

Factors Associated with Development in Children Under Five

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ABSTRACT

Background: The first five years of a child's life are critical for development. The experiences children have in these years help shape the adults they will become. Parent relationship with their children plays a big part in the way children learn and develop. This study aimed to examine factors associated with development in children under five years of age.

Subjects and Method: This was a cross sectional study conducted at 20 posyandus (integrated health posts), Ngemplak, Boyolali, Central Java, from May 5 to June 10, 2018. A total sample of 203 children under five years of age was selected by simple random sampling. The dependent variable was child development. The independent variables were maternal age at pregnancy, prolonged labor, birthweight, birth asphyxia, and family income. Data on child development were measured by pre-screening questionnaire. The other variables were measured by questionnaire. The data were analyzed by a multilevel logistic regression run on Stata 13.

Results: Child development was positively affected by maternal age at pregnancy ($b= 0.33$; 95% CI= 0.03 to 0.64; $p= 0.032$) and absence of birth asphyxia ($b= 0.60$; 95% CI= 0.16 to 1.05; $p= 0.007$), birthweight ($b= 0.01$; 95% CI= -0.01 to 0.01; $p= 0.111$), and family income ($b= 0.27$; 95% CI= -0.04 to 0.58; $p= 0.087$). Children development was negatively affected by prolonged labor ($b= -0.30$; 95% CI= -0.57 to -0.03; $p= 0.029$). Posyandu had a strong contextual effect on child development with ICC= 16.16%.

Conclusion: Child development is positively affected by maternal age at pregnancy and absence of birth asphyxia, birthweight, and family income. Children development is negatively affected by prolonged labor. Posyandu has a strong contextual effect on child development.

Keywords: child development, maternal age at pregnant, prolonged labor, birth asphyxia, birthweight, family income

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BACKGROUND

Development is the result of a process of maturity and learning that has a regular and sequential pattern. Development includes 4 aspects, namely fine motoric, gross motoric, speech and language, and independence socialization (Soetjiningsih, 2014). Children development becomes the main foundation of productivity throughout a person's life, for example children who experience cognitive impairment are predictors of low learning achievement which later have the opportunity to have

low income, high fertility, making it difficult to provide adequate care for their children (Pell et al., 2016).

National data shows that malnutrition prevalence is 19.6% and stunting / short is 37.2%. In addition, the proportion of children under five who have never been weighed in the past six months has increased to 34.3% (Basic health research, 2013). The study shows that there is a significant relationship between growth disorders (poor nutrition, stunting) and developmental disorders. Every year, nearly

200 million children under 5 years of age fail to achieve optimal development in low- and middle-income countries. Risk factors that interfere with development include poor cognitive stimulation, poverty, nutritional status, infection and complications of low birth weight (LBW) and or premature (Pell et al., 2016).

The first five years of life are times that are very sensitive to the environment, run fast, and will never be repeated, so it is often called the golden age. Growth and development at this time need serious attention. Children brain is more plastic than an adult's brain. This plasticity has a negative side and a positive side. Children are more open to the learning process but also very sensitive to the environment that does not support (Ministry of Health, 2013).

Monitoring the growth and development of children aged 12-59 months is carried out through early detection and intervention program for growth and development (SDIDTK) of children under five at least 2 times per year. The percentage of service for children under five in Central Java, in 2016, was 81.5 percent, a slight decrease compared to 2015 of 86.2 percent. Districts / cities with the lowest percentage of children under five are Brebes at 26.94% followed by Wonosobo 30.63%, and Boyolali 43.08% (Central Java Health Office, 2016). This study aimed to determine factors associated with child development in Boyolali, Central Java.

SUBJECTS AND METHOD

1. Study Design

This was an analytic observational study with a cross sectional design. The study was conducted on in Ngemplak community health center, Boyolali, Central Java, from May 5 to June 10, 2018.

2. Population and Samples

The population in this study were all children under five in Ngemplak Health Center, Boyolali. This study uses multilevel analysis, so the sampling was done at two levels. The sampling at the first level is children employing simple random sampling technique. Meanwhile, at the second level is posyandu using stratified random sampling technique in which 20 posyandu selected are divided into four strata, namely pratama, madya, purnama and independent strata. The sample size in this study was 203 children.

