Infant mortality in northeastern Anatolia and associated factors

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Original Article

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Aim: To explore the causes of infant mortality. Infant mortality is the most important criterion for the evaluation of the sufficiency of mother and child health care and the planning of health care provision. In this study, we investigated infant mortality and associated factors in 7 provinces located in northeastern Turkey. The main outcome of this study was reasons for neonatal mortality.

Materials and methods: We created a cross-sectional study and included all babies born in the year 2009 who died during the first 365 days of life. Data were collected from the primary care providers. A data collection form was prepared containing information about the demographic factors, babies, families, causes of mortality, and health facilities. In cases of missing data, an effort was made to contact the baby's mother.

Results: Data for 481 babies and their mothers were analyzed. Most of the infant deaths occurred during the early neonatal period. Prematurity and congenital problems constituted 43.6% (n = 210) of the causes of mortality. Mothers' chronic diseases (P = 0.035; OR = 8.2, 95% CI (1.2-58.6)) and the presence of a neonatal specialist in the hospital (P = 0.023; OR = 7.9, 95% CI (1.3-47.4)) were independent factors affecting mortality due to prematurity.

Conclusion: Field studies are necessary to determine missed infant deaths. In order to minimize infant mortality, appropriate pregnancy follow-ups ending in deliveries assisted by health professionals, preferably in well-equipped hospitals, are necessary.

Key words: Infant mortality, causes of mortality, Turkey

Kuzey Doğu Anadolu'da bebek ölümleri ve ilişkili faktörler

Amaç: Anne ve çocuk sağlığının yeterliliğinin değerlendirilmesi ve sağlık hizmeti sunumunun planlanması için en önemli ölçüt bebek ölümüdür. Bu araştırmada Kuzey Doğu Anadolu'daki yedi ilde bebek mortalitesini ve ilişkili faktörleri inceledik. Araştırmanın ana sorusu bebek ölüm sebepleri idi.

Yöntem ve gereç: Kesitsel bir araştırma tasarımında 2009 yılı içerisinde doğan ve yaşanın ilk 365 günü içerisinde ölen tüm bebekler araştırmaya dahil edildi. Araştırma verileri birinci basamak sağlık sunucularından toplandı. Bir veri toplama formu oluşturuldu. Formda demografik bilgiler, bebekler, aileler, ölüm nedenleri ve sağlık imkanları hakkında sorular vardı. Veri eksikliği halinde bebeklerin annesine ulaşılmaya çalışıldı.

Bulgular: Dört yüz seksen bir bebek ve anneleri hakkındaki veriler analiz edildi. Bebek ölümlerinin çoğu erken neonatal dönemde gerçekleşmişti. Ölüm nedenlerinin % 43,6'sını (n = 210) prematürite ve doğumsal problemler oluşturmaktaydı. Annenin kronik hastalığının olması (P = 0,035; OR = 8,2 % 95 CI [1,2-58,6]) ve hastanede yenidoğan uzmanı olmasının (P = 0,023; OR = 7,9 % 95 CI [1,3-47,4]) prematüriteye bağlı mortaliteyi etkileyen bağımsız faktörler olduğu bulundu.

Sonuç: Kayıt dışı bebek ölümlerinin saptanması için saha çalışmaları yapılmalıdır. Bebek ölümlerini en aza indirmek için tercihan iyi donanımlı hastanelerde sağlık elemanları tarafından desteklenmiş doğumlarla sonuçlanan uygun gebe takiplerinin yapılması gerekmektedir.

Anahtar sözcükler: Bebek ölümü, ölüm nedenleri, Türkiye

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Introduction

Due to its relation with multiple factors such as maternal health, access to health care, socioeconomic status, and public health practices, the infant mortality rate is one of the most important health predictors of a geographical region. Additionally, infant mortality is the most important criterion for the evaluation of the sufficiency of mother and child health care and the planning of health care provision (1). However, epidemiologic data describing infant mortality and its causes in developing countries are limited (2,3). A limited number of studies show a decrease in infant mortality during the last 20 years in developing countries (4).

