Risk factors for Perinatal Death in Juba teaching Hospital, South Sudan

A case-control study.

By

Taban Geofrey Collins

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Supervisor: Dr. Mukooza Edward

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PRELIMINARY:

Declaration

I, Taban Geofrey Collins, do hereby declare that this is my original research work, is not plagiarize and has never been submitted to any University or Institution for any award.

SIGNED: 

TABAN GEOFREY COLLINS

(MPHL STUDENT)

DATE: 7th March 2023

Supervisor approval:

This is to certify that this Dissertation by Taban Geofrey Collins on **"Risk factors for Perinatal Death in Juba teaching Hospital: A case -control study,"** has been submitted with my approval as a supervisor.

SIGNED:

DR. MUKOOZA EDWARD

DATE:11th March 2023

Contents

List of abbreviations and acronyms

APGAR	**A**ppearance (skin color)
	Pulse (heart rate)
	Grimace response (reflexes)
	Activity (muscle tone)
	Respiration (breathing rate and effort)
ANC	Antenatal Care
CDC	Centre for Diseases Control
ENC	Essential newborn care
UN	United Nation
UNICEF	United Nation Children's Fund
EWEC	Every Woman Every Child
ENAP	Newborn Action Plan
IGME	Inter-Agency Group for Mortality Estimation
IUFD	Intra Uterine Fetal Death
ICD-10 PM	International Statistical Classification of Diseases-10th Edition on Perinatal Mortality
IUGR	Intra-Uterine Growth Retardation
LMIC	Low- and Middle-Income Countries

SBA	Skill Birth Attendants
SDG	Sustainable Development Goals
PPOK	Perinatal Period of Risk
MOH	Ministry of Health
VIF	Variance Inflation Factors
WHO	World Health Organization

Operational definitions:

Stillbirth: is a baby born with no signs of life. Different countries use different cut-offs for the minimum number of weeks the pregnancy must have lasted to be classified as a stillbirth, with earlier pregnancy losses considered 'miscarriages. In this study, a 28-week of gestation cut-off be used for international comparison.

It is classified into two. Fresh Still birth or Macerated Still birth.

Macerated Stillbirth occur during pregnancy and prior to birth, before labor begins **(antepartum stillbirth)**

Intrapartum stillbirth -It can also occur during labor and birth (Fresh or non-macerated stillbirth)

Stillbirth rate: Number of babies born per year with no signs of life weighing 1000g and above and after 28 weeks of completed weeks of gestation per 1000 total births

Perinatal mortality rate weight -specific: Number of deaths in fetuses born weighing 1000g and above plus neonatal death weighing 1000g and above at birth per 1000 total births.

Perinatal mortality rate-age specific: Number of deaths in fetuses born after 28 completed weeks of gestation and plus neonatal death with first 7completed days after birth per 1000 total births.

Neonatal mortality rate: Number of live born infant per year dying before 28 completed days of age per 1000 live births.[i]

Intra Uterine Fetal Death (IUFD): is death of unborn baby or a baby die while inside the mother uterus.

Infant: is a baby who is below 1year.

Fetus: means unborn baby.

Controls: are mother baby pairs where babies are alive by the end of the first week after birth

Cases: are mother baby pairs where the baby dies in the perinatal period i.e. Intra Uterine Fetal Death (IUFD) or death in first week of life after birth.

Disinfectant: Liquid use for sterilizing surface of the solid object

APGAR score: is a test given to newborns soon after birth. This test checks a baby's heart rate, muscle tone, and other signs to see if extra medical care or emergency care is needed. Usually it is given twice: once at 1 minute after birth, and again at 5 minutes after birth.

Variance Inflation Factors (VIF): Measure of multicollinearity among independent variables in multiple regression analysis model, which detects reduction of significance of independent variables. Existence of multicollinearity means a correlation between multiple independent variables in multiple regression model.

CHAPTER 1: INTRODUCTION:

1.1 Background to the research

Perinatal death is the death that occur in fetuses born after 28 completed weeks of gestation plus neonatal death within 7 completed days after birth[ii]. The global trend of perinatal death rate remains high, over 5,000 babies are stillborn at 28 weeks or more of gestation per day, 1.9 million every year. In every five babies two die during labor (intrapartum stillbirths).[iii]

Majority (98%) are from low- and middle-income countries (Sub-Sahara Africa and South Asia).

More than half of the perinatal deaths are as result of still birth while a third occurs during childbirth are preventable because it is linked to place of and care at delivery. In developing countries, over 40% of childbirth occurs in health facilities and more than half takes place with support of skilled birth attendants. Further significant progress was made with the launch of the Every Newborn Action Plan (ENAP), the United Nation (UN) Secretary-General's Every Woman Every Child (EWEC) monitoring framework, the "Every Child Alive" campaign, spearheaded by UNICEF, and the Quality of Care network, by the UN Inter-Agency Group for Mortality Estimation (IGME) 2017, all of which focused on reducing perinatal mortality in low and middle income (LMIC) countries in achieving the Sustainable Development Goals (SDGs) target 3.2. [iv]

In Africa, stillbirths are happening with alarming frequency, mothers in Sub-Sharan Africa and Southern Asia have the highest risk of losing their babies to stillbirth about 1.5millions of stillbirth occur in the two region alone in 2021. The stillbirth rate in sub-Saharan Africa alone in 2021 stand at 21 deaths per 1,000 total births. This is seven

times higher than the stillbirth rate in high-income countries in Europe, Northern America, Australia, and New Zealand, where it is just 3 per 1,000 total births.[v]

In South Sudan, Unite Nation Interagency for Mortality estimation estimated the neonatal deaths rate of South Sudan stands as high as 39.3 per 1000 live births [vi](UN IGME 2014) and stillbirths was estimated to 30.1 per 1000 live births[vii].

it is estimated that about 56% of the population has no access to healthcare services, only 44% of the population are within 5 km radius of a health facility. There is widening gap of critical staff for service delivery exists because doctor and Nurse to population ratio stands at 0.15/10,000 and 0.2/10,000 respectively. A significant disparity in health status across socio-demographic characteristics and geographical location is not well documented and no demographic Health survey conducted since South Sudan became independent. South Sudan has huge challenge in establishing data base for perinatal deaths because most of the stillbirth and neonatal deaths occurred at home, unseen, and uncounted. To make it worse again most of stillbirths that happened in health facilities are rarely issue certificate that is why the true burden of perinatal mortality in South Sudan could not be known but to rely on estimation figures.[viii]

1.2 Statement of the problem

South Sudan is among the countries with high perinatal mortality despite the pregnant women attend their antennal care services and childbirth free of charge in public health facility. The perinatal deaths were estimated as high as 30 deaths per 1000 live births. Pregnant women are expected to attend ANC for preventive and curative services on regular basis including delivering at health facility under skilled birth attendant for safe pregnant outcome. Health professionals document both normal and stillbirth but do not issue birth certificate when it is stillbirth that would have been useful to know the causes of stillbirth in the country. Although stillbirth prevention is part of Reproductive,

Maternal, Newborn, Child, and Adolescent Health (RMNCAH) continuum of care, less information are available, and it was not easily accessible because of limited publication about the stillbirth in South Sudan; neither government set stillbirths reduction targets nor developed plan to prevent stillbirth nor the risk factors for perinatal death in South Sudan had been studied. Lack of information on major perinatal risk factors can lead to continue perinatal deaths, SDG target 3.2 of reducing Neonatal Mortality Rate to 12 per 1000 live births and Under 5 Mortality Rate to 25 per1000 live births cannot be achieved without reducing Perinatal Mortality Rate. Government may not be held accountable for their action because there was not plan of action on preventing stillbirth. Since the underlying causes or specific risk factors are not clear, action to reduce this problem up-to date has been ineffective because specific obstacles to be addressed in this high perinatal death is still unknown. Some studies conducted on perinatal mortality, being cross-sectional studies evidence are weak. Other studies used case-control studies combine maternal and neonatal mortality, evidence of associated risk factors cannot be generalized to perinatal death. Possible explanatory risk factors for perinatal death include Inadequate access to health care services (quality care at ANC, labor and childbirth); socioeconomic factors (poverty); environmental impact (indoor and out-door pollution); maternal related conditions (complication during pregnancy, labor and childbirth); infections and maternal health conditions; behavioral factors (unhealthy lifestyle choices). Therefore, this study assessed the associated risk factors of perinatal death through interviewing mothers who lost babies at perinatal period and those who did not, to provide specific information for underlying risk factors which are most prevalent for perinatal death in South Sudan.

The study hypothesis

The null hypothesis for cases with OR more than 1 are risk factors for perinatal death and alternative hypothesis for controls with OR less or equal to 1 are not the risk factors for perinatal death.

- Null hypothesis (Cases) H0: $OR > 1$
- Alternative hypothesis (Control) Ha: OR ≤ 1

1.3 Research questions

What risk factors are associated with perinatal deaths in Juba teaching hospital?

1.4 Research objectives

1.4.1 General objective

To determine the risk factors associated with perinatal deaths in Juba teaching Hospital.

1.4.2 Specific objectives

The specific objectives of this study include:

1. To identify maternal factors that are risks for perinatal deaths.
2. To describe neonatal factors that influence perinatal deaths.
3. To assess health facility factors that influence risks of perinatal deaths.

1.5 Significance of the study

The findings of the study are valuable to researchers, government ministries especially Ministry of Health (MoH), health partners and development partners. The information generated was used to recommend appropriate health service intervention in reducing perinatal deaths in South Sudan. In addition to that, this study could stimulate areas for further research in relation to perinatal survival. It would provide ministry of health-

unit of health promotion and education with valuable information in combating perinatal morbidity and mortality in the country. Nevertheless, this study will inform government on which risk factors to focus on when addressing perinatal mortality in the country and also help the government to developed plan and set stillbirth target in preventing perinatal death in the country as it contributes to achieving Sustainable Development Goal (3.2).

1.6 Justification

In this study the researcher sought to understand the risk factors for perinatal deaths in Juba teaching hospital because there was insufficient information as to why perinatal deaths in South Sudan was as high (neonatal 39.3 per 1000 live births and stillbirths 30.1per live births). Despite world high perinatal death there were few hospital-based studies done and to the present there is no published study on perinatal mortality that had been carried in Juba teaching Hospital. Given inadequacy of reliable perinatal data in a country, it will be very difficult to develop plan of stillbirth reduction neither address the underlying risk factors nor achieve the Sustainable Development Goal target 3.2 by 2030. Thus, with this study the associated risk factors of perinatal death through interviewing mothers who lost babies at perinatal period and those who did common risk were established which provided specific information for underlying risk factors which are most prevalent for perinatal death in South Sudan.

1.7 The conceptual framework of risk factors for perinatal deaths, adapted and modified from Mosely and Chen et al (1984)

Independent variables (IV)

Dependent Variables

Perinatal outcome:

- ✓ Alive

- ❖ Maternal related risk factors (complication in pregnancy, labor and childbirth) associated with perinatal death.
- ❖ Fetal related risk factors (Low birth weight, preterm and congenital) associated with perinatal death.
- ❖ Care provider related factors (delay in action or inappropriate action- inadequate monitoring and lack of equipment) associated with perinatal death.
- ❖ Other maternal factors (illiterate, alcohol & tobacco use, overweight, age extremity and poverty) associated with perinatal death.

- ✓ Death (Fresh stillbirth, Macerated stillbirth, Or Neonatal death within 7days after birth)

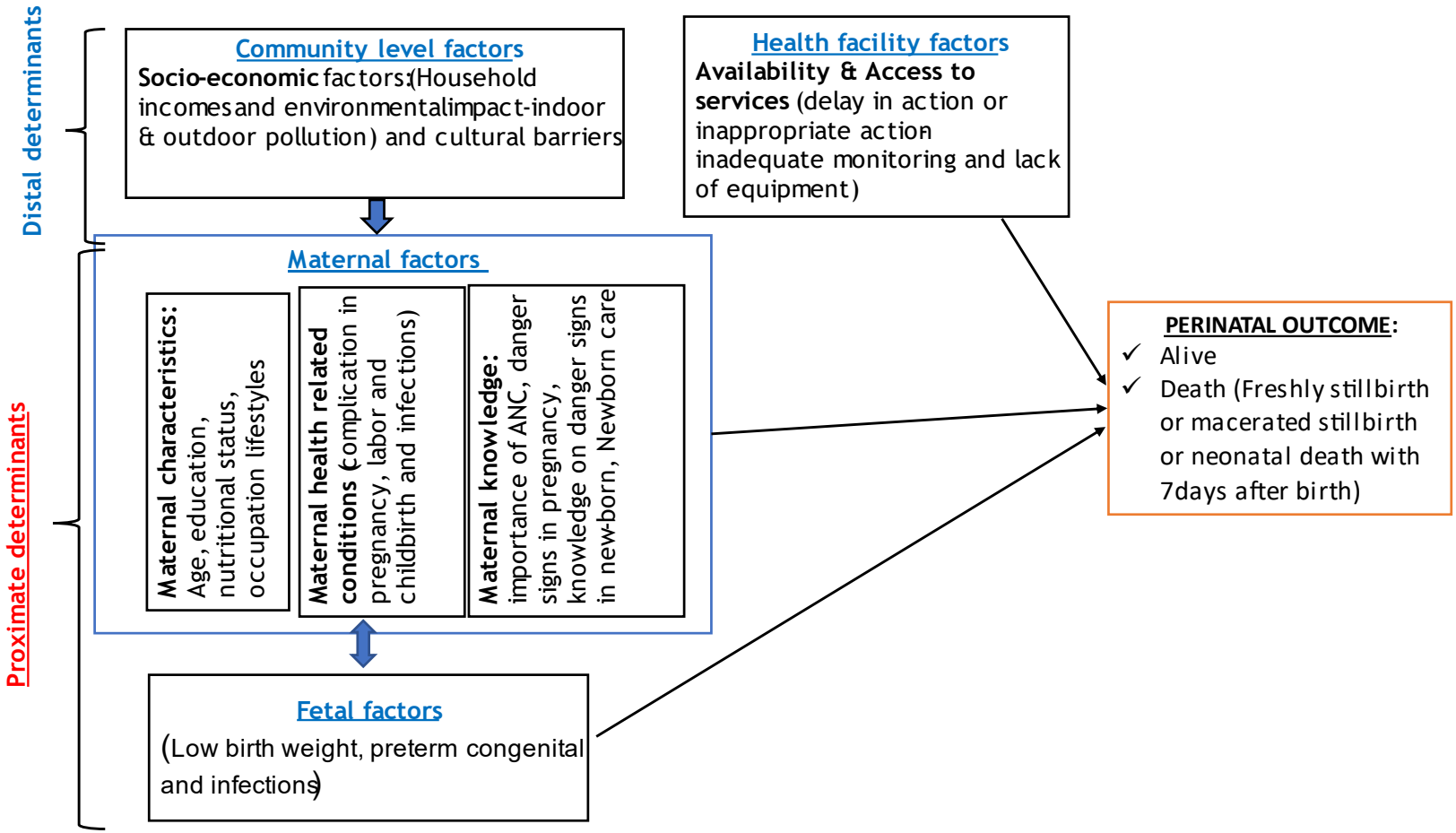

Figure 1.7.1 Modified conceptual framework of Mosely and Chen et al (1984)

1.7.1 Description of conceptual framework

Figure 1.7.1 above, the conceptual framework of Mosely and Chen for study of child survival in developing countries was adapted, modified, and used in this study alongside with selected possible predictors for perinatal death in South Sudan.

