

**AGE RELATED FACTORS AND OTHER SOCIAL DETERMINANTS THAT
INFLUENCE MATERNAL DEATHS AT TWO EXPANSIVE SLUMS IN NAIROBI
KENYA**

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2020

DECLARATION

I declare that this my original work and hasn't been submitted by any other person for research purpose, award of degree or any other purpose.

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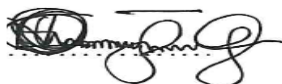
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DEDICATION

I dedicate this study to my family and the University of Nairobi whose unequalled and material support has been great and relentless towards achieving this goal.

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The author solely remains responsible for any errors of omission and/or commission committed while writing the paper.

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LIST OF ABBREVIATION AND ACRONYMS

ANC	Ante Natal Care
BMI	Body Mass Index
DHIS	District Health Information System
ERC	Ethical Review Committee
HIV	Human Immuno-Deficiency Virus
KDHS	Kenya Demographic Health Survey
KNH	Kenyatta National Hospital
LBW	Low Birth Weight
MNHR	Maternal Newborn Health Registry
SPSS	Statistical Package for the Social Sciences
UN	United Nations
UNFPA	United Nations Populations Fund
WHO	World Health Organizations

OPERATIONAL DEFINITIONS OF TERMS

Adolescent mother	Mothers of between the age group of (10 – 19) years. (WHO, 2012).
Adverse pregnancy outcomes	Collectively defined as chromosomal abnormalities, congenital malformations, miscarriage, stillbirth, or preterm birth, post-partum haemorrhage, pre-eclampsia that may lead to baby's or mother's death.
Maternal mortality	Refers to the death of a woman who is pregnant or within a period of 42 days after terminating a pregnancy, which is independent of the duration and site of the pregnancy, from any cause associated with the pregnancy and its management. However this does not apply to causes arising from accidents or incidents, (WHO, 2018).
Pregnancy induced hypertension	This is a disorder portrayed by high blood pressure during pregnancy that can lead to a dangerous condition called preeclampsia, also referred to as toxemia.
Pre-term Delivery	This terminology refers to babies who are born alive before attaining thirty seven weeks of pregnancy in a mother's womb, (WHO, 2018)
Post-partum haemorrhage	Post-partum haemorrhage refers to loss of more than 500ml or 1,000 ml of blood within the first twenty four hours after the birth of a child.

ABSTRACT

Background;

Approximately 830 women die every day from complications related to child birth or pregnancy globally. It is projected that 99% of these deaths mostly occur in low-resource settings. In Kenya, according to the Population Reference Bureau 2015, maternal mortality ratio was estimated at 362 per 100,000 live births. The causes of maternal mortality in Kenya are well comprehended but there is little information as to whether the patterns or trends for causes of maternal deaths among older women are the same as for adolescence girls.

Objective;

This particular study sought to determine the influence of mothers' age and other social determinants on the occurrence of adverse pregnancy outcomes (maternal deaths) at the two expansive slums in Nairobi (Viwandani and Korogocho).

Study Methodology;

The study employed a retrospective study design to identify cases of mothers who had died as a result of maternal deaths from the Nairobi Urban Health and Demographic Surveillance System (NUDHSS) program database run by African Population and Health Research Center (APHRC). A study approval was obtained from KHN-UoN Research Ethics and Research Committee and APHRC as an institution. A sample size of 80 maternal deaths was retrieved using simple random sampling from the secondary data obtained from the NUDSS project between the years 2003 – 2015. The extracted data was the entered into Microsoft Excel, coded using standard coding system, processed and analyzed using IBM SPSS V 25.0 Statistical software. The quantitative data were then analyzed using the descriptive statistics and logistic regression models

Results;

Several causes of maternal deaths were identified, the leading cause was delivery complication (38.8%), pre-term delivery (15.0%), HIV (12.5%), abortion (10.0%), post-partum delivery (8.8%) and the least was puerperal sepsis (5.0%). In terms of cause by age there was a significant association between age and pre term delivery as a cause of maternal mortality. Participants who were aged between 15-19 years were about 6 times more likely to die due to preterm birth as compared to those aged 20-44 years (O.R=5.92; 95% C.I. 1.62-21.67; p=0.007). No significant associations were observed in terms of age with other causes. Participants who had pre-existing conditions were 12.571 times more likely to die of post-partum hemorrhage as compared to those without pre-existing conditions (57.1% vs 9.6%); (O.R. 12.571, 95% C.I. 2.325-67.964; p=0.003).

Conclusions;

The conclusion is that possible causes of maternal deaths affects women of all age groups but some are more prominent amongst certain age groups. More sensitization therefore needs to be done to the women and girls of reproductive age on the possible causes of maternal deaths and how they can work round to combat them. The health facilities also need to be supported with enough medical personnel to assist the mothers during their pregnancy phase and post natally.

CHAPTER 1.0 INTRODUCTION

1 .1 Background of the study

Maternal mortality is a major public health concern that affects many countries especially those in the Sub-Saharan Africa. This has made it to be listed as one of the Millennium development goals Key Indicators. In comparison to the developed Nations, Africa is faced with numerous social, physical, economical and psychological challenges mostly in the rural areas. Lack of qualified health personnel, poor infrastructure in health sector, lack of education, low income levels and general lack of awareness amongst the masses are some of the negative factors that contribute to maternal mortality, (Garenne, 2015). All these unfavorable conditions must be changed if maternal mortality is to be decreased effectively (Garenne, 2015). A millennium declaration signed at the advent of a new millennium by 189 member countries committed to eight goals that were aimed at achieving global development equality during the first period of the millennium, that is 15 years. Among the listed key targets to be achieved between 1990 and 2015 was the reduction of maternal mortality. It was meant to reduce maternal deaths and improve access to reproductive health services universally, (Okonofua, 1997).

Globally, the number of women who die from pregnancy or child related complications daily is approximately 830, (Alkema *et al.*, 2016). These statistics show how maternal mortality is unacceptably high. Majority of the maternal deaths happened in Countries which are very poor and most of the deaths could have been avoided if proper mechanisms were put in place (Alkema *et al.*, 2016).

The maternal mortality was reported at 239 per 100,000 live births in the developing Countries as compared to 1 per 100,000 livebirths reported in the economically advanced countries as per the year 2015, (Alkema *et al.*, 2016). This presented a big difference between countries. Further analysis in in country reports revealed that, women with low income levels were at a greater risk of dying during and after giving birth and those living in the rural areas with restraint resources also faced greater threats, (Alkema *et al.*, 2016).

In Kenya, according to the Population Reference Bureau of the year 2015, the maternal mortality ratio was estimated at 362 per 100,000 live births, (Population Reference Bureau, 2015). This study further showed that maternal mortality is still very high in Kenya and mostly in the rural set up. Comparing the maternal mortality by age, the risk is high for the adolescents' girls under 15 years. The rise has been as a result of pregnancy complications and complications at childbirth which leads to deaths amongst the adolescent girls in the developing countries (Conde-Agudelo *et al.*, 2005). A study conducted by UNFPA indicated that risk of death of adolescent mothers is twice as high as compared to the older women in their 20s, (UNFPA Publication, 2012).

