

Factors contributing to morbidity and mortality among preterm neonates admitted at two major hospitals in Rwanda

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Abstract

Objective: Prematurity is one of the highest global health challenges of the 21st century and has been named the first killer of young children. In Rwanda, it is the leading cause of death in neonates. It is expedient to explore the factors contributing to the observed high morbidity and mortality to plan appropriate interventions. The objective of the study was to identify factors contributing to morbidity and mortality among preterm neonates and neonatal outcomes at discharge.

Methods: Adopting the descriptive design and quantitative approach, 125 preterm babies admitted in the Neonatal Intensive Care Unit (NICU) of the University Teaching Hospital of Kigali and Muhima hospital over ten weeks were recruited in the study using consecutive sampling method. Interviewer administered questionnaire to the mothers, files of mothers and babies were used as sources of data. Frequencies, chi-square, and logistic regression were used for analysis. A p-value <0.05 was considered significant.

Results: Marital status of mothers, mother's participation in the care of her baby, and APGAR score 6 with a p-value (0.007), (0.02), (0.002) respectively, were statistically significantly associated with mortality. Controlling for confounders, neonates with APGAR score 6 had a lower odds of dying compared to those with an APGAR score 6 (OR=0.268 CI:0.102,0.700). Morbidities and mortality was high as gestational age, and birth weight decreased. The main morbidities were neonatal sepsis (88.8%), and Respiratory Distress Syndrome (RDS) (62.4%).

Conclusion: Mothers social background, participation in care, low apgar score and birth weights are critical factors with neonatal sepsis and RDS accounting for highest morbidities in preterm care.

Keywords: Preterm neonates, born too soon, neonatal mortality, neonatal morbidity

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Facteurs contribuant à la morbidité et la mortalité chez les nouveau-nés prématurés admis dans deux grands hôpitaux du Rwanda

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Resume

Objectif: La prématurité est l'un des plus grands défis de santé mondiale du 21^{ème} siècle et a été nommé le premier tueur de jeunes enfants. Au Rwanda, c'est la principale cause de décès chez les nouveau-nés. Il est opportun d'explorer les facteurs contribuant à la morbidité et la mortalité élevées observées pour planifier des interventions appropriées. L'objectif de cette étude était d'identifier les facteurs contribuant à la morbidité et à la mortalité chez les nouveau-nés prématurés et les résultats néonataux à la sortie.

Méthode: Adoptant la conception descriptive et l'approche quantitative, 125 bébés prématurés admis dans l'unité néonatale de soins intensifs (UNSI) de l'hôpital universitaire de Kigali et de l'hôpital Muhima pendant dix semaines ont été recrutés dans l'étude en utilisant une méthode d'échantillonnage consécutive. Questionnaire administré aux mères, les dossiers des mères et des bébés ont été utilisés comme sources de données. Les fréquences, le chi carré et la régression logistique ont été utilisés pour l'analyse. Une valeur $p < 0,05$ était considérée comme significative.

Résultats: L'état matrimonial des mères, la participation de la mère aux soins de son bébé et le score APGAR = 6 avec une valeur p (0,007), (0,02), (0,002) respectivement, étaient statistiquement significativement associés à la mortalité. En contrôlant les facteurs confondants, les nouveau-nés avec un score APGAR = 6 avaient une probabilité de mourir plus faible que ceux ayant un score APGAR = 6 (OR = 0,268 CI: 0,102,0,700). Les morbidités et la mortalité étaient élevées à l'âge gestationnel et le poids à la naissance diminuait. Les principales morbidités étaient la septicémie néonatale (88,8%) et le syndrome de détresse respiratoire (SDR) (62,4%).

Conclusion: Les antécédents sociaux des mères, la participation aux soins, le faible score APGAR d'apparition et le poids à la naissance sont des facteurs critiques, le sepsis néonatal et le SDR étant responsables des taux de morbidité les plus élevés en soins prématurés.