Independent variables

In this study the independent variables are divided into two major sublevels the distal and proximate determinants. The distal determinants include community level and health facility level factors. The community level factors indirectly influence maternal factors include:(Household incomes and environmental impact-indoor & outdoor pollution) and cultural.

While health facility factors covered availability and access to services in relation delay in action or inappropriate action- inadequate monitoring and lack of equipment).

The proximate determinants include maternal factors and neonatal factors.

Maternal characteristics include: the age, education, nutritional status, occupation. lifestyles of the mothers.

Maternal health related conditions may include complication in pregnancy, labor and childbirth and infections) and maternal knowledge on visiting ANC, danger signs in pregnancy, danger signs in new-born, Newborn care can influence the perinatal outcome.

Fetal/Neonatal factors include ; Low birth weight, preterm congenital and infections influence perinatal outcome.

1.7.1.1 Maternal risk factors

The lack of regular attending of Antenatal Care (ANC) services and lack of knowledge on importance of ANC, danger signs in pregnancy and response (e.g reduce fetal movement, rupture membrane, bleeding), danger signs in new-born (e.g not breastfeeding, fever, convulsion etc). Newborn care (cord care, bathing, temperature, and breastfeeding) exposes the baby to perinatal death. Maternal health during pregnancy such as medical conditions, intrapartum complications, malnutritional are

risks of perinatal death. Maternal characteristics such as very low age or over in marriage, no or low education level and low-income level contribute to perinatal death.

1.7.1.2 Neonatal factors

Neonatal factors such as low birth weight, pre-term for gestational age, low Apgar score at birth and complications at birth such as birth trauma, perinatal asphyxia or hypoxia, infection, or sepsis contributed to perinatal death.

1.7.1.3 Health system factors

The health facility factors contribute direct or indirect to the perinatal death. Inaccessibility due to unavailability of live saving services such as antenatal care (ANC), delivery, assisted by skilled birth attendants and other services like use of ultrasound to detect complications and abnormality during pregnancy lead to perinatal death.

Indirectly Infrastructure such as lack of power supply, water, and equipment that aid service delivery.

The poor quality of care such as inadequate fetal monitoring during labor (i.e. ignore signs of fetal distress, poor monitoring labor progress, incorrect management of prolong 2nd stage labor and delay call for doctor /referral expose the baby to perinatal death. Lack of response to ANC warning signs: such as no response to poor past obstetric history, poor uterine growth, fetal movement, hypertension, failure to diagnose twins/more, lack of response to syphilis and proteinuria/glycosuria test result, post-term pregnancy exposes baby to perinatal death. Inadequate newborn resuscitation and delay call for help /referral to next level including mode of delivery and assistant at birth expose baby to perinatal death.

1.7.2 Dependent variable

The outcome of this study was either Newborn alive , or dead (Fresh stillbirth , Macerated still birth) and neonatal death within 7days after birth. This outcome was

because of the impact of maternal factors, neonatal factors and health facility factors as shown in the figure 1.7.1 above.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Building a simple method base on concept of mobilizing community to prioritize appropriate preventive measures of reducing Feto-infant mortality was found to be very important tool. Sappenfield used a simple framework where two dimensions of age and weight in perinatal period is examined using *Period of risk*. He pointed out that very low birth weight related deaths can be prevented by addressing maternal health issues through prevention and treatment of prematurity or pre-term. For higher birth weight related deaths, fetal deaths can be prevented by providing accessible, affordable, and quality maternal care services and last one is neonatal deaths can be prevented through best practice of newborn care and postnatal deaths can be minimized by improving infant health relate care. [ix]

Therefore, in order to address root cause of the deaths it was very important to group the deaths in the same period of risk with similar problems and similar causes of death and same maternal risk factors. By doing so such identification of the deaths within one period of risk has similar problems and may have similar solutions because each period was associated with its own set of risks and ways of preventing it.

2.2 Maternal risks factors

Simone et al., (2017) conducted study entitles “Effect of mother related factors on perinatal outcome targeting mothers seeking antennal care at public and non-public care facilities in Kenya -Kisii county in the context of free maternity care. The study aim was to determine the client level and health system factors that affect perinatal

outcomes among women attending comparable public and non-public health facilities. Prospective cohort study design was carried out. The finding suggests there is association of maternal Body Mass Index (BMI) and the perinatal outcome. Those mothers classified with normal BMI are 5times likely to have normal perianal outcome and vice versa. The study concluded that maternal BMI, parity, knowledge of pregnancy related issues and male accompanying pregnant woman is predictor of perinatal outcome[x]. However, there were huge gaps of study in the continuum of maternal care during pregnancy, labor and post-natal care in determining the perianal outcome. The study concentrates on maternal BMI, parity and knowledge excluded health care provider factors and administrative factors that can affect the perinatal outcome.

Asnawi et al., (2016) conducted study in Indonesia entitle "risk factors associated with neonatal deaths: a matched case-control study." The aim was to identify risk factors associated with neonatal deaths of low and normal birth weight infant that were amendable to health service intervention at community level in a relatively poor province of Indonesia. He used case-control study method where cases were singleton birth by vaginal delivery at home or health facility, matched with two controls satisfying the same criteria. It was found that five factors were significantly associated with maternal factors. The risk factors include complications during birth, lack of early initiation of breastfeeding and lacks of maternal knowledge on neonatal danger signs, age at marriage, and history of abortion, were found to be associated with higher risk of neonatal death among babies with normal birth weight. [xi]

Abubakari et al.,(2019), study entitle "determinant of adverse neonatal outcome among postnatal women in Dares-Salaam Tanzania. It was case-control study to investigate determinants of neonatal outcomes among postnatal women. The study revealed that maternal age and gestational age was significantly associated with

adverse neonatal outcomes. Previous history on number of pregnancies and still birth was not associated with adverse neonatal outcome as well as maternal blood pressure and anemia during pregnancy has no relationship with neonatal adverse outcome. However, the study revealed that there was association of maternal malaria and HIV infections and adverse neonatal outcome. The study missed to examine the care provided during childbirth and immediately after childbirth which might have contributed in determining the fetal survival. The study focused more on maternal health factors and no specific to the newborn care. [xii]

The study of Elias et al (2018) entitle "determinants of perinatal mortality among cohort of pregnant women;" was conducted in three districts of North Showa zone, Oromia, Ethiopia region. The study objective was to assess the determinants and causes of perinatal mortality among babies born from the cohort pregnant women in three selected districts. Case control was used to carry out the study.[xiii]

The finding shows that maternal age 35years and above has higher risk for poor outcome of perinatal death than lower age groups. Multiple babies and pre-term babies have higher risk of poor perinatal outcome than singleton pregnancy and full-term babies. Asphyxia, infection and chorioamnionitis are the leading causes of perinatal deaths. However, the study focused has gaps in examining some maternal specific related factors as such care taken by mothers' and family members, health care providers and administrative consideration to ensure survival of the baby. This study needs to dig deep to the gaps for its bridging.

Lagadec et al (2018), study entitle "factors influencing quality of life of pregnant women." In which he conducted systematic data review from 37selected articles from developed countries with a human development index over 0.7. They searched from PubMed, EMBASE and BDSP (Public health Data base). The research objectives were to

describe the quality of life during uncomplicated pregnancy and to assess its associated socio-demographic, physical and psychological factors in developed countries. The research finding shows that main factors associated with better quality of life were mean of maternal age, early gestational age, absence of social and economic problems, having family and friend, doing physical exercise, feeling happiness at being pregnant and being optimistic.[xiv]

However, in the other hand he found that major factors associated with poor quality of life were medically assisted reproduction, complication before or during pregnancy and sexual domestic violence. Among the factors affecting the pregnancy outcome in the two studies reviewed were alcohol consumption/dependence and smoking prior to the month of conception which associated with poor quality of life. In addition to that obesity, obstetric complications, medical conditions frequently indicate poor quality of life during pregnancy in 9studies. However, exercise was found improving the quality of life of pregnant women. [xv]

In eight studies, it has shown that symptoms of depression, anxiety and stress, have strong negative effect on the quality of life of pregnant women as well as sexual or domestic violence was related to poor quality of life as well as tendency of poor pregnancy outcome.

Therefore, maternal health factors contributed much in determining the fetal and neonatal outcome. The positive factors such as avoiding smoking, alcohol consumption, and other drugs abuse, simple exercise, and family attachment increase better pregnancy outcome which strongly correlate with better quality of life of pregnant women should be encourage for better fetal and neonatal outcome.

Abhishek et al (2018) studied revealed that pregnancy among women with congenital heart disease (CHD) poses exceptional challenges to fetal/neonatal outcome due to

the physiological and hemodynamic changes in relation to pregnancy. He found that pre-pregnancy arrythmias and use of anticoagulant or aspirin predispose a pregnant woman to major obstetric complication such as pre-eclampsia and eclampsia during pregnancy.

Normal pregnancy outcome is as important as the fetal outcome in order to ensure normal development, health and wellbeing. A mother who is exposure to adverse environment such as malnutrition predisposes her offspring to chronic diseases such as cardiovascular diseases, hypertension, diabetes and obesity in later life. [xvi]

Martha et al., (2020), conducted study entitle "identifying risk factors of perinatal death in Tororo district hospital-Uganda: A Case-control study." The study objective was to identify risk factors of perinatal deaths in Uganda. It was retrospective case-control study at district hospital in Eastern Uganda using birth registry data. Admission with stillbirth at or beyond 24 weeks or neonatal death within 28days were considered as cases whereas admission that resulted to birth immediately preceding and following each case were considered controls. The study found that factors associated with increased odds of perinatal deaths include prematurity, low birth weight, multiple gestations, breech presentation, antepartum hemorrhage, caesarian delivery and cord prolapse. On the other hand, it found some factors associated with odds of decreased perinatal deaths which include more or 3prior births and presenting in spontaneous delivery. Pregnancies with obstetric complications have high chance of adverse perinatal outcome.

In which intra-uterine fetal growth restriction and placenta abruptio were significant causes for perinatal death. Multiple pregnancies were associated with significant perinatal deaths, of which 99% of multiple pregnancies had bad outcome were preterm[xvii]

2.3 Neonatal factors

Low Birth Weight (LBW) is birth weight less than 2500grams regardless of the gestational age as a result of pre-term birth, short gestational age and intra-uterine growth retardation. Low Birth Weight (LBW) is considered very important public health indicator of maternal health, nutrition, health care delivery and poverty according to Every Preemie scale (2017). [xviii] Moura (2014) conducted study entitle "Risk factors for perinatal death in two different levels of care: case-control study." The objective was to investigate the maternal, gestational, and neonatal factors associated with perinatal deaths at two different levels. Case-control study was carried out in two hospitals at different care levels-secondary and tertiary in southeastern Brazil. It was found that low birth weight and maternal hemorrhage increases neonatal risk factors for perinatal death in secondary care center. In tertiary hospital it was found the male sex, prematurity, low 5-minutes Apgar score, pregnancy induce hypertension and intra-uterine infection were strongly associated with perinatal death. [xix]

In the study conducted by Yousef Khander (2021) in Jordan entitle "rate, risk factors and causes of neonatal mortality in Jordan: analysis of stillbirth data and neonatal surveillance system." The aim was to determine the rate, risk factors and causes of neonatal mortality. In which electronic data for 2019 for stillbirth and neonatal deaths surveillance were obtained from three cities through five hospitals. Data include all births, neonatal death and causes and other characteristic between 2019 and 2020 and were analyzed.

It was found that low birth weight and pre-term birth were significantly more likely to die during the neonatal period than full- term birth and also being born to housewives has higher chance of perinatal death than being born to employed woman with odd

ration of 2.7 (CI : 1.2-6.0). The main risk factors were found to promote neonatal deaths which were discharge prematurely from the hospital without resolving condition such as respiratory and cardiovascular disorder (43%) and low birth weight and pre-term birth (33%) which occur in post-discharge from the hospital[xx].

Edwin et al (2015) conducted a prospective population-based case-control study in Auckland: Maternal sleep related practice as risk factors for stillbirth. Women with a singleton late stillbirth (≥ 28weeks of gestation) without congenital abnormality were considered as cases and women with singleton ongoing pregnancies were considered as controls and gestation matched to that which the stillbirth had occurred.

It was found that women who slept on their back or on their right side on the prior to stillbirth or interview were more likely to experience late stillbirth than those slept on their left side. In the same note it was found that women wake up for toilet once or less on last night were more likely to experience stillbirth than those wake up at night frequently. In addition to those women who regularly slept during day time in last month were more likely to experience a late stillbirth than those who are not. The researcher explained the pathophysiology of maternal sleeping practice position to risk of still birth as maternal sleep disruption is associated with maternal hypertension, gestational diabetes and intra-uterine fetal growth restriction. This is because maternal posture in late pregnancy has profound effect on maternal hemodynamic. The study in awake pregnancy women demonstrated reduced ejection fraction and cardiac out in lying supine position than left sided. Lying in supine position reduce utero-placental blood flow to fetus the uterus compressed inferior vena-cava which lead to hypotensive syndrome and adverse effect on umbilical artery blood flow and gas exchange between mother and the fetus. Subsequently if no change of posture lead to fetal heart rate retardation and fetal growth restriction. However, health workers being aware of this

was practice when pregnant woman is on labor is asked to lie in left tilt position to displace uterus from inferior vena-cava compression to improve maternal hemodynamic. Thus, avoid supine sleep-in late pregnancy reduce risk of stillbirth by 25%. [xxi]

Yemisrach et al (2017) conducted research entitle "factors associated with perinatal mortality among public health deliveries in Addis Ababa Ethiopian: unmatched case-control study." The study objective was to understand the common and avoidable factors affecting perinatal death in Addis Ababa, Ethiopia. The study design was case control using secondary data as source of information. Considered stillbirth or early neonatal deaths as cases and live births and neonate discharge alive from the hospital and did not die before age 7days. The data were analyzed using Epi info version 7.0 and SPSS version 21. The finding was that birth interval less than 2 years, per-term birth, anemia, congenital anomaly, previous history of early neonatal deaths and low birth weight were the associated risks for perinatal deaths. It was found that use of partograph decreased the risks of perinatal deaths. However, odds of perinatal deaths were found higher among low-birth-weight babies (AOR 16.45; 95%CI (9.57 – 28.26), in the same note risk of perinatal death was higher among newborn with congenital anomaly than newborn which were not. [xxii]

Mayadevi et al (2017study entitle "risk factors for perinatal mortality: case control study in India Thiruvananthapuram, Keral." The study aims at determining maternal risk factors for perinatal deaths in India. The researcher used prospective case control design to conduct the study. The cases were all refresh and macerated stillbirths and early neonatal deaths during the study period and controls were chosen as next birth entry in the birth registry.

The researcher found that low birth weight and congenital anomaly has significant risk factors for perinatal deaths. Prematurity has significant risk factor for perinatal death with odd ratio of 16.455 (CI; 11.309 -23.943). among the deaths of perinatal deaths, 33% were term perinatal death and 66% pre-term perinatal deaths. It means perinatal deaths is 16times higher in prematurity than term perinatal deaths. It was also notice non-vertex presentation had higher perinatal deaths than vertex presentation, which is statistically significant. [xxiii]

2.4 Health facility factors

Yemisrach et al (2017) conducted research entitle "factors associated with perinatal mortality among public health deliveries in Addis Ababa Ethiopian: unmatched case-control study." The study objective was to understand the common and avoidable factors affecting perinatal death in Addis Ababa, Ethiopia. The study design was case control using secondary data as source of information. Considered stillbirth or early neonatal deaths as cases and live births and neonate discharge alive from the hospital and did not die before age 7days.

