The Newly Developed Screening Tool for Detection of Delayed Language Development in Thai Children: A Cross Sectional Study

Jariya Chuthapisith MD, MMedSci*, Pornchanok Wantanakorn MD*,**,
Rawiwan Roongpraiwan MD*, Nichara Ruangdaraganon MD*

* Division of Developmental and Behavioral Pediatrics, Department of Pediatrics, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand
** Chakri Naruebodindra Medical Institute, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Objective: *To examine the diagnostic accuracy and validity of the Ramathibodi Language Development (RLD) questionnaire, a new Thai language development screening tool for young children.*

Material and Method: *The RLD questionnaire was completed by parents of 319 typically developing children, aged 18 to 30 months old. All children were referred to developmental and behavioral pediatricians. The Mullen Scales of Early Learning (Mullen, 1995) was administered to confirm the diagnosis of typically developing children and children with delayed language development.*

Results: *The cut-off score that best distinguished children with delayed language development and typically developing children was 8, with a sensitivity and specificity of 72.1% and 92%, respectively. The discrimination ability was good, with an area under the curve of 0.82 (95% CI 0.74 to 0.90).*

Conclusion: *The RLD questionnaire is a promising screening instrument for use to detect children with language development delay early during well-child care visits or at primary care centers.*

Keywords: *Children, Language development, Questionnaire, Screening*

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The prevalence rates of delayed language development in Thai children aged 18-month-old to 2-year-old is around 2 to 19%[1]. In fact, language development is a useful indicator of a child's cognitive ability and academic achievement[2-4]. Children with delayed language development undiagnosed and untreated are unnecessarily put at risk of poor academic, social, and vocational progress later in life[5-8]. The American Academy of Pediatrics (AAP)[9,10] recommends developmental screening for every child on a regular basis during well-child care. In Thailand, there is no clinical practice guideline to use as a language developmental screening in regular child care. Most children are diagnosed by specialists, rather than general practitioners or pediatricians in primary care settings, which may be because of time constrains, lots of patients to take care, or many tests are used only by experts. As a consequence, there are only 37.7% of Thai children aged under 24-month-old received formal developmental screening and surveillance during routine child care[11]. The Denver development milestone, the most common and useful screening tool for child development, can identify 29% of those under 12 months old, and 57% of those between 1 and 2 years old with delayed language development[4,12,13].

Even though, there are many screening tests used in the identification of delayed development children in all domain of developments, including Denver-II (sensitivity 56 to 83% and specificity 43%)[14], Ages and Stages Questionnaire (ASQ)[15], Developmental Skill Inventory (DSI), and Anamai 55, there is no language screening tool suitable to use in primary care settings. Therefore, the Ramathibodi Language Development (RLD) parental questionnaire was developed with the aim of being easy to complete in a routine, integrated well-child examination to identify children with delayed language development. The present study aimed to show the diagnostic accuracy and validity of the RLD questionnaire before using in general populations.

Correspondence to:
Chuthapisith J; Division of Developmental and Behavioural Pediatrics, Department of Pediatrics, Ramathibodi Hospital, Rama VI Road, Bangkok 10400, Thailand.
Phone: +66-2-2011772, Fax: +66-2-2013366
E-mail: kositprapa@hotmail.com

Material and Method

Populations

The RLD questionnaire was completed by parents of children aged between 18 and 30 months, between November 2013 and October 2014, that visited the Well Child Care clinic, the general outpatient care clinic at Ramathibodi Hospital, a day-care center in an urban area in Bangkok, and convenience participants from the general population. Based on prevalence of language developmental delayed in Thai children, which was approximately 20%[1], and under margin of error (d) 0.05, the total number of participants was 319[16]. The exclusion criteria were children with neuro-developmental problems or hearing impairment.

