

Identification of the Cause of Infant Mortality in Balangan Regency South Kalimantan Province in 2023

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Abstract:

The infant mortality rate is an indicator that reflects the healthcare system and societal well-being. Based on data from BPS of South Kalimantan Province, the infant mortality rate for children under 1 year old in 2020 was 17.22 per 1000 live births, while in Balangan Regency, it was 18.24 per 1000 live births. This research aims to identify the causes of infant mortality in Balangan Regency in 2023. This research is a descriptive study using a total sampling of 30 cases of infant mortality in Balangan Regency in 2023. The research was conducted from May to July 2024, variables include the infant's age, place and cause of death, maternal comorbid conditions, antenatal care, birth attendants, type of delivery, delay in seeking care, and refusal of care. Data was collected using primary (questionnaires) and secondary (perinatal verbal autopsy). Data analysis was performed using univariate analysis, which was presented in the form of frequency distribution tables. The results of data analysis show the classification of infant mortality includes neonatal death (0-28 days) with 19 cases (63%) and post-neonatal death with 11 cases (37 %). Most infant deaths occurred at Datu Kandang Haji Hospital with 14 cases (47%). The majority of infant deaths were caused by ELBW and prematurity with 7 cases (23%), 6 cases (20%) by diarrhea, and 5 cases (17%) by asphyxia. A total of 22 mothers (73%) had comorbid conditions, 5 mothers (17%) had less than 4 antenatal care, 24 cases (80%) had a midwife as the birth attendant, 7 cases (23%) experienced delays in seeking treatment, and 3 cases (10%) refused treatment. The causes of infant mortality in Balangan Regency in 2023 are classified into infant and maternal conditions. Infant conditions were predominantly caused by ELBW with prematurity, diarrhea, and asphyxia, while maternal conditions involved comorbid diseases.

Keywords: Causes of infant mortality; ELBW; prematurity; maternal comorbidities

Introduction

The infant mortality rate, which refers to the death of children during the first year of life, is an important measure that reflects a country's healthcare system and societal well-being.¹ The reduction of the infant mortality rate is one of the global targets in the Sustainable Development Goals (SDGs), by 2030, it is expected to achieve a reduction in the neonatal mortality rate to at least 12 per 1,000 live births and the under-five mortality rate to 25 per 1,000 live births.²

In 2020, approximately 2.4 million newborns worldwide faced death within the first month of their lives. This statistic translates to around 6,700 newborn deaths each day, accounting for 47% of the total number of deaths among children under five years old, a sharp increase from the 40% recorded in 1990.^{1,2}

In Indonesia, reducing the infant mortality rate is one of the key focuses of the National Medium-Term Development Plan (RPJMN) for 2020-2024. In the RPJMN 2020-2024 action plan, the infant mortality rate is expected to decrease to 16 per 1,000 live births.⁴ To design effective intervention strategies and policies, it is crucial to understand the trends and determining factors associated with the infant mortality rate.^{1,2}

According to data from the Central Bureau of Statistics of South Kalimantan Province, the mortality rate for residents aged 0-11 months in South Kalimantan Province in 2020 was 17.22 per 1,000 live births. This figure is still higher than the national rate, which is 16.85 deaths per 1,000 live births. The infant mortality rate in Balangan Regency, South Kalimantan Province, reached 18.24 deaths per 1,000 live births.⁴

Infant mortality is further divided into neonatal mortality, which consists of two periods: early neonatal (from 0 to 6 days of life) and late neonatal (from 7 to 27 days of

life), and post-neonatal mortality (death from 28 to 264 days of life). This classification can serve as an indicator to assess the health situation of the population, as many early deaths are preventable.⁵

Most deaths during childhood occur in the first years of life, particularly in the first month. The causes include prematurity, congenital malformations, intrapartum asphyxia, and perinatal infections. Most of these causes can be prevented through high-quality healthcare during pregnancy, childbirth, and the postpartum period.⁵ According to the 10th Revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) by the World Health Organization (WHO), deaths from preventable causes are those resulting from diseases or situations that can largely be avoided through effective public health interventions and primary prevention.⁶ Deaths from preventable causes during childhood are a global public health issue because they are one of the leading causes of mortality in this age group.⁵

