Factors related to the incident respiratory distress syndrome on neonate at the Harapan and Doa Hospital, Bengkulu City

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ABSTRACT

Background: *Apart from increasing morbidity and motility, respiratory problems in newborn babies are a condition that can result in respiratory arrest and even death. Premature birth, intrapartum problems (asphyxia or shortness of breath at birth), infections, and birth defects are the main causes of newborn deaths worldwide. Newborn babies can die from respiratory distress syndrome, and other causes. It is estimated that respiratory distress syndrome or its consequences cause thirty percent of all newborn deaths.*

Objectives: *This study aims to determine the factors associated with the incidence of respiratory distress syndrome in neonates in the perinatology room at Harapan and Doa Regional Hospital in 2024*

Methods: *This study used a case control design with a retrospective method. The data taken is secondary data AND The sample for this study were all babies who were treated and diagnosed respiratory distress syndrome in the neonatalogy room at RSU Harapan and Doa in 2023, totaling 65 people. The sample collection technique for the control group was taken using a 1:1 ratio systematic sampling using interval multiples, starting from data number 4 and so on using interval multiples of 4 so that you get the numbering numbers 4, 8, 12, 16 etc. up to the 65th control variable, so that the sample in this study amounted to 130 newborns consisting of 65 case variables and 65 control variables recorded in the register in the perinatalogy room at Harapan and Doa Hospital, Bengkulu City in 2023. Data were analyzed using the Chi-Square test to look for a relationship or correlation between the independent variables (maternal complications, type of delivery, gender, gestational age, birth weight) and the dependent variable respiratory distress syndrome. The level of statistical significance was set at a p value <0.05.*

Results: *The results of this study show that the p-value of maternal complications is p=0.595 (p-value ≥0.05), type of delivery p= 0.074 (p-value ≥0.05), gender p= 0.289 (p-value ≥ 0.05), gestational age p= 0.000 (p-value ≤0.05), birth weight p= 0.000 (p value ≤0.05). Multivariate analysis showed that birth weight was the most dominant factor causing respiratory distress syndrome (OR 5.713; p=0.000).*

***Conclusions:** There is a significant relationship between gestational age and birth weight and the incidence of respiratory distress syndrome. However, no significant relationship was found between maternal complications, gender or type of delivery and the incidence of respiratory distress syndrome.*

INTRODUCTION

The Infant Mortality Rate (IMR) is a measure that describes the number of deaths of babies under one year old (0-11 months) per 1,000 live births during a given year. The baby numbers are a key indicator for evaluating public health, because newborn babies are very sensitive to environmental conditions. Developments in the prevention and treatment of diseases that cause death will be reflected in a reduction in infant mortality rates. With thus, the infant mortality rate is a significant indicator for assessing the effectiveness of government intervention efforts, especially in the health sector(1).

According to globally, 2.3 million children die. in the first 20 days of life in 2022 (2). Based on data from the main causes of neonatal death globally include premature birth, intrapartum complications (such as asphyxia or difficulty breathing at birth), infection, and birth defects (3). According to he infant mortality rate in Indonesia reached 16.85 per 1,000 live births. Apart from that, the neonatal mortality rate in Indonesia is recorded at 9.30 per 1,000 live births, which means that around 9 to 10 babies die before reaching the age of one year(1).

Data states that the most common causes of infant death are low birth weight (LBW) at 28.2% and asphyxia at 25.3% (4). Other causes of death include congenital abnormalities, infections, COVID-19, and neonatal tetanus. Asphyxia causes approximately 19% of the 5 million neonatal deaths that occur each year, according to research (5). In Indonesia, the death rate due to asphyxia in provincial central referral hospitals is 41.94%, while the incidence of asphyxia in hospitals in West Java province is 25.2%. Emergency Newborn breathing is a serious problem that can lead to respiratory arrest or even death, thereby increasing morbidity and mortality. Risk factors that may worsen neonatal respiratory distress include perinatal asphyxia, multiple pregnancies (twins or more), and order of pregnancy or parity (6).

