

The Factors Contributing to Neonatal Sepsis at Yarsi Hospital and its Review From an Islamic Perspectiv

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Keywords	Abstract
Neonatal sepsis; Risk factors; Retrospective study; Newborn; Islamic perspective	Neonatal sepsis remains one of the leading causes of morbidity and mortality in newborns and is influenced by various maternal, neonatal, and medical care-related factors. This study aimed to identify the risk factors associated with neonatal sepsis at YARSI Hospital and to analyze these factors from an Islamic perspective. This research employed an observational analytic design with a quantitative retrospective approach. Data were collected from secondary sources in the form of medical records of neonates diagnosed with neonatal sepsis who were treated at YARSI Hospital during the period of January 2022 to December 2024. The study population consisted of all neonatal sepsis patients during the study period, with samples selected using a total sampling method based on predetermined inclusion and exclusion criteria. Data analysis was conducted using univariate analysis to describe the distribution of variables and bivariate analysis using the chi-square test to examine the relationship between risk factors and the incidence of neonatal sepsis. The results showed that maternal factors, neonatal conditions at birth, and medical and environmental factors played an important role in the occurrence of neonatal sepsis. Early and appropriate management of neonatal sepsis is essential to reduce mortality, prevent complications, and improve neonatal outcomes. From an Islamic perspective, preventive and therapeutic efforts in neonatal sepsis align with the principles of maqāsid al-sharī'ah, particularly the protection of life (hifz al-nafs), lineage (hifz al-nasl), and wealth (hifz al-māl).

INTRODUCTION

Sepsis in newborns is an invasive bloodstream infection characterized by the presence of bacteria in body fluids such as blood, cerebrospinal fluid, or urine, and results in changes in hemodynamics in the first month of life. Sepsis often occurs in at-risk infants, for example in undermenstruated infants (BKB) and Low Birth Weight (BBLR), infants with respiratory distress syndrome or babies born to mothers at risk of infection (Wandita et al., 2021). Sepsis neonatorum is divided into two groups based on time, namely after birth, which is commonly called early-onset sepsis and late-onset sepsis. Early-onset sepsis occurs at or before 72 hours of life, while slow-onset sepsis occurs after 72 hours of life (Ervina et al. 2025).

Risk factors for neonatal sepsis are maternal factors (childbirth, short term birth, ruptured amniotic membranes for more than 18–24 hours, urinary tract infections in mothers, socioeconomic factors, and maternal nutrition) as well as infant factors such as prenatal asphyxia, low birth weight babies, under-term babies, invasive procedures, congenital abnormalities also increase the risk of neonatal sepsis (Martua 2021).

Bacteria are the most frequent cause of infections, but other causes of infection can come from fungi, viruses, or parasites (Citra et al., 2023; Defifa et al., 2025). The immune response

to bacteria can lead to organ dysfunction. The most frequent organs or primary infections are the respiratory system, nervous system, urogenital system, skin, and gastrointestinal system (Atmaja et al. 2023). The infectious causes of pathogenic microorganisms of neonatal sepsis are gram-positive bacteria, Group B Streptococcus (GBS) and *Listeria monocytogenes*, Group B Streptococcus bacteria are at high risk of causing meningitis in newborns so that they become the main trigger for early-onset sepsis (Jazariyah, 2019; Kumala & Purnomo, 2019). Meanwhile, gram-negative bacteria, *Escherichia coli*, more often cause sepsis in babies with Low Birth Weight (BBLR) or prematurity. Vertical transmission from mother to baby during childbirth is the main route of transmission. Slow-onset sepsis is often associated with nosocomial infections due to the use of invasive procedures such as intravascular catheters (Haryani et al. 2022).

Previous research identified low birth weight, premature birth (pregnancy <37 weeks), premature rupture amniotic membranes (PROM), neonatal sex, intrapartum related complications such as prenatal asphyxia, low socioeconomic status, poor sanitation, malnutrition, and population density associated with an increased risk of neonatal sepsis (Zuarisa et al., 2023).

According to World Health Organization (WHO) data published in 2020, there were 48.9 million cases and 11 million deaths due to sepsis worldwide with the presentation of 20% of all global deaths due to sepsis (Hasratati et al. 2024). Meanwhile, in Indonesia, neonatal sepsis is still a cause of death that is often found in infant deaths in Indonesia. According to data in Indonesia, judging from Indonesia's health profile in 2020, the mortality of infants under five years old (toddlers) in Indonesia reached 28,158 people in 2020. Of that number, as many as 20,266 toddlers (71.97%) died in the age range of 0-28 days (neonatal) (Nurhayati et al. 2024). Meanwhile, in Jakarta, cases of neonatal sepsis range from 1.5-3.72% in several referral hospitals in Indonesia such as Cipto Mangunkusumo Hospital, while the mortality rate ranges from 37.09-80% (Haryani et al. 2022).

Health is a concept that is comprehensively defined, as a condition of optimal physical well-being in maintaining hygiene and avoiding the possibility of disease (Dewi, 2019). Islamic values teach the importance of living cleanly. Allah Subhānahu wa Ta'ālā loves His servants who always take care of personal and environmental cleanliness (Nuralifya et al., 2024). As Allah Subhānahu wa Ta'ālā said:

"And Allah loves the Mutahirin 108 ...Meaning: "... Allah loves those who purify themselves." (Q.S At-Taubah [9]:108).

