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Original Research Article

Neonatal mortality contributors using the three delays audit: a study from Albuluk paediatrics teaching hospital in Sudan

Fikria Abdalwhab Salih[1], Ebtihal Elameen Eltyeb[2]*

[1]Department of Paediatrics, Omdurman Islamic University, Omdurman, Sudan
[2]Department of Paediatrics, Jazan University of Medicine, Jazan, KSA

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***Correspondence:**
Dr. Ebtihal Elameen Eltyeb,
E-mail: bebotyb@gmail.com

ABSTRACT

Background: In certain developing countries neonatal mortality rates still showed a slower decline. Many factors were attributed to neonatal mortality that varies from one country to another. This study investigated factors attributed to neonatal mortality in Sudan.
Methods: Data was collected from 72 neonatal deaths records at Albuluk pediatrics' teaching hospital, and then it was analyzed using a modified three delays model to determine contributing delays.
Results: 31.9% of neonatal mortality occurred on the first day after birth and 86.1% thereafter. Newborn characteristics showed that more than half of dead newborn were male and more than 80% admitted in the age of more than 2 days although there was 26% of involved newborn were preterm. About two third of deliveries were home deliveries and only 52% of the mothers were in regular antenatal care. The leading causes of death were sepsis and pneumonia in 83% followed by birth asphyxia in 11% of total neonatal mortality. Regarding the three delays audit; delay in decision making were present in 54.2% and that was due to inability of the mothers to recognize danger signs, delay in reaching the health care facility was present in 9.8% of the neonatal mortality, while delay in initiation of treatment in the healthcare facility was present in only 6.9%.
Conclusions: Maternal knowledge of neonatal danger signs and decision to seek medical care is a major contributor for neonatal mortality in this study. Further efforts should be exerting to raise knowledge of the mothers about danger signs of neonatal illness.

Keywords: Audit, Contributors, Neonatal mortality, Three delays

INTRODUCTION

The neonatal deaths were estimated as 3 million every year worldwide in the first week of life.[1,2] Almost all neonatal deaths were in low-income and middle-income countries and mainly occurred at home.[3] Based on analysis of neonatal mortality causes, the three major leaders of neonatal deaths worldwide are infections, prematurity and birth asphyxia and these might show some variation in order between countries depending on their strategies.[4] In one study done in Sudan to assess the associations between neonatal mortality and different social and demographic factors; the male babies, advanced maternal age, poverty, Caesarean section delivery and complications during or after delivery were found to be the major contributors with neonatal mortality.[5]

Sudan, as many African countries had slow progression to achieve Millennium Development Goal (MDG) 4 that adopted by the United Nations in 2000 aiming to decrease child deaths worldwide by 2015.[6] The non-

compliance with effective care that is mandatory to reduce maternal and neonatal mortalities is accused to be the cause. The essential care includes maternal antenatal care, neonatal resuscitate programs, treating maternal infections during and after birth, care of the umbilical cord and immediate, exclusive breastfeeding. Improved registration and analyzing of the available data is the most important part of the monitoring of the programs and strategies for reducing neonatal mortality. In one study done in eastern Sudan during 2005-2009 the maternal mortality is high with lack of antenatal care and high incidence of infections.[7]

For exploring maternal deaths, the three delays model developed by Thaddeus and Maine has been widely used and helped in reducing the maternal mortality indicators.[8-11] The model comprises delay in deciding to seek care on the part of the individual, family or both (Delay 1), delay in reaching an adequate healthcare facility (Delay 2) and delay in receiving adequate care at the health facility (Delay 3). Similar to how maternal death audits have helped in reducing maternal morbidity and mortality, neonatal deaths can possibly be reduced through identification of the existing gaps by means of audits and taking the necessary steps.

To the best of our knowledge, no study has specifically analyzed delays in healthcare delivery to the sick newborn in Sudan. Therefore, this study tried to investigate the causes of delays in seeking healthcare services for the sick newborn and the maternal socio-demographic factors that influence these delays.