In a decade, the infant mortality rate in Balangan Regency decreased from 29 deaths per 1,000 live births in 2010 to 18.24 per 1,000 live births in 2020. The infant mortality rate further declined in 2022 to 9 per 1,000 live births, with a total of 18 infant deaths in absolute terms. However, it significantly increased in 2023 to 15.54 per 1,000 live births, with 30 infant deaths.^{5,7,8}

The high infant mortality rate significantly affects the Life Expectancy (UHH) in Balangan Regency, which impacts the Human Development Index (HDI) of Balangan Regency. Given the substantial impact of infant mortality on the HDI, it is necessary to conduct studies to identify the causes of infant mortality. These studies will serve as a foundation for developing strategies to reduce infant mortality, which will improve

life expectancy and ultimately enhance the HDI of Balangan Regency.

Research Method

Research Design

This study is a descriptive research. It aims to identify the causes of infant mortality in Balangan Regency, South Kalimantan Province, in 2023.

Time and Place of Research

This research was conducted in Balangan Regency, South Kalimantan, from May to July 2024.

Research Subject

The study population consists of all infant mortality cases in Balangan Regency in 2023, totaling 30 cases. The sample for this study uses total sampling.

Research Variables

The research variables include the infant's age, place of infant death, cause of infant death, maternal conditions, antenatal visits, delivery attendants, type of delivery, delays in seeking care, and refusal of care.

Research Data Collection

Data collection involves primary data through questionnaires and secondary data through verbal autopsy (VA). Verbal autopsy data were obtained from each community health center (puskesmas) in the working areas where infant deaths occurred in Balangan Regency.

Data Analysis

Data analysis uses univariate analysis presented in the form of frequency distribution tables to provide an overview of the causes of infant mortality in Balangan Regency, South Kalimantan Province, in 2023

Results

The total number of infant deaths in Balangan Regency, South Kalimantan Province, in 2023 is 30 cases, including neonatal deaths (0-28 days) amounting to 19 cases (63.33%) and post-neonatal deaths (>28 days - <1 year) amounting to 11 cases (36.67%). The neonatal deaths consist of early neonatal deaths (0-7 days) totaling 16 cases (88.89%) and late neonatal deaths (8-28 days) totaling 11 cases (16.67%). (Tables 1 and 2)

Based on the place of infant death, the majority of infants died at RSUD Datu Kandang Haji Balangan, totaling 14 cases (46.67%). Infant deaths were also recorded at hospitals outside Balangan Regency, including RSUD H. Badaruddin Kasim Tanjung with 4 cases (13.33%), RSUD Pambalah Batung Amuntai with 5 cases (15.67%), RSUD H Damanhuri Barabai with 2 cases (6.67%), and RSUD Ulin Banjarmasin with 2 cases (6.67%). Additionally, there were 3 deaths (10%) that occurred at home. (Table 3)

Based on the causes or conditions leading to infant deaths in Balangan Regency, the majority were due to extremely low birth weight (ELBW) with prematurity totaling 7 cases (23.33%), followed by diarrhea with 6 cases (20%), asphyxia with 5 cases (16.67%), sepsis with 4 cases (13.33%), very low birth weight (VLBW) with prematurity with 3 cases (10%), pneumonia with 3 cases (10%), and low birth weight (LBW) with prematurity with 2 cases (6.67%). (Table 4)

Based on the maternal conditions or accompanying diseases, it was found that the majority of mothers had accompanying conditions, with 22 mothers (73.33%), while 8 mothers (26.67%) did not have any accompanying conditions. Among the 22 mothers with accompanying conditions, 14 mothers (46.67%) had early neonatal deaths, 12 mothers (40%) had late neonatal deaths, and 6 mothers (20%) had post-neonatal deaths. Among the 8 mothers without accompanying conditions, there were 2

mothers (6.67%) with early neonatal deaths, 1 mother (3.33%) with late neonatal deaths, and 5 mothers (16.67%) with post-neonatal deaths. (Table 5)

The types of maternal conditions or diseases found were mostly anemia with 14 cases, hyperemesis gravidarum with 13 cases, premature rupture of membranes (PROM) with 9 cases, chronic energy deficiency (CED) with 8 cases, and hypertension with 6 cases. (Table 6).

