OUTCOMES OF NEONATES BORN TO ADOLESCENT MOTHERS: A HOSPITAL-BASED CROSS-SECTIONAL STUDY AT KAPENGURIA COUNTY REFERRAL HOSPITAL, WEST POKOT COUNTY.

PRINCIPAL INVESTIGATOR:
DR. IMMACULATE LUKELA
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DEPARTMENT OF PEADIATRICS AND CHILD HEALTH

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2022

DECLARATION

This proposal is my original work, prepared under the guidance of my supervisors. It has not been presented for the award of a degree in another university. Appropriate citation has been made for references t work done by others.

Signature: **Date:** 24th January 2022

Dr. Immaculate Lukela

CERTIFICATE OF SUPERVISION

This dissertation has been submitted for examination with our approval as supervisors:

Signature: **Date:** 24th January 2022

Dr. L.Owino Okong'o

Lecturer, Department of Paediatrics and Child Health, Faculty of Health Sciences, University of Nairobi

Signature: **Date:** 24th January 2022

Professor A. Wasunna

Professor, Department of Paediatrics and Child Health, Faculty of Health Sciences, University of Nairobi.

DEDICATION

This study is wholeheartedly dedicated to mothers of Kapenguria County Referral without whom this study could not have not been possible. To all health care workers, staff,and personnel at Kapenguria for their continued dedication, co operation, and support in providing services to these mothers and their children.

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I thank the Almighty God for this far He has brought me. The completion of this undertaking could not have been possible without His continued grace and strength.

My family-Husband Dr. J.Kuya, son Amari,dad Mr. Felix Mutunguti,mum Mrs Emily Nyongesa.Siblings-Sophie,Mwila,Bella,Tito.You have continued to support and encourage me. You have always believed in me and prayed for me. Severally when I thought of giving up, you held me down. I love you and am truly blessed to have you.

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ABBREVIATIONS

ANC	Antenatal Care
AOR	Adjusted Odds Ratio
CI	Confidence Interval
ERC	Ethics Review Committee
FGC	Female Genital Cutting
HIV	Human Immunodeficiency Virus
KCRH	Kapenguria County Referral Hospital
KDHS	Kenya Demographic and Health Survey
IMR	Infant Mortality Rate
KNH	Kenyatta National Hospital
KNBS	Kenya National Bureau of Statistics
MMR	Maternal Mortality Rate
NCPD	National Council for Population and Development
NICU	Newborn Intensive Care Unit
NMR	Neonatal Mortality Rate
LBW	Low Birth Weight
LMIC	Low and Middle Income Countries
OR	Odds Ratio
SDG	Sustainable Development Goal
SPSS	Statistical Programme for Social Sciences

U5MR	Under 5 Mortality rate
STIs	Sexual Transmitted Infections
TFR	Total Fertility Rate
UNICEF	United Nations Children's Emergency Fund
UNFPA	United Nation Population Fund
WHO	World Health Organization

DEFINITION OF TERMS

Neonatal mortality refers to death during the first 28 days of life (0-28 days) (1).

Neonatal mortality rate refers to the number of neonatal deaths per 1000 live births (1).

Under-five mortality rate refers to the probability for a child to die before reaching five years of age (0-59 months), expressed per 1,000 live births (1).

Infant mortality rate - Probability of dying between birth and exactly one year of age expressed per 1,000 live births (1).

Maternal mortality rate- The death of women while pregnant or within 42 days of termination of pregnancy, regardless of the duration and the site of the pregnancy from any cause related to or aggravated by the pregnancy or its care per 100,000 births per year (1).

Neonatal morbidity is defined as a diseased condition or state during the first 28 days of life (1).

Preterm is defined as babies born alive before 37 completed weeks of gestation (1).

Low birth weight (LBW) refers to weight at birth of less than 2500 g (1).

Viable birth- Birth at a gestational age at which a human fetus can survive outside the uterus. Considered to be 22 weeks (2).

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ABSTRACT

Background: Adolescent pregnancy is a high risk state that needs specialized care during the antenatal period for a quality outcome. Pregnancies among adolescents have been associated with unfavorable maternal and neonatal outcomes including maternal anemia, premature delivery, neonatal deaths, and low delivery weight. Most of these pregnancies occur in marginalized communities. Globally, adolescents (10-19 yrs) constitute 16 percent of the global population. Although a well-recognized public health problem, there is a paucity of local research on pregnancy outcomes of adolescent pregnancies.

Objective: To determine neonatal outcomes and associated factors among babies born to adolescent mothers at Kapenguria County Referral Hospital.

Methods: We conducted a retrospective hospital study of mothers who gave birth in Kapenguria County Referral Hospital. A sum of 1234 (617 adolescent and 617 non-adolescent mothers) participants were enrolled. The data was collected from the Maternal Services Health Facility Register (MoH 333) from January 2018 to December 2020 by trained personnel. Data was then entered into an excel spread sheet and analyzed using Statistical Package for Social Sciences. (SPSS v26).

Results: Fewer adolescents 25% (n =137) compared to older mothers 46.9% (n =276) attended four or more ANC visits. The association was statistically significant ($p<0.01$). Premature births were significantly higher in older women (11%) compared to adolescents (6.5%) (OR = 1.8, 95%CI: 1.2, 2.7, p =0.003).The proportion of low birth weight was similar in adolescents compared to older women although the association was not significant (12% vs 12.5%, p = 0.435). There was a higher proportion of adolescents who had babies with a low Apgar score at 5 minutes

although the association was not significant, (7.3% vs 5.3%, p =0.179). The rates of neonatal deaths were comparable in adolescents (2.8%) and older women (2.8%).

Conclusion: Adolescent mothers attended fewer ANC visits than non-adolescents. They had lower rates of premature births and higher rates of low Apgar score at 5 minutes. However, the rates of low birth weight and neonatal mortality were similar in adolescent and non-adolescent mothers. Thus, there is a need for intensification of public health interventions and campaigns to increase ANC visits for adolescent mothers. Additionally, there is a need for large population-based studies to be conducted as different hospital-based studies have yielded heterogeneous results.

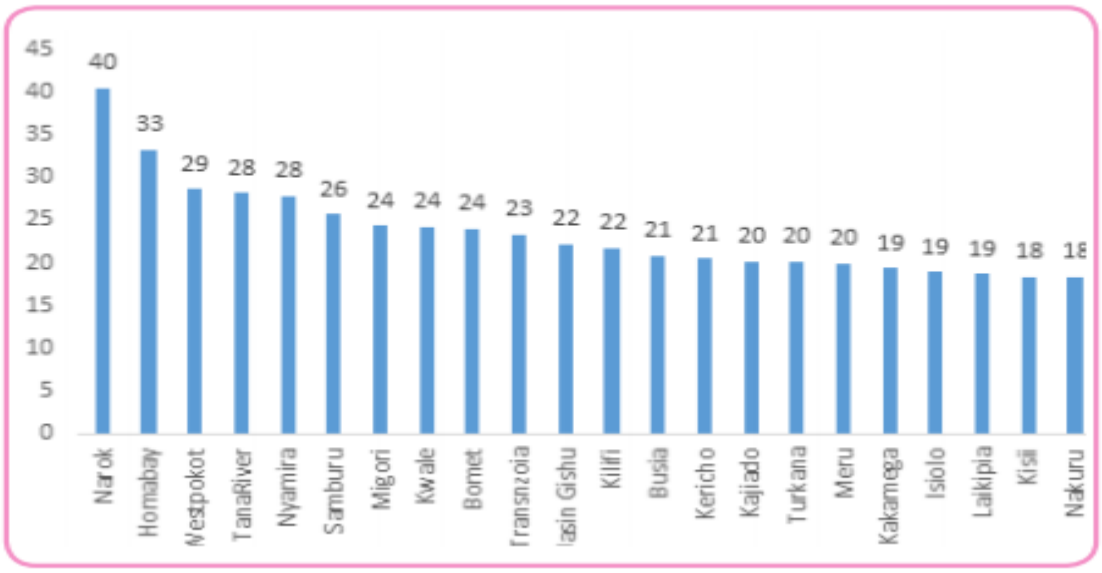
CHAPTER 1: INTRODUCTION

Adolescent pregnancy is a well-recognized public health problem. According to World Health Organization (WHO), an adolescent is a person aged 10-19 years (3). This is a period of transition and thus pregnancy in this age group has been linked with considerable health outcomes for both the mother and her infant. In most LMIC, over 10 million unplanned pregnancies occur annually in adolescent girls aged 15 to 19 years (3). Although the worldwide adolescent-specific birth rate has decreased by 11.6 percent in the recent 20 years, there have been huge regional and country disparities in these rates (4).