Research shows that hypoxia (30.10%) ,sepsis (27.37%), respiratory distress syndrome (18.67%), aspiration syndrome (24.93%), and congenital abnormalities

(43.86%) is the main cause of infant death (7). Respiratory distress syndrome is one of the factors causing neonatal death. It is estimated that around 30% of all neonatal deaths are caused by disease *respiratory distress syndrome* or complications. *Respiratory distress syndrome* occurs in 60-80% of babies born before 28 weeks of gestation, 15-30% of babies born between 32 and 36 weeks, and around 5% of babies born after 37 weeks. This case rarely occurs in babies born at term. The increased frequency is related to factors such as maternal diabetes, delivery before 37 weeks' gestation, multiple pregnancies, delivery by cesarean section, rapid delivery, asphyxia, cold stress, and a history of previous babies experiencing similar conditions. The highest incidence was found in male preterm babies or those with white skin. Respiratory distress syndrome in newborns is caused by a lack of inadequately produced surfactant (8). Low surfactant levels inhibit the lung maturation process in newborn babies, so that the baby's lungs are not fully ready at birth. Surfactant plays a role in reducing surface tension and maintaining the stability of the small airways during the breathing process (9). *Respiratory distress* can result in serious consequences for the baby, such as collapse of the alveoli at the end of expiration, which can lead to respiratory failure, cardiac arrest, and even death (10).

Based on data, the infant mortality rate in the Bengkulu city is 2.8 per 1000 live births. Causes of neonatal death in Bengkulu City in 2023, 2 babies due to LBW, 2 babies due to asphyxia and other causes 3 babies. However, this data still does not represent the actual situation because the death report from the infant mortality rate for 2018 – 2022 is not very complete (11). The initial survey was carried out at 2 public hospitals, namely RSUD Harapan and Doa, Bengkulu City and RSMY Dr M Yunus, Bengkulu City. The initial survey at Harapan and Doa Regional Hospital was carried out on February 12 2024 where data on the number of cases was obtained. *respiratory distress syndrome* in the perinatology room in 2022 is 12.58% of babies or 36 out of 286 newborns diagnosed as having *respiratory distress syndrome*, in 2023 it will increase to 20.44% of babies or 65 out of 318 newborns diagnosed with *respiratory distress syndrome* . In the period from January 2024 to 20 February 2024, there were 15.78% or 6 out of 38 newborns who were diagnosed as having *respiratory distress syndrome* in the perinatalology room at Harapan and Doa Hospital, Bengkulu.

As comparative data to confirm the number of cases respiratory *distress syndrome* the most, researchers conducted a follow-up initial survey at RSMY Dr M Yunus, Bengkulu City on February 22 2024 where data was obtained on the number of cases *respiratory distress syndrome* in the perinatology room in 2022 it is 10.99% of babies or 32 out of 291 newborns, in 2023 it will increase to 16.22% of babies or 63 out of 302 newborns diagnosed with *respiratory distress syndrome* . In the period January 2024 to 20 February 2024, there were 13.33%

or a total of 4 newborns who were diagnosed as having *respiratory distress syndrome* in the perinatology room at RSMY Dr M Yunus, Bengkulu City. Respiratory distress syndrome is a cause of death in newborns, so identifying risk factors for Respiratory distress syndrome is very important as a way to reduce infant mortality.

Based on previous research, there are various risk factors that can cause it *respiratory distress syndrome* in newborns, that is one of the main causes of death and disease in newborn babies. To prevent this condition, it is important to understand the causes and risk factors that may increase the likelihood of it occurring *respiratory distress syndrome* in newborn babies. This motivated the author to conduct research to identify factors related to its occurrence *respiratory distress syndrome* in neonates in the perinatology room at Harapan and Doa Hospital Bengkulu in 2024.

MATERIALS AND METHODS

This study used a case control design with a retrospective approach. The data collected was secondary data from medical records of babies who experienced it *respiratory distress syndrome*. This research was carried out at the Harapan and Doa Hospital, Bengkulu City, case group respondents were selected using techniques *total sampling* A total of 65 respondents and the control group were taken in a 1:1 ratio using *systematic sampling* by using multiple intervals. The control group was taken.

