

# Correlation between Gestational and Maternal Age with Pathological Neonatal Jaundice

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**Abstract**— *Pathologic jaundice is one of the causes of neonatal death, among the risk factor is pre-term pregnancy that causes prematurity. It affects the growth of the fetus due to the immaturity of the reproductive organs. The main objective of this study is to analyze the correlation between gestational and maternal age with pathologic neonatal jaundice. The research used quantitative analytical method with cross sectional approach. The sample consisted of 297 babies chosen using systematic random sampling technique. The analysis used Kolmogorov-Smirnov test, Fisher Exact Test. The result of study found that 5.1% of neonatal had post-term gestation, 21.55% of mothers delivered at risk of ages, 6.06% suffered pathologic neonatal jaundice. Some of neonatal (24.44%) born during pre-term gestation suffered pathologic jaundice. The correlation between gestational age and pathological jaundice got p value = 0.035, the correlation between maternal age with pathological jaundice got p value = 1.000. Gestational age associated with pathological jaundice and maternal age is not associated with pathological jaundice. It is important for health workers to assess gestational age on antenatal and intranatal care to anticipate pathological jaundice and mothers need to always take their baby to health services if the baby appears to have yellow skin.*

**Keywords**—*Bilirubin; Gestational age; Maternal Age; Neonatal; Pathological Jaundice*

## I. INTRODUCTION

Although the IMR in 2015 decreased and reached a target of 22.23 per 1,000 live births but it increased in 2017 to 24 per 1,000 live births [1]-[2]. One of the objectives of the SDGs program in Indonesia is that the health sectors have the targets to reduce neonatal mortality rate to 12 per 1,000 live births. Thus, important for all health workers and citizen to contribute to reduce the number of neonatal deaths to 12 per 1,000 live births [3]-[4]-[5]. The IMR in South Kalimantan was recorded at 22 per 1000 live births in 2014 [6]. Jaundice is one of neonatal complications that can lead to mortality, disability and death in neonatal. The neonatal deaths contribute to infant mortality by 56% [7]-[8].

Several studies indicate that the incidence of jaundice in <28 days is 29.3 per 1,000 live births. In six countries jaundice is a cause of morbidity in infants <6 days of age; it

is one of the severe diseases that cause babies to be hospitalized (12-78%) and 7-59 days infants (2-57%) [9]-[10]. [9]-[10]. Neonatal jaundice is divided into two types, i.e. neonatal jaundice physiology and neonatal pathological jaundice. Jaundice has many symptoms and disorders that are caused by many factors or multifactorial with many symptoms [11]. Epidemiology in neonates is about 15% of newborns experiencing jaundice [12].

Some of the factors that cause hyperbilirubinemia are pre term and maternal age with risk. Gestational age is one of the factors causing neonatal jaundice. The increase in bilirubin serum in preterm tends to be same or slightly slower than the increase of bilirubin in term infants [13]-[14].

Maternal age is a factor that results in neonatal jaundice. Women under the age of 20 years old having imperfect egg cell is feared to have interfered fetus development. At the age of over 35, women have a higher risk of obstructive complications and perinatal morbidity and mortality [15].

Bilirubin encephalopathy causes serious illness and death [12]. Bilirubin encephalopathy may cause residual symptoms of cerebral palsy, high-pitched deafness, paralysis, dental dysplasia that greatly affect the quality of life [16]. The results of previous study show that hyperbilirubin in neonatal must be managed both through medical treatment and care to avoid the failure of health workers in preventing neonatal deaths that can be avoided. If hyperbilirubinemia is not managed properly, many children grow with disabilities [17].

The data obtained from preliminary study in Ulin Hospital Banjarmasin shows that in 2015 there were recorded live births of 1,484 infants and 295 (19.9%) of them had jaundice neonatorum, 112 (38%) infants had pathologic jaundice, 183 (62%) had other physiological jaundice. In 2016, there were 1,148 live births and 259 (22.56%) had neonatal jaundice, 182 (70.3%) infants had physiological jaundice and 77 (29.7%) infants had pathologic jaundice. Based on the description, the researchers were interested in examining whether there is a correlation between gestation and maternal age with pathological jaundice. The aims of this study were to

identify, measure gestational age, maternal age and also to assess its correlations with pathological neonatal jaundice.

