



# Immediate Seven Day Outcomes and Risk Factors of Low Birth Weight Neonates at Referral Hospitals in Mwanza City, Tanzania in October 2020

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## Summary

### BACKGROUND

Every year more than 20 million neonates worldwide are born with low birth weight (LBW) per year. Ninety-five percent of LBW births occur in developing countries. The aim of this study was to determine Immediate Seven Day Outcomes and Risk Factors of Low Birth Weight Neonates at Referral Hospitals in Mwanza City.

### MATERIALS AND METHODS

This was a hospital based observational prospective cohort study of neonates with LBW whom were followed up for seven days in the neonatal wards at referral hospitals in Mwanza city. Maternal social-demographic, newborns clinical data and vitality outcomes were collected. Categorical and continuous variables were summarized and presented in tables or bar charts. Any *p-value* of < 0.05, at 95% confidence interval was regarded as statistically significant.

### RESULTS

Total of 200 neonates with median age of 0.8 days at baseline were enrolled. Amongst 148 (74 %) had prolonged hospitalization; due to sickness 88 (59%), and 60 (40%) due to poor weight gain. Whereas, the remaining 42 (21%) were discharged and 10 (5%) died within seven days. Prolonged hospitalization was associated with family income (*p-value*= <0.001) and place of delivery (*p-value* = <0.001).



**Neonatal death was associated with family income ( $p$ -value =0.035) and birth weight ( $p$ -value = 0.019). Early discharge associated with gestational age at first antenatal visit, family income, mode of delivery, APGAR score at one minute, time interval between delivery and admission and timing of medication initiation.**

#### **CONCLUSION**

**LBW neonates are at high risk of death and prolonged hospitalization due to sickness or due to poor weight gain. Associated factors of these outcomes were family income, place of delivery, birth weight, gestation age during first antenatal visit, mode of delivered and low APGAR score.**

*Keywords: Neonatal Outcomes, Low Birth Weight, Tanzania*

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## **Introduction**

Newborn babies with low birth weight (LBW) encounter much life challenges in their early life than babies with normal birth weight. World Health Organization (WHO) defines LBW as weight of a baby at birth of less than 2,500 grams [1]. Globally, the prevalence of LBW ranges between 15-20% of all newborns [2]. Different associated factors occurring during antenatal, labor, and postnatal period determine outcomes of neonates with LBW [3-5]. LBW is associated with long-term chronic disease including cardiovascular disease and Diabetes mellitus, impaired language development, reduced academic achievement and long-term neurological disability [6, 7]. They have 20 times risk of dying from complications than normal birth weight newborns [8, 9]. Globally thirty percent of deaths are attributed to neonates with LBW[10]. The study done in four districts at Uganda, Tanzania and Kenya revealed among new born died, 53% were neonates with LBW [11]. LBW neonates also encounter prolonged hospitalization with increased treatment cost [10]. The situation become more worse in neonates with extreme low birth weight (ELBW) neonates[12]. The prevalence of LBW remains a global concern and effective care immediately

after delivery is strongly recommended to save lives.

Immediate seven days post-delivery has been a focal point for many studies in trying to save lives of many LBW neonates. At this point, it is well documented that neonates are at higher risk for complications due immaturity of various organs. Studies have shown that neonates with LBW die due to respiratory distress syndrome, hypoxic ischemic encephalopathy and sepsis[13]. In Tanzania, Neonatal morbidity and mortality rate is still high accounting for 19 deaths per 1000 live births. Studies have shown that neonates with LBW accounts for 18% of all the neonatal deaths where most of these babies die in the first 7 days of life.[14, 15] In the study conducted at BMC further demonstrated that mortality rate of 39.4% among LBW neonates is associated with young maternal age, low education level, mode of delivery, extremely LBW and presence of respiratory distress syndrome (RDS) [5]. In this study, however, the risk factors associated with the seven-day outcomes of LBW neonates were not fully addressed. Early detection of risks particularly during seven days of their life with aggressive interventions to this group is highly needed to save lives. Despite the fact that neonates with LBW have increased risk for



mortality and morbidity during the first seven days of their life in Tanzania, however the risk factors associated with the outcomes remain not fully understood [16].

