recruitment setting
Frisk et al, 2009[72]	ASQ; BDIST; BPS; ESP	NA	Screens: ASQ: Set of parent-report questionnaires for children 2-60 months of age. Communication domain, assessing expressive language skills: sentence length, child's ability to express knowledge in sentences; production of appropriate grammar; 6 questions at each of the age levels. BDIST: Communication scale: 18 items, separate scores for receptive and expressive language. Receptive: child's ability to follow instructions; comprehension of specific aspects of grammar. Expressive: sentence length and production of specific grammatical structures. BPS: Children ages 3 years 9 monthss to 4 years 8 months. Understanding Reading Composite: 2 items: child's ability to point to different colors and body parts. Expressive Language Composite: 4 items: child's expressive vocabulary, short-term verbatim memory for sentences, production of specific aspects of grammar, expression of knowledge. ESP: Language scale. Verbal concept scale: 25 vocabulary items. Reference tests: PLS-4: Gold standard. 130 items; Auditory Comprehension, Expressive Comprehension. BBCS-R: Gold standard measure of verbal concept knowledge for children age 2 years 6 months to 7 years 11 months. 11 scales assessing 308 concept words.	NA	No	Canada	5 Infant and Child Development Programs
Guiberson and Rodriguez, 2010[73]	Spanish ASQ communication domain; Spanish CDI-III (Pilot Inventario-III)		Screen: Spanish translation of ASQ communication subscale: parent survey with 6 questions. Spanish translation of CDI-III (Pilot INV-III): vocabulary checklist of 100 items, 12 questions on sentence usage, 12 yes/no questions about language usage; completed by parent Cronbach's alpha: vocabulary: 0.92; sentences: 0.95; usage: 0.94. Diagnostic test:	NA		US	Two Head Start programs, a regional early childhood program, and a medical clinic in the western US

Appendix D Table 2. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2): Intervention Characteristics

Author, Year	Screening and comparators	Intervention between screening and diagnosis	Description of intervention/screening	Fidelity or adherence to treatment	Does the study examine modifying effects of any demographic or other patient characteristics?	Country	Recruitment setting
			PLS-4 Spanish-language: Direct assessment measuring receptive and expressive language skills (expressive used to test classification accuracy). Split-half internal consistency ranged from 0.80 to 0.90 (n=575). Test-retest reliability ranged from 0.77 to 0.86.				
Guiberson et al, 2011[74]	Screen: Spanish ASQ; Spanish translation of CDI Short-form: Inventarios del desarrolo de habilidades comunicativas: palabras y enuciados (INV-II). Mean of three longest reported utterances (M3L) Test: SPLS-4	NA	Screen: Spanish ASQ communication subscale: Parent survey to screen development of communication, 6 questions. Internal consistency on ASQ entire scale (not subscale): Interrater reliability: 0.94 Test-retest: 0.94 Short-form INV-II: Spanish version of MacCarthur CDI Words and Sentences: 100 productive vocabulary checklist and a question about combining words M3L-W: Asks parents to write down 3 longest sentences that they heard their child say. Correlation with parents' report of vocabulary: r=0.63 Diagnostic test: SPLS-4: Spanish edition of PLS-4: Comprehensive language test of receptive and expressive language skills; part of criteria that identified children with ELD. Administered by bilingual SLP. Test-retest: 0.73 to 0.97 Split-half internal consistency correlation: 0.83 to 0.87	NA	No	US	A regional Early Head Start program and 2 Early Intervention programs for infants and toddlers with disabilities
Heilmann et al, 2005[75]	MacArthur CDI	NA	Study 1 & 2: Screen: CDI-WS: Parent-completed assessment of child's vocabulary around 24 months of age; again at 30 months Test: Two 1-hour sessions in lab; direct assessment of children at 30 months: hearing screening, Bayley Scale of Infant Development II; Arizona Articulation Proficiency Scale III; oral motor exam; parent-child language sample; Denver II; Preschool Language Scale III; examiner-child language sample	NR	No	US	University research center

Appendix D Table 2. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2): Intervention Characteristics

Author, Year	Screening and comparators	Intervention between screening and diagnosis	Description of intervention/screening	Fidelity or adherence to treatment	Does the study examine modifying effects of any demographic or other patient characteristics?	Country	Recruitment setting
Rigby and Chesham, 1981[86]	Screen: picture cards and spontaneous sentence Test: Renfrew and Reynell Test, Edinburgh Articulation Test		Screen: Children asked to state the names of familiar objects on picture cards. Second part of screening was analyzing the child's spontaneous sentence for two verbs, comprehensibility, and articulation errors. Screened by doctor. Screening designed for the trial. Test: Renfrew and Reynell Test and Edinburgh Articulation Test. Not described. Administered by speech pathologist.	NR	Parental concern	England (?)	Clinic (?)
Sachse and Von Suchodoletz, 2008[76], 2009[77]	ELFRA-2	Two moms of LT group received parent-focused language intervention program to learn language-facilitating behavior	Screen: German version of the CDI toddler form called the ELFRA-2; parent questionnaire for 2-year-old children: language and communication 3 scales: Productive Vocabulary (total number of words), Syntax, Morphology (word combinations of differing complexity) Screen-defined cutoff: LT=productive vocabulary <50 words or productive vocabulary 50-80 words and grammatical scores <cutoff (syntax <7 and morphology score <2) Time to score (done by parent prior to visit): NR Reliability: NR Diagnostic test: SETK-2 of productive and receptive language. 4 subtests including word production, sentence production, word comprehension, and sentence comprehension. Standardized for 2 groups (ages 24-29 months and 30-36 months). Delay if score below normal on 1 of 4 subtests. SETK-3/5 (1 year later): test for 3- to 5-year olds. 3 of 4 subtests (picture description, marking of plurals, sentence comprehension), delay if score below normal on any.	NA	Mother's education	Germany	Sample recruited via birth announcements in a newspaper (all reported unless parent objects); screen sent to parents to complete

Appendix D Table 2. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2): Intervention Characteristics

Author, Year	Screening and comparators	Intervention between screening and diagnosis	Description of intervention/screening	Fidelity or adherence to treatment	Does the study examine modifying effects of any demographic or other patient characteristics?	Country	Recruitment setting
Westerlund et al, 2006[78]	G1: Swedish Communication Screening at 18 months of age (SCS18) - derived from MacArthur CDI G2: Traditional 18 month assessment-child's use of at least 8 words and understanding of more	NA	Screener: Swedish Communication Screening at 18 months of age (SCS18) developed to discriminate between low-performing children, and medium- and high-performing children, for children 18 months of age. 90 common words checklist for production and understanding -subscale of 13 communicative gestures for parents to check if their child uses Administered to Parents Time to administer: NR Internal consistency: word production: α=.97; word comprehension: α=.96 test-retest reliability: word production r=.97; word comprehension r = 0.89 correlation to longer form SECDI r=.91 Internal consistency gesture scale: α=.56; test-retest reliability r=.89 Correlation to longer form SECDI r = .74 Standard screening : One question to parent about # words used and understood Diagnostic Test: Language Observation at 3 years (LO-3) based on nurse's direct and formalized observation of expressive and receptive language in children 3 years ± 2 months. Failures identified as inability of children to express themselves in 3-word sentences or show comprehension of 3/5 standardized questions that can be answered by talking/pointing at photos Time to administer: NR 95.5% identified as severely language disabled were verified by clinical examination	NA	No	Sweden	community health centers
Wetherby et al, 2003[88]	Infant-Toddler Checklist (from the CSBS)	NA	Parent Checklist; 5-10 minutes	NA	NA	United States	Public Ads, Healthcare providers, childcares, IDEA providers

Appendix D Table 2. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2): Intervention Characteristics

Author, Year	Setting of screening/ diagnostic testing	Method of patient recruitment	N Eligible	N Randomized or enrolled	N Completers	N Analyzed	Comments
Frisk et al, 2009[72]	NR	NR	NR	131	112	112	NA
Guiberson and Rodriguez, 2010[73]	Health center and preschool center	Sending flyers home to families with children enrolled in preschool programs, posting flyers in early childhood centers and medical clinic, participating in preschool family nights, Head Start community health fairs	NR	Total: 48 G1: 22 G2: 26	Total: 48 G1: 22 G2: 26	Total: 48 G1: 22 G2: 26	
Guiberson et al, 2011[74]	Early Head Start center or preschool rooms at the Early Intervention programs	Invitation from research team at centers mentioned	NR	Total: 45 G1: 23 G2: 22	Total: 45 G1: 23 G2: 22	Total: 45 G1: 23 G2: 22	
Heilmann et al, 2005[75]	Home, lab	Via birth registry; newspapers; flyers; posters at health fairs; referrals from 0-3 providers	NR - all participants for both studies were part of a larger longitudinal project of language delay	Study 1: G1: 38 Study 2: G1:38 G2: 62	Study 1: G1: 38 Study 2: G1:38 G2: 62	Study 1: G1: 38 Study 2: G1:38 G2: 62	First study consists of all late talkers and examines concurrent validity with other measures. Second study is the same group of late talkers plus other normal talkers examining sensitivity and specificity.
Rigby and Chesham, 1981[86]	Clinic (?)	Total population attending clinic for school entrant medical examinations	NR	438	438	438	NA
Sachse and Von Suchodoletz, 2008[76], 2009[77]	Screener: mailed to parents-self report Diagnostic test: quiet room in outpatient department of hospital during 2 1-hour sessions, following screening and one year later.	Birth announcement in a newspaper that prints these unless parent objects	Sent screener to 1490; return rate (71%): N=1056 Included: N=932 who were monolingual Based on screener eligible includes: G1: LT: 154 G2: TLD: 109 (random selection)	N=117 G1:LT: 70 G2:TLD: 47	N=117 G1:LT: 70 G2:TLD: 47 1 year later: N=102 G1: LT: 59 G2: TLD: 43	Age 2 (post screening): 117 Age 3 (1 yr later): 102	Other: Nonverbal measure of cognitive functioning and hearing screening measured at 2 years -

Appendix D Table 2. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2): Intervention Characteristics

Author, Year	Setting of screening/ diagnostic testing	Method of patient recruitment	N Eligible	N Randomized or enrolled	N Completers	N Analyzed	Comments
Westerlund et al, 2006[78]	Child health care centers	Cluster sampling: half of clinics in county were selected for screener, other half for traditional screening	NR	G1: 1,145 G2: 1,519	18 mos: G1: 1,021 G2: 1,312 3 Yrs: G1: 891 G2: 1,189	G1: 891 G2: 1,189	
Wetherby et al, 2003[88]	Research lab	Ads for a longitudindal study of child language	392 children completed a Checklist and some were asked to return for a Behavior Sample: all who were <1 SD below mean, a comparable number of randomly selected children beween 16 and 50th percentile and another comparable number of randomly selected who were between 50 and 99th percentile. 80% of those invited came in. This study is comprised of the 232 whose parents completed both the Checklist and the Behavior Sample within 2 months. 12-17 mos: n=151; 18-24 mos: n=81	12-17 mos: 151 18-24 mos: 81	12-17 mos: 151 18-24 mos: 81	12-17 mos: 151 18-24 mos: 81	Long term prediction 2 yrs: n = 246 3 yrs: n = 108

Appendix D Table 3. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2): Outcomes