These series of reports lead us to start thinking whether age plays apart in determining the outcomes of women pregnancy. It stimulates our thinking to research on if there's a linkage between maternal age and adverse perinatal outcomes amongst women. Previous studies have also shown socio-economic factors as confounders in determining the outcomes of the pregnancy outcomes. Poverty levels and lack of education confounding tends to lead more adolescents to a

greater risk of maternal death as compared to older women who might be married and can be supported by their spouse during this period, (Lawlor, Mortensen & Andersen, 2011).

Program designers for the youth/ adolescents program needs the information on the high risk groups to enable them customize their program approach effectively, and that's why this study will play a key role in reproductive health study design.

1.2 Statement of the problem

Approximately 830 women die every day from complications related to child birth or pregnancy globally. It is projected that 99% of these deaths mostly occur in low-resource settings. (Alkema *et al.*, 2016)

In the developing Countries, maternal mortality was reported at 239 per 100,000 live births compared to 1 per 100,000 livebirths in the economically advanced Countries as per the year 2015. This presented a big differences between countries, (Conde-Agudelo t al., 2005). In Kenya, according to the Population Reference Bureau of the year 2015, the maternal mortality ratio was estimated at 362 per 100,000 live births. This study further showed that maternal mortality is still very high in Kenya and mostly predominant within the rural set up. Comparing the maternal mortality by age, the risk is high for the adolescents' girls under 15 years. The rise has been due to impediments in pregnancy and childbirth which leads to deaths amongst the adolescent girls in the low economic developing countries, (Conde-Agudelo, Belizán and Lammers, 2005).

A study conducted by UNFPA indicated that risk of death of adolescent mothers is twice as high as compared to the older women in their 20s, (UNFPA, 2012). District Health Information Systems report form Kenyatta National Hospital, reports that between the years 2017-2018, at total of 180 adolescents and 174 mothers 20+ years succumbed to maternal related deaths,

(District Health Information Sysytem[DHIS Kenya], 2017). This means more adolescents mothers die at the facility as compared to older mothers. These two major slums account for a good proportion of women who passes on as a result of maternal complications hence the rationale for focusing my study in this geographical area.

1.3 Research objectives

1.3.1 General objectives

To determine the influence of mothers' age and other social determinants on the occurrence of maternal deaths at the two expansive slums in Nairobi (Viwandani and Korogocho).

1.3.2 Specific objectives

1. To determine the influence of pregnant women's age on the occurrence of maternal deaths at two expansive slums in Nairobi (Viwandani and Korogocho).
2. To determine the influence of other social factors on the pregnancy outcomes among pregnant women at two expansive slums in Nairobi (Viwandani and Korogocho).

1.3.3 Research questions

1. What is the influence of pregnant women's age on the occurrence maternal deaths at the two expansive slums in Nairobi (Viwandani and Korogocho)?
2. What is the influence of other social factors on the occurrence of maternal deaths among pregnant women at the two expansive slums in Nairobi (Viwandani and Korogocho)?

1.4 Justification of the study

The findings from this study will highly be important as it assessed the influence of age on the perinatal outcomes of mothers presenting at the two expansive slums in Nairobi (Viwandani and Korogocho). District Health Information Systems report form Kenyatta National Hospital, which serves a good proportion of the patients that resides from this study area, reports that between the years 2017-2018, at total of 180 adolescents and 174 mothers 20+ years succumbed to maternal

related deaths, (DHIS, 2017). This justifies why these two slums are perfect sites to conduct this study. This study has been done in other regional parts of the world (Asia) but none has been done in Kenya and since there are different environmental factors faced by the people that reside in these two geographical locations, there is need to conduct one locally. It will also answer the effects of other social factors on pregnant women which is pegged on their capability to have enough resources, time and adequate knowledge levels on the same to see them through this period.

Viwandani and Korogocho slums were chosen as it has quite a number of pregnant women presenting at the various health facilities for care they host a bigger population of the Nairobi County residence.

1.5 Significance of the study

In order to achieve the best results in addressing maternal deaths, the exact causes of maternal deaths must be identified across the varying age groups. Once this is established, a good policy document will be put in place to minimize the number of deaths arising from these causes and also help the government to ensure that the mothers, especially the adolescent mothers receive the best possible care during pre-natal and post-natal periods to avert any possible death. The study findings will be used by the government policy makers to streamline the implementation of the sexual and reproductive health among the women of productive age.

CHAPTER 2.0 LITERATURE REVIEW

2.1 Introduction

This chapter describe in details the literature review related to the problem statement and stating clearly the gaps arising. It presents the studies that have been conducted with respect to the influence of age on the maternal outcomes among mothers.

2.2 Pregnancy Outcomes

About 13,000 newborns die every day in the Sub-Saharan Africa as a result of adverse maternal outcomes. This statistics alone accounts for half of the universal burden of maternal deaths (Kinney *et al.*, 2010). Among the most pressing improvements required in health is therefore a reduction in newborn, maternal and child deaths. In order to address this challenge, the UN-Millennium Development Goals made a goal to reduce by three quarters the maternal mortality and also reduce child mortality by two third by the year 2015, (Attaran, 2005).

The most common causes of maternal and neonatal morbidity and mortality include; malnutrition and micronutrient deficiencies, endemic infectious diseases (malaria, HIV/AIDS, tuberculosis), complications related with child birth, illness to the newborns and insufficient antenatal and perinatal care due to economic and logistic constraints in low economic areas, (Kinney *et al.*, 2010)(ISSIFOU *et al.*, 2006) while other studies do indicate that women above 35 years of age are more vulnerable to dangers related with being pregnant, (Cnattingius, Forman, Berendes & Isotalo, 1992). In the Year 2017, Kenya reported a total of 1,241 maternal deaths of which 406 (34%) were adolescents, (DHIS, 2017). This shows that in as much as these deaths are being reported, a good percentage of the adolescents are affected as well. This study therefore tries to find out the causes of the maternal death that are dependent on the mothers age and see how to form policies that can address this issue.

2.3 Adverse Pregnancy Outcomes

Recently, women of advanced age who become pregnant are usually first time mothers and of better financial and social status as compared to the previous time when they would give birth to more than one child under low economic status, (Carolan & Frankowski, 2011). Contemporary studies have also revealed that pregnancy outcome in women can also be controlled by social and economic status and other variables, for instance body mass index (BMI), (Chan & Lao, 2008).

