RESEARCH ARTICLE

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Analysis of Infant Mortality between 2014-2017 in Elazig*

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Objective: In this study, it was aimed to evaluate the causes of infant mortality examined by the "Infant Mortality Investigation Board" in Elazig.

Materials and Methods: A total of 359 cases that occurred during the four-year period between 2014-2017 were included in the study.

Results: When the cases were evaluated according to the time of death, 44.8% (161) was early neonatal death, 24.0% (86) was late neonatal death, 68.8% (247) neonatal death and 31.2% (112) was determined as postneonatal infant death. By the evaluation of the main causes of death according to the case forms of the provincial board, prematurity and diseases related to prematurity ranked first with 45.2%, congenital heart diseases took the second place with 11.5%, and congenital anomalies took the third place with 9.1%. As a result; 2/3 of the infant mortality rate occurred in the neonatal period. Prematurity and diseases related to prematurity is the first leading cause of infant death. Among infant deaths, mortality rate in the neonatal period; is significantly higher in infants with low maternal education level, in not breastfed, to meconium exposed, and low birth weight cases. In addition, the rate of advanced age pregnancy and consanguineous marriage is also observed as high.

Conclusion: In order to reduce the cause of death due to prematurity, measures should be taken to strengthen prenatal care, prevent advanced maternal age pregnancies and consanguineous marriages.

Key Words: *Infant mortality, maternal and child health, neonatal mortality*

Elazığ İlinde 2014-2017 Arasındaki Bebek Ölümlerinin İncelenmesi

Amaç: Bu çalışmada Elazığ ilindeki "Bebek Ölümlerini İnceleme Kurulu" tarafından incelenen bebek ölüm nedenlerinin değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Çalışma kapsamına 2014-2017 yılları arasındaki dört yıllık süreçte gerçekleşen 359 vaka alınmıştır.

Bulgular: Vakalar ölüm zamanına göre değerlendirildiğinde %44.8 (161)'i erken neonatal ölüm, %24.0 (86)'ü geç neonatal ölüm olmak üzere %68.8 (247)'i neonatal ölüm, %31.2 (112)'si ise postneonatal bebek ölümü olarak belirlendi. İl kurulun vaka formlarına göre vakalardaki temel ölüm nedenleri incelendiğinde prematürite ve prematüriteye bağlı hastalıkların %45.2 ile ilk sırada, konjenital kalp hastalıklarının ise %11.5 ile ikinci, Konjenital anomalilerin ise %9.1 ile üçüncü sırada yer almıştır. Sonuç olarak; bebek ölüm hızının 2/3'ü neonatal dönemde gerçekleşmiştir. Birinci sırada bebek ölüm nedeni prematürite ve prematüriteye bağlı hastalıklar yer almaktadır. Bebek ölümleri arasında neonatal dönemde ki ölüm oranı; anne eğitim seviyesi düşük, anne sütü almayan, mekonyuma maruz kalan ve doğum ağırlığı düşük bebeklerde anlamlı olarak daha yüksektir. Ayrıca ileri yaş gebelik ve akraba evliliği oranı yüksektir.

Sonuç: Prematüriteye bağlı ölüm nedeninin azaltılması için doğum öncesi bakımın güçlendirilmesi, ileri yaş gebeliklerin ve akraba evliliklerinin önlemler alınmasına yönelik önlemler alınmalıdır.

Anahtar Kelimeler: *Bebek ölümü, anne çocuk sağlığı, yenidoğan ölümü*

Introduction

Infant mortality rate (CMR) is a crucial health indicator that informs us about the health status of a region or a country. Newborns are dependent on many factors that can prevent their optimal growth and development and lead to vulnerability. This dependency starts before conception, continues on through the prenatal period in the mothers' womb, and goes on until the end of their first year outside the uterus (1). Most deaths under the age of 5 are caused by a small number of diseases; a vast majority of the newborn deaths are due to preterm birth, asphyxia, and sepsis. The majority of infant mortality is no longer caused by acute infections, but by noncontagious reasons such as preterm birth. Even though environmental, biological, psychosocial, and behavioral mechanisms' relationships with various health indicators such as standard mortality rates, yearly death rates, and infant mortality are not completely explained, these indicators are strongly related to the socioeconomic status. The most striking

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medical difference between developed and developing countries can be seen in perinatal infant mortality rates, which is in some impoverished countries over 100 per thousand, whereas in high-income countries such as Singapore and Japan, it is under 5 per thousand (2).

