

Association between Maternal Age at Pregnancy, Socioeconomic Status, Physical Environment, Prenatal, Perinatal, Postnatal History, and the Risk of Mental Retardation

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ABSTRACT

Background: Mental retardation (MR) is a serious public health problem for a country. The prevalence of mental retardation in Indonesia was estimated at 1-3% of the population. About 0.1% of which need treatment and guidance the whole life. This study aimed to determine the association between maternal age at pregnancy, socioeconomic status, physical environment, prenatal, perinatal, postnatal history, and mental retardation.

Subjects and method: This was an analytic observational study with case control design. This study was conducted in Pare, Kediri, East Java, Indonesia, from October to December 2016. A total 105 study subjects, consisting of 35 MR cases and 70 controls were selected for this study by fixed disease sampling. The independent variables were maternal age at pregnancy, socioeconomic status, physical environment, prenatal, perinatal, and postnatal history. The dependent variable was mental retardation. The data were collected by questionnaire and analyzed by logistic regression model.

Results: Maternal age ≥ 35 years at pregnancy was associated with an increased risk of MR, and it was statistically significant. The result showed that mother's age while pregnant (OR= 10.18; 95%CI= 2.77 to 37.39; $p < 0.001$). High socioeconomic status (OR= 0.23; 95%CI= 0.07 to 0.81; $p = 0.022$), good physical environment (OR= 0.13; 95%CI= 0.04 to 0.45; $p < 0.001$), good prenatal history (OR= 0.24; 95%CI= 0.07 to 0.82; $p = 0.022$), good perinatal history (OR= 0.45; 95%CI= 0.15 to 1.40; $p = 0.168$), good postnatal (OR= 0.43; 95%CI= 0.14 to 1.35; $p = 0.148$), were associated with a decreased risk of MR. Nagelkerke $R^2 = 53.8\%$ for this model.

Conclusion: Maternal age ≥ 35 years at pregnancy increases the risk of MR. High socioeconomic status, good physical environment, good prenatal, perinatal, and postnatal history, decrease the risk of MR.

Keywords: mental retardation, maternal age at pregnancy, socioeconomic status, environment, pregnancy history.

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BACKGROUND

Mental retardation is a serious public health problem for a country. The prevalence of mental retardation is a world problem that has a major impact, especially for developing countries. Nations whose citizens are suffering from mental retardation will experience weaknesses in terms of competitiveness with other nations, thus mental retardation needs to be known, avoided and overcome.

Estimates of severe mental retardation cases accounted for about 0.3% of the population and almost 3% has an IQ below 70. This will certainly complicate the condition of children because 0.1% of these children require care, guidance, and supervision throughout their lives (UNICEF, 2013).

Mental retardation is a state of normal intelligence development from birth or childhood with an IQ of less than 70, which is

associated with limitations in cognitive function and adaptive behavior (Dalami et al., 2013; Huang, 2016; Al-Amri et al., 2016). The prevalence of mentally retarded people is not known for certain, but the figure is estimated at 1-3% of the entire human population (Dwi et al., 2016). Other study in the Netherlands reported based on the meta-analysis population, it revealed a prevalence of 1% mental retardation with 85% of all cases being mild retardation, moderate mental retardation of 10% and severe 5% weight retardation (Iqbal and Bokhoven, 2014).

The cause of mental retardation or intellectual disability is very heterogeneous, due to genetic and non-genetic factors. Chromosomal abnormalities and single gene abnormalities are included in the genetic factors. Non-genetic factors include maternal age at pregnancy, socioeconomic status, environment, prenatal, perinatal and postnatal history (Huang et al., 2016; Iqbal and Bokhoven, 2014).

Pregnancy in older women especially after 35 years has a risk of giving birth to a child with mental retardation because the mother also has accompanying disease. Socioeconomic is anything related to the fulfillment of the needs of society, such as clothing, food, housing, education, health, and others. The socioeconomic status of the family may affect the occurrence of mental retardation in children (UNICEF, 2013; Nisbett et al., 2012).

Other study say mothers who come from families with low socioeconomic status tend to be inadequate for good nutritional needs for the fetus. As a result, the babies born have low weight and short body length and tend to experience malnutrition. Thus, the development of children is disturbed (Irianto, 2014).

Prenatal periods contribute to maternal and fetal mortality and morbidity, including neurological disorders, growth and mental development of children. Ten prenatal factors (maternal age, black race, low education, high parity, consuming alcohol, smoking, had diabetes mellitus, hypertension, maternal epilepsy, or asthma) may increase the incidence of MR (Huang et al., 2016).

