

## Risk factors of developmental delay: a community-based study

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### Abstract

**Background** Developmental delay is a common problem in children. Early detection of this disorders is mandatory in order to provide early interventions. Identification of the risk factors is important for strategic intervention.

**Objective** To identify risk factors of developmental delay in children under five years old.

**Methods** A community-based study of developmental screening was conducted, in Bambanglipuro, Bantul district, Province of Yogyakarta, between September and October 2007. Developmental screening was performed using a *Kuesioner Pra Skrining Perkembangan* (KPSP).

**Results** Out of 632 children aged 3 to 60 months, 407 (64%) had normal development, 81 (28%) doubtful and 43 (8%) suspected developmental delay. A number of factors identified as the risk of suspected developmental delay were undernourished (OR 2.3, 95%CI 1.1; 4.8), low birth weight (OR 2.6, 95%CI 1.1; 6.1), low educational level of mother (OR 2.5, 95%CI 1.3; 4.9), working mother (OR 1.8, 95%CI 1; 3.5), and poor socio-economic status (SES) families (OR 2.7, 95%CI 1.3; 5.4). Multivariate logistic regression analysis showed that poor SES was the strongest risk factor of suspected developmental delay (adjusted OR 2.8, 95%CI 1.4; 5.7).

**Conclusions** Poverty, low maternal educational level and intrauterine malnutrition during as well as malnutrition during infant period are risk factors of developmental delay. Integrated strategies should be conducted to solve the problems to prevent more children suffered from developmental delay. [Paediatr Indones 2008;48:161-5].

**Keywords:** children, developmental delay, risk factors, screening developmental, questionnaire

Developmental and behavioral problems are considered to be a new morbidity in pediatric practice, accounted for 12-16% of US children<sup>1-2</sup> and 13-18% of Indonesian children<sup>3</sup>. The first few years of life is a critical as well as golden period for child development because of rapid brain development.<sup>4-5</sup> In spite of the susceptibility of the brain to insult, a recovery is often possible with early intervention. A number of studies have shown that early intervention programs are not only cost-effective but they also lifelong benefits and optimal developmental attainment. The earlier the intervention the greater the benefit will be.<sup>6-7</sup>

Early cognitive and socio-emotional developments are strong predictors for later academic performance both in developing and developed countries. Children with developmental delay in the first years of life are at risk for poor academic achievement. It may result in low productivity that leads to have low income. They will provide poor care for their children, thus contributing to the intergenerational transmission.<sup>8</sup>

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Child's development is influenced by psychosocial and biological factors as well as genetic factors. Identification of the risk factors for developmental delay in early stage will provide some strategic interventions to improve child's quality of life.<sup>7</sup> A study of developmental delay conducted in Bandung, Province of West Java did not identify the risk factors.<sup>9</sup> Our study was carried out to identify risk factors of developmental delay in community setting.

## Methods

A community-based study of developmental screening was conducted, in Bambanglipuro sub-district, Bantul district, Province of Yogyakarta, between September and October 2007. Subjects were selected by stratified random sampling based on the number of children under five years old in each village. All children aged 3 – 60 months were involved in this study. Those with congenital anomalies or refused to participate were excluded.

Developmental screening was performed by using a *Kuesioner Pra Skrining Perkembangan (KPSP)*, a modification version of prescreening developmental questionnaire (PDQ) that was developed from Denver Developmental Screening Test (DDST).<sup>10-11</sup> This questionnaire was established by Department of Health, Republic of Indonesia, and was revised by Growth and Development-Social Pediatric Working Group, Indonesian Pediatric Society. This instrument has been used in Indonesia since 1997 with a sensitivity of 60% and a specificity of 92% compared to Denver II test.<sup>9</sup> It consists of 10 items that ranged from 3 to 72 months (from 3- 24 months old every three months and from 24-72 months old every six months). It assesses four domains of development i.e, gross motor, fine motor, language and personal-social. The options of responses for each item are "yes" or "no" which scored as 1 or 0. This test is interpreted as normal development, doubtful and suspected development delay according to the total score of: 9-10, 7-8 or  $\leq 6$ , respectively.<sup>12</sup>

