EFFECTIVENESS OF MOBILE SHORT MESSAGE SERVICE REMINDERS ON ANTENATAL CARE AND SKILLED DELIVERY ATTENDANCE AMONG PREGNANT WOMEN IN WEST POKOT COUNTY, KENYA

BY

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DEDICATION

I dedicate this thesis to my parents, Mr Andrew Martin Mshambala and Mrs Odillia Nasambu Mshambala, who have never wavered their high expectations of me, maintained their constant faith in my abilities, and encouraged me throughout my journey to pursue this course. I further dedicate this work to all my siblings for their support, love, and care during this journey.

ABSTRACT

Maternal mortality ratio (MMR) is still high in Kenya at 362, stifling the achievement of the Sustainable Development Goal (SDG) 3.1, which aims to reduce MMR to less than 70 per 100,000 live births by 2030. With MMR of 565 out of 100,000 live births and 73.6% of home deliveries, according to the Kenya Demographic Health Survey (KDHS, 2014), West Pokot County is ranked among the counties contributing to the slow progress. Despite high mobile penetration in Kenya (>100%), evidence is lacking on the use of this technology to improve maternal health outcomes. The purpose of this study was to establish the efficacy of Short Messaging Service (SMS) reminders on improving antenatal care (ANC) and skilled delivery attendance (SDA) among pregnant women in West Pokot County. Specifically, the study was exploring the demographic variables associated with ANC and SDA, comparing outcomes between the study arms, and identifying challenges experienced by women, while seeking maternal health services. A prospective cohort quasi-experimental study design was applied among 462 eligible consenting women, in the control (231) and intervention (231) arms for 3 years from 2017. Upon exit from the first ANC service delivery point at Kapenguria County Referral Hospital, participants were sampled systematically into the study. Only women in the intervention group received SMS reminders 24 hours before appointment dates. Structured questionnaires and Focus Group Discussion (FGD) guides were used for collection of both quantitative and qualitative data respectively. Ministry of Health (MOH), ANC and maternity registers, were used together with study-designed appointment registers to track scheduled appointments. Chi-square test of association and binomial logistics regression were used to test variable relationships while relative risks and relative effects were used to compare study outcomes. Framework analysis was used for qualitative data. Marital status, gravidae, and parity had a statistically significant association with ANC across all the levels: first to the fourth plus ANC appointment. Parity was not statistically significant only at the fourth ANC appointment. Gestation age at first ANC, marital status, education level, mobile phone ownership, gravidae and parity had a statistically significant association with SDA. SMS reminders increase ANC appointment adherence by 61.9% (RR=1.6190); 78.3% (RR=1.7830) and 147.7% (RR=2.477) for 2nd, 3rd and 4th ANC appointments. For more than four ANC appointments, adherence was increased by 284% (p-value 0.000, RR=3.84). SDA is increased by 125.6% (RR=2.256). The null hypotheses are rejected, and the study concludes that there is a significant difference between women who receive SMS reminders and those who do not for both ANC and SDA. Financial constraints, distance from the health facilities and lack of general awareness on the importance of seeking health facility care were among the leading challenges experienced by women in the county. SMS reminders are an effective way to improve ANC and SDA, in conjunction with community education, women empowerment and enhanced male involvement, in West Pokot County.

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OPERATIONALIZATION OF TERMS

Antenatal care is an umbrella term used to describe medical care and procedures that are carried out to and for pregnant women and her unborn baby. The care includes various screening tests, diagnostic procedures, prophylactic treatments, some of which are done routinely, and others are provided to the women based on identified problems and risk factors.

Antenatal care coverage (at least four visits) is the percentage of women aged 15 to 49 years with a live birth in a given time period that received antenatal care.

Antenatal care coverage (at least one visit) is the percentage of women aged 15 to 49 years with a live birth in a given time period that received antenatal care provided by skilled health personnel (doctor, nurse or midwife) at least once during pregnancy.

Maternal mortality describes deaths that occur as a result of complications from pregnancy or childbirth.

Maternal mortality ratio is the proportion of maternal deaths due to pregnancy or childbirth per one hundred thousand live births.

Mobile phone is a portable telephone that can make and receive calls over a radio frequency link while the user is moving within a telephone service area.

