ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

DEPARTMENT OF NURSING

SURVIVAL STATUS AND PREDICTORS OF MORTALITY AMONG LOW BIRTH WEIGHT NEONATES ADMITTED IN SELECTED GOVERNMENTAL HOSPITALS, ADDIS ABABA ETHIOPIA 2021

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A RESEARCH PROPOSAL TO BE SUBMITTED TO THE SCHOOL OF NURSING AND MIDWIFERY, ADDIS ABABA UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER'S OF NEONATAL NURSING

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ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCES SCHOOL OF NURSING AND MIDWIFERY DEPARTMENT OF NURSING A MASTER OF SCIENCE PROPOSAL PROJECT SUBMISSION FORM

Name of Investigator	Jemal Guadu
Name of advisors	Sr. Semarya Berhe (Asst, professor, PHD fellow) Mr. Kerebeh Abere (MSc)
Title of the research	Survival status and predictors of mortality among low birth weight neonates admitted in selected governmental hospitals of Addis Ababa, Ethiopia 2021
Study area	Addis Ababa governmental hospitals
Total cost	32,640
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Acronyms and abbreviations

AGA: Appropriate for gestational age

AHR: Adjusted hazard ratio

ANC: Anti natal care

APGAR: Activity, Pulse, Grimace, Appearance, Respiration

CHR: Crude hazard ratio

CI: Confidence interval

CPAP: Continues positive air pressure

HIV: Human immune virus

INO2: Intra nasal oxygen

KMC: Kangaroo mother care

LBW: Low birth weight

NBW: Normal birth weight

NMR: Neonatal mortality rate

SGA: Small for gestational age

SSA: Sub- Saharan Africa

UNICEF: United nations international children's emergency fund

UTI: Urinary tract infection

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Summary

Introduction: The World Health Organization (WHO) defines low birth weight (LBW) as a newborn weighing is less than 2,500 grams. The UNICEF (united nations international children's emergency fund) and WHO estimates indicate that one in seven live births globally suffered from low birth weight in 2015. The prevalence of low birth weight varied widely across regions from 7.2 per cent in more developed regions to 17.3 per cent in Asia, in Ethiopia neonatal mortality accounts 30 per 1000 live births from 55 per 1000 live birth children deaths, LBW neonates were responsible for most deaths.

Objective: To assess survival status and to identify predictors of mortality of low birth weight neonates admitted in selected governmental hospitals of Addis Ababa, Ethiopia.

Methods: A retrospective cohort study will employed among 404 neonates with LBW admitted to neonatal intensive care unit (NICU) of selected four governmental hospitals in Addis Ababa, between January 2018 and January 2021. The data will be collected from randomly selected records from each year. Data will be entered to Epi-Data version 7.2.2.6 and exported to SPSS Version 24 for analysis. The Kaplan Meier survival curve will used to estimate the cumulative survival time. Log rank tests will used to compare probability of hazard among variables. Bi-varaite and multivariate Cox proportional hazards models will used to identify predictor variables and variables having p value < 0.05 will considered as statistically significant.

Budget: This study will require a total budget of **32,640** birr with 10% contingency added.

INTRODUCTION

1.1Back ground

The birth weight of a neonate is the first weight recorded after birth, the World Health Organization (WHO) defines low birth weight (LBW) as a newborn weighing is less than 2,500 grams, with the measurement taken within the first hours of life, before significant postnatal weight loss has occurred. Low birth weight is further categorized into very low birth weight (VLBW, <1500 g) and extremely low birth weight (ELBW, <1000 g) (1).

Low birth weight is a complex syndrome that includes preterm neonates (born before 37 weeks of gestation), small for gestational age neonates at term and the overlap between these two situations – preterm, small for gestational age neonates, who typically have the worst outcomes (2).

Any baby born prematurely is more likely to be very small. However, many factors have their own impact on neonates weight among them direct causal factors includes infant sex, racial/ethnic origin, maternal height, pre-pregnancy weight, paternal weight and height, maternal birth weight, parity, history of prior low-birth-weight infants, gestational weight gain and caloric intake, general morbidity and episodic illness, malaria, cigarette smoking, alcohol consumption, and tobacco chewing (3).

Mothers in deprived socio-economic conditions frequently have low birthweight infants. In those settings, the infant's low birthweight stems primarily from the mother's poor nutrition and health over a long period of time, including during pregnancy, the high prevalence of specific and non-specific infections, or from pregnancy complications, underpinned by poverty(4)(2).

A newborn's weight at birth is an important marker of maternal and fetal health and nutrition. Low birth weight newborns have a higher risk of dying in the first 28 days of life(4).

Globally more than there are 20.5 million LBW neonates in 2015, more than 96% of LBW newborns are born in developing countries(2).

1.2 Statement of problem

The UNICEF-WHO low birth weight estimates indicate that one in seven live births globally suffered from low birth weight in 2015. The prevalence of low birth weight varied widely across regions from 7.2 per cent in more developed regions to 17.3 per cent in Asia (4).

From 20.5 million LBW neonates half of all low birth weight babies are born in South-central Asia, among the more developed regions, North America averages 8 per cent, while Europe has the lowest regional average at 6 per cent, India alone accounts for 40 per cent of low birth weight births, Africa was home to about one quarter (22%) of all low birth weight newborns, with the majority born in Eastern and Western Africa, low birth weight levels in sub-Saharan Africa are around 13 per cent to 15 per cent, with little variation across the region as a whole, Low birth weight in Ethiopia was around 15% (4)(5).

Epidemiological observations shows that infants weighing less than 2,500 g are approximately 20 times more likely to die than heavier babies, more common in developing than developed countries (5). LBW accounts for approximately 80% of all newborn deaths, it has been shown that the mortality range can vary 100-fold across the spectrum of birthweight and rises continuously with decreasing weight. In Africa LBW is among the strongest predictors of infant morbidity and mortality in most parts of the developing world (4).

Those who survive are more likely to suffer consequences of LBW, low birth weight due to restricted foetal growth affects the person throughout life and is associated with poor growth in childhood and a higher incidence of adult diseases, such as stunted growth, lower IQ, type 2 diabetes, hypertension and cardiovascular disease. An additional risk for girls is having smaller babies when they become mothers (6).

Due to the immaturity of their organ systems the LBW babies are predisposed to a number of neonatal problems like hypothermia, hypoglycemic and Infection (7).

A Malaysia study shows preterm group had the longest median duration of admission at 88 days, parenteral nutrition and disposables, transfusion, parenteral nutrition and disposables costs were especially higher in the extreme preterm group (8).

