

## External risk factors associated with language disorders in children

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### Abstract

**Background** Children with language delay have deficits in the ability to learn and use language, either expressive and/or receptive despite otherwise normal development. Language delay could be influenced by either internal factors (within the child) and external factors (from the environment). Timely identification and modification of these risk factors can allow early intervention to reduce child disability and are associated with better long-term outcomes.

**Objective** To identify possible risk factors related to language delay in children, such as bilingualism, socioeconomic status, maternal and caregiver education level, use of digital media, absence of story reading sessions, breastfeeding patterns, siblings, parenting methods, and maternal occupation.

**Methods** This observational, analytic study included 102 children aged 24-36 months from four daycare centers in Manado, North Sulawesi, selected by cluster random sampling. Parents were interviewed to gather demographic information of child age, gender, presence of older siblings, maternal occupation, socioeconomic status, maternal/caregiver educational level, use of digital media, absence of story reading sessions, breastfeeding patterns, parenting methods, and bilingual environment. Children's language development was assessed by the *Capute Scales*.

**Results** Multivariate analysis revealed 2 factors significantly associated with increased risk of language delay; namely absence of storybook reading (OR=0.16; 95%CI 0.03 to 0.72; P=0.017) and bilingualism (OR=12.58; 95%CI 1.57 to 100.81; P=0.017).

**Conclusion** Story reading sessions is associated with decreased risk of language delay, while bilingualism is associated with increased risk of language delay. [Paediatr Indones. 2021;61:133-40 ; DOI: 10.14238/pi61.3.2021.133-40 ].

**Keywords:** language delay; bilingualism; story reading; risk factors

The prevalence of language development delay in Indonesia is quite high. Data from the Department of Medical Rehabilitation, Dr. Cipto Mangunkusumo Hospital, Jakarta, in 2006 reported that of 1,125 pediatric rehabilitation patient visits, 10.13% were diagnosed with language delay.<sup>1</sup> Similarly, Kariadi Hospital Pediatric Growth and Development Polyclinic, Semarang, Central Java, reported in 2007 that 22.9% of the 436 new patient visits were due to language delay.<sup>2</sup> More recently, Prof. R.D. Kandou Manado Hospital Pediatric Growth and Development Polyclinic, Manado, North Sulawesi, reported in 2015-2016 that 31.4% of 143 new patient visits had language delay.<sup>3</sup>

Previous studies have reported various risk factors associated with language delay in children.<sup>1-3</sup> Language delay is influenced by internal factors (from within the child) and external factors (from the environment). Internal factors include mental retardation, hearing loss, autism, perinatal history, genetics, and gender. External factors include bilingualism, socioeconomic

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Submitted December 11, 2020. Accepted May 28, 2021.

status, maternal/caregiver education level, use of digital media, absence of story reading sessions, breastfeeding patterns, presence of older siblings, parenting patterns, and maternal occupation.

Forty to 60% of preschool children with language delay have future difficulty in learning written language and academic subjects.<sup>4</sup> Language delay should be diagnosed early, so that children can receive optimal treatment. Children with language delay should be further evaluated with regards to their physical condition, hearing ability, language skills, psychological state, motor skills, history of social interactions, and visual ability.<sup>5,6</sup> Early detections of developmental delay and early educational intervention are associated with better long-term outcomes.

This study aimed to identify possible external risk factors related to language delay in children, such as bilingualism, socioeconomic status, maternal and caregiver education level, use of digital media, absence of story reading sessions, breastfeeding patterns, siblings, parenting methods, and maternal occupation.

## Methods

This cross-sectional study was conducted in subjects from four daycare centers in Manado, North Sulawesi, Indonesia. Data collection was carried out from

November 2019 to March 2020. The four centers were selected by cluster random sampling from 35 daycare centers in Manado. The total of 106 healthy, 24-36-month-olds' parents provided informed consent. Healthy was defined as children free of disease who carried out their activities without physical obstacles, based on history-taking and physical examination. Children with a history of low birth weight (<2,500 grams), premature birth (gestational age <37 months), hearing loss [obtained at least one "no" when assessed by hearing test questionnaire or the *Stimulation, Detection and Early Intervention of Child Growth and Development Tool (Stimulasi, Deteksi dan Intervensi Dini Tumbuh Kembang/SDIDTK)* developed by Indonesia's Ministry of Health in 2016],<sup>7</sup> or autism (M-CHAT score  $\geq 8$ ),<sup>8</sup> were excluded from our study. Hence, a total of 102 subjects were evaluated, as 4 children were excluded (**Figure 1**).

