

Maternal socio-economic and neonatal medical characteristics associated with survival of preterm neonates in Torit State Hospital, South Sudan: a descriptive cross-sectional study

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ABSTRACT

Introduction: One in 10 babies is born preterm globally. Preterm birth is a major cause of mortality among children under 5 years old especially in sub-Saharan Africa. The socio-economic and clinical characteristics associated with survival of preterm babies admitted in Torit State Hospital are unknown. This study describes these characteristics to inform quality-of-care initiatives to improve preterm neonatal care.

Method: A retrospective study was conducted of the medical records of 67 preterm neonates admitted from 1st January to 31st December 2021. Neonatal outcome at discharge was recorded as alive, dead, or absconded while neonatal clinical and maternal socio-economic characteristics were recorded as independent variables. The data were analysed using SPSS Statistics software version 21. Descriptive statistics including frequencies and proportions were calculated. Differences in the proportions were tested using the chi-squared statistic. All significance levels were set at $p \leq 0.05$.

Results: Of the 67 preterm babies admitted, 47 (70.1%) were discharged alive with a significant increase in body weight, 18 (26.9%) died and the outcomes of two patients were not recorded. The ability to suckle at the time of admission ($p=0.01$) and having a mother educated to at least primary level ($p=0.035$) were significantly associated with higher preterm survival.

Conclusions: Premature mortality was common among preterm babies who were not able to suckle at the time of admission and lack of formal maternal education was associated with low survival rates. Educating girls to at least primary level can contribute significantly to preterm neonatal survival.

Key words: preterm, neonates, maternal characteristics, maternal education, Torit State Hospital, South Sudan

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INTRODUCTION

Deaths among under-5 year old children have reduced significantly in recent years but this reduction has been slow for deaths during the neonatal period.^[1] Neonatal deaths contribute up to 53.1% of all deaths among children aged under five in low and middle-income countries.^[2] Complications due to preterm birth constitute a major cause (36%) of neonatal deaths.^[3] Globally 15 million babies are born preterm every year (1 in 10 babies born) and about one million of these die^[1] while many who survive face lifetime disability including cerebral palsy, learning disabilities, visual and hearing problems, and respiratory illness.^[4,5] The World Health Organization (WHO) defines a preterm birth as babies born before 37 **completed** weeks of pregnancy.^[4]

There is inequality in survival of preterm neonates depending on where they are born. While more than 50% of those born in low-income countries will die, almost all survive in the high-income countries.^[4] The many risk factors for preterm births in low-income countries include high rates of teenage pregnancy,^[6] heavy physical work,^[7] single mothers,^[8] poor socio-economic status of the mother,^[9] and short pregnancy intervals.^[10] Others include obstetric risk factors such as antepartum haemorrhage, diabetes mellitus, preeclampsia, intrauterine growth retardation, preterm premature rupture of membranes, multiple pregnancies, and maternal infections that are also more frequent in low-income countries.^[5,11]

Preterm birth rates in South Sudan were reported to have increased from 12% in 2014 to 13% in 2017, a total of 59,000 preterm babies.^[12] While 1,300 of these babies survived with a disability, 4,600 died directly from preterm complications.^[13]

The first 24 hours of a neonate's life are critical,^[14] therefore, safe and timely care is needed during the intra-partum and immediate post-partum periods. Evidence shows that clean birth practices during the intra-partum period reduces neonatal mortality due to sepsis by 38% while during the post-natal period neonatal resuscitation reduces mortality by 30-38%, early breastfeeding initiation by 44% and management of hypothermia by 10-20%.^[15,16] However, the availability and access to such care is limited in South Sudan as the protracted political conflict in the country has left large gaps in the health care system.^[17] A national health facility survey in 2014 indicated that only one in four health facilities in South Sudan had the basic supplies and equipment for neonatal care.^[18] There is a severe shortage of health workers as training schools were not functional for a long time^[19] and skilled health workers attend only 19% of births.^[20] Where services exist there is limited information on their quality and their impact on the survival of the preterm neonate.

One study carried out in a displaced people's camp in South Sudan indicated that midwives spent only 6.2% of their time on postnatal care.^[21] In this study none of the essential new-born care elements was practiced consistently: thermal care practice was at 62.5%, infection prevention at 74.8%, feeding support at 63.6% and post-natal monitoring at only 27.7%. The study did not indicate how much of this care was different for the preterm neonates.

The aim of this study was to describe the maternal socio-economic and neonatal clinical characteristics associated with the survival of preterm neonates admitted to the neonatal unit in Torit State Hospital. It is hoped that the results of this study will be useful to partners and policy makers.

METHOD

Study design

This was a retrospective study involving the review of medical records in Torit State Hospital's Neonatal Unit in the department of Obstetrics and Gynaecology. Routine data of all preterm neonates admitted in the unit from 1st January to 31st December 2021 were reviewed (N=67).