According to the Turkish Statistical Institute's (TUIK) report, the infant mortality rate across Turkiye was 9.3 per thousand in 2018. The infant mortality rate for 2018 in the city of Elazig was similar to the average rate in Turkiye (3). In 2017, 4.1 million babies across the world died within the first year after birth. These deaths made up 75% of all deaths under the age of five. The infant mortality rate in the WHO Europe region was 8 per thousand. On the other hand, the infant mortality rate of 8.8 million in 1990 has fallen to 4.1 million in the year 2017 (4).

According to the 2018 health statistics yearbook, 2017 data shows that infant mortality during the perinatal period (11.0 per thousand) was much higher than that of the neonatal (5.8 per thousand) and postneonatal period (3.3 per thousand) in Turkiye (5). In the study done by Korkmaz et al. on infant mortality across Turkiye, when the cases were evaluated based on the time of death, it was determined that 1556 (76.1%) were neonatal deaths, 1157 (56.5%) early neonatal, and 399 (19.5%) late neonatal deaths, respectively, and (23.9%) composed postneonatal infant mortality (6).

Knowing about infant mortality and their causes is imperative for health service planning. This study aims to determine the infant mortality rate and the factors that affect it in an eastern Turkish city between 2014-2017.

Materials and Methods

Research and Publication Ethics: After obtaining the ethics committee approval dated 20.02.2020 Nr 2020/04-05 from the Fırat University Ethics Committee of Non-Invasive Studies and also obtaining permission dated 24.11.2017 Nr 44820559 from the Elazig City Health Administrative, we conducted the necessary analyses using the SPSS 22.0 packaged software.

This is a retrospective and descriptive study. The population of the study is made up of babies that were born alive, had a birth weight of over 500 grams, who were born after the 22nd week of pregnancy, and died before the age of one in Elazig between 2014-2017. Abortions and curettages were excluded. The study data was acquired from the 640 forms obtained from the infant mortality review board reports of the city health administration between the years 2014-2017. Of those reports, 247 stillbirths, 2 miscarriages, and 12 pregnancy terminations were excluded. Besides, due to missing data, 20 forms of infant mortality were not used except for calculating the infant mortality rate. Data collection forms examined the sex of the baby, date of birth/death, information about the mother and the pregnancy, form of pregnancy, duration of pregnancy, number of fetuses for the given pregnancy, mother's age at the time of birth, mother's previous pregnancies, length of time between the mother's last pregnancy and the baby's birth, consanguinity and blood incompatibility between the mother and father, mother's tetanus vaccinations, number of screenings done during the pregnancy, problems determined, mother's substance addiction, baby's mode of delivery, place of birth, information about the newborn baby, how the pregnancy ended, whether or not the baby required resuscitation or had hepatitis, the institution at which the follow-up was conducted, problems determined, place of death, and cause of death.

Cases included in the study were separated into groups according to terms of pregnancy as borderline premature (between 34 weeks and 36 weeks and 6 days), moderate premature (between 32 weeks and 33 weeks and 6 days), highly premature (between 28 weeks and 31 weeks and 6 days), and immature (younger than 28 weeks). They were also categorized into groups according to birth weight as normal birth weight (≥2500 grams), low birth weight (<2500 grams), very low birth weight (<1500 grams), and extremely low birth weight (<1000 grams). Evaluation of the data acquired from the data collection form was done via the statistical package program. Descriptive statistics were presented as numbers and percentages. Relationships between the variables in the categorical structure were examined with the Chi-Square and Fischer's exact tests. The results were evaluated with a 95% confidence interval, and $p<0.05$ was considered significant.

Results

In our study, 78.8% (n=282) of the mothers were between 18-35 years old, and 37.6% (n=135) were primary school graduates. Of the families, 71.0% (n=255) lived in the city center and 29.0% (n=104) lived in towns. There was blood incompatibility between the mother and father in 11.7% (n=47) of the cases. Of the families, 29.2% were blood-related, and 68.5% of them were first-degree relatives; 2.7% of the families had a family member with a genetic abnormality (Table 1). The infant mortality rate in Elazig between 2014-2017 was 10.65 per thousand. While the infant mortality rate in Elazig was 10.0 per hundred thousand in 2013, it was 9.0 in 2017.

The mean pregnancy week was 31.99±5.83 (min: 21, max: 42), and the mean baby weight was 1779.51±1038.13 g. The rate of babies weighing under 1500 g was 48.8%, and the rate of babies dying during the early neonatal period was 42.3%. Of the births, 31.1 (n=113) were via normal vaginal delivery, while 68.9% (n=68.9) were via cesarean section (Table 2).