Mozambique study also shows that health system costs during infancy associated with LBW babies were almost 4 times higher than the average yearly national public health expenditure, Households costs also 16 times higher than the other cost, admissions for LBW was 37.6% and 23.5% for non LBW neonates [Chi2 (3) = 11.93; p = 0.008]. LBW babies were expected to have a rate of hospital admissions during the first year of life 1.52 times greater than non-LBW babies (p = 0.007) (9).

World health organization (WHO) launches a strategy mentioned as Global Nutrition Targets 2025: LBW policy brief to achieve a thirty percent reduction in the number of LBW new- born by the year 2025. This policy will be achieved through intensive follow up of the neonates admitted with low birth weight and appropriate health interventions through determining the time that neonate will die (2).

Many countries of the world including Ethiopia is not on track to meet the WHA global target on low birth weight (4) .

To achieve the goal of WHA Ethiopia have to work first to prevent LBW by giving effective pregnancy care next work on reduction in neonatal morbidity and mortality by giving affordable, accessible and appropriate health care for those neonates born with LBW (2).

The mortality rates among LBW neonates in Ethiopia significantly vary between deferent study areas and ranges from 68 deaths per 1000 live births to 83 deaths per 1000 live births. Predictors of mortality among LBW neonates were inconsistently reported by fragmented studies conducted in different study areas (10)(11).

The survival of LBW neonates depends on a variety of factors, which might vary greatly with economic, socio- demographic, maternal medical and obstetric and clinical factors. Even though neonatal intensive care units increase in number significantly, still LBW neonates were facing several deaths that could be avoided by appropriate interventions on certain contributing (12)(13)(14)(15).

Therefore, this study will be aimed to estimate the survival and the mortality and to investigate predictors of mortality of low birth weight neonates admitted at Addis Ababa governmental hospitals in Ethiopia.

1.3 Significance of the study

Primarily this study determines the survival and predictors of mortality in LBW in NICU of selected governmental hospitals of Addis Ababa. Determining the survival status, time of death and contributing factors help policy makers to improve guidelines, regulations and neonatal care policy for on time management and prevention of LBW neonates survival and morbidity, this research will give recent information because health care protocols need to be regularly reviewed and modified to accommodate new therapies and address specific issues in a particular setting.

Health care professionals also can use the policy, guideline and as well as this research result as a guide to manage neonates in NICU, because clinical management of LBW neonates may depend on the perception that healthcare providers have regarding their expectancy of survival, It will also be also used as a baseline data for organizations and researchers who are working and who want to work in this area for further study.

In cumulative the result of this study could have its own effect in decreasing and combating LBW neonates mortality and also helps in identification of those factors that have significant effect on the increment of LBW survival, sets governments on the path to better data systems and programmes on decreasing low birth weight mortality and safeguard the survival, growth, development and long-term health of their LBW neonates. With robust data and sound programming to reach all neonates particularly the most vulnerable LBW neonates we can help to survive.

2. Literature Review

2.1. Overview of LBW Survival

Low birth weight (LBW) is a worldwide public health problem. Low birth weight is closely associated with foetal and neonatal mortality and morbidity, inhibited growth and cognitive development, and chronic diseases later in life. LBW imposes a considerable burden to health sector and on society as a whole (15).

A baby weighing more than 1500 g is most likely (95%) to survive with intensive neonatal care the survival rate of the baby weighing 751–1000 g is to the extent of 80%. The deaths are due to complications of LBW and increased incidence of congenital malformations. Most of the deaths (two-thirds) occur within 48 hours. Long-term prognoses are major handicaps (cerebral palsy), hearing loss, behavior disorder, chronic lung disease and poor growth are observed (16).

One Spain study shows that of 2015 infants who died, 373 (18.5%) did so during the first 24 hours of life, 1315 (65.3%) during the first month of life and 327 (16.2%) between 30 days of life and final discharge (17).

Study done in England also shows infant mortality rates were significantly greater in the VLBW and LBW groups: the rate ratio and rate per 100,000 person-years were 129.7 and 1,985.2 for the 500–1,499 g group, 9.5 and 145.3 for the 1,500–2,499 g group (18).

A study done in Saudi Arabia shows that rates for LBW 9.4% [24] (19), a study done in Kenya shows that the prevalence of low birth weight in the hospital was (12.3%) Of 327 sampled respondents, 40(12.3%) gave birth to low birth weight (13).

A study done un Ghana shows that infants born weighing 2.00–2.49, 1.50–1.99 and less than 1.50 kg were about two (aHR: 2.13), eight (aHR: 8.21), and 25 (aHR: 25.38) times more likely to die in their first year of life than non-low-birth-weight infants (20).

A Central Hospital in Johannesburg shows that the majority of deaths (111/149, 74.49%) occurred in the early Birth weight was significantly lower in non-survivors (911.4 [227] g) than in survivors (1191.3 [212] g, $p < 0.001$) (21). Other study done in South Africa shows low birth weight babies had a greater risk of mortality (OR 5.89 CI 1.70 to 20.34) than NBW babies (22).

In Uganda the average proportion of neonatal deaths among LBW babies between 1995 and 2011 was about 3.5% while the average proportion of neonatal deaths among normal weight babies (≥2500 g ≤ 4000 g) during the same period was less than 1 % (23).

In South Africa of the total cohort of 1032 <1500gm new born 18.4% of inborns and 33.3% of outborns died (p<0.0001) (24).

Ethiopia is one of the countries greatly affected, in Tigray survival study totally 68 (6.2 %) neonates was died which makes the NMR 62.5 per 1000 live births or 6.25%, survival pattern or time to neonatal mortality has significantly varied over the categories of birth weight (X2 for Log rank test =135.9, p = 0.00), Multivariable analysis result of this study was neonate born with normal birth weight (2500–3500 gm) had 55 % lesser hazard of neonatal death compared to neonates born with a birth weight of less than 2500 gm (low birth weight) (AHR:0.45, 95 % CI: 0.24, 0.84) (10).

A community based cross-sectional study done in rural Ethiopia shows that the overall neonatal mortality rate (NMR) among LBW infants was 110 per 1000 live births (95% confidence interval: 75 –228) (25).

A prospective cohort study conducted at of Arba Minch General Hospital shows the mortality rate among neonates admitted with low birth weight was 83 per 1000 live births or 8.3% the recovery rate was 91.7%. Over all incidence density rate of neonatal mortality among newborns admitted with low birth weight was 14.5 per 1000 neonate days (person time of observation) (11).

3.2 Factors associated with LBW survival

3.2.1 Socio demographic factors

Different studies have different results about association of neonates' sex with prevalence of LBW and survival a study of Saudi Arabia shows that female gender was found to be at double the risk of having LBW (AOR 2.08, 95% CI 1.41, 3.08) than their counterparts, female child (AOR 2.08, 95% CI 1.41, 3.08) (19).