1.1.Pregnancy and adolescent motherhood situation in Kenya

Rates of adolescent pregnancies have remained unchanged in Kenya since 2008. Data indicates that eighteen percent of Kenyan girls aged 15-18 years are pregnant with their first child or already have had a live birth (5). UNFPA reported that 378,397 pregnancies in adolescents were registered between July 2016 and June 2017, and 28, 932 of those pregnancies were among girls aged 10 to 14 years. The rates of adolescent pregnancy in Kenya differ among Counties, with Narok County leading at 40 percent, followed by Homabay (33%). West Pokot County is the third most affected at 29% (5,6).

Figure 1. The Burden of Pregnancy in Adolescents by County in Kenya (6).



Pregnancy in adolescents is a health concern because of a higher likelihood of premature delivery, low birth weight, and deaths in the perinatal period (7). Many of these pregnancies are unplanned and at least 33% of them are aborted. Adolescent mothers may also experience complications that may result in death during and after delivery (8).

Various factors have been implicated as drivers of adolescent pregnancies. These include poverty, harmful societal practices including FGM and early child marriages, and lack of education. In developing countries, more than 60% of adolescents who wish to avoid pregnancy have limited access to modern contraception and other youth-friendly reproductive health services (9). Moreover, adolescents do not utilize these services for fear of being shamed and blamed. Adolescent mothers cannot fully realize their economic potential, which preserves the poverty cycle and weakens the countries' socio-economic development (10).

Neonates delivered to adolescent mothers are likely to have health-related complications. These include low birth weight, preterm delivery, increased need for hospitalization, neonatal deaths among other complications (11). According to UNICEF, neonatal duration is critical for any infant, with the highest probability of death being within the first twenty-eight days of life. The global neonatal mortality rate for every 1,000 live births stood at 18 in 2018 (12). The neonatal mortality rate in Kenya is even higher at 21 deaths per 1000. Preterm births, intrapartum-related complications, and neonatal infections account for over 85% of deaths. These deaths can be prevented with proper regard to the standard of care at the time of pregnancy and childbirth, a challenge encountered by adolescent mothers (13,14).

1.2.Demographic and socio-economic profile of West Pokot County

Data from West Pokot County Integrated Development Plan (WPCIDP) present a worrying scenario. The County's Total Fertility Rate stands at 7.2 births for every woman exceeding the National estimate of 3.9 births for every woman (13). The under-five mortality rate is estimated at 127 deaths for every 1000 live births which is more than double the national figure of 54/1,000 (15). Furthermore, the percentage of deliveries in West Pokot County attended by a trained birth attendant is about 27% compared to the National figure of 62%. The County's Human Development Index (HDI) is 0.45 and is lower than the National HDI which is 0.520. This indicator is a composite of education, income, and health proportions. The crucial challenges in cutting down child death include inequity in obtaining health care services, poverty, insufficient medical personnel, and poor availability of drugs in government facilities (13,16).

Figure 2: Location of West Pokot County in Kenya.

Poverty and low education levels are well-recognized contributors to adolescent pregnancy (6). The percentage of women and men in Kenya with no education was estimated at 7% and 3% respectively in 2014. Even though education levels vary widely among communities, illiteracy levels remain high in West Pokot county with as high as 55% of residents lacking formal education. Moreover,38% of West Pokot residents have a primary level of education only and only 6% have a secondary level of education and above (13,17).

Kenya registered a steady decline of FGM over the years from 37.6 percent in 1998 to 21 percent in 2014. Despite the National decline in the prevalence, the practice is still rampant in West Pokot County with a prevalence rate of 74 percent (5,18). In this community, culture and tradition often override the law when it comes to FGM, with many girls and women regarding FGM as a rite of passage. As such, they willingly undergo this harmful practice for fear of ridicule and being

sidelined. Some girls think that they are required by their community and therefore continue with the practice. Further, constant cross-border conflicts often disrupt anti-FGM campaigns in the community. FGM has been associated with the likelihood of early child marriages, adolescent pregnancies, school dropouts, and a widened gender inequality gap (19,20).

Table 1. West Pokot's socio-economic indicators

Socio-economic characteristics	**Indicators**	
Health	The average number of children for every woman	7.2
	Percentage of women who are married and use contraception	14.2%
	Percentage of births attended by a skilled health professional	27%
	HIV Prevalence	2.8%
Education	Primary school net admission rate	85%
	No of primary-school-age children not in school	22,401
	Net admission rate in secondary schools	18.9%
	No of secondary school-age adolescents out of school	52,330
Socio-Economic	Human Development Index	0.453

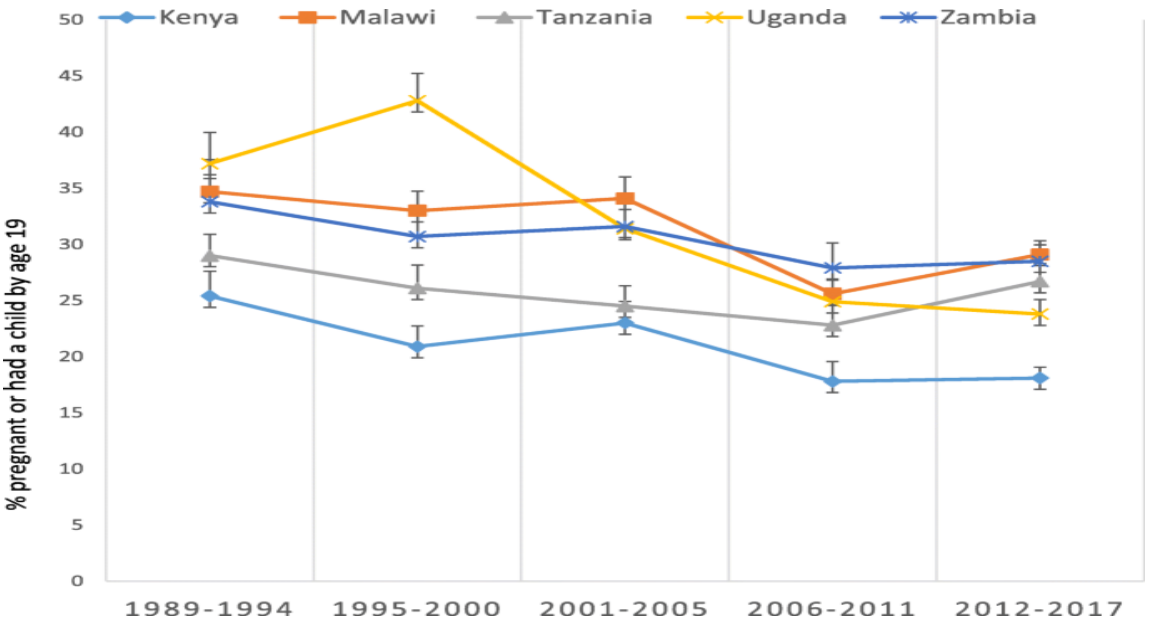
CHAPTER 2: LITERATURE REVIEW

2.1.Pregnancy in adolescents

Pregnancy among adolescents is a worldwide concern irrespective of socio-economic status. According to WHO, adolescent girls aged 15-19 years deliver 16 million babies yearly, approximately 11 percent of deliveries globally. Almost 95% of these births occur in the LMIC (3). The United Nations Population Fund records that the greatest rise in adolescent pregnancy of girls below 18 years of age in the coming 20 years is expected to occur in Sub-Saharan Africa (4). Adolescent pregnancies around the world occur in marginalized societies due to lack of education, poverty, and unemployment (3,4). Adolescent childbearing differs from nation to nation, with 18 percent in Kenya in 2014 compared to 29 percent in both Zambia in 2014 and Malawi (MW) in 2016 (3) (20). A majority of adolescent girls aged 15-19 years are expectant or have had their firstborn at the time of the most current DHS report, estimated at 27 and 25 percent in Tanzania (TZ) and Uganda respectively. TZ and MW saw an increased trend in pregnancy among adolescents in the course of the latest surveys. In TZ it rose from 22.8 percent to 26.7 percent and in Malawi from 25.6 to 29.1 percent (3).