In almost all developed countries, infant mortality rates have decreased to below 10 in 1000. However, in some of these countries, there has been no further decrease in the infant mortality rate. In the United States, for example, there was no decrease in infant mortality rates between the years 2000 and 2005 (5).

Although mainly a problem of developing countries, in developed countries there are still inequalities among different population groups regarding infant mortality (6-8). In the United States, the infant mortality rate among blacks is 2.4 times higher than the rate in the white population (5).

In Turkey, infant mortality has decreased considerably in recent years; it was 42.7, 28.7, and 17.0 per 1000 in the years 1998, 2003, and 2008, respectively. While there was a decrease of 18.8% between the years 1993 and 1998, this number was 38.7% between 2003 and 2008 (9). This change can be understood as an increased success in mother and infant health care service provision in recent years. At the same time, neonatal mortality, which constitutes 73% of the infant deaths (9), demonstrates the difficulty of further increasing the quality of health care services for the neonatal period.

The aim of this study was to investigate infant mortality and associated factors in 7 provinces located in northeastern Turkey. The main study question was the causes of infant mortality.

Materials and Methods

In order to facilitate socioeconomic analysis and produce data comparable to data collected in countries of the European Union, regions in Turkey are classified according to the Nomenclature of Units for Territorial Statistics (NUTS) criteria. The classification has 3 levels, with the first level being divided into 12 areas. Northeastern Anatolia, NUTS-TRA, is one of these areas (10). Our study covers the 7 provinces (Erzurum, Ağrı, Kars, Ardahan, Iğdır, Bayburt, and Erzincan) of the NUTS-TRA region. The NUTS-TRA area is classified as having the lowest socioeconomic status in Turkey (11).

In a descriptive cross-sectional design, we reviewed patient records for the year 2009. All babies born in the year 2009 who died during the first 365 days of life were included in the study.

According to the records from the 7 provinces of northeastern Anatolia, 551 infants died within the study year. Due to insufficient or missing data, as well as difficulty contacting the mothers, we could only examine 481 infant deaths, giving a participation rate of 87.3% (Table 1).

Data were collected from the primary care providers. A data collection form was prepared containing information about demographic factors, babies' families, causes of mortality, and health facilities. Baby follow-up forms, immunization records, household member registries, pregnancy follow-up forms, mortality records, and autopsy reports were reviewed to collect information. In cases of missing data, an effort was made to contact the baby's mother.

Data were analyzed using SPSS 17 (SPSS Inc., Chicago, IL, USA). Results are presented as frequencies (percentages) and means (standard deviations). Chi-square analysis, analysis of variance (ANOVA), and multinomial regression were used to check for factors associated with causes of mortality.

Results

Data for 481 babies and their mothers were analyzed.

Table 1. Infant mortality in the different provinces and sampling proportions.

Province	Infant deaths in 2009	Number of babies sampled (%)	Number of live births	Infant mortality (in thousands)
Erzurum	238	238 (100)	16,511	14.4
Ağrı	149	123 (82.5)	15,984	9.3
Kars	65	46 (70.8)	6687	9.7
Ardahan	21	16 (76.2)	1740	12.1
Iğdır	35	25 (71.4)	3882	9.0
Bayburt	15	11 (73.3)	1286	11.7
Erzincan	28	22 (78.6)	3351	8.4
Total	551	481 (87.3)	49,441	11.1

Families

The mean number of household members was 6.36 ± 3.48 persons (min. 2, max. 19). One-third of the mothers were illiterate. Only 10% had a high school education or above. Only 44.2% (n = 212) of the family members had a regular job. Among the parents, 30.8% (n = 148) were second-degree relatives. Among the mothers, 93.1% (n = 446) had health insurance, 67.4% (n = 324) had a health facility in their district, and 85% (n = 409) of the mothers had a pregnancy follow-up. Of those who did not have follow-ups (n = 72), 23 (31.9%) were not registered with health professionals, 18 (25.0%) had no records, 12 (16.7%) could not be registered due to migration, 11 (15.3%) had insufficient access to health personnel, and 8 (11.1%) did not disclose the pregnancy (Table 2).