This study aimed to determine the seven-day outcomes and associated factors for neonates with LBW admitted at Referral hospitals in Mwanza city. The lack of evidence in the Mwanza city referral hospital has affected the decision-making process on strategies to save the lives of low-birth infants. Therefore, the results of this study are considered useful for policy makers and clinicians to develop new strategies to improve neonatal low birth weight care and clinical outcomes.

The aim of this study was to understand the immediate seven day outcomes and associated factors among neonates with LBW at Bugando Medical Centre and Sekou Toure Regional referral hospitals in Mwanza City, Tanzania.

## **Materials and Methods**

### ***Study design, sampling and participation***

This study was a hospital-based cohort study to determine factors associated with seven days outcome among neonates with LBW in Mwanza City. The fieldwork took place from Mid July 2019 to third week of August 2019. Computerized Epi Tools calculation for cohort study sample size was used to calculate the sample size of this study. Exposed group was neonates who died due to asphyxia 55.6% and unexposed group are those who died with other causes 37.8%. Relative risk was 1.47. After computerized calculation the sample size was 210 neonates with LBW. Convenient sampling technique was used to enroll the LBW neonates in this study. LBW neonates who were available

in the ward during the study and who had or less than seven days since delivery were enrolled

### ***Study Areas***

The study was carried out at BMC and STRH in Nyamagana district. According to the 2012 census, the population of the Nyamagana District was 363,452, BMC is a consultant hospital with a 1,000-bed capacity including 37 and 11 in the neonatal unit and the NICU respectively. BMC serves a population of 16 Million people and attends to around 300,000 patients each year coming from all Lake Zone regions. STRH is a regional hospital, serving people from 7 districts of the Mwanza region. The hospital has 350 beds with 27 beds in the neonatal unit.

### ***Data Collection***

A pretested structured questionnaire was used to collect maternal and newborns socio demographic and clinical data. Maternal demographic data, prenatal and labor factors which were collected included age, height, weight, religion, tribe, marital status, education level, and family income while labor factors included duration of labor, stage of labor on admission, mode of delivery, and gestation age during labor. Prenatal questions included HIV status, syphilis status, number of gravida and para, number of ANC visit, onset of ANC, history of chronic disease and use of herbs during pregnancy and labor.

Neonatal demographic and characteristics information collected comprised admission date, discharge date, sex, tribe, age in days, birth weight, number of days after delivery before admission, mode of delivery, place of delivery, any congenital defect, mode of admission, and reasons for admission.

Daily observations were made on the neonates for seven days to determine the outcomes (discharged, prolonged hospitalization



and death). This data included recording observations from the chart for weight, oxygen saturation by using fingertip pulse oximeter machine, blood glucose levels by Glucoplus machine and body temperature. This study considered prolonged hospitalization to neonates who stayed in the ward for more than seven days and discharge within seven days was considered as early discharge also early neonatal death to those who died within seven days after birth.

The study had two-research assistants one from each site who were the nurses from neonatal unit of the particular hospital. Who assisted in observations of neonates and data collection in the particular site when the primary researcher was present.

### ***Data management and analysis***

Data were entered into a computer using Excel 2013, cleaned, validated and then transferred to STATA version 13 for analysis. Data was summarized in frequency tables and bar chart. Categorical variables was summarized as proportions while continuous variables was summarized as mean  $\pm$  standard deviation or medians (plus interquartile range). T – Test and Chi-square ( $\chi^2$ ) test was used to compare continuous and categorical variables, respectively. The 95% confidence interval was determined and  $p$  – value of 0.05 was considered statistical significant.

### ***Ethical considerations***

Ethical approval was sought from the Joint CUHAS/BMC Ethics and Review Committee. A written permission to carry out the research was requested from Bugando Medical Centre and Sekou Toure regional hospital administration. During the study these neonates were continuing with their treatment as usual in the ward. Confidentiality of study subjects was ensured through the use of ID codes to conceal their Identity. Full disclosure of

the research was given to the parents/guardians. Informed written consent from subjects was sought from all parents or caretakers invited to participate in the study.