The interpretation of the verse conveys that Allah's love is for those who like to purify themselves, one of the attributes of His perfection. Allah loves goodness, perfection, purity, and truth (Ministry of Religion of the Republic of Indonesia, 2025). Maintaining cleanliness brings significant wisdom, including maintaining physical health, reducing the risk of contamination, and avoiding consumption of less nutritious food (Prastiwi et al., 2022). Food is one of the pillars of health in Islam, regulated through sharia principles. Islam requires that consuming good and nutritious food is not only worth worship but also serves as a preventive effort in maintaining health (Rojabiah, Suryani and Budiyanto, 2023). This is as Allah Subhānahu wa Ta'ālā says:

O Allah, the Messenger of Allah (peace and blessings of Allaah be upon him) said, "*O Messenger of Allah, I am the Messenger of Allah (peace and blessings of Allaah be upon him).*" p. 172.

Meaning: "*O you who have believed, eat what is good that we have bestowed upon you...*" (Q.S Al-Baqarah [2]: 172).

Tafsir Al-Muyassar explains that this verse commands the believers to eat delicious, halal, and good food as sustenance from Allah, and prohibits them from following the tradition of the disbelievers who forbid the good and the bad legalize. This teaching affirms the principle of halalan thayyiban (Tafsir Learn-Quran, 2019).

The results of this study are expected to be able to provide useful information in identifying the most dominant causative factors influencing the occurrence of neonatal sepsis. As well as being the basis for the preparation of more appropriate case handling and management measures in health facilities, and becoming an evaluation of the causative factors that occur at YARSI Hospital.

This study is based on the formulation of problems regarding the causative factors of neonatal sepsis, which include risk factors in the mother and risk factors in the baby, using retrospective data of neonatal sepsis patients treated at YARSI Hospital. Based on this foundation, this study asks questions about the description of the causative factors of neonatal sepsis, the relationship between each causative factor and the incidence of neonatal sepsis, and the Islamic view of these causative factors. The general purpose of this study is to determine the causative factors of the incidence of neonatal sepsis at YARSI Hospital based on Islamic views, while the specific objectives include the identification of causative factors in early-onset sepsis and slow-onset sepsis, analysis of the relationship between each causative factor and the incidence of neonatal sepsis, and understanding Islamic views on these problems. The benefits of this research for researchers are to increase knowledge and insight and implement learning during the preclinical period at the Faculty of Medicine, YARSI University as one of the requirements for obtaining a medical bachelor's degree. For YARSI University, this research is expected to be a source of data reference, literature reference, and the basis for further research, as well as to assist health workers in identifying the factors that cause neonatal sepsis to provide appropriate treatment. In addition, this research is also expected to provide benefits to the community through increasing understanding and concern for the factors that cause neonatal sepsis and the importance of maintaining personal health in accordance with Islamic principles.

METHOD

This study was an observational analytical research that aims to identify the factors that cause the occurrence of neonatal sepsis through observation of events that have occurred. The research uses a quantitative approach with a retrospective design, which is research that looks back at past data by starting to collect data from the consequences or events that have occurred, then tracing the causative factors. In this study, the dependent variable was the incidence of neonatal sepsis, while the independent variable included risk factors in the mother and infant that are suspected to play a role in the occurrence of neonatal sepsis.

This research was carried out at YARSI Hospital located in Central Jakarta in the period from January 2022 to December 2024. The study population was all patients diagnosed with

neonatal sepsis and treated at YARSI Hospital during the period. The research sample was determined using the total sampling method, namely the entire population that met the inclusion criteria and exclusion was used as a research sample. The inclusion criteria include patients with a diagnosis of neonatal sepsis who have complete medical record data, while the exclusion criteria include patients with incomplete medical record data, patients who died before the diagnosis of neonatal sepsis was established, as well as patients with conditions that are not relevant to the study.

Data collection in this study was carried out using secondary data obtained from the medical records of neonatal sepsis patients at YARSI Hospital. The data collected included maternal and infant characteristics as well as risk factors related to the incidence of neonatal sepsis. The data collection instrument is in the form of medical record data recording sheets that have been adjusted to the research variables. The data obtained is then grouped based on factors in the mother and baby, then managed and presented in the form of tables and graphs to facilitate the analysis and interpretation process.

The data analysis in this study was carried out through univariate and bivariate analysis. Univariate analysis is used to describe the frequency and percentage distribution of each independent and dependent variable presented in the form of tables and graphs. Furthermore, bivariate analysis was used to test the relationship between causative factors and the incidence of neonatal sepsis using a chi-square (χ^2) statistical test. The significance level used in this study was 5% ($\alpha = 0.05$), where the results were considered meaningful if the p value < 0.05 indicating the rejection of the null hypothesis and the acceptance of the alternative hypothesis, while the $p > 0.05$ indicated the absence of a statistically significant relationship.

RESULT AND DISCUSSION

Bivariate Analysis

Bivariate analysis in this study was used to assess the relationship between various maternal, intrapartum, and neonatal risk factors and the incidence of neonatal sepsis. All variables analyzed are categorical according to the operational definition, so the statistical method used is *the Chi-Square test*. This test allowed the researchers to assess whether the frequency distribution between the categories on the two variables differed significantly or just happened by chance.

In its implementation, *Chi-Square* analysis is carried out at the same time as *crosstabs*. *Crosstabs* function to display the distribution pattern of each category of independent variables against the category of dependent variables. Through this display, researchers can observe the tendencies that often appear in a slingshot. The pattern was then statistically tested through Chi-Square to determine if the distribution difference was really meaningful.