The characteristics of infant deaths based on access to healthcare services revealed that 5 mothers visited antenatal care (ANC) less than 4 times (16.67%), while 25 mothers visited ANC 4 times or more (83.33%). Most infant deaths occurred in the early neonatal period among mothers who had ≥ 4 ANC visits, totaling 13 cases (43.33%). Regarding birth attendants, the majority of infant deaths were attended by midwives, with 24 cases (80%), while 6 cases (20%) were attended by obstetricians. The most frequent infant

deaths occurred in the early neonatal period with midwives as the attendants, totaling 12 cases (40%). In terms of delivery type, the majority of infant deaths occurred with vaginal delivery, totaling 26 cases (86.67%), while 4 cases (13.33%) were delivered by cesarean section. The highest number of infant deaths was found in the early neonatal period with vaginal delivery, amounting to 14 cases (46.67%). (Table 7)

Based on the factor of delays in seeking help/treatment, there were 7 cases (23.33%) with delays in seeking help/treatment, while 23 cases (76.67%) did not experience delays in seeking help/treatment. (Table 8)

Based on the factor of refusal of treatment/care, there were 3 cases (10%) where treatment/care was refused, while 27 cases (90%) did not refuse treatment/care. (Table 9)

Table 1 The Frequency Distribution of Infant Mortality in Balangan Regency in 2023 Based on Neonatal and Post-Neonatal Mortality

Infant Mortality	n	%
Neonatal (0-28 days)	19	63,33
Post-Neonatal (>28 days- <1 year)	11	36,67

Table 2 The Frequency Distribution of Infant Mortality in Balangan Regency in 2023 Based on Early Neonatal and Late Neonatal Mortality

Infant Mortality	n	%
Early Neonatal (0-7 days)	16	88,89
Late Neonatal (8-28 days)	11	16,67

Table 3 The Frequency Distribution of Infant Mortality Locations in Balangan Regency in 2023

Infant Mortality Location	Infant Mortality						Total	
	Neonatal				Post-Neonatal			
	Early Neonatal		Late Neonatal					
	n	%	n	%	n	%	n	%
Datu Kandang Haji Balangan Regional Hospital	8	26,6	0	0	6	20	14	46,67
H. Badaruddin Kasim Tanjung Regional Hospital	3	10	1	3,33	0	0	4	13,33
Pambalah Batung Amuntai Regional Hospital	4	13,33	1	3,33	0	0	5	16,67
H Damanhuri Barabai Regional Hospital	1	3,33	0	0	1	3,33	2	6,67
Ulin Banjarmasin Regional Hospital	0	0	1	3,33	1	3,33	2	6,67
Patient's Home	0	0	0	0	3	10	3	10

Table 4 The Frequency Distribution of Causes of Infant Mortality in Balangan Regency in 2023

Disease/ Disorder	ICD-10	Infant Mortality						Total	
		Neonatal				Post-Neonatal			
		Early Neonatal		Late Neonatal				n	%
		n	%	n	%	n	%		
Asphyxia	P21	3	10%	1	3,33%	1	3,33%	5	16,67%
LBW +	P07.1	2	6,67%	0	0%	0	0%	2	6,67%
Premature									
VLBW +	P07.1	2	6,67%	1	3,33%	0	0%	3	10%
Premature									
ELBW +	P07.0	7	23,33%	0	0%	0	0%	7	23,33%
Premature									
Sepsis	P36	2	6,67%	1	3,33%	1	3,33%	4	13,33%
Diarrhea	A09	0	0%	0	0%	6	20%	6	20%
Pneumonia	J18	0	0%	0	0%	3	10%	3	10%

Table 5 The Frequency Distribution of Maternal Condition/Comorbid Disease Factors in Infant Mortality Cases in Balangan Regency in 2023

Maternal Condition/ Comorbid Disease	Infant Mortality						Total	
	Neonatal				Post-Neonatal			
	Early Neonatal		Late Neonatal				n	%
	n	%	n	%	n	%		
Yes	14	46,67 %	2	6,67%	6	20%	22	%
No	2	6.67%	1	3.33%	5	16.67%	8	%

Table 6 Types of Maternal Condition/Comorbid Disease Factors in Infant Mortality Cases in Balangan Regency in 2023