Author, Year	Screening tool	Primary or secondary outcome	Unit of analysis	Timing of outcome measurement	Data source	N	Sensitivity of outcome results	Specificity of outcome results
Frisk et al, 2009[72]	Screen: ASQ; BDIST; BPS; ESP	To determine how well 4 extensively used American-normed screening tests identify Ontario preschoolers with language delays	Screen: parent and child test: child	Mean length follow-up= 9.9 months	Screen: child and parent test: child	131, 112 at follow-up	Compared to PLS-4 Auditory Comprehension Scale: 25th percentile, 16th percentile; respectively ASQ: 44.8; 50.0 BDIST: 51.7; 55.6 BPS: 34.5; 22.2 ESP: 31.0; 33.3 Compared to BBCS-R total test: 25th; 16th: ASQ: 48.3; 48 BDIST: 55.2; 52 BPS: 27.6; 32 ESP: 34.5; 40 Compared to PLS-4 Expressive communication scale: 25th; 16th: ASQ: 47.1; 59.1 BDIST: 91.7; 95.5 BPS: 75; 90.9 ESP: 27.8; 40.9	Compared to PLS-4 Auditory Comprehension Scale: 25th, 16th ASQ: 81.5; 79.3 BDIST: 71.6; 69.6 BPS: 90.1; 84.8 ESP: 95.1; 92.4 Compared to BCS-R Total test: 25th; 16th: ASQ: 82.7; 81.2 BDIST: 72.8; 70.6 BPS: 87.7; 99.2 ESP: 96.3; 96.5 Compared to PLS-4 Expressive Communication Scale: 25th; 16th: ASQ: 82.4; 83 BDIST: 33.8; 30.7 BPS: 79.7; 75 ESP: 95.9; 95.5
Guiberson and Rodriguez, 2010[73]	Screen: Spanish ASQ communication domain; Spanish version of CDI-III -Pilot Inventario-III	To determine the relationship between Spanish ASQ, Pilot INV-III and Preschool Language Scale (PLS-4)	Screener: parent test: child	7-10 days	Screener: parent test: child	Total: 48 G1: 22 G2: 26	ASQ: .59 Pilot INV-III: .82	ASQ: .92 Pilot INV-III: .81
Guiberson et al, 2011[74]	Screen: Spanish ASQ; Spanish version of MacArthur CDC - Short-form Inventarios del desarrolo de habilidades comunicativas: palabras y enuciados (INV-II),	To determine if toddler-age Spanish-speaking children with expressive language delays can be accurately detected with parent report	Screener: parent test: child	7-10 days	Screener: parent test: child	Total: 45 G1: 23 G2: 22	ASQ: .56 Short-form INV-II: .87 M3L-W: .91	ASQ: .95 Short form INV-II: .86 M3L-W: .86

Appendix D Table 3. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2): Outcomes

Author, Year	Screening tool	Primary or secondary outcome	Unit of analysis	Timing of outcome measurement	Data source	N	Sensitivity of outcome results	Specificity of outcome results
	M3L; demographic and developmental questionnaire	screening tools						
Heilmann et al, 2005[75]		To determine the validity of the CDI-WS in characterizing language skills of 30-month old toddlers who were initially identified as LTs at 24 months	Child and parent	6 months	Screener: parent reference standard: parent-child language samples and child assessments	Study 1: G1: 38 Study 2: G1:38 G2: 62	Sensitivity at 3 CDI cutoffs 11th percentile: .68 19th percentile: .81 49th percentile: 1.00	11th percentile: .98 19th percentile: .79 49th percentile: .44
Rigby and Chesham, 1981[86]	Screen: picture cards & spontaneous sentence Test: Renfrew and Reynell Tests, Edinburgh Articulation Test	To analyze usefulness of screening for speech and language capabilities	Child	NA	Child	438	Pass full 12 elements of articulation test only: 75.6% Pass any 10 elements of articulation test only: 46.7% Pass spontaneous sentence only: 48.9% Pass either 12 elements of articulation or spontaneous sentence: 44.4% Pass either 10 elements of articulation or spontaneous sentence: 35.6% Pass both 12 elements of articulation and spontaneous sentence: 80% Pass both 10 elements of articulation and spontaneous sentence: 62.2%	NR
Sachse and Von Suchodoletz, 2008[76], 2009[77]	ELFRA-2	Comparison of ELFRA-2 (screener) with SETK-2 and SETK-3/5	Child	Exact timing between screener and testing: NR	Screener: parent test: child	N=117 at 2 yo N=102	SETK-2: 93% SETK-3/5: 94% SETK-2 to SETK-3/5: 94%	SETK-2: 88% SETK-3/5: 61% SETK-2 to SETK-3/5: 64%

Appendix D Table 3. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2): Outcomes

Author, Year	Screening tool	Primary or secondary outcome	Unit of analysis	Timing of outcome measurement	Data source	N	Sensitivity of outcome results	Specificity of outcome results
Westerlund et al, 2006[78]	G1: Swedish Communication Screening at 18 months of age (SCS18)- derived from MacArthur CDI G2: Traditional 18 month assessment- child's use of at least 8 words and understanding of more	To evaluate SCS18 in accuracy of prediction in children's later performance at 3 years and to compare effectiveness with standard screening question	Child/ Parent	18 months after screening	Screener: parent test: child	G1: 891 G2: 1,189	G1: .50 G2: .32	G1: .90 G2: .91
Wetherby et al, 2003[88]	Infant-Toddler Checklist	NR	NR	within 2 months	Parent	151; 81	Younger sample: 88.7% Older sample: 85.7%	Younger sample: 74.5%; Older sample: 76.9%

Author, Year	Positive predictive value	Negative predictive value	Positive likelihood ratio	Negative likelihood ratio	Other results	Receiver operator curve characteristics	Unit of analysis
Frisk et al, 2009[72]	NR	NR	ASQ (2nd ed) PLS-4 Receptive: 2.4 ASQ (2nd ed) PLS-4 Expressive: 3.0 BDIST- Receptive PLS-4 Receptive: 1.8 BDIST- Receptive PLS-4 Expressive: 5.0 BPS Receptive: 4.2 BPS Expressive: 1.5 Early Screening Profile Verbal Concepts PLS-4 Auditory: 3.0 Early Screening Profile Verbal Concepts PLS-4 Expressive: 4.5	ASQ (2nd ed) PLS-4 Receptive: 0.46 ASQ (2nd ed) PLS-4 Expressive: 0.36 BDIST- Receptive PLS-4 Receptive: 0.89 PLS-4 Expressive: 0.37 BPS Receptive: 0.12 BPS Expressive: 0.65 Early Screening Profile Verbal Concepts PLS-4 Auditory: 0.08 Early Screening Profile Verbal Concepts PLS-4 Expressive: 0.17	NA	NR	Child and parent
Guiberson and Rodriguez, 2010[73]	ASQ: .87 Pilot INV-III: .78	ASQ : .73 Pilot-INV-III: .84	Spanish ASQ : 7.7 Spanish CDI III: 4.2	Spanish ASQ: 0.44 Spanish CDI III: 0.22	Positive likelihood ratio: ASQ: 7.68 [1.93, 30.41] Pilot INV-III:4.25	NA	Screener: parent test: parent and child

Appendix D Table 3. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2): Outcomes

Author, Year	Positive predictive value	Negative predictive value	Positive likelihood ratio	Negative likelihood ratio	Other results	Receiver operator curve characteristics	Unit of analysis
					[1.88, 9.58] Negative likelihood ratio: ASQ: 0.44 [0.26, 0.74] Pilot-INV-III:0.22 [0.09, 0.55]		
Guiberson et al, 2011[74]	ASQ: .92 Short-form INV-II: .87 M3L-W: .88	ASQ: .67 Short form INV-II: .86 M3L-W: .90	Spanish ASQ:12.4 Short-form INV Spanish CDI: 6.4	Spanish ASQ: 0.46 Short-form INV Spanish CDI: 0.15	NA	INV-II: .87 M3L-W: .93	Screener: parent test: parent and child
Heilmann et al, 2005[75]	11th percentile: .96 19th percentile: .70 49th percentile: .51	11th percentile: .81 19th percentile: .89 49th percentile: .97	CDI-WS: 3.9	CDI-WS: 0.23	NA	Values not provided - only graphic presented	Screener: parent test: parent and child
Rigby and Chesham, 1981[86]	Pass full 12 elements of articulation test only: 59.7% Pass any 10 elements of articulation test only: 80.8% Pass spontaneous sentence only: 73.3% Pass either 12 elements of articulation or spontaneous sentence: 74.1% Pass either 10 elements of articulation or spontaneous sentence: 84.2% Pass both 12 elements of articulation and spontaneous	NR	Trial Speech Screening Test: 12.1	Trial Speech Screening Test: 0.21	Accuracy: Pass full 12 elements of articulation test only: 92.2% Pass any 10 elements of articulation test only: 93.4% Pass spontaneous sentence only: 92.9% Pass either 12 elements of articulation or spontaneous sentence: 92.7% Pass either 10 elements of articulation or spontaneous sentence: 92.7% Pass both 12 elements of articulation and	NR	NA

Appendix D Table 3. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2): Outcomes

Author, Year	Positive predictive value	Negative predictive value	Positive likelihood ratio	Negative likelihood ratio	Other results	Receiver operator curve characteristics	Unit of analysis
	sentence: 58.1% Pass both 10 elements of articulation and spontaneous sentence: 68.3%				spontaneous sentence: 92% Pass both 10 elements of articulation and spontaneous sentence: 93.2%		
Sachse and Von Suchodoletz, 2008[76], 2009[77]	SETK-2: 91% SETK-3/5: 56% SETK-2 to SETK-3/5: 58%	SETK-2: 89% SETK-3/5: 95% SETK-2 to SETK-3/5: 96%	ELFRA-2: 7.3	ELFRA-2: 0.08	Predictive validity of ELFRA-2 and SETK-2 with SETK-3/5 TLD at 2 & normal at 3 ELFRA-2: 95% SETK-2: 96% LT at 2 and below normal at 3: ELFRA-2: 56% SETK-2: 58%	NA	NA
Westerlund et al, 2006[78]	G1: .18 G2: .14	G1: .98 G2: .96	SCS18: 4.8	SCS18: 0.56	NA	NA	NA
Wetherby et al, 2003[88]	Younger sample: 65.3% Older sample: 80%	Younger sample: 92.4% Older sample: 83.3%	Younger sample: 3.5 Older sample: 3.7	Younger sample: 0.15 Older sample: 0.19	Prevalence Younger sample: 35% Older sample: 52%	NR	NR

Appendix D Table 3. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2): Outcomes

Author, Year	Timing of outcome measurement	Data source	N	Results	Subgroup(s)
Frisk et al, 2009[72]	Mean age at screening (SD): 54 months (.6) Mean age at test (SD): 63.9 months (2.8)	Child and parent	131, 112 at follow-up	PLS-4 Auditory Comprehension based on ROC curve cutoff: Sensitivity (25th, 16th): ASQ: 58.6; 66.7 BDIST: 93.1; 55.6 BPS: 48.3; 61.1 ESP: 93.1; 94.4 Specificity (25th, 16th): ASQ: 75.3; 72.8 BDIST: 37; 69.6 BPS: 85.2; 59.8 ESP: 74.1; 68.5 Bracken based on ROC curve: Sensitivity (25th, 16th) ASQ: 82.8; 84 BDIST: 75.9; 76 BPS: 41.4; 58 ESP: 86.2; 80 Specificity (25th, 16th): ASQ: 67.9; 65.9 BDIST: 59.3; 57.6 BPS: 82.7; 83.5 ESP: 74.1; 85.9 PLS-4 Expressive Communication based on ROC curve: Sensitivity (25th; 16th): ASQ: 58.3; 72.7 BDIST: 50; 68.2 BPS: 75; 90.9 ESP: 69.4; 86.4 Specificity: ASQ: 78.4; 76.1 BDIST: 97.8; 86.4 BPS: 83.8; 78.4 ESP: 85.1; 80.7	NR
Guiberson and Rodriguez, 2010[73]	Screeners done at home and test given 7-10 days later	Screener: parent test: child (observed by SLP)	Total: 48 G1: 22 G2: 26	NA	NR
Guiberson et al, 2011[74]	Screeners done at home and test given 7-10 days later	Screener: parent test: child (observed by SLP)	Total: 45 G1: 23 G2: 22	Short-form INV-II: .87 M3L-W: .93	NR