Early marriages are a major contributor to pregnancy among adolescent girls further predisposing them to early childbearing. In low-income countries, at least 39 percent of girls are married before 18 years (22). Unplanned pregnancies in some areas result due to sexual violence. In some nations, greater than a third of girls recount that their first sexual experience was pressurized. Further, 3.9 million risky abortions in girls aged 15–19 years take place yearly, resulting in morbidity, death, and long-term health issues (3,23).

Figure 3: Adolescent Pregnancy and Motherhood Trends in 5 East Africa Nations, 1990 to 2017 (3).



Globally, complications during pregnancy and delivery are the main cause of mortality among adolescent girls aged 15-19 years (3). Despite good progress in reducing MMR from 741 for every 100,000 live births in 1998; to an approximate 342 for every 100,000 live births in 2017 in Kenya, an unacceptably great number of women still die from delivery and pregnancy-associated health problems (5).The MMR in West Pokot County compared poorly with the National estimate and stood at 434 per 100000 live births in 2014 (24). Sustainable Development Goal 3 (SDG-3) aims to reduce MMR to less than 70 per 100,000 live births globally by 2030 (24).

Quality antenatal care is crucial for a good pregnancy outcome. The 2016 WHO ANC model recommends that all expectant women attend at least eight ANC contacts for a positive pregnancy

experience (25). Adolescent mothers have been shown to have consistently lower contact with a health facility during pregnancy and delivery compared to adult mothers. In sub-Saharan Africa, the disparity in attendance of at least four antenatal visits between adolescent mothers aged 15 and 17 and older adolescent mothers aged 20 and 34 is 10 proportionate points (26). Research conducted in KwaZulu-Natal, South Africa established that adolescents tended to have fewer and later ANC visits. Fewer than four visits were associated with premature delivery (OR = 2.64; 95% CI = 1.04; 6.74; $p < 0.05$). Low Apgar scores, low birth weight, and the occurrence of maternal anemia were also linked to late ANC appointments (14).

Adolescent mothers have an increased likelihood of cephalo-pelvic disproportion, systemic infections, and puerperal sepsis, than non-adolescent mothers. A study at Kiambu County Hospital in Kenya on the pregnancy outcome among adolescent and non-adolescent mothers found that cephalopelvic disproportion occurred more in adolescent mothers (8%) than in non-adolescent mothers (1.6%). Puerperal sepsis was higher in adolescent mothers (7.2%) than in older mothers (1.6%) (30). In other studies, adolescent mothers were likely to get perineal tears (OR, 1.6; 95 % CI, 0.95-2.7). Giving birth at an adolescent age was not found to significantly result in premature rupture of membranes, pre-eclampsia, or Caesarian delivery (7).

A study in Russia found that genitourinary infections and underweight status were more prevalent in adolescent mothers than in adult mothers (27).

Adolescent women who are pregnant often face mental health challenges and tend to be stressed, depressed, anxious and uncertain about the pregnancy and their future (28). As such, an early holistic approach of care with attention to their psychosocial support is crucial (29). Pregnancy before 18 years of age predisposes girls to brutality in marriage or relationships. Unmarried pregnant adolescents may be rejected by their peers, parents, and partners. Further, they often drop

out of school thus negatively impacting their education and employment opportunities (30). Daughters born to adolescent mothers may become adolescent mothers with consequent intergenerational motherhood (31).

Pregnancy in adolescents is considered a risky event because the girls are psychologically and biologically immature for reproduction. This has been linked with a high possibility of maternal and neonatal mortality and life-threatening complications such as anemia, eclampsia, obstetric hemorrhage, placental abruption, preterm delivery, and low weight at birth (7,14).

Evidence of the correlation between adolescent pregnancies and adverse neonatal outcomes remains controversial. In some studies, adolescent pregnancies have been linked to lower rates of unfavorable effects such as low birth weight and poor Apgar scores. A population registry-based study conducted in Northwest Russia on adverse pregnancy outcomes among adolescents found that adolescents were at decreased possibility of getting LBW babies. Further, they were less likely to get babies with the 5 minutes Apgar <7 (27). Another study conducted among adolescent mothers in Brazil demonstrated that a minimum number of 6 antenatal care consultations was protective against LBW and prematurity. Odds of prematurity (OR 5.82, 95% CI 3.10 to 10.9) and LBW (OR 2.70, 95% CI 1.45 to 5.06) reduced when the frequency of antenatal visits in the adolescent mother was 6 or more (32).

In Northwest Ethiopia, an institutional-based research concluded that more adolescent women than adult women were not only expectant for the first time (91.7% vs 34.1%) but also did not attend antenatal care (12 percent versus 4.5 percent). Further, the adolescents had late commencement of antenatal visits. The odds of prematurity (1.65 times) and LBW (2.14 times) were higher among adolescents than adult mothers. However, the difference in Apgar score at first and 5 minutes after delivery in the two groups was not statistically significant (11).

The prevalence of adolescent births was 13% in a study conducted in Cameroon. Unfavourable neonatal outcomes in adolescents were LBW (OR 2.79 95% CI), preterm births (OR 1.85;95% CI), and the low Apgar score of less than 7 at 5 minutes (OR 1.66; 95%CI) when compared to outcomes in babies of older mothers (33).

A study conducted by Wasunna et al on LBW babies delivered to adolescent mothers at Kenyatta National Hospital in Nairobi, Kenya found that babies of adolescent mothers were more premature, had reduced birth weight, frequent morbidity events, and increased likelihood of dying compared to those of non-adolescent mothers (34). This was consistent with results of a study conducted at Pumwani Maternity Hospital in Nairobi by Kimeto in which a high neonatal mortality rate (NMR) was observed in the neonates delivered by adolescent mothers as contrasted to those by older mothers (OR 2.269, 95%CI 0.998-5.162,p=0.046) (35).

2.2. Study Justification and Utility

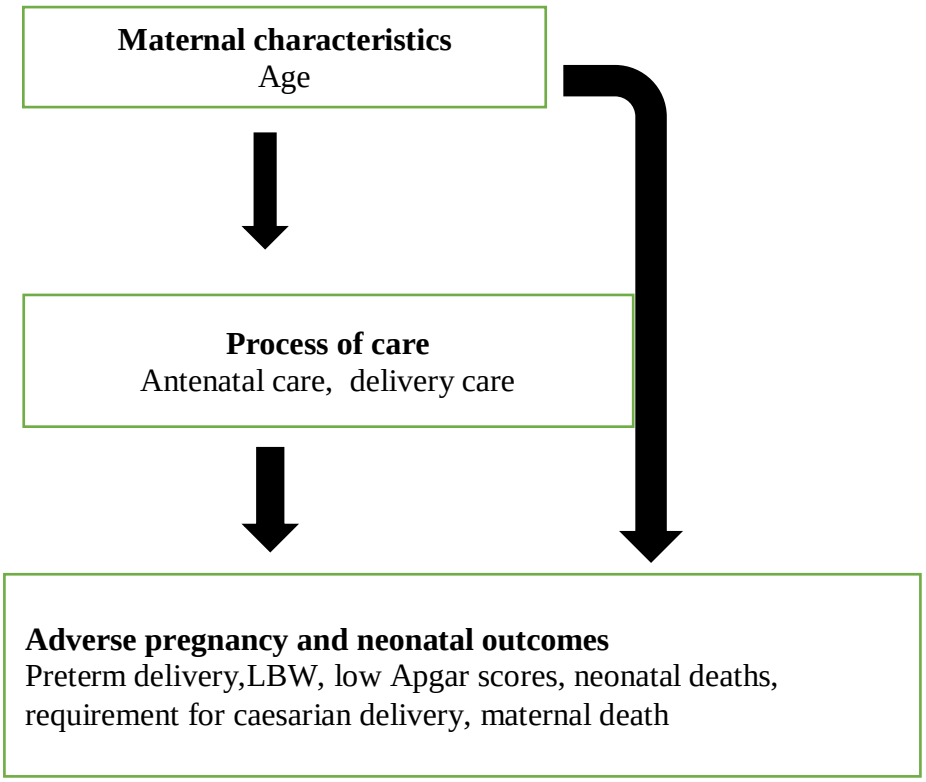
Pregnancies in adolescents are risky given that there is a double burden of developmental growth and reproduction. The growing adolescent competes with the fetus for nutrients leading to relative nutritional deprivation and subsequent maternal anemia. This puts the neonate of the adolescent mother at a risk of prematurity and low weight at birth (36). Despite the greater burden of adolescent pregnancies in LMIC, most epidemiological studies on the topic are largely reported from medium and high-income countries. These studies have generated inconsistent results. While other studies reported that babies of adolescent mothers were less likely to have low birth weight, some demonstrated that there is an increased risk of low birth weight, admission to NICU, and neonatal deaths (27,33,37). Some studies in Sub-Saharan Africa have linked poor outcomes with socioeconomic rather than biological factors (38).