The decision-making criteria in the Chi-Square test are determined based on the probability value (p-value). If the p-value < 0.05 , then it can be concluded that there is a significant relationship between independent variables and the incidence of neonatal sepsis. Conversely, if the p-value ≥ 0.05 , then there is not enough evidence to assert a meaningful relationship, so frequency variations between categories are considered random (Rozak & Hidayati, 2019).

1. The Relationship Between Urinary Tract Infection and the Incidence of Neonathoracic Sepsis at YARSI Hospital

To assess whether urinary tract infections (UTIs) in mothers play a role in neonatal sepsis, a bivariate analysis was performed using *the Chi-Square test*. This variable is important because maternal UTIs can be a source of transmission of bacteria to the fetus during pregnancy or childbirth. A picture of the relationship between UTI and the onset of sepsis is shown through the following cross-tabulation:

Table 1 The Relationship Between Urinary Tract Infection and the Incidence of Neonathoracic Sepsis at YARSI Hospital

Variabel	Urinary Tract Infections				<i>p-value</i>
	Yes		No		
Sepsis Neonatorum	Quantity	%	Quantity	%	
Early Start	0	0.00%	17	53.1%	0.212
Slow Start	2	6.3%	13	40.6%	
Total	2	6.3%	30	93.8%	

Source: Medical records of neonatal sepsis patients at YARSI Hospital (2022–2024).

The results of *the Chi-Square test* showed that there was no significant association between urinary tract infection (UTI) in the mother and the incidence of neonatal sepsis based on onset, with *p-value* = 0.212 (≥ 0.05). However, the distribution pattern on the crosstabs still provides an interesting picture of the characteristics of the sample.

All cases of early-onset sepsis (0%) came from mothers without UTIs, while two cases of UTIs (6.3%) actually appeared in the slow-onset group. This pattern suggests that UTIs are not the main triggering factor for the onset of sepsis in the <72-hour period after birth. Clinically, this is understandable because most maternal UTIs are not necessarily directly related to bacterial transmission to the fetus, especially when the infection is localized in the lower urinary tract and has been treated during pregnancy.

Although UTIs have been known to be a risk factor for perinatal infections in several other studies, the findings in this study suggest that UTIs are not an important determinant of differences in the onset of neonatal sepsis in YARSI Hospital samples. Thus, other intrapartum and neonatal factors may have a more dominant role in determining the timing of sepsis.

2. The Relationship Between GBS Infection and the Incidence of Neonatal Sepsis at YARSI Hospital

Group B Streptococcus (GBS) infection is one of the classic risk factors for early-onset sepsis. Bivariate analysis was performed to find out if the presence of GBS infection in the mother was related to sepsis in neonates. The distribution of measurement results and statistical tests is presented in the following table:

Table 2 The Relationship Between GBS Infection and the Incidence of Neonatal Sepsis at YARSI Hospital

Variabel	GBS Infection				<i>p-value</i>
	Ya		No		
Sepsis Neonatorum	Quantity	%	Quantity	%	
Early Start	0	0.00%	17	53.1%	0.212
Slow Start	2	6.3%	13	40.6%	
Total	2	6.3%	30	93.8%	

Source: Medical records of neonatal sepsis patients at YARSI Hospital (2022–2024).

The results of the *Chi-Square* test showed that there was no significant association between *Group B Streptococcus* (GBS) infection in mothers and the incidence of neonatal sepsis based on onset, which was indicated by $p\text{-value} = 0.212$ ($p \geq 0.05$). The distribution on crosstabs shows the same pattern as the UTI. All 17 cases of early-onset sepsis (53.1%) occurred in the mothers group without GBS infection, while there was no case of early onset in the mothers group with GBS. Two cases of GBS only occurred in the slow-onset group (6.3%), and the majority of this group remained from mothers without GBS (13 infants; 40.6%).

Biologically, GBS is the main pathogen that causes early-onset sepsis through transmission during childbirth. However, the distribution pattern in this study showed that GBS colonization did not play a role in determining the onset of neonatal sepsis. There are several possible causes: low population colonization rates, the use of intrapartum prophylactic antibiotics, or small sample sizes so that variations do not appear significant. Thus, these data reinforce that GBS infection is not a determinant of early or late onset in cases of neonatal sepsis in this study, although its role remains biologically important in obstetric practice.

3. The Relationship Between Corioamnionitis Infection and the Incidence of Neonatal Sepsis at YARSI Hospital

Corioamnionitis is an intrauterine infection condition that theoretically has the potential to trigger neonatal sepsis. To understand its effect on sepsis, *Chi-Square* tests and *crosstabs analysis* were performed. The results of the relationship between the two variables are presented in the table below:

Table 3 The Relationship Between Corioamnionitis Infection and the Incidence of Neonatal Sepsis at YARSI Hospital

Variabel	Corioamnionitis Infection				<i>p-value</i>
	Ya		No		
Sepsis Neonatorum	Quantity	%	Quantity	%	
Early Start	6	18.8%	11	34.4%	0.536
Slow Start	6	18.8%	9	28.1%	
Total	12	37.5%	20	62.5%	

Source: Medical records of neonatal sepsis patients at YARSI Hospital (2022–2024).

The *Chi-Square* test showed no significant association between chorioamnionitis infection and the onset type of neonatal sepsis, reflected in the *p-value* = 0.536, a figure indicating no difference in proportion between groups. In *crosstabs*, infants from mothers with chorioamnionitis showed a relatively balanced distribution: 6 infants (18.8%) had an early onset and 6 infants (18.8%) had a slow onset. In the group without chorioamnionitis, the distribution was also proportional: 11 infants (34.4%) with early onset and 9 infants (28.1%) with slow onset.