Appendix D Table 3. Evidence Table for Screening for Speech and Language Delay in Children (KQ 2): Outcomes

Author, Year	Timing of outcome measurement	Data source	N	Results	Subgroup(s)
Heilmann et al, 2005[75]	Screened at 24 months; tested at 30 months	Screener reported by parent; test child observed by ASHA examiners and reports by parents	Study 1: G1: 38 Study 2: G1:38 G2: 62	NA	NR
Rigby and Chesham, 1981[86]	NA	NA	NA	NA	NR
Sachse and Von Suchodoletz, 2008[76], 2009[77]	NA	NA	NA	NA	Less educated mom related to lower score on vocab subscale of parent report and word production subscale of language test but no assoc was found in relation to accuracy of judgment
Westerlund et al, 2006[78]	NA	NA	G1: 891 G2: 1,189	G1 (SE): word production: .765 (.044) word comprehension: .658 (.049) communicative gestures: .617 (047) combined: .716 (.044)	NR
Wetherby et al, 2003[88]	2 years; 3 years	Child Assessment	246	2 years Sensitivity: 80.5% Specificity: 79.3% 3 ys Sensitivity: 83.3% Specificty 70.2%	NR

ASHA = American Speech-Language-Hearing Association; ASQ = Ages & Stages Questionnaire; assoc = association; BBCS-R = Bracken Basic Concepts Scale-Revised; BDIST = Battelle Developmental Inventory Screening Test; BPS = Brigance Preschool Screen; CDI = Communicative Development Inventory; CDI-III = Communicative Development Inventory Part 3; CDI-WS = Communicative Development Inventory Words and Sentences; dx = diagnosis; ELD = expressive language delay; ELFRA-2 = Elternfragebogen fur die Fruberkennung von Riskokindern; ESL = English as a Second Language; ESP = Early Screening Profile; f/u = followup; G = group; INV-II = Inventario II; INV-III = Inventario III; LT = late talker; M = mean; M3L = 3 longest utterances; mo = month; N = number; NA = not applicable; NICHD = National Institute of Child Health and Human Development; NIDCD = National Institute on Deafness and Other Communication Disorders; NR = not reported; NRCT = nonrandomized controlled trial; PLS = Preschool Language Scale; RCT = randomized controlled trial; ROC = receiver operating characteristic; SCS18 = Swedish Communication Screening at 18 months of age; SD = standard deviation; SE = standard error; SETK-2 = Sprachentwicklungstest fur sweijahrige slindes; SETK-3/5 = Sprachentwicklungstest fur dreibis funfjahrige kinder; SPLS-4 = Spanish-version Preschool Language Scale; TD = typical development; TLD = typical language development; yo = years old; yr = year.

Appendix D Table 4. Evidence Table for Interventions for Speech and Language Delay and Disorders From the 2006 Review

Author, Year, Title	Objectives	Area of intervention	Setting	N	Subjects
Almost, 1998[134]*† *Effectiveness of speech intervention for phonological disorders: a randomized controlled trial*	To examine effectiveness of treatment for children with severe phonological disorders as typically seen in an ambulatory care speech-language pathology clinic in a community hospital	Phonology	Speech and language pathology department clinic in a community hospital in SW Ontario, Canada Assessment from 5/93 to 5/94	26	*Group 1:* mean age 42.5 months (33-61) Male: 12 Female: 1 *Group 2:* mean age 41.4 months (33-55) Male: 9 Female: 4
Gibbard, 1994[136]*† Study 1 *Parental-based intervention with preschool language delayed children*	To examine the effectiveness of a parent trained intervention versus no intervention	Expressive language	Local health center where children were referred for speech and language therapy	36	Male: 25 Female: 11 Age range: 27-39 months Majority of participants in social classes I, II, or III Mean mother age: 30 Mean father age: 33
Girolametto, 1996[137]*†[6] *Interactive focused stimulation for toddlers with expressive vocabulary delays*	To examine the effects of a focused stimulation language intervention on children's' vocabulary and language development	Expressive vocabulary	Children were recruited from waiting lists for parent programs offered at two agencies in metropolitan Toronto, Canada	25	Age range: 23-35 months No gender details given
Girolametto, 1997[138]† *Effects of lexical intervention on the phonology of late talkers*	To examine the impact of a focused stimulation intervention on the vocabulary, language, and emerging phonological skills of late talkers	Phonology	Children were recruited from waiting lists for parent programs offered at two agencies in metropolitan Toronto, Canada.	25	Male: 22 Female: 3 Age range: 23-35 months
Glogowska, 2000[135]† *Randomised controlled trial of community based speech and language therapy in preschool children*	To compare routine speech and language therapy against 12 months of "watchful waiting	Expressive and receptive language and phonology	16 community clinics in Bristol. Children were enrolled between December 1995 and March 1998	159	Male: 120 Female: 39 Age range: 18-42 months Just over half of the children were receiving child care. Most mothers had completed "O" level education. A minority either had no qualifications or had "A" levels
Robertson, 1997[140] Study 2 *The influence of peer models on the play scripts of children with specific language impairment*	To examine the effects of peer modeling using the same peer throughout the intervention on children with speech and language impairments	Expressive and receptive language	Children were enrolled in a language-based early childhood classroom	6	Male: 4 Female: 2 Mean age: 54 months (range 48-57 months)
Robertson, 1997[140]† Study 1 *The influence of peer models on the play scripts of children with specific language impairment*	To examine the effects of peer modeling on children with speech and language impairments	Expressive and receptive language	Children were enrolled in a language-based early childhood classroom	20	Male: 13 Female: 7 Mean age: 50 months (range 36-60 months) Mean maternal education: 14 Years

Appendix D Table 4. Evidence Table for Interventions for Speech and Language Delay and Disorders From the 2006 Review

Author, Year, Title	Objectives	Area of intervention	Setting	N	Subjects
Robertson, 1999[139]† *Effects of treatment on linguistic and social skills in toddlers with delayed language development*	To examine the effects of early language intervention on the development of late-talking toddlers	Expressive and receptive language and phonology	Children were recruited from the community and seen at a research clinic	21	Male: 12 Female: 9 Age range: 21-30 months All participants from middle class households
Shelton, 1978[141]*† Study 1 *Assessment of parent administered listening training for preschool children with articulation deficits*	To compare two parent-administered listening treatments and a control group	Articulation/ Phonology	Children were from nursery schools or pediatric offices; they were seen either at their school or in their home	60	Age range: 36-54 months Bilingual children were included with 2 in each condition

Author, Year, Title	Screening criteria/ diagnostic evaluation	Time from screen to intervention	Intervention
Almost, 1998[134]*† *Effectiveness of speech intervention for phonological disorders: a randomized controlled trial*	Severe phonological disorder as determined by the phonological deviancy score on the Assessment of Phonological Processes - Revised (AAP-R) Receptive language skills >1 SD below the mean on the Reynell Developmental Language Scales - Revised	*Group 1:* immediate treatment implied *Group 2:* 4 months	*Group 1:* 4 months treatment followed by 4 months no treatment. *Group 2:* 4 months no treatment followed by 4 months treatment. Assessments at baseline, 4, and 8 months. *Treatment:* remediation for phonological disorders. Individual 30 minute sessions 2x per week. 4-6 target phonological deviations chosen for each child at treatment cycle initiation. Each target repeated 2-3 times or until correct in conversation
Gibbard, 1994[136]*† Study 1 *Parental-based intervention with preschool language delayed children*	Vocabulary of <30 single words	Immediate	Parental administered expressive syntax intervention emphasizing how to maximize language use in everyday environment: 18 received parental intervention 18 received delayed intervention
Girolametto, 1996[137]*†[b] *Interactive focused stimulation for toddlers with expressive vocabulary delays*	Vocabulary size in the lower 5th percentile for age measured by McArthur Communicative Development Inventories (CDI)	Immediate	Parental administered expressive vocabulary intervention based on HANEN principles and adapted for focused stimulation: 12 received parent intervention 13 received delayed intervention
Girolametto, 1997[138]† *Effects of lexical intervention on the phonology of late talkers*	Vocabulary size in the lower 5th percentile for age measured by McArthur Communicative Development Inventories (CDI)	Immediate	Parental administered expressive vocabulary intervention based on HANEN principles and adapted for focused stimulation: 12 received parent intervention 13 received delayed intervention
Glogowska, 2000[135]† *Randomised controlled trial of community based speech and language therapy in preschool children*	Standardized score <1.2 SD below the mean on the auditory comprehension part of the Preschool Language Scale (PLS). Standardized score >1.2 SD below the mean on auditory comprehension, but <1.2 SD below the mean on the expressive language part of the PLS. Auditory and expressive language scores >1.2 SD below the mean but	Immediate treatment implied	Clinician administered intervention focusing on a variety of language areas: 71 received clinician intervention 88 received delayed intervention

Appendix D Table 4. Evidence Table for Interventions for Speech and Language Delay and Disorders From the 2006 Review

Author, Year, Title	Screening criteria/ diagnostic evaluation	Time from screen to intervention	Intervention
	with an error rate of at least 40% in production of fricative consonants and /or velar consonants and/or sounds occurring after a vowel among the 22 words included in the phonological analysis		
Robertson, 1997[140] Study 2 *The influence of peer models on the play scripts of children with specific language impairment*	Performance at or near 2 SD below the mean on standardized measures of receptive and expressive language; measures not reported	Immediate	Play intervention for expressive narrative language: 4 participants played with each other in pairs 2 participants were paired with a normal peer
Robertson, 1997[140]† Study 1 *The influence of peer models on the play scripts of children with specific language impairment*	Performance at or near 2 SD below the mean on standardized measures of receptive and expressive language; measures not reported	Immediate	Play intervention for expressive narrative language: 10 participants played with each other in pairs 10 participants were paired with a normal peer
Robertson, 1999[139]† *Effects of treatment on linguistic and social skills in toddlers with delayed language development*	Demonstrated significant delays in the acquisition of language measured by the Preschool Language Scale - 3 and the Bayley Scales of Infant Development (BSID-II)	<1 week	Clinician administered intervention for expressive vocabulary and syntax Child-centered approach to provide general stimulation 11 received clinician intervention 10 received delayed intervention
Shelton, 1978[141]*† Study 1 *Assessment of parent administered listening training for preschool children with articulation deficits*	Below the cutoff score for age on the Templin-Darley Articulation Screening Test	Immediate treatment implied	Parent administered speech programs Listening therapy based on auditory discrimination compared to more traditional reading and talking therapy and delayed treatment 20 received experimental listening therapy 20 received a reading and talking therapy 20 received delayed treatment

Author, Year, Title	Length of intervention	Outcome measures	Speech and language outcomes	Non-speech and language outcomes
Almost, 1998[134]*† *Effectiveness of speech intervention for phonological disorders: a randomized controlled trial*	4 months	APP-R (Assessment of Phonological Processes- Revised) score GFTA (Goldman-Fristoe Test of Articulation) score PCC (Percentage Consonants Correct) score MLU (Mean Length of Utterance) score	*4 month assessment:* Group 1- scores of phonological measures reflect improvement: APPR (p=0.05), GFTA (p=0.05), PCC (p=0.01) *8 month assessment:* Group 1- higher measures for speech intelligibility (PCC, p=0.05), but no statistically significant difference on single- word phonological skills *Expressive language measure (MLU):* no significant differences between groups at any assessment point. Group 1 had consistently higher (improved) scores than Group 2	None