Although various efforts and attention have been devoted to addressing adolescent pregnancies and averting neonatal mortality in Kenya, there is a paucity of local data on the neonatal outcomes of adolescent pregnancies. Knowledge of such outcomes could form a basis for the prevention of adolescent pregnancies and mitigating the adverse effects of such pregnancies. Data from the study will be helpful in the generation of policies and intervention strategies involving adolescent and neonatal health in West Pokot County and at the country level. Additionally, such information will benefit health care workers as they plan the management of pregnant adolescent girls.

2.3.Conceptual Framework.

The study employed a simple hierarchical framework of the association between age and various factors associated with unfavorable pregnancy outcomes (39).

Figure 4: A simple hierarchical framework



2.4.Hypothesis

2.4.1. Null Hypothesis

Adolescent and non-adolescent mothers in Kapenguria County Referral Hospital have no differences in adverse neonatal outcomes.

2.4.2. Alternate Hypothesis

There is a higher rate of adverse outcomes in neonates of adolescent mothers compared to those of non-adolescent mothers in Kapenguria County Referral Hospital.

2.5.Research Questions

1. What are the neonatal outcomes of adolescent mothers as compared to non-adolescent mothers at Kapenguria County Referral Hospital between January 2018 to December 2020?
2. What are the factors associated with the neonatal outcomes among adolescent mothers who delivered at Kapenguria County Referral Hospital in West Pokot County between January 2018 to December 2020?

2.6.Objectives

2.6.1. Broad objective

1. To determine the outcomes of neonates of adolescent mothers as compared to those delivered to older mothers and investigate factors associated with their outcome at Kapenguria County Referral Hospital, in West Pokot County between January 2018 to December 2020.

2.6.2. Specific objectives

1. To determine outcomes of neonates delivered to adolescent mothers as compared to those delivered to non-adolescent mothers at Kapenguria County Referral Hospital in West Pokot County, between January 2018 to December 2020.

2.6.3. Secondary objective

1. To investigate the factors associated with the neonatal outcomes among adolescent mothers who delivered at Kapenguria County Referral Hospital in West Pokot County, between January 2018 to December 2020.

CHAPTER 3. METHODOLOGY

3.1.Design of the Study

We utilized a cross-sectional study design with a comparative arm. Neonatal and pregnancy outcomes of adolescent mothers (10- 19 years old) were compared with those of non-adolescent mothers (aged 20-29 years). We reviewed the Maternal Newborn Health Registry for deliveries between January 2018 to December 2020.

3.2.Study Setting

This research was carried out at Kapenguria County Referral Hospital (KCRH). KCRH is the largest hospital in West Pokot County. It is located to the North Rift of Kenya and borders Trans Nzoia County to the South, Turkana County to the North, Baringo County to the East, and Elgeyo Marakwet to the South East. It is adjacent to the Ugandan border to the West. The County's area is approximately 9,169.4 square kilometers. KCRH is a level 5 facility serving its population as well as neighboring Trans Nzoia and Baringo Counties. It offers both outpatient and inpatient facilities. The maternity unit comprises a 34 bed antenatal and postnatal ward,6 delivery beds, and a maternity theatre for both elective and emergency surgical procedures. An average of 15 deliveries are conducted in a day. The newborn unit comprises 10 incubators, 12 baby cots, and a 4-bed kangaroo mother care room. An average of 34-40 babies are seen daily in the newborn unit. Common illnesses encountered in Kapenguria include malaria, respiratory system illnesses, diarrhea, skin conditions, and malnutrition. West Pokot County has an HIV prevalence rate of 2.8%. The Maternal Mortality Rate was 434 for every 100,000 live births in 2014. This was higher than the national estimate of 362 for every 100,000 live births (13,40).

The percentage of women that attended 4 ANC visits was 13.0% in 2017 (13).

Target population

Adolescent mothers 10–19 years of age and non-adolescent mothers 20–29 years of age respectively who delivered in KCRH were included in the study. Only those delivering for the first time (primiparous) were enrolled.

3.3. Inclusion criteria

- Primiparous adolescent women 10-19 years of age who delivered at KCRH in West Pokot County between January 2018 to December 2020.
- Primiparous non-adolescent aged between 20-29 years of age who delivered at KCRH in West Pokot County between January 2018 to December 2020.
- Complete Maternal Newborn Health Registry and patient files which include neonatal outcome.
- Mothers who delivered after 22 weeks of gestation.

3.4. Exclusion criteria

- Women with multiple gestation
- Women who have had a previous pregnancy
- Mothers who delivered outside KCRH.

3.5.Case definitions

- **Adverse/unfavorable neonatal outcome-** described as LBW, preterm birth, low Apgar score at 1^{st} and 5^{th} minutes after delivery, or severe conditions in the neonate (1).
- **LBW** is described as the birth of a live infant whose weight at birth is < 2500 grams (1).

- **Preterm birth** is described as the birth of a baby < 37 weeks of gestation (1).
- **The severe neonatal condition -** described as neonates with: birth weight < 1500 gms, gestational age < 32 weeks, or Apgar score at 5 minutes < 7.
- **Neonatal deaths-** deaths that occur in babies aged < 28 days of life.
- **Maternal mortality-**The death of women during pregnancy or within 42 days of pregnancy termination, irrespective of the site and the duration of the pregnancy from any cause aggravated by or related to the pregnancy or its care (1).
- **Adolescent –** described as a mother aged between 10 and 19 years.
- **Non-adolescent/older women** – This is the comparative group that is aged between 20 and 29 years.

3.6.Sampling procedure and sample size.

3.6.1. Sample size determination

The size of the sample was determined by the proportion formula adapted from the University of California, San Francisco (41). The formula is;

Total size of group = $N = (A+B)^2/C$

Correction of progression (added to N for Group 0) = $CC = 1/ (q_1 * |P_1-P_0|)$

Where:

α is the threshold expectation for rejecting the null hypothesis =0.05

β is the expectation of failure to reject the null hypothesis under the alternative hypothesis =0.20

The standard normal variation for $\alpha = Z_\alpha = 1.9600$

The standard normal variation for $\beta = Z_\beta = 0.8416$

P_0 =the expected sample percentage of Group 0 (baseline risk) i.e older mothers 8.6% (30).

P_1 = the expected sample percentage Group 1 (exposed) i.e adolescent mothers 13.5%.

$q_{1=}$ Percentage of subjects that are in Group 1 (exposed) =50%

$q_{0=}$ Percentage of subjects that are in Group 0 i.e $(1-q_{1)}$ =50%

P = Pooled percentage = $(q_1*P_1) + (q_0*P_0) = 0.1105$

$A = Z_\alpha\sqrt{P(1-P)}\ (1/q_1 + 1/q_0) = 1.2360$

$B = Z_\beta\sqrt{P_1(1-P_1)}\ (1/q_1) + P_0(1-P_0)\ (1/q_0) = 0.5289$

$C = (P_1-P_0)^2 = 0.0027$

Thus,

Total size of group = $N = (A+B)^2/C$ (41).