METHODS

This was cross sectional hospital based study, that was carried out in Albuluk hospital for children which is specialized pediatrics teaching hospital in north of Omdurman Karari locality, in one-year period from January to December 2016. Seventy-two neonatal deaths which occurred during that period were included in this study. Data was collected through revision of hospital records and a properly designed questionnaire, after explanation of the study purpose, Verbal consent was taken from the medical director of the hospital, and from the treating doctors. The information included in the dataset contain some socio-demographic data in form of newborn age, gender, residence, place of delivery, mother age, the number of children whether dead or alive that mother had given birth to, her level of education and social status.

Based on review of the neonatal death records, the assessments of the delay levels were critically evaluated. Delay was defined based on the model proposed by Thaddeus and Maine as showed in (table 1). The levels of delay were classified into: Level 1 delays that includes all delays at household level and delays in decision to seek care; they defined as an interval of more than 12 h between seeking healthcare (the time danger signs were first noticed in the newborn). Level 2 delays include delays from home to healthcare facility that is more than 2hrs in reaching or transporting the newborn from home to a healthcare facility, the distance from healthcare facility, cost of transporting and bad roads are major factors that affect the rapid reaching of sick newborn to target hospital. Level 3 delays include the delay inside healthcare; they are defined as delays of more than 1 h before starting effective treatment to the sick newborn. These include the triage in the hospital, the bad and delayed staff behaviors, inadequate equipment that is needed for resuscitation and availability of needed investigations and drugs.

Table 1: The three delays model.[8]

Model
Delay in recognition of danger signs and decision to seek care
Delay in reaching an appropriate source of care
Delay in obtaining adequate and appropriate treatment source

All collected data were finally entered into the computer using the statistical package program for social science (SPSS) version 24 to analyze the data via simple descriptive statistics. Frequencies and percentages were used to assess the different variables, while Kendall's taub test was used to assess Correlations between seeking medical advice behaviors of the mothers and other variables. Confidence intervals (95%) were calculated and $p < 0.05$ was considered significant.

RESULTS

There were 72 neonatal deaths in the study area during the study period. Mothers' characteristics showed that about half of mothers of dead newborns lied between age group 21-35 years old with only third of them reside nearby the study hospital. As shown in (Table 2) only 52% of the mothers were in regular antenatal care. Newborn characteristics showed that more than half of newborn deaths were male and more than 56% of dead newborn admitted in the hospital after more than 2 days duration of stay with symptoms although, there was 26% of involved newborn were preterm and 18% not cried immediately as (Table 3) showed. About two third of deliveries were home deliveries and this numbers may be attributed to the mother preference as in rural Sudanese culture or it may indicate the distant residence from the health services.

Causes of neonatal deaths

The leading causes of death as records reported were sepsis and pneumonia in 83% of neonatal death, these followed by birth asphyxia in 11% of total neonatal deaths. There were other causes of deaths reported in death records like gastroenteritis with severe dehydration,

congenital heart disease, and other lethal congenital anomalies like anencephaly as shown in (Table 4).

Table 2: Mothers' of dead new born demographic characteristics.

Mothers' characteristic	Variable	Frequency	%
Ag (years)	15 -20	8	11.1
	21 -35	36	50.0
	>35	4	5.6
	Unknown	24	33.3
Residence	< 10 klm from hospital	25	34.7
	10 -20 klm from hospital	24	33.3
	> 20 klm from hospital	23	31.9
Educational level	Illiterate	28	38.9
	Primary	10	13.9
	Secondary	5	6.9
	Unknown	29	40.3
Socioeconomic status	Low	45	62.5
	Moderate	12	16.7
	Unknown	15	20.8
Illness during pregnancy	Yes	17	23.6
	No	38	52.8
	Unknown	17	23.6
Parity	1	17	23.6
	2 -5	33	45.8
	>5	10	13.9
	Unknown	12	16.7
History of neonatal death	Yes	9	12.5
	No	49	68.1
	Unknown	14	19.4
Antenatal care	Yes	38	52.8
	No	21	29.2
	Unknown	13	18.1
Total		72	100