Among the mothers, 1.9% became pregnant through assisted fertility methods and 8.5% had multiple pregnancies. Furthermore, 81.1% (n = 390) received tetanus immunizations. Only 20 mothers (4.2%) had a screening test performed during pregnancy. Among the tests, the most frequently performed was a double or triple test (60%, n = 12). A total of 36.6% of the mothers (n = 176) had a history of abortion or infant death, 5.6% (n = 27) of the mothers had a chronic disease, and 40 mothers (8.3%) were using tobacco products. There was no other type of addiction reported. A total of 39 mothers had a disease during their pregnancy, and urinary tract infection (UTI) was the most commonly reported illness (56.4%, n = 22) (Table 2).

Babies

Among the babies, 54.9% (n = 264) were fully immunized, while 10.8% (n = 52) had missing immunizations and 34.3% had no records or were not immunized at all (n = 165). A total of 87.1% (n = 419) of babies received follow-ups according to the guidelines, 54.1% (n = 260) of the babies had development appropriate for their ages, and 62.2% (n = 299) had a known disease at birth. Most of the infant deaths occurred during the early neonatal period. Prematurity and congenital problems constituted 43.6% (n = 210) of the causes of mortality (Table 3).

Among the babies, 18.3% (n = 88) were hospitalized. Regarding those babies who died as neonates, 67.1% (n = 190) of the hospitals involved had a neonatal unit and 63% (n = 189) had neonatal specialists. In 24.3% (n = 17) of the hospitals in which nonneonatal deaths occurred, there was no pediatric intensive care unit. During the death period, 80.7% (n = 388) of the babies were referred from 1 hospital to another, 97.8% (n = 91) of these referrals were carried out with a fully equipped ambulance, and 2.2% (n = 2) were done using the families' own resources. Among the deceased babies, 69.0% (n = 332) died in the hospital, 29.7% (n = 143) at home, and 1.2% (n = 6) in the ambulance during transportation (Table 3).

The mean duration of hospitalization was 7.17 ± 15.30 days (min. 1, max. 120).

Table 2. Demographic features of the babies' families.

	Frequency	Percent
Type of pregnancy		
Normal	472	98.1
Assisted fertility	9	1.9
Multiple pregnancy		
Yes	41	8.5
No	440	91.5
Mother's educational status		
Illiterate	141	29.3
Primary school	276	57.4
Secondary school	33	6.9
High school	16	3.3
University	15	3.1
Health insurance		
Yes	446	93.1
No	33	6.9
Health facility available		
Yes	324	67.4
No	157	32.6
Pregnancy follow-up		
Yes	409	85.0
No	72	15.0
Parents' regular income		
Yes	212	44.2
No	268	55.8
Parents' consanguinity		
Yes	148	30.8
No	333	69.2
Mother's immunization status		
Yes	390	81.1
No	91	18.9
Genetic screening tests during pregnancy		
Yes	20	4.2
No	461	95.8
History of abortion or infant death		
Yes	176	36.6
No	305	63.4
Does the mother have a chronic disease?		
Yes	27	5.6
No	422	87.7
Does the mother have a drug or tobacco addiction?		
Yes	40	8.3
No	441	91.7
Did the mother have any diseases during pregnancy?		
Yes	39	8.1
No	442	91.9

Table 3. Frequency distribution of features of the babies.

