## Special Article

# Specific Language Impairment: Effect on Later Language Development: A Literature Review

Benjamas Prathanee MA*,
Bandit Thinkhamrop PhD**, Sumalee Dechongkit PhD***

** Department of Otolaryngology, Faculty of Medicine, Khon Kaen University, Khon Kaen*
*** Department of Biostatistics and Demography, Faculty of Public Health, Khon Kaen University, Khon Kaen*
**** Department of Otolaryngology, Mahidol University*

***Background:*** *Children with specific language impairment (SLI) are at considerable risk for later language development. However, there has not been a good literature review to provide understanding and to get information relative to parental counseling and decision making for further management.*
***Objective:*** *To summarize the literature review on SLI and effect on later language development.*
***Material and Method:*** *Longitudinal studies were systematically explored to seek evidence- based information to confirm the lasting effect of SLI in later language development.*
***Results:*** *Natural history data indicated that approximately 50% of children with specific expressive language delay spontaneously remitted or outgrew it at age 5-8. However, long-term follow-up studies showed their language problems emerged later at age 15. The rest of the children's (50%), language impairment persisted and had a high risk for SLI later.*
***Conclusion:*** *The results suggest that active intervention should be performed as soon as possible for children with persisting SLI.*

***Keywords:*** *Language development, Later language development, Specific language impairment, Risk*

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There is a substantial volume of literature which confirms that children with specific language impairment (SLI) are at considerable risk for social, emotional, and behavioral problems[1-4] and reduced literacy skills (reading and spelling)[5] in their later years. These research findings can be used by speech and language professionals in the appropriate management of patients with SLI and in providing counseling to the caregivers of SLI patients. However, there is no existing summary of research to access and interpret the available information relating to many different aspects of SLI: its prevalence, its stability and the magnitude of its association with later language development. This would make it easier for both clinicians and caregivers to manage.

*Corespondance to : Prathanee B, Department of Otolaryngology, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand.*

The objective of the present paper was, therefore, to review the existing literature on prevalence and stability of SLI, and on the impact of SLI on later language development to extract key factors that may be used to identify children with SLI who are at higher risk of later language problems. If this early identification is possible then it will help increase the timeliness, targeting and effectiveness of interventions for children with SLI and hopefully prevent or reduce the magnitude of the expected later language development problems.

**Material and Method**

Literature was reviewed to find the prevalence from various studies to examine the relationship between SLI and later development of language skills. Papers from several longitudinal and cross-sectional studies from the United States, England, and Canada were reviewed. All studies included in the presented literature review were prospective longitudinal studies, based

on the need for follow up to assess the impact of SLI on later language development. Those studies recruited children in the 1-7 year age range since this is the period of clinical interest for early diagnosis and referral of speech and language deficits. Studies that recruited subjects who had language delay as a result of conditions such as mental retardation, physical handicap, hearing loss, pervasive disorder or autistic spectrum disorders, or who had low intelligence performance indicators, were excluded.

***Searching methods***

Relevant research articles were searched in Pubmed (www.ncb.nlm.nih.gov) and related or linked website. Pubmed is a database provided by the National Library of Medicine, USA. Searching terms such as "delayed language development", "specific language impairment" or "SLI", "language impairment", "language development", "language skill", "later language development", "effect or impact SLI", "late talker", "risk of SLI" etc. as well as combination of these terms were used for retrieving articles.

***Statistical methods***

The authors based the review on the magnitude of effects and statistics that were presented in the papers by priory. Mean differences were used for representatives of discrimination scores between children with SLI and normal peers. They were obtained by language development tools, and relative risks (RR) or odds ratios (OR) for dichotomous outcome (such as being SLI: Yes/No) and were used for representatives of risk for late SLI. If such numbers were not presented in the papers, the existing numbers, which allowed us to do, were calculated. Ninety- five percent confidence intervals were also investigated for each of such effects. Summary of findings are presented as forest plots to facilitate the interpretation.

***Term clarification***

Delayed language development is usually considered a delayed onset of productive language compared to peers, with normal development in all other areas. However, several different terms and criteria have been used to identify young children with delayed language development, so the terminology related to language impairment that has been used in this literature review was summarized here. A recent systematic review pertaining to definitions and standard tests of language development from 21 publications revealed that none of the papers used techniques that would allow for determination and manipulation of a cut-off score for classifying SLI. Because there are no tools such as the Receiver Operating Characteristic (ROC) analysis, it makes it impossible to judge the extent that the researchers have sought to optimize cut-offs for the procedures concerned[6]. In all the reviewed studies, the most common terms used for children with delayed language development were "late talker" and "SLI", both referring to a failure to acquire a language at a typical rate, despite having no significant co-occurring cognitive, emotional, neurological, perceptual or sensory deficits. The term "late talker" is normally used for children with delayed language during the period of 2-4 years of age, whereas "SLI" is more often used to describe language deficit among children who are at least 4 years of age[7].