Other public health efforts such as provision of vitamin supplements to mothers, sleeping under treated bed nets by pregnant mothers, use of skilled birth attendance, treatment of malaria through intermittent treatment and adhering to the required guidelines as far as antenatal care access and utilization is concerned can be used to reduce adverse outcomes related to pregnancy (Darmstadt *et al.*, 2005)

Use of overlooked yet preventable risk factors for negative pregnancy outcomes need to be encouraged to reduce neonatal and maternal mortality, (Ramharter *et al.*, 2004). The percentage and number of child bearing adolescent women varies from place to place pegged on the political, religious, cultural, economic and other social factors. Studies from the high and medium income countries have shown conflicting results, (Chen *et al.*, 2010).

Quite notably, there is lack of epidemiological evidence from Sub-Saharan Africa on outcomes of adolescent adverse pregnancy outcomes and related risks involved, (Adam *et al.*, 2008). The study's aim is therefore to determine the influence of mothers' age on adverse pregnancy outcomes at the two slums in Nairobi.

2.4 Age Factor on Pregnancy Outcomes

Scholl et al defines Adolescence pregnancy as a situation where a woman undergoes gestation before their body attains full somatic development(Scholl *et al.*, 1989). Worldwide, around 16 million babies are given birth to by adolescent girls whose lies between the age of 15-19 years which presents around 11% of births worldwide. Interestingly, 95% of these births occur in poor and moderately resourced income countries. It is this poor countries where death of these girls majorly occur as a result of pregnancy or child birth complications, (Howson *et al.*, 2013). In Kenyatta National Hospital between the years 2017-2018, 180 adolescents and 174 mothers 20+ years succumbed to maternal related deaths, (DHIS, 2017).

Unwanted pregnancy outcomes for instance pre-term birth is still associated with adolescence pregnancy, (Weng, Yang and Chiu, 2014). other adverse effects associated with adolescence included; babies born with less the recommended weight, labour dystocia and maternal deaths (Howson *et al.*, 2013)(Weng, Yang and Chiu, 2014). The Evidence however is still controversial; the debate is out there on whether to what extent does the associations observed among the victims were caused by the fact that the young mothers were biological immature , or if the issues were confounded by the habitual poor economic status and to some extent lack of health services to these groups, which is still debatable, (Chen *et al.*, 2010).

It is therefore right to have a high quality studies in a similar low economic environment where most of the undesired pregnancy outcomes do happen. The Global Network research for women and children Health conducted a study to understand as whether the age of a mother plays a role in determining the risk level of the mothers in suffering from adverse pregnancy outcomes, (MNHR)(Bose *et al.*, 2015).

However, while majority of studies have reported increased risks to adverse pregnancy outcomes among the older women, many studies have also not been able to give consistent conclusions as

to whether age plays a key part in determining the pregnancy outcomes., (Berkowitz *et al.*, 1990). In addition, there is also little agreement or consensus on whether the maternal age plays a role in determining any risk of adverse pregnancy outcome. However, some studies have reported that a significant association is achieved for women who are forty years of age and above, (Andersen *et al.*, 2000).

2.5 Social determinants of maternal health

Adverse pregnancy outcomes are influenced by numerous biological, environmental and social factors. A number of studies have found out that inequality in income and persons socio-economic status also correlated with birth outcomes. The social factors that have been linked to poor birth outcomes include; teenage pregnancy, marital status, maternal education and Intention to become pregnant, (Lynch *et al.*, 2001).

Social determinants presents a picture in which human being do exist, are born, grown in, reside, live and work and grows in age, this includes a health system. The situation around the social determinants are guided by the power dynamics, sharing of the money and wealth at local, national and global levels which are mostly influenced by choices of policies. The unbalanced health sector allocations are normally as a result of these social determinants which affect health sector. Study conducted by the World Health Organization indicates that Poverty and unfairness are the inherent causes to most of the maternal, newborn and child deaths. From the same study, it is shown that a household which is resource strained is twice likely in risk of both maternal and newborn mortality as compared to the well to do households, (World Health Organization Report, 2010).

There is also gaps in quality of services offered before, during and immediately after child birth that can affect interventions capable of averting illnesses and saving of the affected persons lives.

World Health organization reports from a study conducted in 51 Count down Countries indicate that the median coverage for 4 or more antenatal care visits to most health facilities was halfway at 50% since the year 2000. That is a range of 6% in Somalia to a maximum percentage of 89% in Brazil. The report also stated that not all women are assisted by a qualified health practitioner during child birth and access the required health services in the post-natal period. One such service that they normally fail to access during the post-natal period include active management of 3rd stage of labour with oxytocin to prevent post-partum haemorrhage, (World Health Organization Report, 2010).

This gap is a missed chance to address the challenges affecting maternal and new born health and also reduce still births. Another gap that needs to be addressed is the postnatal care for mothers and newborns. There is lack of data from many countries (approximately 45 of the 68 have no data), and looking at the 23 countries with available data, coverage is poor in the (median coverage of 38%), and even effective actions are often not provided. This privilege is at times pegged on the age of the mother. Probably those who are older and married might have better support to access the required services as compared to the younger ones, (World Health Organization Report, 2010).

Most of the time, women who receive prenatal care are appropriately screened for conditions, such as diabetes, anemia, hypertension, Rhesus disease, and syphilis; and are eventually treated if any of these conditions are positive. These women have reduced rates of stillbirth and of neonatal and maternal mortality. Some of the barriers identified that can affect the women from a low income households may include lack of money to pay for the essential health services, as bad prior experiences of the women in the hands of service providers and at the facility of care, depression and lack of transportation, (Gardosi *et al.*, 2005). This study also seeks to find out if

age factor plays a role in a woman's capability of going through the full ANC continuum of care to ensure the baby and the mother are eventually safe. Studies have also identified weight of a mother as an influencing factor in determining the pregnancy outcomes. Weight on the other is also related with the age of the mother and in a way influences the ultimate pregnancy outcome. Weight gain among pregnant women can also have an hand in advancing some of the non-desired pregnancy outcomes. These adverse outcomes can possibly include; increased risk for hypertension related with pregnancy, labour and delivery complications, gestational diabetes and maternal obesity which may affect quality breastfeeding. Furthermore, women who become pregnant at older age enters pregnancy cycle with chronic conditions e.g type 2 diabetes that could lead to more illnesses both during the pre-natal and postpartum periods, (National Academic Press, 2009).

2.6 Theoretical framework

The relationship between the dependent and independent variables towards the achievement of the desired impact explains the theoretical approach of explaining the pregnancy outcomes among mothers residing in the two slums. The study borrows from the study of reasoned action. This theoretical model developed in the year 1975 by Fishbein and Ajzen. The model describes the associations between norms, attitudes, beliefs, behaviors, and plans of persons. According to this model, someone's behavior is dictated by its behavioral plans to fulfill them. This purpose is itself dictated by the someone's attitudes and his/her subjective norms towards that particular behavior. As per this model, the beliefs on the consequences of a person's behavior are determined by his beliefs and his/her evaluation of these outcomes. Person's beliefs are defined by the subjective likelihood that executing a particular behavior will yield specific outcomes. Mothers of different ages make independent judgement that other social determinants around them influence their pregnancy outcomes.