Appendix D Table 4. Evidence Table for Interventions for Speech and Language Delay and Disorders From the 2006 Review

Author, Year, Title	Length of intervention	Outcome measures	Speech and language outcomes	Non-speech and language outcomes
Gibbard, 1994[136]*† Study 1 *Parental-based intervention with preschool language delayed children*	An average of 40 minutes per week over 6 months	Reynell Expressive measure Language sample 1-word scores and total scores Renfrew Action Picture Test information Mother's description of vocabulary and phrase complexity MLU (mean length of utterances) from language sample	The mean scores improved for both the experimental and the no-intervention control groups, but the experimental group had larger gains on all measures (p=0.008 for language sample one word scores and p=0.000 for all other measures)	None
Girolametto, 1996[137]*†[b] *Interactive focused stimulation for toddlers with expressive vocabulary delays*	150 minutes per week for 11 weeks	Vocabulary and phrase complexity as determined by the McArthur Communicative Development Inventories (CDI) Number of different words and utterances from a language sample Post test probes for target words Control word measures, target words in interaction, multiword utterances	Children who received treatment had larger vocabularies (p<0.02) and used a greater number of different words (p<0.01) compared to the control group. Those who received treatment used more structurally complete utterances and more multiword utterances than those in the control group (p<0.04 and p<0.01, respectively)	Mother's language interactions with child changed (language input slower, less complex, and more focused after treatment). Few words/minute p<0.01 Shorter utterances p<0.01 Used more target words and focused stimulation of target words p<0.01
Girolametto, 1997[138]† *Effects of lexical intervention on the phonology of late talkers*	11 weeks 8 2.5-hour evening sessions 3 home sessions	Different vocalization Syllable structure at level 1, 2, 3 Consonants inventory: early, middle, late Consonant position: initial and final Proportion of consonants correct	There was no difference between groups on the number of vocalizations made. Children who received treatment used Level 3 vocalizations more than the controls (p<0.01). Those that received treatment also used a greater inventory of consonants in all three classes	None
Glogowska, 2000[135]† *Randomised controlled trial of community based speech and language therapy in preschool children*	Therapy continued for an average of 10 minutes per week for 8.4 months	Preschool Language Scale (PLS): auditory comprehension and expressive language Phonological errors	Although all outcome measures were in favor of the therapy group, only one measure reached the significant level (auditory comprehension, p=0.025)	No significant difference for play level or attention level
Robertson, 1997[140] Study 2 *The influence of peer models on the play scripts of children with specific language impairment*	15 minutes per week for 3 weeks	Language sample: number of words in script, number of different words, number of play related themes	Both children in the experimental group showed significant gains in number of words used, number of different words used, and number of linguistic markers used	Both children in the experimental group showed significant increases in the number of play theme- related acts
Robertson, 1997[140]† Study 1 *The influence of peer models on the play scripts of children with specific language impairment*	20 minutes per week for 3 weeks	Language sample: number of words in script, number of different words, number of play related themes	Those in the experimental group produced significantly more words than those in the control group immediately after treatment and at follow-up (p<0.0001). The experimental group demonstrated greater verbal productivity and employed more lexical diversity than the control group. Also, the experimental group made	Play-theme related acts increased (p<0.0001) for the treatment group

Appendix D Table 4. Evidence Table for Interventions for Speech and Language Delay and Disorders From the 2006 Review

Author, Year, Title	Length of intervention	Outcome measures	Speech and language outcomes	Non-speech and language outcomes
			significantly more gains in the use of linguistic markers than the control group (p<0.0001)	
Robertson, 1999[139]† *Effects of treatment on linguistic and social skills in toddlers with delayed language development*	150 minutes per week for 12 weeks	Language sample: MLU (mean length of utterances), total number of words Parent report of vocabulary (MacArthur Communicative Developmental Inventory- Words and Sentences (CDI))	Compared to children in the control group children in the treatment group demonstrated significantly greater increases in mean length of utterances (p=0.003), the total number of words used (p=0.000), lexical diversity (p=0.000), in their reported vocabulary size (p=0.000) and percentage of intelligible utterances (p=0.000)	Treatment group had an increase in socialization skills (p=0.003) not merely reflective of the language increases; parental stress decreased (p=0.000) for the treatment group
Shelton, 1978[141]*† Study 1 *Assessment of parent administered listening training for preschool children with articulation deficits*	57 days (listening for 5 minutes per day, and reading and talking for 15 minutes per day)	Auditory association subtest of the Illinois Test of Psycholinguistic Abilities McDonald Screening Articulation test	Only the noise subtest of the Test of Auditory Discrimination showed a significant improvement for the listening and control groups compared to the reading-talking group (p=0.03). There were no other significant differences between groups	None

Appendix D Table 5. Evidence Table for Interventions for Speech and Language Delay in Children (KQs 5, 6): Patient Characteristics

Author, Year	Treatment interventions and comparators	Goal of intervention	Inclusion criteria	Exclusion criteria	Study design	Study duration	Funding source
Wake et al, 2011[128]	G1: Modified "You Make a Difference" program G2: Control group	To determine the benefits of a low intensity parent-toddler language promotion programme delivered to toddlers identified as slow to talk on screening in universal services.	We determined eligibility for the trial by a score at or below the 20th centile on the expressive vocabulary checklist, based on population norms.	Children were excluded if they had already been referred for cognitive delay, major medical conditions, or suspected autism spectrum disorder or if parents had insufficient English to complete the questionnaires (written at a year 6 level of English) or participate in the programme.	RCT Cluster	2 years	Australian National Health and Medical Research Council
Lewis et al, 2008[127]	G1: Experimental group G2: Control group	To evaluate the efficacy of telehealth delivery of the Lidcombe Program of Early Stuttering Intervention	Participants were preschool-age children who were stuttering, and their families, from around Australia. Inclusion criteria were (a) age at randomization of 3;0 to 4;6 inclusive, (b) history of stuttering longer than 6 months at randomization, (c) no previous or current treatment for stuttering, (d) history of normal development apart from stuttering, and (e) parent and child proficiency in English.	See inclusion criteria	RCT Parallel	9 months	National Health and Medical Research Council of Australia
Jones et al, 2005[126]	G1: Lidcombe program G2: Control group	Reduction of stuttering	Inclusion criteria were age at recruitment of 3-6 years, stuttering as diagnosed by using standard procedures17 and at least 2% of syllables stuttered, and proficiency in English for children and parents.	Exclusion criteria were treatment for stuttering during the previous 12 months and onset of stuttering in the 6 months before recruitment	RCT Parallel	9 months	None
Fricke et al, 2013[125]	G1: Oral language intervention G2: Waiting control group	To improve children's vocabulary, develop narrative skills, encourage active listening and build confidence in independent speaking	In each of the 15 nursery schools, about 15 children with the lowest mean verbal composite score were selected as possible participants. The verbal composite was based on z-	See inclusion criteria	RCT Parallel	30 weeks	The Nuffield Foundation

Appendix D Table 5. Evidence Table for Interventions for Speech and Language Delay in Children (KQs 5, 6): Patient Characteristics

Author, Year	Treatment interventions and comparators	Goal of intervention	Inclusion criteria	Exclusion criteria	Study design	Study duration	Funding source
			scores on screening measures (CELF Preschool IIUK Recalling Sentences and Expressive Vocabulary subtests [Semel, Wiig, & Secord, 2006]) and the Early Repetition Battery Word and Nonword Repetition subtests (Seeff-Gabriel, Chiat, & Roy, 2008). To validate this initial selection, individual language and literacy assessments were conducted with each of the children (t1; see below). The 12 children in each nursery school (N=180; Mage =4;0) with the lowest scores on a composite measure derived from the CELF Preschool IIUK subtests (Recalling Sentences, Expressive Vocabulary, Sentence Structure, and Word Structure) were selected for the trial and randomly allocated to either the intervention (N=90; 6 from each school) or waitlist control group (N=90; 6 from each school). In addition, 6 children in each school matched by gender and date of birth to a random sample of 3 children from the intervention and waitlist control group acted as a representative peer comparison group against which to benchmark the progress of children (N=82).				

Appendix D Table 5. Evidence Table for Interventions for Speech and Language Delay in Children (KQs 5, 6): Patient Characteristics

Author, Year	Treatment interventions and comparators	Goal of intervention	Inclusion criteria	Exclusion criteria	Study design	Study duration	Funding source
Yoder et al, 2005[129]	G1: Broad target recasts G2: Control	To facilitate both sentence length and speech intelligibility (i.e., broad target recast), and (b) to explore whether pretreatment speech accuracy predicted response to treatment in children with severe phonological and expressive language impairment.	Children met the following criteria establishing the presence of specific language impairment: (a) mean length of utterance (MLU) was at least 1.3 SD below chronological age expectation or a standard score of 80 or below on the expressive scale of the Preschool Language Scale-3rd edition, (b) nonverbal IQs on the Leiter International Performance Scale-Revised above 80, and (c) passing a 25 db threshold hearing screening. Additionally, children scored no higher than a T score of 37 on the Arizona Articulation Proficiency Scale to document speech accuracy impairments. Children had to have initial MLUs below 2.5, and use at least 10 different words in a 20-min language sample with an examiner. English had to be the only language spoken in the home.	Children with evidence of oral motor disorders were excluded.	RCT Parallel	14 months	Scottish Rite Foundation of Nashville, the National Institute on Deafness and Other Communication Disorders (NIDCD), and the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)
Wake, 2013[130]	G1:18 in-home sessions by "language assistant" over 1 year G2: Parents contacted and given info on local speech pathology services	Improved expressive and receptive language at 5 years	Expressive and/or receptive language scores more than 1.25 SD below normal on CELF-P2	Intellectual disability, major medical conditions, hearing loss, autism spectrum disorder, parents with insufficient English	RCT	12 months	Australian National Health and Medical Research Council

Appendix D Table 5. Evidence Table for Interventions for Speech and Language Delay in Children (KQs 5, 6): Patient Characteristics

Author, Year	Diagnosis	Overall age	% Female	% Race/ethnicity
Wake et al, 2011[128]	Children with delay in language development	Mean age at baseline (SD) G1: 13.3 (1.2) G2: 13.3 (1.1)	G1: 48 G2: 51	NR
Lewis et al, 2008[127]	Stuttering	Age 3-4 yrs [N (%)] Overall: 15 (68) G1: 5 (56) G2: 10 (76) Age 4-5 yrs [N (%)] Overall: 6 (27) G1: 3 (33) G2: 3 (23) Age 5-6 yrs [N (%)] Overall: 1 (5) G1: 1 (11) G2: 3 (23)	Overall: 64 G1: 78 G2: 54	NR
Jones et al, 2005[126]	Stuttering	N Age 3-4 years (%) Overall: 29 (54) G1: 17 (59) G2: 12 (48) N Age 4-5 years (%) Overall: 21 (39) G1: 9 (31) G2: 12 (48) N Age 5-6 years (%) Overall: 4 (7) G1: 3 (10) G2: 1 (4)	Overall: 22 G1: 24 G2: 20	NR
Fricke et al, 2013[125]	NR	Overall: 36 (4) G1: 36 (4) G2: 36 (4)	NR	NR
Yoder et al, 2005[129]	Grammatical impairments and speech intelligibility impairments	Overall age in years (SD): 3.65 (0.71) Mean age in months (SD) G1: 43.2 (9.6) G2: 44.3 (7.6)	Overall: 27%	% Euro-American: 71% % African American: 13% % Asian: 2% % Other: 12%
Wake, 2013[130]	Expressive/receptive language delay	G1: 4.2 (0.1) G2: 4.1 (0.1)	32/36	NR

