

A multivariate analysis of factors associated with infant mortality in South-East of Iran

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Abstract

Objectives: To determine the causes and risk factors of infant mortality.

Methods: The population-based case-control study in 2011 comprised infants under one-year-old who had died at Ali-ebn-Abitaleb Hospital in Zahedan, Iran, during 2011 who were taken as the case group, while infants selected randomly through multistage sampling from various health centres formed the control group. Data were analysed using logistic regression model.

Results: There were 186 cases including 103(55.7%) boys, and 29(15.6%) incidents of multiple births. The other group had 300 healthy infants including 139(46.5%) boys, and 4(1.3%) incidents of multiple births. According to the multivariate model, chance of death in neonates with birth weight under 2500 gram, less than 4 antenatal visits, lack of exclusive breast feeding, delivering at home and abortion history among mothers was 46.3%, 27.4%, 13.2%, 9.4% and 7.0% respectively compared to 42.1%, 15.3%, 4.5%, 5.8% and 3.0% respectively in the post-neonatal period. For post-neonatal period, lack of complete vaccination also increased the chance of death by 14.9%.

Conclusion: Most of the factors related to infant mortality can be controlled by providing sufficient information and healthcare to pregnant mothers which will result in reduced infant mortality rate.

Keywords: Mortality rate, Infant, Neonate. (JPMA 64: 1123; 2014)

Introduction

Infant mortality rate is the most important indicator of health, living standard and efficacy of health services in a community. This indicator is of particular importance for developing countries, as over 80% of births in the world, 90% of under 5-year-old child mortality, and 20% of infant mortality occur in these countries.¹⁻³

Respiratory failure, infections and congenital anomalies are the most important mortality factors for infants, and those for children under 5 years are poor nutrition, injuries and poisoning.⁴⁻¹² Respiratory failure causes 20% of infant mortality in the US, and is associated with low gestational age, low birth weight (LBW), male gender, family history, caesarean section (CS) without onset of labour, perinatal asphyxia, neonates of diabetic mothers, and chorioamnionitis.⁶ The most important infections associated with infant mortality are bacterial meningitis, gastroenteritis, pneumonia, and sepsis.^{4-6,10} In the first 6 months of infancy, when growth is exceptionally rapid and nutritional needs are high in relation to weight, the risk of impaired growth and nutrition is also high, which may disturb infant's

neurocognitive development.^{6,11} The highest rate of burning is seen among boys younger than 5 years, and the most common poisonous materials that these children are exposed to include carbon monoxide, hydrocarbons, opiates and drugs that affect function of the heart.¹²

In Iran, the highest infant mortality occurs during the neonatal period. According to a report published by the Ministry of Health in 2010, of the 20,129 cases of prenatal deaths, 49.6% were related to neonates, and the most common causes were respiratory failure (59%), prematurity (54%), congenital anomalies (23%), infection (13%) and asphyxia (9.3%).¹³ In a case-control study, mother's addiction to opium, smoking, LBW, delivery at home and CS, lack of exclusive breastfeeding in the first 6 months, and male gender were reported as factors associated with infant mortality.¹⁴

Although infants have the highest death rates due to diseases and their specific age-group conditions, their mortality rate is directly affected by implementation of specific health programmes.¹⁻³ Even though obstetric complications are seen during labour for the first time and cannot be predicted earlier, 50% of deaths and disabilities are due to high-risk pregnancies identified prior to the delivery, and to prevent their complications, special foetus care should be provided for the mother and the foetus during pregnancy.^{4,5,15} Preterm birth history, intrauterine (IU)

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foetal death, multiple gestation pregnancy, IU growth retardation, congenital malformations, neonatal deaths due to known and unknown causes (such as sepsis with group B streptococcus), delivery trauma, preeclampsia, gestational diabetes, frequent pregnancies, and CS are all associated with high-risk future pregnancies.

All these factors play a significant role in infant mortality, but region-specific, socio-economic and cultural factors should also be considered. Multivariate analysis of factors associated with infant mortality make it possible to consider association between those factors. Therefore, the present study was conducted to assess the most common causes of infant mortality and to perform a multivariate analysis of factors associated with neonatal mortality and also post-neonatal mortality in the city of Zahedan, Iran.

Subjects and Methods

The population-based case-control study between September and December 2011 comprised almost all (98%) infants under one-year-old who had died at Ali-ebn-Abitaleb Hospital in Zahedan, Iran, during 2011 who were taken as the case group, while infants selected randomly through multistage sampling from various health centres formed the control group.

The city was divided into 5 regions, and depending on geographical proximity in each region, two health centres were systematically selected, and records of 30 infants born in 2011 were randomly chosen from each centre, with similar age and gender distribution to that of the case group.

Records of infants were used for extraction and collection of data which included gender, date of birth, place of birth, gestational age, birth weight, milk-feeding type in the first 6 months, vaccination status, congenital anomalies, age at death, and reason for death. Information about mothers

included type of delivery (natural/CS), place of delivery (hospital/home), multiple gestation pregnancy, history of pregnancy, hypertension, gestational diabetes, history of infant death, medication use during pregnancy, addictions, smoking, and antenatal visits. All data was extracted from hospital records for the case group and from health centre records for the controls. Those with unknown causes of death were excluded.