Instruments: the RLD questionnaire

The RLD questionnaire was first developed and used in a pilot study in 2010, with the results of internal consistency at 0.57 to 0.79, sensitivity and specificity at 98% and 72%, respectively. The best cut-off score of 8 was the best discriminative ability (area under the curve [AUC] 0.96) to differentiate typically developing children from children with delayed language development[18]. The RLD questionnaire contains two parts, the first consisting of general information regarding the child and family, such as age, sex, gestational age, physical health problems, family history of delayed speech or delayed development, family income, and parents/main caregiver education, and the second part containing 10 Yes/No questions developed from well-known screening tools including Parents' Evaluation of Developmental Status: Developmental Milestones (PEDS:DM), the ASQ, and the Modified Checklist for Autism in Toddlers (MCHAT). In the present study, the RLD was completed five minutes before a routine examination by physicians, and then all participants were evaluated with the Mullen Scales of Early Learning (MSEL) (Mullen, 1995), a standardized instrument to confirm the diagnosis of typically developing children and language delayed children.

Instruments: the MSEL (Mullen, 1995)

A standardized instrument for measuring the cognitive function of infants and preschool children from birth to 68 months of age, the tool evaluates five developmental domains: gross motor, fine motor, visual reception, receptive language, and expressive language. Internal reliabilities exceed 0.80 on the receptive and expressive language domains. The test-retest reliability and inter-rater reliabilities range from 0.76 to 0.84 and 0.91 to 0.99, respectively. The validity of language scale is 0.53 to 0.80 when compared with the Preschool Language Assessment Auditory Comprehension in the receptive language domain.

Measures and procedures

The RLD questionnaire was completed by parent of participant after giving informed consent. The MSEL (Mullen, 1995), a standardized instrument to evaluate overall developmental levels, was administered to all children to confirm the diagnoses of typically developing children and children with language development delays. Children diagnosed as delayed language development by MSEL were confirmed the definite diagnosis by developmental and behavioral pediatrician and referred to speech therapist.

Ethical approval

The study had the approval of the Mahidol University Ethics Committees. All families recruited to the study provided informed consents to participate, and the research was conducted in accordance with the Ethical Standards Outlined in the Helsinki Declaration.

Statistical analysis

SPSS software version 11.5 (SPSS Inc., Chicago, IL) was used for analysis. Baseline continuous variables such as age and birth weight were expressed as mean (SD), and categorical variables (i.e., gender, gestational age, family history of delayed speech or delayed development, parental education, and family income) were presented as absolute values and percentages. The Discriminant Function analysis (i.e., sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV)) and the ROC analysis were used to evaluate the construct validity and diagnosis accuracy of the questionnaire.

Results

Three hundred forty eight participants were enrolled but 29 were lost to follow-up and did not complete the developmental assessment. Baseline characteristics, including age, sex, gestational age, birth weight, family history of delayed speech or delayed development, parental education, and family income are shown in Table 1. The mean age of participants was approximately 24 months, and 52% of participants were boys. From the remaining participants (n = 319), 43 (estimated 13.5%) were found to have delayed language development. As Fig. 1 shows, the breakdown of children with delayed language development

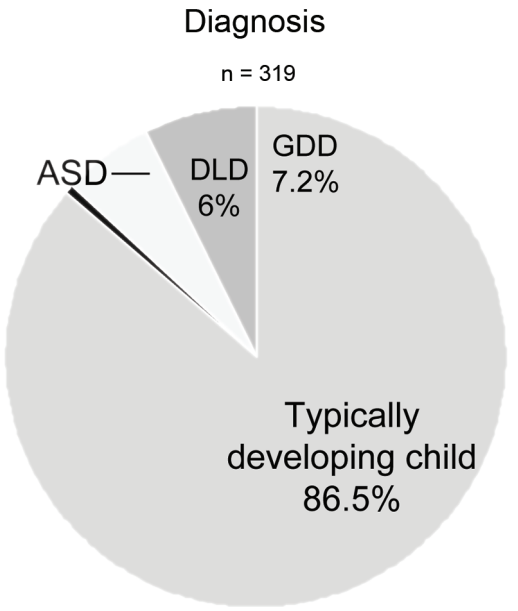

Fig. 1 Diagnosis of all participants by Mullen Scale of Early Learning (Mullen, 1995) and clinical diagnosis by developmental and behavioural paediatrician.