## **Results**

### ***Socio-demographic characteristics of LBW neonates and their mothers***

A total of 200 (100 males, 100 females) LBW neonates with median age of 0.8 days  $\pm$  IQR and mean birth weight of 1.6 kilograms  $\pm$  1.5SD were enrolled in this study. Among the 200 neonates, 156 (78%) were recruited from BMC and 44 (22%) from STRH.

The median age of mothers whose neonates participated in this study was 29 years (IQR 19.5 – 39). The many of the mothers, 122 (56%) had primary education level. Majority mothers were married 180 (90%), petty traders 53%. Moreover, 80 (40%) mothers had family income above one hundred thousand Tanzanian shillings per month (Table 1).

### ***Antenatal, labour and post-natal characteristics of LBW neonates and their mothers***

Out of 200 LBW neonates who participated in the study, majority were born at referral hospitals 104 (52%). Whom were born by spontaneous vagina delivery 154 (77%) and had gestation age  $\geq$  33 weeks 74 (37%) Neonates with ELBW were 120 (60%) while 110 (55%) neonates admitted 24 hours after delivery.

The majority of mothers, 152 (76%) were gravida one to four and 144 (72%) attended ANC one to three visit. Similarly, most participant neonates, 116 (58%) were born by mothers who had early ANC first booking (with  $\leq$  16 weeks) (Table 2).



**Table 1: Socio-Demographic Characteristics of LBW Neonates and their Mothers (N=200)**

Characteristics	Frequency	Proportion (%)
<b><u>LBW Neonates</u></b>		
Age (days) (median=0.8±1IQR)	200	100
Birth weight (Mean=1.6±1.5SD)	200	100
<b>Sex</b>		
Female	100	50.0
Male	100	50.0
<b><u>LBW Neonates Mothers</u></b>		
Age of the mother (median=29 ±19.5-39 IQR)	200	100
Weight of the mother (median=76 ±56-97.1 IQR)	200	100
<b>Level of education</b>		
No Primary	112	56.0
Secondary & Tertiary	88	44.0
<b>Marital status</b>		
Married	180	90.0
Not married	20	10.0
<b>Mother's occupation</b>		
Business	106	53.0
Employed	36	18.0
Farmer	22	11.0
House wife	36	18.0
<b>Family Income (Tshillings per month)</b>		
> 100,000	80	40.0
50,000-100,000	44	22.0
< 50,000	76	38.0

**Key:** N – Total Number; IQR – Interquartile Range; SD – Standard Deviation

### ***Immediate seven-day outcomes of LBW neonates***

Among 200 LBW neonates, 148 (74%) had prolonged hospitalization due to being sick [88, (59.5%)] or poor weight gain [60, (40.5%)] while 42 (21%) were discharged within seven days after recovery from sickness or weight gain and 10 (5%) died (figure 2).

### ***Factors associated with prolonged hospitalization***

From binary logistic regression to probe for predictors of the outcomes which were found to be significantly associated with increased odds for prolonged hospitalization are family income and place of delivery. However Low APGAR scores prevented neonates who participated in this study from prolonged hospitalization ( $p = 0.007$ ), table 3.