The percentage of mothers whose interpregnancy period was 2 years or longer was 94.7%. Of the mothers, 16.7% had never been vaccinated for tetanus, and 10.3% had a history of chronic disease. It was determined that 36.2% of the pregnancies were shorter than 28 weeks and had highly premature babies (Table 3).

Table 1. Distribution of some family features

Maternal ge (n=359)	**n**	**%**
Below 18 years	5	1.4
18-35 years	283	78.8
Over 35 years	71	19.8
Total	359	100
Maternal education (n=359)		
Illiterate	43	12.0
Literate	21	5.8
Primary School	135	37.6
Middle School	61	17.0
High School	61	17.0
University	38	10.6
Total	359	100
Father's education (n=349)		
Illiterate	8	2.3
Literate	13	3.7
Primary School	113	32.4
Middle School	61	17.5
High School	97	27.8
University	57	16.3
Total	349	100
Presence of a person who brings home income (n=342)		
Yes	341	99.7
No	1	0.3
Place of residence		
City center	255	71.0
Town side	104	29.0
Blood incompatibility between parents. (n=359)		
Yes	42	11.7
No	317	88.3
Consanguinity between parents (n=359)		
Yes	105	29.2
No	254	70.8
Kinship degree (n=105)		
1	73	69.5
2	18	17.2
3 and above	14	13.3
Individual with a genetic anomaly in the family (n=337)		
Yes	9	2.7
No	328	97.3

Table 2. Distribution of some features of the babies

Sex (n=359)	**n**	**%**
Male	169	47.1
Female	190	52.9
Birth weight		
Under 1500 g	175	48.8
1500-2499 g	73	20.3
2500 g and over	111	30.9
Infant mortality time (n=359)		
Early neonatal death	152	42.3
Late neonatal death	93	25.9
Postneonatal death	114	31.8
Route of delivery (n=359)		
Normal/Natural birth	113	31.1
Cesarean	246	68.9
Meconium (n=359)		
Yes	16	4.5
No	343	95.5

Table 3. Distribution of maternal properties

Gestational week (n=359)	**31.99±5.83 (min:21, max:42)**	
Number of fetuses (n=359)		
Single	303	84.4
Twin	50	13.9
Triplet	6	1.7
Duration/year between pregnancies (n=351)		
First pregnancy	107	30.5
Less than 2 years	71	20.2
2 years and over	173	49.3
Number of live births (n=214)		
1 and under	99	46.2
2-4	108	50.5
5 and over	7	3.3
Mother's tetanus vaccination (n=359)		
Fully vaccinated	253	70.5
Missing vaccines	46	12.8
Not vaccinated	60	16.7
Chronic disease in the mother (n=341)		
Yes	35	10.3
No	306	89.7
Gestational week	n	%
Less than 28 weeks	130	36.2
28-38 weeks	123	34.3
38 weeks and over	106	29.5

Table 4. Examining the distribution of infant mortality causes

Causes of infant mortality n=359	**Number**	**Percentage**
* Prematurity and diseases related to prematurity	163	45.4
Congenital heart diseases	43	12.0
Congenital anomalies	33	9.2
Respiratory system diseases	31	8.6
Perinatal asphyxia	22	6.1
Metabolic diseases	18	5.0
Sudden infant mortality syndrome	11	3.1
Birth trauma	7	2.0
** Other	31	8.6
Total	359	100.0

* Respiratory distress syndrome, Intraventricular bleeding, necrotizing enterocolitis, sepsis, bronchopulmonary dysplasia. ** Liver disease, immune deficiency, etc.

Median volue of babies' life span was 10 (min:0-max:350). The mean life span was 2.22±2.08 days for the neonatal period, 15.38±5.75 days for the late neonatal period, and 127.36±86.25 days for the postneonatal. Looking at the number of follow-ups of pregnant women during pregnancy, the ratio of those who had four or more follow-ups was 63.1%. Primary care units were the most preferred institution for pregnancy follow-ups. Family medicine units (68.5%) were the most common among the health institutions where pregnancies were monitored. The rate of having difficulty accessing health services was 1.2%.

Of the infant mortalities, 45.4% were due to prematurity or prematurity-related diseases, 12.0% were due to congenital heart diseases, and 9.2% were due to inherent abnormality problems (Table 4).