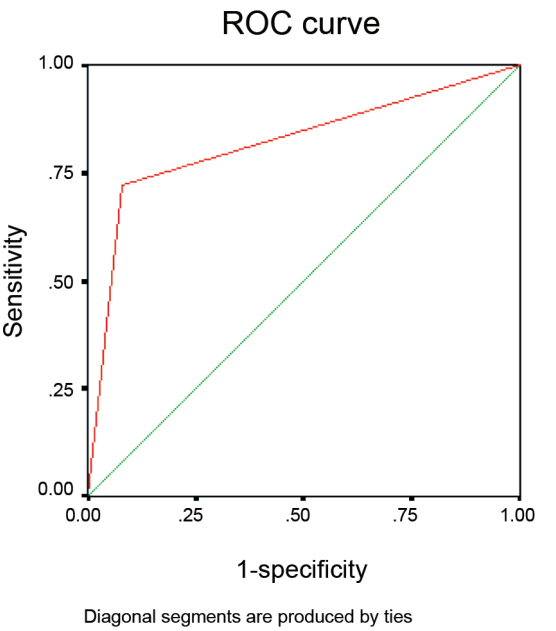

Fig. 2 ROC analysis shows AUC under the best cut-off the RLD score at 8.

consisted of Developmental Language Disorder (DLD) 6%, of which five children had mixed receptive and expressive language delay and 13 children had expressive type, Globally Delayed Development (GDD) 23 children, and Autistic Spectrum Disorder (ASD) diagnosed in one participant.

From the Discriminant Function analysis, the best cut-off RLD score was 8, with a sensitivity of 72.1% and a specificity of 92%. The PPV was 58.5 and the NPV was 95.5 (Table 2). For the diagnosis accuracy of the RLD questionnaire by using the optimal cut-off point of 8, an AUC in the ROC analysis was 0.82 (95% CI 0.74 to 0.9), which was being able to distinguish typically developing children from delayed language development children (Fig. 2). When compared with the standardized test, the MSEL (Mullen, 1995), the RLD questionnaire had an accuracy level of 89.3%.

More boys than girls had delayed speech (79.1% vs. 47.8%, $p<0.001$), and children with a family history of delayed speech had delayed speech more than those without a family history (35.9% vs. 10.3%, $p<0.001$). The typically developing group's mean T-score for the language domains on the MSEL was significantly higher than the delayed language development group for both expressive language (47.77±6.70 vs. 29.30±6.09, $p<0.001$) and receptive

Table 1. Demographic data of study patients

Variable	Participants (n = 319)
Age (month), mean (SD)	24.42 (3.54)
Gender male, %	52.0
Birth weight (g), mean (SD)	3,045 (508.87)
Gestational age >37 weeks, %	86.1
Family history of delayed speech, %	13.6
Parental education, %	
Lower than bachelor degree	11.4
Bachelor degree	54.4
Higher than bachelor degree	34.2
Income (Baht/month), %	
<30,000	20.1
30,000 to 50,000	27.2
>50,000	52.7

Table 2. Sensitivity, specificity, PPV, NPV, and AUC in each cut-off RLD score

Cut-off score	Sensitivity (%)	Specificity (%)	PPV	NPV	AUC
10	100.0	0.0	13.5	-	-
≤9	88.4	66.7	29.4	97.4	0.77
≤8	72.1	92.0	58.5	95.5	0.82
≤7	39.5	97.1	68.0	91.2	0.68
≤6	9.3	99.3	66.7	87.5	0.54
≤5	2.3	100.0	60.0	87.3	-

PPV = positive predictive value; NPV = negative predictive value; AUC = area under the curve in ROC analysis; ROD = Ramathibodi Language Development

language (55.12±8.70 vs. 40.30±14.05, $p<0.001$) (Table 3). For the delayed language development group, the mean expressive T-score of Mullen were 30.10±4.43, 29.43±4.10, and 33 for DLD, GDD, and ASD respectively. The mean receptive T-scores of Mullen were 44.26±14.29 in children with DLD, 38.52±11.34 in children with GDD, and 26 in children with ASD.

The mean RLD questionnaire score of the typically developing group was 9.5 and median score was 9. The distribution of RLD scores among the three delayed language development groups are shown in Fig. 3.