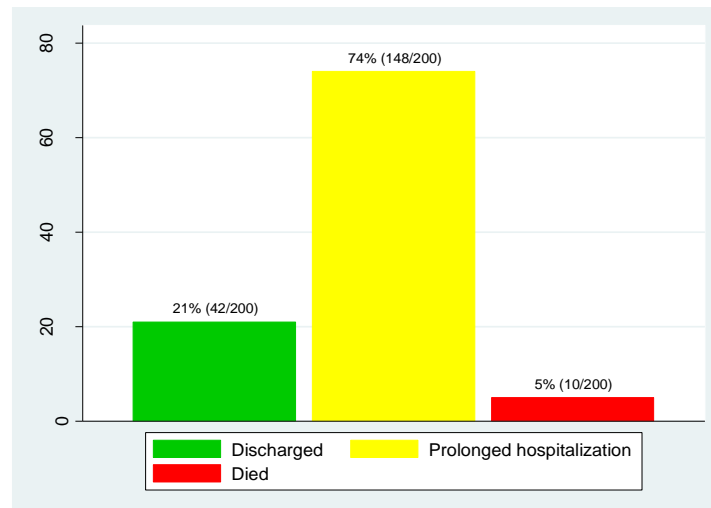


**Table 2: Antenatal, Perinatal and Post-Natal Characteristics of Newborns and their Mothers**

Characteristics	Frequency	%
<b><u>Children Perinatal and Post-Natal Data</u></b>		
Delivery place		
Referral hospitals	104	52.0
Other hospital	96	48.0
Delivery mode		
Normal	154	77.0
Operation	46	23.0
APGAR score in 1 minutes		
< 5 points	48	24.0
5 – 10 points	152	76.0
APGAR score in 5 minutes		
< 7 points	42	21.0
> 7 points	158	79.0
Gestation Age during delivery (weeks)		
< 28 weeks	60	30.0
28 – 32	66	33.0
≥ 33	74	37.0
Categories of LBW in kilograms		
Low birth weight	12	6.0
Very low birth weight	68	34.0
Extremely low birth weight	120	60.0
HCF		
BMC	156	78.0
STRH	44	22.0
Time interval for Admission		
Early admission	90	45.0
Late admission	110	55.0
<b><u>Maternal Antenatal, Perinatal and Post-Natal Data</u></b>		
Gravidity		
Gravida 1 – 4	152	76.0
Gravida ≥ 5	48	24.0
Number of ANC visit		
0 – 3	144	72.0
≥ 4	56	28.0
Gestation age at 1 <sup>st</sup> ANC visit		
≤ 16 weeks	116	58.0
History of chronic disease		
No	184	93.0
Yes	14	7.0
Use of herbs		
No	164	82.0
Yes	36	18.0
Stage of labour		
Stage 1 – 2	172	86.0
Stage 3 – 4	28	14.0

**Key:** ANC – Antenatal Clinic; APGAR – Appearance, Pulse, Grimace, Activity and Respiration; BMC – Bugando Medical Centre; HCF – Health Facility; N – Total Number; STRRH – Sekou Toure Regional Referral Hospital





**Figure 1: Immediate Seven-Day Outcomes for Neonates with Low Birth Weight**

In multivariate analyses after adjusting for all significant variables ( $p = 0.05$ ) from neonates participated in this study from binary logistic regression analyses. Neonates of families with low income who participated in this study were more likely to have prolonged hospitalization than neonates from high income families (OR = 9.1, 95% CI: 2.8 – 29.8,  $p = 0.001$ ).

Compared to neonates who were delivered at referral hospital, neonates who were delivered at home had almost 10 times higher risk of prolonged hospitalization (OR = 9.5, 95% CI: 1.7 – 37.3,  $p < 0.001$ ). Similarly neonates with low APGAR score (3-5 points) had 60% higher risk of prolonged hospitalization ( $p = 0.007$ ).

Although marital status of participant mothers didn't show statistical association with the prolonged hospitalization in univariate regression analyses, there was strong association in multivariate. Neonates from unmarried women were almost 9 times higher risk for prolonged hospitalization (OR = 8.6, 95% CI: 1.1 – 70.1,  $p = 0.04$ ) than participants from married women in multivariate regression analyses.

### **Factors associated with LBW neonates' death**

Several factors were significantly associated with increased odds for LBW neonate death within seven days in univariate regression analyses (table 4). These included family income ( $p = 0.035$ ), neonatal birth weight ( $p = 0.019$ ), maternal STI ( $p < 0.001$ ) and place of delivery ( $p = 0.037$ ). Table 4.

In multivariate analyses after adjusting for all significant variables ( $p = 0.05$ ) from neonates participated in this study from binary logistic regression analyses. Neonates whose parents had monthly income of less than fifty thousand per month were more likely to die than those who had high or medium economic status (OR = 0.2, 95% CI: 0.1 – 1.1,  $p = 0.035$ ).