Early neonatal mortality rate, where the mother was 35 years old or younger, was 42.5%, and where the mother was 35 years old or older, it was 40.8% ($p>0.05$) (Table 5). While the relative marriage rate of mothers with primary school or less education was 33.2%, this rate was 20.6% for those who graduated from high school or above ($p<0.05$).

Table 5. Examination of deaths according to the time of infant mortality

	Early neonatal		Late neonatal		Postneonatal		Total
Sex	**n**	**%**	**n**	**%**	**n**	**%**	
Male	79	46.8	44	26.0	46	27.2	p=0.134
Female	73	38.4	49	25.8	68	35.8	
Way of birth							
Cesarean	55	48.7	22	19.5	36	31.9	
Normal vaginal delivery	97	39.4	71	28.9	78	31.7	p=0.318
Baby's diet							
Received breastfeeding	33	18.1	61	33.5	88	48.4	
Did not receive breastfeeding	115	73.2	28	17.8	14	8.9	p=0.001
Mother's educational status							
No school completed/literate	23	37.1	9	14.5	30	48.4	
Primary/Middle school	85	44.3	54	28.1	53	27.6	p=0.015
Highschool and more	42	43.3	28	28.9	27	27.8	
Mother's age							
35 and under	122	42.5	72	25.1	93	32.4	
35 and over	29	40.8	21	29.6	21	29.6	p=758
Hospital referral							
Yes	18	26.9	28	41.8	21	31.3	p<0.001
No	119	50.0	55	23.1	64	26.9	
Presence of meconium							
Yes	12	75.0	2	12.5	2	12.5	p=0.045
No	139	40.8	91	26.7	111	32.9	
Gestational week	n	%	n	%	n	%	
Less than 28 weeks	67	51.5	45	34.6	18	13.9	
28-38 weeks	52	42.3	30	24.4	41	33.3	**p<0.001**
38 weeks and over	33	31.1	18	17.0	55	51.9	
Birth weight							
Under 1500 g	84	48.0	55	31.4	36	20.6	
1500-2500 g	35	47.9	18	24.7	20	27.4	**p<0.001**
2500 g and over	33	29.7	20	18.0	58	52.3	
Number of pregnancy follow-ups (n=342)							
0-1 follow-ups	12	75.0	0	0	4	25.0	
2 follow-ups	28	52.8	15	28.3	10	18.9	**p<0.001**
3 follow-ups	27	47.4	15	26.3	15	26.3	
4 and more follow-ups	80	37.0	60	27.8	76	35.2	

Discussion

In our study, approximately 21.2% of mothers were outside the 18-35 age range. As it is known, pregnancies occurring in adolescence and older age are evaluated in the category of risky pregnancies. In the study conducted by Sevilay et al. among women delivered in the hospital, the rate of those giving birth under the age of 18 was 2.5%, while the percentage of those giving birth at an older age was 14.5% and the rate of cesarean delivery, blood transfusion, placenta previa, low birth weight, and the need for intensive care was increased for adolescent pregnancies. On the other hand, the risk of gestational diabetes and preeclampsia is high in older pregnancies (7). According to the 2018 TDHS data, the teenage fertility rate was 30 per thousand in Turkiye. Adolescent pregnancies contribute to the continuation of the poverty cycle and the condition of poor health among generations, as well as maternal and child deaths (8).

In our study, while the infant mortality rate was 10.4 per thousand in 2014, this rate was 9.0 per thousand in 2017. After the Classification of Statistical Region Units 1, in which the province of Elazig is located, the infant

mortality rate, which was 18.1 per thousand in the eastern Anatolia region, decreased to 9.7 per thousand in 2018. Turkiye has reduced the overall mortality from 9.3 to 13.9 per thousand in the same period (3). Although there is a downward trend worldwide, quite different rates are detected between regions. The infant mortality rate is an important indicator that negatively affects the life expectancy of a society (9). Infant mortality rates tend to decrease on a global and regional basis. This may be influenced by factors, such as increased resources devoted to health care and an increase in education levels.

Of the cases, 48.8% were babies with very low birth weight, and 20.3% of them had low birth weight. Low birth weight is considered as a crucial risk factor that increases the rate of neonatal death (10).