The researcher found that the proportion of mothers who gave birth without partograph follow up was 21% among cases and 66% among control groups. Of which 21.5% of them were admitted in the hospital with positive fetal heartbeat but later reported stillbirth during childbirth. Thus, use of partograph is found to be protective factors for perinatal deaths because the odd of perinatal deaths were 65% less likely among mothers whose labor were monitored using partograph compared with mothers whose labor was not monitored by partograph.

In the same analysis it was found that use of partograph for labor monitoring was significantly associated with perinatal death. In the same study it was found that odd of perinatal mortality were less likely among mothers who delivered by

instrument/caesarian section than mothers who gave birth by spontaneous virginal delivery with adjusted odd ratios of 21(95% CI: 0.05-0.86) and 0.48(95% CI: 0.27- 0.86) respectively. [xxiv]

Hasan et al (2014), conducted systematic audited review to identify avoidable in maternal and perinatal deaths in low resource setting, data from low- and middle-income countries. The aim was to develop recommendations and interventions target modifiable deficiencies in care through assessing clinical practice against accepted standard for quality improvement. In which 42 avoidable factors for maternal and perinatal deaths were identified and summarize into four major categories. Health workers-oriented factors most common accounted for 66.7% of the 42 factors, patient-oriented factors (14.3%), administrative/supply factors (11.9%) and transport/referral factors (7.1%). All factors were categorize using relative order of attributable deaths. It was found that majority of perinatal deaths were as a result of substandard practice by health workers. Adequate training of health workers and refresher courses, patient safety and quality initiative help to ensure minimum standard care delivered by health workers at every childbirth. Specifically, perinatal deaths would have been prevented 11.1% by health workers standard care and 10.7% by appropriate administrative action. Out of those perinatal deaths would have been prevented 7.1% by appropriate immediate surgical operative intervention, 6% by labor monitoring, 5.5% by appropriate initial maternal assessment and 4% by presence of health workers for key intervention. Thus, improvement of health system contributes to reduction of perinatal deaths.[xxv]

2.5 Summary of known and unknown on risk factors of perinatal death:

From the study of Simone et al (2017) high Body Mass Index (BMI), large parity, lack of knowledge on danger signs in pregnancy increase risk of perinatal death. In addition to that Asnawi et al (2016) complications during birth, lack of early initiation of breastfeeding and lacks maternal knowledge on neonatal danger signs, lower age (below 15 years) or over age (above 35years) at marriage, and history of abortion were found contributors to the perinatal death.

According to Elias et al (2018) pre-terms, asphyxia, infection and chorioamnionitis were the leading causes of perinatal death. Based on Abhishek et al (2018) experimental study, pre-pregnancy arrythmias, Congenital Health Disease (CHD) and use of anticoagulant or aspirin predispose a pregnant woman to major obstetric complication such as pre-eclampsia and eclampsia during pregnancy. Martha (2020) study highlights among risk factors of perinatal death; the multiple gestations, breech presentation, antepartum hemorrhage, and cord prolapse. From the perspective of Nihaya et al (2020), premature discharge from the hospital without resolving conditions such as respiratory and cardiovascular disorder pose risk for perinatal death at post-discharge. While Edwin et al (2015) study revealed that pregnant women who wake up for toilet once or less at night and those who slept on their back and slept daytime were more likely to experience stillbirth. Therefore, the above studies revealed what is known about risk factors for perinatal death.

However, the gaps from the above literature which were not addressed by the studies were levels in which perinatal death occurred from the continuum of care (community level, maternal level, fetal level, and health service provision level). Secondly the context (free or with cost) in which Maternal, Neonatal and Child Health (MNCH) services were provided at public health facilities.

Thirdly, which key drivers for perianal death in context of South Sudan is still unknown though a lot of risk factors for perinatal death had been identified in the literature. Since the underlying causes or specific risk factors are not clear, action to reduce this problem up-to date has been ineffective because specific obstacles to be addressed in this high perinatal death is still unknown.

Therefore, this study sought to bridge knowledge gaps regarding perinatal death in context of free MNCH services at public health facilities in South Sudan. The risk factors for premature deaths of neonates or stillborn is not yet clearly understood in South Sudan because of limited information on country's perinatal deaths to explain as to why there are high perinatal deaths in South Sudan. The study sought to reveal the risk factors of perinatal deaths at three levels (maternal level, fetal level, and health service provision level) in context of free MNCH services at public health facilities in South Sudan.

CHAPTER 3: METHODOLOGY

3.1 Study design:

To comprehend the risks of perinatal deaths in the context of South Sudan case-control study design was conducted. Thus, researcher opted for case-control because it is analytical observational study, where it traces backward from the outcome (perinatal death) to exposure (risk factors). It provided important scientific evidence for multiple risks for perinatal deaths with relatively little time, money and effort compared to other study designs. It requires small sample size and is good for measuring the outcome by ODDs ratio. A Case-Control study design was utilized as it is retrospective. They are particularly useful for studying infrequent events, for example, perinatal death. It was also chosen to investigate multiple exposures because the real exposure (risk factors) to perinatal death was not known so that researcher could use hospital registry to identify cases within Juba teaching hospital.

However, even if it was the best design for investigating risk factors to perinatal deaths, it is prone to bias such selection and recall bias and analytical bias during design and analytical stages. But it was possible to address the bias at design stage through restriction of participants that take part in the study. The controls were matched to cases on basis of same characteristics (28weeks gestation and above) which was the same with the cases. And at analytical stage, It was through adjustment in logistic regression and stratification with Mantel-Haenzel approach. Therefore, based on this background, and this study was undertaken to reveal the risks for perinatal death in Juba teaching hospital using Case-Control study design.

3.2 Sources of data:

The data of cases and control groups were obtained from the hospital registry. The case group were mother baby pairs where the baby dies in the perinatal period and while the control group were mother baby pairs where babies remained alive by the end of the first week after birth. The data were collected from the respondents during the time of study period of March to August 2022.

3.3 Study population:

The study population constituted the mothers of children born in Juba teaching hospital where babies were remained alive by the end of the first week after birth (controls) and mothers of children born in Juba teaching hospital where the baby died in the perinatal period-Uterine Fetal Death (IUFD) or death in first week of life after birth (cases).

3.3.1 Inclusion criteria:

Case:

- Pregnant women with a gestation of 28 weeks and above who delivered at Juba teaching hospital and experienced a perinatal death.
- Pregnant women with a gestation of 28 weeks and above who delivered at Juba teaching hospital and experienced a perinatal death and consented to participate in the study.

Control:

- Pregnant women with a gestation of 28 weeks and above who delivered at Juba teaching hospital and had a live newborn.
- Pregnant women with a gestation of 28 weeks and above who delivered at Juba teaching hospital, had a live newborn and consented to participate in the study

- **3.3.2 Exclusion criteria**

Pregnant women with a gestation of 28 weeks and above who delivered at Juba teaching hospital and source of data in the records at birth was missing since data was obtained retrospectively from the hospital record.

3.3.3 Study location

This study was conducted in Juba teaching hospital, South Sudan which is the only National referral hospital in South Sudan. Juba is South Sudan capital city with estimate total population 421,000 people. Juba hospital was purposively selected because of its higher recorded births and proximal location as a public health facility, relatively well-equipped with better health services than other hospitals. It has 512 beds and 50 doctors with various specialized skills, 400 nurses and midwives. There were 25 babies being born per day in Juba Teaching hospital. The hospital is managed by medical director and supervised by five or seven physicians covering both inpatient and outpatient services. There are 2 to 3 midwives at 13 beds in labor ward and 3 operating theatres which serve all surgical needs. It has been estimated 42,000 pregnant women annually endure related childbirth complication during labor in Juba teaching hospital.

3.4 Sample size determination

The sample size was determined using retrospective case-control study design formula for proportion where parameter of the study or data were nominal/ordinal scale and used to compare risk factors between case group and control group to determine odd ratio (adapted from kelsey and Fleiss formula).

Sample size =

$$\frac{r+1}{r}\frac{(p^*)(1-p^*)(Z_\beta + Z_{\alpha/2})^2}{(p_1 - p_2)^2}$$

Where:

r = Ratio of control to cases, (1:2) for unequal number of case and control

p* = Average proportion exposed = (proportion of exposed cases + proportion of control exposed divide by 2)

Z_{β} = Standard normal variate for power = for 80% power it is 0.84

The power for the study.

$Z\alpha/2$ = Standard normal variate for level of significance

P1 – P2 = Effect size or different in proportion expected based on previous studies.

P1 is proportion in cases (0.39)

P2 is proportion in control (0.56)

Where:

n_1 = number of cases

n_2 = number of controls

$Z_{\alpha/2}$ = (0.05) The standard normal deviation for two-tailed test base on alpha level (related to the confidence interval level)

β = (0.2) The standard normal deviation for two-tailed test base on alpha level (related to the confidence interval level)

r = (2) ratio of controls to cases

p_1 =(0.39) proportion of cases with exposure and $q_1 = 1-p_1$

p_2 = (0.56) proportion of controls with exposure and $q_2 = 1-p_2$

By substituting the above figures in web based Open Epi tool we shall have:

Sample Size for Unmatched Case-Control Study

For:

Two-sided confidence level(1-alpha)	95
Power (% chance of detecting)	80
Ratio of Controls to Cases	2
Hypothetical proportion of controls with exposure	39
Hypothetical proportion of cases with exposure:	56.12
Least extreme Odds Ratio to be detected:	2.00

	Kelsey	**Fleiss**	**Fleiss with CC**
Sample Size - Cases	100	99	108
Sample Size - Controls	199	198	215

Total sample size: 299 297 323

References

Kelsey et al., Methods in Observational Epidemiology 2nd Edition, Table 12-15

Fleiss, Statistical Methods for Rates and Proportions, formulas 3.18 &3.19

CC = continuity correction

Results are rounded up to the nearest integer.

Based on the above sample size calculation, the researcher decided to take sample size of 323 (108 cases and 215 controls) from Fleiss method with continue correction factor. In this method researcher wished to have 80% chance of detecting whether the odd ratio is significantly different from 1 at the 5% level of confidence. An odd ratio of 2 would be considered an important difference between the two the groups because cases and controls are not freely available, selecting equal numbers would make the study most inefficient. Therefore, to achieve the most efficient study result, statistical confidence the researcher decided to take more than one control per case. Ie (*cases* to *control*s ratio is 1: 2) It means everyone case, two controls was selected from the sample frame obtained from hospital delivery register books using purposive sampling method with 95% confident level.

3.5 Sampling procedures

The researcher used simple random sampling techniques without replacement to select the respondents for interview. First the list of the respondents who met the criteria were obtained from the hospital register book. Then researchers also collected their contact details to locate them, but priority was given for those present in the hospital while those at home were contacted by phone calls for appointment later interviewed.

For every perinatal death, two controls from the sampling frame obtained from hospital record book were randomly selected for the interview by picking randomly a name of the respondent from a box contain list of cases without replacement consecutively until the sample size for cases were reached and repeated the same with control subjects.

The eligibility criteria include all mothers of still births, intrapartum deaths, and neonatal deaths within 7days after birth. While control subjects represented mothers of children born in Juba teaching hospital and remain alive. Both cases and controls were mothers who satisfied selection criteria. In order to avoid confounding factors, the researcher limits the study population by matching mother baby pairs of both cases and controls by same 28 weeks and above gestation period as matching criteria. Where in every one case, two controls were selected for the interview as only criterion.

From the delivery register,108 mother baby pairs where the baby died in the perinatal period i.e. Intra Uterine Fetal Death (IUFD) or death in first week of life after birth (cases) and 215 mother baby pairs where babies were alive by the end of the first week after birth (controls) were targeted for selection based on inclusion criteria.

3.6 Study variables

The primary data from interviewed mothers were on the following variables:

- Maternal related risk factors (complication in pregnancy, labor and childbirth)
- Fetal related risk factors (Low birth weight, preterm and congenital)
- Care provider related factors (delay in action or inappropriate action-inadequate monitoring and lack of equipment)
- Other maternal factors (illiterate, alcohol & tobacco use, overweight, age extremity and poverty)

- Mothers' knowledge on importance of ANC, danger signs in pregnancy and response, knowledge on danger signs in new-borns. Postpartum care (cord care, bathing, temperature, and breastfeeding).

3.7 Data collection techniques:

3.7.1 Data review

The researcher reviewed the recorded data from hospital delivery register books to identify the cases and controls that form the research participants. Thus, the hospital data was used as reference data for identifying case subject and control groups for this research.

3.7.2 Assisted Questionnaires

The assisted questionnaires were used to collect data from selected mothers baby pair for case subjects and controls subjects whose information was obtained from hospital delivery register books during the study period. World health Organization verbal autopsy for mortality audit questionnaires were adopted and modified and used for data collection based on the research objectives.

3.8.0 Data analysis

Here the researcher summarized and analyzed quantitative data in descriptive and analytic statistics. In descriptive statistics, the researcher edited, coded, and entered the data in Microsoft excel to summarize the data obtain from the respondents. The data was summarized by its frequencies and percentage distribution to describe the proportion of the data.

Then it was followed by bivariate data analysis to establish variables which have statistically significant association with perinatal death. Significant variables at $P \leq 0.5$ were included in the multivariate analysis. Furthermore, multivariate analysis was

conducted in each of the individual factors (maternal characteristics, maternal factors, neonatal factors, and health facility factors).

Thus, four multivariate models were generated. The first model included Variables related to maternal characteristics, the second model included the variables related maternal factors, the third model included neonatal factors and the fourth model included the health facility factors.

The case-control study was first set in 2 by 2 table and result were expressed as odd ratio. This was to obtain crude odd ratio and then crude odd ratio of significant relationship with perinatal deaths in covariate analysis were adjusted for other confounders (i.e neonatal and health facility factors) that might interfere with result to obtain adjusted odd ratio using logistic regression and enter in step wise. The analysis was conducted using SPSS software version 21.0. Then the corresponding odd ratios were subjected for p-value analysis for conclusion about the study.

3.9.0 Quality control issues

To ensure quality control, researcher trained few research assistants (4) extensively for a period of 3days on application of smart phone where data collection tools were uploaded using Kobo software and 3days practicing how to collect data including pre-testing the tools before it was employed for data collection from the target respondents. The data collection tools were read and translated into the local language (Bari and Arabic) commonly spoken in Juba and recorded in English before it was entered in database.

3.9.1 Pre-testing

The study tools were pre-tested in Munuki Primary Health Care Centre (PHCC) which also provides similar deliveries and neonatal care services. Data obtained from pre-test were collected and analyzed. Then it was refined for its validity and reliability, after which adjustment were made accordingly.

3.10 Ethical considerations

The researcher took extra care of key ethical issues at all stages of data collection. Permission and clearance to carry out this research was sought from the Research Ethics Committee (REC) of Uganda Christian University and permission for entry to the hospital was obtained from South Sudan Ministry of Health department of Research and planning including medical director/superintendent of Juba teaching hospital.