Appendix D Table 6. Evidence Table for Interventions for Speech and Language Delay in Children (KQs 5, 6): Intervention Characteristics

Author, Year	Interventions and comparators	Cointerventions	Detailed description of interventions and comparator	Fidelity or adherence to treatment	Does the study examine modifying effects of any demographic or other patient characteristics?	Country
Wake et al, 2011[128]	G1: Modified "You Make a Difference" program G2: Control group	NR	Modified version of “You Make the Difference” that was shortened from 9 to 6 weekly sessions and supported by resources (guidebook, videotapes) for parents and training workshops for program leaders. Promoted child centered interaction and language modelling responsive interaction strategies. Over 6 weeks, weekly 2-hour sessions were held in the morning at a local community center with child care available. In total, 20 programmes were offered; each included 3 to 8 children and was led by 1 of 3 interventionists who had attended a 3-day Hanen training programme followed by specific training in the modified version. Parents attended the first 1.5 hours while children were supervised in an adjacent room. In each session, the group leader started by reviewing the previous week’s home practice and showing video clips of parent-child interactions to highlight previously learnt strategies; this was followed by a participative lecture. In the last 30 minutes, each parent and child pair was videotaped practicing the new strategies with coaching as needed, from which a short positive clip was drawn for the group to view the following week to reinforce specific strategies. The control group received "usual care" (not further defined).	In the intervention arm, 115 (73%) parents attended at least 1 session (mean 4.5 [SD 1.6, range 1-6]), and 90 (57%) parents attended 4 or more sessions.	NR	Melbourne, Australia

Appendix D Table 6. Evidence Table for Interventions for Speech and Language Delay in Children (KQs 5, 6): Intervention Characteristics

Author, Year	Interventions and comparators	Cointerventions	Detailed description of interventions and comparator	Fidelity or adherence to treatment	Does the study examine modifying effects of any demographic or other patient characteristics?	Country
Lewis et al, 2008[127]	G1: Experimental group G2: Control group	None	Children were treated via weekly telephone consultations with procedures as similar as possible to those in the Lidcombe Program treatment manual, including the following adaptations: regular scheduled telephone consultations, video demonstrations of speech language professionals conducting treatment replaced the individual demonstration of treatment, additional support was provided by phone or email, measures of % syllables stuttered were made from recorded speech samples, parent training was done with recorded speech samples and telephone conversations, observation and evaluation of parent implementation and treatment were based on audio recorded samples	The treating SLP established from audio recordings on a weekly basis that parents were adhering to the recommended treatment procedures and delivering contingencies as directed. The independent SLP noted the following averages per recording per parent for the 5 contingencies: acknowledgment of stutter-free speech, 19; praise for stutter-free speech, 25; request for self-evaluation of stutter-free speech, 3.5; acknowledgment of stuttering, 1.3; and request for self-correction for stuttering, 4.5. This indicates that parents were delivering all the program contingencies and with a high ratio of reinforcement to punishment, as stipulated in the program manual.	No	Australia
Jones et al, 2005[126]	G1: Lidcombe Program G2: Control group	Children in the control arm could receive treatment during the trial at other clinics, provided it was not the Lidcombe Program	G1: Children allocated to the Lidcombe Program arm received treatment according to the program manual. Throughout the program, parents provide verbal contingencies for periods of stutter-free speech and moments of stuttering. The program is conducted under the guidance of a speech pathologist. During the first stage, a parent conducts treatment for prescribed periods each day, and parent and child visit the speech pathologist once a week.	4 children in the control arm received some Lidcombe Program treatment and 1 child allocated to the intervention group received only 3 weeks of treatment	Yes: tx site, sex, age, family history of recovery, baseline severity in % syllables stuttered	New Zealand

Appendix D Table 6. Evidence Table for Interventions for Speech and Language Delay in Children (KQs 5, 6): Intervention Characteristics

Author, Year	Interventions and comparators	Cointerventions	Detailed description of interventions and comparator	Fidelity or adherence to treatment	Does the study examine modifying effects of any demographic or other patient characteristics?	Country
			The second stage starts when stuttering has been maintained at a frequency of <1.0% of syllables stuttered over 3 consecutive weeks inside and outside the clinic and is designed to maintain those low levels. Treatment is withdrawn, and the frequency of clinic visits decreases over a period of at least 1 year, providing stuttering remains at <1.0% of syllables stuttered. G2: Children did not receive treatment as part of the study; they could receive treatment at other clinics during the trial, provided it was not the Lidcombe Program			
Fricke et al, 2013[125]	G1: Oral language intervention G2: Waiting control group	NR	G1: Children allocated to the intervention group took part in a 30-week intervention program delivered by teaching assistants selected by their nursery/school. The first 10 weeks involved 3 15-min group sessions (2-4 children per group) per week delivered in preschool. Once children entered school, this increased to 3 30-min sessions plus 2 15-min individual sessions. G2: Waiting group received no additional teaching during the study	NR	NR	UK
Yoder et al, 2005[129]	G1: Broad target recasts G2: Control	NR	Children in the broad target recasts (BTR) group received 3 30-min treatment sessions per week for 6 months. Children in the control group were free to participate in community-based treatments but were not provided BTR.	Children assigned to the BTR group attended an average of 74 treatment sessions (SD=5.6). Only 1 participant did not meet the attendance criterion for BTR after enrolling in the study (missed treatment in excess of 9 sessions).	Yes; percent consonants correct at baseline; raw score on the Arizona Articulation Proficiency Scale	US

Appendix D Table 6. Evidence Table for Interventions for Speech and Language Delay in Children (KQs 5, 6): Intervention Characteristics

Author, Year	Interventions and comparators	Cointerventions	Detailed description of interventions and comparator	Fidelity or adherence to treatment	Does the study examine modifying effects of any demographic or other patient characteristics?	Country
Wake, 2013[130]	G1:18 in-home sessions by "language assistant" over 1 year G2: Parents contacted and given info on local speech pathology services	NR	18 in-home 1-hour targeted sessions in 3 blocks of weekly for 6 weeks with 6 weeks no intervention between blocks; trained language assistant	10 language assistants trained with 1-day workshop, individual 2-hour training with head SLP, observed on 2 occasions, ongoing guidance of 0.5 hr per week by SLP	Yes: type of delay (expressive vs. receptive), nonspecific vs. specific language delay (per IQ test), and maternal education level	Melbourne, Australia

Author, Year	Recruitment setting	Intervention setting	Method of patient recruitment	N Eligible	N Randomized or enrolled	N Completers	N Analyzed
Wake et al, 2011[128]	Maternal and child health center	Parents administered intervention in the home, following training sessions at local community centers	All newborn infants in Melbourne were allocated to a local maternal and child health nurse who provided developmental care to age 5 years. Nurses preidentified all infants born in May to October 2006 (Banyule, Kingston) or June to December 2006 (Frankston) and, at their 12 month visit (or by mail if they did not attend), ascertained interest in the trial. The research team then contacted interested families and mailed baseline questionnaires and written informed consent forms. Parents consented simultaneously to the baseline survey and entry into the trial if subsequently eligible. At 18 months, the research team mailed recruited parents the screening expressive vocabulary and behaviour checklists.	Overall: 1451 G1: NR G2: NR	Overall: 301 G1: 158 G2: 143	G1: 140 G2: 127	G1: 140 G2: 127
Lewis et al, 2008[127]	Trial was advertised in the press and interested parents were invited to inquire via telephone	Home	Interested patients were invited to telephone the study team	Overall: 37 G1: NR G2: NR	Overall: 22 G1: 9 G2: 13	G1: 8 G2: 10	G1: 8 G2: 10
Jones et al, 2005[126]	Clinic	Clinic	Patients consisted of preschool children who presented to the speech clinics for treatment	Overall: 134 G1: NR G2: NR	G1: 29 G2: 25	G1: 27 G2: 20	G1: 27 G2: 20
Fricke et al, 2013[125]	School	School	Screening was conducted in all children entering 19 nursery schools in the UK; children with the lowest mean composite verbal scores were selected as possible participants	Overall: 229 G1: NR G2: NR	G1: 90 G2: 90	G1: 83 G2: 82	G1: NR G2: NR

Appendix D Table 6. Evidence Table for Interventions for Speech and Language Delay in Children (KQs 5, 6): Intervention Characteristics

Author, Year	Recruitment setting	Intervention setting	Method of patient recruitment	N Eligible	N Randomized or enrolled	N Completers	N Analyzed
Yoder et al, 2005[129]	NR	CND	NR	G1: 33 G2:31	G1:26 G2: 26	G1: 25 G2: 26	G1: NR G2: NR
Wake, 2013[130]	Local government areas (LGAs)	Home	Mail	G1:123 G2:143	G1:99 G2:101	G1:93 G2:91	G1:93 G2:91

Appendix D Table 7. Evidence Table for Interventions for Speech and Language Delay in Children (KQ 5): Outcomes

Author, Year	Treatment interventions and comparators	Primary outcomes of interest	Speech	Unit of analysis	Timing of outcome measurement	Data source	N	Results
Wake et al, 2011[128]	G1: Modified "You Make a Difference" program G2: Control group	Vocabulary, expressive communication, auditory comprehension, sentence use, language use/complexity	No	NA	NA	NA	NA	NA
Lewis et al, 2008[127]	G1: Experimental group G2: Control group	% syllables stuttered	Yes	NA	9 months after randomization	Parents recorded samples of their children's speech, which was sent to speech language professionals for assessment	G1: 8 G2: 10	Mean % syllables stuttered (no variance reported) At randomization G1: 6.7 G2: 4.5 9 months G1: 1.1 G2: 1.9 Between-group difference (95% CI): -69 (13, 89) P: 0.04 Adjusted between-group difference: 73 (25, 90) % decrease in syllables stuttered at 9 months by participant G1: P1: 97 P2: 36 P3: 89 P4: 88 P5: 96 P6: 100 P7: 37 P8: 89 G2: P1: 82 P2: 25 P3: -41 P4: 70 P5: 39 P6: 76 P7: 79 P8: 71 P9: 88 P10: 38

Appendix D Table 7. Evidence Table for Interventions for Speech and Language Delay in Children (KQ 5): Outcomes

Author, Year	Treatment interventions and comparators	Primary outcomes of interest	Speech	Unit of analysis	Timing of outcome measurement	Data source	N	Results
Jones et al, 2005[126]	G1: Lidcombe program G2: Control group	% syllables stuttered	Yes	NA	Before randomization and at 9 months	Data was collected from recorded speech samples collected by parents	G1: 27 G2: 20	% of syllables stuttered before randomization [mean (SD)] G1: 6.4 (4.3) G2: 6.8 (4.9) % of syllables stuttered at 9 months G1: 1.5 (1.4) G2: 3.9 (3.5) Between-group difference in % syllables stuttered: 2.3 95% CI: 0.8 to 3.9 P: 0.03
Fricke et al, 2013[125]	G1: Oral language intervention G2: Waiting control group	Grammar and language	No	NA	NA	NA	NA	NA
Yoder et al, 2005[129]	G1: Broad target recasts G2: Control	Mean length of utterance, intelligibility	Yes	NA	14 months	Study team	G1: 25* G2: 26	Growth in intelligibility over time for both groups: F (1.77, 50)=10.89; p <0.001; η2=0.24 no statistically significant differences between groups p-value >0.38
Wake, 2013[130]	G1:18 in-home sessions by "language assistant" over 1 year G2: Parents contacted and given info on local speech pathology services	Standardized measures of expressive and receptive language	NA	NA	NA	NA	NA	NA

*Not sure if the 1 drop-out was included in analysis.