Perinatal periods that are experiencing difficulties during childbirth (old partus, childbirth with actions that result in trauma to newborns, dystocia, prematurity, premature abnormalities and poor postnatal history, nutrition, stimulation, parental protection, and culture will risk children experiencing mental retardation (Irianto, 2014).

Environmental factors can affect mental development, such as emotional or physical neglect. Stimulation is very important for child development. When children are neglected, such as not getting enough nutrition, their brain development can be disrupted (AAIDD, 2010). Therefore, the study wanted to prove the above concept by doing study about maternal age, socioeconomic, environmental factors, prenatal, perinatal, and postnatal history with mental retardation.

This study aimed to analyzed the relationship of maternal age at pregnancy, socioeconomic, environment, prenatal, perinatal, postnatal history, and the incidence of mental retardation.

SUBJECTS AND METHOD

1. Study Design

This was an analytic observational study with case control approach. This study was conducted in Pare, Kediri, East Java, from October to December 2016.

2. Population and Sample

A total 105 study subjects was selected for this study by fixed disease sampling with a

ratio of 1:2 for case and control groups. Data were collected using questionnaires.

3. Study Variables

The dependent variable was mental retardation. The independent variables were maternal age at pregnancy, socioeconomic, physical environment, prenatal, perinatal, and postnatal history.

4. Data Analysis

The data were analyzed by a multiple logistic regression run on SPSS 20 program.

RESULTS

1. Characteristics of study subjects

Characteristics of study subjects of parents (father and mother) based on maternal age, socioeconomic which includes education, employment, and family income can be seen in Table 1. A total of 57 mothers (54.3%) of the case and control group were women who were not at high risk and the number of women at high risk was 48 mothers (45.7%). Most of the education level of parents (father and mother) in case and control group was \geq senior high school.

Table 1. Parental Characteristics

Parents Characteristics	N	%
Maternal Age (year)		
20 - 34	57	54.3
35 - 40	40	38.1
<40	8	7.6
Maternal Education		
Primary School	11	10.5
Middle School	25	23.8
Senior High School	49	46.7
College	20	19
Maternal Job		
House wife	67	63.8
Farmworker	6	5.7
Civil Servant	8	7.6
Private worker/farmer	24	22.9
Family Income		
< Rp 1,456,000	27	25.7
\geq Rp 1,456,000	78	74.3
Paternal Education		
Primary School	14	13.3
Middle School	17	16.1
Senior High School	40	38.2
College	34	32.4
Paternal Occupation		
Jobless	20	19.1
Farmworker	6	5.7
Civil employees	8	7.6
Private worker/farmer	71	67.6

Most of the employment status of the mother was housewife (67 people), and working father (85 people). Based on interviews, there were 20 fathers who did not work and still earned income from renting

agricultural land. Fathers who did not have jobs due to illness, helped their wives business venture (delivering merchandise to the buyer), and cleaned up the gardens although not every day.

Characteristics of children in case and control groups based on birth status, child age, gender, birth order, infant weight at birth and causation of children with mental retardation. The results of the characteristics of the study subjects are shown in Table 2. Description of study variables was described by characteristics, criteria, frequency and percentage.

Table 2. Characteristics of study subject

Children Characteristics	MR		No MR	
	n	%	n	%
Consanguineous marriage				
Children from consanguineous marriage	35	33.3	70	66.67
Age of children case and control group				
0-5 yo	2	1.91	-	0
5-11 yo	15	14.28	28	26.67
≥12 yo	18	17.14	42	40
Gender				
Male	17	16.19	33	31.43
Female	18	17.14	37	35.24
Birth order				
First child until second	14	13.33	51	48.57
Third child and so on	21	20	19	18.09
The baby's weight at birth				
≤2,500 gram	13	12.38	7	6.66
≥2,500-4,000 gram	22	20.95	63	60
Cause of mental retardation				
Down Syndrome	23	21.91	0	0
Not Down Syndrome/ IQ <70	12	11.43	70	66.67

There was a meaningful relationship with the children birth order of the study subjects between case and control group. Children with MR were more common in the order of the 3rd child and so on. That was 21 children. Whereas in the case group, more children with MR were born on the order of the 1st and 2nd. That was 51 children. The baby's weight at birth between case and control groups showed that both groups were commonly with normal weight, ranging from 2,500 grams to 4,000 grams. The cause of MR in the case group indicated that the MR child is more due to down syndrome. They were 23 children.