In Spain in contrast male gender had a minor impact of death compared to other studies (17), a study done in Central Hospital of Johannesburg shows that the neonate's sex was not associated

with neonatal survival (21). Other study done in Tanzania also shows female newborns were marginally at increased risk of being born with LBW compared to boys (15).

An institution based cross sectional study done in Addis Ababa among total 8.8 % LBW, neonate's female sex accounts 87.5% of the new born (14). Arba Minch study shows that Males account 12(65.7%) of the total admitted newborns with low birth weight and 61.1% of the died neonates (11).

Maternal age has significant association with LBW prevalence and survival, in Tanzania study adolescents and mothers aged above 35 years were more likely to deliver LBW babies compared to those aged 20-35 years, from total LBW 29(13.4%), 147 (68.1%) and 40(18.5%) were categorized under less than 20 years old, 20–34 years old and more than 34 years old respectively. Similarly, 3(16.7%), 6(33.3%) and 9(50%) of the dyed new born categorized on the same maternal age respectively (15). a study done in Central Hospital of Johannesburg shows that mean maternal age was 28.1 years (21).

In Uganda survival analysis maternal age < 20 years of age was associated with having higher proportions of LBW babies in both the 1995 and 2006 findings ($p < 0.01$) (23).

A study conducted in Ethiopia shows from total 29(13.4%), 147 (68.1%) and 40(18.5%) neonates were born from less than 20 years old, 20–34 years old and more than 34 years old respectively. Similarly, 3(16.7%), 6(33.3%) and 9(50%) of the died new born categorized on the same maternal age respectively. In other study also from total 457 about two hundred eighty eight (63.0%) were between 20-29 years (14)(11).

Among socio demographic factors urban living was higher odds of delivering LBW baby than rural living. In Tanzania study also mothers residing in semi-urban areas had 23% higher odds of delivering an LBW baby compared to those in urban areas ($p = 0.001$) (15). A Central Hospital of Johannesburg study shows that Mothers residing in semi-urban areas had 23% higher odds of delivering an LBW baby compared to those in urban areas ($p = 0.001$) (21).

But a study done in Ghana shows the effect of birth weight on mortality did not vary by either distance to the nearest health facility or socioeconomic status with P-values above 0.2 for all the relevant interactions (20).

A prospective cohort study conducted at neonatal intensive care unit of Arba Minch shows that place of residence have p-value less than 0.05 in log rank estimate of mortality (11).

3.2.2. Maternal medical factors

Among maternal medical and obstetric factors newborns delivered from mother with chronic disease like diabetic mellitus, HIV and Hypertension have higher morbidity and mortality than newborns delivered from mother of free from above diseases.

In Spain LBW neonates maternal hypertension had the greatest impact on hospital mortality (17). A Central Hospital in Johannesburg also shows that maternal antenatal steroids, maternal hypertension and maternal HIV infection were significantly associated with survival at discharge outcome (21). In Tanzania study also mothers of LBW babies were more than two times more likely to have a maternal history of anemia, hypertension, multiple gestation and PROM (15).

In South Africa About 11.36% of women tested positive for HIV, and had an increased risk of delivering a LBW infant (OR 1.44 CI 1.07 to 1.94) compared to women who tested negative for HIV, while women who unknown HIV status had had an increased risk of delivering a LBW infant, (OR 2.00 CI 0.90 to 4.43). Women who tested positive for syphilis or had unknown syphilis status had a greater risk of delivering a LBW baby (OR 2.27, CI 1. 54 to 3. 34) compared to women who tested negative for syphilis (22).

In Gonder systematic review there is evidence of an increased risk of perinatal and infant mortality in women who are HIV infected. This increase appears to be most marked for infant mortality OR 3.69 (95% CI 3.03- 4.49) (26).

In Arba Minch study newborns with low birth weight who have developed by mothers with history of diabetes mellitus have four times higher hazard of mortality as compared with the counterparts who did not have history of diabetes mellitus (AHR: 4.79, 95%CI: 1.15, 19.89). The risk of mortality among newborns with low birth weight delivered by mothers with a history of HIV/AIDS was 6 times higher as compared with mothers who did not have a history of HIV/AIDS (AHR: 6.47; 95%CI: 1.43, 29.34) (11).

3.2.3. Maternal obstetric factors

Among maternal obstetric factors newborns delivered from mother who have regular ANC follow up have less probability to become LBW than others, South Africa study shows that the provisions of antenatal care were statistically significant factors predicting survival without morbidity and mortality (24).

The prevalence and mortality of LBW deliveries was higher among mothers with recorded ANC problems but lower among those with a history of caesarean section. On ANC attendance, those who attended less than four times were more than 3 times more likely to deliver LBW compared to those who attended four or more times ($p < 0.001$). A one-week increase in gestational age was associated with 3.4 times higher odds of delivering a normal birth baby ($p < 0.001$) (15). In South Africa also mothers who did not attend ANC had increased risk (OR 2.65, CI 1.58 to 4.43) of delivering a LBW baby (22).

Other study also investigates started first ANC at third trimester and mothers with history of APH during current pregnancy were more likely to give birth to low birth weight infant. It was also found that mothers with; planned pregnancy, pregnant of male baby, ≥ 4 ANC visit less probable to give birth to low birth weight infant. Mothers who booked first ANC at third trimester were seven times more probable to give birth to LBW infant than those mother who booked first ANC at first trimester (adjusted odds ratio [AOR]= 7.41,95% confidence interval [CI] :1.15, 47.79) (14).

A study conducted in Ethiopia also shows mortality among the died newborns, maximum number (33.3%) of the dyed were among mothers who did not attend any antenatal visits while the remaining 5(27.8%), 3(16.7%), 2(11.1%) and 2(11.1%) were among the categories of mothers who have attended one, two, three and four & above antenatal visits respectively (11).

In other Ethiopia study the estimated hazard ratios of mortality were higher among neonates whose mothers did not attend antenatal care (ANC) (HR=1.58, 95 % CI: 1.02-2.43) (25).

Mortality in Tigray region neonates born from mothers who did not have complications were 63 % less likely to die than neonates born from mother's who had complications (AHR: 0.37, 95 % CI: 0.22, 0.63) (10).

A study conducted in South Africa shows the provision of antenatal steroids was statistically significant factor predicting LBW survival (24).