Types of Maternal Condition/Comorbid Disease	n
Hyperemesis Gravidarum	13
Anemia	14
Chronic Energy Deficiency (CED)	8
Pulmonary Tuberculosis	1
Hypertension	6
Premature Rupture of Membranes (PROM)	9
Antepartum Hemorrhage	3
Diabetes Mellitus	1
Hepatitis B	1
Seizures	1
Decreased Consciousness	1

Table 7 The Frequency Distribution of Infant Mortality Characteristics in Balangan Regency Based on Healthcare Access Factors and Time of Infant Death

Healthcare Access Factors	Infant Mortality						Total	
	Neonatal				Post-Neonatal			
	Early Neonatal		Late Neonatal					
	n	%	n	%	n	%	n	%
1. Antenatal Care (ANC) Visits								
<4 times	2	6,67%	1	3,33%	2	6,67%	5	16,67%
≥4 times	13	43,33%	3	10%	9	30%	25	83,33%
2. Birth Attendant								
Obstetrician	4	13,33%	2	6,67%	0	0%	6	20%
Midwife	12	40%	2	6,67%	10	33,33%	24	80%
3. Type of Delivery								
Cesarean Section	1	3,33%	2	6,67%	1	3,33%	4	13,33%
Vaginal Delivery	14	46,67%	2	6,67%	10	33,33%	26	86,67%

Table 8 The Frequency Distribution of Delays in Seeking Help/Treatment in Infant Mortality Cases in Balangan Regency

Delay in Seeking Help/ Treatment	Total	
	n	%
Yes	7	23,33%
No	23	76,67%

Table 9 The Frequency Distribution of Factors Contributing to Refusal of Treatment/Care in Infant Mortality Cases in Balangan Regency

Refusal of Treatment/ Care	Total	
	n	%
Yes	3	10%
No	27	90%

Discussion

This study describes the causes of infant mortality in Balangan Regency in 2023. The research found 30 infant mortality cases in Balangan Regency in 2023, including 19 neonatal deaths (0-28 days), which account for 63.33% of the total, and 11 post-neonatal deaths (1 month to just before 1 year), which account for 36.67%. Among the 19 neonatal deaths, 16 were early neonates aged 0-7 days, representing 88.89% of all neonatal deaths, and 3 were late neonates aged 8-28 days, representing 16.67% of all neonatal deaths (see Tables 1 and 2).

Infant Mortality Rate (IMR) reflects the magnitude of health issues directly related to infant death. It also indicates maternal health, and the living environment of the infant, and is often used as a benchmark to assess the economic, social, and environmental conditions of a country. In 2022, nearly half (47%) of all deaths among children under 5 years old occurred during the neonatal period.⁹

Neonates are vulnerable to both infectious and non-infectious diseases. Their immune system develops gradually, starting from innate immunity established during the mother's pregnancy and becoming more complex after birth.¹⁰ The neonatal period is the most vulnerable stage of life and requires intensive and high-quality intrapartum and newborn care.⁹

Targeted healthcare policies and interventions are necessary to contribute to the reduction of infant mortality rates and ultimately achieve Goal 3 of the Sustainable

Development Goals (SDGs), which is to ensure healthy lives and promote well-being for all people of all ages.^{2,9}

With the increasing number of births in health facilities, there is a significant opportunity to provide newborn care and identify and manage high-risk newborns. However, many newborns still die at home due to early discharge from hospitals, access barriers, and delays in receiving care. The study found that most infant deaths occurred at Datu Kandang Haji Balangan Regional Hospital, with 14 cases (46.67%). Other places of infant death included H. Badaruddin Kasim Tanjung Regional Hospital with 4 cases (13.33%), Pambalah Batung Amuntai Regional Hospital with 5 cases (15.67%), H Damanhuri Barabai Regional Hospital with 2 cases (6.67%), Ulin Banjarmasin Regional Hospital with 2 cases (6.67%), and 3 cases (10%) occurred at home (see Table 3).

Based on Table 3, it is evident that public awareness in Balangan Regency about promptly bringing their babies to health facilities is relatively good. However, there are still 3 cases where infants died at home because the parents did not realize the importance of bringing sick babies to health facilities. This highlights the need for education to help parents recognize emergencies that require immediate medical care to prevent infant mortality. Table 3 also shows 13 cases of infant mortality (43.34%) that were referrals from Balangan Regional Hospital to hospitals outside Balangan Regency. This indicates a need to address the

availability and quality of emergency care facilities at Balangan Regional Hospital.