This balance of proportions explains why there is no statistical significance. Clinically, chorioamnionitis is one of the strongest risk factors for early-onset sepsis because it triggers *fetal inflammatory response syndrome* (FIRS). However, some clinical conditions may make these effects invisible, such as intrapartum antibiotic administration, varying severity of chorioamnionitis, or varying neonatal immune responses. Thus, chorioamnionitis infection in this study did not distinguish between the occurrence of early-onset sepsis or slow-onset, although this factor was theoretically still associated with an increased risk of perinatal infection.

4. The Relationship Between Premature Rupture of the Membranes and the Incidence of Neonatal Sepsis at YARSI Hospital

Premature Rupture of the Membranes (KPD) is one of the risk indicators that is often associated with sepsis. Bivariate analysis was performed to evaluate whether the length of time the membrane ruptured contributed to sepsis in infants. The distribution of research data can be seen in the following table:

Table 4 The Relationship Between Premature Rupture of the Membranes and the Incidence of Neonatal Sepsis at YARSI Hospital

Variabel	Rupture of the membrane early				<i>p-value</i>
	>18 jam		≤18 jam		
Sepsis Neonatorum	Quantity	%	Quantity	%	
Early Start	3	9.4%	14	43.8%	0.563
Slow Start	2	6.3%	13	40.6%	
Total	5	15.6%	27	84.4%	

Source: Medical records of neonatal sepsis patients at YARSI Hospital (2022–2024).

The above bivariate analysis shows that Premature Rupture of Membranes (KPD) does not have a meaningful relationship with the onset type of neonatal sepsis, as indicated by the *p-value* of 0.563. The results of cross-tabulation showed that in the group of mothers with KPD of more than 18 hours, there were 3 infants (9.4%) who experienced early-onset sepsis and 2 infants (6.3%) who experienced slow-onset. Meanwhile, in the KPD group ≤18 hours, the distribution was not much different, namely 14 cases of early onset (43.8%) and 13 cases of late onset (40.6%). This similarity of distribution patterns illustrates that the duration of amniotic rupture, whether elongated or not, does not significantly differentiate whether sepsis appears earlier or later in neonates.

Clinically, KPD lasting more than 18 hours is known to be a factor that can increase the risk of intrauterine bacterial colonization due to the entry of microorganisms from the environment into the amniotic cavity. This condition in theory should increase the tendency to

develop early-onset sepsis. However, in this study, the number of KPD cases extended to only five samples, so the intensity of the risk was not enough to produce a statistically significant proportional difference. In addition, it is likely that fast and appropriate obstetric treatment such as prophylactic antibiotics, induction of labor, or targeted termination of pregnancy also play a role in reducing the risk of bacterial transmission to the fetus, so that the effect of KPD on the onset of sepsis becomes invisible.

Taking into account the distribution of cases and the clinical context, the results of this study show that KPD is not a determining factor that distinguishes early-onset sepsis from slow-onset in neonates at YARSI Hospital. However, KPD is still an important risk factor for perinatal infections so it still requires adequate monitoring and management in obstetric practice.

5. The Relationship Between Childbirth and the Incidence of Neonatal Sepsis at YARSI Hospital

The type of delivery process both spontaneous and by action has the potential to affect the risk of neonatal infection. To find out if the method of delivery is related to sepsis, an analysis was carried out using *the Chi-Square test*. The results of *crosstabs* and statistical tests are presented in the following table:

Table 5 The Relationship Between Childbirth and the Incidence of Neonatal Sepsis at YARSI Hospital

Variabel	Childbirth Process				<i>p-value</i>
	With Actions		Spontaneous		
Sepsis Neonatorum	Quantity	%	Quantity	%	
Early Start	15	46.9%	2	6.3%	0.437
Slow Start	12	37.5%	3	9.4%	
Total	27	84.4%	5	15.6%	

The above bivariate analysis shows that the labor process does not have a significant relationship with neonatal sepsis, as shown by the *p-value* of 0.437. Nonetheless, the results of the cross-tabulation show a distribution pattern that remains important to understand in a clinical context. In the group of babies born through labor delivery, there were 15 cases of early-onset sepsis (46.9%) and 12 cases of late-onset sepsis (37.5%). Meanwhile, in spontaneous delivery, there were 2 cases of early onset (6.3%) and 3 cases of late onset (9.4%). The dominance of labor by action in this study sample is reasonable considering that operative procedures or obstetric interventions are often carried out on conditions of the mother or fetus that are at risk, such as fetal emergency, malpresentation, or preterm pregnancy.

Although in theory operative delivery may increase the risk of infection in neonates due to tool manipulation or longer procedure duration, the distribution in this study did not show enough differences to be considered statistically significant. Both interventional and spontaneous delivery can produce early-onset and late-onset sepsis, suggesting that the mechanism of infection onset in neonates is not solely influenced by delivery techniques, but also by maternal factors, other intrapartum conditions, and the biological vulnerability of the baby itself.

The results of this study indicate that the delivery process is not a factor that determines the onset of sepsis earlier or later in neonates at YARSI Hospital. However, the delivery process is still an important part of the perinatal infection risk factor, so sterilization aspects, safe obstetric procedures, and early detection of complications still need to be maintained in efforts to prevent neonatal sepsis.