Author, Year	Language	Unit of analysis	Timing of outcome measurement	Data source	N	Results	Subgroup
Wake et al, 2011[128]	Yes	NA	6 months post-randomization (12 weeks post-program); 18 months post-randomization	Parents and trained research assistants	Unadjusted 6 months G1: 135-140 G2: 133-134 18 months G1: 103-133 G2: 100-124 Adjusted 6 months G1: 119-125	MCDI Vocabulary raw score [mean (SD)] 6 months G1: 34.5 (22.4) G2: 34.4 (23.4) Unadjusted mean difference: 0.1 Adjusted mean difference (95% CI): 2.1 (-3.0 to 7.2) P: 0.42 18 months G1: 53.5 (27.9) G2: 51.4 (25.2)	NR

Appendix D Table 7. Evidence Table for Interventions for Speech and Language Delay in Children (KQ 5): Outcomes

Author, Year	Language	Unit of analysis	Timing of outcome measurement	Data source	N	Results	Subgroup
					G2: 121-122 18 months G1: 89-116 G2: 91-112	Unadjusted mean difference: 2.1 Adjusted mean difference (95% CI): 4.1 (-2.3 to 10.6) P: 0.21 EVET expressive vocabulary standard score [mean (SD)] 18 months G1: 100.5 (15.6) G2: 101.6 (12.0) Unadjusted mean difference: -1.1 Adjusted mean difference (95% CI): -0.5 (−4.4 to 3.4) P: 0.80 PLS expressive communication standard score [mean (SD)] 6 months G1: 90.4 (12.9) G2: 90.1 (11.2) Unadjusted mean difference: 0.3 Adjusted mean difference (95% CI): 1.2 (-1.6 to 4.0) P: 0.41 18 months G1: 97.7 (16.1) G2: 100.7 (14.0) Unadjusted mean difference: -3.1 Adjusted mean difference (95% CI): -2.4 (-6.2 to 1.4) P: 0.21 PLS auditory comprehension standard score [mean (SD)] 6 months G1: 88.8 (15.2) G2: 88.9 (14.3) Unadjusted mean difference: -0.1 Adjusted mean difference (95% CI): 1.4 (-2.2 to 5.0) P: 0.44 18 months G1: 96.1 (17.5) G2: 97.0 (14.7) Unadjusted mean difference: -0.8 Adjusted mean difference (95% CI): -0.3 (-4.2 to 3.7) P: 0.90 MCDI sentence use raw score [mean (SD)] 18 months G1: 5.6 (4.1) G2: 5.7 (3.8) Unadjusted mean difference: -0.2 Adjusted mean difference (95% CI): 0.3 (-0.6 to 1.3)	

Appendix D Table 7. Evidence Table for Interventions for Speech and Language Delay in Children (KQ 5): Outcomes

Author, Year	Language	Unit of analysis	Timing of outcome measurement	Data source	N	Results	Subgroup
Wake et al, 2011[128] (cont'd)						P: 0.51 MCDI language use/complexity raw score [mean (SD)] 18 months G1: 6.7 (2.9) G2: 7.0 (2.8) Unadjusted mean difference: -0.3 Adjusted mean difference (95% CI): -0.1 (-0.9 to 0.6) P: 0.74	
Lewis et al, 2008[127]	No	NA	NA	NA	NA	NA	NR
Jones et al, 2005[126]	NA	NA	NA	NA	NA	NA	Treatment Site Sex Age Family history of recovery Baseline severity in % syllables stuttered
Fricke et al, 2013[125]	Yes	NA	Measures were taken at screening, during pretest, at 30 weeks, and 6 months later at maintenance test	CND (likely clinicians)	G1: 90 G2: 90	Grammar skills: CELF-Expressive Vocabulary At screening G1: 12.60 (6.09) G2: 12.37 (5.97) 30 weeks G1: 32.16 (10.02) G2: 27.84 (9.60) Cohen's D: .681 6 months: G1: 36.27 (8.54) G2: 32.17 (9.14) Cohen's D: .641 Grammar: CELF-Sentence Structure Pretest G1: 10.15 (4.06) G2: 10.20 (4.45) 30 weeks G1: 23.45 (5.16) G2: 22.86 (4.50) Cohen's D: .151 Vocabulary - APT information Pretest	NR

Appendix D Table 7. Evidence Table for Interventions for Speech and Language Delay in Children (KQ 5): Outcomes

Author, Year	Language	Unit of analysis	Timing of outcome measurement	Data source	N	Results	Subgroup
Fricke et al, 2013[125] (cont'd)						G1: 20.65 (6.16) G2: 21.06 (5.87) 30 weeks G1: 31.40 (4.91) G2: 29.65 (4.88) Cohen's D: .361 6 months G1: 31.37 (4.73) G2: 28.90 (5.08) Cohen's d .481 Grammar - APT grammar Pretest G1: 12.09 (5.41) G2: 14.44 (5.26) 30 weeks G1: 24.60 (5.43) G2: 22.05 (5.71) Cohen's D: .921 6 months G1: 25.11 (4.98) G2: 21.60 (5.15) Cohen's D: 1.101 Listening comprehension Pretest G1: 3.05 (2.43) G2: 3.14 (2.99) 30 weeks G1: 6.41 (3.34) G2: 5.59 (3.33) Cohen's D: .331 6 months G1: 7.57 (3.00) G2: 6.11 (2.75) Cohen's D: .571 Narrative mean length of utterance Pretest: G1: 4.28 (1.96) G2: 4.74 (1.66) 30 weeks G1: 6.81 (2.16) G2: 6.79 (1.78) Cohen's D: .271 6 months G1: 7.62 (1.95) G2: 7.81 (2.38)	

Appendix D Table 7. Evidence Table for Interventions for Speech and Language Delay in Children (KQ 5): Outcomes

Author, Year	Language	Unit of analysis	Timing of outcome measurement	Data source	N	Results	Subgroup
Fricke et al, 2013[125] (cont'd)						Cohen's D .151 Narrative number of words used Pretest G1: 50.50 (32.77) G2: 55.25 (34.80) 30 weeks G1: 102.81 (47.97) G2: 86.58 (38.57) Cohen's D: .621 6 months G1: 113.15 (44.52) G2: 101.51 (45.10) Cohen's D: .481 Narrative number of different words Pretest: G1: 12.49 (7.16) G2: 13.27 (6.93) 30 weeks G1: 26.23 (9.97) G2: 23.15 (8.85) Cohen's D: .551 6 months G1: 27.36 (8.86) G2: 24.42 (9.68) Cohen's D: .531 Reading comprehension Marginal mean group difference: 0.97, 95% CI, 0.40–1.54, z = 3.32, p = .001 with additional covariate reading accuracy: 0.91, 95% CI 0.42–1.41, z = 3.63, p < .001). Latent variable model analyses: effects of intervention: Language: immediate post-test d = .80, z = 6.57, p < .001; maintenance test d = .83, z = 2.41, p < .001), Narrative: (immediate post-test d = .39, z = 2.97; p = .003; maintenance test d = .30, z = 2.04, p = .041) Phoneme Awareness: (immediate post-test d = .49, z = 2.16, p = .031; maintenance test d = .49, z = 2.58; p = .01) Literacy: (immediate post-test d = .31; z = 1.81; p = .07; maintenance test d = .14, z = .93, p = .354)	

Appendix D Table 7. Evidence Table for Interventions for Speech and Language Delay in Children (KQ 5): Outcomes

Author, Year	Language	Unit of analysis	Timing of outcome measurement	Data source	N	Results	Subgroup
Yoder et al, 2005[129]	Yes	NA	14 months	Study team	G1: 25* G2: 26	Growth in mean language utterance (MLU) over time for both groups: F(1.43, 50) = 67.18; p < .001; η2 = .62 No statistically significant differences between groups, p-value >.38	Percent consonants correct at baseline; raw score on the Arizona Articulation Proficiency Scale
Wake, 2013[130]	NA	NA	Post-testing 12 months from initial ascertainment	Child's score on CELF-P2	200	G1: Expressive CELF-P2 score 87.5, receptive 87.6 G2: Expressive 84.6, receptive 86.5 Difference(s) between groups: expressive 2.0 (adjusted), receptive 0.6 (adjusted)	NA

*Not sure if the 1 drop-out was included in analysis.

Author, Year	Subgroup for speech outcome	Unit of analysis	Timing of outcome measurement	Data source	N	Results
Wake et al, 2011[128]	NA	NA	NA	NA	NA	NA
Lewis et al, 2008[127]	NA	NA	NA	NA	NA	NA
Jones et al, 2005[126]	Yes	NA	Before randomization and at 9 months	Data was collected from recorded speech samples collected by parents	Treatment Site: Auckland: 22 Christchurch: 25 Sex Male: 37 Female: 10 Age <4: 28 >4: 19 Family history of recovery No: 26 Yes: 21 Baseline severity in % syllables stuttered <5: 19 >5: 28	Effect size as % syllables stuttered (95% CI) Treatment Site: Auckland: 1.1 (-0.6 to 2.8) Christchurch: 3.3 (0.9 to 5.8) p: 0.15 Sex Male: 2.4 (0.6 to 4.2) Female: 2.0 (−1.6 to 5.5) p: 0.8 Age <4: 2.4 (0.1 to 4.7) >4: 2.3 (0.4 to 4.2) p: 0.9 Family history of recovery No: 3.8 (1.5 to 6.2) Yes: 0.5 (−1.6 to 2.7) p: 0.027 Baseline severity in % syllables stuttered <5: 2.1 (0.2 to 4.0) >5: 2.7 (0.5 to 4.9) p: 0.6

Appendix D Table 7. Evidence Table for Interventions for Speech and Language Delay in Children (KQ 5): Outcomes

Author, Year	Subgroup for speech outcome	Unit of analysis	Timing of outcome measurement	Data source	N	Results
Fricke et al; 2013[125]	NA	NA	NA	NA	NA	NA
Yoder et al, 2005[129]	Yes	NA	14 months	Study team	G1: 25 (not sure if the 1 drop-out was included in analysis) G2: 26	Change in intelligibility by raw score on the Arizona Articulation Proficiency Scale Intelligibility at follow-up R2: .08 t: --2.02 p: .03 Uncentered value on pretreatment variable below which the treatment groups differ: 45.63
Wake, 2013[130]	NA	NA	NA	NA	NA	NA

Author, Year	Subgroup for speech or language outcomes	Unit of analysis	Timing of outcome measurement	Data source	N	Results	Comments
Wake et al, 2011[128]	NA	NA	NA	NA	NA	NA	NA
Lewis et al, 2008[127]	NA	NA	NA	NA	NA	NA	NA
Jones et al, 2005[126]	NA	NA	NA	NA	NA	NA	Subgroup data may not be useful, as it is not broken down by treatment arm
Fricke et al, 2013[125]	NA	NA	NA	NA	NA	NA	NA
Yoder et al, 2005[129]	Yes	NA	6 months, 14 months	Study team	G1: 25 (not sure if the 1 drop-out was included in analysis) G2: 26	Change in mean length of utterance by percent consonants correct at baseline MLU at post-treatment (6 months) R2 change: .12 t: -2.06 p: .01 Uncentered value on pretreatment variable below which the treatment groups differ: 49 MLU at follow-up (14 months) R2 change: .09 t: -2.3 p: .03 Uncentered value on pretreatment variable below which the treatment groups differ: 50.86	NA
Wake, 2013[130]	NA	NA	NA	NA	NA	NA	NA