	Frequency	Percent
Main cause of death		
Prematurity	118	24.5
Congenital disorders	92	19.1
Respiratory disorders	76	15.8
Sepsis	64	13.3
Perinatal asphyxia	37	7.7
Sudden infant death syndrome (SIDS)	34	7.1
Other reasons	60	12.5
Baby's nutrition		
Mother's milk	169	35.1
IV fluids	106	22.0
Total parenteral nutrition (TPN)	81	16.8
No nutrition	61	12.7
Mother's milk plus additional food	33	69
Mother's milk plus water	16	3.3
No mother's milk	15	3.1
Was the baby followed-up with in a health center?		
Yes	419	87.1
No	62	12.9
Was baby's development appropriate for age?		
No	260	54.1
Yes	221	45.9
Disease encountered at birth		
Yes	299	62.2
No	181	37.6
Surgical intervention after birth		
Yes	32	6.7
No	449	93.3
Hospitalization		
Yes	88	18.3
No	393	81.7
Presence of NICU at the hospital		
Yes	190	67.1
No	93	32.9
Availability of medical equipment and devices		
Yes	295	98.3
No	5	1.7
Availability of intensive care unit (for nonneonates)		
Yes	53	75.7
No	17	24.3
Referral between hospitals		
Yes	388	80.7
No	93	19.3
Method of referral		
With ambulance and health professionals	91	97.8
With family's own resources	2	2.2
Place of death		
Hospital	332	69.0
Home	143	29.7
In the ambulance during transportation	6	1.2
Mortality period		
Early neonatal (days 0-7)	255	53.0
Late neonatal (days 8-28)	70	14.6
Postneonatal (days 29-364)	156	32.4

Bivariate comparisons

There was a significant difference in the mortality periods among the provinces (chi-square = 33.0; P = 0.001). Erzincan had the highest early neonatal mortality, Kars the highest late neonatal mortality, and Erzurum the highest postneonatal mortality rate (Table 4).

Causes of mortality were not equally distributed among the provinces. While all provinces except Ağrı had prematurity as the most common cause of mortality, deaths in Ağrı were mainly due to respiratory disorders. Deaths due to sepsis were also higher in Ağrı (P = 0.007) (Table 5).

Causes of mortality were not related to nearly half of the variables studied. Mothers' education (P = 0.302), fathers' education (P = 0.077), number of household members (P = 0.923), presence of social security (P = 0.191), presence of a health facility (P = 0.507), availability of health personnel (P = 0.500), pregnancy follow-up (P = 0.146), mothers' immunization status (P = 0.444), screening tests during pregnancy (P = 0.730), history of abortion/infant mortality (P = 0.529), mothers' sickness during pregnancy (P = 0.389), availability of medical devices (P = 0.08), availability of neonatal intensive care units (NICUs) (P = 0.319), mean number of household members (P = 0.855), and mean duration of hospitalization (P = 0.104) were not related to mortality. All other investigated factors were found to be significantly related to mortality (Table 6).

Table 4. Distribution of mortality rates among different provinces.

	Death time			Total
	Early neonatal (days 0-7)	Late neonatal (days 8-28)	Postneonatal (days 29-364)	
Erzurum, n (%)	124 (52.1)	21 (8.8)	93 (39.1)	238 (100.0)
Ağrı, n (%)	76 (61.8)	17 (13.8)	30 (24.4)	123 (100.0)
Kars, n (%)	17 (37.0)	14 (30.4)	15 (32.6)	46 (100.0)
Ardahan, n (%)	6 (37.5)	4 (25.0)	6 (37.5)	16 (100.0)
Iğdır, n (%)	12 (48.0)	7 (28.0)	6 (24.0)	25 (100.0)
Bayburt, n (%)	6 (54.5)	2 (18.2)	3 (27.3)	11 (100.0)
Erzincan, n (%)	14 (63.6)	5 (22.7)	3 (13.6)	22 (100.0)
Total, n (%)	255 (53.0)	70 (14.6)	156 (32.4)	481 (100.0)

Table 5. Cause of death and province cross-tabulation.