In the present paper, SLI was used in place of the following alternative terms of primary language delay[6], language delay[8], language impairment[5], specific language delay[9], specific language impairment[10], and late talkers[11]. Children with persistent SLI were diagnosed as children who had SLI at recruitment or during a previous assessment, and who still had SLI at a later assessment time. Non-specific language impairment (NLI) is used to refer to language delay with low intelligence performance indicators[12,13].

## Results

***Prevalence***

Estimates of the prevalence of children with language delay vary depending on age at assessment, the criteria and cut-off scores used to define language delay/impairment, the measurement techniques used, and on the geographic location of the presented studies. Consequently, it is difficult to analytically compare the estimates of prevalence from one study to another. A recent epidemiologic study, based on a screening test followed by a battery of diagnostic tests with exclusionary criteria, found an overall prevalence of SLI of 7.4% among monolingual English-speaking kindergarten children from 21 public school districts in Iowa and Illinois, USA[15]. A systematic review of studies that had screened for speech and language delay among children 2-7 years old found an overall median prevalence of 5.95% (range 1.35-19.00%) for primary or specific speech and/or language delay. For language delays only, the overall median prevalence was 4.95% (range 2.63-16.00%). For combined expressive and receptive SLI, the overall median prevalence was 2.14% (range 2.02-3.40%). For expressive SLI only, the overall median prevalence was 3.54% (range 2.27-16.00%), and

for receptive SLI only the overall median prevalence was 3.59% (range 2.63-3.95%)[6].

***The stability of SLI***

From a review of existing literature, a wide range of stability of SLI was found: from 8.7-89%, as shown in Table 1[1,6,11,12,14-18]. The same factors suggested to be responsible for the wide range of SLI prevalence estimates are most likely also responsible for the high variability in findings for stability of SLI. A summary of all these studies, including basic details of methodology and key outcomes, is provided in Table 1. It can be seen from the table that most studies found 50% of children with SLI had stability of persistent SLI. Children who were identified as SLI at an early period had stability of SLI lower than those who were identified as SLI at a late period. In addition, findings indicated that children with SLI either expressive SLI or receptive SLI had lower stability rates than children who had both expressive and receptive SLI, NLI or overall development areas.

Few studies specifically investigate and report on the association between treatment for SLI and the later development of language skills. Bishop and Edmundson conducted one such study in 1987[12] and found no association between therapy and rates of improvement in SLI after a 1 year follow up period. However, the study was not primarily designed to test this association and, therefore, the conclusion was not based on strong and systematically controlled data. A systematic review indicated that randomized controlled trials and quasi-experimental studies found a positive and statistically significant association between intervention therapy and improvements in all areas of speech and language skills, when compared with untreated controls[6]. These previous studies did not provide information about: the long-term outcome of the interventions, the likelihood of an intervention reducing the prevalence of persistent SLI in a given population, or about factors that may help distinguish children with SLI who are likely to catch up from those children who are likely to have persistent language problems and

**Table 1.** Percentage of stability of persistent SLI in children with SLI at eligibility

| Study | Subtype of SLI | Age at eligibility years; months | Percentage of stability of persistent SLI | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Age at reassessment (years; months) | | | | | | |
| | | | 3 | 4;6 | 5;6 | 6 | 7 | 8 | 12 |
| Beitchman et al (1986) | Speech and /or language impairment* | 5 | | | | | | | 72 |
| | Speech and language impairment | 5 | | | | | | | 81 |
| Bishop et al (1987) | Expressive and/or receptive delay | 3; 9-4; 2 | | | 56 | | | | |
| | Expressive and/or receptive delay (NLI) | 3; 9-4; 2 | | | 89 | | | | |
| Paul et al (1991) | Expressive delay | 1; 6-2; 10 | 47.6 | | | | | | |
| Cole et al's (1995) | Expressive and/or receptive delay | 4; 4 | | | | 54 | | | |
| | Expressive and/or receptive delay(NLI) | 4 | | | | 84 | | | |
| Fazio et al (1996) | Expressive delay | 5; 6-6; 5 | | | | | | 17.65 | |
| Tomblin et al (1997) | Expressive and/or receptive delay | 5; 6-6; 5 | | | | | 42 | 44 | |
| | Expressive and/or receptive delay (NLI) | 5; 6-6; 5 | | | | | 75 | 67 | |
| | Expressive delay | 5; 6-6; 5 | | | | | 32 | 42 | |
| | Receptive delay | 5; 6-6; 5 | | | | | 54 | 37 | |
| | Expressive and receptive delay | 5; 6-6; 5 | | | | | 66 | 62 | |
| Weindrich et al (1998) | Expressive delay | 2 | | 21.5 | | | | | |
| | Receptive delay | 2 | | 40.5 | | | | | |
| Law et al (1998)** | Expressive delay | 0; 10 | | | | | 40.0 | | |
| | Receptive delay | 3; 0 | | | | | 8.7 | | |
| | Expressive and receptive delay | 0; 10 | | | | | 75.6 | | |
| Rescorla, Schwartz (1990) | Expressive delay | 2-2; 6 | 50 | | | | | | |

Note: SLI = Specific language impairment;
NLI = Nonspecific language impairment (language impairment with deficit on IQ performance)
* = Subjects had speech disorders or language impairment or speech and language impairment
** = Overall median of stability or persistent specific language impairment from systematic

are, therefore, more likely to experience long-term problems with educational achievement and social adjustment.

