








Analysis of Infant Mortality Causes in Ordu Province from 2019 to 2023

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Abstract

Objective: Infant mortality is influenced by numerous factors, the identification and assessment of which are crucial for the development of preventive strategies. Multiple factors and incidents can directly or indirectly affect infant mortality. This study aims to identify the causes of infant deaths and factors affecting infant mortality in Ordu province and to assist in developing preventive strategies.

Material and Method: This descriptive study was conducted to examine infant mortality rates in Ordu province from 2019 to 2023. The sample consists of 242 infants who died in Ordu province between 2019 and 2023.

Results: In Ordu province, there were 8,304 live births with 54 infant deaths in 2019, 7,691 live births with 38 infant deaths in 2020, 7,099 live births with 45 infant deaths in 2021, 7,066 live births with 69 infant deaths in 2022, and 6,762 live births with 36 infant deaths in 2023. 80.5% of cases in the study were born via cesarean section (C/S). Infant deaths were caused by lung-related diseases (31.4%), prematurity (17.3%), heart-related diseases (17%), sepsis (18.2%), congenital anomalies (5%), and sudden infant death syndrome (1.6%).

Conclusion: Considering the five-year data of Ordu province, the most common causes of infant death were lung pathologies, prematurity, cardiac pathologies, and sepsis. Providing prenatal and postnatal education, information, and high-quality healthcare to expectant mothers is undoubtedly the most crucial parameter to minimize these causes. Special interventions and strategies are needed to reduce infant mortality rates, along with more comprehensive research across the province.

Key Words: Epidemiology, Infant, Mortality

Ordu İlinde 2019-2023 Yılları Arasında Bebek Ölüm Nedenlerinin Analizi

Özet

Amaç: Bebek ölüm oranı, önleyici stratejilerin geliştirilmesi için tanımlanması ve değerlendirilmesi çok önemli olan çok sayıda faktörden etkilenir. Birçok faktör ve olay bebek ölüm oranını doğrudan veya dolaylı olarak etkileyebilir. Bu çalışma, Ordu ilinde bebek ölümlerinin nedenlerini ve bebek ölüm oranını etkileyen faktörleri belirlemeyi ve önleyici stratejilerin geliştirilmesine yardımcı olmayı amaçlamaktadır.

Materyal ve Metot: Bu tanımlayıcı çalışma, Ordu ilinde 2019-2023 yılları arasında bebek ölüm oranlarını incelemek amacıyla yürütülmüştür. Örnekleme, 2019-2023 yılları arasında Ordu ilinde ölen 242 bebekten oluşmaktadır.

Bulgular: Ordu ilinde 2019 yılında 54 bebek ölümüyle 8.304 canlı doğum, 2020 yılında 38 bebek ölümüyle 7.691 canlı doğum, 2021 yılında 45 bebek ölümüyle 7.099 canlı doğum, 2022 yılında 69 bebek ölümüyle 7.066 canlı doğum ve 2023 yılında 36 bebek ölümüyle 6.762 canlı doğum gerçekleşmiştir. Çalışmaya dahil edilen olguların %80,5'inin sezaryenle (C/S) doğduğu belirlenmiştir. Bebek ölümlerinin nedenleri incelendiğinde %31,4'ünün akciğerle ilgili hastalıklardan, %17,3'ünün prematürelikten, %17'sinin kalple ilgili hastalıklardan, %18,2'sinin sepsisten, %5'inin konjenital anomalilerden ve %1,6'sının ani bebek ölümü sendromundan kaynaklandığı bulunmuştur.

Sonuç: Ordu ilinin beş yıllık verileri göz önüne alındığında bebek ölümlerinin en sık görülen nedenleri akciğer patolojileri, prematürelilik, kalp patolojileri ve sepsis olmuştur. Bu nedenleri en aza indirmek için şüphesiz ki anne adaylarına doğum öncesi ve sonrası eğitim, bilgi ve yüksek kalitede sağlık hizmeti sunmak en önemli parametredir. Bebek ölüm oranlarını düşürmeyi amaçlayan özel müdahalelere ve stratejilere ihtiyaç vardır ve bu konuda il genelinde daha kapsamlı araştırmalara ihtiyaç vardır.