Mother who have history of previous small baby and multi para are increasing odds of delivering LBW. In Kenya mothers who had delivered a low birth weight baby in their previous pregnancy were almost 5 times more likely (OR= 4.7, 95%C.I.= 1.53-14.24, p-value=0.01) to give birth to a LBW baby compared to those who had given birth to a normal weight baby (13). In Tanzania study Primigravida and grand multiparous (> 4 deliveries) mothers had increased odds of delivering an LBW infant compared to mothers with 2-4 children ($p<0.001$) (15).

Pre eclampsia and PROM have associated with LBW prevalence and survival, in study of South Africa obstetric risk factors associated with LBW included women with preeclampsia (OR 3.74, CI 1.04 to 8.84) and premature rupture of membranes (PROM) (OR 6.74, CI 2.27 to 20.02) (22).

In Kenya premature rapture of membranes was also one of the risk factors (OR=2.95, 95% C.I. = 1.14-7.62, p value=0.04) (13).

Institution based cross sectional study conducted in Addis Ababa also shows that mothers with; history of previous small baby and parity ≥ 5 pregnancy were more likely to give birth to low birth weight infant (14).

The nutritional status of mother may have a great influence on birth weight of the newborn and its early development (15). Mothers who took additional diet during the current pregnancy two times (AOR=0.25, 95% CI: 0.06, 0.96) less probable to give birth to LBW infant than who did not take additional diet during the current pregnancy than who did not take additional diet during the current pregnancy (14).

Magnitude of mortality was high (66.7%) among the home delivered newborns and least number (11.1%) of neonates were died among delivery attended by health professionals (11). Mothers who supplemented with iron/folic acid three times (AOR=0.30, 95% CI: 0.09, 0.99) less probable to give birth to LBW infant respondents who were not supplemented with iron/folic acid respectively (14).

Mode of delivery also its own impact on neonates birth weight in Saudi Arbia study a baby who is delivered by CS was almost 2.5 times more at risk of being preterm and LBW, CS (AOR 2.29,

95% CI 1.57, 3.35) (19). A South Africa study also shows Mothers that had caesarean deliveries had an increased odds ratio for LBW babies (AOR: 1.7, 95% CI: 1.1–2.7), when compared to those with normal vaginal deliveries (27).

3.2.4. Clinical factors

Among clinical factors gestational age of neonates was significant association with neonatal mortality and it was supported by many studies. Study done in Saudi Arabia showed that preterm birth and LBW were significantly associated with each other; a preterm baby is almost 18 times more at risk of being LBW and vice versa preterm birth (AOR 17.64, 95% CI 11.03, 28.21) (19). In Kenya study there was a statistically significant difference in the birth weights between mothers who gave birth in less than 37 weeks gestation (OR=3.68, 95%C.I.=1.31-10.38, p-value=0.02) and those that delivered at 37 or more weeks gestation (13).

In cohort study conducted of at Arba Minch General Hospital Regarding to the gestational age of the newborn, 89 (41.2%), 126(58.3%) and 1(0.5%) of the newborns were delivered at less than 36, 37–72 and more than 42 weeks of gestation respectively and among each categories of gestational age, 10 (55.6%), 7(38.9%) and1(5.6%) died respectively (11).

In other Ethiopia study born prematurely (before 37 weeks of gestation) carried a higher (HR= 1.47; 95 % CI: 1.07-2.28) risk of death (25).

Post natal age also significant association with LBW neonates survival, different studies shows survival neonates increased with increment of their post natal age, a study done in Ghana shows the magnitude of the association declined over time compared with non-low-birth-weight infants, infants born weighing less than 1.50 kg had about 48 times the mortality rate in the neonatal period (aHR: 48.45) but only eight times in late infancy (aHR: 8.42) (20).

In Tanzania study those dying within 24 hours were three times more likely to be born with LBW ($p < 0.001$) as well those with an Apgar score of less than 7 at the first and fifth minute ($p < 0.001$) (15).

A systematic review in rural Ethiopia higher number of deaths were recorded during the first 41(4.6%), second 25 (2.8%), and third 24 (2.7%) weeks of neonatal life, totally 374 (42.3%), of the LBW neonates died during the first week of life (25).

A study done in Tigray shows that 22.05 % of neonatal deaths occurred in the first 24 hours, 47.0 % in the next 3 days and 73.5 % of the neonatal deaths occurred within 7 days. The remaining 26.5 % died in the next 14 days. The cumulative survival rate of neonates at the end of the follow up was 93.96 % (95 % CI: 92.38, 95.21) (10).

In other study the cumulative proportion of surviving at the end of third days was 99.01% (95%CI: 96.11, 99.75). Similarly it was 97.81% (95%CI: 94.25, 99.18), 96.27% (95%CI: 91.76, 98.33), 94.33% (95%CI: 88.72, 97.19) and 91.46% (95%CI: 83.91, 95.55) at the end of fourth, fifth, sixth and seventh day respectively. The overall mean survival time was 17.13 days (95%CI: 12.76, 21.49) while the overall median survival time was 16 days (95%CI: 13.19, 18.81), 44.4% of the deaths were observed within the first seven days (11). About 95% of all the LBW (< 2500 g) neonatal deaths occurred within the first week of life, in comparison, about 82% of deaths among neonates with NBW (2500 g ≤ 4000 g) took place within in the first weeks (23).

Low APGAR score at first, fifth and tenth minute also other significantly associated clinical factor with LBW neonates prevalence and mortality, In Spain LBW neonates low APGAR score had the greatest impact on hospital mortality (17). In Kenya study also newborns with an Apgar score of less than six (asphyxia) had sevenfold (OR=7.03, 95%C.I.=2.03-24.35, , p-value < 0.01) likelihood of having been born LBW compared to those that were born with a score of 6 or more on Apgar (13).

A study conducted in Ethiopia shows among all neonates with low birth weight admitted to the neonatal intensive care unit 73.1% were cried immediately at birth. Among the newborns delivered at health institution 15.3% and 13.9% had the first and fifth minute APGAR score less than seven, 6.5% of the newborns were resuscitated at birth (11).

In Spain LBW neonates lower admission temperature and severe respiratory distress syndrome are the significant variables that had the greatest impact on hospital mortality (17).

In England study 84% of deaths in the <1500gm group were related to perinatal events, especially prematurity. For the 1,500–2,499 g group, perinatal events were responsible for 31% of deaths, with congenital anomalies explaining 36% of deaths (19).

A study conducted in Ethiopia shows the estimated hazard ratios of mortality were higher among neonates whose mothers gave birth by assisted or cesarean delivery (HR=1.81 and 3.72; 95% CI: 1.10 - 3.02 and 2.11-6.55) (25).