2.7 Conceptual Framework

Independent Variable

Demographic characteristic
- Age of the mother

Other Social factors
- Place of delivery
- Mode of delivery
- Pre-existing health conditions
- Residence
- Education level

Dependent Variable

Maternal Outcomes
- Post- partum haemorrhage
- Pre-eclampsia
- Pregnancy termination
- Pre term delivery
- Delivery complications

Impact

Adverse pregnancy outcome
(Maternal death)

Figure 1: Conceptual Framework

CHAPTER 3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter gives an account on research methodology that was employed in the study. It describes the research design, location of the study, the target group under study, sample size calculation and the research instruments that was used.

3.2 Study Design

The study employed a retrospective study design to identify cases of mothers with adverse pregnancy outcomes (maternal deaths) from the Nairobi Urban Health and Demographic Surveillance System (NUDHSS) program database run by African Population and Health Research Center (APHRC). The study used verbal autopsies data on deaths recorded amongst the females aged 13-49 years spanning in a period between January 2003 and December 2015 in the NUDHSS system managed by the APHRC. APHRC has been implementing this surveillance program since August 2002. Data was extracted from the source document (NUHDSS Database) using a standard extraction tool. The key information that was extracted from the database is included in the standard extraction tool attached in appendix I.

3.3 Location of the study

The study used secondary data from verbal autopsies conducted on recorded deaths of female women aged 15-49 years from the two expansive slums in Nairobi (Viwandani and Korogocho slums) and collected between January 2003 and December 2015 in the Nairobi Urban Health and Demographic Surveillance System. The distance between the two slums and Nairobi City centre is approximately 5–10 km and the two slums sits on an area which is believed to be less than 1km squared. The casual environment of slums indicates why there are poor public infrastructure

in place and lack of proper social services. Very few and countable health centres and hospitals that serves the two slum dwellers. These few facilities are located on the outside environs of Nairobi CBD hence very much inaccessible to the residence especially in the night.

Viwandani slum was established in the year 1973 on a land that had been put aside the City Council along the Ngong River. The Ngong river passes by the slum and is highly contaminated by the industrial sludge from the bordering industries located next to the settlement. Korogocho on the other hand is the third congested slum in Nairobi. On the South East of the slum is the Nairobi Refuse dumpsite. The houses are constructed by the tins and old iron sheets and are arranged in a row. Viwandani slum has the most population (54%, vs 46% in Korogocho). As of 31 December 2012, there was a total population of 63,639 persons living in approximately 25,793 households within the two slums. The nearest level 5 health facility in the area is Mama Lucy Hospital situated 10 km away. Majority of the slum dwellers live on less that one dollar per day.

The residents are from different ethnic backgrounds. Approximately, about 28% are from the Kikuyu community, 24% from the Luhya Community, 21% from the Kamba community and 15% from the Luo community. The residence of Viwandani are majorly migrants who work in the closely situated industrial area while the long term settlers in Korogocho mainly work in the informal sector, (Abdallah et al, 2009).

3.4 Target population

The study used data from verbal autopsies conducted on recorded deaths of female women aged 15-49 years and collected between January 2003 and December 2015 in the Nairobi Urban

Health and Demographic Surveillance System (NUDHSS) managed by the APHRC. The target population had lived in the two slums under study.

3.4.1 Inclusion Criteria

The data was obtained from a record of deceased female study participants aged 13-49 years. The deceased must have succumbed to an adverse pregnancy outcome before giving birth, during giving birth and after giving birth. As captured in the NUDSS verbal autopsy register between the years 2003 – 2015.

3.4.2 Exclusion criteria

All data for deceased women (13-49 yrs) who died from pregnancy non-related causes were not included in the study. Any girl below 13 years and those above 49 years and those who had not resided in the two areas were also not included in the study.

3.5 Sampling Procedure and Techniques

3.5.1. Sample size calculation

The study used the sampling formulae recommended by Mugenda & Mugenda (2003) where it recommends that computation of a sample size for a population of 10,000 is done using the Cochran formula given stated below: $n = pqz^2 / e^2 = 384$, (Mugenda, 2003). According to the DHIS2 data, a total of 677 maternal deaths were recorded between the year 2015-2019 at the Kenyatta National Hospital and the formulae stated below is used to compute a sample for a population less than 10,000.

$$n = Z^2 * P(1-P) / e^2$$

Since the study population is small (677) the study will employ Finite Population Correction to come up with the required sample size.

$$n = Z^2 * P(1-P)/e^2$$

$$n_0 = 1.96^2 * 0.5 * 0.5 / 0.05^2 = 384$$

Required sample size = 384 but only 677 subjects are available

Using the formula

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

$$n_0 = 384, N = 677$$

$$n = 384 / (1 + 384 - 1 / 677) = 246$$

3.5.2. Sampling Technique

A census approach was used to select the target deaths from the NUDSS verbal autopsy register of maternal deaths registered between the years 2003 – 2015 since the number of maternal deaths recorded over the study could not exceed the stated sample size.

3.6 Variables

Table 1: List of Variables

	Variables	Attributes
1	Independent	Age of the mother,
2	Dependent	Causes of maternal deaths (Post- partum haemorrhage, Pre-eclampsia, HIV, Preterm birth, Delivery complications, Abortion, Infection, per term delivery

3.7 Ethical Considerations

Ethical approval was sought from Kenyatta National Hospital Ethics and Research Committee and this was gotten 17th December 2019, see appendix III. Permission was also sought from the African Population and Health Research Center (APHRC), the organization which is implementing the longitudinal Surveillance System and the project officer in charge of the project gave the consent via email. Ethical principles were highly upheld in handling the data extracted from the NHUDSS register.

3.8 Data Management And Analysis

The sampled data extracted was cleaned, coded and analyzed using the SPSS 25.0 Computer program.

The quantitative data was then analyzed using the descriptive statistics and logistic regression models. Analysis for the logistic regression model assumes the outcome variable is a categorical variable.

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \dots + \beta_p X_p;$$

Where, X_1, X_2, \dots, X_p are the explanatory variables and $\beta_0, \beta_1, \dots, \beta_p$ are the unknown regression parameters. Which can be rewritten as:

$$\text{Logit}(P) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p$$

Where;

P: - denote the cause of maternal death and P is dichotomous that have a value 0 or 1 and β_0, \dots, β_p : - are the coefficients of the regression model.

X_1, \dots, X_p : - denote the, demographic (Age of the mother), biological and environmental factors.