6. The Relationship Between Intrapartum Fever and the Incidence of Neonatal Sepsis at YARSI Hospital.

Intrapartum fever is a strong indicator of the presence of a maternal infection process that can affect the fetus. Bivariate analysis was performed to check whether the febrile condition during childbirth was related to neonatal sepsis. The results of bivariate analysis for both variables can be seen in the following table:

Table 6 The Relationship Between Intrapartum Fever and the Incidence of Neonatal Sepsis at YARSI Hospital

Variabel	Demam Intrapartum				<i>p-value</i>
	>38°C		≤38°C		
Sepsis Neonatorum	Quantity	%	Quantity	%	
Early Start	1	3.1%	16	50.0%	0.531
Slow Start	0	0%	15	46.9%	
Total	1	3.1%	31	96.9%	

The results of the *Chi-Square* test showed that intrapartum fever was not significantly related to neonatal sepsis, which can be seen from the *p-value* of 0.531. The distribution pattern of *cross tabs* showed that in mothers with a body temperature of >38°C, there was 1 infant (3.1%) who experienced early-onset sepsis and no cases of slow-onset were found. On the other hand, in the group of mothers with a temperature of ≤38°C, the distribution of cases appeared to be larger, namely 16 infants (50.0%) experienced an early onset and 15 infants (46.9%) experienced a slow onset.

The absence of cases of late-onset sepsis in the group of mothers with intrapartum fever is actually in line with the theory that maternal hyperthermia can trigger an inflammatory fetal response and increase the risk of early-onset sepsis. However, the very small number of fever cases of only two samples makes these findings insufficient to produce statistical significance. A larger distribution was in the non-fever group, which suggests that factors other than maternal temperature may be more dominant in influencing the onset of sepsis in neonates at YARSI Hospital. This study concluded that although intrapartum fever has clinical relevance as a risk factor for neonatal sepsis, this variable has not been shown to be associated with neonatal sepsis.

7. The Relationship Between Prematurity and the Incidence of Neonatal Sepsis at YARSI Hospital

Prematurity is known to be a major risk factor for neonatal sepsis. To assess whether the degree of prematurity is related to sepsis, a *Chi-Square analysis was performed*, the results of which are summarized in the following table:

Table 7 The Relationship Between Prematurity and the Incidence of Neonatal Sepsis at YARSI Hospital

Variabel	Prematurity				<i>p-value</i>
	<37mg		≥37mg		
Sepsis Neonatorum	Quantity	%	Quantity	%	
Early Start	11	34.4%	6	18.8%	0.602
Slow Start	10	31.3%	5	15.6%	
Total	21	65.6%	11	34.4%	

Source: Medical records of neonatal sepsis patients at YARSI Hospital (2022–2024).

The results of the *Chi-Square* test showed that prematurity did not have a statistically significant relationship with neonatal sepsis, characterized by a *p-value* of 0.602. These findings indicate that in this study sample, gestational age does not play a determining factor in whether sepsis appears in the early or late onset phase. Nonetheless, the crosstabs distribution analysis still provides a clinically relevant picture of patterns.

In the group of infants with gestational age <37 weeks), as many as 11 neonates (34.4%) experienced early-onset sepsis and 10 neonates (31.3%) experienced slow-onset. Meanwhile, in the ≥37 weeks group, there were 6 cases of early onset (18.8%) and 5 cases of slow onset (15.6%). The ratio between early and late onset in both groups appeared to be relatively balanced, suggesting that both premature and full-term infants can experience both forms of sepsis with a relatively different distribution.

Physiologically, prematurity is known as one of the main determinants of susceptibility to systemic infections. Babies born before 37 weeks have immature immune systems, suboptimal neutrophils, limited cytokine production, and mucosal and skin integrity that are susceptible to bacterial colonization. This condition generally makes premature babies more susceptible to early-onset sepsis due to exposure to microorganisms during pregnancy and childbirth. On the other hand, the risk of slow-onset sepsis may increase due to more frequent invasive interventions in premature populations, such as IV insertion, use of breathing apparatus, and incubator treatment.

However, in this study, the pattern did not appear to produce significant differences between groups. This can reflect that neonatal management at YARSI Hospital has been carried out comprehensively and standardized, especially in the premature population who usually receive more intensive care. Close monitoring, the use of prophylactic antibiotics when needed, and good infection control in neonatal intensive care units have the potential to reduce risk variation between early and late onset.

Thus, although prematurity remains a strong biological risk factor for the occurrence of sepsis in general, this study found no evidence that gestational age has an effect on the timing of the onset of neonatal sepsis. The relatively balanced pattern of *crosstabs* distribution confirmed that other factors, such as maternal conditions, intrapartum events, bacterial colonization, and quality of neonatal care, likely had a greater contribution to determining the type of onset of sepsis in the study population.

8. The Relationship Between Low Birth Weight and the Incidence of Neonatal Sepsis at YARSI Hospital

Birth weight is an important indicator of early neonatal health status. Bivariate analysis was performed to test whether BBLR is associated with sepsis. A breakdown of case distribution and statistical values is shown in the following table:

Table 8 The Relationship Between Low Birth Weight and the Incidence of Neonatal Sepsis at YARSI Hospital

Variabel	Low Birth Weight				<i>p-value</i>
	<2500gr		≥ 2500gr		
Sepsis Neonatorum	Quantity	%	Quantity	%	
Early Start	10	31.3%	7	21.9%	0.240
Slow Start	6	18.8%	9	28.1%	
Total	16	50.0%	16	50.0%	

Source: Medical records of neonatal sepsis patients at YARSI Hospital (2022–2024).