Data was analysed using univariate and multivariate logistic regression models, with odds ratio (OR) and 95% confidence interval (CI) for the parameters in these models.

Results

The case group consisted of 186 under-one-year-old deceased infants, comprising 103 (55.7%) boys, 29 incidents (15.6%) of multiple-births, and 63 (33.9%) aged equal or less than one month. The control group had 300 infants, comprising 139(46.5%) boys and 4 (1.3%) incidents of multiple-births. The principal reasons for infants' deaths were respiratory diseases 132(71%), prematurity 97(52.2%), septicaemia 74(39.8%) and congenital diseases 64(34.4%). Besides, 48(76.2%) neonates in the neonatal intensive care unit (ICU) diagnosed with prematurity, meconium asphyxia and infection ended up with respiratory system diseases leading to death. Deaths due to diseases of the respiratory system, prematurity, and congenital diseases had higher frequency in neonates compared to the post-neonatal period. There were 36(29.3%) post-neonatal death of central nervous system (CNS) diseases from which 13(36%) had asphyxia in the neonatal period (Table-1).

Although in the univariate model, factors of birth weight, exclusive breastfeeding in the first 6 months, full vaccination, gestational age, type of delivery, antenatal visits, and history of abortion showed a significant association with mortality, but in the multivariate model, only factors of weight at birth,

Table-1: Frequency distribution of main causes of mortality of infants in the case group.

Main cause of death	Neonatal (%)	Post-neonatal (%)	Total number (%)
Prematurity	35 (55.6)	62 (50.4)	97 (52.2)
Septicaemia	20 (31.7)	54 (43.9)	74 (39.8)
Congenital diseases	26 (41.3)	38 (30.9)	64 (34.4)
Congenital heart diseases	16 (25.4)	23 (18.7)	39 (21.0)
Central Nervous System diseases	9 (14.3)	36 (29.3)	28 (15.1)
Digestive system diseases	5 (7.9)	22 (17.9)	27 (14.5)
Asphyxia	8 (12.7)	--	8 (4.3)
Other infections (gut, nervous, urinary)	6 (9.5)	13 (10.6)	19 (10.2)
Meconium aspiration and other birth complications	11 (17.5)	8 (6.5)	19 (10.2)
Urinary system diseases	3 (4.8)	3 (2.4)	6 (3.2)
Poisoning	1 (1.6)	3 (2.4)	4 (2.2)
Accidents	0 (0.0)	1 (0.8)	1 (0.5)
Cancers	0 (0.0)	1 (0.8)	1 (0.5)

Table-2: Odds ratio and 95% confidence interval for assessment of association of mortality with mother and baby factors.

Mother/baby factor	Infant's age	Case Number (%)	Control [§] Number (%)	Univariate analysis OR (95% C.I.) [§]	Multivariate analysis OR (95% C.I.) [§]
Delivery location (home)	Neonatal	5 (8.5)	20(7.0)	1.2 (0.4, 3.4)	9.4 (1.2, 73.3)*
	Post-neonatal	15 (12.3)		1.9 (0.9, 3.8)	5.8 (1.5, 22.7)*
Birth weight (less than 2500 grams)	Neonatal	43 (68.3)	12 (4.0)	51.4 (23.5, 112.6)*	46.3 (12.2, 176.0)*
	Post-neonatal	85 (69.7)		54.9 (27.4, 110.1)*	42.1 (15.6, 113.3)*
Pregnancy age (less than 37 weeks)	Neonatal	43 (68.3)	42 (17.2)	10.3 (5.5, 19.3)*	N.S. #
	Post-neonatal	79 (64.2)		8.6 (5.3, 14.2)*	N.S.
Exclusive breastfeeding (first 6 month)	Neonatal	37 (58.7)	24 (8.0)	16.3 (8.5, 31.3)*	13.2 (3.9, 44.1)*
	Post-neonatal	50 (40.7)		7.9 (4.5, 13.6)*	4.5 (1.6, 12.6)*
Type of delivery (caesarean)	Neonatal	30 (47.6)	56 (19.4)	3.8 (2.1, 6.7)*	N.S.
	Post-neonatal	43 (35.0)		2.2 (1.4, 3.6)*	N.S.
Pregnancy diabetes (yes)	Neonatal	9 (14.3)	22 (7.3)	2.1 (0.9, 4.8)	N.S.
	Post-neonatal	12 (9.8)		1.4 (0.7, 2.9)	N.S.
Full vaccination (no)	Neonatal	N.A.&	N.A.	N.A.	N.A.
	Post-neonatal	80 (66.1)		24.9 (10.2, 60.8)*	14.9 (3.7, 59.7)*
Infant gender (boy)	Neonatal	36 (57.1)	139 (46.5)	1.5 (0.9, 2.7)	N.S.
	Post-neonatal	67 (54.9)		1.4 (0.9, 2.1)	N.S.
Antenatal visits (less than 4)	Neonatal	48 (76.2)	40 (13.7)	20.1 (10.3, 39.2)*	27.4 (7.8, 96.6)*
	Post-neonatal	40 (13.7)		13.5 (8.2, 22.4)*	15.3 (6.3, 37.4)*
Abortion history (at least one)	Neonatal	23 (36.5)	25 (8.3)	6.3 (3.3, 12.2)*	7.0 (1.9, 25.8)*
	Post-neonatal	38 (30.9)		4.9 (2.8, 8.6)*	3.0 (1.1, 8.4)*