Verbal Autopsies

Using the tool adapted from the World Health Organization, a questionnaire is used to conduct the interviews as part of the NUHDSS routine procedures. A trained field worker, stationed in the project area records all deaths in the two slums on a death registration. A trained field worker then conducts a comprehensive verbal autopsy interview. All verbal autopsy interviewers are required to be conversant with the slum setting and have at least formal education spanning over 12 years. They field workers are properly taken through the data collection procedures for a period of two weeks. Refresher training is done to the field workers at the start of each data collection round. Interviews are normally conducted within approximately 6 weeks after the death has been registered and the bereaved family contacted some weeks after the burial. The persons who cared for the deceased prior to his/her death and also remembers well the symptoms that the deceased had becomes the respondents. The interviewees must give consent so as to be engaged in the study. Individual review is then done by three physicians on the completed verbal autopsy forms and each of them assigns the cause of death as per the tenth revision of the International Classification of Diseases. Whenever two or more physicians, agree on the cause of death, the result is picked as the probable cause of death, if not so, a consensus is reached amongst the three physicians. Failure to reaching a consensus, the cause of death is tagged as unknown. In this study, deaths of women recorded between the years 2003 and 2015 were identified from the NUHDSS database.

3.9 Study results dissemination plan

The results of the study will be published in one of the health Journals. The study report will also be shared with the African Population and Health Research Center (APHRC), the organization

which is implementing the longitudinal Surveillance System. Further dissemination will also be done in the local and international conferences.

3.10 Limitation of the study and Mitigation Measures

Since the study depended on secondary data, some gaps were realized such as incompleteness of data. This resulted in census approach to study subjects' selection as opposed to earlier plan of sampling. The study was only done in Viwandani and Korogocho slums.

CHAPTER 4.0 STUDY RESULTS

4.1 Description of the study participants

The ages of the deceased mothers were fairly distributed with the majority falling between the age bracket of 30-39 years 29(36.30%). 20(25%) of the selected deceased mothers were teenagers while only 3(3.8%) were of the age 40 years and above. Majority of the deceased mothers under study resided in Korogocho slums 50 (62.50%) while the rest 30(37.50%) lived in Viwandani slums at the time of their death. From the records, majority of the deceased mothers died within a health facility 57(71.30%) and a few (7(8.80%) died on the way to the health facility. 14(17.5%) of the mothers died within their households as revealed from the records. Those who died six weeks after the termination of the pregnancy 50(62.50%) were the majority as compared to those who died while pregnant 30(37.50%) as summarized in the table below.

Table 2 Demographic Characteristics

Variable	Category	Frequency (N=80)	Percentage (%)
Age Distribution	15-19 Years	20	25
	20-29 Years	28	35
	30-39 Years	29	36.3
	40-44 Years	3	3.8
Age stats	Mean; Median; Range	26.63; 27; 15-44	
Slum of residence	Korogocho	50	62.5
	Viwandani	30	37.5
Place of death	House	14	17.5
	Health facility	57	71.3
	On route to Health facility	7	8.8
	Other	2	2.5

4.2 Age Related Factors

From the findings, majority of the deceased mothers had died as a result of delivery complications directly linked to pregnancy 31(38.80%). 10(12.50%) reported to have died as result of HIV related complications. Pre term delivery also came up a common cause of maternal deaths mostly among the teenage mothers 12(15%). There were deaths also reported as a result of abortions 8(10%) committed by the deceased mothers either in their early trimesters or late trimesters. Post-partum hemorrhage was also reported to be somewhat a major cause 7(8.80%) as compared to the other causes such as pre-eclampsia 8(10%) and Puerperal Sepsis 4(5%).

Table 3 Underlying Causes of Death

Final cause of death	Frequency	Valid Percent
HIV	10	12.5
Abortion	8	10
Delivery Complication	31	38.8
Pre-Eclampsia	8	10
Pre term delivery	12	15
Post-partum hemorrhage	7	8.8
Puerperal Sepsis	4	5
Total	80	100

