Original Article

Infection remains a leading cause of neonatal mortality among infants delivered at a tertiary hospital in Karachi, Pakistan

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Abstract

Introduction: The current cohort study was conducted to determine the frequency and compare the mortality rate with associated characteristics among low birth weight and normal birth weight infants during the neonatal period at a tertiary healthcare facility, Karachi.

Methodology: Close-ended structured questionnaires were used to collect information from the parents of 500 registered neonates at the time of birth. Follow-ups by phone on the 28th day of life were done to determine the mortality among low birth weight and normal birth weight babies during the neonatal period.

Results: The neonatal mortality rate ranged from as low as 2.4% in the normal birth weight and 16.4% in the low birth weight categories to as high as 96% in the very low birth weight category. Respiratory distress syndrome (24.2%) and sepsis (18.2%) were reported as the leading causes of neonatal deaths. The babies' lengths of stay ranged from 2 to 24 hours, and around 90% of neonatal deaths were reported in the first seven days of life. More than 6% of neonates died at home, and 7.6% of the deceased babies did not visit any healthcare facility or doctor before their death. In the 12–15 hours before their deaths, 13.6% of the deceased babies had been unattended. Around 90% of the deceased babies were referred from a doctor or healthcare facility.

Conclusions: The present estimates of neonatal mortality are very high among low birth weight and very low birth weight categories. Infectious diseases, including respiratory distress syndrome (24.2%) and sepsis (18.2%), were leading causes of neonatal deaths.

Key words: normal birth weight; low birth weight; mortality.

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Introduction

Appraising the burden of neonatal mortality in low and normal birth weights is a prerequisite for the future development of health strategies leading to advancement in neonatal health status.

Perinatal and neonatal mortality is an increasingly important public health issue in developing countries [1]. The global burden of neonatal mortality is about four million per year, inviting intensive contribution from public health representatives to control and reduce neonatal mortality. Alarmingly, 98% of these deaths occur in developing countries, and 60% to 70% of neonatal deaths occur within first seven days of life [2].

Low birth weight (LBW) is a well-documented risk factor for neonatal mortality and can be defined as a birth weight of less than 2,500 grams [3]. In developing countries, low birth weight and prematurity are important causes of perinatal mortality [2]. According to a recently conducted hospital-based study, more than 90% of infants who died were of low birth weight and 8.89% were of very low birth weight (< 1.5 Kg) [4]. Lack of information about neonatal mortality in the first four weeks of life has hindered the development of appropriate neonatal interventions [5].

As reported earlier, perinatal and neonatal mortality rates range from 54 per 1,000 births in Karachi to 81 per 1,000 births in Faisalabad, and stillbirths account for 40%–75% of all perinatal deaths [6-8]. The neonatal mortality rates differ by rural, urban, and other locations, even within large demographic surveys [9-10]. Previous studies conducted in Pakistan reported that LBW and maternal illness were the major causes of neonatal mortality [11-16], but no direct data is currently available regarding complications and follow-up during the neonatal period of LBW babies.

In view of the published data, appropriate suggestions are urgently needed in a local setup, based on contextual constraints, to move forward future public health strategy to control and reduce neonatal

mortality using an evidence-based rational scientific approach. Thus, a contemporary study was planned to determine the frequency of neonatal mortality and to compare mortality rates with associated characteristics among LBW and normal birth weight NBW babies during the neonatal period in a local setting – a tertiary care teaching healthcare facility in Karachi.

Methodology

All registered cases at the participating center were contacted and the rationale of the study was explained to them. Following cohort study design, a non-probability purposive sampling technique was adopted to recruit the study population with an equal ratio (1:1) of normal- and low-birth-weight newborns. The sample, consisting of 500 newborn babies, was obtained in seven months, after informed written consent was received from the mothers attending the Obstetrics and Gynecology ward of Jinnah Postgraduate Medical Centre (JPMC), Karachi, between October 2011 and March 2012.