Mots clés: Nouveau-nés prématurés, nés trop tôt, mortalité néonatale, morbidité néonatale

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INTRODUCTION

A premature baby is a baby born earlier 37 ended week or less than 259 days of gestation (1). Morbidity and mortality among preterm newborns is a global challenge documented as one of the highest health challenges of the 21st century. The complications related to prematurity exceed the total of other causes of deaths in children under-five years, and prematurity was recently named as the first killer of children younger than five years (2). World Health Organization reported that the morbidity among babies born prematurely remains high in all countries worldwide especially in lower-income countries (3).

Nearly 15.1million babies, which translates to one out of ten babies born every year, are born pre-term of whom 1.1million of them die. In Africa and South- Asia, prematurity accounts for more than 60% (3). Other high-income countries have higher averages of under-five deaths directly stemming from prematurity even above 17%, which is the global average (2). However, the real causes of preterm birth or events leading to preterm birth are not yet completely understood. For this reason, the global agencies, associations, and universities are working together in four core-study initiatives to discover the origins of preterm deliveries as well as how to prevent and limit the consequences (2).

Rwanda is among few African countries that achieved Millennium Development Goal 4 (MDG), but neonatal mortality rate remains high and contributes to 30% of mortality of children under-five years. Prematurity is the leading cause contributing up to 36% of these deaths. Mortality among preterm babies was 10.6% (4). Generally, prematurity was the main cause of deaths in the general population in all health facilities in Rwanda and accounted for a total of 43% of all deaths as documented by the Ministry of Health in 2014. However, in Rwanda, like many low income countries, there is dearth of data on many critical issues about preterm neonates.

Furthermore, premature birth is a primary root of continuing loss of human potential in survivors in all stages of life, and also loss of money (5). Therefore, newborns' health takes its place among the unfinished agendas of the MDGs and thus becomes a priority in Sustainable Development Goals (SDGs). The WHO is concentrating its effort in reducing the premature neonatal deaths because two-thirds of these deaths could be prevented (6)

The WHO has a goal of reducing 50% deaths in preterm babies by the year 2025 and the

global Sustainable Development Goals (SDG) have set a target of terminating preventable illness in neonates by 2030 (3).

All preterm newborns are at risk due to immaturity of their organs (7). The outcomes in newborns are related to several interactions of characteristics or factors thus health of a newborn is highly correlated to the mother's health especially as such relate to the intrapartum and postpartum attention received by the mother (8) (9). This study investigated factors related to the mother and the preterm in relation to the outcomes of care.

MATERIALS AND METHODS

This study was conducted at two Neonatal Intensive Care Unit (NICU) of two hospitals located in Kigali, the University Teaching Hospital of Kigali mainly known as Centre Hospitalier Universitaire de Kigali (CHUK) and Muhima hospital. Ethical approvals were sought from the Institutional Research and Ethical Committee (IREC) of Moi University, Kenya, and the Institutional Review Board (IRB) of College of Medicine and Health Sciences (CMHS), Rwanda. Informed consent to participate in the study was obtained and signed by mothers. The University Teaching Hospital of Kigali is the largest public teaching referral hospital in Rwanda. Its monthly average of neonates' admission in NICU is 50, whereby three-quarters of them have been born preterm. CHUK has a catchment area of 29 district hospitals. Within this hospital, there are 17 clinical departments. Each department is tasked with two or three services. In pediatrics department, there are general pediatrics and NICU. The bed occupancy is almost always 100%. Regarding Muhima hospital which has been in operation since 2001, the hospital has a catchment area of 302,778 populations from ten health centers. Muhima hospital is a primarily a maternal-child Hospital. Its monthly birth rate is 630 babies while the annual birth rate is 7563 babies. The average monthly number of admission in NICU is 125 where preterm neonates are 80. Among routine care given to newborns after birth include immediate neonatal care such as administration of Vitamin K, Tetracycline Eye Ointment. Neonatal resuscitation, feeding. In NICU, there is provision of warmth, oxygenotherapy, Intravenous fluid administration and medications administration according to specific baby's condition, health education to the parents.