A Central Hospital in Johannesburg shows that mode of delivery, resuscitation at birth, and major birth defects were significantly associated with survival at discharge outcome. hypoglycemia, atelectasis, pulmonary haemorrhage, pneumothorax, blood transfusion, exchange transfusion, and sepsis (both early and late on- set), were not significant predictors of mortality (21).

In Tigray survival study the leading cause of death were 23 (34 %) premature and low birth weight and 21 (31 %) asphyxia, 8 (12 %) infections, 5 (7 %) congenital abnormality and 11 (16 %) died due to other causes. Neonates were followed up for 27357.508 neonate-days (10).

In Saudi Arabia the risk for LBW nearly doubled among first child order (AOR 1.98, 95% CI 1.35, 2.89), first child order (AOR 1.98, 95% CI 1.35, 2.89) (19).

Stillborn babies had an almost 7 times higher chance of being born with LBW ($p < 0.001$), and mothers who delivered by caesarean section were 40% less likely to have an LBW delivery in the index delivery ($p < 0.001$) (15).

WHO recommends kangaroo mother care is recommended for the routine care of newborns weighing 2000 g or less at birth, and should be initiated in health-care facilities as soon as the newborns are clinically stable (28).

Kangaroo mother care was associated with a statistically significant reduction in risk of mortality at discharge or at 40 to 41 weeks' postmenstrual age (3.2% vs 5.3%; RR 0.60, 95% CI 0.39 to 0.92; I 2 = 0%; NNTB = 47, 95% CI 31 to 236; eight trials, 1736 infants) (29).

A Central Hospital in Johannesburg study shows Fifty-one percent of neonates received KMC, and KMC was strongly associated with survival. Five of the 237 babies (1.7%) who had KMC died as compared to 118 of the 237 babies (49.8%) who did not have KMC ($p < 0.001$) (21).

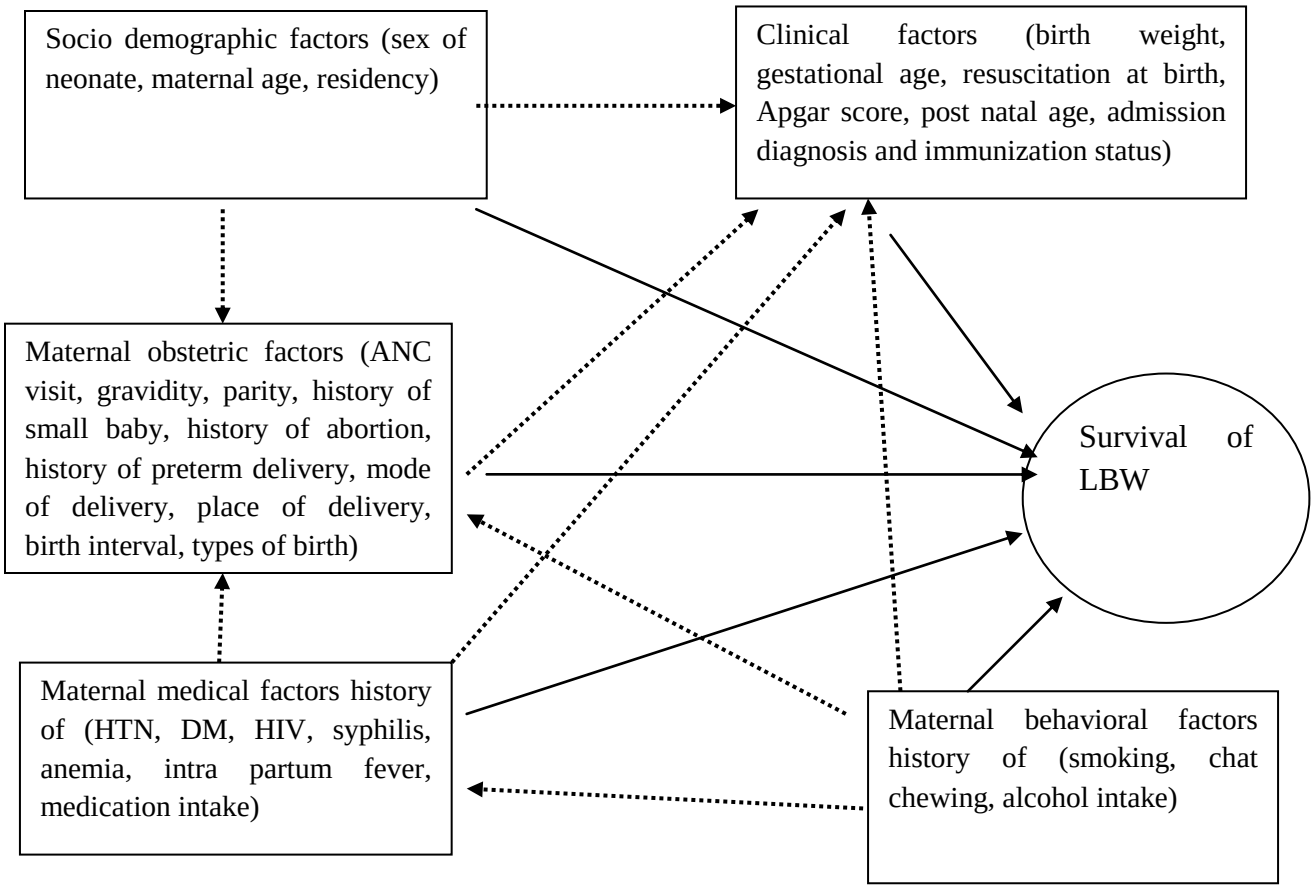

Figure 1: conceptual framework showing socio demographic, maternal medical, maternal obstetric, maternal behavioral and clinical factors contributing to LBW survival (23).

3. Objectives

3.1 General objective:

To assess survival status and to identify predictors of mortality of low birth weight neonates admitted in selected governmental hospitals of Addis Ababa, Ethiopia.

3.2Specific objectives:

To estimate survival status of low birth weight neonates admitted in selected governmental hospitals of Addis Ababa, Ethiopia.

To identify predictors of mortality among low birth weight neonates admitted in selected governmental hospitals of Addis Ababa, Ethiopia.

