

Parents Evaluation of Developmental Status and Denver Developmental Screening Test II in high risk infant and toddler

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Abstract

Background. Developmental screening is important particularly for high risk infants and toddlers. Parents Evaluation of Developmental Status (PEDS) and Denver Developmental Screening Test II (Denver II test) are recommended instruments with good sensitivity and specificity. Compared to Denver II test, PEDS is simpler, thus it is important to assess the agreement of PEDS and Denver II test.

Objectives. To determine the prevalence of developmental disorder in high risk infants and toddlers and agreement of PEDS and Denver II test.

Methods. Infants and toddlers registered at pediatric high risk clinic were recruited. PEDS questionnaire was answered by parents while the Denver II test performed by the investigator. Agreement of PEDS and Denver II instrument was assessed by Kappa score.

Results. Out of 71 subjects, 41 (58%) were male, 43 (61%) were >12 months old, 35 (49%) were undernourished, 42 (59%) were preterm (<37 week gestational age), and 43 (60.6%) were low birth weight (LBW). The prevalence of developmental disorder was higher in subjects >12 months old (42%), undernourished (49%), preterm (48%), and LBW (47%). The prevalence of developmental disorder was 49% by PEDS and 39% by Denver II test. Agreement of PEDS and Denver II test was good with Kappa score 0.52, particularly for gross motor and language domain.

Conclusions. The prevalence of developmental disorder is higher in high risk infant and toddler, who >12 months old, undernourished, premature, and LBW. PEDS instrument are equivalent to Denver II test, shows good agreement, particularly for gross motor and language domain. [Paediatr Indones. 2010;50:26-30].

Keywords: developmental screening, high risk infant and toddler, PEDS, and Denver II

The first three year of life is a window period to optimize child's growth and development because of the very fast growth of brain development.¹⁻³ About 16-18% of children in the United States have developmental problems, but only 20-30% of them are detected before school-age.³⁻⁵ The recommended standard instrument for routine developmental screening (sensitivity and specificity 70-80%) is only performed by 29% doctors. Screening instrument based on parental report is recommended because it is simpler, less time consuming, minimal skill requirement, inexpensive, and able to cover more children.⁴⁻⁷

High risk babies are infants who clinically seems normal but has the potential to suffer developmental disorder.⁸ The prevalence of developmental disorders are high. Kadi⁹ found that 22.4% children have developmental disorder. Social Pediatrics-Growth and Developmental (SP-GD) Outpatient Clinic, Department of Child Health (DCH), Cipto Mangunkusumo Hospital (CMH) uses Denver II as standard developmental screening instrument, but it requires skilled examiner, a lot of examination tools, and longer

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examination time (15-20 minute). Parents' evaluation of developmental status (PEDS) should be considered because it is simple, based on parents' report, good sensitivity (74-79%) and specificity (70-80%), less time consuming (2-5 minute), and doesn't need skilled examiner.¹⁰⁻¹² Theeranate et al¹³ (Thailand) found agreement of PEDS and Denver II is good with Kappa score 0.42.

Based on these facts, developmental screening by using standard instrument is important particularly for high risk infant and toddler. PEDS instrument could also be used besides Denver II instrument but it should be evaluated the agreement of both instrument, especially in Indonesian context. This study was also intended to find the characteristics of high risk infant and toddler (HRIT), risk factors of developmental disorder, and the prevalence of developmental disorder.

Methods

This was a descriptive cross-sectional study carried out at SP-GD outpatient clinic of DCH, CMH, Jakarta during April-May 2009. Subjects were selected consecutively from high risk baby clinic with inclusion criteria: age <36 months, has risk factors such as prematurity, low birth weight (LBW), prenatal, perinatal, and postnatal risk factors. We excluded children with congenital anomaly associated with developmental disorders, hearing or vision problem. Informed consent was obtained and the study was performed after approval from the Ethics Committee, Faculty of Medicine, University of Indonesia. Parents filled PEDS questionnaire while the investigator performed the Denver II test. Assessment of agreement between PEDS and Denver II was done by calculating the coefficient of agreement with Kappa score.