Before the data collection, informed consent was sought from the respondents through explaining to them what the researcher will do and how it may affect them including whether there was any risk to their wellbeing or not. Since those (cases) who lost a child were traumatized, the researcher considered working with a counselor during the interview to counselled mothers who broke down while talking with them. In no circumstances the confidential information about the participants' identity were not exposed and privacy of each individual respondent were assured during the study.

CHAPTER 4: RESULTS

4.0 Introduction

A total 108 cases of perinatal death and 215 surviving neonates were included in the main analysis of this study. It was found 79% (85) had intrauterine fetal deaths and 21% (23) early neonatal deaths. Cases and controls were selected from Juba Teaching Hospital, South Sudan. In this chapter the details description of maternal characteristics, maternal factors, neonatal factors, and health facility factors to perinatal deaths were provided and analysis of the above risk factors associated with perinatal death were elaborated.

4.1 Maternal Characteristics

Table 4.1: Maternal characteristics to perinatal outcome

Maternal characteristics	**Perinatal outcome**		
Maternal age	**Alive(control)**	**Death (Case)**	**Total**
15-24	92(43%)	35 (32%)	127 (39%)
25-34	111 (52%)	58(54%)	169 (52%)
35-44	12(6%)	15 (14%)	27 (8%)
Education level			
None	37(17%)	30(28%)	67(21%)
Primary	93 (43%)	45 (42%)	138 (43%)
Secondary	79(37%)	28(26%)	107 (33%)
Tertiary	6(3%)	5(5%)	11(3%)
Maternal occupation			

Farming	9 (4%)	7(6%)	16 (5%)
Housewife	179 (83%)	67 (62%)	246 (76%)
Office work	9 (4%)	15 (14%)	24 (7%)
Trading	18 (8%)	19(18%)	37 (11%)
Monthly income level			
Greater than 60,000 SSP	4(2%)	12(11%)	16(5%)
Less than 60,000 SSP	66(31%)	37(34%)	103(32%)
None	145(67%)	59(55%)	204(63%)

From table 4.1 above it was found that perinatal death occurs accounted to 32% (35) at age of 15-24years, 54% (58) at age of 25-34 years and, 14% (15) at age of 35-44year respectively.

Out of 323 mothers who participated in the studies, only 3% (11) reached tertiary education, 33% (107) completed secondary education, less than halve 43% (138) completed primary education and 21% (67) did not go to school. Among those who lost their babies; 42% (45) were primary leavers, 26% (28) secondary leavers and 5% (5) reached tertiary level education.

In this study, 76% (246) respondents were housewife, 11% (37) were businesswomen, 7% (24) were working in offices and 5% (16) were working in farms. Out of those, 62% (67) lost their babies were housewives compare to 18% (19) who lost their babies were businesswomen and 14% (15) works in the offices. This depicts maternal work nature contributing the risk of perinatal death.

Among the participants ,63% (204) could not raise money at least 60,000 South Sudanese pound (equivalent to USD 100) per month, only 32%(103) can afford and 5%(16) raise more than 60,000 South Sudanese pound (equivalent to USD 100) per month.

Out of those, 55% (59) perinatal death were from mothers who earn nothing in the family per month compared to 11% (12) mothers who earn more than 60,000 South Sudanese pounds (equivalent to USD 100) per month.

4.2 Maternal risk factors

Table 4.2: Maternal risk factors to perinatal outcome

Maternal risk factors	Alive (control)	Death (case)	Total
Alcohol consumption			
1-3 times/week	16 (7%)	24 (22%)	40 (12%)
4 times or more/week	3(1%)	2 (2%)	5 (2%)
Less than 1 /week	15 (7%)	14 (13%)	29 (9%)
Never drink	181 (84%)	68 (63%)	249 (77%)
# of ANC attended			
At least 4	161 (75%)	72 (67%)	233(72%)
More than 4	48(22%)	29(27%)	77(2%)
None	5(2%)	1(1%)	6(2%)
# of TT doses received			
>two doses	55(26%)	18(17%)	73 (23%)
Once dose	74(34%)	21(19%)	95(29%)
Two doses	86(40%)	69 (64%)	155(48%)
Malaria preventive medicine received status			
No	28(13%)	26(24%)	54(17%)

Yes	187(87%)	82(76%)	269(83%
ITN used status			
No	16(7%)	6(6%)	22(7%)
Yes	199(93%)	102(94%)	301(93%)
HIV test result status			
Negative	197(95%)	94(82%)	291(90%)
Positive	11(5%)	21(18%)	32(10%)
ARV received when positive			
No	198(92%)	93(86%)	291(90%)
Yes	16(8%)	15(14%)	31(10%)
# of Previous stillbirth			
0	178(83%)	36(33%)	214(66%)
1	27(13%)	59(55%)	86(27%)
2	7(3%)	10(9%)	17(5%)
3	2(1%)	2(2%)	4(1%)
5	1(0.3)	0%	1(0.3%)
6	0	1(1%)	1 (0.2%)
Birth location			
Home	19(9%)	31(27%)	50(15%)
Private medical Centre	2(1%)	8(7%)	10(3%)
Public health facility	187(90%)	76(66%)	263(81%)
Birth assistant			
Doctor	31(15%)	23(20%)	54(17%)
Midwife	154(74%)	56(49%)	210(65%)

Nurse		6(5%)	6(2%)
Relative	4(2%)	7(6%)	11(3%)
TBA	19(9%)	23(20%)	42(13%)
Bleeding history			
No	184(88%)	65(67%)	249(77%)
Yes after birth	18(9%)	23(20%)	41(13%)
Yes before birth	4(2%)	19(17%)	23(7%)
Yes both during & after	1(0.3%)		1(0.3%)
Yes during birth	1(0.3%)	8(7%)	9(3%)
Baby's Cord care			
Ashes	68(33%)	28(24%)	96(30%)
Clorhexidine	50(24%)	16(14%)	66(20%)
Don't know	71(34%)	62(54%)	133(41%)
Dung	4(2%)		4(1%)
Herbs	10(5%)	1 (1%)	11(3%)
Iodine/methylate spirit	5(2%)	8(7%)	13(4%)

From the table 4.2, it was found that for those who attended ANC at least 4times during pregnancy, 75% (161) babies survive and 67% (72) had perinatal death. And among those who attended ANC more 4times, 22% (48) babies remained alive and 27% (29) lost their babies. Those who did not attend ANC had 2%(5) babies remained alive and 1%(1) baby died during perinatal death.

In this study, 84% (181) respondents never drink alcohol had live babies and 63% (68) had lost their babies. Those who drink 1-3times per week, 7% (16) babies survived and 22% (24) lost their babies.

Among those who received 2doses of Tetanus Toxoid (TT) vaccination 40% (86) babies survived and 64% (69) lost their babies. Those who received one dose of TT, 34% (74) babies survived and 19% (21) lost their babies. While those who received more than two TT doses, 26% (55) babies survived and 17% (18) lost their babies.

Among the respondents who received malaria prevention prophylaxis, 87% (187) babies survived and 76% (82) had lost their babies and those who didn't receive malaria prevention prophylaxis 13% (28) had live babies and 24% (26) lost their babies.

Among the mothers who used Insecticide treated Bed Nets (ITNs) during pregnancy, more than halve 93% (199) had live babies and 94% (102) mothers lost their babies. While those who did not use ITNs during pregnancy, 7% (16) had live babies and 7% (22) lost their babies.

It was found that mothers who tested negative for HIV during ANC visit, majority 95% (197) had live babies and 82% (94) lost their babies. While among the mothers who tested positive, 5% (11) babies survived and 18% (21) lost their babies.

Among the mothers who had zero previous stillbirths, 83% (178) had live babies and 33% (36) lost their babies for the first time. Out of those who had one previous stillbirth,13% (27) had live babies and 55% (59) lost their babies. While those who have two previous stillbirths, 3% (7) had live babies and 9% (10) lost their babies and those who had three previous still birth, 1% (2) had live babies and 2% (2) lost their babies.

Among mothers whose delivery was assisted by midwives, 74% (154) had live babies and 49% (56) lost their babies, those whose delivery was assisted by doctors 15% (31) had live babies and 20% (23) lost babies, those whose delivery was assisted by Traditional Birth attendants (TBA) only 9% (19) had live babies and 20% (23) lost babies.

Out of those mothers who had no bleeding history during pregnancy, 88% (184) babies survived and 67% (65) lost their babies and those who had bleeding before birth only 2% (4) had live babies and 17% (19) lost their babies and those who had bleeding after birth had 9%(18) babies survived and 20%(23) lost their babies.

Among mothers who delivered in public health facility, 90% (187) had live babies and 66% (76) had their babies died, while those who delivered at home, 9% (19) had live babies and 27% (31) lost their babies and those who delivered in private health facilities only 1%(2) had live babies and 7%(8) lost their babies.

It was found that respondents who used ashes for cord wound care, 33%(68) had live babies and 24%(28) lost their babies, those who could not remember what they used for cord wound care, 34%(71) had live babies and 54%(62) lost their babies.

4.3 Neonatal risk factors

Table 4.3.1: Neonatal risk factors to perinatal death

Neonatal risk factors	Alive (control)	Death (case)	Total
Gestation			
7months	4(2%)	31(27%)	35(11%)
8months	19(9%)	15(13%)	34(11%)
9months	182(88%)	39(34%)	221(68%)
Greater than 9months	2(1%)	1(1%)	3(1%)
Less than 7months	1(0.3%)	29(25%)	30(9%)
Baby's sex			
Female	94(45%)	56(49%)	150(46%)
Male	114(55%)	59(51%)	173(54%)
Birth weight			
>2.0kg	187(90%)	44(38%)	231(72%)
1.6-2kg	16(8%)	34(30%)	50(15%)
1-1.5kg	5(2%)	28(24%)	33(10%)
1kg		9(8%)	9(3%)
Injury status after birth			
No	198(95%)	104(90%)	302(93%)
Yes	10(5%)	11(10%)	21(7%)
Immediate baby's cried after birth			
Don't know	3(1%)	4(3%)	7(2%)
No	4(2%)	81(70%)	85(26%)
Yes	201(97%)	30(26%)	231(72%)

Table 4.3.2: Perinatal death by sex

Period of deaths	Female	Male	Total
Died from uterus	49(92%)	36 (65%)	85(79%)
Died within 7days	4(8%)	19(35%)	23(21%)
Total	**53**	**55**	**108**

From the table 4.3.1, it was found that respondents who had 9 months gestation, 88%(182) had live babies and 34%(39) lost their babies while those who had 8months gestation, 9%(19) had live babies and 13%(15) lost their babies, those with 7months gestation,2%(4) had live babies and 27%(31) lost their babies and those with gestation less than 7months, 0.3%(1) had live babies and 25%(29) lost their babies.

Based on the sex of the babies, among the male babies, 55% (114) survived and 54% (173) died while among the female babies, 45% (94) survived and 49% (56) died.

Among those babies whose birth weight more than 2kg, 90% (187) survived and 38%(44) died, those whose birth weight was 1.6-2kg, only 8%(16) survived and 30%(34) died, those whose birth weight was 1-1.5kg, 2%(5) survived and 24%(28) died.

From the table of 4.3.2, out of 79% (85) babies who died from uterus, 92% (49) were females and 65%(36) were males and among those who died within 7days after birth, 8%(4) were females and 35%(19) were males. Thus, majority of perinatal death occur in uterine life with greater number of females babies, but more males' babies died outside uterus than female babies.

4.4 Health facility factors

Table 4.4: Health facility risk factors to perinatal death

Parameter	Perinatal outcome		
Health facility factors	**Alive (control)**	**Death (Case)**	**Total**
Does SBA check fetal heartbeats status			
Don't know	1(0.3%)	6(5%)	7(2%)
No	34(16%)	31(29%)	65(20%)
Yes, with Doppler	74(34%)	30(28%)	104(32%)
Yes, with fetoscope	106(49%)	41(38%)	147(46%)
Does SBA practice hands wash before conducting delivery			
Don't know	14(7%)	11(10%)	25(8%)
No	17(8%)	19(18%)	36(11%)
Yes	184(86%)	78(72%)	262(81%)

From the table 4.4, it was found that respondents whose fetal heart beats was checked during labor with fetoscope, 49%(106) had live babies and 38%(41) lost their babies, those whose fetal heart beats was checked with doppler ultrasound scan 34%(74) had live babies and 28%(30) lost their babies and those whose fetal heart beats was not checked, 16%(34) babies survived and 29%(31) lost their babies and those who could not remember their fetal heart beats was checked, 0.1%(1) had live babies and 5%(6) lost their babies.

The respondents who reported birth attendant practice hand hygiene either wash hand with soap or wear gloves during childbirth, 86% (184) had live babies and 72% (78) lost their babies and those who reported birth attendant did not practice hand hygiene 8% (17) babies survived and 18% (19) lost their babies. While those who could not remember whether birth attendants had practice hand hygiene 7% (14) had live babies and 10%(11) lost their babies.

4.5 Analysis of risk factors for perinatal death

4.5.1 Bivariate analysis of the risk factors of perinatal deaths

The variable found to be associated with a high risks for perinatal death are summarized in table 4.5.1 (Bivariate) and table 4.5.2 (Multivariate).

In bivariate analysis, it was found that (i) Four variables in community level under maternal characteristics where never went to school, had history of drinking, or drank alcohol during pregnancy and is a housewife and earn nothing in a month. (ii) six variables under maternal health factors were no attendance of ANC, delivery at home, Birth assisted by SBA, never received malaria preventive medicine received, HIV positive, cord treatment used non disinfectant and bleeding in pregnancy. (iii) three variables under neonatal factors were low birth weight, baby's failure to cry after birth and low gestation. (iv) two variables under health facility factors where Birth attendant didn't wash hand before conducting labor and baby not assisted to breath.

4.5.2 Multivariate analysis of risk factors for perinatal death

However, when adjusted for all significant variables related to perinatal death in four models of multivariate analysis, in first model is maternal alcohol consumption and not having monthly income were found significantly associated with perinatal death. In second model, three maternal health factors were found significantly associated with high risk of perinatal death were bleeding in pregnancy, lack of ANC attendance and HIV positive mothers.

In third model, one health facility factor found significantly associated with high risk of perinatal death was home delivery.

in fourth model, two neonatal risk factors were found significantly associated with higher risk of perinatal death (i.e low birth weight and low gestation age) as showed in table 2.5.2 below.

Table 4.5.1 Bivariate analysis of risk factors associated with perinatal death: unadjusted odd ratios.

