Ramathibodi Language Development Questionnaire: A Newly Developed Screening Tool for Detection of Delayed Language Development in Children Aged 18-30 Months

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

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

Objective: *To develop a parental questionnaire for screening children with delayed language development in primary care settings.*
Material and Method: *Ramathibodi Language Development (RLD) questionnaire was developed and completed by groups of 40 typically developing children age 18 to 30 months old and 30 children with delayed language development.*
Results: *The mean score was significantly lower in the delay language group (6.7±1.9), comparing with the typically developing group (9.6±0.7). The optimal ROC curve cut-off score was 8 with corresponding sensitivity and specificity were 98% and 72%, respectively. The corresponding area under the curve was 0.96 (95% CI = 0.92-0.99).*
Conclusion: *The RLD questionnaire was the promising language developmental screening instrument that easily utilized in well-child examination settings.*

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

J Med Assoc Thai 2015; 98 (8): 748-55
Full text. e-Journal: *http://www.jmatonline.com*

Delayed language development is a common problem in child health that general practitioner should deal properly with easily-used screening tool. However, even in developed countries, less than half of preschool children with delayed language development were identified[1,2]. The problem becomes a challenge in primary health care service.

Language development is a crucial indicator of a child's social development, and academic achievement[3]. Early identification of language delay can lead to early intervention, and thus results in lessening impact on the functioning of the child[4]. The American Academy of Pediatrics (AAP) and the Center for Disease Control and Prevention recommend developmental screening, including speech and language, for every child on a regular basis during a well-child examination[5].

In a national survey of Health Status from Thailand, 17% of children younger than 5 years old had delayed development, which 18.9% had delayed language development problem[6]. The vast majority of children miss opportunities for developmental assessment due to the lack of screening tool, lack of time, the competing demands of the primary care visit, and a limited number of physicians. Moreover, clinical observation was used instead of standardized screening tool, thus results in less accurate detection[7].

There are many standardized screening instruments designed specifically for communication domains such as the McArthur Communicative Development Inventory[8], Ward Infant Language Screening Test[9], and Early Language Milestone Scale[10], which are mostly used in the western countries. However, different culture and language may affect the use of these tools to evaluate delayed language development. Several questions in the previously mentioned tools are not suitable for Asian population. Therefore, the aim of the present study was to develop a parental questionnaire capable of being easily completed in a routine integrated well-child examination and to evaluate the effectiveness of the questionnaire to identify children with delayed language development for children in Asia, including Thailand.

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

Screening tool for detection of delayed language development

Ramathibodi Language Development (RLD) Questionnaire (Table 1) is a parental questionnaire developed from modified questions from various standardized screening tools, i.e., Parents' Evaluation of Developmental Status: Developmental Milestones (PEDS: DM)[11], Ages and Stages Questionnaire (ASQ)[12], and Modified Checklist for Autism in Toddlers (MCHAT)[13,14]. All questions selected are based on appropriate culture and environment for children in Asia. The questionnaire contains 10 Yes/No Thai questions and covers the expressive language skills (question 1, 3, 4 and 8), receptive language skills (question 5 and 8), and social interaction skills (question 2, 6, 7, 8, 9, and 10). Each item is scored 1 if the answer is "Yes" except question 1 (scored 1 if answer is "No"). The total score is 10.

Participants

The study was ethically approved by the Intuitional Board Review. Two groups of samples were recruited; first, a group of parents of 30 children age 18 to 30 months old with clinical diagnoses of delayed language development who attended the Developmental and Behavioral Clinic, Ramathibodi Hospital, Bangkok, Thailand, between March 2009 and September 2010. The diagnoses were made by a developmental and behavioral pediatrician. All of the children in this group were screened by using Denver Developmental Screening Test (DDST) to identify those with delay in language domain, as indicated by failure in two or more of the items in this domain[15]. To confirm the diagnosis of language delay, the Vineland Adaptive Behavior Scales (VABS) was performed and all of the participants in this group had the score in communication domain <85 (see details of the participants' language development in Appendix 1). The second group included 40 parents of typically developing children from the well-child clinic, Ramathibodi Hospital, during the same period. All of the participants in the present group pass the DDST (no failure of any item in all domains) and the VABS scores ≥85 in all domains. None of the typically developing children had any developmental problems, as determined by the developmental and behavioral pediatrician.