Similarly, neonates with ELBW were almost 11 times higher risk to die than LBW neonates (OR = 11.8, 95% CI: 1.5 – 92.9,  $p < 0.019$ ) additionally; neonates who delivered from other health facilities were almost four times higher risk to die than those who delivered in referral hospitals (OR = 4.6, 95% CI: 1.2 – 22.4,  $p = 0.037$ ).



**Table 3: Factors Associated with Prolonged Hospitalization among LBW Neonates from BMC and STRH (N=190)**

Variables	Prolonged hospitalization				Crude OR OR (95% CI)	P – Value	Adjusted OR		P – Value	
	Yes No	(%)	No No	(%)			OR (95% CI)	P – Value		
<b>Maternal factors</b>										
Age in groups (yrs.)										
≥ 29	74	74.0	26	26.0	1.0					
≤ 28	74	82.2	16	17.8	1.6	0.8 – 3.3	0.172	1.6	0.4 – 5.6	0.465
Marital status										
Married	130	76.5	40	23.5	1.0					
Not married	18	90.0	2	10.0	2.8	0.6 – 12.4	0.168	8.6	1.1 – 70.1	<b>0.04</b>
Mother's Education level										
Sec. & Tertiary	66	76.7	20	23.3	1.0					
Primary school	82	78.9	22	21.1	1.1	0.6 – 2.2	0.728	0.5	0.1 – 1.9	0.395
GA first ANT visit										
≤ 16 weeks	80	72.7	30	27.3	1.0					
> 16 weeks	68	85.0	12	15.0	1.0	0.9 – 1.0	0.325	0.4	0.1 – 1.7	0.243
Family Monthly Income in Tshs										
> 100,000	56	71.8	22	28.2	1.0					
50,000-100,000	28	63.6	16	36.4	9.1	2.8 – 29.8		1.4	0.4 – 4.9	0.555
< 50,000	64	94.1	1	5.9	6.2	2.0 – 19.3	< 0.001	0.1	0.0 – 0.4	< 0.001
Use of Herbs										
No	120	76.0	38	24.0	1.0					
Yes	28	87.5	4	12.5	2.2	0.7 – 6.7	0.151	0.2	0.0 – 1.1	0.07
<b>Neonatal factors</b>										
Category of LBW in kilograms										
LBW	54	69.2	24	30.8	1.0					
VLBW	32	53.3	28	46.7	0.5	0.3 – 1.0				
ELBW	2	20.0	8	80.0	0.1	0.0 – 1.6	0.05			
APGAR score 1 min										
3 – 5 points	32	76.2	10	23.8	1.0					
> 5 points	56	52.8	50	47.2	0.4	0.2 – 0.8	0.007	2.4	0.01 – 313	0.72
GA on delivery										
≥ 33 weeks	12	75.0	4	25.0	1.0					
28 – 32 weeks	52	61.9	32	38.1	0.5	0.2 – 1.8				
< 28 weeks	24	50.0	24	50.0	0.3	0.1 – 1.2	0.160	0.3	0.1 – 0.8	0.02
Time interval for admission										
Early admission	76	100.0	0	0.0						
Late admission	12	16.7	60	83.3						
<b>Other factors</b>										
Delivery place										
Referral hospitals	66	64.7	36	35.3	1.0					
Other hospitals	58	93.6	4	6.4	0.8	0.1 – 4.8	0.833	0.6	0.1 – 4.3	0.62
Home	24	92.3	2	7.7	9.5	1.7 – 37.3	< 0.001	5.9	1.1 – 33.0	0.04
Key: ANT – Antenatal; APGAR – Appearance, Pulse, Grimace, Activity and Respiration; CI – Confidence Interval; ELBW – Extremely Low Birth weight; GA – Gestation Age; LBW – Low Birth weight; OR – Odds Ratio; TSH – Tanzanian Shillings; VLBW – Very Low Birth weight; YRS – Years										