	Erzurum	Ağrı	Kars	Ardahan	Iğdır	Bayburt	Erzincan	Total
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Prematurity	62 (26.1)	21 (17.1)	14 (30.4)	2 (12.5)	8 (32.0)	4 (36.3)	7 (31.8)	118 (24.5)
Sepsis	31 (13.1)	22 (17.9)	6 (13.0)	1 (6.3)	3 (12.0)	1 (9.1)	0 (0.0)	64 (13.3)
Respiratory dis.	29 (12.2)	32 (26.0)	4 (8.7)	5 (31.2)	2 (8.0)	2 (18.2)	2 (9.1)	76 (15.8)
Perinatal asp.	12 (5.0)	16 (13.0)	3 (6.5)	0 (0.0)	2 (8.0)	1 (9.1)	3 (13.6)	37 (7.7)
Congenital dis.	52 (21.8)	20 (16.3)	4 (8.7)	4 (25.0)	7 (28.0)	1 (9.1)	4 (18.2)	92 (19.1)
SIDS	17 (7.1)	4 (3.3)	8 (17.4)	2 (12.5)	1 (4.0)	1 (9.1)	1 (4.6)	34 (7.1)
Other causes	35 (14.7)	8 (6.4)	7 (15.3)	2 (12.5)	2 (8.0)	1 (9.1)	5 (22.7)	60 (12.5)
Total	238 (100)	123 (100)	46 (100)	16 (100)	25 (100)	11 (100)	22 (100)	481 (100)

Chi-square = 60, 40; P = 0.007.

Table 6. Cross-tabulation of causes of mortality and other investigated factors.