## II. LITERATURE REVIEW

Jaundice is a condition where there is yellow color in the baby's body that occurs because of an increase in the amount of protein in the blood called bilirubin. Neonatal or babies with the age of <28 days can experience jaundice. This yellow color arises because the babies need to adjust their liver to be able to excrete bilirubin from the blood which is done up to several weeks after birth. If there is failure or delay, the serum or plasma bilirubin in the blood can occur which can be seen from the yellow sclera. The conjunctiva and body of the baby are called neonatal jaundice. Neonatal jaundice can be marked from the high level of total bilirubin serums in baby's blood taken in normal amount. If the bilirubin exceeds the normal range, hyperbilirubinemia might occur. Hyperbilirubinemia can also occur due to the immaturity of liver and intestinal track [13], [18], [19].

Some risk factors for neonatal jaundice are 35 to 37 weeks gestation, polycythemia such as mother's Hemoglobin (Hb), platelet count (PLT), White Blood Cell (WBC), different degrees of bilirubin with T4 levels, Thyroid Stimulating Hormone (TSH), septicemia, infants of diabetic mother, labor assisted by vacuum or forceps, labor trauma, Asian races, a history of jaundice in previous children, hemolytic causing like rhesus, ABO incompatibility and glucose-6-phosphate dehydrogenase (G6PD) deficiency, pyruvate kinase deficiency, spherocytosis congenital, Lucey-Driscoll syndrome, Crigler-Najjar disease, hypothyroid, and hemoglobinopathy and wrong breastfeeding track [11], [20], [21].

The increasing number of red blood cells with any cause is also at risk for hyperbilirubinemia. Various types of infections in infants can also increase the risk of neonatal jaundice track [21]. The event of the baby jaundice can be experienced in baby in the first 24 hours of birth. Based on the research results, sepsis onset and/or jaundice happen during the baby's <28 days, in which 2 of 3 born babies have jaundice in day 4-5 birth track [19].

Hyperbilirubinemia occurs in neonatal if there is an increase in blood bilirubin levels > 5 mg/dl. The neonatal state of hyperbilirubinemia can have clinical signs. Neonatal jaundice can be divided into two, physiological neonatal jaundice and pathological neonatal jaundice. Physiologic neonatal jaundice is characterized by levels of unconjugated bilirubin > 2 mg/dl in the first week of birth, an increase in blood bilirubin levels reaching 10-12 mg/dl even up to 15 mg/dl without abnormalities in neonatal bilirubin metabolism [13], [22], [23].

Neonatal jaundice complication is also the most common cause of neonatal hospitalization in the first month after birth (around 19%). Most neonatal jaundice can be transient and non-permanent which can disappear at the end of the first week after birth, while a small minority experience severe hyperbilirubinemia which has the potential to pose a high risk of neonatal acute bilirubin encephalopathy and kernicterus [9], [22], [24] [25].

Bilirubin encephalopathy is the most severe complication of jaundice neonatorum and has a high mortality rate. Bilirubin encephalopathy may also cause residual symptoms of cerebral palsy, damage hearing such as high-pitched deafness, paralysis of upward vision and dental dysplasia, serious sensor damage, and intellectual disability that greatly affect neonatal in the future, therefore, they impact the quality of life [12], [16].

The high level of bilirubin that causes neurotoxicity in each baby varies because it depends on the interaction of various factors that cause kernicterus including acidosis, gestational age, infectious diseases that occur together with the condition of hyperbilirubinemia, the increase rate of bilirubin serum per day and serum albumin concentration. Babies will have increased risk of kernicterus if they experience hemolytic diseases such as G6PD deficiency, ABO or Rhesus hemolytic disease [12], [16].

Treatment and care for infants experiencing neonatal jaundice depend on the type, whether physiology neonatal jaundice or pathology neonatal jaundice. Neonatal jaundice management includes phototherapy, exchange transfusion, intensive transfusion, pharmacological therapy and follow-up care at home [19], [23].

The timely diagnosis and treatment of neonatal jaundice is very important to prevent complications. One of them is identifying predisposing factors and causes. There have to be serious discussion and evaluation by health care providers to effectively control physiological and pathological neonatal jaundice [18], [19], [23], [24].