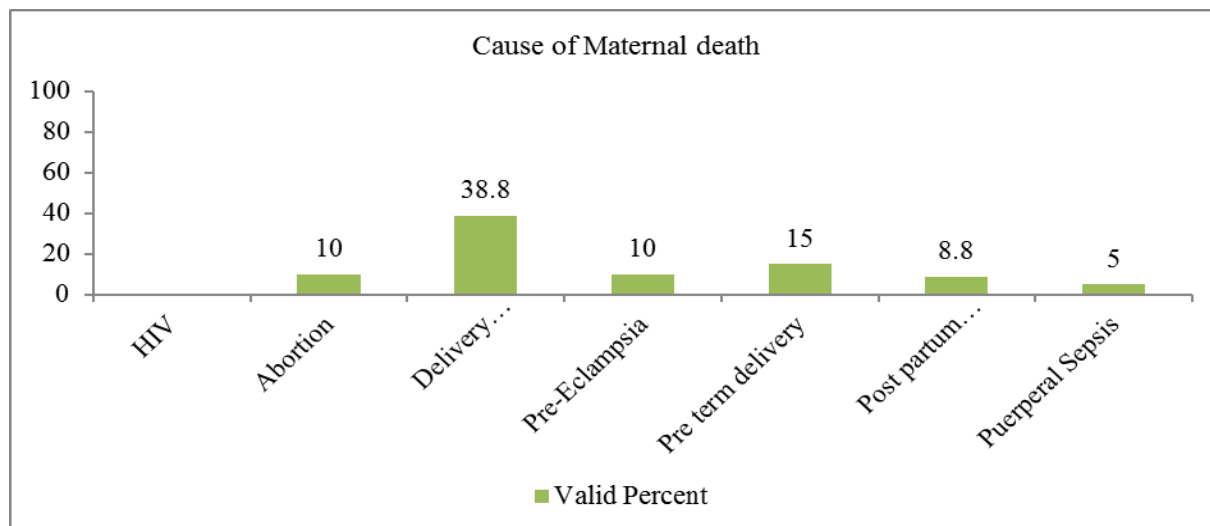


Figure 2: Causes of Maternal Deaths

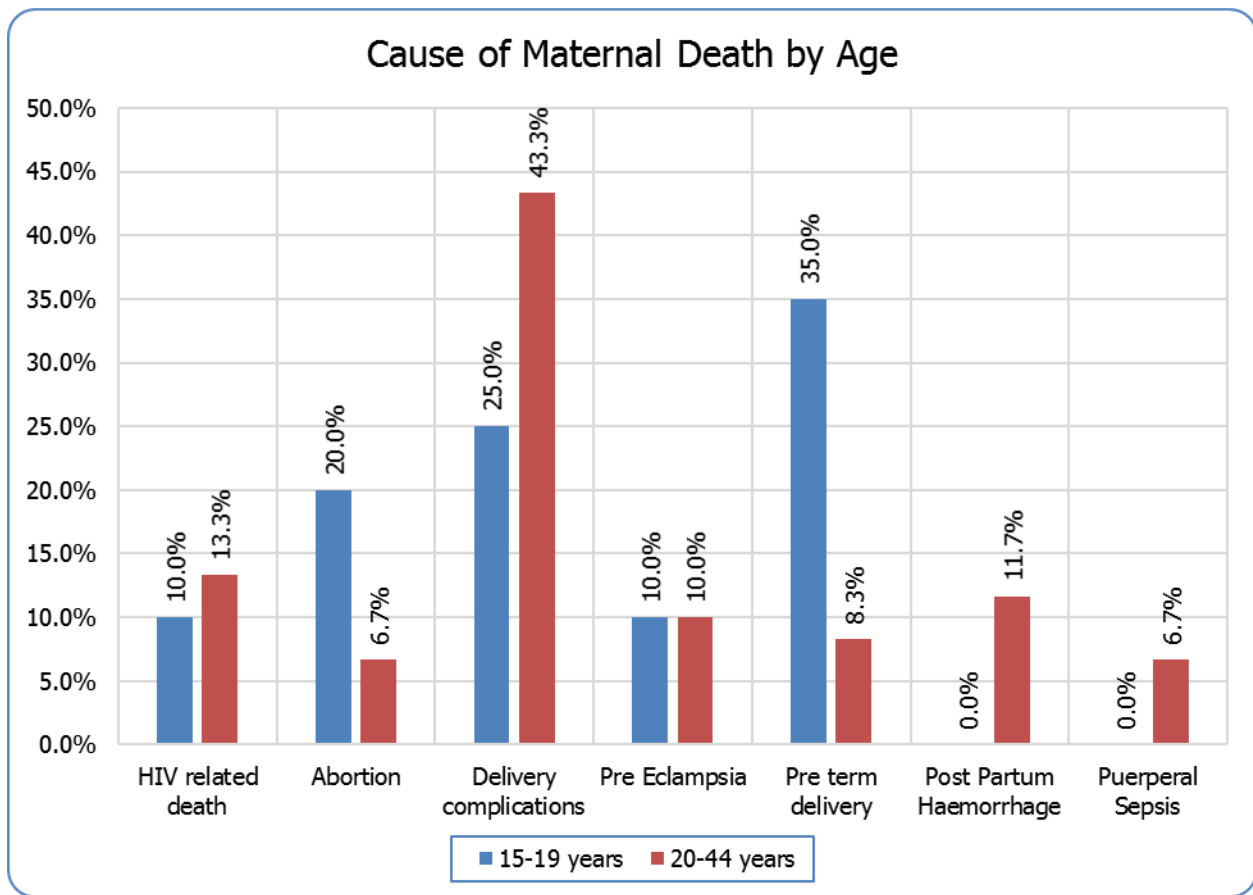


Figure 3: Causes of Maternal Deaths Segregated by Age

Pre term delivery 35.0% and procuring of abortion 20.0% came up as the major causes of maternal deaths amongst the adolescents' mothers of age 15-19 years. For the older women, delivery complications 43.3% and post-partum haemorrhage stood out as the most common cause of death. Causes as a result of pre-eclampsia and HIV related illness was equally pre dominant amongst the two age categories of deceased mothers.

4.3 Causes of Maternal Deaths Compared across the age groups (Adolescents vs the older women)

The subsequent analysis below gives a summary of the cause maternal deaths for the deceased mothers from the two study sites across the two age categories (adolescent mothers' vs older women).

The dependent variable in this case was the patient's age classified as either teenager (15-19 years) or other (women aged 20-44 years). The independent variables were different causes of deaths ranging from HIV related illness, abortions, pre term delivery, delivery complications, Pre-eclampsia, Post-partum haemorrhage and Puerperal Sepsis.

HIV related maternal death

Table 4: Maternal deaths related to HIV/AIDS illness

Parameter	Category	Age		O.R.	95% C.I. (O.R.)		P-Value
		15-19 Years	20-44 Years		Lower	Upper	
HIV related death	No	18(90.0%)	52(86.7%)	Ref.			
	Yes	2(10.0%)	8(13.3%)	0.722	0.140	3.722	0.697

Participants who were aged between 20-44 years were more likely to die of HIV related complications (13.3%) as compared to those who were aged 15-19 years (10.0%) (p=0.697).

Participants who were aged between 20-44 years were about 0.7 times more likely to die due to HIV related causes as compared to those aged 15-19 years (O.R=0.722; 95% C.I. 0.269-7.135; p=0.697). However the association was not statistically significant.

Table 5: Maternal Deaths Caused by Abortion

Parameter	Category	Age		O.R.	95% C.I. (O.R.)		P-Value
		15-19 Years	20-44 Years		Lower	Upper	
Abortion	No	16(80.0%)	56(93.3%)	Ref.			
	Yes	4(20.0%)	4(6.7%)	3.5	0.786	15.578	0.1000

Participants who were aged 15-19 years were more likely to die due to procuring abortion (20.0%) as compared to those aged 20-44 years (6.7%) (p=0.1000).

Participants who were aged between 15-19 years were 3.5 times more likely to die due to abortion complications as compared to those aged 20-44 years (O.R=3.50; 95% C.I. 0.786-15.578; p=0.1000). However the association was not statistically significant as per the P-value.

Table 6: Deaths arising from Delivery Complications

Parameter	Category	Age		O.R.	95% C.I. (O.R.)		P-Value
		15-19 Years	20-44 Years		Lower	Upper	
Delivery Complications	No	15(75.0%)	34(56.7%)	Ref.			
	Yes	5(25.0%)	26(43.3%)	0.436	0.14	1.354	0.151

Participants who were aged between 20-44 years were more likely to die of delivery complications (43.3%) as compared to those who were aged 15-19 years (25.0%) (p=0.151).

The odds of dying as a result of delivery complication was 43.6% lower among the teenagers (15-19 years) as compared to those aged 20-44 years, however this was not statistically significant (O.R=.436; 95% C.I. 0.14-1.354; p=0.151).

Table 7: Maternal deaths due to Pre-Eclampsia

Parameter	Category	Age		O.R.	95% C.I. (O.R.)		P-Value
		15-19 Years	20-44 Years		Lower	Upper	
Pre-Eclampsia	No	18(90.0%)	54(90.0%)	Ref.			
	Yes	2(10.0%)	6(10.0%)	1.000	0.185	5.403	1.000

Participants who were aged between 20-44 and 15-19 years were equally likely to die due to pre-eclampsia (O.R=1.00; 95% C.I. 0.185-5.403; p=1.000).

Table 8: Deaths from Pre Term Delivery

Parameter	Category	Age		O.R.	95% C.I. (O.R.)		P-Value
		15-19 Years	20-44 Years		Lower	Upper	
Pre-term delivery	No	13(65.0%)	55(91.7%)	Ref.			
	Yes	7(35.0%)	5(8.3%)	5.92	1.62	21.67	0.007

Participants who were aged between 15-19 years were more likely to die of pre-term delivery (35.0%) as compared to those who were aged 20-44 years (8.3%) (p=0.007). For mothers who are past the adolescent age 20+ years and above, 8.3% of them were reported to have died as a result of pre-term delivery.

Participants who were aged between 15-19 years were about 6 times more likely to die due to preterm birth as compared to those aged 20-44 years (O.R=5.92; 95% C.I. 1.62-21.67; p=0.007).

This association was statistically significant.