We then conducted interviews with subjects' parents and assessment of language delay were done in one day. Information collected were child age, gender, presence of siblings, maternal occupation status, socioeconomic status, maternal/caregiver educational level, use of digital media, story reading sessions, breastfeeding patterns, parenting methods, and bilingual environment. We did not do any questionnaires about the capability of child's language development. The subjects then were assessed for

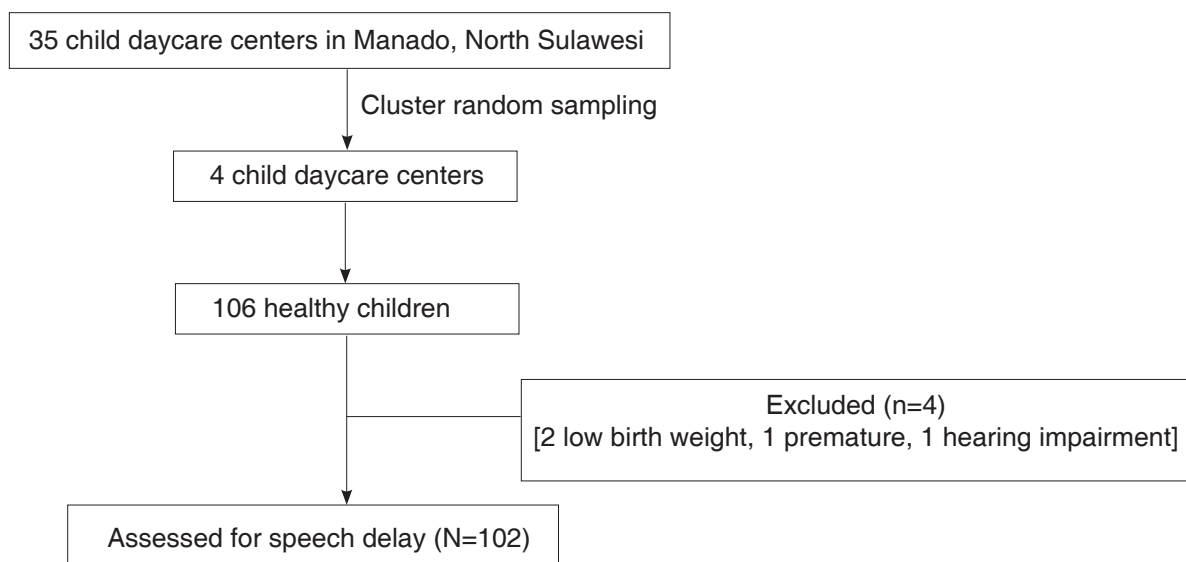


Figure 1. Study flow chart

language delay using the *Capute Scales*, which consisted of two sets of assessment, cognitive adaptive test (CAT) and clinical linguistic and auditory milestone scale (CLAMS). The CAT consisted of 19 age levels of testing with 57 visual-motoric milestones that should be assessed. Meanwhile, CLAMS was intended to assess the milestone of children receptive and expressive language. Developmental quotient (DQ) was a score which describes the normal developmental proportion with child at that age. The DQ was calculated by dividing the equivalent age with the chronological age of children in percentage. Language delay was defined as  $DQ-CLAMS < 75\%$  and  $DQ-CAT \geq 75\%$ .<sup>9</sup>

The possible risk factors for language delay were defined below. Digital media was any media in machine-readable formats, including modern electronic devices, such as computers, television, and cell phones. In this study, data on the use of digital media were dichotomous. Participants were categorized as “using digital media” if the cumulative duration was more than 1 hour per day. Story reading was defined as an oral presentation of a story by an individual (particularly parents or caregiver) to the children from the text of a picture book. Story reading was considered to be present if it was done four or more times per week for a duration of 10 minutes or more per session. Breastfeeding pattern was defined as exclusive if the baby was fed only breast milk for the first six months of life, with no complementary food.