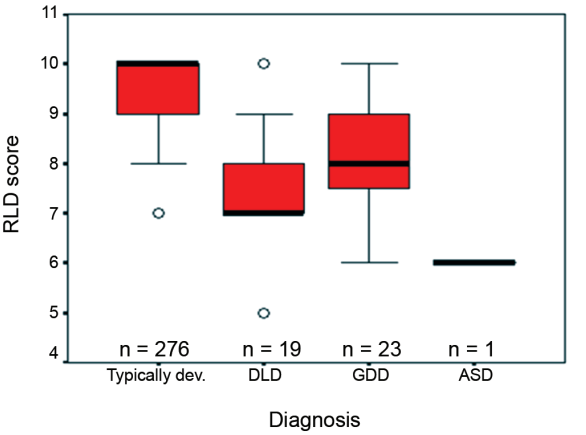

Fig. 3 The distribution of RLD scores in each group of children.

Discussion

The present study was the first Thai-language development screening tool for early detection. It showed promise in benefitting children with delayed language development. In the past, some language screening tests being used in Thailand had some limitations. For example, the Receptive and Expressive Emergent Language of Thai Children (REEL-3) was translated from Western language so it had some language cultural problems[18]. The Thai Speech and Language Test (TSLT), which was newly developed expressive and receptive language development screening tool for Thai children aged 0 to 4 years of age by Prathanee et al were not suitable for use as language development screening tool in young children because both took times to complete[19] and both were used only by the speech therapist or well-trained personel. When compared to the commonly used developmental screening test, Denver-II, which has sensitivity and specificity in the language domain of 67% and 73%, respectively[20], the RLD questionnaire had a higher discriminative ability in sensitivity and specificity. The RLD questionnaire is a promising language developmental screening instrument that can be validated and easily utilized in well-child examination settings with a cut-off point of 8 (sensitivity 72.1%, specificity 92%) and in community-based screenings

Table 3. Demographic data between typically development children and delayed language development children

Variable	Typically developing children (n = 276)	Delayed language development* (n = 43)	*p*-value
Age (month), mean (SD)	24.45 (3.54)	24.23 (3.57)	0.71
Gender male, %	47.8	79.1	<0.001
Gestational age ≥37 weeks, %	87.0	81.0	0.29
Birth weight (gm), mean (SD)	3,060 (493.10)	2,947 (599.68)	0.36
Family history of delayed speech, %	10.3	35.9	<0.001
Parental education, %			0.16
Lower than bachelor degree	10.2	18.6	
Bachelor degree	53.5	60.5	
Higher than bachelor degree	36.3	20.9	
Family Income (Baht/month), %			0.44
<30,000	19.5	24.3	
30,000 to 50,000	28.5	18.9	
>50,000	52.0	56.7	
Mullen's expressive language T-score, mean (SD)	47.77 (6.70)	29.30 (6.09)	<0.001
Mullen's receptive language T-score, mean (SD)	55.12 (8.70)	40.30 (14.05)	<0.001

* Children in delayed language development group were children who had T-score in receptive and/or expressive language domain of Mullen Scale of Early Learning (Mullen, 1995) less than 1.5 SD, and were confirmed diagnosis by developmental and behavioral pediatrician

with a higher sensitivity cut-off point of 9 (sensitivity 88.4%, specificity 66.7%), also consistent with the PPV at the cut-off score of 9, which was lower than of the cut-off score at 8. It means that in community-based screenings, this tool can detect children with delayed language development with high level of sensitivity, with lower level of false positive, which leads to an over-diagnosis and referring.

The prevalence rate of delayed language development in the present study was 13.5%. This was in line with the AAP report that speech and language delay in pre-school children occur at prevalence rates of between 2% and 19%[21]. From the baseline characteristics of the typically developing group and the delayed language development group, more boys than girls had delayed language development, similar to the findings of many previous studies mentioned that the language delay in boys was common and fitted in the literature[22,23]. In addition, children with a family history of delayed speech development showed more delayed language development compared with those without family history, again similar to other studies[22-24].