Measures and procedures

Owing to the differing levels of functioning of children that might be found in both groups, all were assessed with the Vineland Adaptive Behavior Scales (VABS). The VABS is a semistructured interview that assesses social competence. The total score is computed from the subscores of four domains, i.e., communication, motor skills, daily living skills, and socialization. The mean score is 100 and standard deviation (SD) is 15. Subsequently, the questionnaire was administered to all participants' parents. All parents were given information on the purpose of the research and all gave written informed consent to the study.

Statistical analysis

Chi-square tests of significance were used for bivariate analysis of discrete variables, and student

Table 1. Ramathibodi Language Development Questionnaire (English version)

Question		No	Yes	Comment
1.	Do you have any concerns about your child's talks and speech sounds?			
2.	Does your child use gesture to communicate with others (e.g. bye, greetings, begs for thing)?			
3.	Does your child say 15 words or more?			
4.	Are your child's words understood by others most of the time?			
5.	Does your child understand what you say? (e.g. Where is your ball?, goes get thing, takes thing to dad)			
6.	Does your child ever use his/her index finger to point, to indicate interest in something?			
7.	Does your child imitate you? (e.g. imitate your face, talking phone, imitate doing house work)			
8.	Does your child respond to his/her name when you call?			
9.	Does your child ever bring objects over to you to show you something?			
10.	Can your child read facial expressions or tone of voice e.g. realize when other people sad or angry?			

t-test was used to compare any continuous variables differences between the two groups. Discriminant function analysis (i.e., sensitivity, specificity, positive predictive value, and negative predictive value) was performed to evaluate the discriminative power of the questionnaire for the two groups. The receiver operating characteristics (ROC) were performed to find the best cut-off score that best predicted the participants with delayed language development compared with typically developing children. The area under the ROC curve was measured with a score of 0.5 represents a chance relationship. Scores less than 0.5 represent a worthless test and 1.0 represents a perfect test.

Results

The language delay group consisted of 30 children. Seven were diagnosed as autism spectrum disorders (ASDs), 23 were diagnosed as specific language impairment (SLI) and globally delayed development (GDD) based on the DSM-IV-TR criteria. The mean age was 24 months (SD 3.2). Boys were overrepresented in this group (84.6%, 25 children). For 40 children in the typically developing group, mean age was 21.7 months (SD 3.9). Sixteen children (40%) were male. There were differences with respect to age (p<0.05) and gender (p<0.001). There were no significant differences among group in terms of family history of language developmental delay, parental education and family income. Regarding the VABS scores, the mean score was 99 (SD 9.6) in the typically developing group and was 72 (SD 6.9) in the language delay group; there was a significant difference between the mean scores (p<0.005). All of the typically developing children had adaptive function within the normal range, offering reassurance that they were an average ability sample. Whereas, all of the children in language delay group had the score in communication domain of VABS below 85, which confirmed language delays. The demographic characteristics and mean scores of the VABS were illustrated in Table 2.

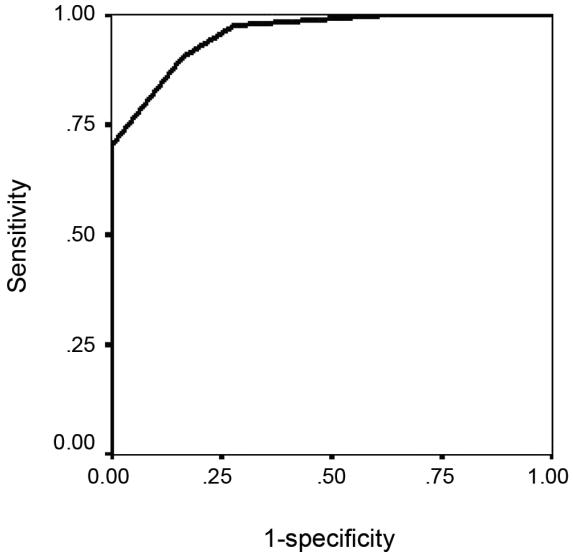

Fig. 1 ROC curve of the sensitivity and specificity of the scores.