Results

This study was performed from April to May 2009 with 78 HRIT subjects, 7 subjects were excluded so that 71 subjects recruited at the end of the study period. Subject characteristics are depicted in **Table 1**.

The male to female ratio was 1.4:1, the median age of the subjects was 14 months old (3-33 months),

Table 1. Subject characteristics of HRIT (n=71)

Characteristics	n (%)
Sex	
Male	41 (58)
Female	30 (42)
Age (month)	
3-12	28 (39)
>12-36	43 (61)
Nutritional status	
Undernourished	35 (49)
Good-over nourished	36 (51)
Gestational age (GA/week)	
<37	42 (59)
37-41	29 (41)
Birth weight (BW/g)	
<2500	43 (61)
2500-4000	28 (39)
Neonatal status	
Appropriate for gestational age (AGA)	55 (78)
Small-large for gestational age (SGA-LGA)	16 (23)

and there was no post-term subjects. The median gestational age of the subjects was 34 weeks (27-41 weeks) and median birth weight was 2200 g (800-4000 g). Parents' characteristics showed that mean age of mothers' was 32 ± 6 years old, 59.2% mothers were 25-35 years old, 83.1% had medium-low education level, all were low income (<935,000 IDR/month/life), and the median income was 300,000 IDR (50,000-1,300,000 IDR).

The prevalence of developmental disorder found by the PEDS instrument was 49%, while by Denver II instrument was 39%. Median time to fill in the PEDS questionnaire and to perform the Denver II examination were 5 minutes (4-8 minutes) and 15 minutes (10-20 minutes), respectively.

The characteristics of subjects based on the screening results with PEDS and Denver II instrument were presented in **Table 2**.

The Kappa score determined the agreement of PEDS and Denver II instrument. If the Kappa score was ≥ 0.75, the agreement between both instrument was very good, if the Kappa score was 0.4- <0.75, the agreement was good, and if the Kappa score was <0.4, the agreement was poor.

The Kappa score in this study, based on the coefficient of agreement between PEDS and Denver II instrument presented in **Table 3** was 0.52 (the agreement was good). Assessment of agreement in each developmental domain showed that there was no agreement between those instruments in the fine

Table 2. Characteristics of subjects based on screening results (n=71)

CHARACTERISTIC	PEDS		DENVER II	
	Suspect	Normal	Suspect	Normal
	N=35	N=36	N=28	N=43
Sex				
Male (n=41)	22	19	15	26
Female (n=30)	13	17	13	17
Age, mo				
3-12 (n=28)	12	16	10	18
>12-36 (n=43)	23	20	18	25
Nutritional Status				
Undernourished (n=35)	20	15	17	18
Well nourished (n=36)	15	21	11	25
Gestational age, wk				
<37 (n=42)	22	20	20	22
37-41 (n=29)	13	16	8	21
Birth weight, g				
<2500 (n=43)	22	21	20	23
2500-4000 (n=28)	13	15	8	20
Neonatal status				
AGA (n=55)	28	27	24	31
SGA-LGA (n=16)	7	9	4	12
Total	35	36	28	43

Table 3. Instrument agreement in over all developmental domains

Instrument	Denver II			
	Suspect	Normal	Total	
PEDS	Suspect	23	12	35
	Normal	5	31	36
Total	28	43	71	

motor developmental domain. The Kappa score for the personal-social, gross motor, and language developmental domain was 0.23 (<0.4), 0.55 (0.4-0.75), and 0.63 (0.4-0.75), respectively, so the agreement between both instruments were good in gross motor and language, but poor in personal-social developmental domain.

Discussion

The prevalence of developmental disorder was more frequent in the male subjects when using the PEDS instrument. On the other hand, when using the Denver II instrument, the prevalence of developmental disorder was more frequent in the female subjects. Khan et al¹⁴ found developmental disorder in male subjects more

frequent (54.0%). Based on the literature, there is no conclusion about the association between sex and developmental disorder.