Appendix D Table 8. Evidence Table for Interventions for Speech and Language Delay in Children (KQ 6): Outcomes

Author, Year	Treatment interventions and comparators	Secondary outcomes of interest	Academic achievement	Unit of analysis	Timing of outcome measurement	Data source	N	Results
Wake et al, 2011[128]	G1: Modified "You Make a Difference" program G2: Control group	Externalizing behavior, internalizing behavior	No	NA	NA	NA	NA	NA
Lewis et al, 2008[127]	G1: Experimental group G2: Control group	NR	NA	NA	NA	NA	NA	NA
Jones et al, 2005[126]	G1: Lidcombe program G2: Control group	NR	NA	NA	NA	NA	NA	NA
Fricke et al, 2013[125]	G1: Oral language intervention G2: Waiting control group	Phonological awareness, literacy skills, and general cognitive ability	Yes	NA	Measures were taken at screening, during pretest, during mid-test 1 and 2, at 30 weeks, and 6 months later at maintenance test	CND (likely clinicians)	G1: 90 G2: 90	Alliteration matching Pretest G1: 3.72 (2.31) G2: 4.31 (2.18) 30 weeks G1: 7.17 (2.28) G2: 6.59 (2.28) Cohen's D: .521 Sound isolation Pretest G1: 0.09 (0.36) G2: 0.29 (0.87) 30 weeks G1: 5.83 (3.70) G2: 5.46 (3.56) Cohen's D .132 Segmentation, Blending, and Deletion 6 months G1: 8.42 (4.11) G2: 7.55 (4.32) Cohen's D: .212 Letter knowledge Pretest G1: 1.36 (1.70) G2: 1.35 (2.35) 30 weeks G1: 13.62 (3.68) G2: 12.50 (3.53) Cohen's D: .541 6 months G1: 27.94 (5.59) G2: 26.88 (5.60) Cohen's d: .511

Appendix D Table 8. Evidence Table for Interventions for Speech and Language Delay in Children (KQ 6): Outcomes

Author, Year	Treatment interventions and comparators	Secondary outcomes of interest	Academic achievement	Unit of analysis	Timing of outcome measurement	Data source	N	Results
Fricke et al, 2013[125] (cont'd)								Early word reading Pretest G1: 0.00 (0.00) G2: 0.03 (0.18) 30 weeks G1: 7.73 (6.34) G2: 6.68 (6.98) Cohen's D: .162 6 months G1: 11.94 (7.03) G2: 11.57 (8.73) Cohen's D: .052 Text reading accuracy (errors) 6 months G1: 8.57 (5.41) G2 :8.32 (5.84) Cohen's D: -.052 Reading comprehension 6 months G1: 4.80 (1.58) G2: 3.91 (1.83) Cohen's D: .522 Spelling At test 2 (no time specified) G1: 4.07 (5.20) G2: 5.42 (7.59) 30 weeks G1: 35.75 (18.17) G2: 31.78 (18.24) Cohen's D: .821 6 months G1: 70.86 (30.21) G2: 69.94 (32.44) Cohen's D: .351 General cognitive ability: WPPSI block design At test 1 (no time specified G1: 9.00 (2.65) G2: 8.91 (3.02)
Yoder et al, 2005[129]	G1: Broad target recasts G2: Control	NR	NA	NA	NA	NA	NA	NA

Appendix D Table 8. Evidence Table for Interventions for Speech and Language Delay in Children (KQ 6): Outcomes

Author, Year	Treatment interventions and comparators	Secondary outcomes of interest	Academic achievement	Unit of analysis	Timing of outcome measurement	Data source	N	Results
Wake, 2013[130]	G1:18 in-home sessions by "language assistant" over1 year G2: Parents contacted and given info on local speech pathology services	Health related quality of life (Peds QL and HUI3)	Yes	NA	12 months between pre and post-test	Parent	200	G1: Peds QL 76.6, HUI3 0.9 G2: Peds QL 76.4, HUI3 0.9 Difference(s) between groups: Peds QL -0.8, HUI3 -0.02

Author, Year	Behavioral competence	Unit of analysis	Timing of outcome measurement	Data source	N	Results
Wake et al, 2011[128]	Yes	NA	6 months post-randomization (12 weeks post-program); 18 months post-randomization	Parents and trained research assistants	Unadjusted 6 months G1: 135-140 G2: 133-134 18 months G1: 103-133 G2: 100-124 Adjusted 6 months G1: 119-125 G2: 121-122 18 months G1: 89-116 G2: 91-112	CBCL externalising behaviour raw score [mean (SD)] 6 months G1: 12.3 (7.8) G2: 12.0 (7.3) Unadjusted mean difference: 0.3 Adjusted mean difference (95% CI): −0.3 (−1.6 to 1.1) P: 0.71 18 months G1: 10.8 (7.9) G2: 10.7 (6.9) Unadjusted mean difference: 0.1 Adjusted mean difference (95% CI): −0.1 (−1.6 to 1.4) P: 0.86 CBCL internalising behaviour raw score [mean (SD)] 6 months G1: 5.7 (5.2) G2: 5.4 (3.9) Unadjusted mean difference: 0.3 Adjusted mean difference (95% CI): 0.1 (−0.9 to 1.1) P: 0.78 18 months G1: 6.3 (5.7) G2: 6.0 (4.6) Unadjusted mean difference: 0.2 Adjusted mean difference (95% CI): −0.1 (−1.3 to 1.2) P: 0.92
Lewis et al, 2008[127]	No	NA	NA	NA	NA	NA
Jones et al, 2005[126]	No	NA	NA	NA	NA	NA
Fricke et al, 2013[125]	No	NA	NA	NA	NA	NA
Yoder et al, 2005[129]	No	NA	NA	NA	NA	NA
Wake, 2013[130]	No	NA	NA	NA	NA	NA

Appendix E. Formulas

Formula for Calculating 95% Confidence Interval for Sensitivity
95% confidence interval = sensitivity +/- 1.96 ($SE_{sensitivity}$)
Where $SE_{sensitivity}$ = square root [sensitivity – (1-sensitivity)]/$n_{sensitivity}$)

Formula for Calculating 95% Confidence Interval for Specificity
95% confidence interval = specificity +/- 1.96 ($SE_{specificity}$)
Where $SE_{specificity}$ = square root [specificity – (1-specificity)]/$n_{specificity}$)

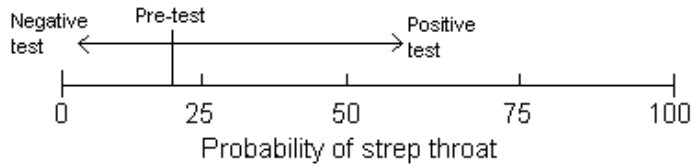
Source: Robert M. Hamm, PhD (http://www.fammed.ouhsc.edu/robhamm/cdmcalc.htm)

Derivation of Formula for Any Proportion or Probability

		pi*n =		(p/n)*n		
		(1-pi)*n =		(q/n)*n		
	The normal approximation is not trustable as pi nears 0 or 1					
Confidence interval =						
	Best estimate +/- (z for desired (1-alpha)) times (standard error of pi)					
	Best estimate is pi			pi		
	z for 95% CI, 2 tailed is			1.96		
	Standard error of pi is					
	Square root of (pq/nnn)			pq/nnn		
	Or sqrt(pi*(1-pi)/n)					
	Confidence interval =	pi	+/-	1.96	*	pq/nnn

Source: Ott L. An Introduction to Statistical Methods and Data Analysis. 3rd ed. Boston: PWS-Kent Publishing; 1988.

Likelihood Ratios
When we decide to order a diagnostic test, we want to know which test (or tests) will best help us rule-in or rule-out disease in our patient. In the language of clinical epidemiology, we take our initial assessment of the likelihood of disease ("pre-test probability"), do a test to help us shift our suspicion one way or the other, and then determine a final assessment of the likelihood of disease ("post-test probability"). Take a look at the diagram below, which graphically illustrates this process of "revising the probability of disease".



Likelihood ratios tell us how much we should shift our suspicion for a particular test result. Because tests can be positive or negative, there are at least two likelihood ratios for each test. The "positive likelihood ratio" (LR+) tells us how much to increase the probability of disease if the test is positive, while the "negative likelihood ratio" (LR-) tells us how much to decrease it if the test is negative. The formula for calculating the likelihood ratio is:

Probability of an individual **with** the condition having the test result
LR = probability of an individual **without** the condition having the test result

Thus, the positive likelihood ratio is:

Probability of an individual **with** the condition having a positive test
LR+ = probability of an individual **without** the condition having a positive test

Similarly, the negative likelihood ratio is:

Probability of an individual **with** the condition having a negative test
LR- = probability of an individual **without** the condition having a negative test

You can also define the LR+ and LR- in terms of sensitivity and specificity:

$$LR+ = \frac{\text{sensitivity}}{\text{1-specificity}}$$

$$LR- = \frac{\text{1-sensitivity}}{\text{specificity}}$$

Of course, if you're using sensitivity and specificity on a scale of 0 to 100 instead of 0 to 1, the equations would be sensitivity/(100-specificity) and (100-sensitivity)/specificity, respectively.

Let's consider an example. In a study of the ability of rapid antigen tests to diagnose strep pharyngitis, 90% of patients with strep pharyngitis have a positive rapid antigen test, while only 5% of those without strep pharyngitis have a positive test. The LR+ for the ability of rapid antigen tests to diagnose strep pharyngitis is (select one):

LR+ = 90%/5% = 18
LR+ = 95%/10% = 9.5
LR+ = 90%/95% = 0.95

Interpreting Likelihood Ratios
The first thing to realize about LR's is that an LR > 1 indicates an increased probability that the target disorder is present, and an LR < 1 indicates a decreased probability that the target disorder is present. Correspondingly, an LR = 1 means that the test result does not change the probability of disease at all! The following are general guidelines, which must be correlated with the clinical scenario.

LR	Interpretation
>10	Large and often conclusive increase in the likelihood of disease
5-10	Moderate increase in the likelihood of disease
2-5	Small increase in the likelihood of disease
1-2	Minimal increase in the likelihood of disease
1	No change in the likelihood of disease
0.5-1.0	Minimal decrease in the likelihood of disease
0.2-0.5	Small decrease in the likelihood of disease
0.1-0.2	Moderate decrease in the likelihood of disease
<0.1	Large and often conclusive decrease in the likelihood of disease

The decision to order a test is also based on our initial assessment of the likelihood of the target disorder, and how important it is to rule-in or rule-out disease. For example, a chest x-ray might have a good likelihood ratio for pneumonia. But if you believe a patient has a simple cold, this test, no matter how good the LR, probably shouldn't be ordered. It is sometimes helpful to be able to calculate the exact probability of disease given a positive or negative test. We saw that this is next to impossible using sensitivity and specificity at the bedside (unless you can do Bayes' Theorem in your head!).