Anahtar kelimeler: Epidemiyoloji, Infant, Mortalite

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INTRODUCTION

Infant mortality statistics are a vital indicator reflecting the general health status of society and guiding infant and maternal health. Evaluating infant death statistics locally and examining the causes and timings of deaths are very important for the development of a healthy society (1). These statistical data ensure the correct planning and organization of healthcare services. Infant mortality rate (IMR) is defined as the number of infant deaths occurring per 1,000 live births (2). The infant mortality rate has two components: the neonatal mortality rate, which refers to the number of deaths within the first four weeks of life per 1,000 live births, and the post-neonatal mortality rate, which includes deaths occurring after the first four weeks (3). A high infant mortality rate is closely associated with child healthcare services during infancy, low birth weight, and premature birth. Hence, all efforts aimed at reducing the infant mortality rate not only focus on our country but also form the primary goal of public health development activities worldwide (4).

According to the CDC (Centers for Disease Control and Prevention), in 2022, the five leading causes of infant death were birth defects, preterm birth and low birth weight, sudden infant death syndrome, injuries, and maternal pregnancy complications (5). In 2019, WHO (World Health Organization) reported that preterm birth, birth-related complications (birth asphyxia or inability to breathe at birth), infections, and birth defects were the primary causes of neonatal deaths. In 2020, approximately 2.4 million neonates faced death worldwide, translating to approximately 6,700 neonatal deaths daily. However, thanks to the healthcare measures taken globally, it is significant that the number of neonatal deaths has decreased from 5 million to 2.4 million since 1990 (6). According to the latest CDC data, the infant mortality rate in 2023 was recorded at 5.65, while this number was determined as 5.55 in 2024 (7). In our country, the infant mortality rate was 9.2 in 2022, while this number was determined as 10.1 in 2023 (8).

This research was conducted to evaluate infant mortality rates and investigate their causes in Ordu province between 2019 and 2023. The study encompasses a range of variables, including demographic and maternal components, such as maternal age, education level, and birth methods. Our study aims to identify the variables affecting infant mortality rates and determine the necessary measures through these data.

MATERIALS AND METHODS

This descriptive study was conducted to examine infant mortality rates in Ordu province from 2019 to 2023. The sample consists of 242 infants who died in Ordu province between 2019 and 2023. Written permission was obtained from the Ordu Provincial Health Directorate, and ethics committee approval was obtained from Ordu Education and Research Hospital (Ethics committee no). Information was obtained from the files related to infant deaths. The files were examined by the researchers. Information such as gender of the dead infants, education level of the parents, maternal age, smoking/alcohol use, chronic disease status, number of pregnancies, the interval between the previous pregnancy and the dead infant's birth, prior stillbirth history, tetanus vaccination status, Rh incompatibility between parents, consanguinity status, birth method, birth place, birth weight, resuscitation requirement at birth, presence of meconium, survival times, and causes of death were included in the study. Descriptive statistics of the data obtained in the study were given in numbers and percentages. Chi-square test was used in the comparison of nominal variables between groups. "IBM Statistics Package for the Social Sciences version 30.0 (SPSS ver. 30.0)" was used for statistical evaluations.

This study received ethics committee approval from the Ordu University Clinical Research Ethics Committee (ethics committee date: 03.01.2025 and no: 2025/09).