$N = (1.236+0.5289)^2/0.0027 = 1156$

Correction of progression (added to N for Group 0) = $CC = 1/ (q_1 * |P_1-P_0|) = 38$

Size of the sample (with correction of continuity) =1234 (617 adolescent mothers, 617 young adult mothers).

Therefore we included 617 adolescent mothers (10-19 years) and 617 non-adolescent mothers (20 -29 years) in the study.

Proportions of neonatal outcomes of adolescents and non-adolescent mothers were derived from former research done in comparable settings (33,35). The outcome variable that yielded the maximum sample size was selected to power the study to ascertain the difference in the various outcome variables of low birth weight, premature deliveries, asphyxia, and neonatal deaths between adolescent and non-adolescent mothers. Calculation of sample size using NMR of non-adolescent mothers from Kimeto et al (35) yielded a sample size of 778. Calculations adopting the proportion of young adult mothers with LBW, prematurity, and Apgar score at 5 minutes less than 7 from a study done in Cameroon gave a sample size of 622, 892, and 1234 respectively (33).

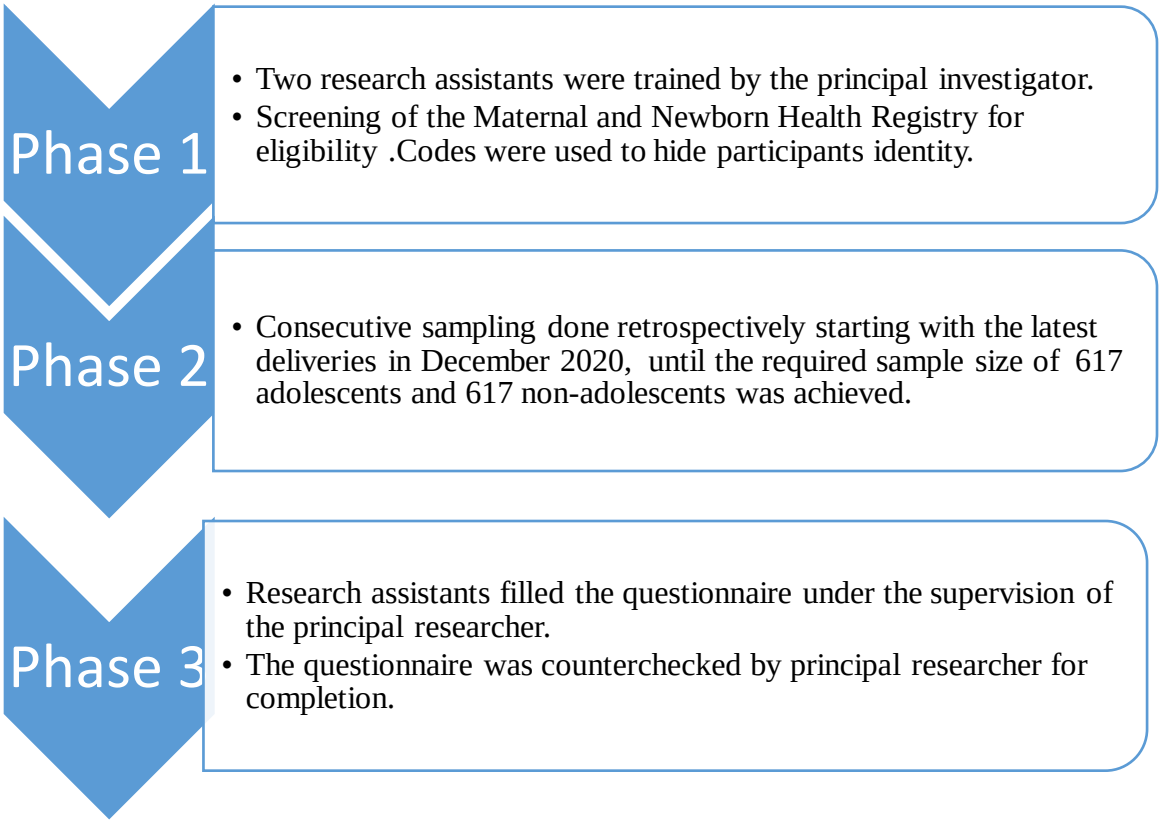
3.6.2. Sampling technique

Consecutive sampling technique was used to enrol the participants. All the patients that met the inclusion criteria within the study period of January 2018 to December 2020, were sampled retrospectively starting with the latest deliveries in December 2020, until the required sample size of 617 adolescents and 617 non-adolescents was achieved. This enabled us to capture the most present data. We utilized the Maternal Newborn Health Registry (ANC and delivery registers) at the Labor ward. Only singleton deliveries were considered to remove any confounding caused by multiple gestation.

3.6.3 Study procedure

The study procedure was carried out as follows:

Figure 5: Flow chart representing study procedure



3.7. Research assistant recruitment

Two research assistants were recruited. These were nursing officers with diploma certificates in the nursing field. They were trained for 2 days on how to retrieve specific data based on the data abstraction tool. The first day entailed familiarization with the data abstraction tool and the objectives of the study. On the second day, they were trained to retrieve only accurate information from the Maternal and Newborn Health Registry.

3.8. Pretest, Validity, and Reliability

A pre-test was conducted at Kitale County Referral Hospital. This hospital was selected as appropriate for pretesting of the study tool because of similar structures and comparable patient characteristics. To minimize selection bias, only those who met eligibility criteria were included in the study. The use of a structured questionnaire harmonized the method of abstracting data thereby reducing information bias.

3.9.Quality assurance

The data collection tool was filled by trained research assistants under the guidance and supervision of the principal investigator to obtain the demographic and clinical data. The research assistants recruited had a minimum of a diploma in nursing qualification. The research assistants were trained for two days to ensure that they are well conversant with the research tool-this involved familiarizing them with the inclusion and exclusion criteria and how to extract data from the Maternal and Newborn Health Registry. The principal investigator had practical sessions with them to ensure that they were well trained.

3.10. Ethical consideration

The study was designed to comply with the international ethical guidelines and was conducted after approval from KNH/UoN Ethics and Review Committee. We also sought approval from Kapenguria County Referral Hospital.

Anonymity and Confidentiality: Principles of confidentiality and privacy of information were maintained throughout the research process. Patients' data was be kept confidential at data abstraction, processing, and analysis stages. We anonymized data and used none identifiers such

as codes that cannot link a participant with the information provided during the study and analysis stages.

3.11. Data analysis and management

After the collection of data, data was entered into an excel sheet then imported to Statistical Package for the Social Sciences (SPSS) version 26 software. Median was used to analyze continuous variables while frequencies and proportions were computed for categorical variables. Chi-square test for association was conducted to compare the association of demographic characteristics and age group (adolescents and older women). A binary logistic regression was conducted to investigate the association between adverse neonatal outcomes (LBW, low Apgar score at 5 minutes, preterm births, and neonatal deaths) in adolescents and non-adolescent mothers. The crude odds ratio was calculated to determine the extent and direction of the association. Further, in identifying risk factors associated with preterm births among adolescents, a binary logistic regression was conducted and the odds ratio was explained. The level of significance was evaluated at 0.05.

CHAPTER FOUR: RESULTS

4.1.Introduction

The study sought to determine the outcomes of neonates delivered to adolescent mothers as compared to those delivered to older mothers and to determine factors associated with their outcome at Kapenguria County Referral Hospital in West Pokot County between January 2018 to December 2020. A total of 16, 102 patients within the study period were screened for eligibility, where 1234 patients (617 adolescents and 617 adult women) were selected retrospectively using the Maternal and Newborn Health Registry (MOH 333).

