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PREFACE

The International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) is an autonomous, international, philanthropic and non-profit centre for research, education and training as well as clinical service. The Centre is derived from the Cholera Research Laboratory (CRL). The activities of the institution are to undertake and promote study, research and dissemination of knowledge in diarrhoeal diseases and directly related subjects of nutrition and fertility with a view to develop improved methods of health care and for the prevention and control of diarrhoeal diseases and improvement of public health programmes with special relevance to developing countries. ICDDR,B issues two types of papers: scientific reports and working papers which demonstrate the type of research activity currently in progress at ICDDR,B. The views expressed in these papers are those of authors and do not necessarily represent views of International Centre for Diarrhoeal Disease Research, Bangladesh. They should not be quoted without the permission of the authors.

ABSTRACT

The causes and risk factors of neonatal and post-neonatal mortality were analysed by following a cohort of 1,351 infants born between July 1976 and June 1977 for a one year period in the Teknaf Dysentery Project in rural Bangladesh. Tetanus (31%), prematurity (22%) and congenital illnesses (12%) were the commonest causes of neonatal deaths. Pneumonia (33%), malnutrition (18%), diarrhoeal illnesses (10%) and fever (9%) were the most important causes during the post-neonatal period. Delivery complications of the mother and the newborn were found to be significant determinants of neonatal mortality. Infant mortality was highest for mothers below the age of 20 years and lowest between 25-29 years. The size of the family was directly related to the infant mortality rates.

INTRODUCTION

Infant mortality rate is very high in Bangladesh as in many other developing countries. It is the most important component of the overall mortality rate accounting for 40 percent of the crude death rate in Bangladesh (1-2). The neonatal component of infant death tends to be dominated by prenatal causes such as prematurity, congenital malformations and birth injuries. However, post-neonatal mortality tends to be dominated by infectious diseases or their sequelae, particularly pneumonia and nutritional deficiencies (3). Neonatal deaths are thought to be biological in origin although environmental factors also have impact on neonatal survival (4). The post-neonatal deaths are most sensitive to improvement in health conditions, while the neonatal deaths are difficult to alter (5). Break-down of the infant mortality rate provides a clear indication of the state of a country's development, particularly with respect to maternal and child health.

The purpose of this paper is to examine the causes and some of the factors of neonatal and post-neonatal mortality and identify the population at highest risk. Analysis of the data will include variations in neonatal and post-neonatal mortality according to cause of death, delivery complications of the mother and the newborn, age of the mother, and the size of the family.

MATERIALS AND METHODS

The study area in Teknaf *thana* (an administrative unit) is under Cox's Bazar sub-division of Chittagong district in Bangladesh. The International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B, the former Cholera Research Laboratory) has been providing treatment of diarrhoeal patients through a field clinic in the Teknaf *thana* headquarters since late 1974 and conducting a longitudinal demographic surveillance since the beginning of 1976. The basic design and operation of the Teknaf field project was described in a previous study (6). All births, deaths, migrations and marital events have been routinely registered in the project area. A cohort of 1,351 infants born between July 1, 1976 and June 30, 1977 was longitudinally followed up for one year in the Teknaf Dysentery Project (TDP) demographic surveillance system. Relevant data in this paper were obtained by matching birth and death reports in a population of 25,000. The data collection system was as follows: a male high school graduate field assistant residing in his village of work visited every household once every seven to ten days. He filled out reporting forms with the help of a female

worker. The field assistant normally contacted the head of the household or a senior member to collect relevant information. The work of the field assistant was supervised by a field surveillance assistant. A physician checked and verified the completed death report for the final diagnosis which often necessitated a visit to the household of the deceased.

DEFINITIONS

Neonatal mortality rate was defined as the number of deaths in the first 28 days of life and post-neonatal mortality rate as the number of deaths from 29 days to 12 months per 1,000 live births.

Deaths due to neonatal tetanus occurred mostly within the first fortnight of birth and the symptoms reported were convulsions or spasms, inability to suck, lock-jaw and low fever.

Deaths due to prematurity were considered when the small-for-date infants died within hours of birth. Most of the premature births took place in the seventh or eighth month of pregnancy.

Deaths attributed to congenital anomalies included inborn defects or deformities of the newborn.

Deaths due to birth injury were cases of obstructed or complicated deliveries which resulted in damage or an apparent wound to the newborn. Little physical movement was noticed in these infants and most of the deaths occurred within a day of birth.