**Table 4: Factors Associated with Early Neonatal Death (Seven Days post Delivery) among Neonates**

Variables	Death within Seven Days				Crude OR OR (95% CI)	P – Value	Adjusted OR		P – Value	
	Yes No	(%)	No No	(%)			OR (95% CI)	P – Value		
<b>Maternal factors</b>										
Age in groups (yrs.)										
≥ 29	4	3.9	100	96.1	1.0					
≤ 28	6	6.3	90	93.7	1.7	0.4 – 6.1	0.435	5.2	0.8 – 33.3	0.07
Mother's Education level										
Sec. & Tertiary	2	2.3	86	97.7	1.0					
Primary school	8	7.1	104	92.9	3.3	0.6 – 15.9	0.101	5.5	0.8 – 36.3	0.97
GA first ANT visit										
> 16 weeks	4	4.8	80	95.2	0.9					
≤ 16 weeks	6	5.2	110	94.8	1.0	0.2 – 3.4	0.895	0.6	0.1- 3.5	0.64
Income in T shillings per month										
> 100,000	2	2.5	78	97.5	1.0					
50,000-100,000	0	0.0	44	100.0						
< 50,000	8	10.5	68	89.5	0.2	0.1 – 1.1	0.035			
Stage of labour on arrival to the Health facility										
Stage 1 – 2	8	4.7	164	95.3	1.0					
Stage 3 – 4	2	7.1	26	92.9	1.6	0.3 – 7.8	0.572	0.9	0.1 – 9.3	0.96
STI										
Negative	8	4.2	184	95.8	1.0					
Positive	2	50.0	2	50.0	0.04	0.0 – 0.3	<0.001	0.02	0.0 – 0.2	<0.001
Use of Herbs										
No	6	3.7	158	96.3	1.0					
Yes	4	11.1	32	88.9	3.3	1.1 – 12.3	0.053	0.2	0.1 – 1.6	0.16
<b>Neonatal factors</b>										
Gender										
Female	4	4.0	96	96.0	1.0					
Male	6	6.0	94	94.0	1.5	0.4 – 5.6	0.516	0.7	0.1 – 3.2	0.65
Delivery method										
Operation	2	4.4	44	95.6	1.0					
Normal	8	5.2	146	94.8	1.2	0.2 – 5.9	0.817	0.9	0.1 – 4.6	0.95
Birth weight in kilograms										
LBW	2	16.7	10	83.3	1.0					
VLBW	6	8.8	62	91.2	2.1	0.4 – 11.7	0.412			
ELBW	2	1.7	118	98.3	11.8	1.5 – 92.9	<0.019	0.2	0.03 – 0.9	0.04
APGAR score in 1 minute										
5 – 10 points	6	4.0	146	96.0	1.0					
3 – 5 points	4	8.3	44	91.7	2.2	0.6 – 8.2	0.224	1.1	0.1 – 8.8	0.90
APGAR score in 5 minutes										
> 7 points	6	3.8	152	96.2	1.0					
≤ 7 points	4	9.5	38	90.5	2.7	0.7 – 9.9	0.130	5.8	0.5 – 59.7	0.13
Delivery place										
Referral hospitals	2	1.9	102	98.1	1.0					
Other hospital	8	8.3	88	91.7	4.6	1.2 – 22.4	0.037	5.9	1.1 – 33.0	0.04

ANT – Antenatal; APGAR – Appearance, Pulse, Grimace, Activity and Respiration; CI – Confidence Interval; ELBW – Extremely Low Birth weight; GA – Gestation Age; LBW – Low Birth weight; OR – Odds Ratio; TSH – Tanzanian Shillings; VLBW – Very Low Birth weight; YRS – Years



## Discussion

This study examined the seven day outcomes of LBW neonates at BMC and STRH and its associated factors. Among 200 neonates, 74% had prolonged hospitalization while 21% were discharged and 5% died within seven days. Prolonged hospitalization was associated with family low income, and place of delivery. Moreover those delivered at home were at higher risk. Death was associated with family low socioeconomic status and extreme low birth weight.