Distribution of the deaths according to the levels of delay involved

Of the 72 neonatal deaths audited, delays in 46 deaths (63.9%) were present. First delay (delay in decision making): Of the 72neonatal deaths audited, delay in decision making were present in 54.2% that was due to the inability of the mothers to recognize danger signs as appeared in the records. Second delay (delay in reaching a health care facility): it was present in 9.8% of the neonatal deaths (In one death (1.4%), it was due to the unavailability of transport, the need to travel a long distance because of a lack of a health facility in the vicinity in five deaths (7%), and a lack of funds to bear the cost involved in transport and treatment in one death) and this manifested as second contributor in the delay in reaching a health care facility. Third delay (delay in initiation of treatment): Of all neonatal deaths 83.3% were given proper treatment and this is clearly manifested in the records of died neonates. As compared with the first and the second delay, the delay in initiation of treatment in the hospital was present in a fewer number (6.9%) of neonates who died while non-availability of drugs and equipment present in 4.2%, also referral without providing any treatment was noticed in 2.8% of neonatal deaths.

Table 3: Dead newborn characteristics.

Neonates' characteristic	Variable	Frequency	%
Sex	Male	40	55.6
	Female	26	36.1
	Missed	6	8.3
Place of delivery	Home	45	62.5
	Hospital	25	34.7
	Missed	2	2.8
Gestational age	Preterm	19	26.4
	Term	53	73.6
Cried immediately	Yes	52	72.2
	No	13	18.1
	Missed	7	9.7
Admitted to nursery	Yes	6	8.3
	No	52	70.8
	Missed	15	20.8
Total		72	100

Correlations between mothers' seeking behavior to medical advice and other variables

By entering the data into Kendall's taub correlation to assess the possible correlations between mothers' medical seeking behaviors to residence, mother age, mother education, sex of the baby, past history of neonatal death, number of children, place of delivery, attendance to antenatal care, and socioeconomic status; as showed in (Table 5) the result indicates no possible correlation between these factors and mothers' medical seeking behaviors.

DISCUSSION

This study is one of the few studies in Sudan that document the social factors surrounding neonatal deaths based on the three delays model. It proved that delay in decision making to seek care (Delay 1) followed by the delay in reaching the healthcare facility (Delay 2) were the major contributors to neonatal mortality in the study sample. Our results on the contribution of delays to newborn death are similar to Waiswa et al study in eastern Uganda and to the Indian study done by Upadhyay et al in 28 villages, however, our study varies from this Indian in that it depends on hospital-based records while the Indian one was community-based study.[12,13] On another hand, there is a vast difference from the Tanzanian study by Mbaruku, et al that found the neonatal mortality were due to Delay 3 and from the study conducted by Jammeh A in Gambia that found that

Level 2 delays were the major factors contributing to the delayed presentation at health facilities.[14,15]

Table 4: Neonatal death circumstances.

Neonatal illness and death circumstances	Variable	Frequency	%
Main complain	Fever	27	37.5
	Convulsions	21	29.2
	Difficult - breathing	19	26.4
	Others	3	4.2
	Unknown	2	2.8
Duration of the illness (days)	1	31	43.1
	2	24	33.3
	3 or more	17	23.6
If seek medical advice	Yes	8	11.1
	No	45	62.5
	Unknown	19	26.4
Cause of delay to reach hospital	Not aware about the illness	39	54.2
	No transportation	1	1.4
	Others	6	8.3
	Unknown	26	36.1
If given proper treatment	Yes	59	81.9
	No	5	6.9
	Unknown	8	11.1
Age at death (days)	1	23	31.9
	2 -7	39	54.2
	>7	7	9.7
	Unknown	3	4.2
Cause of death	Birth asphyxia	8	11.1
	Sepsis	55	76.4
	BP	5	6.9
	Others	4	5.6
Total		72	100

In the present study most of the neonatal deaths were occurred on the first day of birth (31.9%) or within the first week of life after that (54%). The striking results of this study are that; majority of the newborn were home deliveries (62%), and more than half of dead newborn admitted to the hospital after more than 2 days duration of stay with symptoms although, there were considerable percentage of preterm deliveries and history of delay in crying in 18% of the cases.