VARIABLES	Perinatal outcome (28 weeks of gestation-7days after birth)			
	UNADJUSTED ODD RATIO AT 95% CI			
	OR Case (death) N=77	OR Control (Alive) N=135	Overall OR at 95% CI	P-value (0.05)
DISTAL DETERMINANT				
COMMUNITY LEVEL (MATERNAL CHARACTERISTICS)				
Educational level (Went to school or never went to school)	1.410(1.032-1.926)	0.800 (0.630-1.015)	0.567 (0.328-0.980)	0.041
Maternal monthly income (< 60,000 SSP or > 60,000 SSP)	1.366(1.022-1.826)	0.833(0.695-0.998)	0.610 (0.382 -0.974)	0.038
Occupation (Housewife or employed)	1.770(1.334-2.349)	0.669(0.520-0.860)	0.378 (0.224-0.638)	0.000
Alcohol consumption (yes or no)	2.010(1.527-2.644)	0.589(0.445-0.780)	0.629 (0.473-0.837)	0.000
HEALTH FACILITY FACTORS				

SBA washed hands before delivery mother (yes or no)	1.505(1.035- 2.188)	0.596(0.426- 0.833)	2.526(1.252- 5.097)	0.008
Does health worker check fetal heart beats by used of fetoscope/doppler during childbirth (yes or no)	1.170(0.899-1.523)	0.781(0.545- 1.120)	1.498(0.804- 2.790)	0.201
Is baby assisted to breath (yes or no)	1.641(1.163-2.315)	0.542(0.404- 0.729)	3.025(1.615-5.667)	0.000
PROXIMATE LEVEL				
MATERNAL HEALTH FACTORS				
Did you attend ANC? (yes or no)	2.485 (1.771-3.486)	0.218 (0.035-1.341)	0.88(0.010-0.738)	0.005
Delivery location (home or Health facility)	1.822(1.268-2.619)	0.496(0.375-0.657)	3.671(1.963-6.867)	0.000
Who assisted you during childbirth (SBA or Non-SBA)	1.798(1.340-2.413)	0.633(0.461-0.870)	0.352(0.193- 0.642)	0.000
Did you get malaria preventive medicine with this pregnancy? (Yes or no)	1.528(1.113- 2.099)	0.743(0.562-0.983)	0.486(0.269- 0.878)	0.015

HIV test results (positive or negative)	1.969(1.212-3.199)	0.492(0.364- 0.665)	4.001(1.853-8.639)	0.000
What did you used for treating the cord? (Used disinfectant or used non disinfectant)	1.553(1.091-2.209)	0.805(0.688-0.941)	0.518(0.313- 0.858)	0.010
Is there bleeding in pregnancy (yes or no)	2.278(1.627-3.192)	0.386(0.297-0.502)	5.897(3.359-10.355)	0.000
NEONATAL FACTORS				
Cord wrap around the neck (yes or no)	1.046(0.778- 1.406)	0.976(0.829- 1.148)	0.933(0.590- 1.476)	0.767
What was the baby's weight at birth (less than 1kg or more than 1kg)	4.052(3.037- 5.405)	0.282(0.193-0.413)	0.070(0.039- 0.125)	0.000
Does baby cry at birth (yes or no)	7.114(5.069- 9.984)	0.087(0.043- 0.179)	0.012(0.005-0.029)	0.000
Gestational age (<9months or >9months)	4.222(3.107- 5.737)	0.310(0.221-0.434)	0.073(0.042-0.129)	0.000

When logistic regression for bivariate analysis was run for risk factors of perinatal death, Table 4.5.1 presented unadjusted odd ratio and a statistical association with perinatal death.

At distal level, in the community, the maternal consumption of alcohol was found the only variable with strong statistical association of perinatal death with a mother who drinks alcohol during pregnancy or had history of drinking alcohol before pregnancy. The risk of mother drinking alcohol was found 2times (95% CI:1.527-2.644) p<0.000 more likely to have perinatal death among the cases compare to 0.589 times (95% CI: 0.445-0.780) less likely to have perinatal death among control subjects.

Again, at distal level, one health facility factor with strong statistical association of perinatal deaths was health worker failure to check fetal heartbeats during labor. The risk of health worker's failure to check fetal heart during labor was found 1.170times (95% CI: 0.899-1.523) more likely to have perinatal death among cases compare to 0.781times (95% CI: 0.545- 1.120), p=0.201 less likely to have perinatal death among control subjects.

In addition to when a baby failed to breath and if not assisted to breath it was found that 1.641times (95% CI: 1.163-2.315) p< 0.000 more likely to die among cases compare to 0.542times less likely to have perinatal death among controls.

At proximately level, under maternal health factors, five variables were found significantly associated with high risk of perinatal death were home delivery, bleeding in pregnancy, no ANC attendance, and HIV positive mothers respectively.

The risk of not attending ANC among cases found 2.485times (95% CI: 1.771-3.486),more likely to have perinatal death compare to 0.218times (95% CI: 0.035-1.341) p< 0.000 less likely to have perinatal deaths among control subjects.

The risk of having nonskilled birth attendance at birth was found 1.798times (95% CI:1.340-2.413) among cases more likely to have perinatal death compared to 0.352times (95% CI: 0.193- 0.642) less likely to have perinatal death among controls.

The risk of home delivery among cases were found 1.822times (95% CI:1.268-2.619) more likely to have perinatal death compared to 0.496 times (95% CI:0.375-0.657), p<0.000 less likely to have perinatal deaths among control.

The risk of being HIV positive mother was found 1.969times (95% CI:1.212-3.199)p<0.000 more likely to have perinatal death among cases compare to 0.492times (95% CI:0.364-0.665) less likely to have perinatal death among controls.

The risk of bleeding in pregnancy was found 2.278times (95% CI: 1.627-3.192), p<0.000 more likely to have perinatal death among cases compare to 0.386times (95% CI: 0.297-0.502) less likely to have perinatal death among controls.

Lastly, at proximate level, three neonatal factors associated with risk of perinatal death (low birth weight <1kg, uncrying baby after birth, and lower gestational age <9months).

The risk of low birth weight (<1kg) was found 4.052times (95% CI: 3.037- 5.405) more likely to have perinatal death among cases compare to 0.282times (95% CI: 0.193-0.413) less likely to have perinatal death among control subjects. The risk of baby's failure to cry immediately after birth was found 7.114times (95% CI: 5.069-9.984) more likely to have perinatal death compared to 0.087times (95% CI: 0.043-0.179), p<0.000 less likely to have perinatal death among control subjects.

The risk of lower gestational age (<9months) was found 4.222times (95% CI: 3.107-5.737) more likely to have perinatal death compared to 0.310times (95% CI : 0.221-0.434), p<0.000 less likely to have perinatal death among control subjects.

Table 2.5.2 Multivariate analysis of risk factors associated with perinatal death: adjusted odd ratios.

Variables	Model 1: Maternal characteristics	Model 2: Maternal health factors added	Model 3: Health Facility factors added	Model 4: Neonatal factors added
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
DISTAL DETERMINANT				
MATERNAL CHARACTERISTICS				
Alcohol consumption (drunk alcohol or don't drink alcohol)	2.769(1.580-4.854) p<0.000	2.330(1.192-4.554), p>0.013	1.934(0.963-3.883), p>0.064	0.340(0.080-1.443),p<0.143
Occupation (Housewife or Employed	2.359(1.097-5.073) P<0.028	1.864(0.792-4.384), p<0.154	1.683(0.701-4.039), P>0.244	42.217(2.247- 793.082)
MATERNAL HEALTH FACTORS				
Bleeding in pregnancy (yes or no)		0.152(0.077-0.300), P<0.000	0.147(0.073- 0.295), P<0.000	.072(0.012-0.447),p<0.005
Attended ANC (yes or no)		5.678(0.499-64.566), p<0.161	7.293(0.534-99.531), P>0.136	
HIV test (negative or positive)		0.368(0.147-0.917), p<0.032	0.321(0.126-0.822),p<0.018	0.006(0.000-0.123),p<0.001
IPT received (yes or no)		1.954(0.945-4.042), p<0.071	2.158(0.996-4.679), p<0.051	6.075(0.670-55.096),p>0.109
HEALTH FACILITY FACTORS				
Does health worker check fetal heart beats during labor? (yes or no)			1.545(0.844-2.828), p>0.158	12.181(1.805- 82.199),p<0.001

Wash hands before labor (yes or no)	0.866(0.336-2.230), p>0.766	2.629(0.241-28.658),p>0.428
Delivery location (Home or health facility)	0.190(0.037-0.970), p<0.046	0.003(0.000-0.229),p<0.009
NEONATAL FACTORS		
Weight at birth (<1kg or >1kg)		0.023(0.003-0.195),p<0.000
Does baby cry at birth (yes or no)		
Gestational age (<9months or ≥9months)		0.096(0.016-0.567),p<0.010

In Table 4.5.2 when the variables of statistical significance in bivariate analysis were adjusted for multivariate analysis model-wise. The first model (adjusted for individual factors) had all significant variables. The magnitude of individual factors from the unadjusted odd ratio level had changed from strongly significant variables in model 1-2 to insignificant variables in model-3-4.

In model 2, after adding maternal health factors, individual variables did not change significantly from model 1. In which three variables remained significantly associated with risk of perinatal death where bleeding in pregnancy (AOR: 0.152(0.077-0.300), P<0.000, HIV positive in pregnancy (AOR: 0.368(0.147-0.917), p<0.032 and Lack of Intermittent Preventive Treatment during pregnancy (AOR:1.954(0.945-4.042), p<0.071.

After adding the health facility factors in model 3, one variable remained significantly associated with the perinatal death was home delivery (AOR: 0.190(0.037-0.970), p<0.046. Then when adding neonatal factors in model 4, two variables remained significantly associated with the perinatal death were low birth weight (AOR: 0.023(0.003-0.195),p<0.000 and lower gestational age (AOR: 0.096(0.016-0.567),p<0.010.

Though there was a significant associated risk of not attending ANC in bivariate analysis, this factor was not significantly associated in the final multivariate model 2. The same finding with model 3, where health worker failure to check fetal heartbeats during labor had strong associated risk of perinatal death in bivariate analysis but no association in the final model.

The likelihood of perinatal death decreased from model 1 to model 4. The average Variance Inflation Factors (VIF) of the model 1 to 4 is 0. 4395.This model fit statistics

including the adjusted-R^2 indicate that model 1 and model 2 explains the variability better than the other models.

CHAPTER 5: DISCUSSION

5.1 Key finding of risk factors.

In this study, seven (7) risk factors were found significantly associated with perinatal death. The risk factors were (1) maternal alcohol consumption, (2) maternal occupation, (3) delivery at home, (3) bleeding in pregnancy, (4) low birth weight, (5) Lower gestation, (6) lack of ANC attendance, (7) HIV positive mothers.

5.2 Maternal characteristics

In this study, under maternal health characteristics in bivariate analysis, alcohol consumption by pregnant mother, being housewife and not having monthly income were found to be the risk factors more likely result to perinatal death. Alcohol consumption was 2times (95% CI:1.527-2.644) p<0.000 more likely to have perinatal death among the cases compare to 0.589 times (95% CI: 0.445-0.780) less likely to have perinatal death among control subjects.

It was found that women who earn nothing in a month was1.366times (95% CI: 1.022-1.826) more likely to have perinatal death among the cases compare to 0.833times (95% CI: 0.695-0.998) less likely to have perinatal death among control subjects. This also related to nature of occupation being housewife was 1.770times (95% CI: 1.334-2.349) more likely to have perinatal death among the cases than control with odd of 0.669(95% CI: 0.520-0.860). However, when adjusted for other predicator variables, the adjusted odd ratio was alcohol consumption remained statistically significant as in bivariate analysis showed strong significant associated risk of alcohol consumption during pregnancy with perinatal death. This means, alcohol consumption during pregnancy can be detrimental to safe pregnancy outcome. Thus, alcohol consumption wasn't the root

cause but one of the risk factors contributing to perinatal death. This means maternal risk behaviors of drinking alcohol are the contributing risk to perinatal death.

In the previous study, "Simone (2017) identified lack of knowledge on danger signs in pregnancy increase risk of perinatal death could be attributed to one of the risks of maternal alcohol consumption during pregnancy contribute the perinatal death." Since the study did not specify which danger signs the maternal knowledge was being examined in the study. The effect of alcohol in fetus is great which can affect the brain and body organs development because when it passes through the placenta of the fetus it can't be processed like in an adult. It is also risky factor for low birth weight and premature birth or miscarriage.[xxvi] This can be attributed underlying risk factor in this study because it was found that 76% (54) babies died from uterus. It means alcohol consumption play a role for the perinatal death.

5.3 Maternal factors

In the study, it was found that maternal risk factors statistically associated with perinatal death were (1) bleeding pregnancy and (2) delivery at home.

5.3.1 Bleeding in pregnancy

It was found that the risk of bleeding in pregnancy has unadjusted odd ratio of 2.278 times (95% CI: 1.627-3.192), p<0.00 more likely to have perinatal death among cases compare to 0.386times (95% CI: 0.297-0.502) less likely to have perinatal death among control subjects. When adjusted for other predicator variables, the adjusted odd ratio was 0.152(0.077-0.300), P<0.000 in model 2, 0.147(0.073- 0.295),P<0.000 in model 3 and 0.072(0.012-0.447),p<0.005 in model 4 respectively.

This shows, bleeding in pregnancy was the one of the root causes to perinatal death among cases subjects. This is true because studies shown that Placenta accreta, second

trimester bleeding and preterm labor were significantly more prevalent in pregnant women ($P \leq 0.05$).[xxvii]

Thus, this study finding to some extend agreed with study of Christiana (2008), “the odds of neonatal death were 81 per cent higher for neonates born to mothers experiencing complications during delivery, such as vaginal bleeding, fever, and convulsions.” It means that neonates born to women experiencing complications such as vaginal bleeding, fever or convulsions during childbirth had remarkably higher odds of dying compared to those born to women without any complications. Similar finding with Asnawi et al (2016) regarding perinatal death which include: lacks maternal knowledge on neonatal danger signs, history of abortion, maternal complication during pregnancy and high-risk pregnancy were statistically significant associated with perinatal death. In Uganda Martha et al (2020) found bleeding in pregnancy associated with increased risk of perinatal deaths, which was consistent with other study by Asnawi et al (20216) in Indonesia where complications in pregnancy including antepartum hemorrhage contributed to approximately 23.4% of neonatal deaths and it was found to be independently associated with neonatal death.

Therefore, in relation to modifiable factors in term of the levels of system failure, perinatal death could have been prevented in first phase by maternal or family action to seek medical care as early as possible and health care provider would have provided appropriate quality care to avert perinatal mortality in the course bleeding given that all necessary equipment and essential medicines are available in the facilities. Thus, this risk factor requires integration of modifiable factors (i.e. Family level, provider level and administration level factors) with Thaddeus and Maine’s 'Three delays’ Model(3Ds). In the 3D model, Thaddeus and Maine convincingly argued that the prevention of maternal mortality is largely dependent on the length of the interval

between the onset of obstetric complication and its outcome. Quick and adequate treatment promotes positive outcomes while delayed treatment adversely affects outcomes. Delay I refer to delays in in recognition of danger signs and seeking care. Delay II involves delays in accessing a health facility with functional Emergency Maternal Obstetric Care (EmOC) services; and Delay III involves the delay in accessing appropriate EmOC services once at the facility, or due to subsequent referral from one health facility to another (ie, delays related to correct diagnosis of complications and appropriate action and, delays in the referral pathways). [xxviii]

5.3.2 Place of delivery

Place of delivery was strongly associated with a higher risk of perinatal death. The risk of mother delivery at home among cases were found 1.822times (95% CI: 1.268-2.619) more likely to have perinatal death than controls 0.496times (95% CI: 0.375-0.657), p<0.000 less likely to have perinatal deaths among control subjects. When adjusted the odd ratio it was 0.190(0.037-0.970), p<0.046 in model 3 and 0.003(0.000-0.229),p<0.009 in model 4 respectively. This means the home delivery has higher risk for perinatal death compared to health facility delivery. It is an indication that home delivery is one of the risk factors that contributed to perinatal death. This is consistent with previous study of Asnawi et al 2016, "Infants born at home and assisted by a TBA had a risk of death six times higher compared with infant born at health facility". In South Sudan this had been attributed to the cultural preference and challenges in accessing quality obstetric care services, women opted to deliver at home which is cheaper and cultural friendly. This makes it hard to encourage pregnant women to deliver at a health facility without addressing the cultural barriers and improving quality care service at health facilities Thus pragmatic intervention needs to focus on addressing the cultural beliefs

and values that adversely hindering health facility delivery through community-based health education on importance of delivering under skilled health professional support. Even if these factors had been a statistically significant association, it does not necessarily point to the root causes of perinatal death and doesn't mean increasing health education on the danger signs on newborn care will automatically reduce perinatal deaths. However, it shows that early recognition of perinatal illness is one step forward in improving newborn survival and care during postnatal is an importance aspect in reducing perinatal death and reinforce with health education during ANC and postnatal visits including home visit.