Actually mothers come for delivery after receiving antenatal care which include administration of albendazole, folic acid, tetanus toxoid immunization, provision of bednets, treatment of any existing conditions and health education.

The study design was cross-sectional descriptive using quantitative approach. The sample size was calculated using Peduzzi formula for logistic regression;

$$N=10K/P(10).$$

Where

K is the number of covariates and

p is the proportion of cases in the population.

In this formula,

Ten is a constant; K equals to 8 according to this study.

P-Prevalence of morbidity among preterm neonates (64%) referred to the study done by Zamudio (11)

$$\text{Then } 10 \times 8 / 0.64 = 125$$

To select the sample, all consecutive preterm neonates admitted to two NICUs over a period of ten weeks in each of the hospitals used during the period of the study were included in the study. By weeks based on gestational age very preterm who were between 24-28 weeks, moderate preterm between 29 and 33 weeks and late preterm neonates between 34 to 36 weeks and 6 days were all recruited. The research tool was adapted from the theoretical framework established by Vandresse (8) and permission to use was granted.

To ensure reliability of the tool, the pilot study was carried out at CHUK with 10% of the sample size. This pre-test was also to detect for inconsistencies, sensitivity as well as estimation of needed time. Data collection followed a process of recruiting preterm neonates who were admitted the first day of data collection following the step by step of identification/recruitment of the participants from NICU registry.

Getting informed consent

The population of this study was categorized among vulnerable group and the investigator was sought out the signed consent from the mothers of babies.

Administration of questionnaire

A number of 125 mothers were

interviewed using one-on-one interview of the mother using the interviewer administered questionnaire. This was about socio-demographic characteristics, maternal reproductive history, problems during this pregnancy, environmental characteristics during pregnancy, behavioral characteristics during pregnancy, health education received by mother during hospital stay of her baby.

Filling of checklist from ANC cards and maternity records

Data from antenatal card was also gathered to enhance and to complete what was missing from interview. Then information from maternity files was all about obstetrical characteristics which was labor, intrapartum care, and any complications occurred in immediate postnatal period.

Information retrieving from files of neonates

In NICU, information from medical files of preterm neonates was retrieved at admission time until discharge. Therefore information documented was care received by baby, any morbidity where outcomes were documented at exit point.

Data was analyzed using STATA version 13 (Stata Corp). Data were summarized using descriptive statistics including frequencies, percentages, pie charts and bar graphs. Statistical test such as Chi-square was used to assess the association between categorical independent variables and outcomes in preterm babies in cases where the cell count was below five the Fishers' exact test was used. Logistic regression was used to assess factors associated with neonatal outcome. The level of significance was set at 0.05

RESULTS

Characteristics of preterm baby

Out of the 125 preterm neonates, 27 (21.6%) were twins, and the majority were male 67 (53.6%). At birth, 81 (64.8%) of the neonates had APGAR score greater or equals to seven out of ten, and majority (64.8%) had received some resuscitation. Most of the newborns, 64 (51.20%) were moderate preterm, with majority 84 (67.20%) having a low birth weight and a big proportion having birth weight appropriate for their gestational age, 83 (66.40%).

Mortality was higher in multiple birth than in singleton one where mortality rate was 33.3% and 17.3% respectively. Furthermore mortality rate was higher, 75% (9/12) in severe preterm babies, 25% (16/64) in moderate

preterm babies, and 2% in late preterm babies. Mortality according to birth-weight showed 85.7% in babies with extremely lower birth weight, 53.5% in babies with very lower birth weight, 5.9% in those with lower birth weight whereas no mortality was recorded amongst the normal birth weight babies. Mortality was higher in males where 25.3% of them died. In females, the mortality rate was 15.5%.