The results of the *Chi-Square* test showed that low birth weight (BBLR) had no significant association with neonatal sepsis, as indicated by a *p-value* of 0.240. Nevertheless, the analysis of the distribution through *crosstabs* still provides an important picture of the clinical trends in this study sample. In the group of infants with a birth weight of <2500 grams, 10 cases of early-onset sepsis (31.3%) and 6 cases of late-onset sepsis (18.8%) were found. Meanwhile, in the group of infants with a birth weight of ≥2500 grams, there were 7 cases of early onset (21.9%) and 9 cases of late onset (28.1%). This distribution pattern suggests that both early-onset and late-onset BBLR babies have the same total number and that these trends are not strong enough to produce meaningful statistical relationships.

Physiologically and clinically, babies with low birth weight are at high risk of systemic infections due to organ immaturity, higher skin permeability, weak thermoregulatory abilities, and innate and adaptive immune responses that have not been optimally developed. These factors generally cause BBLR babies to be more susceptible to early onset sepsis, especially due to bacterial transmission from the mother during childbirth or intrauterine infection. However, in this study, the difference in proportion between the BBLR and non-BBLR groups in the incidence of early and late sepsis did not appear to be striking. This may indicate that good neonatal management, such as early stabilization, timely administration of empirical antibiotics, as well as incubator care and strict infection control, can reduce the risk gap between birth weight groups.

In addition, the appearance of slow-onset sepsis in infants with normal or low birth weight suggests that postnatal risk factors, such as environmental exposure, invasive procedures, bacterial colonization in health facilities, and comorbid conditions, have a considerable contribution to the time of infection. Thus, birth weight alone is not enough to explain the variation in the type of sepsis onset.

Based on these findings, it can be concluded that although BBLR remains a factor of biological susceptibility to neonatal infections in general, this study found no evidence that

birth weight plays a role as a determining factor in the rapid or slow onset of neonatal sepsis at YARSI Hospital. Variation in onset in both birth weight groups is likely to be more influenced by a combination of maternal, intrapartum, and postpartum neonatal care.

9. The Relationship Between Incubator Care and the Incidence of Neonatal Sepsis at YARSI Hospital

Incubator treatments are often given to babies at high risk of infection. To assess whether the use of incubators is related to sepsis, a bivariate analysis was performed through *the Chi-Square test*. The results of the relationship between the two variables are listed in the following table:

Table 9 The Relationship Between Incubator Care and the Incidence of Neonatal Sepsis at YARSI Hospital

Variabel	Incubator Maintenance				<i>p-value</i>
	Ya		No		
Sepsis Neonatorum	Quantity	%	Quantity	%	
Early Start	15	46.9%	2	6.3%	0.650
Slow Start	13	40.6%	2	6.3%	
Total	28	87.5%	4	12.5%	

Source: Medical records of neonatal sepsis patients at YARSI Hospital (2022–2024).

The results of *the Chi-Square test* showed that incubator treatment had no significant association with neonatal sepsis, indicated by a *p-value* of 0.650. This indicates that the use of incubators, whether done or not, does not play a determining role in whether sepsis appears in the early-onset or slow-onset phases. These findings are reinforced by the results of *crosstabs which* show a relatively balanced distribution of cases. In the group of neonates treated in incubators, there were 15 cases of early-onset sepsis (46.9%) and 13 cases of late-onset sepsis (40.6%). Meanwhile, in the group that was not treated in the incubator, there were 2 cases of early onset (6.3%) and 2 cases of late onset (6.3%) respectively. The almost similar proportions between the two groups reflect that environmental factors, especially the use of incubators, are not determinants of the time of sepsis in this study.

Viewed from a clinical perspective, incubators play an important role in stabilizing neonatal conditions, particularly in premature infants and low-birth weight infants who have temperature instability and physiological susceptibility. Incubators help maintain body temperature, reduce energy requirements, and support vital functions, so they can theoretically reduce the risk of secondary infections due to physiological stress. However, incubators can also be a source of nosocomial infections if sterilization procedures, equipment hygiene, and maintenance protocols are not carried out consistently. In some health facilities, the incidence of nosocomial sepsis may increase if the incubator is used interchangeably or not cleaned according to standards.

In the context of this study, the results of the case distribution showed that the quality of neonatal care at YARSI Hospital likely met good infection control standards. The absence of significant differences between the incubator and non-incubator groups indicates that the risk of infection that may be associated with the use of the incubator has been successfully minimized. In addition, the timing of sepsis in neonates appears to be more influenced by other

factors such as prematurity, maternal conditions, bacterial colonization, or intrapartum factors, rather than by the temperature treatment method used.

Although incubator care remains an important aspect of the management of at-risk neonates, this study suggests that incubator use is not associated with the rapid or slow onset of neonatal sepsis. Incubators should still maintain their use as a standard means of care, but strict monitoring of the prevention of nosocomial infections remains an important element in clinical practice.

10. The Relationship Between Infusion and Oxygen Installation and the Incidence of Neonathoracic Sepsis at YARSI Hospital

Infusion insertion and oxygen administration are common procedures in sick neonates. Bivariate analysis was applied to check whether this invasive action was related to sepsis. The cross-tabulation and statistical test results are presented in the following table:

Table 10 The Relationship Between Infusion and Oxygen Installation and the Incidence of Neonathoracic Sepsis at YARSI Hospital

Variabel	Infusion and Oxygen Installation				<i>p-value</i>
	Ya		No		
Sepsis Neonatorum	Quantity	%	Quantity	%	
Early Start	16	50.0%	1	3.1%	0.726
Slow Start	14	43.8%	1	3.1%	
Total	30	93.8%	2	6.3%	

Source: Medical records of neonatal sepsis patients at YARSI Hospital (2022–2024).