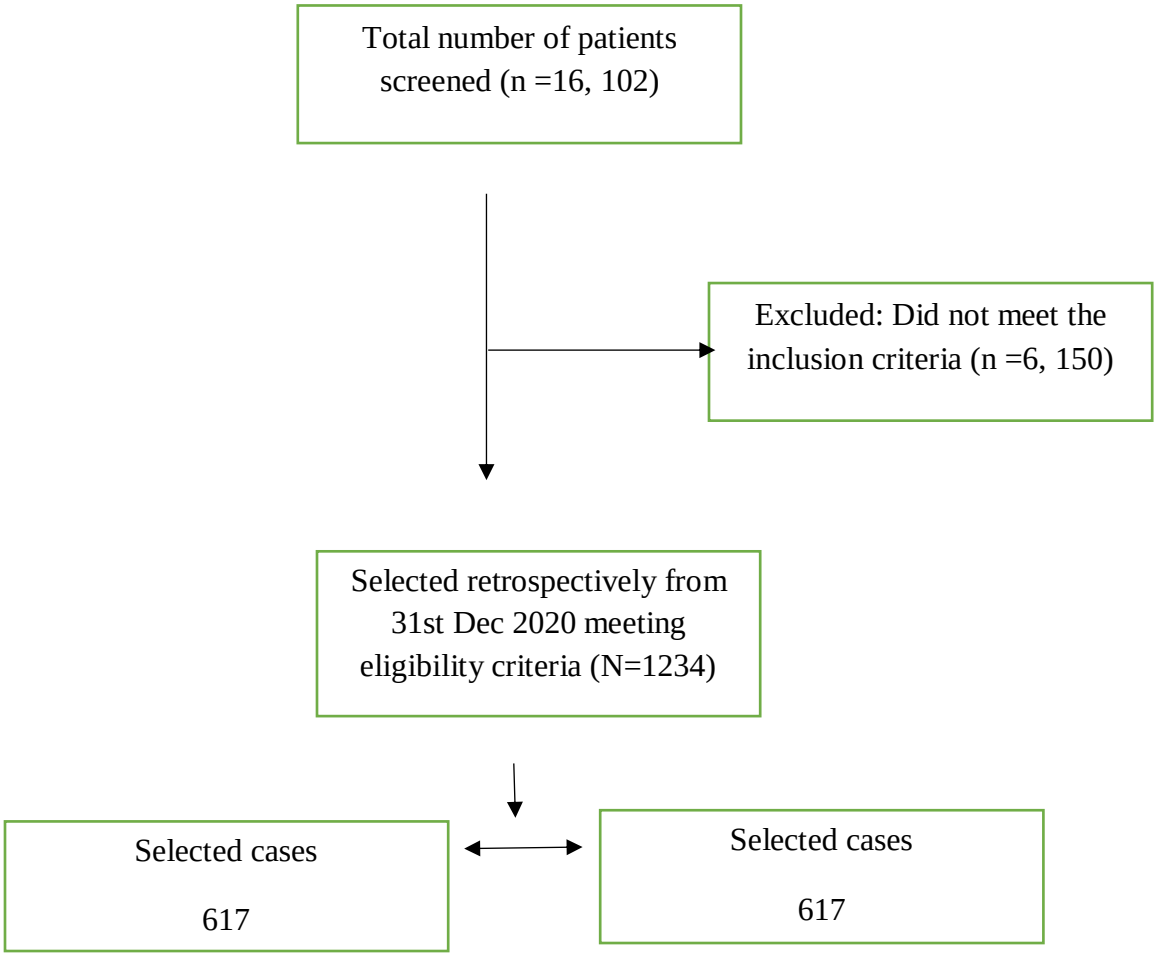


Figure 6: A schematic representation of the selection of cases

4.1.1. Distribution of maternal age among mothers (10 – 29 years)

The histogram as shown in Figure 7 shows the distribution of maternal age among mothers recruited in the study. Majority of the mothers in the study were aged between 17 years and 21 years.

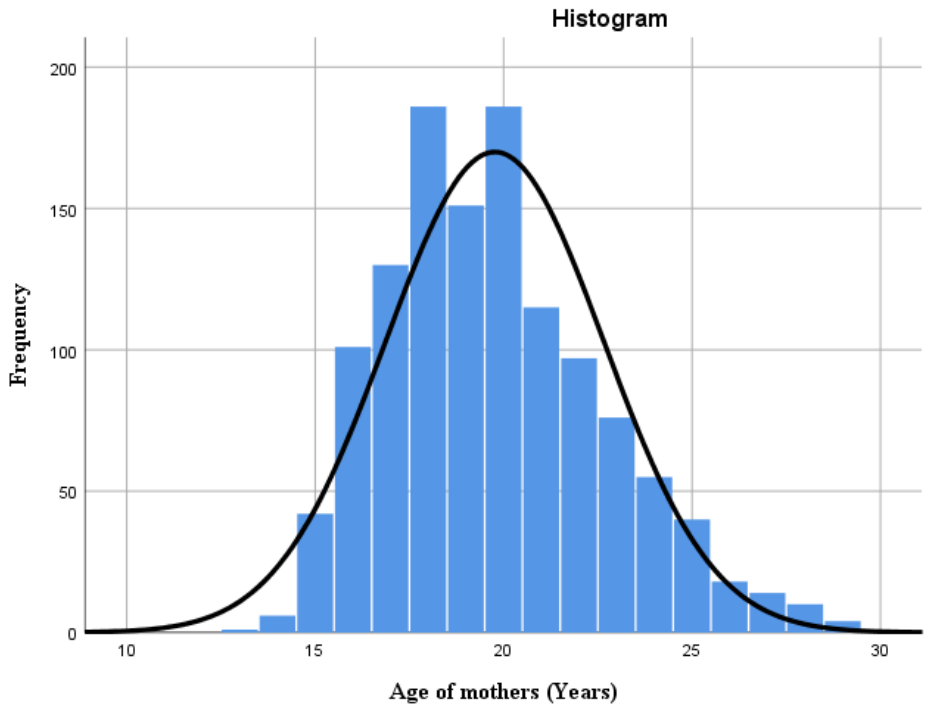


Figure 7. Distribution of age of adolescent and non-adolescent women.

4.2. Socio-demographic characteristics of adolescent and non-adolescent women

In this study, the mean age for adolescents was 17.5 (SD =1.3) while the average age for non-adolescent women was 22.1(SD =2). In investigating marital status, 71.8% (n =443) of non-adolescent women were married compared to 40.8% of adolescents. The association was significant ($p<0.001$). The proportion of ANC visits were higher in non adolescent women, 95.5% (n =589) compared to 89% (n =549) in adolescents. The association was statistically significant.

Fewer adolescents 25% (n =137) than older mothers 46.9% (n =276) had four or more ANC visits. The mode of delivery was comparable in both adolescents and other women considering that 80.4% (n =496) of adolescents and 79.3% (n =489) of non-adolescent women delivered via SVD as shown in Table 2.

Table 2: Socio-demographic characteristics

Characteristics	Total n (%)	10 - 19 years n (%)	20 - 29 Years n (%)	p-value
Maternal age at delivery (Mean ± SD)	19.8 (±3)	17.5 (±1.3)	22.1(±2)	
Marital status				
Single	534(43.4)	362(59.2)	172(27.9)	
Married	693(56.4)	250(40.8)	443(71.8)	p<0.001
Widowed	2(0.2)	0	2(0.3)	
ANC visit				
Yes	1138(92.2)	549(89)	589(95.5)	p<0.001
No	96(7.8)	68(11)	28(4.5)	
No. of ANC visits				
<4 visits	725(63.7)	412(75)	313(53.1)	
4 Visits +	413(36.3)	137(25)	276(46.9)	p<0.001
Mode of delivery				
Spontaneous vaginal delivery	985	496(80.4)	489(79.3)	
Cesarean section	245(19.9)	119(19.3)	126(20.4)	0.628
Other	4(0.3)	2(0.3)	2(0.3)	
Maternal status after delivery				
Stable	1218(98.9)	607(98.7)	611(99)	
Unstable/ deteriorated	13(1.1)	8(1.3)	5(0.8)	0.427
Died	1(0.1)	0	1(0.2)	
Gender of the baby				
Male	632(51.2)	330 (53.5)	302(48.9)	0.062
Female	602(48.8)	287(46.5)	315(51.1)	

4.3. Outcomes of neonatal outcomes delivered to adolescent mothers as compared to those delivered to non-adolescent mothers

The neonatal outcomes of adolescents and older women were investigated as shown in Table 3.