Regarding the questionnaire's scores, the delay language group significantly obtained lower scores than typically developing group (p<0.001). The mean score was 6.7 (SD 1.9) in the delay language group. For the typically developing group, the mean score was 9.6 (SD 0.7). Values of Cronbach's alpha as a measure of internal consistency reliability for both groups were 0.57, 0.79, and 0.79 for questions in receptive language domain, expressive language domain and social interaction domain, respectively. ROC curve was used to determine the optimal cut-off point to differentiate between children with language

Table 2. The demographic characteristics and mean scores of the Vineland Adaptive Behavior Scales (VABS) of typically developing children and children with delayed language development

Characteristics	Typically developing children (n = 40)	Children with language delay (n = 30)
Age (months), mean (SD)*	21.7 (3.9)	24.0 (3.2)
Male (%)**	40.0	84.6
Parental education >bachelor degree (%)	56.4	37.5
Family income (baht¶/month), mean (range)	34,375 (10,000-80,000)	60,909 (1,300-500,000)
Family history of delayed language development (%)	10.0	23.0
VABS scores, mean (SD)*	96.9 (11.7)	63.2 (11.3)

* p-value <0.05, ** p-value <0.001, ¶ 1 US$ = 30 baht

Table 3. Sensitivity, specificity and positive and negative likelihood ratio for cut-offs for screening children with language developmental delay against typically developing children

Cut-off	Sensitivity	Specificity	Positive likelihood ratio	Negative likelihood ratio
10	70	100		0.30
9	90	84	5.62	0.11
8	98	72	3.48	0.03
7	100	36	1.56	0.00
6	100	8	1.08	0.00
2	100	4	1.04	0.00
1	100	0	1.00	

delays and typically developing children (Fig. 1). The optimal cut-off point was 8 for differentiation between two groups, with sensitivity of 98% and specificity of 72% (Table 3). The area under the ROC curve was 0.96 (95% CI = 0.92-0.99).

Discussion

In order to early detect delayed language development, screening with effective tool is important. Findings from the study supported that the newly developed questionnaire was an effective screening tool for detecting children with delayed language development. The RLD questionnaire demonstrated acceptable sensitivity and specificity at the cut-off of 8. Previously, many studies showed that the parental questionnaires, when systematically elicited, could identify children with developmental problems effectively[16,17]. Furthermore, the parental reports were by far the least costly as study regarding cost-benefit analysis[18]. The questionnaire took less than five minutes to complete and easily filled out by parents, therefore, it could be effectively used in busy clinical settings such as child health centers and primary care centers. However, to make it an effective and more accurate screening tool, larger representative samples has to be conducted.

Regarding the internal consistency reliability for each domain, the internal consistency reliability for questions in receptive language domain was 0.57, which was unacceptable. This is possibly due to the number of questions in this domain were low (2 questions). Furthermore, the receptive language evaluation in younger children is difficult and unreliable[19].

Many studies reported a family history of language delay as a risk factor of children with language delay[20-22]. However, the present study did not find the difference between the two groups in term of family history of language delay. The increase in number of participants might show significant difference.

Although screening for language delay in young children has been done routinely in many developed countries[23], this remains limited in developing country due to the lack of validated screening instrument. Application of a screening instrument from the Western is indeed a challenge due to complexities of language. Very few studies in Asia adapted the Western standardized screening instrument for young children to use in their countries; for example, the DDST and the language screening procedure as used by Westerlund and Sundelin[24] were adapted to use in the United Arab Emirates[25], the Developmental Language Screening Scale (DLSS) was adapted to use in Hong Kong[26]. However, in Thailand, those instruments might not appropriate for primary care setting and some instruments need to carry out by trained personnel. Therefore, the RLD questionnaire might be the first language development screening step for community based setting that takes short administration time and can be used by non-professional individuals.

Finally, limitations of the study need to be acknowledged. Firstly, the children with delayed language development in the present study were diagnosed by clinical teams rather than using a standardized diagnostic instrument. Secondly, the participants were recruited from one center, so they may not be representative of all children in general population. Further study in multi-center with a larger sample size should be conducted. Lastly, we conducted the present study without controlling for age and gender in both groups, which might affect the result of the study. In our experiences, we usually found that parents of children with language developmental delay in Thailand concerned and presented to our

clinic approximately at the age of two years or later. This result in the children in delayed language group was older than the typically developing group. Furthermore, it has been established that male gender is more likely to have delayed language development than female gender[27]. Therefore, boys were overrepresented in the delayed language group in the study.

Conclusion

Detection of delayed language development by general practitioners in primary health care service is challenging, due to lack of reliable and easily used screening tool. The RLD questionnaire offers a promising and useful instrument for identifying delayed language development. In the future study, the RLD questionnaire should be utilize in the general population to study the effectiveness as a screening tool for early detection of language developmental delay.