Nutritional status was assessed using weight for age Z score (WAZ) index according to WHO 2006 child growth chart standard. Nutritional status was interpreted as undernourished, normal and overweight according to the WAZ index: below -2SD, -2SD to 2 SD and above 2 SD, respectively.<sup>13</sup> Socio-economic

status (SES) was categorized according to the total life expense. Threshold of 890 000 Indonesian Rupiah was used based on the mean total live expense per family in Bantul district from National Socio-economic survey, 2004.<sup>14</sup> The family's SES was categorized as poor if the total life expense less than the threshold. Data on demographic and history of delivery were obtained from care givers. Pre-screening development test, anthropometric measurement and data collecting were performed by 10 trained-graduate students of Child-Maternal Department, Medical School, Gadjah Mada University. Different proportions between groups were tested using the Chi square test. Univariate associations of variables with outcomes were expressed by odds ratio (OR) with 95% confidence. Multivariate associations for significant risk factors were tested by multiple logistic regressions to demonstrate the adjusted OR (AOR). Informed consent was obtained from care givers. This study was approved by the Ethics Committee of Medical School, Gadjah Mada University.

## Results

Six hundreds and thirty two children aged 3-60 months were enrolled in this study. The characteristics of the subject are shown in **Table 1**. The proportion of male and female was similar, with the median of age of 27 months. This study found that 103 (16%) children were undernourished, and 59 (9%) had history of low birth weight. Most mothers (70%) were housewife and most of them (81%) had an intermediate educational level.

Out of 632 children, 407 (64%) were identified to have normal development, 81 (28%) with doubtful developmental delay and 43 (8%) suspected developmental delay. Ideally, a doubtful result should be re-screened two weeks after the first test to categorize it into normal or suspected developmental delay. A re-screening was not performed because of time and funding limitations. Therefore, the risk factor analysis was only performed for normal and suspected results.

This study showed that children older than two years old were more likely to suffer from suspected developmental delay (15% vs 5%,  $P=0.01$ ). Other factors were identified as risk of suspected developmental delay, namely low birth weight (OR 2.6, 95%CI 1.1; 6.1), undernourished (OR 2.3, 95%CI 1.1; 4.8), maternal low

educational level (OR 2.5, 95%CI 1.3; 4.9), working mother (OR 1.8, 95%CI 1;3.5), and poor SES families (OR 2.7, 95%CI 1.3; 5.4) (Table 2).

Logistic regression analysis showed that poor SES was the strongest risk factor of suspected developmental delay (Table 3). Risk of suspected developmental delay was not influenced by gender, mode of delivery, exclusively breastfeeding or the age of mothers.

## Discussion

This study showed that developmental delay was more frequently observed in children older than two years old than that in younger children. This

finding was similar to that of study in Ecuador.<sup>15</sup> This study also revealed that low birth weight, poor SES, malnourished, low educational level of mother and working mother were risk factors of suspected developmental delay.

The prevalence of low birth weight in our study was similar to that in other developing countries.<sup>16</sup> Children who born with low birth weight were 2.6 times higher to have developmental delay than those with normal birth weight. Some studies found that low-birth weight infants with intrauterine growth retardation (IUGR) had lower developmental levels than those with normal birth weight.<sup>17-9</sup> IUGR indicates constrains in fetal nutrition during critical