Study setting

Torit State Hospital is the only major referral hospital in Eastern Equatoria State. While Torit County, with an estimated population of 238,000,^[22] is the main catchment area, the hospital serves five other surrounding counties as a referral point for complicated medical cases including preterm underweight neonates. The hospital has a 140-bed capacity. The Neonatal Unit offers basic neonatal care, it has four electric baby warmers and oxygen concentrators but it lacks capacity for advanced respiratory support such as mechanical ventilation, continuous positive airway pressure (CPAP), surfactant therapy and exchange transfusion. Babies who require such advanced care are referred to Juba Teaching Hospital.

The unit adapted a WHO standard protocol to guide admissions and treatment for neonates.^[23] Criteria for admission for preterm neonates included babies born before 34 weeks of gestation and/or those with a birthweight of less than 1.8 kg. Preterm babies weighing between 1.8 and 2.5 kg would be admitted only if they had other medical conditions such as respiratory distress, neurological problems such as seizures, or impaired consciousness. The criteria for discharge included weight gain of 1.8 kg or more and absence / resolution of all other medical conditions.

Study population

All preterm and low birth weight neonates admitted to the hospital's neonatal unit were included. A preterm neonate was defined as a neonate delivered before gestational age 37 weeks based on calculation from the last menstrual period reported by the mother and low birth weight (LBW) as less than 2.5 kg.

Data collection

We developed a data collection tool which was used by the nurse-in-charge, to extract data from patient files based on maternal socio-economic and neonatal clinical characteristics that affect the survival of preterm births.^[11, 24, 25] and the first author (BD) reviewed and validated the data.

The main outcome variable was survival while those who absconded were excluded. The independent variables

included the mother's age, education, marital status, employment, and place of birth, as well as the neonate's weight, any febrile illness (defined as body temperature above 38°C and/or presence of local sepsis such as cord infection) and mode of feeding at the time of admission, presence of any congenital abnormalities, and other treatment given. The APGAR (synonym for appearance, pulse, grimace, activity, and respiration)^[26] score at admission and whether baby received treatment with oxygen, aminophylline and incubator and/or Kangaroo mother care (KMC) were recorded.

Data management and analysis

The data were analysed using SPSS Statistics software. Descriptive statistics including frequencies and proportions were calculated. Statistical significance of the difference in the proportions of preterm neonates who survived versus those who died were tested using the chi-squared statistic. Significance levels were set at $p \leq 0.05$.

Ethical considerations

Ethical clearance was sought from the State Ministry of Health Ethical Board and permission to retrieve the data was granted by the hospital authorities. Only initials were included as identifiers on the data collection forms and data were password locked.

RESULTS

Characteristics of the participants

Of the 67 preterm babies who were admitted during the study period, 47 (70.1%) were discharged alive, while 18 (26.9%) died, and the outcomes of two were not recorded (Table 1). Fifty (74.6%) were health facility births, all but one (98.5%) weighed more than 1 kg, but less than 2.5 kg. At admission only 42 (62.7%) were breastfeeding, 44 (65.7%) were febrile and three (4.5%) had congenital abnormalities. Twenty (29.9%) of the babies had an APGAR score of less than 7 while 14 (20.9%) had no information recorded regarding their APGAR score. Only 23 (34.4%) received oxygen therapy, 33 (49.2%) received aminophylline and 22 (32.8%) received care in baby warmers and/or through KMC. Fifty-nine (88.1%) were born to mothers aged above 18 years, 77.6% of the mothers had either not gone to school at all or stopped at primary level and only nine mothers (13.4%) had formal employment.

Characteristics of neonates discharged alive compared to those who died.

Table 2 shows the characteristics of neonates who died compared to those discharged alive. There was no difference in terms of maternal age, marital status, and

employment status of the mothers in the two groups. However, the neonates of mothers who had some formal education were more likely to survive than those whose mothers had no formal education at all ($p=0.035$).

Mortality was significantly higher among babies who were not able to suckle breast milk at the time of admission ($p=0.001$) and among those who had medical conditions, other than a febrile illness, although this difference was not statistically significant. Survival was significantly higher among babies who had APGAR scores of 7 or more ($p=0.001$) and therefore, did not need treatment with oxygen ($p=0.013$).

DISCUSSION

This study sought to determine the maternal social and neonatal medical characteristics that may affect preterm neonatal survival in Torit State Hospital. We found a preterm neonatal mortality rate of 26.9%, which is similar to findings in other studies in the region: in Uganda 31.6%,^[27] and 22.2% in northern Ethiopia,^[28] and 27.6% in Ghana.^[29]

The survival of a preterm neonate is related to the birthweight and gestation age with survival being particularly low if the birth weight is less than 1kg and/or gestation age is less than 28 weeks, especially in the developing world where resources for care are limited.^[30, 31]

The babies of educated mothers were more likely to survive than those of uneducated mothers. It has been established that early neonatal deaths are an indicator of poor social condition of families and populations.^[32] But it has also been noted that maternal education significantly determined neonatal survival even after controlling for other important factors such as socio-economic characteristics of the male partner.^[33]

This study also showed a significantly high neonatal mortality among those that were not suckling breast milk at the time of admission. Poor suckling, which leads to hypoglycemia, is a common cause of death among premature babies.^[13,23] Therefore, premature babies need additional feeding and nutritional support through either IV fluids or nasogastric tube feeds^[13] and healthcare providers need to be trained to be able to provide this care.