Table 9: Maternal deaths caused by Post-Partum Haemorrhage

Parameter	Category	Age		O.R.	95% C.I. (O.R.)		P-Value
		15-19 Years	20-44 Years		Lower	Upper	
Post-partum haemorrhage	No	20(100.0%)	53(88.3%)	Ref.			
	Yes	0(0.0%)	7(11.7%)	0.00	0.00	0.00	0.999

In terms of deaths caused by post-partum hemorrhage was only observed among women aged 20-44 years, therefore statistical comparison between the two age groups was not possible.

Table 10: Maternal deaths caused by Puerperal Sepsis

Parameter	Category	Age		O.R.	95% C.I. (O.R.)		P-Value
		15-19 Years	20-44 Years		Lower	Upper	
Puerperal Sepsis	No	20(100.0%)	56(93.3%)	Ref.			
	Yes	0(0.0%)	4(6.7%)	0	0	0	0.999

In terms of deaths caused by Puerperal Sepsis, this was only observed among women aged 20-44 years, therefore statistical comparison between the two age groups was not possible.

4.4 Other Social Determinants to Maternal Deaths

Looking at the other social determinants that had influence on the prevalence of maternal deaths, majority of the mothers who died during the post-natal period had given birth at a Health Facility 32(64.00%). A good percentage, 95% of the deceased had also sought health care at a health facility at least once during their pregnancy; only 5 % percent sought health care from traditional leaders and religious leaders. 41(51.2%) of the deceased mothers had pre-existing health condition at the time of their death.

Table 11: Social determinants of maternal deaths

Characteristic	N	Percent (%)
Place of delivery		
Within a Health Facility	32	64.00
Outside health facility	18	36.00
Sought health care for illness		
Yes	75	93.30
No	5	6.70
Where the patient sought for care during illness		
Hospital	47	58.75
Private clinic	16	20
Traditional healers	3	3.75
Religious leaders	1	1.25
Other	13	16.25
Had Pre-existing Health Condition		
Yes	41	51.2
No	39	48.8

This chapter looked at the possible causes of maternal deaths and the most prominent cause was as a result of delivery complications. When these causes are looked into as per age groups, pre term delivery came up as the only cause with statistical significance. Many of the deceased mothers had sought health care from a medic.

Causes of Maternal Deaths Compared by existence of Pre-existing condition

Table 12: Causes of Maternal deaths Compared by pre-existing conditions

Parameter	Category	Pre-existing condition		O.R.	95% C.I. (O.R.)		P-Value
		Yes	No		Lower	Upper	
Abortion	No	62(86.1%)	10(13.9%)	Ref.			
	Yes	7(87.5%)	1(12.5%)	0.886	0.098	7.987	0.914
Delivery Complications	No	39(79.6%)	10(20.4%)	Ref.			
	Yes	30(96.8%)	1(3.2%)	0.13	0.016	1.072	0.058
Post-partum haemorrhage	No	66(90.4%)	7(9.6%)	Ref			
	Yes	3(42%)	4(57.1%)	12.571	2.325	67.964	0.003
Pre-eclampsia	No	62(86.1%)	10(13.9%)	Ref			
	Yes	7(87.5%)	1(12.5%)	0.886	0.098	7.987	0.914
Pre term delivery	No	59(86.8%)	9(13.2%)	Ref			
	Yes	10(83.3%)	2(16.7%)	1.311	0.246	6.981	0.751

Participants who had pre-existing conditions were 12.571 times more likely to die of post-partum hemorrhage as compared to those without pre-existing conditions (57.1% vs 9.6%); (O.R. 12.571, 95% C.I. 2.325-67.964; p=0.003). There was no significant association between pre-existing conditions and death by abortion, delivery complications, pre-eclampsia and pre-term delivery (p>0.05).

The other social determinant did not yield any significant associations hence the existence of the pre-existing conditions as a factor was used for this analysis.

CHAPTER 5.0 DISCUSSION

5.1 Introduction

This chapter discusses the results in chapter 4 in details as it focuses on the causes of the maternal deaths and with an intended focus on the influence of age on these causal factors.

5.2 Discussion of the findings

The study aimed to determine the influence of mothers' age and other social determinants on the occurrence of maternal deaths at the two expansive slums in Nairobi (Viwandani and Korogocho). Among the causes of maternal deaths found out by the study include HIV related deaths, deaths due to abortions, delivery complications, pre term delivery, pre-eclampsia, post-partum haemorrhage and Puerperal Sepsis.

From the study majority of the deceased mothers had died as a result of delivery complications directly linked to pregnancy 38%. This finding is quite similar to a study carried out by Kinney et al which pointed out delivery complications as one of the key causes of maternal deaths amongst mothers, (Kinney *et al.*, 2010)(ISSIFOU *et al.*, 2006). Looking at this in details as per age category, the older women succumbed more to delivery complications 43.3% as compared to younger women. This has further been found out in a similar study carried out by Cnattingius et al which indicated that women above 35 years of age were more vulnerable to dangers related with being pregnant, (Cnattingius, Forman, Berendes & Isotalo, 1992).

The other cause of maternal death which stood out was pre term delivery amongst the deceased mothers. 35% of the mothers were reported to have died as a result of pre term delivery. Further analysis as per the age of the deceased mother, revealed that deceased mothers who were aged

between 15-19 years were more likely to die of pre-term delivery (35.0%) as compared to those who were aged 20-44 years (8.3%). A debate is still out there on whether to what extent does the associations observed among the victims of pre term births were caused by the fact that the young mothers were biological immature (Chen *et al.*, 2010).

HIV related illness as a cause, 13% of the deceased mothers were reported to have died as result of HIV related complications. There is no much difference in terms of number of mothers dying out of HIV related illnesses as compared among the age groups, no statistical significance was found from the study. Kinney *et al* mentions HIV/AIDS amongst pregnant women as one of the causes of martenal deaths affecting women of all age groups, (Kinney *et al.*, 2010).

Procuring of abortion resulted into maternal deaths of more adolescent mothers (15-19 years old) 20%, than the older women (20-44 years) 6%. However there was no statistical significance to support this case. This can be associated with socio-economic status of these deceased mothers. Probably the younger mothers were more likely to procure abortion because of uncertainty on how they will take care of their babies once the babies were born. The economic aspect could have played a part in their decision making. Lynch et al in their previous study have linked inequality in income and persons socio-economic status as correlated with birth outcomes. The social factors that have been linked to poor birth outcomes include; teenage pregnancy, marital status, maternal education and Intention to become pregnant (Lynch *et al.*, 2001).

The other cause of death which the study found out was post-partum haemorrhage. From this particular study, Post-partum Haemorrhage was only observed among older women above 35 years of age (11%), statistical comparison between the two the adolescents vs older women was therefore not possible. This could be as a result of obstetric complications and interventions the

women go through during such a time. A similar study conducted by Lao et al (2014) found out that advanced maternal age only served as a surrogate factor for post-partum haemorrhage due to the associated increased risk factors, obstetric complications and interventions, (Lao *et al*, 2014).