RESULTS

In Ordu province, there were 8,304 live births with 54 infant deaths in 2019, 7,691 live births with 38 infant deaths in 2020, 7,099 live births with 45 infant deaths in 2021, 7,066 live births with 69 infant deaths in 2022, and 6,762 live births with 36 infant deaths in 2023 (Table 1). The socio-demographic data of the dead infants were examined, and based on these data, 50% of the dead infants were male, and 50% were female. 28.5% of mothers were aged 24 and under, 33.5% were between 25-29 years, 20.7% were between 30-34 years, and 17.4% were 35 years and older. 36.4% of mothers and 35.5% of fathers were high school graduates. Additionally, 11.6% of mothers of deceased infants had chronic diseases (Table 2).

Table 1. Distribution of the number of infant deaths and mortality rate by years

Years	Number of live births (n)	Number of infant deaths (n)	Infant mortality rate (%)
2019	8304	54	6.5
2020	7691	38	4.9
2021	7099	45	6.3
2022	7066	69	9.7
2023	6762	36	5.3
Total	36922	242	

Table 2. Frequency distribution of demographic data of the dead infants and their parents

Characteristics (n=242)	n	%
Sex of infant		
Male	121	50.0
Female	121	50.0
Maternal age at childbirth		
≤ 24	69	28.5
25-29	81	33.5
30-34	50	20.7
≥ 35	42	17.4
Mother's education status		
Illiterate	5	2.1
Primary school graduate	47	19.4
Secondary school graduate	65	26.9
High school graduate	88	36.4
University or postgraduate degree	37	15.3
Father's education status		
Primary school graduate	48	19.8
Secondary school graduate	72	29.7
High school graduate	86	35.5
University or postgraduate degree	36	14.8
Chronic disease status in mother		
Yes	29	11.9
No	213	88.1
Total number of pregnancies of the mother		
≤2	149	61.6
≥3	93	38.4
The time between the previous pregnancy and the birth of the dead infant		
First pregnancy/less than 1 year	97	40.1
1-3 years	26	10.7
3 years and above	119	49.2
Maternal tetanus vaccination status		
Fully vaccinated	212	87.6
Incompletely vaccinated	30	12.4
Previous stillbirth status		
Yes	9	3.7
No	233	96.3
Rh incompatibility status		
Yes	14	5.7
No	228	94.2
Relationship status between parents		
Yes	23	9.5
No	219	90.4

The distribution of information regarding the pregnancies of mothers of dead infants is shown in Table 3. Based on the examination of these data, 61.6% of mothers had two or fewer pregnancies, 49.2% had an interval of 3 years or more between the previous pregnancy and the dead infant's birth, 40.1% had their first pregnancy or an interval of less than one year, and 10.7% had an interval of 1-3 years. 87.6% of mothers of deceased infants had complete tetanus vaccinations, 3.7% had a history of stillbirths, 5.4% had Rh incompatibility, and 9.5% had relationship issues (Table 2).

The study found that 80.5% of cases were delivered by cesarean section, 31.4% required resuscitation at birth, and 3.3% had meconium present. Regarding the survival times of dead infants, 41% survived for 0-7 days, 18.6% survived for 8-28 days, and 40.4% survived for 29-365 days (Table 3). The birth weights and gestational weeks of dead infants were not normally distributed; therefore, the data were presented as median and interquartile ranges. The median birth weight was 1,490 (400-4,200) grams, and the median gestational week was 31 (21-41) weeks. An analysis of the causes of infant deaths revealed that 31.4% were attributed to lung-related diseases, 17.3% to prematurity, 17% to heart-related diseases, 18.2% to sepsis, 5% to congenital anomalies, 1.6% to sudden infant death syndrome, 0.8% to food aspiration,

0.4% to accidents (such as fire), and 8.3% to other reasons.