Source: Ebell M, Barry H. Evidence-Based Medicine Course. Office of Medial Education Research and Development, College of Human Medicine, Michigan State University. 2008.
http://omerad.msu.edu/ebm/index.html

Appendix F Table 1. External Validity of Screening Studies

Author, Year	Screener and comparators	Study design	Is the study population broadly applicable?	Comments	Is the screener broadly applicable?	Comments
Sachse and Von Suchodoletz, 2008[76], 2009[77]	German version of the CDI Toddler form called the ELFRA-2	Prospective follow-up of screened group	Yes	Population appears to be representative of 2 year olds in one community in Germany - 71% response rate to screening	Yes	German version of CDI
Westerlund et al, 2006[78]	G1: Swedish Communication Screening at 18 months of age (SCS18) - derived from MacArthur CDI G2: Traditional 18 month assessment- child's use of at least 8 words and understanding of more	RCT Cluster	Yes	Population is representative of 18 month olds in Sweden	Yes	Swedish version of CDI
Heilmann et al, 2005[75]	Communicative Development Inventory Words and Sentences (CDI-WS)	Other	Yes	NA	Yes	NA
Guiberson et al, 2011[74]	Screen: Spanish version of Ages and Stages Questionnaire (Spanish ASQ); Spanish version of MacArthur CDC - Short-form Inventarios del desarrolo de habilidades comunicativas: palabras y enuciados (INV-II), Mean of three longest reported utterances (M3L); demographic and developmental questionnaire	0	Yes	Spanish speaking population from Head Start and early intervention programs. Probably representative of lower income Spanish speaking families.	Yes	Screener information is applicable for Spanish speaking toddlers
Guiberson and Rodríguez, 2010[73]	Screen: Spanish Ages and Stages Questionnaire (ASQ) communication domain; Spanish version of CDI-III -Pilot Inventario-III	Prospective follow-up of screened group	Yes	Applicable to Spanish speaking preschool children in Head Start	Yes	Applicable to Spanish speaking children
Frisk et al, 2009[72]	Screen: Ages & Stages Questionnaire (ASQ); Battelle Developmental Inventory Screening Test; Brigance Preschool Screen; Early Screening Profiles	Prospective follow-up of screened group	No	Very high risk group with the majority evidencing one or more risk factors and 42% displaying < average intelligence	Yes	NA
Rigby and Chesham, 1981[86]	A Trial Speech Screening Test	0	Cannot be determined	No information other than they were the total population of children (somewhere in the UK) who came for school entrant medical	Cannot be determined	NA

Appendix F Table 1. External Validity of Screening Studies

Author, Year	Screener and comparators	Study design	Is the study population broadly applicable?	Comments	Is the screener broadly applicable?	Comments
				examination who were being seen by a speech therapist.		
Wetherby et al, 2003[88]	Infant-Child Checklist - 5-10 minute checklist completed by parents	Other	Yes	Racially/ethnically diverse, though fewer low SES. Also sample was weighted with more children who failed the screen	Yes	NA

Author, Year	Is the comparator broadly applicable?	Comments	Are the outcomes broadly applicable?	Comments	External validity assessment	Comment
Sachse and Von Suchodoletz, 2008[76], 2009[77]	NA	NA	NA	NA	Fair	German health care system may be different
Westerlund et al, 2006[78]	Yes	Comparison screener is single question	NA	NA	Fair	Swedish situation may be different than U.S.
Heilmann et al, 2005[75]	NA	NA	NA	NA	Good	Study was carried out in U.S and includes children who are broadly representative of those with LT and typical language development, allthough not quite as demographically and racially diverse as would be desired.
Guiberson et al, 2011[74]	NA	NA	NA	NA	Fair	Small sample of lower income families (Spanish speaking)
Guiberson and Rodríguez, 2010[73]	NA	NA	NA	NA	Fair	Small sample of lower income families
Frisk et al, 2009[72]	NA	NA	NA	NA	Poor	While the study may have applicability for an at risk population, the findings may not apply to a U.S. primary care population
Rigby and Chesham, 1981[86]	NA	NA	NA	NA	Fair	Screener was used in primary care settings in the UK, so presumably it could be done in this country, but little is known about other aspects of the population of children or where the settings were.
Wetherby et al, 2003[88]	NA	NA	NA	NA	Fair	Fewer low SES children and greater weighting of children who failed the screen.

Appendix F Table 2. External Validity of Intervention Studies

Author, Year	Treatment interventions and comparators	Study design	Is the study population broadly applicable?	Comments	Is the intervention broadly applicable?	Comments
Fricke et al, 2013[125]	G1: Oral language intervention; 30-week program to improve vocabulary, narrative skills, listening and speaking G2: Waiting control group	RCT parallel	Yes	NA	No	School-based study implemented in the UK where children are in Nursery classrooms at ages 3 to 4 years and in Reception classrooms at age 5 years; the intervention spanned Nursery and Reception classrooms. Dissimilarites with US early education system constrain applicability
Jones et al, 2005[126]	G2: Lidcombe program of early stuttering	RCT parallel	Yes	NA	No	Lidcombe program not widely available in US; training in Lidcombe program not widely available and costs ~$500 currently
Lewis et al, 2008[127]	G3: None	RCT parallel	Yes	NA	No	Lidcombe program not widely available in US; training in Lidcombe program not widely available and costs ~$500 currently
Wake et al, 2011[128]	G1: Modified "You Make a Difference" (Hanen Parent Training program) G2: Control group	RCT cluster	Yes	NA	No	Study was implemented in Australia; use of Hanen requires certification; many certified providers of Hanen Parent Training programs in US, especially in private practice; current cost of 3-day certification workshop is ~$850
Gibbard, 1994[136] Study 1	G1: Parent group training sessions 60-75 minutes every other week for 6 months focusing on language activities to use with children G2: Waiting control group	RCT parallel	No	Excluded children with medical conditions associated with speech and language delay, including otitis media, which occurs frequently in this age group	Yes	Study was implemented in the UK but seems feasible in US context

Appendix F Table 2. External Validity of Intervention Studies

Author, Year	Treatment interventions and comparators	Study design	Is the study population broadly applicable?	Comments	Is the intervention broadly applicable?	Comments
Girolametto et al, 1996[137], 1997[138]	G1: Hanen Parent Program parent training, comprising eight 2.5 hour parent group sessions and 3 home visits to teach parents to do focused stimulation of children's language G2: Waiting control	RCT parallel	Yes	NA	No	Study was implemented in Canada; use of Hanen requires certification; many certified providers of Hanen Parent Training programs in US, especially in private practice; current cost of 3-day certification workshop is ~$850
Robertson et al, 1999[139]	G1: Speech-language pathologist-directed small group therapy 150 minutes per week for 12 weeks G2: Waiting control	RCT parallel	Yes	NA	No	Study in US in a center-based birth-to-3 program; current public Part C programs in US are primarily home-based in accordance with IDEIA
Robertson et al, 1997[140]	G1: At least four 15-20 minute unstructured play sessions in "house" area with normal peers over 3 weeks G2: No play sessions with normal peers	RCT parallel	Yes	NA	Yes	NA
Almost et al, 1998[134]	G1: Speech-language therapy for phonology using a cycles approach 2 30-minute sessions per week for 4 months G2: Waiting control	RCT parallel	Yes	NA	Yes	Study conducted through a secondary-care facility in Canada, but the approach is widely used in the US across varied settings
Shelton et al, 1978[141]	G1: Parent-directed speech sound listening/discrimination activities 5 minutes per day G2: 15 minutes per day parent-child storybook interaction (reading and talking group) for 57 days G3: Control	RCT parallel	Yes	NA	No	Use of parents to provide explicit treatment of articulation as in G1 is not a common practice in the US currently; G2 group that used storybook interactions would be applicable
Glogowska et al, 2000[135]	G1: Clinician-directed individual intervention routinely offered by the therapist for 12 months (mean of 6.2 total hours of therapy) G2: Watchful waiting control	RCT parallel	Yes	NA	Yes	Study conducted in the UK but level of service was feasible within the US system of care
Yoder et al, 2005[129]	G1: Broad target recasts intervention G2: No intervention control; “free to participate in community-based txs”	RCT parallel	Yes	NA	Cannot be determined	Study did not limit community-based services and so replication of comparison would be difficult

Appendix F Table 2. External Validity of Intervention Studies

Author, Year	Treatment interventions and comparators	Study design	Is the study population broadly applicable?	Comments	Is the intervention broadly applicable?	Comments
Wake et al, 2013[130]	G1:18 in-home sessions by "language assistant" over 1 year G2: Parents contacted and given info on local speech pathology services	RCT	Yes	NA	Yes	Manualized intervention that can be delivered by non-specialist staff

Author, Year	Is the comparator broadly applicable?	Comments	Are the outcomes broadly applicable?	Comments	External validity assessment
Fricke et al, 2013[125]	No	Comparator (wait list control) involved children enrolled in Nursery and Reception classrooms in the UK who did not get the experimental program.	Yes	NA	Fair
Jones et al, 2005[126]	Yes	NA	Yes	NA	Fair
Lewis et al, 2008[127]	Yes	NA	Yes	NA	Fair
Wake et al, 2011[128]	Yes	NA	Yes	NA	Fair
Gibbard, 1994[136] Study 1	Yes	NA	Yes	NA	Fair
Girolametto et al, 1996[137], 1997[138]	Yes	NA	Yes	NA	Fair
Robertson et al, 1999[139]	No	Wait list for same intervention.	Yes	NA	Fair
Robertson et al, 1997[140]	Yes	NA	No	Outcomes are tied closely to the context of the intervention; they were maintained across time, but evidence of generalization to broader gains in language was not provided.	Fair
Almost et al, 1998[134]	Yes	NA	Yes	NA	Good
Shelton et al, 1978[141]	Yes	NA	Yes	NA	Fair
Glogowska et al, 2000[135]	Yes	NA	Yes	NA	Good
Yoder et al, 2005[129]	Cannot be determined	Study did not limit community-based services and so replication of comparison would be difficult	Yes	NA	Fair
Wake et al, 2013[130]	Yes	NA	Yes	NA	Good

RCT = randomized controlled trial; tx = treatment; UK = United Kingdom.

Appendix G. Ongoing Trials

Principal investigators	Location	Population	Approximate size	Investigations	Outcomes	Status as of 2014
Magalie Demilly and Gabriela Certad, MD, PhD	France	Children, age 28-32 mos, born preterm	140	Parent-implemented language intervention	Language score of the developmental neuropsychological assessment (NEPSY)	Not yet recruiting
Alan L. Mendelsohn, MD	US	Infant-mother dyads receiving care at Bellevue Hospital Center	675	Parenting programs to promote language development and school readiness for at-risk children	Language development Parenting Literacy development School readiness	Data collection anticipated to be completed June 2017
Holly Storkel	US	Children with specific language impairment, age 5-6, normal intelligence	104	Use of interactive book reading to optimize word learning	Naming Ability to define words	Recruiting, anticipated to be completed September 2018
Shuvo Ghosh, MD	Canada	Children 24-42 months with diagnosed language impairment	30	Use of omega-3 supplementation to improve fast-mapping language skills	Change in learning assessed by a fast-mapping task	Recruiting, completion date unknown
Ann Kaiser	US	Children 24-42 months with language delay	120	RCT of Enhanced Milieu teaching with parents' language support services to improve their children's language skills	Expressive language at 4 months Number of words and average sentence length	Final data collection completion anticipated to be September 2015
Anke Buschmann, MA	Germany	Children 24-27 months with receptive or expressive language delays	150	RCT of highly-structured parent-based language intervention	Parent report through screening instruments	Start date 2003, completion date unknown
Aravind Namasivayam, PhD	Canada	Children 3-10 years, moderate to severe speech sound disorder	44	RCT of Prompts for Restructuring Oral Muscular Phonetic Targets (PROMPT) approach	Change in speech motor control Change in speech articulation Change in word-level speech intelligibility Change in phonological processes	Recruiting, anticipated completion December 2015
Mark Onslow, MD	Australia	Children 3-7 years who have completed Lidcombe Program on stuttering	180	RCT of short message service reminders	Percentage of syllables stuttered	Estimated completion December 2011, actual completion unknown
Mark Onslow, MD	Australia	Children 3-6 years with early stuttering	120	RCT of Lidcombe method, varying the time between clinic visits during the first stage of the program	Number of clinic visits needed to achieve various stages of reduction in stuttering	Estimated completion December 2009, actual completion unknown