Infants of both low and normal birth weights were recruited at the time of birth from the hospital and were followed up at home by phone when they were 28 days of age; information was recorded on a structured pro forma. Hospital records and attending doctors were also consulted to confirm desired information regarding the newborns. The LBW babies were further categorized in to very-low-birth-weight (less than 1.5 Kg weight) and low-birth-weight babies (1.5 Kg to 2.49 Kg). For all participants who died either before discharge from the hospital or at home, a structured verbal autopsy pro forma was used for data collection, and the clinical diagnosis was confirmed from the attending doctor or hospital records. The verbal autopsy is an inexpensive and scientifically validated technique used to collect information from family members and other informants to elicit the deceased's cause of death, to identify associated risks for the death, and to assess the convenience and quality of healthcare delivery received by the deceased.

Close-ended structured questionnaires were used, consisting of two parts. Part one was used to collect information at time of birth in the hospital, while second part was used for those infants who were discharged from the hospital and were followed up by phone. The 31-item-containing pro forma included age, height, and birth weight of the baby, problems encountered during the neonatal period, and socioeconomic factors including parental education, family income, and paternal occupation. In the first part, information was collected from the mothers of the newborns. The members of the research team during the day shift were responsible for the collection of data in part one of the pro forma, while the second part of the pro forma was completed by members of the research team, consisting of a principal investigator and co-investigator by phone to parents or caregivers of the research participant. Finally, both descriptive and statistical tools were used for comparative analysis of mortality and other characteristics among both low-birth-weight and normal-birth-weight neonates and their caregivers.

Ethical review

Informed written consent was obtained from potential participants after explaining the purpose of the study before inclusion. The participants were given the right to disassociate from the study at any time. Ethical clearance to conduct the study was obtained from institutional ethical review committee.

Results

The socioeconomic description of 500 families showed significant differences in neonatal mortality rates based on the father's ($p = 0.004$) and mother's ($p = 0.018$) education levels (Table 1). Neonatal mortality rates were significantly higher ($p = 0.012$) among infants in the very low birth weight VLBW female category (7.0%) versus the VLBW male category (2.5%). There was also a significant difference in average birth weight ($p = 0.005$) and average birth height ($p = 0.011$) of male and female babies (Table 2). The length of stay of newborn babies at the gynecology ward varied from 2 to 24 hours. The neonatal mortality rates were as low as 2.4% in NBW and 16.4% in LBW, to as high as 96% in the VLBW category (Table 3). In this study, around 90% of neonatal deaths occurred in the first seven days of life, and more than 6% of the neonates died at home, while 7.6% of the babies who died did not visit any healthcare facility or doctor before death. Meanwhile 13.6% of babies who died were unattended in the 12–15 hours before death. Ambulance (33.3%), public transport (24.2%), and private taxi (22.7%) were the most common modes of reaching the healthcare facility, and more than 98% of the deceased babies reached their respective healthcare facilities within an hour. Around 90% of the deceased babies were referred from a doctor or healthcare facility, and more than 33% of parents reported that they were not informed about the diagnosis or ailment of their deceased neonate.

Table 1. Socioeconomic statuses of registered families of newborn babies (n = 500)

Description	No. of subjects	Mortality		
		Number	Percent	P value
Education of father				
Illiterate	172	33	19.2	0.004*
Literate	328	33	10.1	
Education of mother				
Illiterate	185	33	17.8	0.018*
Literate	315	33	10.5	
Occupation of the head of family				
Laborer	130	23	17.7	0.078
Service/business	370	43	11.6	
Family income (in rupees)				
≤ 10,000	300	46	15.3	0.084
> 10,000	200	20	10.0	
Number of family members				
Siblings – Yes	269	36	13.4	0.896
No	231	30	13.0	
Elders – Yes	322	39	12.1	0.333
No	178	27	15.2	
Mother tongue				
Urdu	265	34	12.8	0.775
Not Urdu	235	32	13.6	

*Statistically significant

Table 2. Average height and weight categories

	Overall	Male	Female	P value M *vs.* F
Total booked cases registered for deliveries Nov 2011 to Feb 2012	**500**	**242**	**258**	
Category of weight				
NBW	250 (50.0%)	131 (54.1%)	119 (46.1%)	0.073
LBW	226 (45.2%)	105 (43.4%)	121 (46.9%)	0.430
VLBW	24 (4.8%)	6 (2.5%)	18 (7.0%)	0.012*
Weight in Kg				
Range	0.5 – 4.4	1.0 – 4.4	0.5 – 4.1	0.005*
Mean ± S.D	2.54 ± 0.67	2.63 ± 0.67	2.46 ± 0.65	
Height in cm				
Range	24 – 54	32 – 54	24 – 54	0.011*
Mean ± S.D	47.4 ± 3.99	47.9 ± 3.35	47.0 ± 4.47	

*Statistically significant; NBW: normal birth weight; LBW: low birth weight; VLBW: very low birth weight.