**Table 1.** Characteristics of subjects

Characteristics	n (%)
Sex	
Male	324 (51)
Female	308 (49)
Age (months), mean +SD	28.6 +16.4
3-12 months	135 (21)
12-24 months	158 (25)
24-60 months	339 (54)
Breastfeeding	
Six months exclusive	204 (32)
Birth weight	
Normal weight (2.500 – 4.000 gram)	567 (91)
Low birth weight (<2.500 gram)	59 (9)
Delivery	
Spontaneously	550 (87)
Vacuum extraction or SC	82 (13)
Nutritional status	
Underweight	103 (16)
Normal	516 (82)
Overweight	12 (2)
Order of child	
First child	299 (47)
Second child	203 (32)
Third child or more	130 (21)
Mothers	
Age: mean, median (years)	30.7 +6.1; 30
Educational status	
low (< 6 years)	120 (19)
intermediate ( 6-9 years)	433 (69)
high (> 9 year)	79 (12)
Occupation	
housewife	439 (70)
employee	192 (30)
Social-economic status	
Poor	307 (49)
Prosperous	318 (51)
Developmental screening	
Normal	407 (64)
Doubt	182 (28)
Suspected	43 (8)

**Table 2.** Risk factors of developmental delay

Risk factors	Developmental screening		OR 95%CI	P
	Normal (407)	Suspected (43)		
Age				
3-12 months	106 (95)	6 (5)	1	
12-24 months	110 (96)	5 (14)	0.8 (0.8; 5.0)	0.71
24-60 months	192 (85)	32 (15)	2.9 (1.1; 7.2)	0.01
Gender				
Male	195 (48)	24 (55)	1	
Female	213 (52)	19 (45)	1.3 (0.4; 1.3)	0.20
Exclusive breastfeeding				
yes	140 (89)	17 (11)	1	
no	226 (92)	20 (8)	1.3 (0.4; 4)	0.38
Nutritional status				
Normal	354(87)	32 (74)	1	
Undernourished	53 (13)	11 (26)	2.3 (1.0; 4.8)	0.02
Birth weight				
Normal	370 (91)	35 (9)	1	
Low birth weight	32 (80)	8 (20)	2.6 (1.1; 6.1)	0.02
SES				
Prosperous	218 (94)	13 (6)	1	
Poor	184 (86)	30 (14)	2.7 (1.3; 5.4)	0.003
Mother's educational status				
High	341 (92)	29 (8)	1	
Low	66 (83)	14 (17)	2.5 (1.3; 4.9)	0.008
Mother's occupation				
Housewife	292 (92)	25 (8)	1	
Employee	114 (86)	18 (14)	1.8 (1.0; 3.5)	0.05

**Table 3.** Multivariate analysis of risk factors of developmental delay

Factor	AOR	95%CI	P
Undernourished	1.8	0.8; 4.0	0.14
Low birth weight	1.9	0.7; 5.0	0.14
Low educational level of mother	2.1	1.0; 4.5	0.04
Working mother	2.3	1.2; 4.5	0.01
Poor socio-economic status	2.8	1.4; 5.7	0.004

period of brain development. In developing countries, it is mainly due to poor maternal nutrition. The effect of IUGR may persist until adolescence or even longer, depends on the severity and duration of IUGR.

We noted that malnourished children have greater risk for developmental delay. A systematical review found that in young children, underweight and stunting are also related to apathy, less positive affect, lower levels of play and more insecure attachment.<sup>7</sup> The review also showed that undernourished children have poorer attention and poorer social relationships at school age.

Children whose mothers are working or have low educational level were two times higher to have developmental delay. It is not surprising that their mother will provide less attention and less knowledge of stimulation for their development.

Regression analysis showed that poor SES was the strongest risk factor of developmental delay. Poverty is related with inadequate food, poor sanitation and hygiene that lead to increase infections and malnutrition in children. Poverty is also correlated to poor maternal education, increased maternal stress and depression that lead to inadequate stimulation at home. All these factors contribute to delay achievement of child development.

The limitation of this study is that we did not analyze children with doubtful results. More children might be identified as suspected developmental delay. Further study should be conducted by including all children.

In conclusion working mothers, low maternal educational level and malnutrition during intrauterine life as well as during infancy are independent risk factors of developmental delay. Integrated strategies should be conducted to solve the problems in order to prevent more children suffers from developmental delay.

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