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Developmental Performance of Young Children Aged 1 – 42 Months in Mueang Pitsanulok, Thailand: The Bayley-III Screening Survey

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Abstract

The Bayley-III Screening test is one of the most worldwide used standardized assessments for young children aged between 1-42 months, however, it is less well-known in Thailand. This preliminary study aimed to conduct developmental screening using the Bayley-IIIscreening test and to report the cross-sectional developmental performance of infants and toddlers in Mueang Phitsanulok, Thailand during August 2007. The secondary objective was to explore the feasibility of using Bayley-III Screening in Thailand. We assessed 67 Thai children (31 boys and 36 girls; age range 1-42 months old [mean=16 months; SD=9.74, this included bothchronological age and corrected age for prematurity]). The Bayley-III test was administered to assess five subtests of development: cognitive, expressive- and receptive-communication, fine and gross-motor functioning. Summary scores for each subtest were determined using the Bayley-III subtest cut-score information regarding the child's age, and classified into 'competent', 'emerging', and 'at risk' categories. All 67 children were assessed but three infants were dropped-off during the assessments as they were in an inattentive state. In all five subtests, the majority of those 64 included children were classified as 'competent', i.e. as typically developing, while only about 3-20% of the children were categorized as 'emerging' risk and 3-7% of the children were found 'at risk' to developmental delays. For the latter, 4 children exhibited 'at risk' in both cognitive and communication subtests. Based on the Bayley-III identification, the developmental performance of young children in Mueang Phitsanulok during August 2007 was generally at the lowest risk for developmental delays.

Keywords: Developmental performance, Bayley-III screening test, Young children, Risk to developmental delay

Introduction

Developmental screening is one of the guidelines of preventive care for infants and young children. Identifying and addressing this concern is of great importance so that early intervention and services can be provided to treat risks and prevent further delays (Committee on Children with Disabilities, 2002; Johnson & Marlow, 2006; Aylward, 2009). Developmental screening is an

important first step to identify whether infants and young children have risks to developmental delay (Committee on Children with Disabilities, 2001; Johnson & Marlow, 2006; Aylward, 2009). According to the study by Visser, Vlaskamp, Emde, Ruiter, & Timmerman (2017), standardised developmental assessment instruments assume consistency between children's order of skill development. Developmental surveillance and screening in Thailand, and an early intervention program in many parts of our country have been established for many years (Sirithongthaworn et al., 2013b; Morrison, Chunsuwan, Bunnag, Gronholm & Lockwood, 2018). However, the use of standardized developmental assessments in Thailand is currently limited (Techasaensiri, Chuthapisith, Thaowan, & Ruangdaraganon, 2011). The pioneer study of the Department of Mental Health, Ministry of Public Health completed by Sirithongthaworn et al., (2013a) aimed to determine the developmental norms for children from birth to 5 years in Chiang Mai. Presently, standardised developmental screening tools that are available in Thailand (Department of Health, Ministry of Public Health, 2007) may include, but are not limited to, the Denver Developmental Screening Test II (Frankenburg, Dodds, Archer, Shapiro, & Bresnick, 1992; Kotchapakdi & Lersawassadatrakul, 2003), the Developmental Surveillance and Promotion Manual (DSPM) screening tool and the Developmental Assessment and Intervention Manual (DAIM) screening tool; version 2015. DSPM & DAIM: (Sirithongthaworn, 2018; Morrison et al., 2018). Research showed that although the Denver II is the most widely used screening tool for young children, it may over-identify children as delayed when they are typically developing. The test had limited specificity (43%) and this may cause a high over-referral rate (Glascoe et al., 1992). These limited numbers of standardized assessmentsand screening tools may affect the effectiveness of early detection for infants and young childrenwith risks to developmental problems, especially in preterm infants (Committee on Children withDisabilities, 2002; Johnson & Marlow, 2006). Another important point of concern is in terms of research and database. National statistics on developmental surveillance of young Thai children are rarely published internationally, with only surveillance reports being found locally. According to Developmental Surveillance by the Department of Health during the years 1998 - 2007, a decreasing number of children in the norm range was found. That means that many Thai children were increasingly delayed compared with the developmental norm. The national try-out phase was conducted in a demographically stratified sample of 1,558 children aged between 1-3 years. Based on the modified Denver-II screening, four developmental categories were tested which were gross motor function, language, fine motor-adaptive skill, and personal-social skill). Data showed that 71% of children were typically developing in the year 1998, 72% in the year 2004, and 67.7% in the year 2007, respectively (Department of Health, Ministry of Public Health, 2007). There is a need to explore alternative screening tools that provide more reliable and predictive accuracy and cost-effectiveness for the appropriate referrals, including database collection for research in this field (Hess, Papas, & Black, 2004)