Deaths due to pneumonia were reported when there was high fever with cough and breathing difficulty.

Most of the deaths associated with malnutrition took place between the second and the sixth month of age. Absent, irregular or inadequate breastfeeding with poor supplementation by cow's milk or rice gruel were mostly responsible for causing malnutrition.

Deaths due to diarrhoeal illnesses were associated with history of loose or watery motions with or without vomiting during the last fortnight before the death. Dysentery was included in this category when infants passed stool mixed with mucus or blood with occasional fever. Patients during fever suffered from high temperature and shivering.

Deaths due to measles were associated with high fever followed by appearance of rash and cough.

RESULTS

The infant mortality rate was 160, neonatal mortality rate 89, and post-neonatal mortality rate 71 (Table 1). Of the total infant deaths, tetanus accounted for 21 percent (34 deaths per 1,000 live births), pneumonia 19 percent, prematurity 12 percent, malnutrition 8 percent, diarrhoeal illness 7 percent and fever 6 percent. Causes of deaths prevalent only during the neonatal period were tetanus - 31 percent (27 deaths per 1,000 live births), prematurity 22 percent, congenital illnesses 12 percent and birth injury - 7 percent. The frequent causes of post-neonatal deaths were pneumonia - 33 percent, malnutrition - 18 percent, diarrhoeal illnesses - 10 percent, fever - 9 percent, and measles - 6 percent.

The neonatal and post-neonatal mortality rates according to delivery complications were shown in Table 2. Neonatal mortality rate was 153 for mothers with delivery complications compared to 82 for those without complications. This difference was statistically significant ($P < 0.05$). Neonatal mortality rate was 400 among newborns with birth complications compared to 64 among those with no complications. This difference too was statistically significant ($P < 0.01$).

The neonatal and post-neonatal mortality rates by age of the mother were shown in Table 3. The highest neonatal mortality rate was found among mothers below the age of 20 years. Neonatal mortality rate gradually decreased among mothers aged 20-24 and 25-29. Neonatal mortality rate then increased among mothers aged 30-34 and further among mothers aged 35 years and over. This trend was present for post-neonatal and infant mortality rates with minor variations (Figure 1).

Neonatal and post-neonatal mortality rates by family size were presented in Table 4. Families having more than seven children accounted for higher infant mortality rates than smaller families. A statistically significant infant mortality rate ($P < 0.05$) was found according to family size.

Table 5 presented neonatal and post-neonatal mortality rates according to family size and age of mother. When age of mother was controlled, the positive influence of larger family size on neonatal, post-neonatal and infant mortality rates emerged.

TABLE 1

NEONATAL AND POST-NEONATAL DEATHS BY CAUSE

Cause of Death	Neonatal Deaths			Post-neonatal Deaths			Infant Deaths		
	No.	Percent	Rate ^a	No.	Percent	Rate ^a	No.	Percent	Rate ^a
All causes	120	100.0	88.8	96	100.0	71.1	216	100.0	159.9
Tetanus	37	30.8	27.4	9	9.4	6.7	46	21.3	34.1
Prematurity	26	21.7	19.3	-	-	-	26	12.0	19.3
Congenital illness	14	11.7	10.4	-	-	-	14	6.5	10.4
Birth injury	8	6.7	5.9	-	-	-	8	3.7	5.9
Pneumonia	8	6.7	5.9	32	33.3	23.7	40	18.5	29.6
Malnutrition	-	-	-	17	17.7	12.6	17	7.9	12.6
Diarrhoeal illnesses	4	3.3	3.0	10	10.4	7.4	14	6.5	10.4
Fever	3	2.5	2.2	9	9.4	6.7	12	5.6	8.9
Measles	-	-	-	6	6.3	4.4	6	2.8	4.4
Other and undiagnosed	20	16.6	14.8	13	13.5	9.6	33	15.2	24.4

a Per 1,000 live births.

TABLE 2

NEONATAL AND POST-NEONATAL DEATHS BY DELIVERY
COMPLICATION OF MOTHER AND THE NEWBORN

Delivery Complication		Number of Live Births	Death Rate per 1,000 Live Births		
			Neonatal	Post-neonatal	Infant
The Mother:	Not reported	1,227	82.3	71.7	154.0
	Reported*	124	153.2	64.5	217.7
The Newborn:	Not reported	1,251	64.0	68.0	131.9
	Reported**	100	400.0	110.0	510.0

* Convulsions and Prolonged Pain Lasting over 24 hours..