The parenting methods were classified into positive parenting (authoritative) or negative parenting (authoritarian, permissive, or negligent). Children were considered bilingual if they were exposed to a language other than their mother tongue (Indonesian) from birth, for a duration of 5 hours or more per week (either from home, daycare centers, or communicative digital media). Socio-economic status was categorized based on parental income according to provincial minimum wage. Government of North Sulawesi had set the provincial minimum wage in 2017 amounting to 2,824,286IDR per month.<sup>10</sup> If parental income was equal or more than this level, they were categorized as “middle-high socioeconomic status”, and if below this level as “low socioeconomic status”. Maternal education level was the highest degree of schooling that the mother or caregiver has reached (“high school graduate” and “never attended high school”). We categorized maternal occupation into two groups,

namely working mothers and non-working mothers. Working mothers were mothers who also work outside the home to earn income in addition to their main role as housewives. Indonesian labor law prescribed the normal working hours as no more than 40 hours per week, and six days per week.<sup>11</sup> Presence of older sibling was considered if the participants had one or more older siblings from the same parents. Previous studies suggested that older siblings were skilled as parents in guiding their younger sibling’s language learning process.<sup>12,13</sup>

Parametric data was reported in mean and standard deviation (SD). Language delay and age were analyzed with independent sample T-test. Relationships between language delay and gender, story reading, breastfeeding pattern, siblings, as well as maternal occupation were analyzed with Chi-square test. Meanwhile, relationships between language delay and bilingualism, socioeconomic status, maternal occupation, use of digital media, and parenting method were analyzed using Fisher’s exact test. Multivariate analysis was used to analyze independent variables together to assess which factors contributed most to language delay, by multivariate logistic regression. Data were processed using *SPSS for Windows version 25* software.

This study was approved by the Ethics Committee of Prof. Dr. R.D Kandou Manado Hospital, North Sulawesi. Daycare center staff and parents consented to participation right before physical examination and *Capute Scales* examination.

## Results

The mean age of subjects was 31 months. Subjects’ characteristics are shown in **Table 1**. Of 102 subjects, 19 had language delay (18.6%). We showed a significant difference in story reading sessions between children with and without language delay ( $P=0.028$ ). Fourteen children (73.68%) with language delay had a frequency of story reading  $< 4$  times per week with duration of  $< 10$  minutes. Majority of mothers or caregiver were high school graduates, had middle-high socioeconomic status, applied a positive parenting style, and were working mothers. However, statistical analysis revealed no significant differences between those with and without language delay.

**Table 1.** Characteristics of subjects

Characteristics	Language delay	
	Yes (n= 19)	No (n=83)
Mean age (SD), months	31.21 (3.31)	31.16 (3.36)
Gender, n (%)		
Male	10	36 (43.4)
Female	9	47 (56.6)
Bilingualism, n (%)		
Yes	17	61 (73.5)
No	2	22 (26.5)
Socioeconomic status, n (%)		
Low	3	7 (8.4)
Middle-high	16	76 (91.6)
Mother/caregiver educational level, n (%)		
Not a high-school graduate	3	10 (12.0)
High school graduate	16	73 (88.0)
Use of digital media, n (%)		
Yes	18	65 (78.3)
No	1	18 (21.7)
Story reading, n (%)		
Yes	5	45 (54.2)
No	14	38 (45.8)
Breastfeeding patterns n (%)		
Exclusive	10	39 (47)
Non-exclusive	9	44 (53)
Presence of older siblings, n (%)		
Yes	11	51 (61.5)
No	8	32 (38.5)
Parenting method, n (%)		
Positive	16	66 (79.5)
Negative	3	17 (20.5)
Working mothers		
Yes	12	59 (71.0)
No	7	24 (29.0)

Univariate analysis showed only story reading that had a significant protective association with language delay (OR=0.30; 95%CI 0.1 to 0.91; P=0.034). Other variables showed nearly significant associations, bilingualism (OR=3.06; 95%CI 0.65 to 14.3) and digital media use (OR=4.98; 95%CI 0.62 to 39.9) (Table 2).

Multivariate logistic regression adjusted for children's age revealed two factors significantly associated with language delay, story reading and bilingualism (OR=0.16; 95%CI 0.03 to 0.72; P=0.017 and OR=12.58; 95%CI 1.57 to 100.81; P=0.017, respectively).