4. Method and material

4.1 Study area and study period

The study will be conducted in Addis Ababa which is the capital city of Ethiopia and seat of African Union & Economic Commission for Africa. Addis Ababa has a population size of over 3 million (3038096) with annual growth rate of 2.1(data obtained from central statistical agency of Ethiopia). Addis Ababa is located between 8055° and 9005° North Latitude and between 38040° and 38050° East Longitude and the total Land area is 54,000 hectares. It is established on November, 1887 by Emperor Menelik II and Empress Taitu. Its average elevation is 2,500 meters above sea level, and hence has a fairly favorable climate and moderate weather conditions.(30)

The city has 12 governmental hospitals five hospitals owned by Addis Ababa health bureau, four by federal ministry of health (FMOH), one is under ministry of education (Addis Ababa university), two by defense force according to Addis Ababa health office. The study will be conducted in randomly selected Tikur Anbessa specialized hospital, Gandhi memorial hospital, Zewditu hospital and Yekatit12 hospital medical college. The study will be conducted from February 8, 2021 to April 8, 2021 G.C in Addis Ababa.(31)

4.2. Study design

Retrospective cohort study design will be used.

4.2. Source population

The source population will be all neonates admitted in governmental hospitals of Addis Ababa neonatal intensive care unit (NICU) with diagnosed low birth weight and who had age less than 28 days between January, 2018 and January, 2021.

4.3. Study population

The study population will be selected neonates admitted in selected governmental hospitals of Addis Ababa neonatal intensive care unit (NICU) with diagnosed low birth weight and who had age less than 28 days between January, 2018 and January, 2021

4.4. Eligibility criteria

4.4.1. Inclusion criteria

All neonates admitted in selected governmental hospitals of Addis Ababa neonatal intensive care unit (NICU).

4.4.2. Exclusion criteria

Records of neonates with LBW who admitted to selected governmental hospitals of Addis Ababa neonatal intensive care unit (NICU) but whose records of neonate's admission date and discharge date not recorded and records of neonate whose treatment outcome not recorded will exclude.

4.5. Sample size determination

The sample size for the first objective (death as outcome of LBW treatment) was determined by the single population formula with the specification of death rate 8.3%, 95% confidence level, 5% margin of error

$$n = \frac{(Z_{\alpha/2})^2 p(1-p)}{d^2}$$

The ultimate sample size of records to review wills 129. The sample size for second objective (predictor variables of mortality) was determined by Epi-info version 7.2.2.6 by considering the following assumptions: CI = 95%, power =80, ratio of unexposed to exposed 1:1 and parameters:

P1-percent of death outcome among exposed LBW neonates

P2- percent of death outcome among unexposed LBW neonates

Table 1: Sample size for specific objective two by double population proportion formula

Variables	Proportion of outcome	Risk ratio	Sample size	Add 10%	References
Diabetic mellitus Yes (p1) No (p2)	P1=8.8% P2=1.73	4.79	404	445	16
HIV Yes (p1) No (p2)	P1=10.2% P2= 1.58	6.47	278	306	16

By comparing sample size of both objectives I will take the largest sample size 445

4.6. Sampling procedure

Simple random sampling method will be used to select four hospitals from 12 governmental hospitals and LBW neonatal cards will be selected proportionally according to their total LBW neonatal admission at NICU.

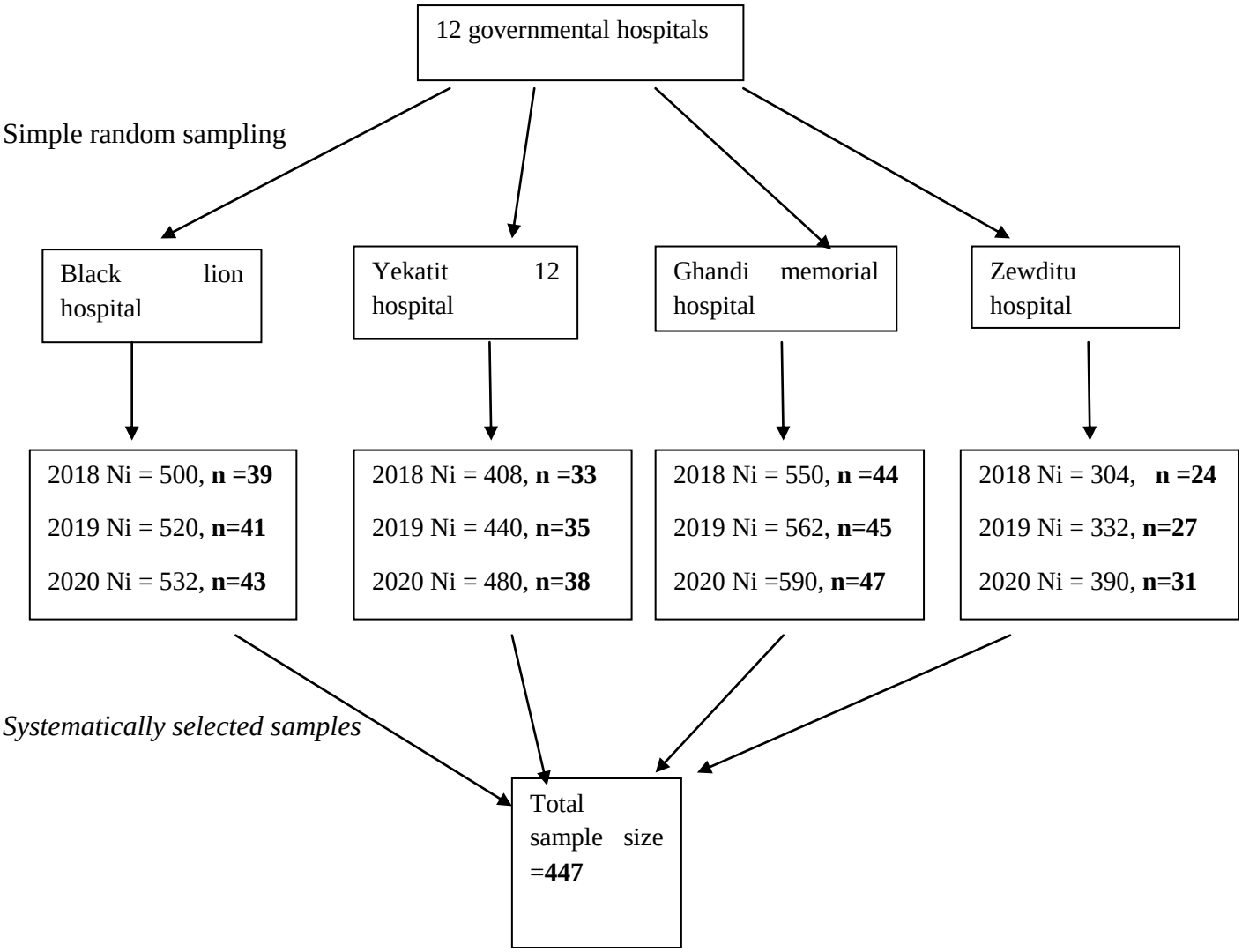

Figure 2: Sampling procedure

4.7. Operational definition

Survival: lack of experience of death. It is being alive and not experiencing LBW related death during hospitalization period.