Cook and Campbell suggested that there were two important conditions that might affect a situation in the stability rate of SLI[19]. First, the measurement might have an error; second, the sub sample must be selected from the population due to scores that deviate from the population mean. These conditions contributed to the mean regression that involves the selection of an individual or group of individuals because of scores that deviate from the mean. The person who had poor language scores (true-positive cases) or measurement error (false-positive cases) might deviate from the mean. A regression to mean was caused by the presence of false-positive cases in the sample, as these individuals would very likely test negative on subsequent measures. In addition, the measurement error in these false-positive cases was always in the direction away from the population mean, as a result, lead to a biased sampling of measurement error. These false-positive cases might, therefore, appear as individuals who improved between evaluations, when in fact they represented individuals who were never actually doing poorly. The distribution of false-positive cases would be the highest group near cut-off point for diagnosis. The regression effects resulted in the higher rate proportion of recovery or lower rate stability in the false-positive group (who had better scores) than the severe group or true positive group. The regression to mean caused from diagnostic measures contains error and these measures are to sample a group because their scores fall outside a cutoff value. The baseline assessment, separate from the measure used for diagnosis, which was an unbiased estimate of the initial trait status for group, was suggested to reduce bias from sub sample selection due to scores that deviate from the population mean, for which the diagnostic score was a biased estimate[20].

***Effect on later language development***

To better understand, a summary of selected longitudinal studies of later language development included in this review is shown in Table 2. Results of these studies including age at recruitment and followed up times are also presented in forest plots (Fig. 1, 2) to better visualize the magnitude of the effect of SLI on later language skills. The mean differences in vocabulary between children with and without SLI are shown in the forest plot in Fig. 1 and the mean differences in language scores and Mean Length Utterances (MLU) between children with and without SLI are shown in the forest plot in Fig. 2.

***Vocabulary***

Children with SLI had significantly lower scores than children without SLI in tests of vocabulary related to nouns and a number of different words[21], naming vocabulary[12], the Peabody Picture Vocabulary Test-Revised (PPVT-3)[22], and the use of noun phrase morphemes (articles, nominative pronouns)[23] (Fig. 1). Even though most 3 years old children with SLI scored in the average range on the Expressive One-Word Picture Vocabulary Test (EOWPVT) and on the Reynell Expressive Language Scale, some of these children still scored behind normal peers[24]. When children with SLI were followed up at 15-16 years old, findings consistently indicated that children with persistent SLI, who had stability of SLI at 5 years old, had significant impairments in all aspects of spoken and written language including: naming vocabulary, receptive language, picture naming, and the Wechsler Intelligence Scale for Children-III (WISC-III) for both comprehension and vocabulary[25]. These children were also observed to have fallen behind their normal group in language growth over time (Fig. 1).

***Language scores***

There are several aspects of language skills, which are different, based on developmental stage, context, language, tests, etc. It is not possible to assess all aspects of language during the same period of age. Thus, there are different tests that can be used for assessment and follow up of language skills. A summary of the findings from studies of language skills that were included in this review is given below:

Several studies used the Index of Productive Syntax (IPSyn) to assess language scores and most of the results agreed that children with SLI had significantly lower skills than their normal peers[24,26,27] even though their scores were in normal range or not deviant in development[26]. Rescorla et al found that only 24% of children with expressive SLI had an IPSyn score within the average range (for normal peers) during 1 year follow-up assessments at 3 years old[24]. Another study related to IPSyn found that children who had both receptive and expressive SLI when they were young had significantly lower IPSyn scores at later follow up than children who had expressive SLI only when younger, suggesting that having both expressive and receptive SLI puts a child at greater risk for continued delays[27]. The mean differences in IPSyn