		Prematurity	Sepsis	Respiratory disorders	Perinatal asphyxia	Congenital disorders	SIDS	Other causes	Total	Chi-square; P
Does either parent have a regular job?	No	78 / 66.1%	34 / 53.1%	28 / 36.8%	16 / 43.2%	58 / 63.7%	19 / 55.9%	35 / 58.3%	268 / 55.8%	21.187 / **0.002**
	Yes	40 / 33.9%	30 / 46.9%	48 / 63.2%	21 / 56.8%	33 / 36.3%	15 / 44.1%	25 / 41.7%	212 / 44.20%	
Consanguinity between parents	No	83 / 70.3%	41 / 64.1%	61 / 80.3%	26 / 70.3%	62 / 67.4%	28 / 82.4%	32 / 53.3%	333 / 69.2%	15.245 / **0.018**
	Yes	35 / 29.7%	23 / 35.9%	15 / 19.7%	11 / 29.7%	30 / 32.6%	6 / 17.6%	28 / 46.7%	148 / 30.8%	
Mother has chronic disease	No	104 / 88.1%	54 / 84.4%	63 / 82.9%	31 / 83.80%	82 / 89.10%	32 / 94.1%	56 / 93.3%	422 / 87.7%	20.829 / 0.053
	Yes	11 / 9.3%	5 / 7.80%	4 / 5.3%	0 / 0.0%	5 / 5.4%	1 / 2.9%	1 / 1.7%	27 / 5.6%	
	NA	3 / 2.5%	5 / 7.8%	9 / 11.8%	6 / 16.2%	5 / 5.4%	1 / 2.9%	3 / 5.0%	32 / 6.7%	
Does the mother use tobacco?	Yes	2 / 1.7%	8 / 12.5%	9 / 11.8%	4 / 10.8%	13 / 14.1%	2 / 5.9%	2 / 3.3%	40 / 8.3%	16.093 / **0.013**
	No	116 / 98.3%	56 / 87.5%	67 / 88.2%	33 / 89.2%	79 / 85.9%	32 / 94.1%	58 / 96.7%	441 / 91.7%	
Type of pregnancy	Normal	110 / 93.2%	64 / 100.0%	75 / 98.7%	37 / 100.0%	92 / 100.0%	34 / 100.0%	60 / 100.0%	472 / 98.1%	21.085 / **0.002**
	AF	8 / 6.8%	0 / 0.0%	1 / 1.3%	0 / 0.0%	0 / 0.0%	0 / 0.0%	0 / 0.0%	9 / 1.9%	
Multiple pregnancy	No	97 / 82.2%	61 / 95.3%	73 / 96.1%	36 / 97.3%	86 / 93.5%	33 / 97.1%	54 / 90.0%	440 / 91.5%	19.869 / **0.003**
	Yes	21 / 17.8%	3 / 4.7%	3 / 3.9%	1 / 2.7%	6 / 6.5%	1 / 2.90%	6 / 10.0%	41 / 8.5%	
Baby followed up with in a health center?	No	7 / 5.9%	9 / 14.1%	11 / 14.5%	4 / 10.8%	9 / 9.8%	8 / 23.5%	14 / 23.3%	62 / 12.9%	15.525 / **0.017**
	Yes	111 / 94.1%	55 / 85.9%	65 / 85.5%	33 / 89.2%	83 / 90.2%	26 / 76.5%	46 / 76.7%	419 / 87.1%	
Surgical intervention after birth	No	114 / 96.6%	60 / 93.8%	72 / 94.7%	36 / 97.3%	79 / 85.9%	33 / 97.1%	55 / 91.7%	449 / 93.3%	12.516 / 0.051
	Yes	4 / 3.4%	4 / 6.3%	4 / 5.3%	1 / 2.7%	13 / 14.1%	1 / 2.9%	5 / 8.3%	32 / 6.7%	
History of hospitalization	No	114 / 96.6%	46 / 71.9%	65 / 85.5%	32 / 86.5%	61 / 66.3%	28 / 82.4%	47 / 78.3%	393 / 81.7%	38.047 / **<0.001**
	Yes	4 / 3.4%	18 / 28.1%	11 / 14.5%	5 / 13.5%	31 / 33.7%	6 / 17.6%	13 / 21.7%	88 / 18.3%	
Presence of NICU at the hospital	Yes	85 / 81.0%	17 / 48.6%	5 / 21.7%	12 / 40.0%	50 / 80.6%	3 / 75.0%	18 / 75.0%	190 / 67.1%	51.962 / **<0.001**
	No	20 / 19.0%	18 / 51.4%	18 / 78.3%	18 / 60.0%	12 / 19.4%	1 / 25.0%	6 / 25.0%	93 / 32.9%	
Availability of neonatal specialist	Yes	84 / 79.2%	17 / 43.6%	8 / 28.6%	9 / 30.0%	50 / 79.4%	5 / 55.6%	16 / 64.0%	189 / 63.0%	54.021 / **<0.001**
	No	22 / 20.8%	22 / 56.40%	20 / 71.4%	21 / 70.0%	13 / 20.60%	4 / 44.4%	9 / 36.0%	111 / 37.0%	
Referral between hospitals	Yes	99 / 83.9%	46 / 71.9%	68 / 89.5%	31 / 83.8%	64 / 69.6%	32 / 94.1%	48 / 80.00%	388 / 80.7%	19.203 / **0.004**
	No	19 / 16.1%	18 / 28.1%	8 / 10.5%	6 / 16.2%	28 / 30.4%	2 / 5.9%	12 / 20.0%	93 / 19.3%	

AF = Assisted fertility, NA = information not available, SIDS = sudden infant death syndrome.

Multinomial regression

Multinomial regression analysis was performed to check for the independent factors affecting the causes of mortality. For this purpose, causes were grouped into 5 categories: prematurity, sepsis, respiratory disorders, congenital disorders, and others. "Other causes of mortality" was taken as the reference category. Significant variables in the bivariate comparisons were included as factors in the analysis.

Mothers' chronic disease (P = 0.035; OR = 8.2, 95% CI (1.2-58.6)) and presence of a neonatal specialist in the hospital (P = 0.023; OR = 7.9, 95% CI (1.3-47.4)) were independent factors affecting mortality due to prematurity. Presence of a neonatal specialist in the hospital was also a significant independent factor affecting mortality due to congenital disorders (P = 0.036; OR = 10.2, 95% CI (1.2-90.0)).