Table 3. Demographic data of dead infants during and after birth

Characteristics	n	%
Type of birth		
Normal spontaneous vaginal delivery (NSVD)	47	19.5
Caesarean section (C/S)	195	80.5
Birthplace		
Hospital	240	99.2
House	2	0.8
Status of resuscitation application at birth		
Yes	76	31.4
No	166	68.6
Presence of meconium at birth		
Yes	8	3.3
No	234	96.7
Survival times dead infants		
0-7 days	99	41.0
8-28 days	45	18.6
29-365 days	98	40.4
Cause of infant death		
Lung diseases	76	31.4
Prematurity	42	17.3
Cardiac disease	41	17.0
Sepsis	44	18.2
Congenital anomaly	12	5.0
Sudden infant death	4	1.6
Accident (fire etc.)	1	0.4
Food aspiration	2	0.8
Other reasons	20	8.3

DISCUSSION

Infant mortality rate, a demographic indicator of public health, is a significant parameter reflecting a country's health development. Due to the transformation and changes in healthcare in recent years, there has been a significant reduction in infant mortality rates in our country, and this reduction has also been reflected in the numerical data of Ordu province. According to

the latest CDC data, the infant mortality rate in 2023 was recorded at 3.65, while this number was determined as 3.61 in the preliminary data for 2024 (7). In our country, the infant mortality rate was 9.2 in 2022, while this number was determined as 10.1 in 2023 (8).

Based on the results of our study, the infant mortality rates in Ordu province between 2019 and 2023 were below the national average, although some years did not meet the World average. The increase in infant mortality rates in 2021 (6.33) and 2022 (9.76), following the COVID-19 pandemic period, was balanced in 2023, and the average infant mortality rates of Ordu province were restored. The COVID-19 pandemic likely increased these rates due to high ICU occupancy, challenges in preventive health care, and unclear treatment guidelines for infants with lung issues. Our data are consistent with the literature in this regard (9).

Based on the literature review, maternal age, one of our socio-demographic variables, is a highly related parameter to infant mortality. Studies have shown that infant mortality rates are lower in pregnancies of older mothers due to increased expectations and more cautious and informed approaches during pregnancy compared to younger mothers (10). Although there was no statistically significant difference, it is thought that this situation is clinically significant. Young mothers may lack awareness and experience in postnatal care. In our study, infant mortality rates

were higher among mothers aged under 24 and between 25-29 years, and it is essential to provide education and information focused on this population about infant health and care.

In this study, the educational status of parents of dead infants was evaluated. It is thought that as the education level and awareness of infant health, prenatal care, and postnatal care increase, infant mortality rates might decrease. However, no significant difference was found based on our study data. The significance of this situation could not be determined as our study did not compare the educational status of families of stillborn and non-stillborn infants. Based on the literature review, studies have shown that as the education level increases, infant mortality rates decrease (11). Similarly, the impact of maternal chronic diseases on infant mortality rates was evaluated, but no significant difference was found. Based on our literature review, infant mortality rates increase as the number of comorbidities in the mother increases (12). Accurate rate evaluation was not possible due to missing comorbidity data for normally born infants.

In our study, 80.5% of infant deaths occurred in cases delivered by cesarean section. However, it should be noted that the high proportion of cesarean deliveries is often attributable to high-risk pregnancies, such as fetal distress, obstructed labor, or maternal hypertensive disorders. Therefore, establishing a direct causal

relationship between cesarean delivery and infant death may be misleading, as cesarean delivery is frequently chosen for more complicated and high risk cases (confounding by indication) (13). For example, emergency cesarean deliveries, performed in the presence of maternal risk factors or fetal distress, have been associated with higher neonatal mortality due to indirect complications such as low birth weight and prematurity. Moreover, when performed for appropriate medical indications, cesarean delivery can reduce maternal and neonatal morbidity and mortality; however, unnecessary cesarean sections may lead to adverse outcomes for both mother and infant in the short and long term (14).