**Table 2.** Summary of selected longitudinal studies related to later language development

| Author | N | Type of SLI | Inclusion criteria for SLI |
|---|---|---|---|
| | | United State Studies | |
| Weismer et al (1994) | - 4 Children with SLI<br>- 19 Normal | Expressive SLI | - Restricted expressive vocabularies |
| Paul et al (1991) | - 21 Children with SLI<br>- 21 Normal | Expressive SLI | - Language Development Survey (LDS, Rescorla, 1989): expressive vocabulary < 50 words or no use two - word combinations at 2-2; 10 |
| Paul et al (1997) | - 32 SLI<br>- 27 Normal | Expressive SLI | - See Paul et al (1991) |
| Fazio et al (1996) | - 12 Kindergarten with SLI<br>- 12 Normal | Expressive SLI | - Score $\leq$ -1SD of mean on two or more of the five Test of Oral Language Development - 2 Primary (TOLD-2P) subtest and Columbia Test of Mental Maturity (CMMS) $\geq$ 85 |
| Rescorla et al (1997) | - 34 SLI<br>- 21 Normal | Expressive SLI | - Reynell Receptive Language Scale within 3 months of chronological age and score at least months below chronological age on expressive scale<br>- Bayley Mental Development Scale on Mental Development Index (MDI) > 85 |
| Rescorla et al (2000) | - 34 SLI<br>- 16 Normal | Expressive SLI | - See Rescorla et al (1997) |
| Rescorla (2002) | 6 years<br>- 34 SLI<br>- 32 Normal<br>7 years<br>- 35 SLI<br>- 29 Normal<br>8 years<br>- 37 SLI<br>- 27 Normal<br>9 years<br>- 34 SLI<br>- 25 Normal | Expressive SLI | - See Rescorla et al (1997) |
| Rescorla and Robert (2002) | - 37 SLI<br>- 16 Normal | Expressive SLI | - See Rescorla et al (1997) |
| Thal et al (2004) | - 20 SLI<br>- 17 Normal | Expressive SLI | - The MacArther Commune active Development Inventory: Expressive Vocabulary Test (CDI) < 15$^{th}$ percentile of normal - Reynell Development Language Scale: Expression Score $\leq$ 85 |
| | | English Studies | |
| Bishop and Edmundson (1987) | - 38 SLI<br>- 25 Normal at 4 year<br>- 23 Normal at 4; 6<br>- 19 Normal at 5; 6 | Expressive or/ and receptive SLI or/and phonology disorders | - Score of each test (Phonology, Syntax and morphology, Semantics, Language comprehension) at or below the 3$^{rd}$ centile of normal control data |
| Bishop and Adam (1990) | - 37 SLI<br>- 30 Normal | Expressive or/ and receptive SLI or/and phonology disorders | - See Bishop, Edmundson (1987) |

**Table 2.** Summary of selected longitudinal studies related to later language development (continued)

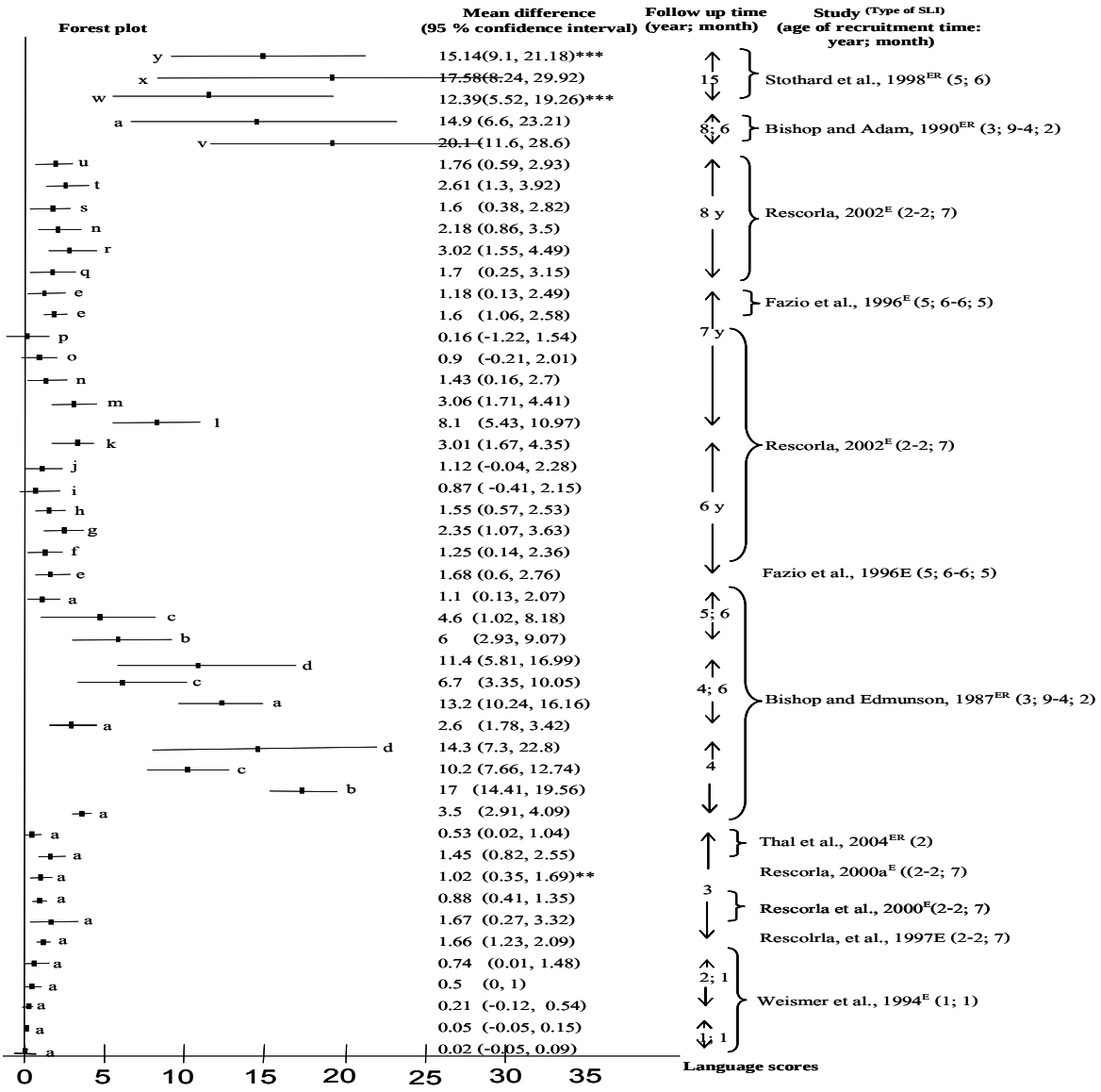
| Author | N | Type of SLI | Inclusion criteria for SLI |
|---|---|---|---|
| Stothard et al (1998) | Resolved and Persistent SLI groups<br>- 26 Resolved SLI or good outcome<br>- 30 Persistent SLI or poor outcome<br>- 49 Normal<br>Satisfactory and impaired speech-language groups<br>- 17 Satisfactory and impaired speech-language children at ages 5; 6 and 15<br>- 21 Impaired speech-language children at ages 5; 6 and 15 | Expressive or/ and receptive SLI or/and phonology disorders | - Persistent SLI or poor outcome: score of each test at or below the 3rd centile of normal control data<br>- Satisfactory speech-language group or good outcome: no score in the impaired range and no more than one score below the satisfactory range (score above 10th centile on five of six measures) |
| Nathan et al (2004) | - 19 SLI and speech difficulty<br>- 19 Normal | Expressive or/ and receptive SLI or/and speech disorders | - Score < 10th canticle on two or more receptive or expressive language measures |
| | Canadian studies | | |
| Johnson et al (1999) | - 78 SLI<br>-128 Normal | Expressive or/ and receptive SLI or/and speech disorders | - Score of each test < -1 SD of norm for Peabody Picture Vocabulary Test-Revised (PPVT-R) or Test of Adolescent/adult Language -3 (TOAL-3) |