In this study, there were more deaths among those born at home than those born at a health facility although this was not statistically significant due to small number of the study.

This study used routine medical data to inform continuous quality improvement initiatives of the hospital and its implementing partners. South Sudan is coming out of prolonged civil war, the health system structures are still under development. Our study aims to stimulate local efforts to improve directly the quality of neonatal data

Table 1. Characteristics of participants

Participant characteristics		n (%)
Mother's age in years	<18	8 (11.9)
	≥18	59 (88.1)
Mother's level of education	Primary	28 (41.8)
	Secondary	12 (17.9)
	University	3 (4.5)
	Not gone to School	24 (35.8)
Mother's occupation	No formal employment	33 (49.3)
	Formally employment	9 (13.4)
	No information	25 (37.3)
Mother's marital status	Single	3 (4.5)
	Married	64 (95.5)
Mother's Parity	≤4	30 (44.8)
	>4	30 (44.8)
	No information	7 (10.4)
Baby's medical condition at ad-mission	Febrile illness	44 (65.7)
	Other illness	7 (10.4)
	No other illness	16 (23.9)
Place of birth	Home	17 (25.4)
	Health facility	50 (74.6)
Gestation age at birth	≤28 weeks	1 (1.5)
	>28 weeks	58 (86.6)
	No information	8 (11.9)
Participant characteristics		n (%)
Birth weight	≤1 kg	1 (1.5)
	>1 - <2.5 kg	66 (98.5)
APGAR Score at admission	<7	20 (29.9)
	≥7	33 (49.2)
	No information	14 (20.9)
Baby breastfeeding	Yes	42 (62.7%)
	No	25 (37.3)
Presence of congenital abnormalities	Yes	3 (4.5)
	No	64 (95.5)
Baby given oxygen treatment	Yes	23 (34.3)
	No	44 (65.7)
Baby given aminophylline treatment	Yes	33 (49.2)
	No	30 (44.8)
	No information	4 (6.0)
Baby received care in baby warm-er and/or Kangaroo mother care	Yes	22 (32.8)
	No	45 (67.2)
Outcome at discharge	Alive	47 (70.1)
	Died	18 (26.9)
	Escaped/ Lost to follow-up	2 (3.0)

Table 2. Maternal social and neonatal medical characteristics of preterm neonates who were discharged alive compared with those who died

Maternal social and neonatal medical characteristics		Alive n (%)	Died n (%)	p-value
Maternal age (years)	≤ 18	6 (75.0)	2 (25.0)	0.856
	>18	41 (71.9)	16 (28.1)	
Mother's employment status	No formal employment	24 (75)	8 (25)	0.095
	Formally employed	9 (100)	0 (0)	
Mother's education level	Some formal education	34 (81)	8 (19)	0.035
	No education at all	13 (56.5)	10 (43.5)	
Mother's marital status	Single	2 (66.7)	1 (33.3)	0.823
	Married	45 (72.6)	17 (27.4)	
Gestational age in weeks	≤ 28	1 (100)	0 (0)	0.569
	>28	43 (75.4)	14 (24.6)	
Baby's condition at admission	Febrile illness	36 (76.6)	7 (38.9)	0.057
	Other illness	3 (6.4)	4 (22.2)	
	No other illness	8 (17.0)	7 (38.9)	
Place of birth	Home births	10 (58.8)	7 (41.2)	0.148
	Health facility births	37 (77.1)	11 (27.7)	
Breast feeding/suckling	Yes	36 (85.7)	6 (14.3)	0.001
	No	11 (47.8)	12 (52.2)	
APGAR score at admission	<7	10 (52.6)	9 (47.4)	0.001
	≥7	31 (93.9)	2 (6.1)	
	No information	6 (46.2)	7 (53.8)	
Baby treated with oxygen	Yes	11 (52.4)	10 (47.6)	0.013
	No	36 (81.8)	8 (18.2)	
Baby treated with aminophylline	Yes	21 (67.7)	10 (32.3)	0.393
	No	22 (73.3)	8 (26.7)	
	No information	4 (100.0)	0 (0)	
Baby received care in baby warmer and/or Kangaroo mother care	Yes	12 (57.1)	9 (42.9)	0.059
	No	35 (79.5)	9 (20.5)	

collection and the quality of care for preterm neonates.

The study had limitations. The sample size was small, and some variables were often missing or unusable. Lastly, although a standard protocol is available for the care of preterm babies, it was not possible to ascertain if all the patients received the same standard of care.

CONCLUSION

Preterm neonatal mortality at Torit State Hospital is high among those whose mothers have no formal education. The inability to suckle breast milk at admission was associated with high risk of death. Girls' education should be prioritized as they are future mothers. Preterm neonates who are not able to suckle at admission require extra care from providers to improve chances for survival.

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