## Discussion

Language developmental delay is a universal term to identify children aged 18 to 36 months who fail to achieve the minimum expressive vocabulary milestones expected for their age and sex.<sup>7</sup> We found two variables were associated with language delay, the absence of story reading and bilingualism. Multivariate analysis showed that story reading sessions at a frequency of > 4 times per week, with duration of > 10 minutes per session, had an OR of 0.16 (95%CI 0.03 to 0.72), indicating that such children had an 84% lower risk of language delay. Bivariate analysis showed a significant association between the absence of story reading and

**Table 2.** Univariate analysis of possible risk factors for language delay in children

Factors	Standard error	Univariate OR (95% CI)	P value
Gender			
Female	0.51	Reference	0.466
Male		1.45 (0.53 to 3.94)	
Bilingualism			
No	0.78	Reference	0.155
Yes		3.06 (0.65 to 14.3)	
Socioeconomic status			
Middle-high	0.71	Reference	0.339
Low		2.03 (0.47 to 8.73)	
Maternal/caregiver educational level			
High school graduate	0.72	Reference	0.660
Not a high school graduate		1.37 (0.33 to 5.54)	
Digital media use			
No	1.06	Reference	0.130
Yes		4.98 (0.62 to 39.9)	
Story reading			
No	0.56	Reference	0.034*
Yes		0.30 (0.10 to 0.91)	
Breastfeeding pattern			
Non-exclusive	0.50	Reference	0.657
Exclusive		1.25 (0.46 to 3.40)	
Presence of older siblings			
No	0.51	Reference	0.775
Yes		0.83 (0.31 to 2.37)	
Parenting style			
Negative	0.68	Reference	0.643
Positive		1.37 (0.35 to 5.26)	
Working mother			
No	0.53	Reference	0.499
Yes		0.69 (0.24 to 1.98)	

**Table 3.** Multivariate analysis of possible risk factors for language delay

Factors	S.E.	OR (95%CI)	P value
Gender	0.60	1.51 (0.46 to 4.92)	0.494
Bilingualism	1.06	12.58 (1.57 to 100.81)	0.017
Socioeconomic status	1.03	2.66 (0.35 to 20.24)	0.343
Maternal/caregiver educational status	0.92	2.69 (0.44 to 16.40)	0.281
Digital media use	1.16	3.75 (0.38 to 36.71)	0.256
Story reading	0.76	0.16 (0.03 to 0.72)	0.017
Exclusive breastfeeding	0.58	0.92 (0.29 to 2.90)	0.927
Presence of order siblings	0.61	0.85 (0.25 to 2.84)	0.852
Parenting style	0.85	1.35 (0.25 to 7.17)	0.722
Working mother	0.76	0.36 (0.08 to 1.63)	0.189

Adjusted to children's age (months)

language delay (P=0.035). Absence of story reading sessions could influence the language delay with a prevalence ratio (PR) value of 2.38, thus, children whose parents do not read stories to them have twice

the risk of language delay. A study showed a significant difference in language skills in children who had story time sessions with their parents at a minimum frequency of 4 times per week with a duration of 10

minutes per session compared to children who did not.<sup>14</sup> Furthermore, another study showed specific advances in language skills such as vocabulary, comprehension, recall of stories, and communication, such as transferring information, in children who are frequently read stories.<sup>15</sup> During story reading and telling, the child hears new vocabulary, and evaluates and processes the new information (assimilation). The addition of new vocabulary can be done with the story teller pointing directly at teaching aids or directly practicing a behavior, so the child is able to visualize and copy the behavior. The addition of vocabulary supports the child's ability to communicate with others and express their feelings.<sup>10,11</sup> Language development is very important in child development, especially for cognitive and socio-emotional aspects. Parents and caregivers can motivate children to play an active role in the learning process. Preschoolers are naturally more drawn to picture books that tell interesting stories. Stories with repeated phrases help maintain the child's attention. Reading stories is an effective way to develop a child's cognitive (knowledge), affective (feeling), social, and conative (appreciation) aspects.<sup>16</sup>

While our univariate analysis revealed bilingualism to lack a significant association with language delay, multivariate analysis revealed a significant association (OR=12.58; 95%CI 1.57 to 100.81), indicating that bilingual children had 12 times higher risk of language delay compared to monolingual children. This finding might have been due to the influence of other non-adjusted factors related to bilingualism (suppressor variable) in our study.