Control variables were taken in multiples of in multiples of 4 from 253 infant patients who were not diagnosed with RDS, with a total of 130 respondents. Inclusion Criteria: 1) babies who are being treated are recorded in the register in the inpatient room of Harapan Hospital and DOA, Bengkulu City, 2) Patients have complete medical record data that will be studied, namely gestational age, birth weight, gender, type of delivery. Exclusion Criteria: 1) Newborns with congenital defects recorded in the register in the inpatient room of Harapan Hospital and DOA, Bengkulu City. 2) Patients who do not have complete medical record data, especially those who do not include information on gestational age, birth weight, gender and type of delivery.

RESULTS AND DISCUSSION
RESULTS

There were 65 samples that were analyzed. Based on **Table 1**, it shows that out of 65 cases of babies experiencing *respiratory distress syndrome*, almost all (81.5%) babies were born during pregnancy preterm, the majority (53.8%) of mothers gave birth to babies with this condition without complications, the majority (50.8%) of babies were born naturally caesarean section, the majority (61.5%) of babies who experience this condition are male and the majority (73.8%) of babies weigh <2,500 grams.

Cesarean section does not give birth to a baby re*spiratory distress syndrome.* In the case group, there were (61.5%) male babies who experienced this *respiratory distress*

Table 1. Frequency distribution of maternal complications, type of delivery, gender, gestational age, birth weight and incidence Respiratory Distress Syndrome at the Harapan and Doa Hospital, Bengkulu City in 2024

Variable	Case (n = 65)		Control (n=65)	
	f	%	f	%
Gestational Age				
Pre Term	53	81.5	16	24.6
Term	12	18.5	49	75.4
Maternal Complications				
Yes	30	46.2	26	40
No	35	53.8	39	60
Types of Childbirh				
Sectio Caesarea	33	50.8	44	67.7
Spontanneous	32	49.2	21	32.3
Gender				
Male	40	61.5	33	50.8
Female	25	38.5	32	49.2
Weight				
<2.500 gram	48	73.8	10	15.4
≥ 2.500 gram	17	26.2	55	84.6
Total	**65**	**100**	**65**	**100**

syndrome, and in 65 respondents there was a control group (50.8%) male babies do not *respiratory distress syndrome.* In the case group there were (81.5%) babies experiencing *respiratory distress syndrome* born from preterm pregnancy, while in the control group there were (24.6%) babies who did not *respiratory distress syndrome* born from a preterm pregnancy. In the case group there were (73.8%) babies *respiratory distress syndrome* born with a weight of <2,500 grams, while of the 65 respondents in the control group (15.4%) the babies did not *respiratory distress syndrome* born weighing ≥ 2,500 grams. The results of data analysis **Table 2** using the chi square test showed no significant relationship between maternal complications, Caesarean delivery and gender with the incidence of respiratory distress syndrome. Gestational age at birth and birth weight had a significant relationship with the incidence of respiratory distress syndrome. Based on *statistical* tests in **Table 3**, it was found that birth weight was the most significant factor related to incidence *respiratory* distress *syndrome*, with a p-value of 0.007 and an OR value of 5.713.

DISCUSSION
Frequency Distribution of Maternal Complications, Type of Delivery, Gender, Gestational Age, Birth Weight

Based on **Table 1** almost all (81.5%) babies were born in preterm pregnancies.

Table 2. Relationship between maternal complications, type of delivery, gender, gestational age and birth weight with incidence *Respiratory Distress Syndrome* at the Harapan and Doa Hospital, Bengkulu City in 2024

Variable	Case		Control		p-value	OR
	n	%	n	%		
Complications Mother						
Yes	30	46.2	26	40	0.595	1.286
No	35	53.8	39	60		
Types of Childbirth						
Sectio Caesarea	33	50.8	44	67.7	0.074	0.492
Spontan	32	49.2	21	32.3		
Gender						
Male	40	61.5	33	50.8	0.289	1.552
Female	25	38.5	32	49.2		
Gestational Age						
Pre Term	53	81.5	16	24.6	0	13.529
Term	12	18.5	49	75.4		
Birth Weight						
<2.500 gram	48	73.8	10	15.4	0	15.529
≥ 2.500 gram	17	26.2	55	84.6		