According to the WHO, 75% of neonatal deaths occur in the first week of life, with around 1 million neonates dying within the first 24 hours. The main causes of neonatal death are preterm birth, birth complications (such as asphyxia or trauma during birth), neonatal infections, and congenital anomalies.⁹ In Balangan Regency, the primary causes of infant death are Extremely Low Birth Weight (ELBW) with prematurity: 7 cases (23.33%); diarrhea: 6 cases (20%); asphyxia: 5 cases (16.67%); sepsis: 4 cases (13.33%); Very Low Birth Weight (VLBW) with prematurity: 3 cases (10%); pneumonia: 3 cases (10%); Low Birth Weight (LBW) with prematurity: 2 cases (6.67%). (See Table 4)

Based on Table 4, it can be seen that the majority of early neonatal deaths are caused by LBW with prematurity, accounting for 7 cases (23.33%), followed by asphyxia with 3 cases (10%). Mechanistically, infants with a birth weight of less than 2500 grams are at risk of complications such as asphyxia, improper physical growth, as well as respiratory and metabolic dysfunction, which can increase the likelihood of infectious diseases and malnutrition. These factors can reduce the chances of infant survival.¹¹

According to Kusumawati's study (2020), there is a link between neonatal asphyxia and early neonatal death. Asphyxia occurs when a newborn fails to initiate and maintain spontaneous and regular breathing immediately after birth. Newborns rely on their lungs to draw in oxygen and circulate it throughout the body to the tissues. Proper and continuous respiration requires interaction between the respiratory system, cardiovascular system, and central nervous system.¹²

According to Table 4, the leading cause of post-neonatal mortality is diarrhea, accounting for 6 cases (20%). The WHO

defines diarrhea as having three or more episodes of watery stools within 24 hours. Infants (under 1 year) have the highest mortality rate due to diarrhea among children under 5 can lead to death due to severe dehydration caused by fluid loss. It can also negatively affect a child's growth and cognitive development. years old. Diarrhea Therefore, special attention is needed for this age group to reduce the significant impact on infant mortality. Risk factors contributing to infant death from diarrhea include biological and social factors, as well as environmental factors such as inadequate water supply, sanitation, and hygiene.¹³

According to Table 5, 22 mothers (73.33%) had comorbid conditions, while 8 mothers (26.67%) did not have any comorbid conditions. The most commonly found comorbid conditions among the mothers were anemia: 14 cases; hyperemesis gravidarum: 13 cases; Premature Rupture of Membranes (PROM): 9 cases; Chronic Energy Deficiency (CED): 8 cases; and hypertension: 6 cases (See Table 6).

Trisnawati's study (2021) concluded that mothers with various pregnancy-related conditions, such as infectious diseases, non-infectious diseases, hypertension, and others, pose a risk to both the mother and fetus. These conditions can disrupt the physiological processes of metabolism and gas exchange in the fetus, leading to preterm birth and increasing the risk of Low Birth Weight (LBW), which indirectly heightens the risk of infant mortality. Diseases during pregnancy have a six-fold increased risk of causing LBW compared to pregnancies without such conditions.¹⁴

According to Table 7, regarding the Antenatal Care (ANC) visits, 5 mothers (16.67%) had fewer than 4 ANC visits, while 25 mothers (83.33%) had 4 or more ANC visits. Inadequate ANC visits can increase the risk of infant mortality. Research by Inpresari &

Pertiwi (2020) found a significant relationship between the frequency of pregnancy check-ups and the incidence of low birth weight, which is a risk factor for infant mortality.¹⁵ ANC visits are aimed at preparing mothers for childbirth and monitoring dangerous conditions that may affect fetal health, allowing for early detection of issues such as anemia and low birth weight.¹⁶

The standard for maternity care specifies at least four antenatal visits during pregnancy: one visit in the first trimester, one in the second trimester, and two visits in the third trimester.¹⁷ The results of this study show that the majority of mothers of infants who died in Balangan Regency in 2023 had more than the recommended four ANC visits (83.33%). Despite this, the infant mortality rate remains high. This could be due to the suboptimal quality of ANC services, indicating a need for special attention to the quality of ANC provided. Improved early diagnosis and appropriate care, along with a comprehensive and integrated approach to maternal health, are necessary to address this issue.