scores between children with SLI and their normal peers are shown in Fig. 1.

Regarding the Test of Oral Language Development (TOLD) subtests that are common for young children, previous studies suggested that children with SLI significantly performed scores on of TOLD subtests behind normal children did through 2nd grade[17,28]. Mean differences of TOLD subtest scores between children with SLI and normal peers are shown in Fig. 1 and 2. Exploring language skills on Clinical Evaluation of Language Fundamentals - Revised (CELF-R), several studies found children with SLI had lower scores on various subtests than comparative peers from primary school to adolescence[25,29] as shown in Fig. 2. For the screening test, it is an assessment tool for young adult language test.

Johnson et al conducted a cohort study that recruited children age 5 years old and followed up to adolescence[22]. Assessments were carried out from primary school to adolescence by using four tests (Screening Test for Auditory Comprehension of Language: STACL, Bankson Language Screening Test: BLST, Test of Adolescent/Adult Word Finding, Brieft Test: TAWF, and Test of Adolescent/ Adult Language-3: TOAL-3) which included tests of speech and language, and cognitive, academic and psychiatric tests. The results showed that children with SLI (either expressive or receptive) scored lower than normal. The authors concluded that children with early language impairments showed clear long-term deficits in language, cognitive, and academic domains compared to peers without early language difficulties. The mean difference in these scores between normal and children with SLI are shown in Fig. 1.

Considering other language tests, including nonword repetition and The Long Form of the British Picture Vocabulary Scale: BPVS[25] results indicated that children with persistent SLI had significant impairments in all aspects of these language tests and fell further behind their normal peer group in growth over time (Fig. 1). Interesting results suggested that language abilities at the adolescence period (15-16 years) were strongly associated with language skills at recruitment time (5 years 6 months), especially for children in the




a: Noun, b: Number of different words, c: Vindland Adaptive Behavior Scale (expression) d: Expressive One-Word Picture Vocabulary (EOWPVT), e:Index of Productive Syntax (IPSyn), f: Article, g: Nominative case pro noun, h: Third Person-s, i: Contractible copula, j: Contractible auxillary be, k: Auxillary do, l: Naming vocabulary, m: Expressive Language, n: Receptive language, o: Screening Test for Auditory Comprehension of Language (STACL), p: Bankson Language Screening Test (BLST), q: Test of Oral Language Development (TOLD) Listening Quotient Standard Score, r: TOLD Speaking Quotient Standard Score, s: Word Finding, t: Receptive vocabulary, u: Picture Naming, v: WISC-III Comprehension, w: WISC-III Vocabulary, x: Test of Adolescent/Adult Word Finding, Brieft Test (TAWF), y: Peabody Picture Vocabulary Test-Revised (PPVT-3), z: Test of adolescent/Adult Language-3 (TOAL-3)