3. Study Variables

The dependent variable is the development of infants, while the independent variables are the age of the mother during pregnancy, prolonged labor, history of asphyxia, birth weight (BBL) and family income.

4. Operational Definition of Variables

Child development included gross motoric, fine motoric, speech and language, and socialization of independence. The data were measured by pre-screening development questionnaire (KPSP). The measurement scale was continuous.

Maternal age during pregnancy was defined as the period of life of the mother from birth to the time of birth delivery.

Prolonged labor was defined as labor that lasts more than 24 hours.

Birth weight was defined as infant's weight at birth which was weighed within one hour after birth.

A history of asphyxia was defined as a condition where newborns cannot breathe spontaneously and regularly.

Family income is the amount of family income that is used to fulfill the family needs in one month.

The instrument in this study was a to measure child development and questionnaire sheets which included maternal age during pregnancy, prolonged labor, history

of asphyxia, birth weight and family income.

6. Data Analysis

The data in this study were analyzed using multilevel analysis. The multilevel model provides a strong technical framework that can be used to analyze the correlation properties of variables and is relevant when predictors are measured together. The first level multilevel analysis is on individual characteristics, while the second level is at the posyandu. Furthermore, multilevel analysis was done to generate access as an effect of all levels was carried out by multiple logistic regression analysis multilevel models using the STATA 13 program.

7. Research Ethics

Research that uses humans as study subjects should not conflict with ethics. This study was declared ethically feasible by the Health Research Ethics Commission (KEPK) Sebelas Maret University Medical Faculty No. 70 / UNS27.6 / KEPK / 2018

Table 2. Results of Univariate Analysis

No.	Characteristics	N	%
1.	Maternal Age		
	< 20 years old	9	4.5
	20-35 years old	171	84.2
2.	> 35 years old	23	11.3
	Prolonged labor		
3.	≤ 24 hours	158	77.8
	> 24 hours	45	22.2
4.	Birth Weight		
	< 2500 gram	24	11.8
	2500-4000 gram	177	87.2
5.	> 4000 gram	2	2
	A history of asphyxia		
6.	Yes	20	9.9
	No	183	90.1
7.	Family Income		
	< Rp 1,519,289	51	25.1
8.	≥ Rp 1,519,289	152	74.9
	Child Development		
9.	Poor	80	39.4
	Good	123	60.6

Table 2 shows that most of the maternal age during pregnancy are in their 20-35 for

RESULTS

1. The Characteristics of Subjects

Table 1 shows that most of the study subjects were female for about 106 children (52.2%) with the age of children mostly aged ≥24 months accounting for 107 (52.7%).

Table 1. Study Subject Characteristics

Characteristics	n	%
Gender		
Male	97	47.8
Female	106	52.2
Children age		
< 24 months	96	47.3
≥ 24 months	107	52.7

2. Univariate Analysis

The description of univariate analysis show the general description of the data of each variable in nominal data including maternal age during pregnancy, prolonged labor, history of asphyxia, birth weight, family income, and child development. The results of univariate analysis can be seen in table 2.

about 171 (84.2%). Most of the mothers underwent the delivery process ≤ 24 hours

158 (77.8%). Most of the children had birth weight 2500-4000 grams were 177 (87.2%), did not have history of birth asphyxia (183, 90.1%). The family income of most of the children under five years old is high, amounting to 152 (74.9%). Most of children had appropriate development for their age which is about 123 (60.6%).

3. Bivariate Analysis

Bivariate analysis showed the relationship between an independent variable (maternal age during pregnancy, prolonged labor, history of asphyxia, birth weight, family income) to the dependent variable (child

development). The statistical test used is chi-square.

Table 3 shows the results of bivariate analysis of the factors associated with infant development including maternal age during pregnancy (OR= 2.64; 95% CI = 1.22 to 5.70; p= 0.011), prolonged labor (OR = 0.48; 95% CI= 0.23 to 1.00; p= 0.034), birth history not asphyxia (OR= 3.21; 95% CI= 1.22 to 8.45; p= 0.014), and family income (OR= 4.09; 95% CI= 2.09 to 8.00; p<0.001). Birth weight was not significantly associated with child development (OR= 0.79; 95% CI= 0.28 to 2.12; p= 0.378).