*Significant; § Odds Ratio (95% Confidence Interval) ; # N.S.: Not Significant & N.A.: Not Applicable

§ : As mother/baby factors are not to change after baby birth, all individuals of the control group have been compared with both case groups (death before one month, death after one month).

exclusive breastfeeding in the first 6 months, full vaccination, antenatal visits, history of abortion, and birth location showed a significant association with mortality. According to the multivariate model, for neonates with birth weight lower than 2500 grams, less than 4 antenatal visits, lack of exclusive breastfeeding, birth at home, and at least one history of abortion, the chance of mortality was more than the rest by 46.3%, 27.4%, 13.2%, 9.4%, and 7.0%, respectively, and for post-neonatal period with birth weight less than 2500 grams, less than 4 antenatal visits, incomplete vaccination, birth at home, lack of exclusive breastfeeding in the first 6 months, and history of at least one abortion, chances of mortality were more than others by 42.1%, 15.3%, 14.9%, 5.8%, and 4.5%, respectively. As during the neonatal period the only vaccination is Bacillus Calmette-Guérin (BCG) or oral polio vaccine (OPV), association of vaccination in the neonatal period was not considered.

Gestational diabetes and infant gender in univariate and multivariate models had no significant relationship with mortality (Table-2). Hypertension during pregnancy, history of medication use during pregnancy, history of infant deaths in previous children, history of death at birth in previous children, and history of preterm births were not considered due to lack of frequency in the control group.

Pregnancy hypertension, history of medication use during

pregnancy, history of death at birth, and history of preterm birth in deceased neonates were 20.6%, 25.8%, 34.4%, 25.4%, and 33.3%, respectively, and in deceased post-neonatal period they were 17.9%, 10.6%, 25.4%, 16.3%, and 22.0%, respectively. However, as these parameters were not recorded in the health centre files, these factors could not be compared between the two groups.

Discussion

According to the results, birth weight lower than 2500 grams, less than 4 antenatal visits, lack of exclusive breastfeeding, birth at home and history of at least one abortion increased the chance of mortality in the neonates. Also, lack of complete vaccination increased the risk of mortality in post-neonatal period.

Delivery location, due to its direct effect on the childbirth process, through lack of hygiene standards and also through the midwife, can be one of the most important determining factors in death, especially of infants.¹³ In the present study, delivery at home increased chances of neonatal and post-neonatal mortality which can be attributed to difficult deliveries at home, and it can be predicted that the process of natural birth would be difficult for them.

LBW (less than 2500 grams) was the most important predicting parameter in infant mortality rate. The results of

other studies confirm this, as LBW is the underlying factor in most other disorders and paediatric diseases.^{7,16,17} Although infant prematurity showed a correlation in the univariate model, no such correlation was observed in the multivariate model, caused by the relationship of prematurity with birth weight. Therefore, despite common information between low weight and prematurity, only the low weight that had higher association with death was implicated in the multivariate model. In other studies, prematurity has been considered as an important factor in infant mortality.^{13,14,16,18} This shows the importance of accurate monitoring of mothers during pregnancy in order to prevent factors causing preterm births and also care of the premature babies to reduce their deaths.

In this study, lack of exclusive breastfeeding in the first 6 months of life was an important predicting factor in infant mortality. Previous studies also confirm the importance of breastfeeding, and considered lack of breastfeeding an important factor in deaths of infants.¹⁴ Therefore, exclusive breastfeeding in the first 6 months of life is effective in preventing and reducing various paediatric diseases and subsequent deaths.

Even though there was a correlation between CS and infant mortality in the univariate model, which could have been due to CS complications, this factor was eliminated in the multivariate model that indicated this factor's relationship with other effective factors, especially delivery location and LBW. Nonetheless, all CSs were performed in hospital, and some of the cases, due to particular conditions of the mother or the baby, could have been related to LBW.¹³

Lack of complete vaccination was identified as an important factor in post-neonatal mortality. The countrywide routine vaccination programme that is designed and implemented with the aim of eradicating fatal diseases must be taken seriously, because lack of vaccination predisposes infants to these diseases, and in some cases, there is no definitive cure. Unfortunately, in reviewing previous studies, we did not find any report based on the relationship between infant mortality and vaccination. The clinical importance of vaccination is clear to one and all, though.

Conclusion

Most of the factors related to infant mortality can be controlled by providing sufficient information and healthcare to pregnant mothers. If done, it will result in reduced infant mortality rate.

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