** Birth Injury, Birth Defect, Breathing Difficulty, etc.

TABLE 3

NEONATAL AND POST-NEONATAL DEATHS BY AGE OF MOTHER

Age of Mother	Number of Live Births	Death Rate per 1,000 Live Births		
		Neonatal	Post-neonatal	Infant
≤ 19	268	123.1	89.6	212.7
20 - 24	402	87.1	72.1	159.2
25 - 29	267	59.9	56.2	116.1
30 - 34	215	79.1	79.1	158.1
35 +	199	95.5	55.3	150.8

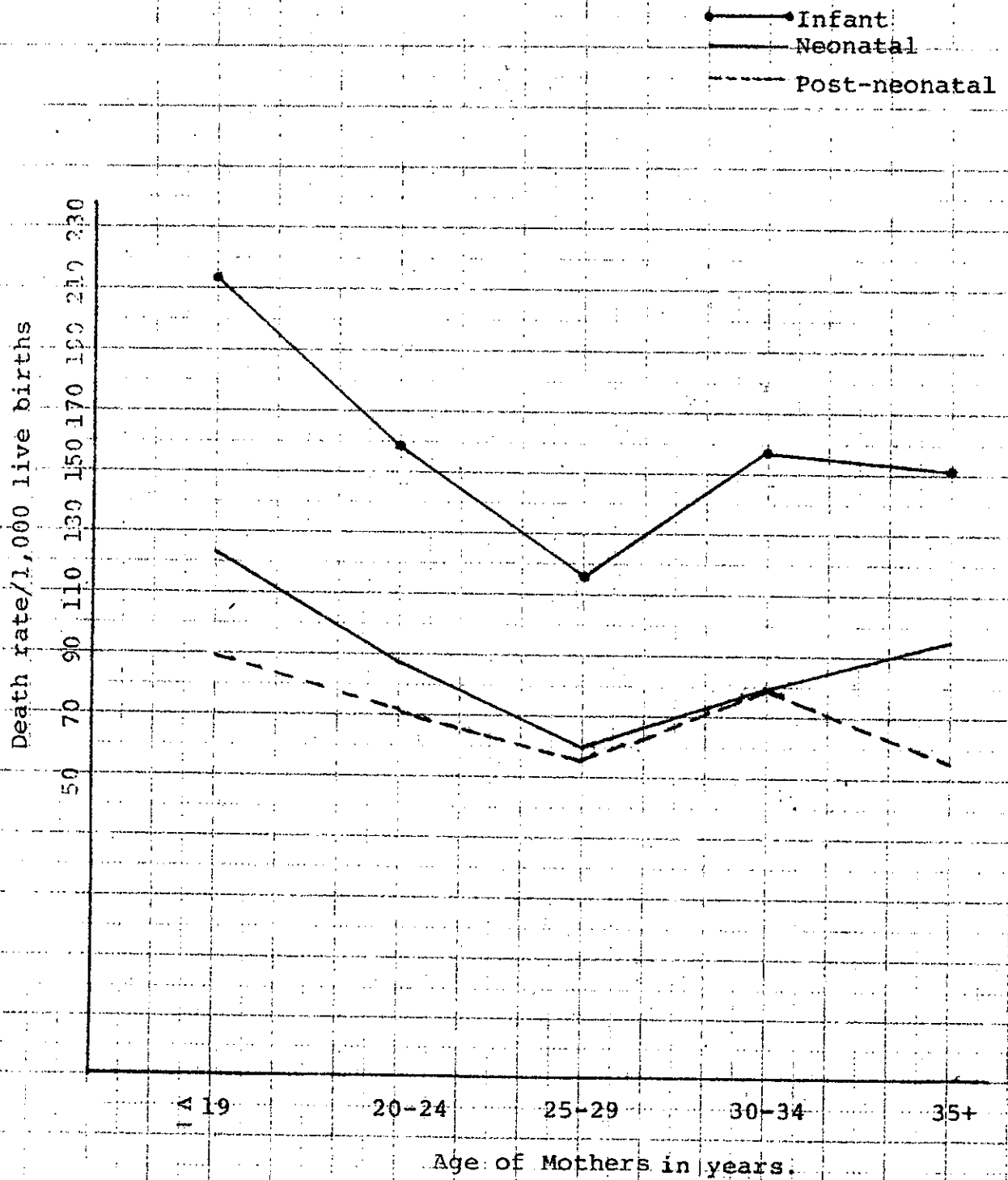


Figure 1. Neonatal, Post-neonatal and infant mortality by age of mother.