Care Provided for the Preterm Neonates

At birth, 15 (12%) of the neonates had not received both Vitamin K and tetracycline eye ointment. Methods of warmth provision included the use of radiant warmer, incubator, cribs and cots (wrapped in warm linen) and Kangaroo Mother Care and each neonates received more than one mode of warmth provision. Majority, 103 (82.4%) had warmth provided by radiant heater with very few reporting use of crib 31(24.8%). None of the neonates received cord care with chlorhexidine or get immunized. Among 125 interviewed mother, seventy-five percent (75%) of them reported having participated in the care of their newborn baby at least every three hours. However, 38 (30.4%) of these mothers did not receive any health education from nurses while (32%) reported having been educated on hygiene and breastfeeding. In the NICU 91.2% (114/125) received Intravenous fluid while 14/125(11.2%) who were HIV exposed received nevirapine.

Socio-Demographic Characteristics of Mothers.

In this study, only mothers were interviewed Overall, 89 (71.2%) of mothers and 84 (67.2%) of fathers were aged between 21-35 years with a small proportion aged below 20 years. The majority of mothers 64(51.2%) had primary level education while 60 (48%) were living in cohabitation marital status. A large proportion of the mothers were casual workers 53(42.4%) with majority 59 (47.2%) having a family income below 62.5US\$ per month. (While carrying the pregnancy of that resulted to the preterm birth 25 (20%) of mothers reported to have been living or working around the air polluted environment

Obstetrical characteristics and morbidity in pregnancy among mothers

The majority of mothers 51(40.8%) were primigravida, and 58 (56.4%) of the pregnancies were unplanned. Almost all mothers 123 (98.4%) did not seeking pre-conception care of any form

while 16 (12.8%) of the pregnancies were unaccepted. Among mothers who attended antenatal care (ANC) 124 (99.2%) started ANC visit after eight weeks of gestation, with most of them 72 (57.6%) having attended two to three ANC visits. Those who did not attend any ANC visits were 7 (5.6%). Concerning care given during ANC, the majority 30 (24%) had been offered three out four services together (up to date immunization, folic acid and deworming). Only 16 (20%) had gotten long lasting insecticide treated nets (LLINs) while 10(8%) did not get anything.

Mother's health status

Looking at the health status of mothers to preterm babies during current pregnancy, they also had morbidities that affected babies outcome. The most prevalent conditions in mothers were urinary tract infections (UTI)/vaginal infections - 55(44%), malaria - 44(35.2%), anemia 29(23.2%), pre-eclampsia - (19.2%), periodontal infections - 22(17.6%) and Human Immunodeficiency Virus (HIV) 14(11.2%). Moreover a proportion of 36 (28.8 %) babies were born from mothers who had Preterm premature rupture of membranes (PPROM). A number of 8(18.1%) of babies born to mothers with malaria died and mortality was high among babies of mother's with malaria though lower than mortality from other morbidities and 18(22.2%) babies born from mothers with other morbidity, not malaria died. In preterm babies, neonatal mortality associated with anemia was 1(3.4%) compared to neonatal mortality of babies born from mothers with other morbidity that was 25(26%). Neonatal mortality associated with UTI in mothers was 10(18.1%) compared to 16(22.8%) mortality of babies born from mothers who did not have UTI. The majority of babies who died (25%) were born to mothers with eclampsia as compared to those born from mothers without eclampsia (19.8%). Fetal distress was present in 17(13.6%) while babies born from mothers with fever occupied 9 (7.2%). Among babies born from mothers who received treatment during labor, the majority of babies were born from mothers who had received antibiotics 53(42.4%), antenatal corticosteroids 29(23.2%) and Sulphate Magnesium (MgSO₄) 19 (15.2%). The babies born by Caesarian Section (C/s) was 37.6%. The mortality rate among preterm babies was 20.5% for the baby born by Spontaneous vertex delivery (SVD) and 21.2% for a baby born by C/s

Social Habits and Drug Use

Majority of the mothers 67(53.60 %) had at least drank alcohol or were exposed from tobacco nicotine by their sexual partner, family member or neighbors. during pregnancy of the current baby while 8 (6.4%) had eaten non-edible foods like soil. Majority of mothers 67(53.6%) took pharmaceutical medications while 17(13.6%) took traditional medications.