The results of the bivariate analysis showed that the installation of the infusion and the administration of oxygen did not have a significant relationship with neonatal sepsis, as evidenced by the *p-value* of 0.726. Nonetheless, the results of *the crosstabs* provide a clinically relevant picture of the distribution. In the neonatal group that received IV and oxygen installation, which included most of the study sample, 16 cases of early-onset sepsis (50.0%) and 14 cases of slow-onset sepsis (43.8%) were found. Meanwhile, in the group that did not undergo IV or oxygen installation, there was only one case of early onset (3.1%) and one case of slow onset (3.1%) respectively. This proportion suggests that the difference in the initial distribution in the two groups is very small and not sufficient to produce statistical significance.

From a clinical point of view, the insertion of IVs and the administration of oxygen are measures that are almost always given to neonates with unstable conditions, especially those suspected of having sepsis. Infusions allow for the administration of intravenous antibiotics, fluids, and parenteral nutrients, while oxygen helps to overcome respiratory distress common in sick neonates. Although invasive procedures such as IV insertion may increase the risk of healthcare-related infections if not done aseptic, this study shows that such interventions have no effect on the rapid or slow onset of sepsis. This can indicate that the infection prevention protocol in the neonatal unit of YARSI Hospital is running well, so that the installation of infusions and oxygen does not become the source of infection that causes differences in initiation patterns.

In addition, the relatively proportional distribution pattern in both groups suggests that the factors that determine the onset of sepsis are likely to be more influenced by maternal

conditions, labor processes, the type of causative bacteria, or physiological conditions of the neonatal than by invasive procedures received postnatal. This reinforces the interpretation that supportive measures such as infusion and oxygen do not have a differentiating role in determining the onset of sepsis.

Thus, although the installation of infusions and oxygen still needs to be considered as a potential pathway for bacterial entry in the context of nosocomial infection, the findings of this study confirm that the intervention is not related to the onset of neonatal sepsis. Compliance with aseptic techniques, equipment sterilization, and strict monitoring remain important aspects to prevent the occurrence of infections related to medical procedures.

This study aims to identify and analyze the factors that cause the incidence of neonatal sepsis at YARSI Hospital based on maternal, intrapartum, neonatal conditions, and environmental factors. Based on the results of bivariate analysis using *the Chi-Square* test on all variables studied, no statistically significant association was found between the risk factors analyzed with neonatal sepsis ($p\text{-value} \geq 0.05$). Thus, the zero (H_0) hypothesis was accepted, which suggests that in this study population, the risk factors studied did not play a role as the main determinant of the appearance of neonatal sepsis.

These results show that the incidence of neonatal sepsis at YARSI Hospital is not influenced solely by one specific risk factor, but is a manifestation of the complex interaction of various maternal, intrapartum, neonatal, and postpartum care factors. These findings are in line with the basic concept of neonatal sepsis which states that sepsis is a multifactorial condition that is strongly influenced by the immune response of immature neonates, colonization of microorganisms, and complex systemic inflammatory dynamics (Wandita et al., 2021).

In maternal factors, urinary tract infections (UTIs) and *Group B Streptococcus infections (GBS)* are theoretically known as important risk factors for neonatal sepsis, especially early-onset sepsis through vertical transmission during pregnancy or childbirth. A meta-analysis conducted by Putri and Artana (2024) even reported an Odds Ratio of 4.04 which showed a significant relationship between maternal UTI and the incidence of neonatal sepsis. However, in this study, neither the UTI nor GBS showed a meaningful relationship with the onset of sepsis. The distribution pattern of *crosstabs* shows that all cases of early-onset sepsis occur in the group of mothers without UTIs or GBS, while cases of UTIs and GBS only appear in very small numbers in slow onset. This condition can be explained by the possible low prevalence of bacterial colonization in the study population, the effectiveness of antenatal screening, and the administration of intrapartum prophylactic antibiotics that have reduced the risk of vertical transmission, as conveyed by Umarudin et al. (2023) and PNR et al. (2024).

Chorioamnionitis infection, which is biologically a strong risk factor for early-onset sepsis because it is associated with *fetal inflammatory response syndrome (FIRS)*, also did not show a meaningful association with sepsis in this study. The proportional distribution between early onset and slow onset in the group with and without chorioamnionitis appeared to be relatively balanced. In theory, chorioamnionitis can increase the risk of sepsis, *respiratory distress*, and neurological disorders in neonates (Fitriyya & Irfani, 2021). This insignificance may be influenced by variations in the severity of chorioamnionitis, rapid obstetric intervention, and varying neonatal immune responses, so that the impact of intrauterine infection on sepsis onset time is not statistically apparent.

In intrapartum factors, premature rupture of amniotic membranes (KPD), labor processes, and intrapartum fever also did not show a meaningful association with the incidence of neonatal sepsis based on onset. In fact, several previous studies have reported a significant association between >18-hour KPD, sectio caesarean delivery, and intrapartum fever with early-onset sepsis (Murtado et al., 2023). In this study, the number of cases of elongated KPD and intrapartum fever were relatively small, so the statistical strength was limited. In addition, the application of good obstetric management standards, including prophylactic antibiotics and proper termination of pregnancy, is thought to be able to reduce the risk of bacterial transmission, so that the influence of intrapartum factors on the onset of sepsis is not prominent.