Table 3. Results of multivariate analysis between birth weight and gestational age and events respiratory distress syndrome at the Harapan and Doa Hospital, Bengkulu City

Variable	B	*P* value	Odds Ratio/OR	CI 95%
Type of Chilbirth	0.786	0.162	2.194	0.729-6.608
Birth Weight	1.871	0.005	6.495	1.759-23.987
Age Pregnancy	1.602	0.019	4.961	1.300-18.933

respiratory distress syndrome especially occurs in premature babies, preterm gestational age, increased frequency *respiratory distress syndrome* associated with caesarean section delivery, rapid labor, cold stress, male gender or white skin (12). An increase in the frequency of respiratory distress syndrome is also associated with maternal diabetes. The results of this study showed that babies with *respiratory distress syndrome* Most were born to mothers who did not experience complications, namely 35 out of 65 births, so maternal complications had no direct influence on the incident *respiratory distress syndrome*.

Based on the data obtained, namely babies with *respiratory distress syndrome* most are born through childbirth *caesarean section* as many as 32 babies from 65 cases and 44 babies from 65 controls. Data from *this* study shows that the type of delivery by caesarean section does not directly cause an

increase in incidence *respiratory distress syndrome*. In the gender *variable*, *it* was found that babies with *respiratory distress syndrome* Most were male, namely 40 babies from 65 cases and 33 babies from 65 controls. In this study, researchers assumed that the baby's gender was not a direct cause *respiratory distress syndrome* due to differences in the prevalence of male babies *respiratory distress syndrome* between baby boys no *respiratory distress syndrome* not too different. Based on data obtained by babies with *respiratory distress syndrome* Most were born with a body weight < 2500 grams, namely 48 babies out of 65 babies recorded in the register. This is in accordance with the theory put forward Babies with low birth weight (LBW) generally have lung structures that are not fully mature and tend to experience atelectasis more often (13). Premature babies with LBW have difficulty in creating sufficient expiratory pressure because their chest walls are flexible and their respiratory muscles lack tone, strength and coordination. This is in line with research that the severity of the clinical picture of respiratory distress syndrome is greatly influenced by weight(14).

Birth weight and gestational age, which influence the level of lung maturity. The lower the birth weight and gestational age, the more serious the clinical symptoms will appear. Respiratory distress syndrome is one of the main causes of death in *babies*, especially babies with low birth weight. Babies born with a weight below 2500 grams generally cannot

adapt well to conditions outside the womb. One of the serious complications of low birth weight that affects the respiratory system is *respiratory distress syndrome.* The results of this study showed that babies with *respiratory distress syndrome* Most babies born in preterm pregnancies were 53 out of 65 babies recorded in the register. Premature or preterm babies often have organs that are not fully mature, so they often experience complications during the birthing process —(15). One of the main causes of morbidity and mortality in newborns, including neonatal death, is prematurity. Premature birth causes immaturity of the lungs in babies, where the organs are not yet fully developed. This condition is caused by a lack of surfactant, a protective substance that helps the lungs stay inflated and prevents air sacs from collapsing (16).

Relationship between maternal complications, type of delivery, gender, gestational age, birth weight

Based on **Table 2**, the p value = 0.595 is obtained, which shows that there is no significant correlation between maternal complications and the incidence of respiratory distress syndrome.*.* In line with research which stated that there was no significant relationship between maternal illness and respiratory problems in newborn babies, this study is also in line with researchers which showed that there was an indirect relationship between complications and respiratory emergencies in neonates

(17). Health problems in pregnant women, such as diabetes, hypertension and anemia, can cause complications for both mother and baby. Babies born to mothers with diabetes are at risk of experiencing various complications, including respiratory problems. High blood sugar levels in the mother can inhibit surfactant production, due to high insulin levels in the fetus, which then inhibits the development of the baby's lungs (18). Hypertension suffered by the mother will affect Vasoconstriction of blood vessels and can reduce blood flow to the placenta, which has the potential to cause hypoxia in the fetus (19). Mothers who experience anemia are at risk of giving birth to babies who are born with asphyxia (20). Anemia in the mother can result in decreased blood flow to the placenta, thereby supplying it oxygen and nutrients become insufficient for the fetus's metabolic needs, which can cause respiratory problems (21). Based on the data obtained, the researchers assumed there was no relationship between maternal complications and the incident *respiratory distress syndrome* because the maternal complication variables studied are still globally unspecific, such as diabetes and hypertension, which are maternal complications that can influence the incidence *respiratory distress syndrome*. Another factor is that the baby data recorded in the register is not all babies born at the Harapan and Doa Regional Hospital, Bengkulu City, so the history of complications experienced by the baby's mother is not completely recorded because some of the babies are referral patients from other hospitals.