In developed countries, the most common causes of infant deaths are reported to be congenital anomalies, prematurity, and morbidities related to low birth weight, sudden infant death syndrome, maternal disease-related morbidities, and accidents (1). Based on our research, the main causes of infant deaths in Ordu province were found to be lung diseases, prematurity, cardiac pathologies, sepsis, congenital anomalies, and sudden infant death syndrome. Compared to the literature, lung pathologies, cardiac pathologies, and sepsis diagnoses stand out as different causes in Ordu province. The reasons for infant deaths due to lung pathologies were mainly determined as respiratory distress syndrome (rds) and aspiration, thought to be

related to cesarean births and parallel to births occurring before the lungs have matured. It is also thought that deficiencies in some postnatal care parameters could be the cause, but the data in our study are insufficient in this respect, and more extensive studies with comprehensive parameters are needed.

Cardiac pathologies represent a significant contributor to infant mortality, yet the extent to which these outcomes are preventable warrants careful discussion. Many congenital heart defects (CHDs) can indeed be detected prenatally through advances in fetal echocardiography and targeted ultrasound screening, allowing for planning of specialized perinatal care and timely interventions and measures that have been shown to improve neonatal outcomes and reduce mortality (15). Additionally, the implementation of universal newborn screening using pulse oximetry allows for early postnatal detection of critical congenital heart defects (CCHDs), potentially averting up to 33% of early infant deaths associated with these conditions. Nonetheless, not all CHDs are amenable to prenatal diagnosis, and access to specialized diagnostic and treatment resources may vary across regions. Therefore, while a meaningful portion of CHD-related infant deaths are potentially preventable through timely screening and healthcare infrastructure, residual mortality underscores the need for systemic improvements

in both prenatal and postnatal cardiovascular care (16).

Sepsis is a common and preventable cause of death in both infants and adults. Sepsis diagnosis is a major cause of infant mortality worldwide. However, due to advancements in education, awareness, and diagnostic and treatment methods, the incidence has proportionally decreased (17). However, based on our study, sepsis is one of the common causes of infant deaths in Ordu province between 2019 and 2023. The fight against sepsis is highly important both worldwide and in our country, and associations and organizations established for this cause regularly publish guidelines and strategies. The health status of the infant and the parameters to be considered by healthcare professionals in the approach to the infant, especially during birth and postnatal periods, are quite clear. It is crucial to pay attention to sterilization criteria during the approach to the infant and to promptly evaluate an infant suspected of sepsis. Early diagnosis and treatment of sepsis, in addition to its prevention, are highly important in preventing infant deaths (18). Therefore, it is necessary to provide more frequent and comprehensive education to healthcare professionals, especially since sepsis is one of the major causes of infant deaths in Ordu province.

The cross-sectional epidemiological nature of our study and the lack of a query about the number and quality of prenatal, natal, and

postnatal health follow-ups are significant limitations. Another limitation of our study is the lack of socio-demographic data on living babies and their families, and further statistical analysis of comparison and influencing factors could not be performed.

CONCLUSION

In conclusion, analysis of five-year data from Ordu province revealed that the most frequent causes of infant deaths were lung pathologies, prematurity, cardiac pathologies, and sepsis. These outcomes are multifactorial and may be influenced by perinatal risk factors, maternal health conditions, and healthcare access. Although a high proportion of the deceased infants were delivered by cesarean section, our study does not provide evidence to support a causal relationship between delivery mode and infant mortality. This finding should be interpreted cautiously, as confounding factors such as high-risk pregnancies, underlying maternal complications, and sociodemographic characteristics likely influenced both the indication for cesarean delivery and neonatal outcomes.

Efforts to reduce infant mortality should focus on strengthening prenatal and postnatal care, improving early diagnosis and timely management of preventable conditions such as sepsis and certain congenital heart defects, and ensuring equitable access to specialized neonatal

services. Public health strategies tailored to the regional epidemiology, alongside further research that adjusts for potential confounders, are essential to more precisely identify modifiable risk factors and guide effective interventions.

Ethics Committee Approval: This study received ethics committee approval from the Ordu University Clinical Research Ethics Committee (Date: 03.01.2025 and No: 2025/09).

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