2. Bivariate Analysis

Variables in the study were maternal age at pregnancy, socioeconomic, environmental,

All study subjects were born from parents who had no relationship of inbreeding. The study subject between cases and controls had similar characteristics except for age and birth order of the child. The age of the study subjects of case group was more at the age of 6-11 years, while the control group was more in the age range ≥ 12 years.

prenatal, perinatal and postnatal history with MR incidence. The method used was chi-square test.

The result of bivariate analysis showed that maternal age at no risk (<35 years) would reduce the incidence of 0.20 times higher compared with the age of the mothers at risk (≥35 years). Higher social economy would reduce the incidence of MR 0.30 times higher than the non-risk environment (≥28.52) would reduce the incidence of MR 0.33 times higher than the risky environment.

A non-risk prenatal history (≥16.04) would decrease the incidence of MR by 0.30 times higher than with a prenatal history at risk. A non-risk perinatal history would decrease the incidence of MR 3.30 higher than

with a non-risk perinatal history. A non-risk postnatal history (≥ 10.63) would decrease

the incidence of mental retardation by 0.20 higher than with a risky postnatal history.

Table 3. Bivariate analysis with Chi square

Variable	Categories of mental retardation				Total	%	OR	p
	Yes	%	No	%				
Maternal age at pregnancy							0.20	<0.001
≥35 years	25	71.4	23	32.9	48	45.7		
<35 years	10	28.6	47	67.1	57	54.3		
Socioeconomic Status							0.30	0.006
High (score ≥ 3.2)	10	28.6	40	57.1	50	47.6		
Low (score < 3.2)	25	71.4	30	42.9	55	52.4		
Physical Environment							0.33	0.008
Poor (score < 28.52)	21	59.9	23	32.9	44	41.9		
Good (score ≥ 28.52)	14	40.1	47	67.1	61	58.1		
Prenatal History							0.30	0.007
Poor (score < 16.04)	28	79.9	37	52.9	65	61.9		
Good (score ≥ 16.04)	7	20.1	33	47.1	40	38.1		
Perinatal History							3.30	0.006
Poor (score < 11.66)	25	71.4	30	42.9	55	52.4		
Good (score ≥ 11.66)	10	28.6	40	57.1	50	47.6		
Postnatal History							0.20	< 0.001
Poor (score < 10.63)	24	68.6	19	27.1	43	40.9		
Good (score ≥ 10.63)	11	31.4	51	72.9	62	59.1		

3. Logistic Regression Analysis

The results of logistic regression analysis showed that there was a negative and significant relationship between maternal age to the risk of children experiencing mental retardation. Children born to pregnant women aged <35 years had a risk of mental retardation 10.18 times lower than children born to mothers aged ≥ 35 years (OR= 0.10; 95%CI= 0.03 to 0.36; $p < 0.001$).

There was a negative and significant relationship between the socioeconomic parent and the risk of the child experiencing mental retardation. Children born from a high-socioeconomic parent had a quarter lower risk of mental retardation than children with low socioeconomic parents (OR= 0.23; 95% CI= 0.07 to 0.81; $p = 0.022$).

Table 4. Logistic regression analysis of risk factors for mental retardation

Variable	OR	95%CI		P
		Lower limit	Upper limit	
Maternal age at pregnancy ≥ 35 year	10.18	2.77	37.39	<0.001
High Socioeconomic	0.23	0.07	0.81	0.022
Good prenatal history (score ≥ 16.04)	0.24	0.07	0.82	0.022
Good perinatal history (score ≥ 11.66)	0.45	0.15	1.40	0.168
Good postnatal history (score ≥ 10.63)	0.43	0.14	1.35	0.148
Good physical environment (score ≥ 28.52)	0.13	0.04	0.45	<0.001
N Observation	105			
-2 Log likelihood	82.169			
Nagelkerke R ²	53.8%			

There was a negative and significant relationship between the environment and the child's risk of experiencing mental retardation. Children who were born and raised in a good physical environment, had one eighth mental retardation lower than children who were born and lived in an environment that was not good (OR= 0.13; 95%CI =0.04 to 0.45; $p < 0.001$).

There was a negative and significant relationship between prenatal history with a child's risk for experiencing MR. Children born from mothers who gained well with ANC would lose 0.24 times lower than children born from mothers whose gestation did not receive good ANC (OR= 0.24; 95% CI= 0.07 to 0.82; $p = 0.022$).

There was a negative relationship between perinatal history and the risk of a child to have an MR although not statistically significant. Children born safely during the birth process and able to adapt to the environment outside the womb were able to reduce the risk of children having MR 0.45 times lower than those in children who experienced complications in the perinatal period, (OR= 0.45; 95%CI= 0.15 up to 1.40; $p = 0.168$).