### *Immediate seven-day outcome of lbw neonates: Prolonged hospital stay*

The majority of LBW neonates in our study had prolonged hospital stays which indicated that 148 neonate's studied were in need of care and treatment even after seven days of hospitalization. This situation was associated with poor weight gain or being sick. Poor weight gain can be associated with low income; whereby mother could not afford to buy nutrition supplements and prescribed drug that cause delay in drug administration. Immaturity of body systems and Low APGAR score were associated with prolonged hospital stay because of immaturity of respiratory system.

Neonates born at home or other health facilities had prolonged hospitalization, this is due to inadequate proper immediate care after delivery. However; the proportion of LBW neonates who had prolonged hospitalization is lower compared to the findings reported in ten European regions by *Maier et al* (2018), found the proportion 85.5% of neonates, had prolonged hospitalization [17]. Contrary to other studies; In our study most neonates stayed longer in hospital are due to poor weight gain while *Rolf FM et al.* 2018 in European regions, found that

most neonates who had prolonged hospitalization mainly were due to respiratory distress syndrome (RDS) and few prolonged days were due to congenital abnormalities. Similar findings were reported by *M. E Quaresma et al*, of Brazil, that prolonged hospitalization were associated with being sick or poor weight gain. They further reported that proportion of prolonged hospital stays of neonates from the government health facilities in Brazil was up to 12.8% (n=258) [18]. Contrary to study of *M. E Quaresma et al* from government hospitals in Brazil, our results are from a faith based hospital and one government regional hospital. These two health facilities admit neonates from urban and village areas which indicate the differences from Tanzania and Brazil study.

### *LBW neonatal death*

Our study indicated deaths to occur in 5% of all LBW neonates. Regarding categories of LBW; our results showed death rate from Extremely Low Birth weight (ELBW), Very Low Birth weight (VLBW) and Low Birth weight (LBW) to be 2 (1.7%), 6 (8.8%) and 2 (16.7%) respectively. The results shows as the body weight decreases the survival rate decrease too. This can be due to immaturity of body system, inadequate advanced equipment in neonatal unit for managing them. Neonates who came from low family income and mothers who were STI positive during pregnant were more likely to die because of inadequate money to buy nutrition supplements or medicine on time and due to ascending infection through placenta respectively.

Neonates born at home or other health facility were likely to die because of inadequate immediate care after delivery compared with advanced hospitals. A prospective descriptive study by *Mbawala et al* 2014 in Mwanza city



Tanzania reported LBW neonates death to be 39.4%. The difference with this study can be explained on the enrollment differences. Mbawala's study enrolled only premature neonates which was an associated factor of death in LBW while in this study all LBW neonates were included regardless of their maturity [5].

The prevalence of death observed in the current study is also lower compared to results from studies in other low income countries [19]. A cohort study in Bangladesh by *Sohely Y et al* in 2001 and a cross section study in Uganda by *Kananura RM et al* in 2016 reported 13.3 % of 771 and (31.9%) 34/1000 respectively of LBW neonates died [19] [20]. Although in the present study, the proportion on neonates death is lower compared to studies in Bangladesh and Uganda; to large extent the associated factors for death were the same such as maturity of the neonates' family income, and place of delivery.

### ***Factors associated with seven day outcome of lbw neonates: Prolonged hospitalization and early discharge***

In this study prolonged hospital stay was associated by late onset of ANC visit during pregnancy ( $\geq 16$  weeks of GA), resulting in their neonates having prolonged hospitalization. Our results are comparable with a case control study done in South Africa by *Tshotetsi L et al.* (2019) which found that mothers who had fewer ANC visit and high GA on onset, their LBW neonates developed complications which caused prolonged hospitalization [21].

The association between prolonged hospitalization and low family economic status is consistent with a hospital based cross sectional study done at Amhara region, Northwest Ethiopia by *Asmare T. et al* 2017. This study which enrolled 232 neonates with LBW, found most neonates from families with

low income stayed longer in hospital than those with middle and high income. Lack or inadequate money to buy medicines needed and nutritious food for mother to take, so as to get quality and quantity breast milk which will facilitate weight gain of the newborn can be the reason for prolonged hospitalization.