Died: neonate that has died while s/he was in the in-patient care and death report is recorded in patient card.

Defaulted- LBW neonate cases that are sign (parents on behalf of their child)against treatment to leave treatment before cure.

Medical transfer: neonate is referred to other health facilities for medical reasons

Percentage of recovered - number of recovered/total number of discharged x 100

Percentage of died - number of deaths/total number of discharged x 100

Percentage of defaulted - number of defaulters/total number of discharged x 100

Gravidity: the total number of times that the woman has been pregnant.

4.8. Variables

4.8.1 Outcome variables

Time to death

4.8.2 Independent variable

Socio-demographic factors: (sex of the neonate, maternal age and residence).

Maternal behavioral factors: (maternal habit of alcohol intake, smoking and chat chewing).

Maternal medical factors: (history of maternal DM, HIV/AIDS, syphilis, iron deficiency anemia, pregnancy induced hypertension, UTI/STI, intra-partum fever and any medication intake).

Maternal obstetrical factors: (ANC visit, gravidity, parity, history of small baby, history of abortion, history of preterm delivery, mode of delivery, place of delivery, birth interval and types of birth).

Clinical factors: (gestational age, birth weight, admission diagnosis, APGAR score, resuscitation at birth, immunization status and post natal age).

4.9. Data Collection Method and Tools

Data abstraction sheet will be used to assess survival status and predictors of LBW, the abstraction sheet will be prepared in English by reviewing relevant literature to the problem under study to include all possible variables that address the objective of the study and contains four parts; checklist related to (socio demographic, maternal obstetric and medical condition and clinical) factors.

To collect the study participant's total LBW caseload will be assessed in the data base on the electronic system from the catalog of admitted neonates in NICU ward's of selected four hospitals. Then medical registration number (MRN) of all diabetic pediatric patients will be sorted. After this, simple random method will be applied to select the study subject. Finally the selected medical registration number will pick out the medical card of each LBW neonates patient. Data will be collected by two masters' students and the supervisor will be a masters' student in Epidemiology, the starting point for retrospective follow-up will be the time of admission and the end point will be date of discharge, date of death, date of lost to follow up and date of transfer out.

4.10. Data quality control

Data quality will be assured by giving one day training for supervisors and card reviewers to improve the skill of data collectors and to ensure the consistency of the data extraction tool. Orientation will be given to the supervisor separately on how to supervise the data collectors, check for completed data abstraction checklist and correct any problem. Data extraction forms will be checked before data collection. Completeness of the collected data will be checked onsite daily basis during data collection and give prompt feedback by the supervisor and the principal investigator. Besides this, the principal investigator will carefully enter and thoroughly clean the data before the commencement of the analysis. Pretest will be done on 5% of the study samples in Minilik hospital, Addis Ababa where is assumed to have similar characteristics to the study area, after the pretest necessary corrections will be done on the check list.

4.11. Data analysis

The collected data will be coded and entered in Epi data version 7.2.2.6 and will be transferred and cleaned to SPSS 24 (Statistical Package for the Social Sciences) for analysis.

The actuarial life table will be used to estimate probabilities of survival after admission at different time intervals. Kaplan Meier survival curve together with log rank test will be used to check the presence of difference in survival among categories of covariates and log rank test will used to compare survival curves. Cox regression will be carried out to find predictors of survival status. Patient's cohort characteristics will described in terms of central tendency and dispersion value for continuous data, and frequency distribution for categorical data. Finally, the outcome of

each subject will dichotomized into censored or death. Bivariate Cox regression will be first fitted and those independent variables which became significant on the bivariate regression having p-value ≤ 0.25 level of significance will be included in the multivariable analysis. Cox proportional-hazard regression will be fitted at 5% level of significance to determine the net effect of each explanatory variable on time to death after admission (Hazard ratio with its 95% confidence interval and p-values will be used to measure strength of association and identify statistically significant result). P-value < 0.05 will be considered as statistically significant association. Finally, the results of the study will be presented with text, graph and table.

4.12. Ethical considerations

An ethical clearance will be obtained from the research and ethics committee of school of nursing and midwifery, Addis Ababa University (AAU). After the approval of the proposal the letter will be and submitted to TASH and Addis Ababa health bureau (AAHB). Ethical clearance will be obtained from Addis Ababa public health research and emergency management directorate. All the collected data will be kept confidential and no one except the members of the research team have access to the collected information. All paper of the study will kept in a secured place &the name or other personal information has not been notified in any report. The data collection will be started after official permission is secured from selected four hour hospitals to conduct the study and to assess the record.

Work plan

Table 2: work plan of the research will be done in LBW neonate's survival and predictors of mortality admitted in selected governmental hospitals Addis Ababa, Ethiopia

No	Tasks to be performed	Responsible Person	Time (November 2020_ july 2021)							Remark
			Nov-Dec	Dec-Jan	Jan-Feb	Feb-Mar	Mar-Apr	Apr-Jun	Jun-July	
1	Development of the proposal	Researcher	✓							
2	Presentation and submission of the proposal	Researcher		✓						
3	Getting a permission to do the research and getting ethical review				✓					
4	Securing fund	Researcher			✓					
5	Pre-data collection preparations (printing, purchasing…)	Researcher				✓				
6	Recruitment of additional data collectors	Researcher				✓				
7	Basic training and orientation for data collectors	Researcher and data collectors				✓				
8	Data collection in selected governmental hospitals	Data collectors				✓	✓			
9	Data review, check and recording	Researcher								
10	Data analysis	Researcher								
11	Writing the final report	Researcher								
12	Presentation of the final result	Researcher								
13	Publishing and submission of the result to each hospitals	Researcher								

Budget

Table 3: Budget break down of the research will be done among LBW neonates survival and predictors of mortality admitted in selected governmental hospitals Addis Ababa, Ethiopia

No	Budget category	Budget detail	Unit cost	Multiplying factor	Total cost
1	**Personnel**	-	Daily wage	(No. of staff x No. of working days)	Total(in Birr)
		Principal investigator subsistence allowance	300	1*20	6,000
		Data collectors	200	2*20	8,000
		Supervisors	250	1*20	5,000
		Secretarial work	200	1*15	3,000
	Subtotal				**22,000**
2	**Supplies /Stationary**	Item	Cost per item	Quantity	Total
		Questionnaire duplication	3birr /que.	500	1,500
		Pen	10	20	200
		Markers	30	5	180
		CD-RW	20	200	4,000
		Photocopying cost	1	500	500
	Subtotal				**= 6,380**
3	**Total**				**28,380**
4	**Contingency (15%)**				**4257**
5	**Grand total**		**32,640**		

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ANNEXS

Annex 1: Information sheet

Title of the Research Project: Survival status and predictors of mortality of low birth weight neonates admitted in selected governmental hospitals of Addis Ababa, Ethiopia, 2020.