There was a negative relationship between postnatal history with a child's risk for experiencing MR although it was not statistically significant. Children who had good body resistance during infancy, children and adolescents and were able to pass the stage of growth and development according to the age of children, could reduce the risk of children experiencing mental retardation 0.43 times lower than in children who are susceptible to disease (OR= 0.43; 95%CI= 0.14 to 1.35; $p = 0.148$).

The results of multiple logistic regression analysis in Table 4 showed that all independent variables had a value of -2 Likelihood log < 100 so that in the analysis

of the model and sample data it was interpreted to be quite appropriate. The percentage of Nagelkerke R^2 showed that the independent variables studied were able to explain the incidence of MR 53.8% and the other 46.2% were influenced by other factors.

DISCUSSION

1. The relationship between maternal age and MR incidence

Based on the results of the study, maternal age at pregnancy has a positive and significant relationship with the incidence of mental retardation. Based on the findings obtained during the study, mothers aged 35 years old and above have a higher risk of giving birth to children with mental retardation. Pregnancy in older age especially after 40 years has a worse risk. This is because at that age often accompanied by hypertension, diabetes and uterine myoma. The incidence of congenital anomalies is also increasing, generally Down Syndrome (Irianto, 2014).

The results of this study was in accordance with Huang et al. (2016) that the maternal age at pregnancy of ≥ 35 years had a positive or more at risk of childbirth with mental retardation (OR= 1.53; 95%CI= 1.35 to 1.72 $p < 0.001$). This was related to hormonal changes that could cause non disjunction or failure of division on chromosome 21, although no one knew for sure why MR occurred in mothers aged ≥ 35 years at pregnancy and there was no way to prevent chromosomal errors that caused mental retardation. Scientists knew that the mothers would have a higher risk of giving birth to children with mental retardation.

2. The relationship between socioeconomic with MR incidence

Low socioeconomic will increase the incidence of mental retardation. Education is a

process of changing attitudes and behavior of a person or group that in an effort to mature humans through guidance, teaching and training for future roles (RI Law No. 20, 2013). Higher education level would make it easier for a person to find and receive information. The more knowledge would certainly get a better job and income. This theory was in accordance with a study conducted by Hunter et al. (2013) in the USA, which stated that low socioeconomic (low education and low wages <\$ 25,000) will increase the incidence of Down Syndrome 2.17 times. Down syndrome is the most common cause of mental retardation.

Low socioeconomic plays an important role in the survival of premature babies, children who experience congenital or acquired growth and development disorders after birth. An infant born <28 weeks of gestation of a parent with low socioeconomic will experience death 90% compared with premature infants from families with high socioeconomic 10% (Rogers and Hintz, 2016).

3. Analyzing the relationship of environmental factors with MR incidence

A risky environment would increase the incidence of mental retardation higher than an environment that was not at risk. The results of this study was in accordance with a study in Brazil conducted by Karam et al., (2016) that mental retardation was caused by environment (44.4%), genetic (20.5%), idiopathic (12.6%), and other diseases (9.3%). It meant that 40% of children with mental retardation were caused by non-biological factors, and this indicated that the incidence of mental retardation could be suppressed or reduced by appropriate interventions in early life.

The environment is divided into 3 major groups, namely physical, biological

and mental environment. The three large groups that are divided into the environment cannot be separated because it is a unity and can interact and influence each other. Living things are formed by the surrounding environment and can change to respond to the environmental changes that occur around it (Sembel and Tje, 2015). The environment functions as a provider of children's basic needs to grow and develop (UNICEF, 2013) and the environment influences the intellectual disability or mental retardation (Reichenberg et al., 2015). Children who live at home with lead containing paint (Pb) are at risk of poisoning (Pb) and result in intellectual disability (Irianto, 2014).

The right intervention at the beginning of life as stated by Karam et al., (2016) was very appropriate. Fulfillment of good nutritional needs in the family was very important, besides providing complete immunization, exclusive breastfeeding for babies, regularity of parents to come to the health center to stimulate and monitor child development, good hygiene and sanitation in the family, physical fitness and recreation were efforts made as early intervention to become human beings who are physically and mentally healthy, thus avoiding the occurrence of mental retardation.

4. Analyze the relationship of prenatal history to MR incidence

Prenatal history that is at risk will increase the incidence of mental retardation higher compared with prenatal history of mothers who are not at risk. Antenatal care is carried out with the aim of monitoring pregnant women so that they are truly physically and mentally prepared, and saving mothers and children during pregnancy, childbirth and postpartum, so that their postpartum is

healthy and normal, both physically and mentally (Irianto, 2014).