Outcomes

Most of the babies 111(88.8%) were suspected or confirmed to have sepsis, in the study period the culture was not regularly done due to equipment scantiness and 78 (62.4%) of all preterm neonates had RDS. Other morbidities were jaundice (27,21.6%) and asphyxia neonatorum (22, 17.6%). Most babies 99 (79.2%) had multiple co-morbidities, and 26 (20.8%) had single morbidity. Respiratory Distress Syndrome rate was increased as birth weight decreased with ELBW babies (85.7%) VLBW (71.4%), LBW (58.3%). Similarly, neonatal asphyxia was increased as the BW decreased where it was (40%) in ELBW, (28.5%) in VLBW, and (1.19) in LBW. High RDS rate was associated with decreased gestational age. (Severe prematurity (83.3%), moderate prematurity (67.1%) and 50% in late prematurity). Neonatal asphyxia rate was also high as the gestational age decreased and was respectively (25%), (20.3%) and (12.2%) in severe, moderate and late preterm neonate. Neonatal sepsis was prevalent among babies born to mothers with UTI and PPROM with (92.7%) and (94.4%) respectively). The duration of admission was 7days in 56% (70/125). Overall neonatal mortality rate among preterm babies was 20.8%. All babies who stayed less than 24 hours died. Those who stayed between one to seven days, 20% of babies whose admission stay was less than 7days died), while those who stayed between eight days to fourteen days (17.2%) died, and from fifteen days and above none died. Table 1 shows univariate analysis logistic regression of significant variables of babies related factors associated with outcomes. Table 2 is about also logistic regression for mothers related factors to outcome. From the table 3, the only variable statistically significant in the multivariate analysis was APGAR score.

DISCUSSION

The challenge of providing quality care for increasing number of preterm babies to increase survival in third world countries has become an issue that cannot be underplayed in perinatal care (6). Quality care to reduce pre-term

birth should cover pre-conception, ante-natal, intranatal and postnatal care hence the consideration for maternal factor, baby factor and baby care. The findings from this study are discussed looking at mother related, baby related factors and care given to preterm babies but this does not remove the interconnected nature of all these factors for the outcome.

Mother's related factors

The finding that majority of mothers were in the low socio-economic group is similar to findings from previous study (19) that showed that mortality in preterm babies is linked to low socioeconomic status because in general these people have factors such ignorance, poverty, living in remote area which can hinder the use of maternity services. Majority of the mothers never had pre-conception care to prepare them for reproductive life and for many the pregnancies that resulted to preterm birth were unplanned. This is similar to findings from previous study done (21) where 41% of all women reported that their pregnancies were unplanned. Lawn (22) stated that unaccepted pregnancy is a predictor of mortality in a newborn. Pre-conception services for women are non-existence within the minimum package in public health facilities. Most mothers in this study claimed to have attended ANC clinic from eight weeks and received folic acid. A meta-analysis study done by Imdad and Bhutta in (23) highlights that folic acid supplementation reduces the risk of neural tube defects by 53%. A figure of 25 (20%) of mothers reported that during pregnancy, they had been exposed to factories pollution either at home or work. This exposure has actually adverse effect to unborn baby and similarly to the study done by Pope et al in 2010 (20) indicated that 20% of LBW in neonates are from exposure to indoor air pollution throughout pregnancy. In this study, some mothers claimed they were exposed to second-hand smoking in the current pregnancy and previous studies (24, 25) reported that many pregnant women are victims of nicotine from second-hand smoking, and this is associated to low birth weight. Concerning mothers that were not been given corticosteroids during labor, this is a missed opportunity since/antenatal corticosteroid administration have been widely approved since 1994 by evidence gotten in more than twenty clinical trials together with extra research that when it is given to the pregnant mother at high risk of preterm delivery leads to baby's lung maturation and formation of surfactant which prevents lungs to collapse by then prevents neonatal mortality. (26, 27, 28).