Table 3. Frequency of neonatal mortality and gender distribution

Category	No. of subjects	Mortality		
		Number	Percent	P value
Gender of baby				
Male	242	29	12.0	0.436
Female	258	37	14.3	
Baby's weight category				
NBW	250	6	2.4	
LBW	226	37	16.4	0.001*
VLBW	24	23	95.8	

*Statistically significant; NBW: normal birth weight; LBW: low birth weight; VLBW: very low birth weight

Respiratory distress syndrome (24.2%), sepsis (18.2%), and premature (13.6%) and neonatal jaundice (12.1%) were the leading causes of direct neonatal deaths (Figure 1).

Discussion

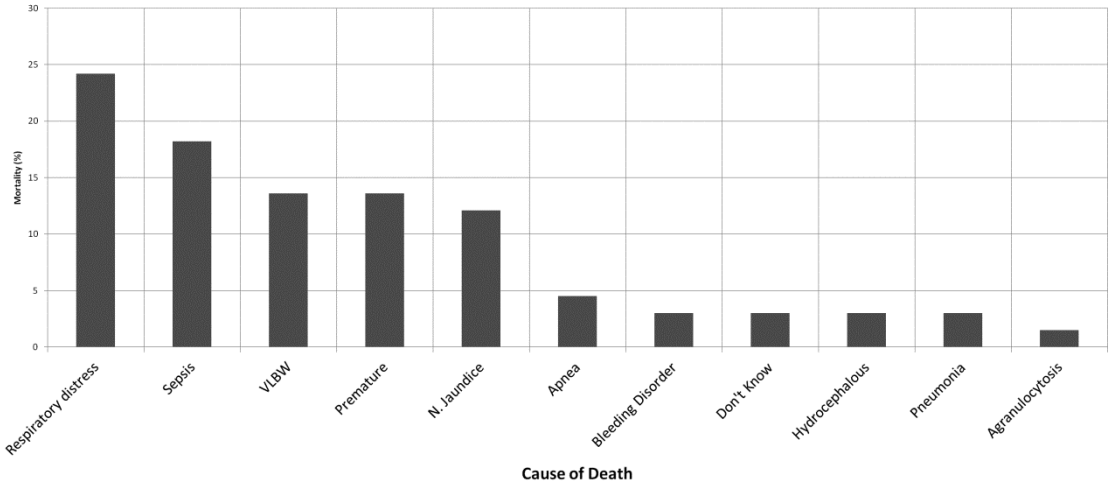
In the current study, neonatal mortality rate is very high especially among low birth weight and very low birth weight categories and infection remains a leading cause of neonatal deaths. . Although this data cannot be strictly compared with other populations and community-based studies, there has been about a 2.5-fold increase, from 13.4% in 1990 to 34.3% in 2006/2007, in the rate of births that occurred in the healthcare facility [17], which enhances the importance of the current findings and provides evidence-based inductive information on neonatal care at one of the leading tertiary public healthcare facilities of Pakistan.

The main limitation of this study was that only deceased neonates delivered at the participating tertiary public healthcare facility were followed up. Another limitation was the predictability and shortcomings in verbal autopsies due to a lack of logical causal structure. Finally, recall of death events prior to death by participating family members may have led to misclassification of the cause of death.

The socioeconomic description of data showed that there was a significant difference in neonatal mortality rates based on the father's ($p = 0.004$) and mother's ($p = 0.018$) education levels (Table 1), showing significantly higher mortality rates among illitrate participants compared to literate participants, reflecting lack of awareness about neonatal health and care.