## III. METHODOLOGY

The researchers chose Ulin Banjarmasin Hospital as the location of this study because it was a type-A referral hospital in Borneo. The research design is cross sectional with the design of quantitative analytic research. The population is the entire research objects or objects to be studied and considered to represent the entire population [27]. The population was infants born in the delivery room of Ulin Banjarmasin Hospital in January to December 2016 which was recorded in the baby room register of Ulin Hospital, Banjarmasin, South Borneo, Indonesia, as many as 1,148 babies. The study was conducted in 2017 after getting all the baby data in the baby's room from the medical record notebook. The sample was taken from the population; some babies were born in January to December 2016 at Ulin Hospital Banjarmasin. This study was approved by the ethics committee of the hospital.

The data collection sampling techniques was done systematically through systematic random sampling technique. Systematic random sampling is a system in which every ninth case after the start is randomly selected and has a simple advantage in how to take the sample [28]. The sample size or the number of research samples was measured using a formula with a 95% confidence level. The sample was 297 babies with neonatal jaundice.

The data was obtained through check list of documentation based on the data of registration books in the baby room and delivery room at Ulin Hospital Banjarmasin. Documentation is a method of collecting data by retrieving data from original documents. The original document is in

the form of notes in the book register of the baby's room and delivery room.

The data was analyzed using univariate and bivariate technique. Univariate analysis is an analysis process; the percentage of each variable from the results of the study, i.e. the gestational age, maternal age and incidence of neonatal jaundice both physiological and pathological neonatal jaundice. The analysis is in the form of frequency distribution and percentage of each variable. The Bivariate test is obtained through *Kolmogorov-Smirnov test*, *Fisher Exact Test*. The hypothesis has been "There is a correlation gestational age and maternal age with pathological neonatal jaundice".

#### IV. RESULTS AND ANALYSIS

##### A. Univariate Analysis

###### 1. Gestational Age

Table 1. Frequency Distribution of Laboring Mothers Based on Gestation Age

Category (Gestation Age)	Frequency (n)	Percentage (%)
Pre-term (<37 weeks)	45	15.15
Aterm (37-42 weeks)	236	79.46
Post-term (>42 weeks)	16	5.39
Total	297	100

Table 1 shows 79.8% of maternity mothers during aterm gestation (37-42 weeks) and 5.1% of maternity mothers during post-term gestation (>42 weeks).

###### 2. Maternal Age

Table 2 Frequency Distribution of Mothers' Age Based Labouring

Category Maternal age-based labouring	Frequency (n)	Percentage (%)
At risk (<20 or >35 years)	64	21.55
Not at risk (20-35 years)	233	78.45
Total	297	100

In table 2, it can be seen that among 297 mothers, 78.45% of them delivered babies at the non-risk ages (20 to 35 years) and 21.55% of them at the ages of risk (less than 20 or more than 35 years old).

###### 3. Cases of Pathological Jaundice

Table 3 Distribution of Infant Frequency Based on Pathological Jaundice Case

Category (Pathologic Jaundice)	Frequency (n)	Percentage (%)
Yes	18	6.06
No	279	93.94
Total	297	100

Table 3 shows that out of 297 babies born at Ulin Hospital, most of them (73.7%) did not suffer from pathological neonatal jaundice, and only some of them (26.3%) had pathological neonatal jaundice.

##### B. Bivariate analysis

###### 1. The correlation between gestation age and pathologic neonatal jaundice

Table 4. The Correlation between Gestation Age and Pathologic Neonatal Jaundice

Gestation age	Pathologic jaundice				Total	
	Yes		No		(n)	(%)
	(n)	(%)	(n)	(%)		
Pre-term	11	24.44	34	75.56	45	100
Aterm	3	1.28	233	98.72	236	100
Post-term	4	25.00	12	75.00	16	100
Total	18	6.06	279	93.94		

*P value = 0.035*

Table 4 shows that most of the babies (98,72%) born during aterm gestation age did not suffer from pathologic jaundice, and some of them (24,44%) born during pre-term gestation age suffered from pathologic neonatal jaundice and few of them also born post-term gestation age suffered from pathologic neonatal jaundice as much as 25.00 %.

The results of the research suggest that there is a correlation between gestation age and the case of pathological jaundice neonatal. This is enhanced by Kolmogorov-Smirnov test obtaining P value = 0.035 smaller than  $\alpha = 0.05$  which means there is a correlation between gestation and pathological neonatal jaundice.