The Screening Test of the Bayley Scales of Infant and Toddler Development, Third Edition (Bayley-III screening test) has been designed for briefly assessing the cognitive, language, and motor functioning of infants and young children aged between 1 month and 42 months (Bayley, 2006). The Bayley-III screening test is a subset of the cognitive, language, and motor items of the Bayley Scales of Infant and Toddler Development, Third Edition (BSID-III; Bayley, (2006)). It is one of the most worldwide used standardiz ed assessments (Aylward, Verhulst, & Bell, 1996; Aylward & Verhulst, 2000; Aylward, 2009; Bayley, 2006;

Hess et al., 2004). Validity of the Bayley-III screening test has been evaluated by examining sensitivity, specificity, positive predictive power, and negative predictive power. The diagnostic accuracy of the Bayley-III screening test is highly acceptable (Bayley, 2006). It is administered by qualified personnel such as psychologists, psychiatrists, speech and language therapists, occupational and physical therapists specializing in early intervention, early interventionists, social workers, developmental paediatricians, and paediatric nurse practitioners (Bayley, 2006; Hess et al., 2004). However, it is less well-known for Thai clinicians and researchers. This concern led to our interest in implementing the use of the Bayley-III Screening test in Thailand and conducting a feasibility study of the use of the Bayley-III screening test at Well-Baby Clinics in Mueang Pitsanulok, Thailand.

Objectives

This preliminary study aimed to conduct preliminary surveillance of the developmental performance of infants and toddlers in Mueang Pitsanulok, Thailand by means of Bayley-III screening. The secondary objective was to explore the feasibility of using Bayley-III Screening in Thailand.

Methods

Study design

Cross-sectional Descriptive study design

Participants

Sixty seven Thai young children participated (31 boys and 36 girls; aged 1-42 months old; this included both those with chronological age and corrected age for prematurity (mean age=16 months; SD=9.74). The children were drawn from the Well Baby Clinics of four Community Health Centers in Pitsanulok Province, Thailand. Parents were sent an invitation letter with a study information sheet prior to their appointment of well-child visits. Children werere cruited if parents agreed to participate and signed an informed consent. Children were excluded if a) parents did not agree, nor respond to the invitation, b) families were not compliant with the follow-up visits, and c) a child had been formally diagnosed with a developmental delay. Our developmental screening was scheduled during well-child visits, following an immunisation schedule, during the period of August 2007. The Central Committee on Research involving Human Subjects of Naresuan University approved the study.

Measures

The Bayley-III screening test, originally the English version (Bayley, 2006), consists of five subtests as follows: Cognitive subtest 33 items, Receptive communication subtest 24 items, Expressive communication subtest 24 items, Fine-motor subtest 27 items and Gross motor subtest 27 items. The number of test-items depends on the child's age. The subtests and scoring are designed such that an examiner may administer any or all subtests and determine a cut score for each administered subtest. The cut scores are used to determine whether the child shows competence in age-appropriate tasks, shows evidence of emerging age-appropriate skills, or shows evidence of being at risk for developmental delay (Bayley, 2006). Thus, the summary score of a child reflects the child's level of risk for developmental delays or neurological impairments and is classified as one of three categories: competence, emerging, or at risk (Bayley, 2006). The cut scores for each age group were well developed by the Bayley research team using the normative sample and special group samples, so the cut scores used to determine risk classification vary according to the child's age (Bayley, 1993; Bayley, 2006; Hess et al., 2004). The average reliability coefficients (Silver & Dunlap, 1987) of the Bayley-III test by group age has been reported to be high, ranging from 0.82 to 0.88 for children aged 1-42 months