All of these factors besides high percentage of maternal illiteracy might have direct impact on neonatal mortality. To reduce the number of newborn deaths, addressing Delay 1, or a delay in problem recognition and in deciding to seek quality care, all the reasons behind this should be critically assessed and evaluated. Although correlations between mothers' seeking behavior to medical advice and other demographic variables were insignificant as the analysis of our data in this study deduced, other major reasons for delay in seeking care like inability to recognize danger signs, preference of use the traditional medicine, previous bad experiences with health care facilities, financial limitations, and distance from healthcare facilities should be predicted and evaluated as one study in Ghana reported.[16] Considering that the time frame for seeking medical advice is short, decreases maternal knowledge of neonatal danger signs still constituted the major pitfall in this study in more than half of neonatal mortality, while more than third of deaths showed unknown obvious cause behind that (Table 4).

Table 5: Kendall's taub Correlations between seeking medical advice behaviors of the mothers and other variables.

Correlations	Variable	Frequency	%
Residence	Correlation Coefficient	1.000	-.062
	Sig. (2-tailed)	0.638	-
	N	72	52
History of neonatal death	Correlation Coefficient	0.035	1.000
	Sig. (2-tailed)	0.818	.
	N	44	58
Place of delivery	Correlation Coefficient	-0.125	1.000
	Sig. (2-tailed)	0.383	.
	N	50	70
Number of children	Correlation Coefficient	0.259	1.000
	Sig. (2-tailed)	0.076	.
	N	45	60
If mother attended antenatal care	Correlation Coefficient	0.079	1.000
	Sig. (2-tailed)	.595	.
	N	46	59
Socioeconomic status	Correlation Coefficient	-0.273	1.000
	Sig. (2-tailed)	0.077	.
	N	43	57
Education of mother	Correlation Coefficient	-0.146	1.000
	Sig. (2-tailed)	0.407	.
	N	31	43
Age of mother	Correlation Coefficient	-.038	1.000
	Sig. (2-tailed)	0.825	.
	N	34	48
Sex of baby	Correlation Coefficient	-0.138	1.000
	Sig. (2-tailed)	0.338	.
	N	49	66

These findings are similar to the Kenyan study which found very low awareness among mothers attending well

baby clinic to the neonatal danger signs.[17] Many interventions can be used for elimination of the first delay of decision and to seek medical care and this can be achieved through including neonatal counseling during antenatal care visits, raising awareness of the mothers or caregivers regarding newborn danger signs in any gatherings, or through the different types of social media, and by advocacy for attended deliveries by trained midwives. This approach was adopted by Dongre, et al in the rural part of India, which resulted in a significant improvement in mothers' knowledge regarding newborn illness danger signs and subsequent improvement of health care-seeking behavior.[18] Similar improvements in recognition of danger signs and early care seeking owing to behavior change communications were observed in India and Bangladesh.[19-21] More broadly, besides problem recognition, referral for sick newborns also needs to be Strengthening, both from the community and from first level health facilities by improving referral system, ambulance services, triage system, and preparedness of the services to accept and manage the sick newborn.

In our study, the major causes of neonatal deaths were neonatal sepsis followed by birth asphyxia and this is similar to that report by the world health organization (WHO).[22] This study had some methodological limitations as it was involved the neonatal deaths that occurred in 1 year period only, the sample size might seem to be insufficient, also the data was collected from hospital records some of which was not completed. However, the nature of the results can be generalized to most pediatrics' hospital in Sudan because of similar socio-economic and cultural backgrounds.

CONCLUSION

The three delays model is substantial audit process that helped in identification of the existing gaps in the neonatal mortality and planning for strategies to reduce it. Decreased maternal knowledge of neonatal danger signs and delay in decision to seek medical care were the major contributors for neonatal mortality in this study. Further efforts should be exerting to raise knowledge of the mothers about danger signs of neonatal illness and to improve rapid decision to seek medical care.

Recommendations

To improve accessible and affordable healthcare services in peripheries with essential ambulance services and strong referral system. To introduce regular and decisive neonatal audit in healthcare facilities. To raise mothers' and community awareness about neonatal danger signs those need urgent seeking of the medical care. To strength and activate the triage system with priority for newborn assessment. To make use of, and to compare similar studies of low resource countries with similar settings that found effective measures to lower down neonatal mortality.

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