###### 2. The correlation between maternal age and pathologic neonatal jaundice

Table 5. The Correlation between Maternal Age and Pathologic Neonatal Jaundice

Maternal Age	Pathologic jaundice				Total	
	Yes		No		Yes	No
	(n)	(%)	(n)	(%)		
At risk (<20 or >35 years)	4	6.25	60	93.75	64	100
Not at risk (20-35 years)	14	6.01	219	93.99	233	100
Total	18	6.06	279	93.94	297	100

*P value 1,000*

Table 5 shows that most of the mothers (93,99%) at the ages of non-risk when delivering babies did not suffer from pathologic jaundice, some of them (6,25%), at the age of risk delivered babies suffering from pathologic jaundice.

The results of the study suggest that there is a correlation between maternal age and pathologic jaundice neonatal. This is enhanced by Fisher Exact Test that obtained P value = 1,000 greater than  $\alpha = 0.05$  which means that there is no correlation between maternal age and pathological jaundice neonatal.

##### C. Discussion

###### 1. Gestational age

Neonatal jaundice occurs in term infants > 60% and premature infants > 80% in the first week of life. Newborn deaths are in small babies (preterm or small for gestational age. More than 80% are in the highest burden settings [29]. The results of a previous study show the incidence of referral for neonatal jaundice was 29.3 per 1,000 live births with a 95% confidence interval: 26.9, 31.7) [9]. The conditions of prematurity and low birth weight lead to the occurrence of pathological jaundice in infants. The gestational age greatly determines the

quality of the baby's growth and birth. Babies born in early gestational age with very low birth weight have the potential to be exposed to a variety of complications brought to life as adults. The best way for babies to grow optimally is to extend life in the womb [30]-[32].

The factors affect the course of bilirubin to the brain and increase the risk of acute bilirubin encephalopathy include those at less than 37 weeks gestation or premature birth, seizures, sepsis, hypoxia, acidosis and hypoalbuminemia in infants especially in term infants. The risk of kernicterus greatly increases in infants having bilirubin levels above 515 micromole/liter. In premature babies, kernicterus can occur at lower bilirubin levels. The importance of protocol management for less-term infants can increase the results in reducing the impact on perinatal mortality [9], [23], [32], [33].

## 2. Maternal age

The age distribution from the point of view of maternal mortality reproductive age is divided into safe age and unsafe age. The safe age for pregnancy and childbirth is the age of 20 to 30 years and the age that is not safe for pregnancy and childbirth is the age of less than 20 years or more than 35 years. Pregnancy at the age of 35 years and over is at risk of experiencing various problems. Problems that arise at the age of 35 years and over are gestational diabetes, high blood pressure and bladder disorders. Pregnancy in under the age of 20 years also has a higher risk of health. Regarding under the age of 20, medical science reveals that the reproductive organs are not ready and at high risk of experiencing poor health conditions during pregnancy. The condition of an imperfect egg is feared to interfere with fetal development. Health conditions that may occur are high blood pressure in pregnant women and preterm birth [9], [34].

The Government of Indonesia appoints the National Population and Family Planning Agency (*Badan Kependudukan dan Keluarga Berencana Nasional*, abbreviated as BKKBN) to carry out government's duties in the field of family planning and welfare families to take preventive actions through family planning programs to prevent various risks from being at risk, including through the marriage maturation program. It is an effort to increase the age of the first marriage, i.e. minimum 20 years old for women. Marriage Age Maturity program does not only encourage to postpone marriage until a certain age but also tries to make the first pregnancy occur at a fairly mature age. If someone fails to mature at the age of marriage, then the birth of the first child must be delayed. The birth of a good child is when born to a mother who is 20 years old. Therefore it is highly recommended for a woman who is less than 20 years old to delay her marriage. If she has already become a wife, it is recommended to postpone pregnancy. The period of prevention of pregnancy is in

the PUS period aged 35 years and over, because empirically it is known that there are many side effects of giving birth to children over the age of 35 [34]-[35].

## 3. Pathological neonatal jaundice

Bilirubin is one of the final products of hemoglobin catabolism. Newborns have different abilities in the level of hemoglobin catabolism compared to older children and adults. Newborns produce high bilirubin because of the increase in the number of hematocrit and the volume of red blood cells per body weight, the newborn red blood cells as well as a shorter life span (70 to 90 days) normally 120 days. Although the production of bilirubin is increased in newborns, the conjugation process and cleansing of bilirubin can be slow. Some of which are the immaturity of the liver's glucuronosyltransferase and the inadequacy of babies getting adequate breast milk intake can cause delays in cleaning bilirubin. If bilirubin levels increase above normal, it will cause yellowness on the baby's body due to accumulation of bilirubin in the skin and mucous membranes [9], [11], [23], [31].