Our study has some limitations. First, there is no study in Thailand to compare reliability between the MSEL, both expressive and receptive language domains, and the standard diagnostic tool of Thai language. Therefore, the researcher can confirm the diagnosis of delayed language development and refer these children to the developmental behavioral pediatrician and speech therapist. Second, because of the inclusion of volunteers from a general website and patients from the out-patient care unit, the results may have been affected by selection bias in these populations and do not represent the general population. Lastly, we did not follow the 29 children who were lost to follow-up and did not complete the developmental assessment, which might affect the test result (sensitivity and specificity). However, the prevalence rates of delayed speech and language development in the present study were not higher than in previous studies. This could be explained by the age at the time of diagnosis.

Conclusion

The RLD questionnaire is a promising instrument developed to use during well-child care visits, which is time limited, for the effective early identification of children with language development delays. However, further study should be done in general populations. Researchers are developing the web-based RLD questionnaire for easy access in communities and health care services, which would be the prospective project.

What is already known on this topic?

Early detection of language developmental delayed is resulting in the early intervention and better outcome. The RLD questionnaire has good internal reliability and validity in the pilot study, which is the promising screening tool for identifying young children with delayed language development.

What this study adds?

The RLD questionnaire, a brief parental questionnaire, is useful instrument for identifying delayed language development in both routine well-child care clinic and in community setting by others health care providers. Further development of this screening tool is under developing to web-based form for general population.

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Potential conflicts of interest

None.

References

1. Thailand health profile 2008-2009 [Internet]. 2009 [cited 2014 Jan 8]. Available from: http://www.saiyairakhospital.com/back-office/upload/document/aaaa.doc
2. Laing GJ, Law J, Levin A, Logan S. Evaluation of a structured test and a parent led method for screening for speech and language problems: prospective population based study. BMJ 2002; 325: 1152.
3. Snowling MJ, Adams JW, Bishop DV, Stothard SE. Educational attainments of school leavers with a preschool history of speech-language impairments. Int J Lang Commun Disord 2001; 36: 173-83.
4. American Academy of Pediatrics, Committee on Children with Disabilities. Developmental surveillance and screening of infants and young children. Pediatrics 2001; 108: 192-6.
5. Schuster MA. Developmental screening. In:

McGlynn EA, Damberg CL, Kerr EA, Schuster MA. Quality of care for children and adolescents: A review of selected clinical conditions and quality indicators. Santa Monica, CA: RAND; 2000: 157-68.
6. Catts HW, Fey ME, Tomblin JB, Zhang X. A longitudinal investigation of reading outcomes in children with language impairments. J Speech Lang Hear Res 2002; 45: 1142-57.
7. Bishop DV. Development of the Children's Communication Checklist (CCC): a method for assessing qualitative aspects of communicative impairment in children. J Child Psychol Psychiatry 1998; 39: 879-91.
8. Coplan J, Gleason JR, Ryan R, Burke MG, Williams ML. Validation of an early language milestone scale in a high-risk population. Pediatrics 1982; 70: 677-83.
9. US Preventive Services Task Force. Screening for speech and language delay in preschool children: recommendation statement. Pediatrics 2006; 117: 497-501.
10. Nelson HD, Nygren P, Walker M, Panoscha R. Screening for speech and language delay in preschool children: systematic evidence review for the US Preventive Services Task Force. Pediatrics 2006; 117: e298-319.
11. Kumraksa N, Theeranan P, Srihirunrussame S, Kuhapun B, Kedsawad A. Situation of child developmental promotion. J Ment Health Thai 2014; 22: 76-83.
12. Glascoe FP, Dworkin PH. Obstacles to effective developmental surveillance: errors in clinical reasoning. J Dev Behav Pediatr 1993; 14: 344-9.
13. Frankenburg WK, Camp BW, van Natta PA. Validity of the Denver developmental screening test. Child Dev 1971; 42: 475-85.
14. Frankenburge WK. Criteria in screening test selection. In: Frankenburge WK, Camp BW, editors. Pediatric screening tests. Springfield, IL: Charles C. Thomas; 1975: 23-37.
15. Saihong P. Evaluating reliability and use of the Ages and Stages Questionnaires: Thai in northeast Thai early child care settings [dissertation]. Oregon: University of Oregon Graduate School; 2009.
16. Woodward M. Epidemiology study design and analysis. Boca Raton: Chapman and Hall; 1999.
17. Chuthapisith J, Wantanakorn P, Roongpraiwan R. Ramathibodi language development questionnaire: A newly developed screening tool for detection of delayed language development in children aged 18-30 months. J Med Assoc Thai 2015; 98: 748-55.
18. Lattanan P. Receptive and expressive language of Thai children from birth to 36 months by using a Thai adaptation of the receptive–expressive emergent language test (REEL-3) [thesis]. Bangkok: Mahidol University; 2010.
19. Prathanee B, Pongjanyakul A, Chano J. Thai Speech and Language Test for children between 1 and 2 years of age. Int J Lang Commun Disord 2008; 43: 125-40.
20. Glascoe FP, Byrne KE, Ashford LG, Johnson KL, Chang B, Strickland B. Accuracy of the Denver-II in developmental screening. Pediatrics 1992; 89: 1221-5.
21. Conti-Ramsden G, Falcaro M, Simkin Z, Pickles A. Familial loading in specific language impairment: patterns of differences across proband characteristics, gender and relative type. Genes Brain Behav 2007; 6: 216-28.
22. Campbell TF, Dollaghan CA, Rockette HE, Paradise JL, Feldman HM, Shriberg LD, et al. Risk factors for speech delay of unknown origin in 3-year-old children. Child Dev 2003; 74: 346-57.
23. Tallal P, Ross R, Curtiss S. Familial aggregation in specific language impairment. J Speech Hear Disord 1989; 54: 167-73.
24. Tomblin JB, Smith E, Zhang X. Epidemiology of specific language impairment: prenatal and perinatal risk factors. J Commun Disord 1997; 30: 325-43.