Table 3: Comparison of neonatal outcomes between adolescent and non-adolescent women

Neonatal outcomes	Total n (%)	10 - 19 years n (%)	20 - 29 years n (%)	OR(95%CI)	P-value
Birthweight					
Normal weight	1081(87.7)	543(88)	540(87.5)	Ref	
Low birth weight	151(12.3)	74(12)	77(12.5)	1.0(0.7, 1.5)	0.435
Gestation at birth					
Term (≥37 weeks)	1126(91.2)	577(93.5)	549(89)	Ref	
Preterm (<37 weeks	108(8.8)	40(6.5)	68(11)	1.8(1.2, 2.7)	0.003
Apgar score at 5th Minute					
7-10	1153(93.4)	572(92.7)	581(94.2)	Ref	
Less than 7	81(6.6)	45(7.3)	36(5.8)	0.8(0.5, 1.2)	0.179
Neonatal discharge outcome					
Alive	1200(97.2)	600(97.2)	600(97.2)	Ref	
Dead	34(2.8)	17(2.8)	17(2.8)	1.0(0.5, 2.0)	0.569

4.3.1. Birth weight

There was no difference in low birth weight proportions between adolescents (12%) and older women (12.5%). The findings also show that there was no significant association in low birthweight between adolescent and older women (p =0.435).

4.3.2. Prematurity

There was a significant association in preterm deliveries between adolescents (6.5%) and older women (11%). The findings show that the odds of older women having a preterm delivery were 1.8 times higher in the non-adolescent mothers (OR = 1.8, 95%CI: 1.2, 2.7, p =0.003).

4.3.3. Low Apgar score

Neonates of adolescent mothers had higher rates of low Apgar score of less than 7 at 5 minutes (7.3%) compared to those of older women (5.8%). However, this association was not significant ($p = 0.179$).

4.3.4. Neonatal deaths

The rates of neonatal deaths were similar in adolescents (2.8%) and older women (2.8%). Thus, the association was not significant as demonstrated in Table 3. All neonatal deaths among older women were stillbirths while 58.8%(n =10) among adolescents had stillbirths and 41.2% (n =7) were mortality after admission to NBU.

4.4. Factors associated with adverse neonatal outcomes among adolescent mothers

Our secondary objective sought to investigate factors associated with the outcomes of neonates of adolescent mothers. In this study, there was a significant association between adolescent mothers and lower rates of preterm deliveries as shown in Table 3. There was no association between preterm deliveries and factors that were investigated in the study such as marital status and the number of ANC visits as demonstrated in Table 4.

However, in investigating neonatal deaths among term and preterm deliveries in adolescents, the findings show that 12.5% of adolescents with preterm delivery reported death of neonate compared to 1.6% who reported newborn deaths among those who had term deliveries. The likelihood of a newborn death was 9 times more likely in preterm compared term newborns among adolescents OR = 9.02, 95%CI:2.87, 18.34, $p < 0.001$) as shown in Table 4.

Table 4: Factors associated with prematurity among adolescent mothers

Factors	Term (37 weeks and above)	Preterm (Less than 37 weeks	OR (95%CI)	P-value
Marital status				
Single	338(59)	24(61.5)	0.9(0.5,1.8)	0.446
Married	235(41)	16(38.5)	Ref	
ANC				
No	62(10.7)	6(15)	0.7(0.28,1.69)	0.271
Yes	515(89.3)	34(85)	Ref	
No. of ANC visits				
<4 visits	385(74.8)	33(82.5)		0.274
4 Visits +	130(25.2)	7(17.5)	Ref	
Maternal status after delivery				
Stable	567(98.6)	40(100)	-	-
Unstable	8(1.4)	0		
Gender of the baby				
Male	310(53.7)	20(50)	1.1(0.61,2.2)	0.384
Female	267(46.3)	20(50)	Ref	
New-born outcome				
Dead	9(1.6)	5(12.5)	9.02(2.87,28.34)	p<0.001
Alive	568(98.4)	35(87.5)	Ref	

CHAPTER FIVE: DISCUSSION, LIMITATIONS, CONCLUSION, AND RECOMMENDATIONS

5.1. Discussion

The study compared the neonatal outcomes between adolescent mothers and older mothers at the Kapenguria County Referral Hospital in West Pokot County, Kenya. The median age in our study was 19 years. The average age of the adolescent mother was 17 years and that of the older mother was 22 years. These findings differ from those in a study conducted in Uganda comparing perinatal outcomes and birth defects among adolescents and older women. The findings from their study revealed that the median age for both groups was 25 years (42). The difference could be associated with the differences in the comparative age groups. The median age for adolescents in our study was 17 years compared to 18 years in the Uganda study whereas, in the older women, our study found a median age of 22 years compared to 26 years in their study. Further, 67.6% of adolescents included in our study were aged between 16 and 18 years while 73.3% of non -adolescent women were aged between 19 years and 21 years. This is likely because our study was limited to only primiparous mothers.

In our study, the majority of women in the adolescent group were single while the majority in the older women group were married. These findings are comparable to the majority of previous studies which found that many adolescents are single while many older women are married (11,33,42). In another study conducted in Cameroon, 68% of older women were married compared to 35% of adolescents (33). Even so, as high as 40.8% of adolescents were married and this is consistent with reports of a high prevalence of child marriages in West Pokot County (43).

ANC attendance was lower in adolescent women (89%) compared to non-adolescents (96%). This was significant. Further, the findings from our study revealed that less than one-quarter of adolescents attended at least four ANC visits compared to almost half among older women. Adolescents who attended less than 4 ANC visits had higher rates of prematurity than adolescents who attended fewer ANC visits. These findings are comparable to a study done by Serunjogi et al which almost half of older women attended at least four ANC visits compared to 35% among adolescents (43). Another study conducted in Kwa Zulu Natal reported similar findings that adolescents tend to have fewer ANC visits (44). However, our findings are inconsistent with a multi-country study conducted in Southern Asia, Sub-Saharan Africa, and Latin America which revealed that more than half of adolescents in Sub-Saharan Africa and Latin America attended at least four ANC visits (46). The difference observed, in this case, could be attributed to the inclusion of both Latin American and Sub-Saharan African populations in the same group despite the difference in cultural underpinnings between the two settings. The relatively high attendance rate in both age groups in our study could be partly explained by the uptake of community health strategies aimed at increase reproductive health services.

In our study,12 % of adolescents compared to 12.5% of older women had low birthweight babies. However, the association was not significant. These results are in line with a study conducted by Nderitu et al (7) and another by Govender et al which found that there was no significant association between low birth weight and adolescents (14). These findings are inconsistent with those from a study by Serunjogi et a that found that the proportion of low birth weight was higher in adolescents (10.5%) than older women (7.5%) and was statistically significant (42). Another study done conducted in Zambia revealed that low birth weight decreased with increasing maternal age (47). The existing difference between these studies and our findings could be as a result of age

distribution in our study where the mean age for both groups was 19 years suggesting the likelihood of both groups showing a similar pattern in outcomes and the differences in sample sizes,with some studies picking fewer adolescents.

The proportions of low Apgar score at 5 minutes was higher in the adolescent group (7.3%) as compared to older women (5.8%). However, the association was not significant at 95% confidence level. These findings are comparable to a study conducted in Cameroon which found that 13.5% of babies born of teenage mothers compared to 8.6% born of older women had an Apgar score of less than 7 at 5 minutes (33). These findings are consistent with those of a study conducted in Russia which found that there was a slight variation in the proportion of low Apgar score at 5^{th} minute in adolescents (1.8%) compared to older women (1.9%). However, the association was not significant (27). Further, a study conducted in Northwest Ethiopia also found that there was no significant association between low Apgar score at the 5^{th} minute after birth and adolescents (11).