In general, there are two types of bilingualism: simultaneous bilingualism, in which children are exposed to two languages before the age of 3 years, and subsequent bilingualism, in which the child learns a second language after the first language has been mastered, usually well after the age of 3 years.<sup>17</sup> More than half of Indonesians could master their local traditional language and Indonesian language. Most of the time, a child's local language is their mother tongue and first language, while Indonesian becomes their second language. And nowadays, children are also frequently taught other foreign languages from an early age.<sup>18</sup> The experience of two or more languages from an early age is sure to have a different effect compared to if the child is only exposed to one language. Children who are exposed to two different languages

often experience misunderstandings. The bilingualism factor may also interact with many other factors that influence language development in children including socioeconomic factors and parental education.<sup>19</sup>

A systematic review compared ten studies on language development in children who were raised in bilingual vs. monolingual environments. Three studies showed a negative impact on both language development among children raised in a bilingual environment, three studies showed no difference in language development, three studies showed a negative impact on one language in bilingual children, and one study showed a positive impact on both language development in bilingual children.<sup>17</sup> In our study with 78 bilingual children, 14 (18%) had language delay and 64 (82%) had normal language and speech development. Of the 24 monolingual subjects, 2/24 children who had language delay and 22/24 had normal language development.

We found no significant associations between language delay and digital media usage or exclusive breastfeeding. Modern digital technology allows multi-sensory interaction and could provide rich input in the form of visual, auditory, and haptic stimuli. Nevertheless, previous studies on digital media use and TV viewing on language development were inconclusive. A study on the popular children's program, Sesame Street, found a positive effect of TV viewing on language development, however, only in combination with adult intervention.<sup>20</sup> Other findings suggested that overwhelming exposure to input from TV had deleterious effects, particularly for young children (toddlers).<sup>21</sup> A previous study also documented that early TV exposure in children <3 years of age was associated with adverse effects on cognitive development.<sup>22</sup>

Systematic reviews have attempted to summarize the effect of breastfeeding on children's cognitive and language development, but with inconsistent results. A study evaluated breastfeeding-related outcomes of language development among children in Western Australia. They showed that communication and adaptability were the most sensitive domains associated with breastfeeding duration, with lower scores in children breastfed <4 months. Lower scores on the *Peabody Picture Vocabulary Test – Revised* (PPVT) were associated with shorter breastfeeding duration among 6-year-olds.<sup>23</sup> In addition, Walker *et al.*<sup>24</sup> showed that longer duration of breastfeeding was associated with



increased cognitive abilities, including language and motor development at 18 months, regardless of various parent and child demographic characteristics. In contrast, a study found no significant difference in language development of children exclusively breastfed for 6 months compared to those who breastfed for only 4 months.<sup>25</sup>

We also noted no significant associations between language delay and other variables such as socioeconomic status, presence of older siblings, parenting methods, and working mothers. A study showed that socioeconomic status was not related to language delay in children aged 2-36 months.<sup>26</sup> Another study reported that the absence of siblings was not related to language delay.<sup>27</sup> Lastly, Suparmiati et al.<sup>28</sup> also showed there was no significant association between working mothers and language delay in their children.

On the contrary, other opinions on these variables are documented and reported as well. Bridges et al.<sup>29</sup> conducted two separate studies (Study 1 and 2) that examined older siblings' influence on the language development of US-born toddlers who were being raised in bilingual homes (English and Spanish-speaking). Both studies found that the older siblings used English more in talking to the toddlers than did other household members and that the toddlers with older sibling were more advanced in English language development. Siblings can serve as a source of language-advancing input.<sup>30</sup> A study reported a medium and significant correlation between parenting style and language development in 3 to 5-years-old preschoolers ( $r = 0.488$ ;  $P=0.000$ ).<sup>31</sup> A positive parenting style allows children to express their thoughts freely to their own parents. This parenting style provides children the opportunity to practice their language skill at home.<sup>32</sup>

To our knowledge, this study was the first in Indonesia to evaluate language delay using the *Capute Scales*. This subject age of 24-36 months was suitable age for language screening. Our study showed story reading was associated with decreased risk of language delay, while bilingualism was associated with increased risk of language delay. In contrary, socioeconomic status, maternal or caregiver educational level, use of digital media, breastfeeding patterns, siblings, parenting style, and working mothers had no significant associations with language delay.

Our study had several limitations, including not assessing other genetic factors, child characteristics, or maternal medical conditions, which creates room for a potential bias, nor did we differentiate between expressive and receptive language delay. In addition, the cross-sectional design of the study precludes defining the exact timing of language delay onset in our study participants.

## Conflict of Interest

None declared.

## Funding Acknowledgment

The authors received no specific grants from any funding agency in the public, commercial, or not-for-profit sectors.

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