Procedures

The child was administered items from five separate parts of the record form: cognitive, receptive, expressive-communication, fine motor, and gross motor. According to the Bayley administration guidelines, for children aged 12 months and younger, administration time for the entire Bayley-III screening test (all five subtests) should range between 15 and 20 minutes, whiletesting time for children aged 13 months and older was approximately 30 minutes (Bayley, 2006). However, if the child became fatigued, inattentive, overly restless or uncooperative, the test was stopped, and a child was allowed to take a 5-minute break, have a snack or other feedingif needed. The child's response was recorded and scored as credit = 1, or no credit = 0. When thechildren were aged 1 - 12 months old, the Bayley-III test was administered by the first author (MA). When the children were 13 months and older, the Bayley-III test was administered by one of three undergraduate students of physical therapy who had been trained in administration and scoring by an experienced paediatric physical therapist (MA). After the Bayley-III test for a developmental screening platform was done, all parents were invited to give feedback about the developmental screening platform. The parents filled out the satisfaction questionnaire in three areas: i) impression of raters, ii) environment of the screening venue, and iii) satisfaction regarding the Bayley – III screening process.

Reliability

Prior to the study, training on the procedure of administration and scoring the Bayley-III test (original version) by three undergraduate students was done as a pilot study at the Naresuan University Day Care Center. The reliability of scoring was assessed by evaluating the agreement of three undergraduate students and MA, which was obtained from a sample of 12 young children aged between 1 - 42 months. Reliability was measured for both Intra-rater reliability andInter-rater reliability. The reliability information showed Intra-rater reliability of the first, second, and third rater on the same child on two occasions in the interval of seven days = 0.995, 0.995 and 0.994 (Intraclass Correlation Coefficients; ICCs, 95% confidence interval), and Inter-rater reliability among all users = 0.99 (two-way consistency average-measures of ICCs, 95% confidence interval).

Results

All 67 children were assessed but three infants were dropped-off during the assessments as they were in an inattentive state (hungry and fatigued). Children characteristics were presenten in Table I. Of 64 children included in the sample, 85.94% of them were classified as 'competent'in the cognitive subtest, 95.31% in the gross-motor subtest, 81.25% in the fine-motor subtest, 71.88% in the expressive- communication subtest, and 70.31% of them in the receptive-communication subtest respectively, while 10.94%, 3.13%, 17.19%, 21.88% and 21.88% of children were categorized as 'emerging' risk in the above subtest sequences. Lastly, 3 - 7% of children were determined to be 'at risk' to developmental delays as follows: 3.12% of children with cognitive delays, 1.56% with gross-motor delays, 1.56% with fine-motor delays, 6.24% with expressive-communication delays, and 7.81% with receptive-communication delays respectively. Of these, 4 out of 64 children exhibited 'risk' in all three subtests, namely, cognitive, expressive-, and receptive-communication delays. The age range that posed the highest 'risk' to delays was found to be 19-24 months old (Figure 1).

Table I: Participant characteristics (n=64 children)

Characteristic of participants	No. (%) of children
Age (months old)	
1-6 mo	10 (15.63%)
7-12 mo	18 (28.13%)
13-18 mo	12 (18.75%)
19-24 mo	10 (15.63%)
25-30 mo	9 (14.06%)
31- 42 mo	5 (7.81%)
(average age=15.96 ± 9.74 months old)	
Body type (mean ±SD)	
Weight (kg)	11.08 ± 3.69
Height (cm)	76.83 ±12.26
Labour delivery	
Normal labour	61.19%
Cesarian section	38.81%
Gestational period	
Full term	77.61%
Preterm	15.20%
Post term	7.19%
Risk factor to developmental delay	
no risk	88.24%
hyperbilirubinemia	7.35%
receiving care in new-born incubator	2.94%
Nutritional problems after birth	1.47%
Maternal health	
Healthy pregnancy	94.03%
Other problems during pregnancy	5.97%