Furthermore, recent study indicated that antenatal corticosteroids are also effective in late preterm neonates (between 34 to 36 weeks) (29). The caesarean section rate was high comparing to WHO recommendation to be between 10-15% (30), controversially majority of the babies who died in this study were born by caesarian section compared to those born by normal delivery. This is due to the labour-associated catecholamine and steroid surge do not occur during C/s thus causing decreased pulmonary surfactant release which leads to high morbidity of respiratory distress syndrome. The figures from this study are similar to previous studies that showed that there is a relationship between preterm birth and high cesarean birth rates (31). Preterm baby birth to the mothers with preterm premature rupture of the membranes (PPROM) from previous studies is strongly associated with chorioamnionitis leading to poor outcomes in preterm baby (27). Neonatal sepsis are also mostly found in babies whose mothers had urinary tract infections (UTI) during pregnancy and in babies whose mother had PPRM. Studies have shown an association of PPRM with neonatal sepsis (32). From the table, there were significant association between mothers' marital status, mothers' participation in care, APGAR score and outcomes of care for the preterm babies.

Baby's related factor

Around one in every five neonates was small for gestational age and this is similar to the study done in Nepal where one in every six infants was small at birth (13). Results from this study showed that APGAR within one minute after birth, equal or lower than 6 is a factor contributing to mortality in preterm neonates. APGAR score of a newborn is a measure of the functioning of the main organs and systems that sustain life. Effective monitoring of labor can prevent birth asphyxia, moreover newborn resuscitation should help improve survival in preterm with low APGAR score (22).

This study shows that mortality rate is inversely related to gestational age (mortality increases as gestational age decreases), This is similar to WHO (14) report, where over 90% of preterm babies born before 28 weeks in low-income countries died within an early neonatal period. Similarly, findings from this supported previous findings (5, 10) showing that mortality is inversely related to birth weight (mortality increases as the gestational age decreases). Mortality among preterm babies in this study was higher in male babies (25.3%) compared to the

15.5% mortality in females. Khalessi (15) had similar findings in a study on risk factor of intracranial bleeding in preterm newborns. Khalessi therefore concluded that male babies are exposed to IVH than females because for reasons yet to be established, male baby organs appear to be weaker and unable to withstand adverse complications of prematurity such as respiratory distress and IVH. Survival of the baby in such circumstances becomes difficult and male baby mortality rises. In this study it was also interesting to note that Respiratory Distress Syndrome was also a major contributory factor of neonatal mortality among the preterm babies.

Care related factors for babies

Provision of quality care, moreover comprehensive is paramount to survival of the preterm neonate. Health professional teams should also integrate parents into newborn's care especially in availing useful information regarding neonatal care

1. Feeding the preterm baby

A tenth of babies were exclusively fed on formula milk, according to studies done, formula feeding in preterm babies have been associated with high incidence of morbidity. Literature documented the effectiveness of breast milk to the newborn baby and this one should be fed exclusively on breast milk which actually contains all nutrients needed by the baby (13).

2. Educating mothers of babies during NICU stay

Less than 50% of mothers reported not having been taught by nurses about hand washing before touching the baby. Educating the parents is integral part of newborn care to improve the outcome, therefore family members should be integrated in decision making and support while also availing useful information regarding all about ongoing care provided to the baby and hygiene furthermore World Health Organization recommends regular hand washing in NICU for the purpose of infection control (5). In this study showed that lack of health education especially non-adequate participation was associated to neonatal mortality.

Cord care

Among all participants, none had received cord care with chlorhexidine. This is also a missed opportunity because cluster-randomized trials have shown benefits of chlorhexidine application to the baby's cord and associated with decreased mortality (16, 17). Use of 4% chlorhexidine has been approved to be more useful if provided to the newborn in 24

hours of life even to apply it once is effective (18).