What is already known on this topic?

Delayed language development is one of the most common developmental problems in children. Early identification of language delay can lead to early intervention, and results in lessening impact on the functioning of the child. However, in Thailand, there is no language development screening tool to easily use in primary care setting.

What this study adds?

RLD Questionnaire, a newly developed parental questionnaire offers a promising and useful instrument for identifying delayed language development in primary care setting. It is easy to use and takes less than 10 minutes to complete by children's caretaker. The internal consistency is in the good level and under the optimum cut off point. Its sensitivity and specificity are acceptable levels.

Acknowledgements

The present study was conducted with the financial support of the Faculty of Medicine, Ramathibodi Hospital, Bangkok, Thailand. We gratefully acknowledge the contributions of Mrs. Umaporn Udomsubpayakul for assistance with statistical analyses and Miss Sauwanee Thaowan, clinical psychologist. This study would not have been possible without the support of the families and children who donated their time to participate in this study.

Potential conflicts of interest

None.

References

1. Dearlove J, Kearney D. How good is general practice developmental screening? BMJ 1990; 300: 1177-80.
2. Glascoe FP. Early detection of developmental and behavioral problems. Pediatr Rev 2000; 21: 272-9.
3. Schum RL. Language screening in the pediatric office setting. Pediatr Clin North Am 2007; 54: 425-36.
4. Law J, Rush R, Schoon I, Parsons S. Modeling developmental language difficulties from school entry into adulthood: literacy, mental health, and employment outcomes. J Speech Lang Hear Res 2009; 52: 1401-16.
5. US Preventive Services Task Force. Screening for speech and language delay in preschool children: recommendation statement. Pediatrics 2006; 117: 497-501.
6. Health Systems Research Institute (HSRI). The national survey of health status in Thailand. Nonthaburi: HSRI; 2010.
7. Schonwald A, Horan K, Huntington N. Developmental screening: is there enough time? Clin Pediatr (Phila) 2009; 48: 648-55.
8. Fenson L, Dale PS, Reznick JS, Thal D, Bates E, Hartung J, et al. The MacArthur communicative development inventories: User's guide and technical manual. San Diego, CA: Singular Publishing Group; 1993.
9. Coulter L, Gallagher C. Piloting new ways of working: evaluation of the WILSTAAR Programme. Int J Lang Commun Disord 2001; 36 (Suppl): 270-5.
10. Coplan J, Gleason JR. Quantifying language development from birth to 3 years using the Early Language Milestone Scale. Pediatrics 1990; 86: 963-71.
11. Brothers KB, Glascoe FP, Robertshaw NS. PEDS: developmental milestones--an accurate brief tool for surveillance and screening. Clin Pediatr (Phila) 2008; 47: 271-9.
12. Squires J, Potter L, Bricker D. The ASQ user's guide for the ages and stages questionnaires: a parent-completed child monitoring system. Paul Baltimore: Brookes Publishing; 1999.
13. Kleinman JM, Robins DL, Ventola PE, Pandey J, Boorstein HC, Esser EL, et al. The modified

checklist for autism in toddlers: a follow-up study investigating the early detection of autism spectrum disorders. J Autism Dev Disord 2008; 38: 827-39.
14. Robins DL, Fein D, Barton ML, Green JA. The Modified Checklist for Autism in Toddlers: an initial study investigating the early detection of autism and pervasive developmental disorders. J Autism Dev Disord 2001; 31: 131-44.
15. Frankenburg WK, Dodds J, Archer P, Shapiro H, Bresnick B. The Denver II: a major revision and restandardization of the Denver Developmental Screening Test. Pediatrics 1992; 89: 91-7.
16. Glascoe FP. Parents' concerns about children's development: prescreening technique or screening test? Pediatrics 1997; 99: 522-8.
17. Glascoe FP. Evidence-based approach to developmental and behavioural surveillance using parents' concerns. Child Care Health Dev 2000; 26: 137-49.
18. Glascoe FP, Foster EM, Wolraich ML. An economic analysis of developmental detection methods. Pediatrics 1997; 99: 830-7.
19. Ross B, Cress CJ. Comparison of standardized assessments for cognitive and receptive communication skills in young children with complex communication needs. Augment Altern Commun 2006; 22: 100-11.
20. 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.
21. 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; 46: 261-72.
22. Tomblin JB, Smith E, Zhang X. Epidemiology of specific language impairment: prenatal and perinatal risk factors. J Commun Disord 1997; 30: 325-43.
23. Law J, Boyle J, Harris F, Harkness A, Nye C. Screening for speech and language delay: a systematic review of the literature. Health Technol Assess 1998; 2: 1-184.
24. Westerlund M, Sundelin C. Screening for developmental language disability in 3-year-old children. Experiences from a field study in a Swedish municipality. Child Care Health Dev 2000; 26: 91-110.
25. Eapen V, Zoubeidi T, Yunis F. Screening for language delay in the United Arab Emirates. Child Care Health Dev 2004; 30: 541-9.
26. Wong V, Lee PW, Lieh-Mak F, Yeung CY, Leung PW, Luk SL, et al. Language screening in preschool Chinese children. Eur J Disord Commun 1992; 27: 247-64.
27. 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.