Based on **Table 2**, the p value obtained is 0.074, which indicates that there is no significant relationship between the type of delivery and the incidence of respiratory distress syndrome. In line with research which states that the type of delivery does not have a significant relationship with the event *respiratory distress of neonates (18)*. This research supports the findings that there is no relationship between the type of delivery and respiratory problems in babies in the perinatology department of RS X Jakarta. Delivery via caesarean section can result in excess fluid remaining Much remains in the lungs, resulting in a decrease in the amount of surfactant on the surface of the alveoli and slowing down the process of cleaning lung fluid (22). Delivery via caesarean section can increase the risk of respiratory problems. In vaginal delivery, about one third of the fetal lung fluid is lost due to compression of the baby's chest, while in caesarean section, the residual volume of the baby's lung fluid is greater, which results in a decrease in surfactant production on the surface of the alveoli. This increases the risk of respiratory disorders, such as respiratory distress syndrome (23). Researchers argue that there is no relationship between the type of delivery and the event *respiratory distress syndrome* in neonates due to the number of babies *respiratory distress syndrome* with birth weight < 2500 grams and gestational age ≥ 20 weeks are more likely to be born

spontaneously than babies *respiratory distress syndrome* who were born by cesarean section. Theoretically, surfactant production begins at 20 weeks of gestation and will continue to increase until the lungs reach maturity, around 30-34 weeks of gestation. This surfactant functions to reduce surface tension in the lungs and helps stabilize the alveolar walls, preventing them from collapsing at the end of the respiratory cycle (24).

Based on **Table 2**, the p value = 0.287, meaning there is no relationship between gender and the incident *respiratory distress syndrome*. In line with research which states that there is no significant relationship between gender and gender *respiratory distress of neonates (18)*. This research is also in line with research which found that there was no relationship between gender and incidence *respiratory distress syndrome.* In female babies, the hormone estrogen will accelerate the formation of surfactant in the uterus. In contrast, male infants on androgen hormones tend to inhibit pulmonary fibroblast secretion of fibroblast-pneumocyte factor, which may interfere with type II alveolar cell development and reduce surfactant formation (22).

Androgens delay pulmonary fibroblast secretion of pneumocyte fibroblast factor, which can slow the formation of type II alveolar cells and reduce the release of pulmonary surfactant (25). Androgens slow fetal lung development by resetting epidermal growth factor signaling pathways and transforming growth factor beta. On the other hand, estrogen increases pulmonary surfactant synthesis, including phospholipids, lecithin, and surfactant proteins. Estrogen also accelerates fetal lung development by increasing the number of type II alveolar cells. Based on the results obtained, Researchers assume that there is no connection between gender and incidents *respiratory distress syndrome*, because there are more male babies with a baby weight of ≥ 2500 grams than male babies with a body weight of < 2500 grams. Babies who weigh ≥ 2500 grams have mature organ function. Based on table 2, the p value = 0.000 is obtained, which shows that there is a relationship between gestational age and *respiratory distress* in newborn babies. In accordance with research which shows that the incidence of respiratory distress syndrome is correlated with *gestational* age (7). This study supports research that found a strong correlation with infant respiratory distress syndrome and gestational age (26). Premature babies have a risk of having difficulty adjusting to life outside the womb. This is caused by the immaturity of their body organs, such as the lungs which are not mature enough to produce surfactant (27). Babies born prematurely have a higher risk of hypothermia, hypoglycemia, jaundice, infections, and breathing difficulties (28). The earlier the gestational age when the baby is born, the higher the risk of neonatal respiratory problems. Lack of surfactant in the lungs can cause collapse of the alveoli (7). Researchers

assume that babies are born before gestational age 37 weeks of lung immaturity, where the lungs are not fully developed. This is due to the lack of surfactant, making premature babies more susceptible to respiratory distress syndrome.