CONCLUSION

Generally mothers social background, inadequate participation in care, low APGAR score and birth weights are critical factors with neonatal sepsis and RDS accounting for highest morbidities in preterm care. The researcher recommends to prior prevent fetal distress and when it occurs should be managed well. In addition nurses working in maternity and NICU should enhance involvement of mothers in the care of their babies and this will have a positive impact when discharged home as they will be single-handed to care their fragile babies. As this study was limited to hospital stay period, another research should be done on assessment on mothers home care practices and outcome in preterm neonates after discharge from NICU.

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Table 1. Univariate analysis of babies related factors associated with outcome

Variable	Outcome		p-value
	Cured/ Improved	Dead	
NOB			
Singleton	81 (82.7)	17 (17.3)	0.07
Twin	18 (66.7)	9 (33.3)	
Gender			
Female	49 (84.5)	9 (15.5)	0.176
Male	50 (74.6)	17 (25.4)	
APGAR			
6 and below	28 (63.6)	16 (36.4)	0.002
7 and above	71 (87.7)	10 (12.3)	
BW to GA			
AGA	66 (79.5)	17 (20.5)	0.089
LGA	17 (94.4)	1 (5.6)	
SGA	16 (66.7)	8 (33.3)	

As APGAR score has P-value of 0.002 therefore is associated with the mortality.

2. Univariate analysis of mothers related factors associated with outcome

Variables	Outcome		p-value
	Cured/ Improved	Dead	
Mothers participation			
At least every 3hrs	79 (84)	15 (16)	0.02
Fewer than every 3 hrs	20 (64.5)	11 (35.5)	
Health Education			
None	27 (71.1)	11 (28.9)	0.138
Yes	72 (82.8)	15 (17.2)	
Maternal age			
18-20	12 (92.3)	1 (7.7)	0.468
21-35	69 (77.5)	20 (22.5)	
>35	18 (78.3)	5 (21.7)	
Marital status			
Cohabitation	41 (68.3)	19 (31.7)	0.007
Common-law married	41 (85.4)	7 (14.6)	
Single	17 (100)	0 (0)	
Education			
illiterate	11 (73.3)	4 (26.7)	0.198
primary	47 (73.4)	17 (26.6)	
secondary	37 (88.1)	5 (11.9)	
tertiary	4 (100)	0 (0)	
Factories			
Factories around	23 (92)	2 (8)	0.078
No factory around	76 (76)	24 (24)	
ANC visits			
One	21 (87.5)	3 (12.5)	0.188
2-3	63 (75)	21 (25)	
4 and above	10 (100)	0 (0)	
None	5 (71.4)	2 (28.6)	
Smoking			
Drinking and smoking	14 (93.3)	1 (6.7)	0.392
Drinking alcohol in this pregnancy	13 (86.7)	2 (13.3)	
None of the above	44 (75.9)	14 (24.1)	
Passive smoking in this pregnancy	28 (75.7)	9 (24.3)	
Delivery			
C/S	37 (78.7)	10 (21.3)	0.919
SVD	62 (79.5)	16 (20.5)	

The table results from the Chi-square test to assess factors associated with outcome. From the table, we observe that the variables: marital status, mother's participation are statistically significant

Table 3. Multivariate logistic regression analysis

Variable	OR	95% CI	p-value
Apgar >6 versus ≤6	0.268	(0.102, 0.700)	0.007
Mothers participation (Less than 3 hours versus at least 3 hours)	2.359	(0.855, 6.511)	0.097
Married by common-law married versus cohabitation	0.395	(0.141, 1.107)	0.077

From the table, we observe that the only variable statistically significant in the multivariate analysis was APGAR score. Controlling for marital status and mother's participation neonates with APGAR score greater than 6 had a lower odds of dying compared to those with an APGAR score less than or equal to 6 (OR=0.268 CI:0.102,0.700).