5.4 Neonatal factors

Low Birth Weight (LBW) is birth weight less than 2000grams regardless of the gestational age(WHO 2014). In this study low birth weight and low gestational age were identified as major neonatal risk factors for perinatal death.

5.4.1 Low birth weight:

The risk of low birth weight was found 4.052 times (95% CI: 3.037- 5.405) more likely to have perinatal death among cases compare to 0.282times (95% CI: 0.193-0.413), p<0.000 less likely to have perinatal death among control subjects.

When adjusted for other predicator variables, it was found that the adjusted odd ratios was 0.023(95% CI: 0.003-0.195), p<0.000 in model 4.

This indicate that low birth weight was one of the contributors of risk factors to perinatal. This was consistent with babies who were delivered prematurely with gestational age below 9months was found 4.222times (95% CI: 3.107-5.737) more likely to have perinatal deaths among cases than among control subjects with unadjusted odd ratio of 0.310 times (95% CI: 0.221-0.434).

This also confirmed with the previous study conducted by Moura et al (2014) in southeastern Brazil, found that low birth weight and maternal hemorrhage increases neonatal risk for perinatal death in secondary care center and Al-sheyab et al (2020) in Jordan, found that low birth weight and pre-term birth were significantly more likely to die during the neonatal period than full- term birth.

World Health Organization report 2014 on low-birth-weight policy brief acknowledged that low birth weight continues to be a significant public health problem globally and is associated with a range of both short- and long-term consequences. Preterm birth is the most common direct cause of neonatal mortality. [xxix]There are multiple causes of low birth weight, including early induction of labor or caesarean birth (for medical or non-medical reasons), multiple pregnancies, infections and chronic conditions such as diabetes and high blood pressure[xxx]. Pre-eclampsia, which only occurs in pregnancy, is associated with both preterm birth (spontaneous or induced due to severe disease) and small for gestational age, owing to reduced placental function, which includes poorer transfer of nutrients to the fetus. The mother's nutritional status also alters her risk of pre-eclampsia. Based on the results of a large trial conducted by the WHO, which has been confirmed by several systematic reviews, calcium supplementation during pregnancy for women with low calcium intake has been identified as one of the effective nutritional interventions because it reduces the incidence of pre-eclampsia and may also reduce the rate of preterm births[xxxi].

This finding is consistent with study of Asnawi et al (2016) that low birthweight neonates with low Apgar scores, has risk of neonatal death 28-fold higher compared with those with normal Apgar scores.

Although these factors had a statistically association, it does not necessarily point to the causation by itself but maternal health conditions, birth and pregnancy

complications etc) and maternal health complications during pregnancy. The prevention of low birth weight and low gestational age (pre-term) could be reduced by addressing maternal risk factors and health complication problems during pregnancy. This means maternal previous obstetric history and care during pregnancy and childbirth negatively impact on the risk of perinatal death. It means there is need to strengthen nutritional health education of pregnant mothers during ANC visits as well as during postnatal period is very important.

5.5 Health facility factors

Quality care at health facility can prevent avoidable risk factors to perinatal death. The continuum of care starts from pre-pregnancy (family planning services and counseling for conception) to prepare couple to get ready for pregnancy, ANC services to check and prevent complications and health problems during pregnancy as well as during labor.

5.5.1 Fetal Heartbeat being Checked.

In this study, not checking of fetal heartbeats during labor was found statistically significant. The risk of health worker's failure to check fetal heart beats during labor was found 1.170 times (95% CI: 0.899-1.523) more likely to have perinatal death among cases compare to unadjusted odd ratio of 0.781 times (95% CI: 0.545-1.120), $p<0.02$ less likely to have perinatal death among control subjects. When adjusted for other predicator variables, it was found that adjusted odd ratio was 1.545(0.844-2.828), $p>0.158$ in model 3 and 12.181(1.805- 82.199),$p<0.001$ in model 4 respectively. Thus, checking fetal heart beats is key for raising alarm about status of the fetus for further early investigation. This help in addressing pathological progress, avoid Intra-Uterine Fetal Death (IUFD) and improve fetal survival rate. In this study, the behavior of health workers was not assessed as to why the care provided was substandard or missed to

check fetal heartbeat during labor. Based on this finding, it is possible to assumed that care provider does not use the partograph, had inadequate fetal monitoring during labor, didn't take timely action or had taken inappropriate action (instead of prompt referral or call for assistance had delayed until late fetus was found death).This finding was approximately consistent with other studies like Hasan et al (2014), found that majority of perinatal deaths were because of substandard practice by health workers. Adequate training of health workers and refresher courses, patient safety and quality initiative help to ensure minimum standard care delivered by health workers at every childbirth. Specifically, perinatal deaths would have been prevented 11.1% by health workers standard care and 10.7% by appropriate administrative action such as drug and equipment availability including other technology for diagnostic and treatment such ultrasound, MRI and CT scan machines etc. Thus, improvement of health system contributes to reduction of perinatal deaths.

5.6 The strength and limitation of this study

5.6.1 Strength of the study

Most of the evidence on risk factors associated with perinatal death in South Sudan has been derived from current practices because there was no demographic survey nor health survey conducted since South Sudan became independent nation in 2011. The strength of this study has its focus on a specific population of newborns, those whose death was reported to health services and its exploration of potential factors of health service intervention. The sample size was sufficient and representative to enable detect risk factors. By reducing the confounding factors outside the control of the health care service, the study design enable focus on the potential health care service intervention. Sub-analysis by taking small sample to identify differences in various categories of risk factors and require further related study in future.

5.6.2 Limitation of the study

However, the study had number of limitations, the study population may probably be underrepresented in terms of births taking place outside health facility with higher risk for perinatal death. Apart from that there was a challenge of getting respondents to accept and consent to take part in the study due to painful memory to talk about the death child. This made some respondents who met criteria refuse to be interviewed which prolong data collection period while 9 respondents' data found invalid were discarded not included in analysis. However, at end of sample size a total of 323 respondents with valid data were analyzed.

The data collected relied on mother's recall which is subject to inaccuracy including recall bias because mothers' interpretation of health problems exaggerates the reporting on the risk factors. But since identification of factors help in planning for intervention, risk factors identified were still necessary which serve as important indicators that require attention in health sector to address perinatal risk factors in future.

5.7 Implication for further research

1. For future research on perinatal risk factors, the future researcher should assess perinatal risk using the three delays model of Thadeus and Maines (1984) to determine associated risk factors to perinatal death in rural or low resource setting.
2. Future researcher should assess perinatal risk factors under three categories of modifiable factors (i.e Family/patient level factors, provider level factors and administration level factors) to determine which level is most associated with perinatal mortality.

3. Lastly the future researcher should assess perinatal risk factors by integrating 3delay models with three categories of modifiable factors to determine the associated risk factors to perinatal mortality.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

In the design of this study, the researcher intended to determine the risk factors associated with perinatal death in Juba in different level of continuum of care where Maternal health Care services are provided free of charge at public health facilities. The study confirmed a high proportion of perinatal death 79% occur from uterus and 21% occur within 7days after birth.

6.1 Conclusion

6.1.1 Maternal characteristics

- The associated risk with maternal alcohol consumption indicates lack of knowledge on pregnancy care and risky lifestyles during pregnancy.

6. 1.2 Maternal factors

- The associated risk of bleeding in pregnancy is indicative of lack of knowledge on danger signs in pregnancy which goes on unattended until too late to intervene.
- The high risk associated with home delivery shows cultural preference and lack of awareness on importance of health facility delivery despite of free health care services at all public health facilities.

6.1.3 Neonatal factors

- The associated risk of low birth weight and low gestational age still reflects lack of knowledge in maternal well-being during pregnancy regarding prevention of maternal complications, unhealthy lifestyles, and poor feeding.

6.1.4 Health Facility factors

- ❖ The associated risk with health facility which required skill birth attendant to check fetal heartbeats but failed to do so indicate knowledge gaps in monitoring and management of labor among health care providers.

6.2Recommendations:

6.2.1 Juba Teaching Hospital:

6.2.1.1Based on this study finding, Juba teaching Hospital should strengthen community health programmatic intervention to focus on making pregnancy and delivery safer both for mother and the baby through health education awareness about the dangers of risky lifestyles during pregnancy and recognizing danger signs such as bleeding in pregnancy and seek prompt medical attention.

1. Juba teaching hospital should encourage health facility delivery through community health education programs and building maternity waiting home for safer childbirth.
2. Juba teaching Hospital should work with development partners to support women economic empowerment for easy access to medical services at their convenience, minimize seeking care from TBA and use of traditional herbs.
3. Juba Teaching Hospital should develop a plan for continuous medical education that improves medical practice and care among health professionals, especially the skilled birth attendants.

6.2.2 Ministry of Health:

6.2.2.1 The Ministry of health should develop policy on mentorship and in service training for health professionals that improve quality of maternal, newborn and child health care services delivery.

6.2.2.2 Ministry of health should provide guidelines on management of labor and childbirth including Emergency Obstetric Newborn Care equipment.

6.2.3: Researchers

6.2.3.1 Should assess perinatal risk using the three delays model of Thadeus and Maines (1984) to determine associated risk factors to perinatal death in rural or low resource setting.

6.2.3.2 Should assess perinatal risk factors under three modifiable factors (i.e Family/patient level factors, provider level factors and administration level factors) to determine which level is most associated with perinatal mortality.

6.2.3.3 Should assess perinatal risk factors by integrating 3delay models with three modifiable factors to determine the associated risk factors to perinatal mortality.

7.0 APPENDICES:

Appendix 7.1: Informed Consent Form

Introduction of research assistant

Hello my name is…….. I work here in Juba hospital; we are conducting a survey in this Hospital that asking all women who delivered here about health issues of newborn babies. The interview will take about 15 minutes. I am asking you to take part in this survey because I am trying to learn more about the issues concerning newborn babies.

This information will help us to understand health challenges faced by newborns or know whether the improvements in health care planned for Juba are helping so that we recommend to government and its partners on status of health care services in Juba.

All the information we obtain will remain strictly confidential and your answer will never be identified because we shall use code for each respondent. Also, you are not obliged to answer any questions you don't want to, at any time. "

"At this time, do you want to ask us anything about the survey? May I start now?"

□***Yes****, permission is given*⇒start on the questionnaire

□***No****, permission is not given*⇒Complete this front page. Discuss this result with your supervisor

Appendix 7.2: Data collection tools (Research questionnaires)

RESPONDENT GENERAL INFORMATION	
Community:	Boma:
Payam:	County:
Respondent Code: …… *A001 for mothers whose babies died *B002 for mothers whose babies alive	Date of visit:
Name of interviewer:	
Name of supervisor:	

TOPIC 1: DEMOGRAPHIC CHARACTERISTICS				
#	**Respondent Information**	**Coding Categories**	**Code**	**Skip**
DC 1	Sex of the respondent	Male Female	1 2	
DC 2	How old are you? *(Enter # of years)*	……..		
DC 3	What is highest level of your education?	None Primary Secondary Tertiary	0 1 2 3	
DC 4	What is your current occupation or kind of work you do?	House wife Farming Office work Trading	1 2 3 4	
DC 5	How much is your monthly income?	None <60,000 SSP >60,000 SSP	0 1 2	

TOPIC 2 : PREGNANCY HISTORY & CARE				
#	**Questions**	**Coding Categories**	**Code**	**Skip**
PC1	Have you received antenatal care with this pregnancy?	Yes No	1 2	 ➡ PC4
PC 2	How many ANC visits have you attended with this pregnancy?	None At least 4	0 1	

		More than 4	2	
PC 3	How many months of pregnancy was the first ANC visit? (*Enter # of months)*	…….		
PC 4	Before with this pregnancy, how many times per week do you drink alcohol beverage?	Never drink <1 /week 1-3 times/week 4times or more/week	0 1 2 3	
PC 5	During this pregnancy, have you received vaccination against tetanus?	Yes No	1 2	 ➡ PC8
PC 6	How many times /doses?	Once dose Two doses >two doses	1 2 3	
PC 7	During this pregnancy, have you received medication for malaria prevention?	Yes No	1 2	 ➡PC10
PC 8	How many times/doses?	Once dose Two doses >two doses	1 2 3	
PC9	During this pregnancy have you received iron/folic supplement?	Yes No	1 2	
PC 10	During this pregnancy have you received deworming tablets?	Yes No	1 2	
PC 11	During this pregnancy, do you sleep under bed nets?	Yes No	1 2	
PC 12	During this pregnancy, have ever tested for HIV/AIDS?	Yes No	1 2	
PC 13	What was the result?	Negative Positive	x y	➡PC17
PC 14	Have you received treatment when your result was positive?	Yes No	1 2	
PC 15	During child birth were you given ARVs?	Yes No	1 2	
PC 16	During pregnancy were you informed by health worker that you have one or more of these disease/conditions *(read all options and circle appropriately)*	<u>Diseases/conditions</u> High Blood Pressure Heart Disease Diabetes Epilepsy/Convulsion Malnutrition Malaria TB Anaemia Sickle cell anaemia Syphilis Other(specify) ----------	Yes 1 1 1 1 1 1 1 1 1 1 1	No 2 2 2 2 2 2 2 2 2 2 2
PC 17	Before this pregnancy, how many births do you have including stillbirths? *(Enter the # of births)*	# Of births…….		