Appendix 1. The details of clinical diagnosis of participants in delayed language group

Number	Age (months)	Language development	VABS (communication domain)
1	26	Jargon, no meaningful word	66
2	26	Speak less than 10 meaningful words	68
3	21	Jargon, no meaningful word	60
4	28	No meaningful word	61
5	20	Speak less than 10 meaningful words	60
6	25	Speak only one word (mom)	66
7	24	No meaningful word	61
8	25	Speak less than 50 meaningful words, no combined word	69
9	29	Speak 5 meaningful words	65
10	20	Speak less than 10 meaningful words	74
11	25	Speak less than 50 meaningful words, no combined word	76
12	29	No meaningful word	69
13	20	Speak only one word (no)	78
14	24	Speak less than 10 meaningful words	76
15	23	No meaningful word	70
16	23	Speak only two words	83
17	29	Speak less than 50 meaningful words, no combined word	71
18	28	No meaningful word	70
19	21	Speak only two words	82
20	21	Speak less than 10 meaningful words	78
21	19	No meaningful word	64
22	18	No meaningful word	81
23	20	Speak less than 10 meaningful words	77
24	22	No meaningful word	84
25	23	No meaningful word	76
26	19	Speak only one word (dad)	74
27	28	Speak only one word (mom)	69
28	29	Speak less than 10 meaningful words	65
29	22	No meaningful word	73
30	22	Speak 5 meaningful words	74

แบบสอบถามจากผู้ปกครอง Ramathibodi Language Development (RLD) Questionnaire เพื่อคัดกรองภาวะพัฒนาการล่าช้าทางด้านภาษาในเด็กอายุ 18-30 เดือน

จริยา จุฑาภิสิทธิ์, พรชนก วันทนากร, รวิวรรณ รุ่งไพรวัลย์

วัตถุประสงค์: *เพื่อพัฒนาแบบสอบถามจากผู้ปกครองเพื่อคัดกรองภาวะพัฒนาการล่าช้าทางด้านภาษา Ramathibodi Language Development (RLD) ในการบริการสาธารณสุขระดับปฐมภูมิ*

วัสดุและวิธีการ: *แบบสอบถามความเห็นผู้ปกครองเพื่อคัดกรองภาวะพัฒนาการล่าช้าทางด้านภาษา RLD ถูกพัฒนาขึ้นและกรอกโดยผู้ปกครองของเด็กที่มีพัฒนาการปกติอายุ 18-30 เดือน จำนวน 40 คน และผู้ปกครองของเด็กที่มีพัฒนาการล่าช้าทางด้านภาษาในช่วงอายุเดียวกัน จำนวน 30 คน*

ผลการศึกษา: *ค่าเฉลี่ยของคะแนนของแบบสอบถาม RLD ในกลุ่มเด็กที่มีพัฒนาการล่าช้าทางด้านภาษา (6.7±1.9) น้อยกว่ากลุ่มที่มีพัฒนาการปกติ (9.6±0.7) อย่างมีนัยสำคัญทางสถิติ และค่าจุดตัดของคะแนน RLD ที่เหมาะสม อยู่ที่ 8 คะแนน ด้วยค่าความไวเท่ากับร้อยละ 98 และค่าความจำเพาะเท่ากับ ร้อยละ 72 ตามลำดับ*

สรุป: *แบบสอบถาม RLD น่าจะเป็นเครื่องมือที่มีประโยชน์ในการนำมาใช้คัดกรองภาวะพัฒนาการล่าช้าทางด้านภาษาในเด็กในบริการสาธารณสุขในระดับปฐมภูมิต่อไป*