Appropriate neonatal visits are 4 times during pregnancy that is 1 time in the first trimester, 1 time in the second trimester, and 2 times in the third trimester. It will reduce the incidence of MR, because early problems can be detected in pregnant women and can be properly handled immediately. Fetal development is very susceptible to damage, especially in the first few months of its development. The consumption of drugs, alcohol or smoking is one of the factors that cause bad effects on infant development (Huang et al., 2016).

5. Analyzing the relationship of perinatal history with MR incidence

The perinatal history was associated with an MR incidence. Children who were born from a mother with a poor or risky perinatal history would increase the incidence of mental retardation. The perinatal period is a period of 28 weeks pregnancy to 7 days after birth. There were so many important moments that occurred in the perinatal period if the mother had a dangerous problem in the perinatal period that could endanger the health of the mother and fetus that were still in the womb.

Childbirth and perinatal have almost the same meaning that is the process of delivery the fetus that occurs in a term pregnancy (37-42 weeks), spontaneous birth with a percentage of the back of the head that lasts for 18 hours, without complications in both the mother and fetus. Expectations of mothers, families and health workers who provide assistance in childbirth hoped this period can be passed by all mothers properly and safely, do not experience interference. However, in reality there were several women who experience difficulties in childbirth due to one or several disturbances in power (power),

passenger (fetus and placenta), passage (birth canal), psychological (mother and helper), helper (health worker trained), whose consequences could interfere with the growth and development of newborns and the worst could cause mental retardation.

Babies born prematurely before 27 weeks of gestation will increase the incidence of mental retardation. Children with prematurity must have less than normal weight or called LBW. Other study explained that mental retardation can be caused by infants with LBW, neonatal asphyxia, and seizures. The prevalence of LBW is estimated to be 15% of all births in the world with a limit of 3.3 to 38% and are more common in developing or low socio-economic countries. The most common causes of LBW are premature birth, maternal age at pregnancy, parity, fetal factors such as hydramnios, gemelli, chromosomal abnormalities (Irianto, 2014). Other study say that perinatal period hypoxia is the most common cause of cognitive impairment or mental retardation (Cabarcas et al., 2013).

6. Analyze the relationship between postnatal history and the incidence of MR

Postnatal history that is at risk will increase the incidence of mental retardation; the relationship in influencing the incidence of mental retardation is in the moderate lower category compared to maternal age, socio-economic and prenatal history. Postnatal is the period after delivery that is needed for recovery of the uterus for 6 weeks (Irianto, 2014). Growth is a major change in number and size at the level of cells, organs and individuals. Early childhood is a critical period in child development.

Children's intelligence development takes place very rapidly in the early years of their lives. About 50% of an adult intelli-

gence capacity is obtained when a child is 4 years old, 80% is obtained when a child is around 18 years old (Susilaningrum et al., 2013; Nugroho, 2009).

Factors that affect mental retardation include trauma to the head, as the baby falls, infection of the brain, e.g. by cerebral meningitis, measles, tropical malaria, lack of nutrition (Kartono, 2007).

Postnatal history is a series of life events of a child after childbirth. A healthy child physically, mentally and spiritually is influenced by many things, ie from the beginning before the mother was pregnant, maternal physical, socioeconomic and environmental readiness will influence how the child will be born. If from the beginning, the mother has an unfavorable condition, for example the age of the mother who is too old, supported by a low socioeconomic and physical, mental, and social environment that is not good then in the process of pregnancy until postnatal will have a negative impact on children. In lifelong epidemiology, it has been shown that early life impacts will result in future life, and this poor or risky postnatal condition, as a continuation of a poor medical history in the past.

7. The relationship of maternal age, socioeconomic, gestational, environmental factors, and the incidence of mental retardation

Maternal age at pregnancy is the highest risk factor affecting the incidence of mental retardation, followed by environmental factors, socioeconomic factors, prenatal history, postnatal, and finally the perinatal history. Age is very influential in the reproductive process. The age that is considered optimal for pregnancy is between 20 to 30 years, whereas what is considered dangerous is pregnancy at the age of 35 years and over. Difficulties that occur in older women

pregnancy are mothers often accompanied by comorbidities such as hypertension, diabetes, uterine myoma and decreased reproductive function. The conclusion of this study is that there is a relationship between maternal age at pregnancy, socioeconomic, environmental, prenatal, perinatal and postnatal history with the incidence of mental retardation.

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