PC 18	How many were stillbirths in previous pregnancy? *(Enter # of stillbirths i.e. baby born death after 7 months of pregnancy)*	# Of stillbirths……		

TOPIC 3 : DELIVERY HISTORY				
#	**Questions**	**Coding Categories**	**Code**	**Skip**
DH1	Where have you delivered with this last pregnancy?	Home Public health facility Private medical Centre	1 2 3	➡ PC4
DH2	Who assisted you during the delivery?	No one Relative TBA Nurse Midwife Clinical officer Doctor	0 1 2 3 4 5 6	
DH3	How long was the labor in terms of hours taken before delivery	< 1hours 4-6hours 6-12hours >12hours	0 1 2 3	
DH 4	Have you received medication to speed up labor and delivery?	Yes No	1 2	
DH 5	When was water broken?	Before delivery During delivery	1 2	
DH 6	How many hours it takes for birth after breakage of water?	< 1hours 4-6hours 6-12hours >12hours	0 1 2 3	
DH 7	What was the color of the water?	Colorless Bright red Green/yellow Green/brown Dark red Don't know	0 1 2 3 4 5	
DH 8	Was the water smell full?	Yes No	1 2	
DH 9	Was there excessive bleeding before, during and after birth?	No Yes before birth Yes during birth Yes after birth Yes both during & after	0 1 2 3 4	
DH 10	Did you experience convulsion before, during and after birth?	No Yes before birth Yes during birth	0 1 2	

		Yes after birth Yes both during & after	3 4	
DH 11	Did baby stop moving in the womb?	Yes No	1 2	➡ DH13
DH 12	When did the baby stop moving in the womb?	Before onset of labor During labor Don't know	1 2	
DH13	Did birth attendant check baby's heart beat sound during labor with Doppler or *fetoscope*?	No Yes with Doppler Yes with fetoscope Don't know	0 1 2 3	
DH14	Was the fetal heart beat present?	Yes No Don't know	1 2 3	
DH15	Was ultrasound scan done before or during labor?	Yes before onset of labor Yes during labor No, neither before onset nor during labor Don't know	1 2 3 4	➡DH17
DH16	Did the scan shown any fetal heart beat?	Yes No	1 2	
DH17	What type of delivery was it?	Normal vaginal delivery Forces/vacuum delivery Caesarian section Assisted breech delivery Don't know	1 2 3 4 5	
DH18	Which part of the baby came first during delivery?	Head Bottom Hand/arm Cord Feet Don't know	1 2 3 4 5 6	
DH19	Was there injection given to you immediately after delivery to contract the uterus?	Yes No Don't know	1 2 3	
DH20	Was the cord wrapped around the baby's neck?	Yes No Don't know	1 2 3	➡ DH22
DH21	Was there a cord knot?	Yes No Don't know	1 2 3	
DH22	What was the color of the cord?	Normal white/grey color	1 2	

		Red/brown Green/yellow Don't know	3 4	
DH23	Was placenta normal in terms of red in color, soft in touch and circular shape?	Yes No Don't know	1 2 3	
DH24	On what surface did you deliver the baby?	Floor with mattress cover Floor with mackintosh/plastic cover Floor with mat cover Floor without cover Delivery bed Don't know	1 2 3 4 5 6 7	
DH25	Did the birth attendant wash hands before examining you?	Yes No Don't know	1 2 3	
DH26	Did the birth attendant wear gloves before examining you	Yes No Don't know	1 2 3	
DH27	Was there anything applied on the cord?	Yes No Don't know	1 2 3	
DH28	What was it that is applied on the cord?	Iodine/methylate spirit Clorhexidine Herbs Dung Ashes Don't know	1 2 3 4 5 6	
DH29	What was used for cutting the cord?	New razor blade Old razor blade Scissors Other specify……. Don't know	1 2 3 4 5	
DH30	What was used for tying the cord?	Clean piece of threat Unclean piece of threat Clamp Other specify…… Don't know	1 2 3 4 5	

TOPIC 4: NEWBORN CARE HISTORY				
#	**Questions**	**Coding Categories**	**Code**	**Skips**
NC 1	At what gestational age was the baby born?	<7months 7months	1 2	

		8months 9months >9months	3 4 5	
NC 2	In what day, month and year the baby was born?	Day …… Month …… Year ……		
NC 3	How many babies in single pregnancy?	Single Twins Triplet Quadruplets	1 2 3 4	
NC 4	What was the sex of the baby (ies)?	Male Female	1 2	
NC 5	What was the birth weight of the baby?	<1kg 1kg 1-1.5kg 1.6-2kg >2.0kg	1 2 3 4 5	
NC 6	What size do you think was the baby?	Smaller than normal Normal Bigger than normal Don't know	1 2 3 4	
NC 7	Was the baby dried immediately after birth?	Yes No		
NC 8				
NC 9	Was the baby kept warm after birth?	Yes No		
NC 10	How the baby was kept warm?	Yes No Don't know Place skin to skin 1 2 3 Covered with blanket 1 2 3 Place in incubator 1 2 3 Other specify …… 1 2 3 Don't know 1 2 3		
NC 11	How was the baby clean on the first day after birth?	Not clean Bath with cold water Bath with warm water Wipe with piece of cloth Other specify Don't know	1 2 3 4 5 6	
NC 12	Were there signs of injuries on the baby after birth?	Yes No	1 2	➡BI 9
NC 13	Which parts of the body were the injuries marked?	Specify…….		
NC 14	Did the baby have malformation during birth?	Yes No	1 2	➡ B11
NC 15	What malformation did the baby have?	Swelling/defect at the back Very big head than normal Very small head than normal	1 2 3	

		Defect of lip/palate Extra fingers Protruding intestine through abdomen Other specify Don't know	4 5 6 7 8 9	
NC 16	What was the color of the baby at birth?	Normal/pink Pale blue all over Blue all over Pale/blue hands/feet Other specify…….. Don't know	1 2 3 4 5 6	
NC 17	Did the baby cry after birth, even if little?	Yes No Don't know	1 2 3	➡ NC 21
NC 18	Did the baby breathe after birth even if little?	Yes No Don't know		
NC 19	Was the baby assisted to breathe?	Yes No Don't know	1 2 3	➡ NC21
NC 20	What assistances were given to help the baby breath? (*circle all that were applied*)	Action taken Yes No Don't know Stimulation 1 2 3 Rubbing the back 1 2 3 Ambu bag and mask 1 2 3 Suction 1 2 3 Intubation 1 2 3		
NC 21	Did the baby stop being able to cry?	Yes No	1 2	
NC 22	What is the status of the baby (ies)?	Death Alive	A B	➡ NC 26
NC 23	In what day, month and year did the baby die?	Day ……. Month ……. Year ……		
NC 24	At what age was the death?	Died from uterus Died during birth Died after 1day Died after 7days	A1 A2 A3 A4	
NC 25	What do you think the primary cause of the death of the baby?	…… …….. ……..		
NC 26	How old is the baby (ies)?	<7days old 7days old >7days old	B1 B2 B3	

NC 27	Was the baby given the following vaccines within 1week?		Yes	No	Don't know	
		BCG	1	2	3	
		Polio	1	2	3	
		Hepatitis B	1	2	3	
NC 28	Did you sleep with the baby in bed net?	Yes			1	
		No			2	

TOPIC 5: NEONATAL ILLNESS HISTORY (Investigating causes of the death after birth)				
#	**Questions**	**Coding Categories**	**Code**	**Skips**
HI1	How old was the baby when the fatal illness started	7days old 7days old >7days old	1 2 3	
HI2	Was the baby able to suckle or bottle fed?	Yes No	1 2	
HI3	How many days after birth did the baby stop suckling or bottle feeding?	Specify …….		
HI4	Was the baby having fever?	Yes No	1 2	
HI5	How many hours/days did the fever start after birth? (*enter number of hours or days)*	Hours …….. Or Days…… Don't know	1 2 3	
HI6	How long did the fever last?	Hours …….. Or Days…… Don't know	1 2 3	
HI7	Did baby's body feel cold when touch?	Yes No	1 2	
HI8	Did baby have cough?	Yes No	1 2	
HI9	How many days did the cough start after birth? (*enter number of hours or days)*	Days…… Don't know	1 2	
HI10	How long did the cough last?	Days…… Don't know	1 2	
HI11	Did the baby have difficulty in breathing?	Yes No	1 2	
HI12	How many days did the difficulty in breathing start after birth? (*enter number of days)*	Days…… Don't know	1 2	
HI13	For how long was the difficulty in breathing last?	Days…… Don't know	1 2	
HI14	Did the baby have convulsion?	Yes No	1 2	

HI15	How many days did the convulsion start after birth? (*enter number of days)*	Days…… Don't know	1 2	
HI16	Did the baby become stiff and arch backward?	Yes No Don't	1 2 3	
HI17	During the illness that led to death, did the baby have sunken fontanels?	Yes No Don't know	1 2	
HI18	During the illness that led to death, did the baby have bulging or raised fontanels?	Yes No Don't know	1 2 3	
HI19	Did the baby have a swollen stomach (Abdomen)?	Yes No	1 2	
HI20	How many days after birth did the baby develop a swollen stomach?	Days …… Don't know	1 2	
HI21	Did the baby vomit?	Yes No	1 2	
HI22	How many days after birth did vomiting start?	Days …… Don't know	1 2	
HI23	When the vomiting was most severe, how many times did the baby vomit in a day?	Times …… Don't know	1 2	
HI24	Did the baby have diarrhea (more frequent or more liquid stools than usual)?	Yes No	1 2	
HI25	How many days after birth did the baby have diarrhea?	Days …… Don't know	1 2	
HI26	On the day when the diarrhea was most severe, how many times did he/she pass stools in a day?	Times…… Don't know	1 2	
HI27	At any time during the final illness was there blood in the stool?	Yes No	1 2	
HI28	Did the baby have redness around, or drainage from, the umbilical cord stump?	Yes No	1 2	
HI29	During the illness that led to death, did the baby have a skin rash?	Yes No	1 2	
HI30	Did the baby have yellow palms or soles?	Yes No	1 2	
HI31	How many days after birth did the yellow palms or soles begin?	Days …… Don't know	1 2	
HI32	For how many days did the baby have yellow palms or soles?	Days …… Don't know	1 2	
HI33	During the illness that led to death, did the baby bleed from anywhere?	Yes No	1 2	
HI34	Did the baby appear to be healthy and then just die suddenly?	Yes No	1 2	

TOPIC 6: INJURY/ACCIDENT HISTORY				
#	**Questions**	**Coding Categories**	**Code**	**Skips**
AH1	Did the baby die from an injury or accident?	Yes No		
AH2	What kind of injury or accident?	Poisoned Fall Road traffic accident Drowned Burnt Other specify ……..	1 2 3 4 5 6	

TOPIC 7: TREATMENT HISTORY				
#	**Questions**	**Coding Categories**	**Code**	**Skips**
TH 1	Did the baby receive any treatment before s/he died?	Yes No	1 2	➡TH3
TH 2	Why did the baby not receive any treatment?	…….		
TH 3	What type of treatment was given to the baby at home?	No treatment Drugs Herbs Don't know	1 2 3 4	
TH 4	Were you aware whether the baby needs medical help before she/he died?	Yes No	1 2	
TH 5	From where did the baby die?	Home Health facility	1 2	 ➡TH7
TH 6	What were the reasons as to why the baby died from home? *(circle all that are mentioned)*		Mentioned	Not mentioned
		Sudden death	1	2
		Did not recognize it is serious illness	1	2
		Did not know where to go	1	2
		Had no one to take care of other children	1	2
		Transport not available	1	2
		Transport too expensive	1	2
		No money for health care	1	2
		Very far health facility	1	2

		Do not trust quality care	1	2
		Fear staff blame mother for home delivery	1	2
		Fear of being shouted at by staff	1	2
TH 7	Which type of health facilities did you go to seek treatment for the illness of the baby? *(circle all that are mentioned)*		Yes	No
		Public hospital	1	2
		Public health unit/center	1	2
		Private clinic	1	2
		Drug shop/pharmacy	1	2
		Traditional healer	1	2
		Other specify	1	2
TH 8	Did health walker tell you the cause of baby's death?	Yes No	1 2	 ➡ TH10
TH 9	What did he/she said?	……..		
TH 10	Did you face difficulties when you sought care for your baby's illness?	Yes No	1 2	 ➡ end
TH 11	What Difficulties did you faced?		Mentioned	Not mentioned
		There was no problem	1	
		Had been turned away	1	2
		Waited long to be seen	1	2
		Lack of qualified staff	1	2
		Lack of equipment	1	2
		Lack of supplies	1	2
		Lack of medication	1	2
		No electricity	1	2
		Treated poorly/disrespected	1	2
		Treatment not available, too complex	1	2
		Delayed referral for better care.	1	2
		Cost/denied treatment for fees	1	2
		other (specify)	1	2

		died without being given care

The end of the interview
Thanks, respondent, for cooperation and participation.

Appendix 7.3: Proposed Budget of the study

SN	Activity	Unit	Unit cost ($)	Freq	Q'ty	Total cost ($)
1	Mobilization of research assistants (fuel, airtime, refreshment)	day	$120.00	1	4	$480.00
2	Transport fund for data collectors	day	$10.00	1	4	$40.00
3	Training of enumerators (workshop)	day	$100.00	1	4	$400.00
4	Incentive for data collectors/enumerators	day	$25.00	5	4	$500.00
5	Internal transport (Hired car and boda-boda)	day	$50.00	5	1	$250.00
6	Airtime for Communication	day	$10.00	5	5	$250.00
7	Data entry	day	$50.00	2	4	$400.00
8	Data validation and editing	day	$25.00	1	1	$25.00
9	Data analysis and interpretation	day	$400.00	4	1	$1,600.00
10	Printing of the report	day	50	1	3	$150.00
11	Stationery	day	$20.00	1	4	$80.00
Total						**$4,175.00**

Appendix 7.4: Proposed Research work plan

		Timeframe									
SN	Activity	week 1	Week 2	Week 3	week 4	Week6	Week7	Week8	Week9	Week10	Week11
1	Finalization of Research instruments										
2	Acquisition of Research permission from UCU										
3	Seeking permission from South Sudan Local Health authority										
4	Mobilization of research assistants										
5	Training of enumerators (workshop)										
6	Collection of data										
7	Data entry										
8	Data validation and editing										
9	Data analysis and interpretation										
10	Writing of chapter 4 (Research result)										
11	Writing of chapter 5 and 6 (discussion, conclusion and recommendations)										
12	Presentation and defending of the proposal										
13	Incorporation of comments										
14	Submission of final copy and approval										
15	Dissemination of the research										

Appendix 7.5: UCU application form for ethical approval (see attachment)

UGANDA CHRISTIAN UNIVERSITY

School of Research and Postgraduate Studies

"A Center of Excellence in the Heart of Africa

Template:

Use clear and simple language. Avoid technical terms wherever possible.

Application for Ethical Approval

Outline of Research Project

1. IDENTIFY THE PROJECT.

1.1 **Title of Project:**

Risk factors for Perinatal Death in Juba teaching Hospital, South Sudan: A case-control study.

1.2 **Researcher(s) name and contact information**

Taban G. Collins (MPHL) +211920236987

Email Address tabancollins@gmail.com

1.3 **Supervisor's name and contact information (if relevant)**

Dr. Mukooza Edward

1.4 **Anticipated date to begin data collection**

15/3/2022

2. DESCRIBE THE RESEARCH.

2.1 **Briefly outline what the project is about, introduction, literature review, problem statement, justification, research goals (and objectives) and anticipated benefits. Include links with a research program, if relevant.**

The project is about assessing the Risk factors for Perinatal Death in Juba teaching Hospital: A case -control study.

Perinatal death is the death that occurs within 28weeks of gestation period or 7days after birth where the birth weight may be equal or greater than 1000grams.The global trend of perinatal death rate remains high, majority (98%) are from low and middle incomes countries (Sub-Sahara Africa and South Asia). World Health Organization (WHO) report 2017 estimated 7,000 of newborn deaths occur every day globally. 2.5 million children die in the 1st month of life every year, and 2.6 million babies are stillborn. 1/3 dying on the day of birth and ¾ dying within first week of life. Sub-Saharan Africa region risk of neonatal death is 40%-49% and South Sudan Under 5years old children mortality is 75 per 1000 lives birth and perinatal death is 39.3 per 1000 live births based on UN Inter-Agency Group for Mortality Estimation (IGME) 2017.

The literature review has been so helpful to highlight the existing literature by other scholars and writers that is related to the risk factors for perinatal deaths.

South Sudan has no maternal and perinatal death audited report. The estimate was based on deaths reported to or from health facilities. Limited information on risk factors for perinatal deaths within and outside the health facilities to explain why perinatal deaths is high. This makes combating perinatal death become very hard for frontline health workers.