* Result between children who had at least 100 words and those who had not at least 100 words at 2 years 6 months

** Result between children with satisfactory speech - language impairment and children with persisted speech and language impairment at ages both 5 years and 15 years

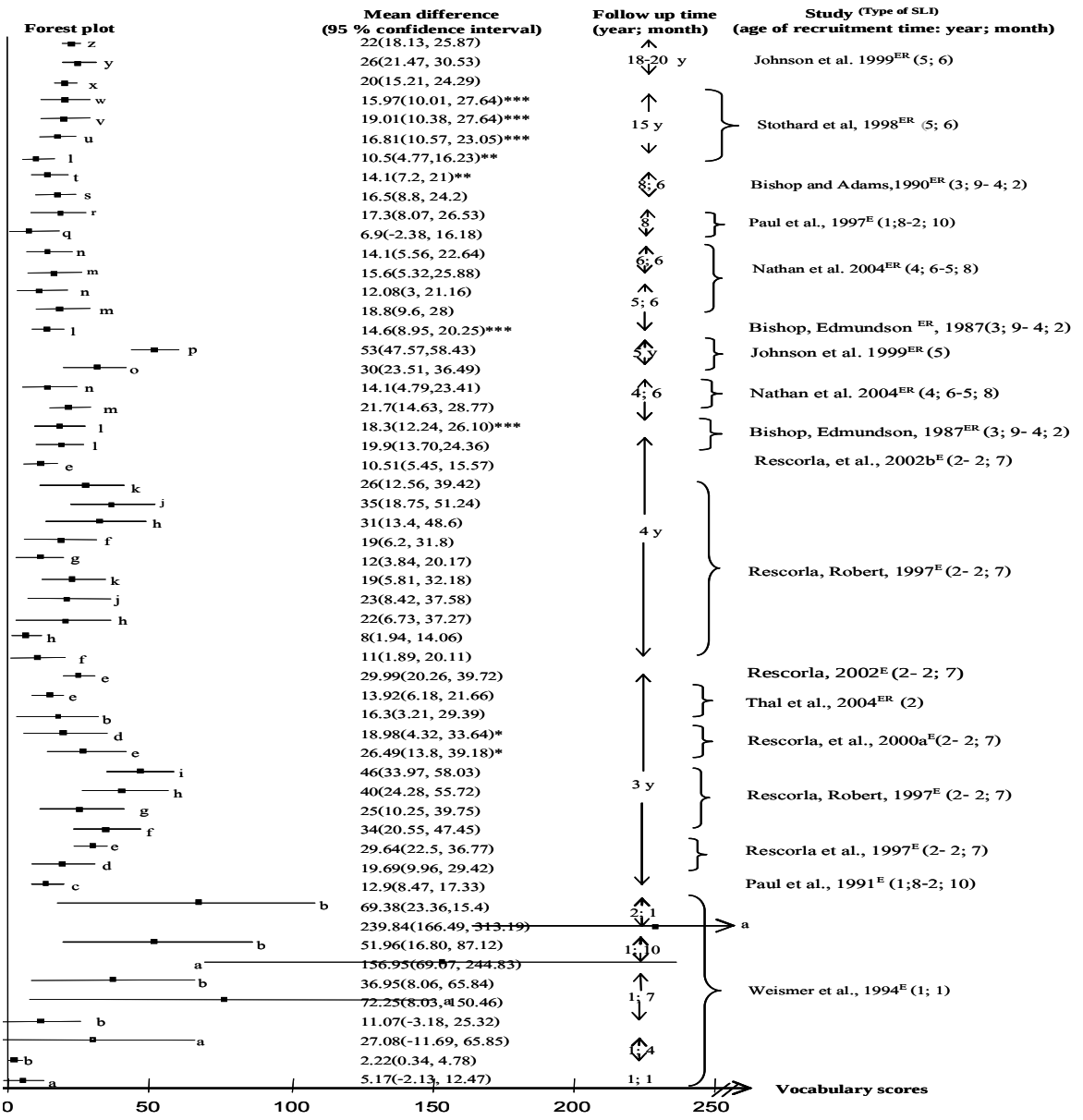
*** Results between children with the resolved SLI and children with persisted SLI

Type of SLI

E: This study identified children with specific expressive language impairment at recruitment time

ER: This study identified children with specific expressive and receptive language impairment at recruitment time

**Fig. 1** Mean differences (95%CI) of vocabulary scores at each follow up time between children with and without SLI classified at recruitment event using various subtests of each study (age at recruitment time, years: months)




a: Mean Length Utterance (MLU), b: Action Picture Grammar, c: Bus Story Information, d: Verbal Comprehension, e: Test of Oral Language Development (TOLD-2P), f: TOLD Oral Vocabulary, g: TOLD Picture Vocabulary, h: TOLD Grammatic Completion, i: TOLD Grammatic Understanding, j: TOLD Word discrimination, k: Sentence Imitation, l: Boston Naming, m: WISC-R Vocabulary, n: CELE-R Formulated Sentence, o: CELF-R Word Structure, p: CELF-R Sentence Structure, q: CELF-R Word Associations, r: CELF-R Word Classes, s: CELF-R Linguistic Concept, t: CELF-R Semantic Relationship, u: CELF-R Listening to paragraphs, v: Expression Semantic, w: Nonword Repetition, x: CELR-R Sentence Repetition, y: The Long Form of the British Picture Vocabulary Scale (BPVS)