Pre-Eclampsia 10% and Puerperal sepsis 5% were the two other causes of the maternal deaths revealed by the study, but it could not determine any substantial difference in prevalence between the two age groups under comparison.

The other social determinants of maternal outcomes were also analyzed and the result shows that majority of these mothers indeed sought for medical care from the health facilities 58% and 64% of them delivered or were served by the medical personnel in various health facilities. Due to limitation of data, the study could not find out the impact of other socio economic variables such income levels to correlate the causes discussed above as per different age groups.

5.3 Conclusion

The study came with the following conclusions; a number of causes of maternal deaths were identified, but the leading cause was delivery complication (38.8%) while the least was puerperal sepsis (5.0%). In terms of cause of maternal death by age, Participants who were aged between 15-19 years were about 6 times more likely to die due to preterm birth as compared to those aged 20-44 years (O.R=5.92; 95% C.I. 1.62-21.67; p=0.007). No significant associations were observed in terms of age with other causes. Participants who had pre-existing conditions as a social factor were 12.571 times more likely to die of post-partum hemorrhage as compared to those without pre-existing conditions (57.1% vs 9.6%); (O.R. 12.571, 95% C.I. 2.325-67.964; p=0.003).

5.4 Recommendations

Study recommendations are as follows;

1. More sensitization needs to be done to the women and girls of reproductive age on the possible causes of maternal deaths and how they can work round to combat them.
2. The health facilities need to be supported with enough medical personnel to assist the mothers during their pregnancy phase and post natally.
3. Adolescent reproductive health programs needs to be rolled out to address teenage pregnancies which will ultimately translate to less maternal deaths.

5.4.1 Recommendation on further area of study

The study recommends deeper research as to why pre term delivery poses a threat to the lives of adolescent mothers as compared to the older women.

5.4.2 Policy recommendations

The study also recommends establishment of policy guidance on how the adolescent mothers who have fallen pregnant can be taken care of so as to ensure they safely deliver the babies and also for the overall benefit and survival of the mother.

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APPENDICES

Appendix I: Budget

COMPONENT	UNIT OF MEASURE	DURATION/ NUMBER	UNIT COST	TOTAL COST
DIRECT COSTS				
PERSONNEL				
Data Analyst	1	5	2,000.00	10,000.00
STATIONERY & SUPPLIES				
Printing - Final Reports	1	1	2000	2,000.00
Binding	5	1	500	2,500.00
ERC fees - Protocol approval	1	1	2500	2,500.00
Dissemination of report	15	1	2000	30,000.00
INDIRECT COSTS				
Transport to the Facility	1	5	1000	5,000.00
Internet Costs* 2 months	1	1	4000	4,000.00
Airtime costs	1	1	1000	1,000.00
Total				57,000.00

Appendix II: Standard Data Collection (Extraction) Tool

Instructions

1. NUHDSS database will be used as the primary data source of these information
2. No identification data such as the Deceased person's name, Facility will be indicated in the tool
3. In order for the tool to be valid, all sections of the form will have to be filled up completely.

Date of Data Extraction; _____

Study ID; _____

Demographic Data

1. Age of the deceased at the time of her death. (*in years*)

2. County of origin of the deceased _____

3. Source of income of the deceased

Formally employed

Casual laborer

Self employed

Other, Specify _____

4. Weight of the deceased _____ kgs

5. Year of death of the deceased _____

6. The slum where the deceased lived in prior to her death.

Viwandani

Korogocho

Other, Specify _____

7. Place of delivery at the time of death. (*applies only to those who died postnatally*)

At home

Health Facility

On route to a health facility

I don't know

Other, specify

Section 1

#	Variable	Response options
8	At what pregnancy stage did the deceased person die? <i>If the response is Antenatal, skip to Question 9</i>	1- Antenatal stage 2- Post Natal stage
9	The deceased had symptoms of complicated delivery	0 – No 1 – Yes 2 – Don't know 3 – other 4 - missing
10	The deceased had illness around the time of death	0 – Less than a day 1 – Since Birth 2 – Rest of life 3 – During pregnancy 4 - No duration given 5- Refused 6 – Don't know
11	The deceased sought for health care attention during illness	0 – No 1 – Yes 2 – Don't know 3 – other 4 - missing
12	What was the duration of pregnancy of the deceased at the time of her death?	0 – within 6 weeks of pregnancy 1 – 1-5 months of pregnancy 2 – 6 + months 3 – 6 weeks post delivery
13	Number of Antenatal care visits completed by the deceased	_____

14	What was the pregnancy related underlying cause of death of the deceased?	1 – Pre-eclampsia 2 – Eclampsia 3 – Haemorrhage in pregnancy 4 – Pre term delivery 5 – Failed induction of labor 6 – Labor and Delivery complicated by fetal stress 7 - Labor and Delivery complicated by Cord complications 8 – Post Partum haemorrhage 9 – Low birth weight 10 – still birth 11 – other _____ specify
15	Was the patient ill with HIV/AIDs?	0 – No 1 – Yes 2 – Don't know 3 – other 4 - Refused
16	What was the mode of delivery? <i>For the deceased mothers who died while or after giving birth.</i>	1 – Caesarean mode 2 – Natural birth

Appendix III: ERC Approval



UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
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KNH-UON ERC
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Website: <http://www.erc.uonbi.ac.ke>
Facebook: <https://www.facebook.com/uonknh.erc>
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC



KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/468

17th December, 2019

Wilbert O. Nango
Reg. No. W61/7945/2017
Institute of Tropical and Infectious Diseases (UNITID)
College of Health Sciences
University of Nairobi

Dear Wilbert

RESEARCH PROPOSAL: AGE RELATED FACTORS AND OTHER SOCIAL DETERMINANTS THAT INFLUENCE MATERNAL DEATHS AT TWO EXPANSIVE SLUMS IN NAIROBI, KENYA (P694/08/2019)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 17th December 2019 – 16th December 2020.

This approval is subject to compliance with the following requirements:

- a. Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
- b. All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH-UoN ERC before implementation.
- c. Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
- d. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
- e. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
- f. Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

For more details consult the KNH- UoN ERC website <http://www.erc.uonbi.ac.ke>

Yours sincerely,



PROF. M. L. CHINDIA
SECRETARY, KNH-UoN ERC

- c.c. The Principal, College of Health Sciences, UoN
The Director, CS, KNH
The Chairperson, KNH- UoN ERC
The Assistant Director, Health Information, KNH
The Director, UNITID, UoN
Supervisors: Prof. Julius Oyugi, Dept. of Medical Microbiology, UoN
Mr. Evans Otieno, Strathmore Institute of Mathematical Sciences, Strathmore University

Appendix IV: Turn it in Report

Document Viewer

Turnitin Originality Report

Processed on: 31-Jul-2019 16:34 EAT

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INFLUENCE OF MOTHERS
AGE ON ADVERSE
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Nango

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