The prevalence of developmental disorder was more frequent in subjects aged >12 months old. Rosenberg et al⁵ found developmental disorder more frequent in children aged 24 months old (13.8%) compared to children aged 9 months old (12.0%). Enhance communication, education, and information about the importance of developmental screening to parents of HRIT are necessary. The prevalence of developmental disorders was more frequent in the undernourished subjects. Halpern et al¹⁵ found undernourished subjects had developmental disorder 10 times more frequent with odds ratio (OR) 10.16. Vazir et al¹⁶ in India found developmental delayed at all developmental domains in undernourished subjects.

The prevalence of developmental disorder in subjects with gestational age <37 week were more frequent. Khan et al¹⁴ found 68% preterm babies (<33 week) had developmental disorder. Soleimani et al¹⁷ in Iran and Bang¹⁸ in South Korea stated that prematurity had an association with developmental disorder, with OR 2.52 and 3.47 respectively.

Developmental disorder was more frequent in

LBW infants (<2500 g). Kadi⁹ found developmental disorder in infants LBW (1500-2500 g), was 22.4%, fewer than this study. Bucher et al¹⁹ in Swiss found that children <2 years of age with gestational age <32 week and very low birth weight (VLBW) infants <1500 g had higher prevalence of developmental disorder compared to VLBW infants >1500 g (10.9% vs 6.5%). In this study, there were 2 subjects with extremely low birth weight/ELBW (800 g).

Developmental disorder in HRIT subjects in this study was 49.3% by PEDS and 39.4% by Denver II instrument. We have not found any other study concerning the prevalence of developmental disorder in HRIT yet. This study result was higher than result found by Kadi⁹ on 2008 in Bandung with LBW 1500-<2500 g subject based on *Kuesioner praskrining perkembangan* (KPSP) and Denver II instrument that found prevalence of developmental disorder was 17.6% and 22.4%, respectively. Khan et al¹⁴ on 2003 in Bangladesh with preterm subjects (<33 week) found developmental disorder in 45-68% subjects, based on developmental specialist examination and BSID II instrument. This study result is similar to result found by Khan et al.¹⁴ Our study was performed in HRIT subjects from high risk clinic with many risk factors and also subjects came from tertiary hospital (CMH), this could cause the similar prevalence found with Kahn et al¹⁴ study and higher than Kadi's⁹ study.

Agreement of PEDS and Denver II instrument include gross motor, fine motor, personal-social and language domain. Agreement was defined very good if Kappa score was ≥ 0.75 , good if Kappa score between 0.4-0.75 and poor if Kappa score <0.4.²⁰ Agreement of fine motor domain couldn't be counted so there was no agreement. In the personal-social domain, the agreement was poor (Kappa 0.23), but in the gross motor and language domain agreement of both instrument was good (Kappa 0.55 and 0.63, respectively). Questions in the PEDS questionnaire should be well understood by parents to answer correctly. We suggested that PEDS questionnaire should be evaluated particularly for questions number four, seven, and eight. Some of the developmental domain such as fine motor and personal-social domain may be need direct assessment. The all over agreement of both instruments was good (Kappa 0.52). Theeranate et al¹³ also found agreement of PEDS and Denver II good (Kappa 0.43), but fewer

than this study result. Theeranate et al¹³ didn't show agreement in each developmental domain. Several studies also showed parents' evaluation of their child's development was good particularly in language and gross motor domain.²¹ Although the agreement was good, but it was only good in language and gross motor domain, while in the fine motor and personal-social domain the agreement was poor.

In conclusion, developmental disorder is higher in high risk infant and toddler, who >12 months old, undernourished, premature (<37 week), and LBW (<2500 g). Parents' evaluation of developmental status (PEDS) instrument could be used equivalent to Denver II test due to its good agreement (Kappa score 0.52), mainly in the gross motor and language domain.

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