** Result of satisfactory speech-language children and impaired speech- language children at ages both 5 years and 6 months and 15 years

*** Results of resolved and persisted specific language impaired children

Type of SLI

E: This study identified children with specific expressive language impairment at recruitment time

ER: This study identified children with specific expressive and receptive language impairment at recruitment time

**Fig. 2** Mean differences of language scores (95% confidence interval) at each follow up time between children with and without SLI classified at recruitment event by using various subtests of each study (age at recruitment, years: months)

poor outcome group or persistent SLI. The recent investigation of expressive language and receptive language skills[30] found children with expressive or/ and receptive SLI scored significantly lower language skills than the normal peers (Fig. 1).

***Mean length of utterance***

MLU is a very common and simple tool for language assessment. Children with SLI generally had short phrases or sentences. Most studies related to MLU, agreed that children with SLI had significantly lower scores on MLU than normal children[12,25-27] because they generally had limited vocabulary and grammar. Even though a study indicated that there was no significant difference in MLU score between children with expressive SLI and normal children, they were still delayed when compared to normal children[26]. Only thirty-five percent of children with expressive SLI performed in the average range at follow-up[24]. A long follow up study found that children with persistent SLI still had MLU growth further behind their normal peer group over adolescence (15-16 years)[25]. Magnitude effects on mean differences of MLU between children with SLI and normal peer from recruitment times to follow up times are shown in Fig. 2.

***Risk for later SLI***

Risk for later SLI was early explored in children aged 3 years. Language abilities were followed up 1 year[23], 3, 4 and 5 years[29] later, respectively. The consistent pattern indicated that children with persistent SLI had a significantly higher risk of being later SLI around 0.56-2.34 times relative to normal peers (Fig. 3). Considerable risk was confirmed by Paul et al[28] who found children with SLI were significantly higher risks for being later SLI than normal children (3.88-10 times) at reassessment time (Fig. 3). This result was also supported by Thal et al[27] who recruited children age 2-3 years old to compare language scores between children with SLI and normal, and then follow up at age 4 years. Summary of these reports indicated that children with SLI had considerably more risk for later SLI than normal children had.

***Limitation of literature review***

There are some limitations of various studies that regard to their application in this literature review as follows:

- Number of subjects: A small number of subjects recruited for study[21,28] and short duration of follow up time (1 year)[21,27], power of magnitude effect might not be general acceptance, clear evidence for application, and it is difficult to detect significant differences between the SLI group and normal.

- Methodology for recruitment of subjects: Some studies recruited children by announcement and advertisements[28] or notification through pediatric clinics or speech clinics and subjects most likely included those whose parents were concerned about their language development[12,23-26,29,31], therefore, results might be biased to children with more severe disorders than those that would be found in a community-based study. Another study recruited children with low economic status[17], from which the results did not allow the possibility to draw real conclusions related to children with SLI. The application of these results for general clinical practice may be limited to populations of similar socio-economic status, since poverty is a factor effecting later language development.

- Recruitment age: Children in some studies did not begin assessing children until age 4, by which time language impairments were much more likely to be severe and persistent[12,25,31].

- Treatment effect: Speech remediation or special education services may also effect the stability of (or rate of recovery from) SLI.

- Liberal cutoff point: Children were categorized as language-impaired used the cut off score 1 SD below the mean[22]. These children might be persons who had poor language scores (true-positive cases) or measurement error (false-positive cases) might deviate from mean SLI[19]. If children who were identified as SLI are false-positive cases or not actually having poor language skills, they might improve between evaluations and result in reduction rate of stability of SLI.

- Normal or comparative group: Some studies [12,25,31] did not include normal or comparative children in a longitudinal study. Larney commented that it was weak of any longitudinal comparisons about the relative skills between the control groups and the language impaired group at different ages[32].