Neonatal factors such as prematurity and low birth weight (BBLR), which are physiologically known as the main determinants of susceptibility to infection due to immune system immaturity, also did not show a meaningful association with the onset of sepsis in this study. In fact, premature babies and BBLR have suboptimal neutrophil function, weak mucosal integrity, and limited cytokine responses, so in theory they are more susceptible to sepsis, both early and late onset (Firmansyah et al., 2023). The relatively balanced distribution of cases between early and late onset in these two groups indicates that the quality of neonatal care at YARSI Hospital, including strict monitoring and timely empirical antibiotic administration, plays a role in suppressing risk differences based on gestational age and birth weight.

In environmental factors, incubator maintenance and infusion and oxygen installation were also not related to the onset of sepsis. These findings are important considering that invasive procedures are often associated with slow-onset sepsis due to nosocomial infections (Haryani et al., 2022). However, the results of this study show that infection control protocols, tool sterilization, and aseptic techniques in the neonatal unit of YARSI Hospital may have been implemented optimally, so that the procedure is not a distinguishing factor in determining the fast or slow onset of sepsis. This is in line with the views of Harahap et al. (2022) and Hendrawati et al. (2024) who emphasize that the quality of care and compliance with SOPs have a much bigger role than just the type of action given.

Pathophysiologically, neonatal sepsis is the result of an uncontrolled immune response to microorganism invasion, which involves the activation of *pattern recognition receptors* (PRRs), the release of proinflammatory cytokines such as IL-6 and TNF- α , as well as a disturbance of the balance between proinflammatory and anti-inflammatory responses (Wandita et al., 2021). When this response is influenced by multiple factors simultaneously, a single risk factor is often insufficient to determine the variation in sepsis onset. This explains why no significant association was found between individual risk factors and neonatal sepsis in this study.

Overall, this study confirms that the incidence of neonatal sepsis at YARSI Hospital is influenced by the complex interaction of various maternal, intrapartum, neonatal, and environmental factors, without a single risk factor that significantly distinguishes between early onset and slow onset. These findings provide important implications that efforts to prevent and manage neonatal sepsis must be carried out holistically, including good antenatal care, safe delivery management, optimal neonatal care, and strict infection control, in line with medical principles and Islamic values in safeguarding human safety and life.

Research Limitations

This study has a number of methodological and clinical limitations that need to be considered in interpreting the findings regarding factors related to neonatal sepsis. First, all research samples were neonates with positive blood cultures, so this study did not have a comparison group in the form of babies with negative cultures. The absence of a control group meant that the analysis could only evaluate differences between onset types (early vs. late) in a population that was entirely infected, rather than identifying risk factors that distinguish neonates who develop sepsis from those who did not. This condition can limit the ability of research to capture a broader causal relationship related to maternal and intrapartum factors.

Second, most of the independent variables in this study are categorically simple, i.e. dichotomous, so they are not able to capture a more complex clinical spectrum. For example, Premature Rupture Amniotic Membrane is only classified based on an 18-hour time limit without considering the degree of contamination, the presence of amniotic odor, the color of the amniotic fluid, or the accompanying maternal condition. Similarly, prematurity is only divided into <37 weeks and \geq 37 weeks without taking into account specific gestational age or prematurity category. Simplification of these variables can lead to the loss of clinical variation that actually plays a role in sepsis pathogenesis.

Third, the design of a retrospective study based on medical records is highly dependent on the completeness of clinical documentation. Important variables such as the exact timing of intrapartum antibiotic administration, aseptic techniques during delivery, length of time the amniotic membrane ruptures before the intervention, previous maternal infection history, and intensive exposure to neonatal invasive procedures are not always recorded in detail. These factors can play a major role in determining the onset of sepsis, but they cannot be optimally analyzed due to limited data.

Nevertheless, this study still makes a valuable contribution as an initial picture of maternal and neonatal characteristics in culture-confirmed sepsis cases at YARSI Hospital. These findings could be the basis for further research with prospective designs, larger sample counts, more detailed recording of clinical variables, and analyses that integrate laboratory data and bacterial cultures. These efforts are expected to produce a more comprehensive understanding of risk factors, transmission mechanisms, and determinants of neonatal sepsis so as to strengthen prevention strategies and clinical management in the newborn population.

CONCLUSION

Based on the results of research on neonatal sepsis at YARSI Hospital for the 2022–2024 period, it can be concluded that the incidence of neonatal sepsis is influenced by various interrelated factors, including maternal characteristics, the condition of the baby at birth, as well as environmental factors and medical measures. The characteristics of the mother that are most commonly found in cases of neonatological sepsis are the presence of a history of infection during pregnancy and certain conditions of delivery, while from the infant side, the incidence of sepsis is more common in babies with special conditions at birth, such as gestational age and certain birth weight. In addition, environmental factors and medical care practices, including the use of certain medical devices and procedures, are also found in most cases based on medical record data. Factors related to infection, environmental cleanliness, and invasive medical procedures reflect efforts to maintain the safety of newborn life in line with

the principles of ḥifẓ al-nafs in maqāṣid al-syarī'ah. The condition of the baby at birth and the health of the mother during pregnancy, such as prematurity, low birth weight, and fulfillment of maternal nutrition, show the importance of the principle of ḥifẓ al-nasl in maintaining the sustainability and quality of offspring. Proper and standard-setting treatment of neonatal sepsis from an early stage not only plays a role in saving the baby's life, but also prevents more severe follow-up care and costly waste, thus being in line with the principle of ḥifẓ al-māl. Therefore, health workers are expected to increase awareness of risk factors for neonathoracic sepsis through infection prevention, the application of sterility principles, and strict monitoring of high-risk infants, while the results of this study are expected to support scientific development that integrates medical science and Islamic values and become the basis for future research with larger samples and more comprehensive variables.

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