เครื่องมือคัดกรองพัฒนาการล่าช้าทางด้านภาษาสำหรับเด็กไทย Ramathibodi Language Development

จริยา จุฑาภิสิทธิ์, พรชนก วันทนากร, รวิวรรณ รุ่งไพรวัลย์, นิชรา เรืองดารกานนท์

วัตถุประสงค์: *เพื่อหาค่าความแม่นยำในการวินิจฉัยและความเที่ยงตรงของแบบสอบถามความเห็นจากผู้ปกครองเพื่อคัดกรองภาวะพัฒนาการล่าช้าทางด้านภาษา Ramathibodi Language Development (RLD) ซึ่งเป็นเครื่องมือที่พัฒนาขึ้นใหม่เพื่อใช้คัดกรองภาวะพัฒนาการล่าช้าทางด้านภาษาในเด็กไทยอายุ 18-30 เดือน*

วัสดุและวิธีการ: *ผู้ปกครองของเด็กที่มีพัฒนาการปกติอายุ 18-30 เดือน จำนวน 319 คน กรอกแบบสอบถามความเห็นผู้ปกครองเพื่อคัดกรองภาวะพัฒนาการล่าช้าทางด้านภาษา RLD และเด็กที่เข้าร่วมโครงการทุกคนได้รับการตรวจประเมินพัฒนาการโดยกุมารแพทย์พัฒนาการและพฤติกรรมเด็กด้วยเครื่องมือประเมินพัฒนาการมาตรฐาน Mullen Scales of Early Learning (Mullen, 1995) เพื่อยืนยันการวินิจฉัย*

ผลการศึกษา: *ค่าจุดตัดของคะแนน RLD ที่เหมาะสมในการคัดกรองเด็กที่มีพัฒนาการล่าช้าทางด้านภาษาออกจากเด็กปกติอยู่ที่ 8 คะแนน ด้วยค่าความไวเท่ากับร้อยละ 72.1 ค่าความจำเพาะเท่ากับ ร้อยละ 92 ตามลำดับ และมีค่าอำนาจการแจกแจงอยู่ในระดับดีโดยมีพื้นที่ใต้กราฟ ROC เท่ากับ 0.82 (95% CI 0.74-0.90)*

สรุป: *แบบสอบถาม RLD สามารถนำไปใช้เป็นเครื่องมือคัดกรองภาวะพัฒนาการล่าช้าทางด้านภาษาในเด็กที่คลินิกสุขภาพเด็กดีระดับปฐมภูมิต่อไป*