In summary, even though there were several limitations and differences of tests, subtypes of SLI, children's age at enrollment time, designs, criteria, and cut off point for identification of SLI, number of subjects and countries, forest plots in figure 1 and 2 present the consistent pattern of magnitude effects of SLI on later language development of children age 13 months to adolescent (18-20 years.). Similar to magnitude effects of SLI, forest plot in Fig. 3 also presents the consistent pattern of impact of SLI for risk on later language problems or SLI.

a: Contractible copula, b: Third person - s, c: Nominative case pronoun, d: Article, e: Vocabulary, f: IPSyn, g: Auxillary do, h: Contractible auxiliary be, i: WRMT word identification, j: TOLD Sentence imitation, k: TOLD Picture Vocabulary, o: CELF-R Sentence Structure, p: CDLF-R Word Sentence, q: CELF-R Formulate Sentences, r: WISC-R Vocabulary, s: CELF-R Listening to Paragraphs, t: CELF-R Semantic Relationships, u: CELF-R Sentence Assembly, v: CELF-R Linguist Concepts, w: CELF-R Word Classes, x: CELF-R Word Associations, y: Grammatical Completion, z: Sentence imitation
Type of SLI
[E]: This study identified children with specific expressive language impairment at recruitment time
[ER]: This study identified children with specific expressive and receptive language impairment at recruitment time

**Fig. 3** Relative risk (95% confidence interval) of children with SLI for later SLI at each follow up time classified at recruitment event by using various subtests of each study (age at recruitment time years: months)

**Conclusion and implications for future research**

This literature review proposed 3 important issues. First, natural history data indicated that approximately 50% of children with specific expressive language delay spontaneously remitted or outgrew at age 5-8 that referred to the resolved language impairment (resolved SLI) or good outcome. Thereby, they were at lower risk of later language difficulties. Fifty percent of children did not remit or were referred as persistent at language impairment (persistent SLI) or poor outcome. However, the findings revealed the resolved SLI group emerged language problems at age 15 for longer-term

follow up studies[25]. This evidence clearly supported the illusory recovery[33] that is not able to conclude definitively that this relationship was a real remission at preschool or school age.

Second, most studies did not definitely indicate the predictors to identify consistent and reliable outcome for children with SLI. However, children with language impairment in preschool years and persists at older ages, was the best indicator to be considered as a high risk factor for later language impairment, and might be irrespective of SLI. The active intervention should be performed as soon as possible.

Third, children with more severe or with more than one deficit in terms of SLI were less likely to recover from the deficits because of a limitation of available resources to facilitate such recovery.

Literature review is very useful for making conclusions about the impact of early language impairment on later language skills, as well as the magnitude of effect. For interpretation of these results, the readers should consider the methodological limitations because there are several wide aspects such as various definitions of language delay, assessment tests, inclusion criteria, and the ages at which they recruited for samples, and criteria or cut-off points to identify language impairment at recruitment (Table 2) and reassessment times. For better understanding and more information relative to parental counseling and making a decision for further intervention, factors or predictors that affect SLI on later language development should be reviewed and summarized for further reviewing.

This literature review agrees with Larney's comments and suggestions[33] for further studies in order to identify consistent and reliable predictors of outcome for children with SLI as follows:-

1. Future investigation on association between early SLI and later language development should be longitudinal, prospective, studies that recruit children from a community-base aged no older than 2 years and follow them through adolescence. A longer follow-up will allow for better assessment of the effect of early SLI on later language skills

2. Inclusion criteria for such research should differentiate between different SLI subtypes and exclude children with secondary language delay.

3. The cut-off points for classification of children with language delay at each follow-up interval should be clearly stated and adhered to.

4. The method of assessment used in such research should be standardized and provide proven and reliable indicators of language ability.

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## *ความบกพร่องทางภาษา: ผลต่อการพัฒนาภาษาและการพูด-การทบทวนวรรณกรรม*

***เบญจมาศ พระธานี, บัณฑิต ถิ่นคำรพ, สุมาลี ดีจงกิจ***

***หลักการและเหตุผล:*** *เด็กที่มีพัฒนาทางภาษาล่าช้ามีความเสี่ยงต่อการมีภาษาล่าช้าในวัยต่อมา แต่ยังไม่มีการทบทวนวรรณกรรมที่เกี่ยวข้องเพื่อใช้ในการให้คำปรึกษาสำหรับพ่อแม่และประกอบการตัดสินใจในการรักษาบำบัด*

***วัตถุประสงค์:*** *เพื่อรวบรวมผลการศึกษาของงานวิจัยที่เกี่ยวกับผลของการมีพัฒนาทางภาษาล่าช้าต่อพัฒนาการทางภาษาในวัยต่อมา*

***วัสดุและวิธีการ:*** *ทบทวนงานวิจัยที่เป็นการศึกษาระยะยาวอย่างเป็นระบบเพื่อสรุปผลดังกล่าว*

***ผลการศึกษา:*** *เด็กที่มีพัฒนาทางภาษาล่าช้าประมาณร้อยละ 50 ที่มีการพัฒนาภาษาดีขึ้นทันเด็กปกติในวัยเดียวกันตอนอายุ 5-8 ปี แต่อาจพบปัญหาอีกครั้งในช่วงอายุ 15 ปี ส่วนเด็กอีกร้อยละ 50 ยังคงมีพัฒนาทางภาษาล่าช้าอยู่และมีความเสี่ยงสูงต่อการพัฒนาภาษาล่าช้าในวัยต่อมา*

***สรุป:*** *ควรให้การบำบัดเด็กที่ยังคงมีพัฒนาทางภาษาล่าช้าอยู่ให้เร็วที่สุด*