Mode of delivery was associated with prolonged hospital stay in our study, similar to a cross sectional study done in Brazil in the year 2018 by *Quarema ME et al* which found 258 (12.0%) neonates who were delivered by SVD had prolonged hospitalization compared with those who delivered by caesarian section [18]. This can be associated with birth trauma which leads to poor progress of LBW neonates.

Another factor of prolonged hospitalization of LBW neonates found in this study was low APGAR score in one minute and in five minutes. Consistence with a study done in European regions by *Maier et al* (2018) showed that neonates with ELBW were at higher risk for prolonged hospitalization and those with low APGAR score in 5 minutes stayed longer than those with higher scores [17]. This finding is in agreement with previous studies which showed that APGAR score has an impact in LBW neonates' progress. A cohorts study done at Lusaka Zambia in 2017 by *Chibwasha C J. et al* with 200,557 neonates, where by 2445 (12.9%) had low APGAR score which resulted in poor progress and made them to stay for long in the hospital. Furthermore in Brussels 2017 a cohort study by *Jerry J.* reports found that 153 (8.4%) out of 1909 LBW neonates had lower APGAR score which led the neonates to have prolonged hospitalization for the treatment of complications arises [22, 23]. Low APGAR score is significantly associated with poor progress in LBW neonates also was found in our study



Our study has demonstrated that being sick is significantly associated with prolonged hospital stay similar to a cross sectional study conducted by Rolf FM *et al.* 2018 in European region which found that 81.1% of neonates who had prolonged stays to suffered from respiratory distress syndrome (RDS) and 5.0% of them had congenital abnormality [17].

In this study the place of delivery was an associated factor for prolonged hospital stay for LBW neonates. Neonates who were delivered at home 83.3% (20), stayed in the hospital for more than seven days compared to those who delivered at BMC 33.3% (n=10) and STRH by 61.1%. (n= 22). A cross section study done in Benin Nigeria 2015 by *Oladeinde H. et al* with a sample size of 780 neonates found 60 - 80% of deliveries were conducted at home. Among them 49 (6.3%) had LBW neonates who developed adverse outcomes to cause them to stay longer in the hospital. The percentage of home deliveries was small compared with this current study because they include all neonates regardless of their birth weight from one city while in our study we recruited LBW neonates from two referral hospitals which provide care to neonates from one city and more than five political regions.[24].

### ***Seven-day LBW neonatal death***

Mothers with low social economic status and neonate's birth weight were found to be associated with the deaths among LBW neonates compared to middle and high social economic status. This association of birth weight and early neonatal death is similar to the previous study which was done at BMC where neonatal death was found to be associated with extremely LBW [5]. These observations are different with findings from Uganda study conducted in 2011 by *Malachi O et al* in their study, which found low income and high income women death rate

of their neonates was almost the same [25]. The study done by *Darjan K et al* showed 33.3% of LBW neonates born vaginally were died within seven days of delivery compared to those born by caesarian section [26]

## **Strengths**

Daily observation of neonates for seven days helped to detect other defects from neonates and minimized chances of lost to follow up because mothers with neonates enrolled in the study were appreciating the daily observation done to their children.

## **Limitation**

Time was limited to get the targeted sample size.

## **Conclusion**

LBW neonates are at high risk of death and prolonged hospitalization due to sickness or due to poor weight gain. Associated factors of these outcomes were family income, place of delivery, birth weight, gestation age during first antenatal visit, mode of delivery and low APGAR score.

## **Recommendations**

We recommend that mothers should be encouraged to start attending ANC early ( $\leq 12$  weeks of GA) and follow the sequence of visits in order to detect any deviation from normal pregnancy, early. This will help to prevent some factors which may lead to adverse outcomes of LBW neonates. Moreover, health workers should emphasize to pregnant mothers to get delivered their baby in the health facilities to get adequate immediate care in order to minimize or to prevent adverse outcomes. Lastly, further multicenter cohort studies are needed to confirm the current findings.



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## Competing interests

The authors declare no competing interest.

## Authors' contributions

All authors contributed equally in proposal writing, data collection, data analysis and writing of the manuscript.

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