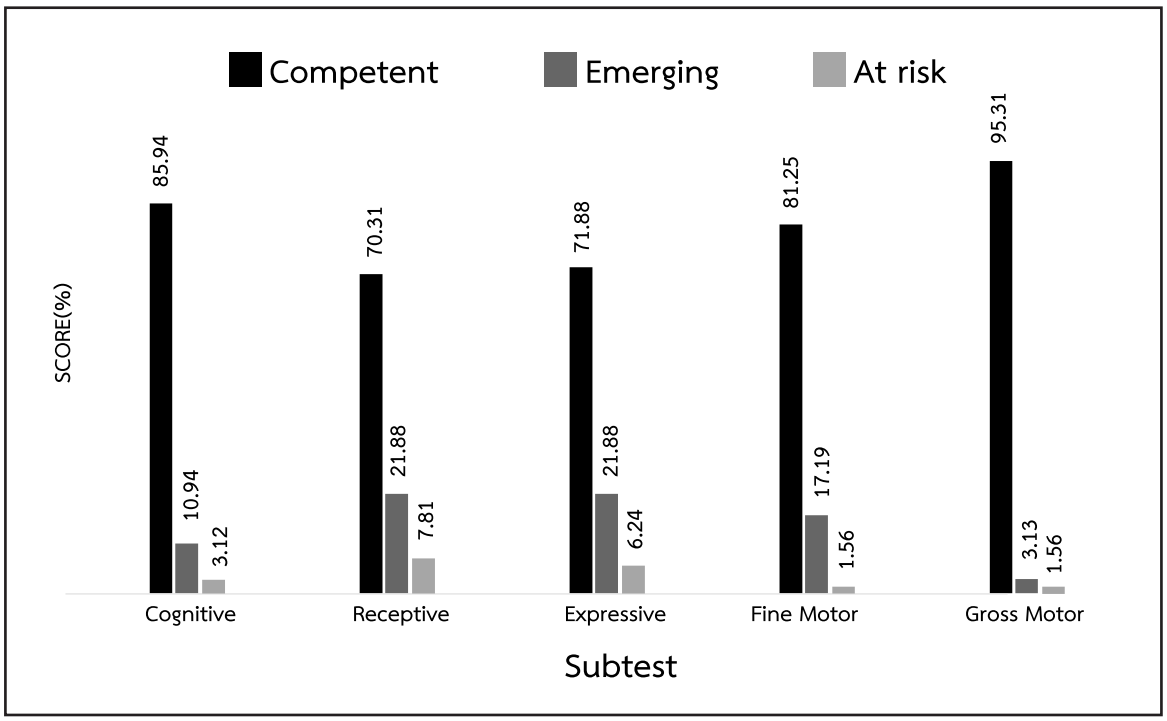

Figure 1: Classification based rates by the Bayley-III screening test of 64 young children with age ranges between one month and 42 months (corrected age)

Questionnaires regarding satisfaction were carried out with all 64 parents or caregivers. Parents or caregivers gained great satisfaction with all of the rater team. This included the team's manners, willingness and enthusiasm during assessment, and team member's personality. Secondly, parents gained great satisfaction with the standard Bayley Kit tools which were clean and safety tested tools or toys, a well managed screening procedure, the clean and spacious venue of the testing room. There was less satisfaction regarding some noisy environments duringthe test. Regarding satisfaction of the Bayley - III screening procedure, parents or caregivers fully appreciated being informed about their children's developmental performance, and the benefits of developmental screening. The only least satisfaction was about the time spent on screening.