Based on **Table 2**, the p value = 0.000, meaning there is a relationship between birth weight and *respiratory distress syndrome*. According to research conducted at Abdul Wahab Sjahranie Hospital in Samarinda, there is a relationship between birth weight and the occurrence of respiratory distress syndrome (29). This research is consistent with research which found that newborns born with very low birth weight (LBW) were more likely to experience respiratory distress syndrome. The possibility of this occurring is a lack of surfactant caused by lung immaturity which is one example Physiological and anatomical immaturity that can occur in LBW newborns (30). Another reason is that as birth weight decreases, the risk of exposure/ susceptibility to various medical problems such as hypoglycemia, sepsis and cold stress increases. Therefore, these medical problems individually, or together, increase the risk of development *respiratory distress syndrome*. Babies with low birth weight are more likely to experience lung immaturity, which can make it difficult for them to regulate their breathing and increase the risk of developing breathing problems later in life. Neonates who have excess birth weight have almost the same risk as neonates with low birth weight. This is caused by compression of the lungs by excess fluid and fat, which can result in breathing difficulties in the neonate (29). According to the researchers' assumptions, neonates with low birth weight have a high risk of experiencing breathing difficulties. This is caused by the immaturity of the body's organs, especially the lungs, so that newborn babies cannot channel oxygen to the brain through the bloodstream.

The Most Dominant Factor Associated with the Incidence of Respiratory Distress Syndrome

Based on **Table 3** the most dominant factor associated with the incidence of respiratory distress syndrome in Harapan and Doa Hospital, Bengkulu City is the birth weight variable which has a p value = 0.007 with an OR value of 5.713 (1.616- 20.192). premature babies with low birth weight have immature organ function, especially the lungs. Small alveoli are difficult to enlarge, and because the chest wall is still weak and surfactant production is not optimal, development alveolar not ideal (31). Respiratory disorders in newborns are mainly caused by delayed lung development, lack of surfactant, and physiological immaturity of the chest. The majority of babies with low birth weight experience respiratory distress syndrome (32). This study is consistent with research that found an association between birth weight and the development of respiratory distress syndrome. Newborns are more likely to experience respiratory distress syndrome if their birth weight is lower(7).

It is known that the incidence of babies *respiratory distress syndrome* In Harapan and Doa Hospital, Bengkulu City, there were 48 cases (73.8%) of 65 respondents who were born with a weight < 2500 grams, most of which were pure premature babies. This is in line with the theory put forward by(33). Pure prematurity and pure premature dysmaturity are terms used to describe neonates with a gestational age of less than 37 weeks and a weight appropriate to their gestational age. These babies are also known as premature babies based on gestational age. Because of their predisposition to infection, difficulty breathing, and greater susceptibility to hypothermia, low birth weight babies present a unique challenge.

Significant in their care. Additionally, low birth weight newborns are more susceptible to problems such as hypoglycemia and jaundice, which can result in fatal respiratory problems. babies with low birth weight have imperfect lungs because the alveoli are still small and difficult to expand, thereby reducing the amount of oxygen in the lungs and the amount of oxygen in the blood that reaches the brain(33).

CONCLUSIONS AND RECOMMENDATION

Almost all babies *respiratory distress syndrome* born in preterm pregnancy, the majority of mothers give birth to babies with this condition without complications, the majority of babies are born by caesarean section weight. The occurrence of respiratory distress syndrome in the perinatology room at Harapan and Doa Hospital, Bengkulu City, was proven not to be related to maternal complications, gender or type of delivery. The most important factor influencing the possibility of a newborn baby experiencing respiratory distress syndrome is birth weight.

Future researchers are expected to be able to deepen and develop it related research *respiratory distress syndrome* by using other methods, increasing the number of research sites, and examining other variables such as maternal complications with diabetes and hypertension, multifetal pregnancies, asphyxia, and a history of previous baby exposure. *respiratory distress syndrome.*

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