The proportion of preterm deliveries was higher in older women (11%) as compared to adolescents (6.5%). Hence, the odds of preterm births were 80% higher in older women compared to adolescents. The association was found to be significant. These findings are comparable to a study in Northwest Russia which revealed that the proportion of preterm delivery was slightly higher in older women (1.3%) compared to adolescents (1.1%). In their study, the association was not significant (27). Langdon et al found that the rates of preterm delivery were similar between adolescent and adult mothers and it was statistically significant (38). However, our findings contrast those from many studies that found that the odds of preterm birth are higher in adolescent than in non-adolescent women (11,33,42,48). Being a low resource community with strong cultural beliefs and relatively high proportions of home deliveries, women that had home births were not included in the study. This may have been a source of bias. It is also likely that there was

a selection bias in that the adolescent mothers selected in the study had fewer preterm deliveries hence the need for further research. Additionally, in this community with great gender inequalities, married older women tend to perform domestic chores that are not limited to fetching water from the river and tending to their family and animals (50). This stress and strain while at home could explain their higher likelihood of having preterm babies. Adolescents who attend schools and become pregnant are encouraged by the Ministry of Education to continue schooling. Provision of school meals and protection from heavy chores at home could partly explain their reduced odds of getting premature babies (50). The median age of 19 years may also suggest an overall younger population of nonadolescent mothers hence the high rates of premature births in that age group. In this retrospective hospital-based study, we did not have the information to evaluate the nutritional status, maternal infections, and co-morbidities that contribute to premature births. As such, the findings of lower preterm births should therefore be interpreted cautiously.

The proportion of neonatal deaths was comparable in the two groups (2.8%). These findings are similar to those from a previous study conducted by Nderitu et al which revealed that there was no significant difference in the proportion of neonatal outcomes among teenage mothers (1.6%) and older women (1.6%) (7). Similarly, Kawakita et al found that there was no significant association between neonatal deaths and the adolescent group (48).

The findings from the current study also revealed that there were no significant factors associated with lower preterm births among adolescents in the study settings. The odds of neonatal deaths as a result of preterm births were 9 times higher among adolescents. In a study in Northwest Russia, no factors investigated were associated with lower preterm births in the adolescent group (27). The lack of association could be explained by the lower proportion of preterm births among adolescents (6.5%, n =40). Thus, this sample size is small to make any significant meaningful associations

hence explaining the lack of significance in our current study. Being retrospective data, some of the factors that cause prematurity such as fetal and maternal factors were not investigated.

5.2. Study limitations

Being a hospital-based study located in a rural setting, the results may not be a reflection of the outcomes of pregnancy among adolescent mothers in the population. Further, adolescents who deliver in smaller hospitals and at home were not captured and this constitutes a large bias. The study was done retrospectively from the Maternal and Newborn Registry and so there was narrow scope for follow-up. Neonatal infections and mortality beyond their discharge from the hospital were not sought. In addition, information on important maternal clinical and demographic factors such as nutrition, infections, and socioeconomic status that affect neonatal outcomes were not investigated.

5.3. Conclusion

1. Adolescent mothers attended fewer ANC visits.
2. Adolescent mothers had lower rates of premature babies and higher rates of low Apgar score at 5 minutes.
3. Most neonatal deaths in adolescents occured after admission to the newborn unit.

5.4. Recommendations

1. Need for intensification of public health interventions and campaigns to increase ANC visits for adolescent mothers.
2. Close monitoring of neonates of adolescent mothers admitted to newborn unit is necessary.
3. There is a need for large population-based studies to be conducted as our findings on high rates of preterm deliveries in non-adolescents differed from the results of many studies.

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51. REPUBLIC OF KENYA MINISTRY OF EDUCATION.

APPENDICES

Appendix I: Sample maternity ANC and Delivery register.

For Maternity Register:

Ministry of Health				Maternity Register							MOH 333									*Page 1*
												Delivery								
Admission number	Date of admission	No. of ANC visits	Full Names	Village/ Estate	Age	Marital status	Parity	Gravidae	Date of last menstrual period (LMP)	Expected date of delivery	Diagnosis	Duration of labour	Date of delivery	Tired delivery	Gestation at birth (wks)	Mode of delivery	Placenta complete (Y/N)	Blood loss (in mls)	Condition after delivery (A/D)	Other delivery complications (Codes)
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)

Ministry of Health				Maternity Register															*Page 2*
Baby					HIV status		ARV Prophylaxis					Partner HIV C&T				Discharge			
Sex (M/F)	Birth Weight (in grams)	Live birth FSB, MSB	APGAR score	VDRL, RPR Results (P/N)	ANC (Drug Code)	Maternity (Drug Code)	ANC (Drug Code)	To baby codes	To baby	CTX to mother (Y/N)	Vitamin A (Y/N)	Tested	HIV test results	Delivery conducted by (Enter Name)	Birth notification	Date (dd/mm/yy)	Status of baby (Dead/Alive)	Comments	
(v)	(w)	(x)	(y)	(z)	(aa)	(ab)	(ac)	(ad)	(ae)	(af)	(ag)	(ah)	(ai)	(aj)	(ak)	(al)	(am)	(an)	

Appendix II. Data collection tool.

OUTCOMES OF NEONATES BORN TO ADOLESCENT MOTHERS: A HOSPITAL-BASED CROSS-SECTIONAL STUDY AT KAPENGURIA COUNTY REFERRAL HOSPITAL, WEST POKOT COUNTY.

MATERNAL OUTCOMES

1. Study ID ..... Date .....

2. What is the mother's age in years at delivery? .....

3. What age group is the mother at delivery?

   a) 10-19 b) 20-29

4. Marital status of the mother

   a) Single c) Divorced/separated

   b) Married d) Widowed

6. Antenatal visit clinic during pregnancy?

   a) Yes b) No

If yes, how many times did the mother attend the clinic?

   a) One visit c) 3 visits

   b) 2 visits d) 4 + visits

7. What was the mode of delivery?

a) Spontaneous vaginal delivery

b) Caesarian section C)Other

8. What was the maternal status after delivery?

a) Stable c) Died

b) Unstable/ deteriorated

9. If the mother is not alive, what was the main cause of death diagnosed?

a) Post-partum hemorrhage (PPH) c) Infectious disease diagnosis

b) Hypertension disorder (Specify): _____

(Specify): _____ d) Other(Specify)_____

NEWBORN OUTCOMES

1. What is the gender of the baby?

a) Male b) Female

2. What was the newborn outcome?

a) Alive b) Dead

3. What was the birth weight of the baby in (grams)?

a) >4000 c) 1500-2499 e) <1000

b) 2500-3999 d) 1000-1499

4. What was the gestation age of the baby at birth?

a) >or= 37 weeks c) 32 to < 34 weeks e) Less than 28 weeks

b) 34 to <37 weeks d) 28 to < 32 wks

5. What was the Apgar score at 5 minutes after birth?

a) Less than 6 b) 7-10

7. Was the baby HIV exposed?

a) Yes b) No.

8. If HIV, was exposed, was the mother on HAART?

a) Yes b) No

9. Was the baby exposed to maternal syphilis?

a) Yes b) No

10. What was the outcome at discharge?

a) Dead
b) Alive

11. What was the cause of death?

a) Neonatal sepsis
b) Prematurity
c) Respiratory distress syndrome
d) Birth asphyxia
e) Other(specify)

Appendix III: Workplan

Item	Dec 2020 – March 2021	April 2021	May 2021	June 2021	July 2021	August 2021	Sept 2021	Oct
Development of study proposal and budget								
Submission and approval by the ethical review committee								
Engagement and training of study assistants				X				
Data collection								
Data coding, and analysis								
Report compilation/ Results presentation								
Final Report/ Dissemination								

Appendix IV: Budget

Components	Unit of Measure	Duration/ Number	Cost (Kshs)	Total (Kshs)
Personnel				
Research Assistant	2 assistants	28	1500	84000
Statistician	1		30000	30000
Participants				-
Transcribing Fee				-
Printing				
Assent Form				-
Questionnaires	1 copy	9 pages	10	90
Final Report	1	55	10	550
Photocopying				
Consent Form	400	2	3	2400
Assent Form				
Questionnaires	1234	9	3	33,318
Final Report	5	55	3	825
Final Report Binding	6		500	3000
Other costs				
ERC Fees				2000
Training	4 pcs	4	150	600
Pens	4 pcs	4	20	80
Notebooks	4 pcs	4	50	200
Total				**157,063**