Discussion

This study described detailed causes of mortality and associated factors in northeastern Turkey. The demographic features of the studied population are similar to those previously described for this region (12).

Our study revealed an infant mortality rate of 11.1 per 1000 in northeastern Anatolia. The country average for infant mortality in 2008 was reported as 17 per 1000 (9). Although there is no subclassification in the infant mortality rates, the same report classifies northeastern Anatolia as the least developed region from the perspective of different indicators. Indeed, according to the 2003 report of the Turkish Prime Ministry Undersecretary of State Planning Organization, northeastern Anatolia has the lowest national socioeconomic development index (11).

Economic problems and consanguinity have been shown to be related to mortality in previous studies. Consanguineous marriages have significantly higher rates of still births and infant mortality in general (13,14). When we consider that the main cause of death in one-tenth of the babies was congenital anomalies, the genetic screening rate of pregnant women in this region is low. Consanguinity among parents is also relatively high in this region.

Since infant mortality is highly correlated with socioeconomic development (15), we would expect the mortality rates in the studied area to be above the country's average. On the other hand, among the provinces studied, Erzurum has the highest socioeconomic wealth (16). Despite this, Erzurum had a higher mortality rate than the neighboring provinces. One explanation for this discrepancy could be the underreporting of infant mortality in some provinces. Our personal observations support this idea. In underdeveloped and rural areas in particular, it is difficult to arrange pregnancy follow-ups with health personnel due to geographical barriers as well as a lack of health personnel. As a result, some families prefer not to report infant deaths, especially if they occur in the early neonatal period before the birth is recorded at the birth registration office.

This problem was also depicted in a study done by Okyay et al (17). Using data from the local health authority, the infant mortality rate in Aydın Province for the year 2004 was calculated as 12.2 per 1000, while the Turkey Demographic and Health Survey (TDHS) had reported an infant mortality rate of 22 per 1000 in 2003 for the region, including Aydın.

Our findings regarding illiteracy among the mothers are in accordance with the 28.6% given by the 2008 TDHS for the same region (9). A low education level is one of the important factors contributing to infant mortality. In a departure from the 2008 TDHS results, the proportion of uninsured women in our study was relatively low (20.7% versus 6.9%). This major change could be attributed to recent efforts to establish a social health system that covers all citizens; this needs further verification.

In addition, the rate of women in our study who received prenatal health care was higher when compared with the 2008 TDHS findings (85% versus 73.9%). Since the TDHS study covers the previous 5 years, this improvement is an expected change over time.

Although smoking rates in Turkey have substantially decreased as a result of recent nationwide efforts (18), we think that there might be other factors behind the low tobacco use reported by our subjects in comparison with 2008 TDHS findings (8.3% versus 18.5%). Mothers might have underreported their smoking status as a result of feeling responsible for the mortality of their babies.

The fact that Erzurum has the highest postneonatal mortality rate among the studied provinces can be related to the availability of a level 3 NICU in Erzurum, the only such center in the region. With the modern facilities available at this NICU, most of the serious neonatal health problems are managed successfully. However, babies referred from the wide geographical area around Erzurum are at increased risk during the transfer.

Prematurity was the most important cause of mortality in all provinces except Ağrı. Premature babies usually have low birth weights, as well. The 2008 TDHS reported that northeastern Anatolia has the highest number of low-birth-weight babies (18%), which could explain the high mortality due to prematurity in this area.

The fact that almost one-fourth of the mothers had no pregnancy follow-up and delivered outside of hospitals was an important risk factor, especially for premature babies who need to be transferred to appropriate units soon after delivery. The study by Okyay et al. (17) in Aydın produced results parallel to ours. They found the main causes of infant mortality to be prematurity, congenital anomalies, and respiratory problems.

Conclusion

Field studies are necessary to determine the number of missed infant deaths. In order to minimize infant mortality, appropriate pregnancy follow-ups ending in deliveries assisted by health professionals, preferably in well-equipped hospitals, are necessary.

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