Name of Investigator: Jemal Guadu (BSc in Nursing)

Name of the Organization: Addis Ababa University, College of health science, school of nursing and midwifery and department of neonatal nursing.

Name of the Sponsor: Addis Ababa University.

Introduction: This information sheet will prepared for administration and NICU coordinating offices of selected governmental hospitals in Addis Ababa. The aim of the form is to make the above-concerned offices clear about the purpose of research, data collection procedures and get permission to conduct the research.

Purpose of the Research Project: To assess survival status and predictors of mortality of low birth weight neonates admitted in selected governmental hospitals of Addis Ababa, Ethiopia, 2020

Procedure: In order to achieve the above objective, information which is necessary for the study will take from neonatal medical record form.

Risk and /or Discomfort: Since the study will conducted by taking appropriate information from medical chart, it do not inflict any harm on the patients. The name or any other identifying information will not be recorded on the questionnaire and all information is taken from the chart will kept strictly confidential and in a safe place.

Benefits: The research have no direct benefit for one whose document/ record is included in this research and already died, discharged or transfer to other hospitals. But it could have indirect benefit for neonates who will treat in NICU. This is because if program planners are preparing predicted plan there is a benefit for clients in the program of getting appropriate care and

treatment services for those survived and other newly born ones. In all, the research work will have a paramount direct benefit for health care planners and managers.

Confidentiality: To reassure confidentiality the data on the chart will be collect without the name of the clients and the information collected from this research project will kept confidential and stored in a file cabinet. In addition, it will not been revealed to anyone except the investigator and it will kept in a key and locked system with computer pass ward.

Person to contact: If you have any question you can contact any of the following individuals (Investigator and Advisors) and you may ask at any time you want.

1. Jemal Guadu, (BSc) --Addis Ababa University, College of Health Science, school of Nursing and midwifery and Department of Nursing: principal investigator

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2. Sr. Semarya Berhe (professor, PHD fellow) ---Primary advisor

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3. Mr. Kerebeh Abere (msc)---Secondary advisor

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Annex 2: Data collection check list Code----------

Table 1: A checklist to assess the survival status and predictors of mortality among neonates admitted in NICU from 2018- 2020 in selected governmental hospitals in Addis Ababa Ethiopia, 2020.

No	**Socio demographic characteristics**	
101	Sex	1. Male 2. Female
102	Residency	1. Urban 2. Rural
103	Maternal age	-------
	Behavioral factors	
201	History of chewing chat	1. Yes 2. No
202	History of alcohol intake	1. Yes 2. No
203	History of smoking	1. Yes 2. No
	Maternal medical factors	
301	History of chronic disease	1. Diabetic mellitus 2. Hypertension 3. HIV 4. Respiratory disease 5. Cardiac disease 6. Syphilis 7. Other specify---
302	History of medication taking	1. Yes 2. No
303	If yes for question 302	Specify------
	Maternal obstetric factors	
401	History of previous small baby	1. Yes

		2. No
402	History of abortion	1. Yes 2. No
403	Mode of delivery	1. SVD 2. C/s 3. Instrumental
404	ANC follow-up	1. Once 2. Twice 3. Three times 4. ≥Four
405	Parity	1. Primipara 2. Multipara 3. Grand multipara
	Clinical factors	
501	Resuscitation at birth	1. Yes 2. No
502	APGAR score	1st minute---- 5th minute---- 10th minute-----
503	Gestational age	1. ≥42weeks 2. 37weeks-42weeks 3. 37weeks-32weeks 4. 32weeks- 28weeks) 5. ≤28weeks
504	Birth weight	1. 1500gm-2500gm 2. 1000gm-2500gm 3. ≤1000gm
505	Admission diagnosis	1. Asphyxia 2. EONS 3. LONS 4. RDS

		5. prematurity 6. Neonatal jaundice 7. Congenital anomalies 8. Neonatal seizure 9. Other
506	Current status	1. Alive 2. Dead 3. Lost follow up 4. Transfer to other hospital
507	From 506 if dead when after admission	**(------) minutes/hour/days**
508	From 506 if lost follow up when after admission	**(------) minutes/hour/days**
509	From 506 if transferred to other hospital when after admission	**(------) minutes/hour/days**

Table 1: Shows percentage and frequency socio demographic factors

No	**Characteristics**	**Frequency**	**Percentage**
101	**Sex**		
	Male		
	Female		
102	**Residency**		
	Urban		
	Rural		

Table2: Shows percentage and frequency of behavioral factors

	Characteristics	**Frequency**	**Percentage**
201	**History of chat chewing**		
	Yes		
	No		
202	**History of alcohol intake**		
	Yes		
	No		
203	**History of smoking**		
	Yes		
	No		

Table 3 Shows percentage and frequency of maternal medical conditions

	Characteristics	Frequency	Percentage
301	**History of chronic disease**		
	Diabetic mellitus		
	Hypertension		
	HIV		
	Respiratory disease		
	Chronic cardiac disease		
	Other		

Table 4: Shows percentage and frequency of maternal Obstetric factors

	Characteristics	Frequency	Percentage
401	**History of previous small baby**		
	Yes		
	N o		
402	**History of abortion**		
	Yes		
	No		
403	**Mode of delivery**		
	SVD		
	C/S		
	Instrumental		
404	**ANC follow up**		
	Once		
	Twice		
	Three times		
	Four times and above		
405	**Parity**		
	Primipara		
	Multi para		
	Grand multi para		

Table 5: Shows percentage and frequency of Clinical factors

	Characteristics	Frequency	Percentage
501	**Resuscitation at birth**		
	Yes		
	No		
502	**APGAR score**		
	≤ 6 at 5^{th} minute		
	≤3 at 10^{th} minute		
503	**Gestational age**		
	≥42weeks		
	37weeks-32 weeks		
	32weeks-28weeks		
	≤28weeks		
504	**Birth weight**		
	1500gm-2500gm		
	1000gm-1500gm		
	≤1000gm		
505	**Admission diagnosis**		
	Asphyxia		
	EONS		
	LONS		
	RDS		
	Neonatal jaundice		
	Prematurity		
	Congenital anomalies		
	Neonatal seizure		
	Other		
506	**Currents status**		
	Alive		
	Dead		
	Discharge		
	Transfer to other hospital		