Sistiarani's study (2008) found that mothers with poor-quality antenatal care have a 5.85 times higher likelihood of delivering Low Birth Weight (LBW) or preterm infants compared to mothers with good-quality antenatal care.¹⁸ Inadequate ANC services result in mothers with preterm risk not receiving timely treatment and care.¹⁹

According to Table 7, regarding the type of birth attendant, most deliveries were assisted by midwives, with 24 cases (80%), while 6 cases (20%) were assisted by obstetricians. The highest number of neonatal deaths was observed among those delivered by midwives, with 12 cases (40%). Mogi et al. (2021) found no significant relationship between the type of birth attendant and infant mortality at Ende Regional Hospital, with a p-value of 0.419. This is attributed to the fact that many mothers now have their

deliveries attended by healthcare professionals such as midwives, nurses, or obstetricians, and there is an increasing availability of nearby health facilities.²⁰

The results of this study show that all mothers (100%) of infants who died in Balangan Regency in 2023 had their deliveries attended by healthcare professionals, such as midwives and obstetricians. Despite this, the infant mortality rate remains high. This situation may be due to the suboptimal quality of emergency obstetric and neonatal services and infrastructure. Therefore, there is a need for special attention to improve the quality of obstetric and neonatal care provided by healthcare professionals.

According to Table 7, regarding the type of delivery, the majority of cases were vaginal deliveries, with 26 cases (86.67%), while 4 cases (13.33%) were cesarean sections. The highest number of neonatal deaths occurred among those delivered vaginally, with 14 cases (46.67%). Mogi et al. (2021) concluded that the type of delivery was not associated with infant mortality at Ende Regional Hospital, with a p-value of 0.845.²⁰ Similarly, Widiанти and Wijayanti (2018) found no significant relationship between the mode of delivery and infant mortality, with a p-value of 0.153.²¹

In Balangan Regency in 2023, infant mortality was also classified according to delays in seeking help/treatment. There were 7 cases (23.33%) where there was a delay in seeking help/treatment, while 23 cases (76.67%) did not experience such delays (see Table 8). Delays in obtaining quality care for infants are a significant cause of infant mortality. These delays can occur in several stages, including late recognition of the infant's health problems, delays in deciding to seek treatment, delays in reaching a health facility, and delays in receiving quality care at the health facility.²² Factors influencing access to healthcare include the level of knowledge

of the patient or family about the severity of the illness, travel distance and road access to healthcare facilities, availability of transportation, and the quality of healthcare services provided.²³

Table 9 shows the distribution of infant deaths in Balangan Regency in 2023 according to refusal of treatment/care. There were 3 cases (10%) where the death involved refusal of treatment/care, while 27 cases (90%) did not involve such refusal. According to Rahmadhini (2021), medical decision-making is influenced by the explanation and education about medical procedures, the provision of informed consent to patients and their families, and the educational level of the patients and their families.²⁴

This study uses secondary data, namely verbal autopsy (VA), which can provide information about infant mortality. Its limitation lies in the difficulty faced by the authors in clarifying data deficiencies due to the limited information recorded by healthcare workers in medical records.

Conclusions

The causes of infant mortality in Balangan Regency in 2023 are classified into conditions of the infants and the mothers. For infants, the major causes were Extremely Low Birth Weight (ELBW) with prematurity, diarrhea, and asphyxia. For mothers, the primary comorbid conditions included anemia, hyperemesis gravidarum, premature rupture of membranes (PROM), chronic energy deficiency (CED), and hypertension. Follow-up actions should focus on increasing maternal knowledge regarding risk factors and prevention of infant mortality, recognizing danger signs in infants, and improving the quality of maternal and infant care in Balangan Regency.

Acknowledgments

The author would like to thank the Research and Community Service Institution of Lambung Mangkurat University (LPPM ULM), the Regional Planning, Research, and Innovation Agency (Bapperida) of Balangan Regency, the Health Office of Balangan Regency, and the Public Health Centers in Balangan Regency for their support and facilitation provided to the research team.

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