Globally, 99% of neonatal deaths occur in low-income and middle-income countries, and there has been minimal improvement in neonatal survival over the past 20 years [18]. Earlier reports indicated that in Pakistan, the mortality rate was 78 (range 78 to 100) per 1,000 live births [19-20], contrary to current study results, may be due to the facility-based approach. A separate study reported early neonatal mortality up to first 7 days of life as 70 neonatal deaths per 1,000 live births, and late perinatal mortality from 8 to 28 days of life was reported as 47 neonatal deaths per 1,000 live births [21]. Neonatal deaths may be averted if healthcare facilities provide evidence-based interventions such as provision of skilled maternal and immediate neonatal care, emergency obstetric care, antibiotics for preterm premature rupture of membranes, and antenatal corticosteroids for preterm labour during the intrapartum period [17]. The proposed target set forth by Pakistan for infant mortality rates is 40 per 1,000 live births in the evaluation of the 2009 USAID/Pakistan Maternal, Newborn & Child Health Program. Alarmingly, our results showed more than a double increase of mortality trends (132/1000 live births) in neonatal trajectory of infants born in public healthcare facilities in Karachi, Pakistan. However, around 90% of neonatal deaths occurred in the first seven days of life. The mortality among LBW (16.4%) and VLBW (96%) babies remains significantly higher than in NBW (2.4%) babies, which may be due to scarce or limited resuscitation facilities, lack of awareness and training among parents about LBW and VLBW neonatal care, and provision of limited skilled and trained emergency neonatal healthcare providers.

Figure 1. Trajectory of neonatal deaths: The figure shows causes of death of neonates involved in the study.



In this study, the average length of stay of babies ranged from 2 to 24 hours, which may have been due to unavailability of neonatal wards in the facility, due to the condition of the newborn, or due to workload. Early discharge creates potential health risks to the newborn. Facility-based published data suggested that the majority of health problems, including jaundice, infection, feeding difficulties, birth defects, and respiratory problems may not be detected until after the initial assessment. Late preterm infants are biologically vulnerable to experiencing temperature instability, hypoglycemia, apnea and bradycardia, sepsis, hyperbilirubinemia, and feeding difficulties [22-24]. Similarly, respiratory distress syndrome (24.2%), sepsis (18.2%), and premature (13.6%) and neonatal jaundıce (12.1%) were the leading causes of direct neonatal deaths in our study, showing a high prevalence of infectious diseases.

The verbal autopsy form included questions related to the place or facility where treatment was received for the infant and questions related to the number of contacts with the place or facility. Around 90% of the deceased babies were referred from a doctor or healthcare facility. More than 6% of the neonates died at home, and 7.6% of the deceased babies did not visit any healthcare facility or doctor before death. While 13.6% of the deceased babies were unattended in the 12–15 hours before their deaths, more than 33% of parents reported that they were not informed about the diagnosis or ailment of their deceased neonate, suggesting lack of awareness among parents of the deceased baby. This could have been due to hesitation or counselling difficulty among healthcare providers regarding the issues related to disclosure of bad news to the parents or caregivers by the attending doctors, or it could have been due to the workload in the emergency department.

Ambulance (33.3%), public transport (24.2%), and private taxi (22.7%) were the most common modes of reaching the healthcare facility, and more than 98% of the deceased babies reached their respective healthcare facilities within an hour, showing overall good coverage in reaching healthcare facilities in limited time.

Conclusions

Present estimates of neonatal mortality are 132 per 10,00 live births, which is very alarming. More than 90% of neonatal deaths were recorded in LBW and VLBW categories, with elevated rates of infectious diseases. At this stage, there is an obvious need to improve resuscitation facilities with the provision of neonatal care units in obstetrics and gynecological wards and to enhance skills at the indigenous level with distinct orientation to low birth weight neonatal care.

In the given context, provision of a neonatal care facility in the obstetrics and gynecological ward could provide, under one umbrella, hands-on training workshops and routine refresher courses for healthcare providers, and routine awareness sessions for pregnant mothers with certified counselors during routine checkups and follow-ups, which could help to further reduce infection rates and neonatal mortality.

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