Table 3. The result of bivariate analysis of factors associated with child development

Variable	Child Development				OR	95 % CI		p
	Poor		Good			Lower Limit	Upper Limit	
	n	%	n	%				
Maternal MUAC								
< 23.5	28	50	28	50	1.83	3.41	0.98	0.041
≥ 23.5	95	64.6	52	35.4				
Maternal Age at Pregnancy								
< 20, >35 years	13	40.6	19	59.4	2.64	5.70	1.22	0.011
20-35 years	110	64.3	61	36.7				
Prolonged labor								
≤ 24 hours	90	57	68	43	0.48	1.00	0.23	0.034
> 24 hours	33	73.3	12	26.7				
Birth Weight								
< 2500 or >4000 g	17	66.4	17	34.6	0.79	2.12	0.28	0.378
2500-4000 g	106	59.9	71	40.1				
History of Asphyxia								
Yes	7	36	1	66	3.21	8.45	1.22	0.014
No	116	63.4	67	36.6				
Family Income								
Low	18	35.3	33	64.7	4.09	8.00	2.09	<0.001
High	105	69.1	47	30.9				

4. Multivariate Analysis

Table 4 showed that child development was positively and significantly related to the maternal age at pregnancy (b=0.33; 95% CI= 0.03 to 0.64; p=0.032). Mothers who were pregnant at the age of 20-35 years old were more likely to have infants with appropriate development compared to

mothers who were pregnant at the age of <20 or> 35 years old.

There was a negative relationship between history of prolonged labor and child development which was statistically significant (b= -0.30; 95% CI= -0.57 to -0.03; p= 0.029). Mothers with prolonged labor increased the risk of inappropriate child development.

There was a relationship between birth weight and child development which was statistically insignificant (b= 0.01; 95% CI= -0.01 to 0.01; p= 0.111). Children who were born with low birth weight have an inappropriate development.

There was a relationship between history of asphyxia and child development which was statistically significant (b= 0.60; 95% CI= 0.16 to 1.05; p= 0.007). Children who have a history of non-asphyxic birth were more likely to have appropriate development compared to children with asphyxia.

There was a relationship between family income and child development

which was statistically insignificant (b= 0.27; 95% CI= -0.04 to 0.58; p= 0.087). High family income were more likely to have children with appropriate development because they were able to provide optimal nutrition and stimulation to their children.

Posyandu stratification had a strong contextual effect on child development with ICC= 16.16%. This showed that Posyandu with mandiri and purnama strata increased the tendency of appropriate child development compared to Posyandu with pratama and madya strata.

Table 4. The results of multilevel analysis of factors related to child development

Independent Variable	b	95 % CI		p
		Upper Limit	Lower Limit	
Fixed Effect				
Maternal age at pregnancy (20-35 years)	0.33	0.64	0.03	0.032
Prolonged labor	-0.30	-0.03	-0.57	0.029
Birth weight (2500-4000 g)	0.01	0.01	-0.01	0.111
Did not have asphyxia	0.60	1.05	0.16	0.007
High family income	0.27	0.58	-0.04	0.087
Random effect				
Posyandu				
Var (asphyxia)	0.25	0.94	0.06	
Var (constant)	0.11	1.15	0.01	
N Observation = 203				
Number of groups= 20				
Log likelihood = -253.78				
ICC = 16.16 %				

DISCUSSION

1. The relationship between maternal age at pregnancy and child development

The result of the study showed that there was a relationship between maternal age at pregnancy and child development. This was in line with a study by Pieters and Levenstond (2015), which stated that maternal age has an effect on fine motor development and social personalities for children aged 0-18 months. A study by Morinis *et al.* (2013) also showed that

children who were born from teenage mothers (≤ 18 years old) tend to experience delays in verbal abilities than children who were born from 25-34 years old mothers. This was due to lack of verbal stimulation between mother and child due to depression which was susceptible to occur in adolescent mothers. A study by Rahmawati *et al.* (2018) stated that maternal age at pregnancy affected child development through birth length.

Maternal readiness to take care of their children to achieve optimal growth

and development became very important, especially in nurturing at the early ages of life. Getting married at a relatively young age with immature physical and psychological readiness did not only affect the lives of the women but would also have an impact on the lives of their children. At a relatively young age (<18 years old), maternal (emotional) and cognitive readiness was still considered to be immature. This affected the maternal understanding of nurturing that would be applied to their children (Yunarsih and Quyumi, 2013).