Some other types of neonatal hyperbilirubinemia include hemolytic jaundice due to incompatibility of Rh factors, ABO blood groups between mother and fetus, jaundice associated with deficiency of Glucose-6-phosphate dehydrogenase (G6PD), pyruvate kinase deficiency, spherocytosis congenital, Lucey-Driscoll syndrome, Crigler-Najjar disease, hypothyroid, hemoglobinopathy, jaundice due to breastfeeding factors [11], [18], [36]. One of the infants aged <28 days was taken to hospital with hyperbilirubinemia in addition to sepsis. The results of this study indicate a small number of infants with pathological jaundice. About 4 million infants, both moderately and near term, have life-threatening conditions such as brain injury, severe bacterial infections and pathological jaundice [29].

The clinical appearance of infants with pathological jaundice includes an increase in bilirubin serum exceeding 5 mg/dl/day within 24 hours, total bilirubin serum >0.5 mg/dL/hour, the presence of basic disease signs in each baby such as vomiting, lethargic, lazy sucking, rapid weight loss, apnea, tachypnea, unstable temperature, jaundice that survives after eight days in term infants or after 14 days in less-term infants, clinical jaundice of more than 2 weeks and conjugated bilirubin (characterized by dark urine color and tarnishing clothing). Babies who experience hyperbilirubinemia on average take medical treatment in the form of phototherapy for 1.6 - 6.7 hours, the duration of stay and hospitalization for 17.8 to 41.8 hours [11], [21], [23], [29], [37].

## 4. Pathological jaundice

Pathological jaundice causes lifelong disruption, moderate to severe disability and even life threatening or death every year around four million neonates in the world. The study recommends that it is very important to ensure that the neonatal yellow condition does not lead to pathological conditions by conducting early detection, appropriate treatment, proper care and rehabilitation efforts, comprehensive follow-up care at home for neonates who are able to survive the disease in which

they experience long-term neurodevelopmental disorders in order to achieve optimal survival [38]. Therefore, the government of Indonesia starts to reduce IMR, neonatal mortality rate through EMAS program by increasing the quality of neonatal care services. Neonatal complications care needs must be provided by professional health workers who are competent and trained to provide health services which are in line to the standards and established guidelines such as integrated management of sick children, integrated management of children less than 5 years old, neonatal care and provision of basic or primary health care facilities, Comprehensive Obstetric and Neonatal Emergency Care, Basic Obstetric, Neonatal Emergency Care and referral care [3].

5. The correlation between gestation age and pathologic jaundice case.

The test of gestational age correlation with pathologic jaundice used Kolmogorov Smirnov test showed P value = 0,035 which means that there is a gestational relationship with pathological jaundice. The results of this study are in line with other research which also shows that there is a gestational relation in the case of jaundice neonatorum at Dr. Soegiri Hospital, Lamongan in 2010-2011 [14]. The results of this study support the previous research conducted by Yuliawati and Astutik which finds there is a relationship between gestational age and the incidence of neonatal jaundice with a p value = 0.044; POR = 0.202 95%, CI 0.049-0.836). Conditions for low birth weight babies, prematurity, male sex, and newborns with a history of perinatal complications (cephalohematoma, asphyxia, sepsis) lead to the occurrence of pathological jaundice in infants.

The results of this study are in line with the previous research stating that there is a significant relation between the age factor of pregnancy and the incidence of neonatal jaundice [39]. The research findings of Mojtahedi et al. on 200 mothers and neonates in Tehran, Iran, show that the gestational age of mothers when childbirth and the number of leukocyte counts (WBC), platelet counts (PLT count) and Hb values for mothers is associated with neonatal jaundice [31].

Infants born at pre-term gestation are susceptible to neonatal jaundice due to immature liver function. Baby's liver is not good enough to do its job so that the breakdown of erythrocytes (bilirubin) causes the yellowing of the baby, the increasing of the body of the baby and getting the baby looks yellow; this situation arises due to the accumulation of bilirubin pigments that causes the color of jaundice in the sclera and skin [40].