In order to comprehend the risks of perinatal deaths in the context of South Sudan, case-control study design has been has chosen for the study.

This design is analytical observational study, which traces backward from the outcome (perinatal death) to exposure (risk factors). It provides scientific evidences for multiple

risks for perinatal deaths with relatively little time, money and effort compare to other study designs.

The study will determine the risk factors associated with perinatal deaths in Juba teaching Hospital. It will identify maternal factors that are risks for perinatal deaths, neonatal and health facility factors that influence risks of perinatal deaths.

The information generated in this study will help to recommend to MOH, health and development partners appropriate health intervention in reducing perinatal deaths in South Sudan.

2.2 **Briefly outline your method.**

A Case-Control study design is chosen to investigate multiple exposures because the real exposure (risk factors) to perinatal death is not known so that researcher can intentionally search for cases within Juba teaching hospital. In addition to that case-control study design has greater statistical power when compare to other study designs because it is cheap, take short time, require small sample size and good for measuring odd ratio of only outcome. By so doing the researcher will compare the frequency of risks factors between case group and control group.

The data can be obtained by assisted interview from mothers of children born in Juba teaching hospital. Cases will be selected from the list of perinatal death record in hospital delivery register books that occur during the study period. In each case two control group that satisfied criteria from the same period of the month will be selected.

2.3 **Describe plans to give participants information about the research goals.**

All respondents 18 years and above will be given a consent form, where the researcher will read out and explain the contents of the form, and those below 18 years their guardians will consent for them. This will be followed by explaining the goal of the study and any other details that the respondents may need.

2.4 **Identify the expected outputs of this research (e.g., reports, publications, presentations).**

After the study is completed the researcher will compile a report which will be presented to the supervisor and later presented to a panel of lecturers. The report will be submitted to the University for marking. Report findings will be shared with South Sudan Ministry of Health-department of Research, Monitoring, Evaluation and planning, Child Health department and Director of Juba Teaching Hospital.

2.5 Identify who is likely to see or hear reports or presentations on this research.

MOH- Department of Research, Monitoring, Evaluation and planning, Juba teaching Hospital management, researchers and academics.

2.6 Identify the physical location(s) for the research, the group or community to which your potential participants belong, and any private data or documents you will seek to access. Describe how you have access to the site, participants and data/documents. Identify how you obtain(ed) permission from relevant authorities/gatekeepers if appropriate and any conditions associated with access.

The research will be conducted at Juba Teaching Hospital, Juba County Central Equatoria State South Sudan. It is purposively selected because of its higher recorded births and proximal location as a public health facility, relatively well-equipped with better health services than other hospitals. It has been estimated 42,000 pregnant women annually endure related childbirth complication during labor in Juba teaching hospital. It's being proximity to government –sponsored facility helps to mitigate the cost and transport when evaluating risk to perinatal death in neonatal ward.

3. OBTAIN PARTICIPANTS' INFORMED CONSENT, WITHOUT COERCION.

3.1 **Describe how you will select participants (e.g., special criteria or characteristics) and how many will be involved.**

The researcher will use purposive sampling where case subjects will be identified using birth record in the hospital and eligibility criteria which include all mothers of still births, intrapartum deaths and neonatal deaths with 7days after birth. While control subjects will represent mothers of children born in Juba teaching hospital and remain alive. Both cases and controls will be mothers who satisfied homogeneous characteristics (selection criteria) such as maternal age within 15- 40 years, gestational age(28-42weeks), assisted normal vaginal delivery, and singleton pregnancy.

This sampling procedure is chosen because Case and Control subjects may not be freely available. For convenience and easy access of the participants to participate in the study, purposive sampling will be used. For each Case obtained from the hospital registry, a mother who can be located and willing to participate in the study will be interviewed. Then in each Case, two Controls mothers with same eligibility criteria during the study will be interviewed. This is done by identifying the next suitable birth from the hospital register resulted from surviving neonates whose mother is willing to take part in the study. This will be done retrospectively starting from recent births going backward up-to 7days old births until desire sample size is reached.

From the delivery register,108 case groups will be selected based on inclusion criteria and unmatched with 215 control groups. Consecutive sampling method will be used to collect data by interview with mother baby pairs where babies are alive by the end of the first week after birth (controls) and mother baby pairs where the baby dies in the perinatal period i.e. Intra Uterine Fetal Death (IUFD) or death in first week of life after birth (cases).

3.2 Describe how you will invite them to participate.

The researcher will first seek permission from the management of Juba Teaching hospital through the Hospital director. Then visit to the neonatal ward/labor ward to obtain list of mothers' delivery record and select respondents base on selection criteria. After that makes self-introduction to available mothers and the purpose of the study and request those who meet the criteria and willing to take part in the study to consent by signing on consent form. Then later private space will be arranged for conduct interview with the respondents.

3.3 Show how you provide prospective participants with all information relevant to their decision to participate. Attach your information sheet, cover letter, or introduction script. See document on informed consent for recommended content. Information should include, but is not limited to:

- **what you will ask them to do;**

The researcher will ask those who have accepted to take part in the study to sign on the consent form and those below 18 years of age their guardians to consent for them.

Then the research questionnaire will be read and translated into local language, take notes and recorded in device by research assistants.

- **how to refuse to answer any particular question, or withdraw any information they have provided at any time before completion of data collection;**

The researcher will explain to the participants that they could skip any questions they fill they can't answer or don't want to answer.

- **how and when to ask any further questions about the study or get more information.**

The researcher will give an opportunity to the respondents to ask any questions about the study.

- **the form in which the findings will be disseminated and how participants can access a summary of the findings from the study when it is concluded.**

The researcher will encourage the respondents to access the findings of the study from the service providers at the Hospital or MOH-department of Research, Monitoring, evaluation and planning since each a copy will be provided to them.

3.4 Describe how you get their consent. (Attach a consent form if you use one.)

The researcher will distribute the consent form to all participants, explain it to them and request them to sign it before taking part in the study.

3.5 Explain incentives and/or compulsion for participants to be involved in this study, including monetary payment, prizes, goods, services, or favours, either directly or indirectly.

No money will be given to any respondents who will be involved in answering the questionnaires because they will be convince that it is for the purpose of improving the health services in order to reduce perinatal deaths. Except research assistants will be given transport and lunch to facilitate the data collection process.

4. MINIMISE DECEPTION.

4.1 **If your research involves deception - this includes incomplete information to participants -- explain the rationale. Describe how and when you will provide full information or reveal the complete truth about the research including reasons for the deception.**

The researcher will not use any deception, since there is no such information or contents of the study that is classified as sensitive ethically or culturally.

5. RESPECT PRIVACY AND CONFIDENTIALITY

5.1 **Explain how any publications and/or reports will have the participants' consent.**

All participants will be explained to that confidentiality will be a respected value as the study is being carried out. For example, their names will not be disclosed and all information wouldn't be published without their consent.

5.2 **Explain how you will protect participants' identities (or why you will not).**

There will be no participants; name, signature, photograph and contact address will be disclosed on any of the documents used in the study.

5.3 **Describe who will have access to the information/data collected from participants. Explain how you will protect or secure confidential information.**

The researcher, and the supervisor will have access to the filled questionnaires, and it will be stored in a lockable safe place.

6. MINIMISE RISK TO PARTICIPANTS.

'Risk' includes physical injury, economic injury (i.e. insurability, credibility), social risk (i.e. working relationships), psychological risk, pain, stress, emotional distress, fatigue, embarrassment, and cultural dissonance and exploitation.

6.1 **Where participants risk change from participating in this research compared to their daily lives, identify that risk and explain how your procedures minimize the consequences.**

There are no anticipated risks to the participants in this study except emotional breakdown during the interview. Since those (cases) who lost a child may still be traumatized, the researcher ensures working with a counselor during the interview because a mother may break down while talking about the circumstance that led to the dead of her child. Therefore, involvement of counselor to deal with mothers who

breakdown will be taken priority to provide counseling in order to safeguard total breakdown of the mother during data collection.

6.2 **Describe any way you are associated with participants that might influence the ethical appropriateness of you conducting this research – either favourably (e.g., same language or culture) or unfavorably (e.g., dependent relationships such as employer/employee, supervisor/worker, lecturer/student). As appropriate, describe the steps you will take to protect the participants.**

There is no association by the researcher with the participants that might influence the ethical appropriateness of the researcher's conducting this study.

6.3 **Describe any possible conflicts of interest and explain how you will protect participants' interests and maintain your objectivity.**

There is no anticipated conflict of interest as far as this study is concerned.

7. EXERCISE SOCIAL AND CULTURAL SENSITIVITY.

7.1 **Identify any areas in your research that are potentially sensitive, especially from participants' perspectives. Explain what you do to ensure your research procedures are sensitive (unlikely to be insensitive). Demonstrate familiarity with the culture as appropriate.**

There is no ethically sensitive or culturally invasive information anticipated in this study.

7.2 **If the participants as a group differ from the researcher in ways relevant to the research, describe your procedures to ensure the research is culturally safe and non-offensive for the participants.**

The researcher will do a check on the background, cultural values and norms of the study population so as to remain appropriate and relevant which will help prevent variances.

Appendix 7.6 UCU approval letter for data collection (see attached nested pasted)

UGANDA CHRISTIAN UNIVERSITY
A Centre of Excellence in the Heart of Africa

08/07/2022

To: Taban Geofrey

Uganda Christian University
+211921671245

Type: Initial Review

Re: UCUREC-2022-288: Risk factors for Perinatal Death in Juba teaching Hospital, South Sudan: A case-control study. , March 2022, 2022-03-24

I am pleased to inform you that the Uganda Christian University REC, through expedited review held on **08/07/2022** approved the above referenced study.
Approval of the research is for the period of **08/07/2022** to **08/07/2023.**

As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the REC for re-review and approval **prior** to the activation of the changes.
3. Reports of unanticipated problems involving risks to participants or any new information which could change the risk benefit: ratio must be submitted to the REC.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Continuing review application must be submitted to the REC **eight weeks** prior to the expiration date of **08/07/2023** in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study.
6. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
7. You are required to register the research protocol with the Uganda National Council for Science and

No.	Document Title	Language	Version Number	Version Date
1	Data collection tools	English	March 2022	2022-03-24
2	Protocol	English	March 2022	2022-03-24
3	Informed Consent forms	English	March 2022	2022-03-24

Yours Sincerely

Peter Waiswa
For: Uganda Christian University REC

Appendix 7.7: South Sudan MOH approval letter for data collection

REPUBLIC OF SOUTH SUDAN

Ministry of Health, Research Ethics Review Board (MOH-RERB), Juba.

MOH-RERB Protocol: 08/15/02/2022 Date: 08/03/ 2022

MOH-RERB Approval: 07/08/03/2022

Approval Period: one Month

Principal Investigator(s)(PI): Taban Geoffrey Collin, Uganda Christian University

Dear Geoffrey

Notice Research Approval Letter

Project: "Risk Factors for Perinatal Death at Juba Teaching Hospital, South Sudan: A case-control Study"

I refer to your letter dated 15th February 2022 requesting for approval to conduct the study on risk factors for perinatal death in Juba Teaching Hospital, South Sudan.

2. Hence, I am pleased to inform you that the Ministry of Health Research Ethics Review Board(MOH-RERB) has no objection to your request to conduct research at JTH, Central Equatoria State.

3. Please observe the following conditions of approval for conducting study in South Sudan settings:

   a. Adhere to the approve research proposal/protocol

   b. Not to publish your findings without clearance from MOH-RERB

   c. Complete the study in the selected facility within the stimulated period in approval letter

   4. Attached herewith the Responsibilities Principal Investigator/Chief Investigator/ supervisor's

Yours sincerely,

MINISTRY OF HEALTH RESEARCH ETHICS REVIEW BOARD MOH-RERB 08 MAR 2022 JUBA SOUTH SUDAN

Amanya Jacob, MPH-SMU

D/Director for Research, M &E MOH-Juba, Republic of South Sudan

D/Chairperson, Ministry of Health, Research Ethics Review Board(MOH-RERB), Juba/RSS

Cc: Hon. Under Secretary, MOH-Juba/RSS

Cc: D/G/Admin JTH/MOH-Juba

Tel: +211920536030 Email: ministryofhealthrerb@gmail.com

REPUBLIC OF SOUTH SUDAN

Ministry of Health, Research Ethics Review Board (MOH-RERB), Juba.

Date: 8th/03/2022

MOH-RERB Protocol No: 08/08/03/2021

Approval No. MOH-RERB: 07/08/03/2022

Approval Period: one Month

Authorized Principal Investigator: Taban Geoffrey Uganda Christian University

MINISTRY OF HEALTH, RESEARCH ETHICS MOH-RERB 08 MAR 2022 JUBA - SOUTH SUDAN

Dear Taban Geoffrey,

Subject: In-country Authorized Principal Investigator Responsibilities

The MOH-RERB is fully constituted board/committee in accordance with the national guidelines for research involving humans in the Republic of South Sudan. The RERB draw to your attention the requirement that a report on this research must be submitted quarterly during the study period from the date of approval or on completion of the project, whichever occurs first. Failure to submit reports will result in withdrawal of consent for the project to proceed or impact on the next cycle.

Principal Investigator/Chief Investigator/ MOH-supervisors to ensure that:

1. All serious and unexpected adverse events should be reported to the MOH-RERB as soon as possible
2. Unforeseen events that might affect continued ethical acceptability of the project in South Sudan should be reported to the MOH/RERB as soon as possible
3. The MOH-RERB must be notified immediately if possible of any changes to the protocol. All changes must be approved by the MOH-RERB before continuation of the research project. These to include but limited to;
   - If any of the investigators change or withdraw from the participation
   - Any changes to the participants' information statement and/or consent forms.
   - Any amendment or changes to the reagents, tools and other requirement set forth in the protocol
4. All the research participants are to be provided with a participants' information statement and consent Form, unless otherwise agreed by the board. The participant's information statement and Consent Form are to be on the MOH-RERB disposal and include the full title of research project and contact for researchers, unless otherwise agreed by the board and the following statement must appear on the bottom of the participant information statement. Any person with concerns or complain about the conduct of the research study can contact the A/Director General, Policy, Planning/Budgeting & Research, MOH on +211920327674 email: kediendemapuor@gmail.com or amanyajazy@yahoo.com
5. Copies of all signed consent Forms must be retained and made available to the Board on request

6. It is your responsibility to provide a copy of this letter to any internal/external granting agencies if requested
7. The MOH-RERB approval is valid for one year (12) months from the approval period stated thereof, Investigators are requested to submit a progress report quarterly/annually for longer studies
8. No report, material or findings should be published without the consent to publish from the MOH-RERB or DPPB and Research, MOH-Juba/RSS

Yours sincerely,

MOH-RERB
08 MAR 2022
MINISTRY OF HEALTH, RESEARCH ETHICS REVIEW BOARD
JUBA - SOUTH SUDAN

Dr. Kediende Chong

A/Chairman, Ministry of Health, Research Ethics Review Board(MOH-RERB), Juba,

Republic of South Sudan

Cc: Hon. Under Secretary, MOH-Juba, Republic of South Sudan

Cc: Dr. Samson Paul Baba, Community Health Advisor and Special Programs, MOH-Juba

Cc: Dr. John Rumunu, Director General, Preventive Health Services, MOH-Juba

Cc: MOH-RERB, Secretariat,

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