Discussion

This preliminary study of the use of the Bayley-III screening test was found to be feasible and satisfactory. We could screen and identify the developmental performance of 64 young children aged from 1 month to 42 months in Mueang Phitsanulok, Thailand by means of the Bayley-III screening (original version) and report that 3-7% of them were in the 'at risk' category. Based on Bayley-III identification in this descriptive and exploratory cross-sectional study, the developmental performance of 64 young children aged below 42 months old in Mueang Phitsanulok during August 2007 was generally at the lowest risk for developmental delays with 70% - 95% of the studied children typically developing in each of the developmental subtests. Thus, in most cases, children did not need further evaluation. This proportion of developmental competency was, however, lower than the data reported by the Public Health Ministry in the year 2006 (1st trimester) which indicated that 99.97% of children in Mueang Pitsanulok were healthily developing (Phitsanulok Health Data, unpublished data). This may be because we only did the test once and did not follow-up for a proper course of time. Nevertheless, in our preliminary findings the percentages of children with 'competent' classification, i.e. those who were typically developing, were much higher than in the report in the year 2007 of the Thai Department of Health that showed that 67.7% of children were typically developing (Department of Health, Ministry of Public Health, 2007). This means that there was quite a number of young children who were determined to be 'at risk' to delay. We questioned that it might be because the children with potentially normal development also received abnormal, questionable, or unstable identifying scores (Committee on Children with Disabilities, 2001). This might lead to, for example, over-referral rates of those likely to be at-risk, but not disabled, babies who receive stimulation programs. An impact of this example may include the high false-positive rates carrying costs and being part of economic constraints in health care and education (Glascoe, 2001). From our preliminary findings, the most 'at risk' developmental performance was in receptive- and expressive communication which accounted for 3-7% of these 64 young children. The age ranges that posed the highest 'risk' to delays were the group 13-18 months old and 19-24 months old. This should be interpreted with caution as our sample size was small, and the test region was only specific to the District of Phitsanulok Province. Another factor might be the different cultural context of language used in the test, which may use different words in reception and expression for the Thai content, after translation from English, as studied and reported by Techasaensiri and colleagues (Techasaensiri et al., 2011).

Routine developmental screening is recommended for all children during well-baby visits(Morrison et al., 2018). The combination of surveillance and screening for developmental behavioral problems in children enhance early identification (Guevara et al., 2013; Schonwald, Huntington, Chan, Risko, & Bridgemohan 2009; Hix-Small, Marks, Squires, & Nickel, 2007) and promote earlier intervention, which is associated with an outcome improvement (Anderson et al., 2003). Experts suggested that clinical impressions of development alone, are less accurate than the use of validated screening tests and that reliance on surveillance alone, may miss children with developmental-behavioural problems who would benefit from early intervention (Guevara et al., 2013). Implementation of validated developmental screening in primary care canbe challenging. The ideal screening test should have established psychometric qualities (i.e., validity, reliability, accuracy) and be easy to perform and interpret, inexpensive, and acceptable to the child and parents. Children who truly fail a screening test should be promptly referred for additional developmental assessment and evaluation,starting

with an early intervention program or special education. These evaluations are provided without cost to families in government hospitals and Well-Baby Clinics in Phitsanulok Province, Thailand.

Strengths and Limitations

Strengths of this preliminary study on the application of the Bayley-III screening test were: this standardized assessment has a flexible administration format to accommodate variability in the child's age and temperament, and provides norm-referenced scores while the scaled scores can be calculated for all subtests. Thus, children can be identified for specific problems, e.g. risk to delay in language, cognitive, or motor function. With the use of the Bayley-III screening procedure, young children can be identified for specific problems in each developmental domain. Nevertheless, limitations of the Bayley-III application were that the Thai version of the Bayley-III test has not yet been made officially available, and its original tool kit is expensive. Our preliminary findings with a small sample size were only a feasibility study and cannot be generalized.

Conclusion

In conclusion, based on Bayley-III identification, the developmental performance of young children in Mueang Pitsanulok of Pitsanulok Province during the period of August 2007 was generally at the lowest risk for developmental delays; and in most cases, did not need furtherevaluation. Lastly, we would like to address that implementation of validated developmental screening and assessment tools with acceptable psychometric qualities in Thailand, can be challenging. Importantly, it urgently needs further research and development. For true benefits to young children's quality of life, several choices of developmental assessment should be debated and effectively used.

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