TABLE 4

NEONATAL AND POST-NEONATAL DEATHS BY FAMILY SIZE

Family Size	Number of Live Births	Death Rate per 1,000 Live Births		
		Neonatal	Post-neonatal	Infants
0 - 3	237	92.8	67.5	160.3
4 - 7	598	75.3	60.2	135.5
0 - 7	835	80.2	62.3	142.5*
<u>> 8</u>	516	102.7	85.3	188.0*

* $P < 0.05$.

TABLE 5

NEONATAL AND POST-NEONATAL DEATHS BY FAMILY SIZE AND AGE OF MOTHER

Family Size	Death Rate per 1,000 Live Births								
	Neonatal			Post-neonatal			Infant		
	Age of Mothers			Age of Mothers			Age of Mothers		
	≤ 19	20-29	30+	≤ 19	20-29	30+	≤ 19	20-29	30+
0 - 7	113.6	75.4	71.4	68.2	57.7	67.5	181.8	133.0	138.9
(No. of deaths)	(15)	(34)	(18)	(9)	(26)	(17)	(24)	(60)	(35)
≥ 8	132.4	78.0	111.1	117.7	78.0	67.9	250.0	156.0	179.0
(No. of deaths)	(18)	(17)	(18)	(16)	(17)	(11)	(34)	(34)	(29)

DISCUSSION AND CONCLUSIONS

Tetanus accounted for one-third of the neonatal deaths and one-sixth of the infant deaths. Comparable results were found in two contemporary studies carried out in Bangladesh (7-8). Neonatal tetanus is mainly associated with the use of unsterile instruments for cutting the umbilical cord by the traditional birth attendants, unsanitary surroundings and the prevalent practice of dressing the umbilical cord with substances like cow-dung, ash or burnt earth (9-12). Usually, the principal foci of infection are the rural areas associated with manure-fertilized soil, and a damp warm climate (13). The other causes of neonatal deaths were prematurity, congenital illnesses and birth injuries. The chance of an early infant death is greatly enhanced by these factors: too young or too old a mother, short duration of pregnancy or large family size.

Pneumonia, malnutrition, diarrhoeal illnesses, fever and measles were causes of post-neonatal deaths. These illnesses are generally caused by infection, poor housing, poverty, lack of safe water supply and basic sanitation.

Neonatal mortality rate was significantly higher due to delivery complications of the mother as well as the infant. The mother's nutritional status during pregnancy, her physical and mental conditions and the quality of prenatal and postnatal care might explain this difference.

The highest neonatal and post-neonatal mortality rates were found among the infants of mothers aged under 20. Premature births, unwanted pregnancies, unstable marital unions, lack of knowledge and experience in child care threaten the survival of infants born to young mothers (14). Certain birth defects such as chromosomal abnormalities are more frequent in older women hence the older mothers have a higher neonatal mortality rate (15). The lower neonatal mortality rate in the mothers aged 35 and above compared to those below 20 years was supported by earlier studies (16-17).

Increase in family size correlated positively with the neonatal and post-neonatal mortality rates. Although the predominance of young and relatively older mothers in larger families might account for this finding, the positive influence of family size was apparent from the results of this investigation. Two previous studies demonstrated that post-neonatal mortality rate was higher for infants born into larger families (18-19). Our findings also suggests that large family size perhaps leads to increased chance of contracting infectious diseases as well as strain on parental care resulting in increased post-neonatal mortality. Smaller families, on the other hand, enables the parents to take better care of their infants which results in reduced post-neonatal mortality.

From the analysis of the principal causes and the risk factors associated with neonatal and post-neonatal deaths it is evident that a large proportion of infant mortality in rural Bangladesh might be influenced by appropriate interventions. Neonatal mortality could be reduced by immunization of the mothers with tetanus toxoid (20) or improved delivery practices. Congenital illness and injuries sustained due to obstructed labour could be avoided by appropriate screening before the delivery. The incidence of premature births, perhaps, could be reduced by improving maternal nutrition during the pregnancy. Malnutrition, pneumonia and diarrhoeal illnesses could be reduced by better and accessible child care as well as improvements in the environmental hygiene and socioeconomic conditions.

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