2. The relationship between prolonged labor and child development

The result of the study showed that there was a relationship between long history of parturition and child development. Mothers with a long history of parturition were more likely to have under-age children development than mothers who have no history of parturition ($b = -0.30$; 95% CI = -0.57 to -0.03 ; $p = 0.029$). Prolonged labor was one of the causes of maternal and fetal mortality. In mothers, it can cause infection, exhausted, dehydration, and post partum hemorrhage. In the fetus, it can cause infection, injury, and asphyxia (Ardhiyanti and Susanti, 2016). This could affect the development of the next child.

3. The relationship between birth weight and child development

The result of the study showed that there was a relationship between birth weight and child development. This was in line with a study by Arumsari (2013) which concluded that birth weight as a risk factor for global developmental delay (GDD) among child at the Polytechnic of Growth and Development in Dr. Soetomo Hospital, Surabaya. Other studies stated that low birth weight (LBW) was associated with developmental delay in children (Moonik et al, 2015; Zwicker *et al*, 2013).

Huang *et al.* (2013) who conducted a study to 8,389 Chinese children aged 4-7 years old stated that premature babies, birth weight, and postnatal growth (weight, height, head circumference) were not related to cognitive and behavioral development, whereas in term infants, birth weight and growth after birth were related to cognitive development and behavior. This happened because of a large difference in the number of samples between preterm infants ($n = 654$) and term infants ($n = 7735$). In addition, the author explained other factors such as the adequacy of nutrition in the first 1000 days, growth hormone, environmental factors, social, and parental economic that could affect the development of cognitive and behavior.

4. The relationship between history of asphyxia and child development

The result of the study showed that there was a relationship between history of asphyxia and child development. This was in line with a study by Rai and Thakur (2013), which stated that asphyxia babies were more likely to experience hearing disorders. Zwicker *et al.* (2013) stated that the duration of ventilation use and oxygen delivery to LBW infants affected the occurrence of impaired coordination of motor development.

5. The relationship between family income and child development

The result of the study showed that there was a relationship between family income and child development. This was in line with a study by Morinis *et al.* (2013) which stated that poverty was a predictor of delay in cognitive development and low learning achievement. Taywade and Pisudde (2017) stated that family income affected the incidence of LBW. The results of the study stated that low birth weight babies were born from families with low economic status. Stunting and wasting in children

also occurred mostly in families with low economic status (Nurliyana *et al*, 2016). Low economic status was associated with the ability to provide nutritious and sanitary food, and lack of hygiene would cause an enhancement in infections and stunting in children (Ernawati *et al*, 2014).

Other studies showed that family income did not affect the developmental delays. (Santri *et al*, 2014; Mooniket *al*, 2015; McDonald *et al*, 2016; Pieters and Levenstond, 2015). Santri *et al*. (2014) stated that child's development was not affected by the family's economic status, but it was affected by parental stimulation. The better the stimulation given by parents, the more it would spur the development of children to be better. Depression during pregnancy, premature birth, lack of "me time", and lack of parents interaction with children in playing and reading books were the risk factors for developmental delays in the first year of a child's life (McDonald *et al*, 2016).

6. The relationship between posyandu and child development

The result of multilevel analysis showed the score of ICC was 16.16%, this showed that there was a contextual effect of Posyandu on child development. This was in line with a study by Sinta *et al*. (2017) which stated that Posyandu with *mandiri* strata increased the success of exclusive breastfeeding compared to Posyandu with *madya* and *purnama* strata.

In the Posyandu pocket book issued by the Ministry of Health RI, the activities of the Posyandu consisted of main activities and development activities. The main activities include maternal and child health, family planning, immunization, nutrition, and prevention of diarrhea. Development activities including Development of Toddler Families (DTF), Family Medicinal Plants (FMP), Elderly Family Development (EFD),

and Early Childhood Education Program (ECEP). Posyandu targets include all community members, especially infants and children; pregnant women, postpartum mothers, and nursing mothers; reproductive age couples; and child's caregivers.

The result of the study by Indriati and Lidyawati (2014) stated that there was a relationship between the level of maternal participation in participating in Posyandu activities and children nutritional status. Hidayat and Jahari (2012) also stated that households that used Posyandu were more likely to have children with good nutritional status and low morbidity compared to those who did not use Posyandu.

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