Of the infant mortality, 68.2% occurred in the neonatal period, 25.9% of which was observed in the late neonatal period and 42.2% in the early neonatal period, and the other 31.8% occurred in the postneonatal period. In the study done by Korkmaz et al. (6) on infant mortality across Turkiye, when the cases were evaluated based on the time of death, it was determined that 76.1% were neonatal deaths, 56.5% of which were early neonatal and 19.5% were late neonatal deaths, and 23.9% were postneonatal infant mortality. In the study conducted by Ma et al. (11), 38.5% of infant mortalities were in the early neonatal period, 18.1% in the late neonatal period, and 43.4% in the postneonatal period.

In our study, 68.9% of the deliveries were cesarean sections. In the survey conducted by Taş et al. (12) in the city of Kahramanmaras, the cesarean rate was 39.2%. The caesarean section rate is increasing rapidly in most countries, including Turkey. (14). The cesarean rate is influenced by many factors, such as education, wealth, age, and regional factors (15). According to the study of Betran et al. (16), cesarean rates tend to increase worldwide. Cesarean delivery and low birth weight rates are high among dying babies.

In 21.0% of births in our study, the time between two births is less than two years. In a similar study, the frequency of the time between two pregnancies being less than 24 months was 17.6% (12). The time between birth intervals is generally affected by the settlement, region, education, and welfare levels. In those who have less than two years between two births, the infant mortality rate is higher. Among women with high levels of welfare and education, the frequency of those with a shorter pregnancy duration of fewer than 24 months was lower (15). It can be a useful intervention to prevent mortality by training new couples about pregnancy planning.

We observed that 63.1% of pregnant women had at least four follow-up visits, and 36.9% had 3 or fewer follow-ups. In a study carried out by pregnant women in the city of Elazig by Akkus et al. (17), it was found that all pregnant women went to pregnancy controls at least once, and 74.5% had four or more pregnancy follow-ups. It is known that prenatal care services starting late in the pregnancy cause an increase in the proportions of infant mortality (10). Lack of care in the prenatal period increases the infant mortality rate (15).

In our study, prematurity, prematurity-related diseases, congenital heart diseases, and congenital anomalies were among the top causes of infant mortality. In the survey conducted by Tas et al. (12) in the city of Kahramanmaras, congenital anomaly, respiratory distress syndrome, and sepsis were in the first three ranks. In a study conducted by Kosan et al. (18), congenital defect and sepsis were the leading causes of infant mortality. To prevent infant mortality, it is imperative to provide full prenatal care services and detect anomalies early.

It was observed that the early neonatal infant mortality rate decreased with the increase in the number of pregnancy follow-ups. In the study of Wolde et al. (19), being born from a mother with no ANC visit increased neonatal death odds compared to mothers with ≥4 ANC visits. According to the study by Atkinson (20), women who faced obstacles in accessing prenatal care have been shown to have higher infant mortality rates than women facing no barriers. In the study by Annan et al. (21), it was stated that taking high-quality antenatal care would prevent a significant number of neonatal deaths. It may be beneficial to intervene by targeting factors that reduce antenatal care (22). This finding is compatible with the literature (23, 24). Due to insufficient lung development resulting in hypoxia, which can result in respiratory failure and death, preterm babies can't adapt to extra-uterine life (25).

The mortality rate of low birth weight babies in the neonatal period was significantly higher compared to normal birth weight babies ($p<0.001$). Also, infant deaths are higher in those with low birth weight or gestational intervals of less than two years. Studies are showing that low birth weight increases the mortality rate in the neonatal period (26, 12).

The frequency of consanguineous marriage is significantly lower among mothers with high school or higher education levels. In a similar study conducted by Taş et al. in Kahramanmaras, the frequency of blood-related couples was 25.9% (12). It has been observed that those who have consanguineous marriages have lower education levels, lower socioeconomic statuses, earlier gestational ages, higher risk of delivering a baby with a congenital anomaly, and, although there was no significant difference, higher risk of stillbirths (27), As seen in the studies above, preventing consanguineous marriage will also prevent infant mortality and stillbirths. Thus, increasing the level of education with social supports and increasing the socioeconomic levels will benefit the creation of healthy new generations.

As a result, two-thirds of infant mortality rates occurred during the neonatal period. Prematurity and related diseases are in the first place within the causes of infant mortality. The neonatal period's mortality rate is significantly higher in babies with a low level of maternal education, breastfeeding, exposure to meconium, and

low birth weight. Additionally, adolescent pregnancy and consanguineous marriage rates were high.

It will be effective to strengthen prenatal care, increase the number and quality of newborn services, provide educated and sufficient personnel, and home follow-up and care services to reduce the causes of premature deaths. Furthermore, measures should be taken to prevent adolescent pregnancies and consanguineous marriages.

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