Pregnancy through time is one risk pregnancy because it can cause danger and greater complications both for the mothers and to the fetus. If the pregnancy has been overdue, the placenta will experience aging process so that the function will be decreased or reduced. Decreased placental function will result in a baby's growth. Babies begin to lack of nutrients and oxygen supplies from their mothers. The amniotic fluid can turn into very thick and green in which the liquid can be inhaled into the lungs and respiratory clog so that the baby asphyxiated. Asphyxiated infants with bilirubin

bind with the protein become disturbed and it causes the disruption of plasma bilirubin breakdown that can lead to increased levels of bilirubin body. It can happen if the level of Y and Z protein decreases. Other circumstances that show an increase in bilirubin levels are found to interfere when the hepatic conjugation or neonates with impaired excretion of bile duct blockage, for example due to a metabolic disorder due to lack of oxygen [40].

The results of this study are different from previous studies, namely that there is no association between gestational period with neonatal jaundice, even in gestational periods of >37 weeks compared to other gestational ages that increase sharply referred to hospital due to neonatal jaundice both pathological and physiological one. This difference was due to the differences in which in this study, multivariable adjustments were not made on the sample, while on the findings it was after multivariable adjustments. The findings found that several neonatal jaundice causes were gender, birth weight, prolonged labor, primiparous, oil massage, ambient temperature and ethnicity [9].

5. The correlation between maternal age and pathologic jaundice case

Maternal age test results with pathologic jaundice events using the Fisher Exact Test test results show the value of P value = 1.000 greater than  $\alpha = 0.05$ , then it is rejected and  $H_a = H_o =$  acceptable, meaning that there is no relation between maternal age with the incidence of pathologic jaundice. The results of this study are in line with the study of Najib et al. which states age does not increase the risk of severity of neonatal jaundice [42].

The theory suggests that age may increase medical risks associated with immature female reproductive organs functioning at less than 20 years of age and decreased reproductive organs functioning at the age of more than 35 years old [14]. That age is not a direct cause of pathological jaundice in infants because it only affects the function of the mother's reproductive organs.

There are other risk factors that affect pathological jaundice in addition to gestational age and polycythemia in the mother, namely bilirubin levels associated with TSH values, T4 and G6PD levels that are deficient so that early identification of health is needed through physical assessment, diagnostic examination of these factors, so that early diagnosis of jaundice in infants can be found to reduce further complications of hyperbilirubinemia that threatens death [11], [31].

Based on the findings of this study on the number of pre-term and post-term babies who do not experience pathologic jaundice, the researchers observed the gestational age of the mother using a cross-table and obtained the results that babies born during pre-term and post-term pathologic pathologies are born by mothers at no risk. This can suppress pathologic/pathological events in infants born during pre-term and post term gestation. Although there is no relation between maternal age and pathological neonatal jaundice, the same findings are also found in the study by Scrafford, Mullany, and Katz in which babies are born to more and more young mothers who are referred to hospital due to neonatal

jaundice instead of in older mothers, the increase after 5 years significantly decreases or less likely the baby is referred to neonatal jaundice [9].

The suggestion for health workers is to examine and provide more intensively extra care to small (either small for gestational age, preterm) and sick babies. The factors that influence pathological neonatal jaundice are such as maternal risk factors/high risk factors such as gestational age, maternal age at birth and vulnerable newborns such as pre-term, post-term, low-birth weight. Therefore, intervention and evaluation can be carried out effectively in preventing, managing complications of neonatal pain and death because these high risk factors play an important role in the incidence of neonatal jaundice at all levels of health services, especially in hospitals. Further, it is important to evaluate the pathological incidence of neonatal jaundice at all levels of health services so that basic policies can be made in providing medical care and care for pregnant women, mothers childbirth, and newborn baby because that is particularly important in reducing neonatal mortality and morbidity [29].

## V. CONCLUSION AND RECOMMENDATION

The findings of the study are that among babies born to mothers at the age of risk, the majority of infants do not experience pathologic jaundice. Through observation using a cross table, it is known that the babies are born at the age of the mother at risk, born at the time of gestation aterm, which further reinforces the results of the research. There is a correlation between gestational and pathologic jaundice. This study was conducted in hospitals with a large sample size. Thus, it would be better and more extensive to conduct multi-year population-based research involving several referral hospitals and primary health care providers or community health centers or health centers to confirm the risk factors associated with the incidence of jaundice in newborns which is expected to help reduce and prevent neonatal morbidity and mortality.

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