Mobile phone ownership refers to having a phone for regular use that belongs to the user.

Mobile phone subscription refers to the use of public mobile telecommunication systems (also called mobiles or cellphones) using cellular technology.

Mobile Access Penetration is the number of unique individuals who have regular access to a mobile phone, even if they do not personally own one, as a percentage of the total population.

Mobile phone penetration is the number of unique mobile subscribers or the number of SIM cards or mobile phone numbers in a certain country. It does not refer to the number of mobile phone devices.

Predictor variables are naturally occurring characteristics of the study participants that may affect the outcome of the study, in addition to the intervention. The researcher does not manipulate the predictor variables. In this study, these are identified as the demographic variables.

Skilled delivery attendance (also known as skilled birth attendance) is the presence of a skilled health professional (doctor, nurse or midwife) during delivery.

Skilled health professional refers to accredited health professionals, workers or attendants such as midwifes, doctors or nurses, who have been educated and trained to proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth and the immediate postnatal period, and in the identification, management and referral of complications in women and newborns. Both trained and untrained traditional birth attendants are excluded.

Subscriber identity module or subscriber identification module (SIM), is an integrated circuit running a card operating system (COS) that is intended to securely store the international mobile subscriber identity (IMSI) number and its related key, which are used to identify and authenticate subscribers on mobile telephony devices (such as mobile phones and computers).

Sustainable Development Goals (SDGs) are a collection of 17 global goals set by the United Nations (UN) General Assembly in 2015 for the year 2030.

Unique Subscriber Penetration is the number of unique individuals who own a mobile phone, as a percentage of the total population.

ABBREVIATIONS

ANC	Antenatal Care
ARV	Anti-Retroviral Drugs
ASAL	Arid and Semi-Arid Land
CHS	Community Health Strategy
CHV	Community Health Volunteer
CHMT	County Health Management Team
CIDP	County Integrated Development Plan
COK	Communications Authority of Kenya
COVID 19	Corona virus disease 2019
EBF	Excusive Breast Feeding
FANC	Focussed Antenatal Care
FGD	Focus Group Discussion
FIGO	Fédération Internationale de Gynécologie et d'Obstétrique (International Fédération of Gynécologie and Obstétrique)
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSMA	Groupe Speciale Mobile Association
HIV	Human Immunodeficiency Virus
ICM	International Confederation of Midwives
KDHS	Kenya Demographic Health Survey
KEMRI	Kenya Medical Research Institute
KHIS	Kenya Health Information System
KIRA	Kenya Integrated Rapid Assessment

KNBS   Kenya National Bureau of Statistics

MCH   Mother Child Health

MDG   Millennium Development Goals

MMR   Maternal Mortality Ratio

MOH   Ministry of Health

MUERC   Maseno University Ethical Review Committee

NASCOP   National Aids and STI Control program

PMTCT   Prevention of Mother to Child Transmission

PNC   Post Natal Care

RMNCAH   Reproductive Maternal Newborn Child and Adolescent Health

SDA   Skilled Delivery Attendance

SCHMT   Sub-County Health Management Team

SDG   Sustainable Development Goal

SMS   Short Messaging Service

TBA   Traditional Birth Attendant

UNFPA   United Nations Population Fund

UNICEF   United Nation Children's Fund

UNDP   United Nations Development Program

UNPD   United Nations Development Programme

UNSD   United Nations Statistics Division

WHO   World Health Organization

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter presents the general background of the study. It expounds on the problem statement, general and specific study objectives and the hypotheses to be tested. It further explains the justification for the study, the study scope and study limitations. At the end of this chapter, an outline of the chapters in the entire thesis has been provided.

1.2 Background

Sustainable Development Goal (SDG) 3.1 aims to reduce the global maternal mortality ratio (MMR) by less than seventy out of a hundred thousand live births by 2030 and have all births attended to by a skilled health personnel. According to the United Nations International Children's Emergency Fund (UNICEF), global maternal mortality annual reduction rate was at 2.9 per cent between 2000 and 2017 compared to the desired target of 6.4 per cent. Even though there is a decline globally, Sub-Saharan Africa accounts for two thirds of all maternal deaths (UNICEF, 2019). All these deaths are deemed preventable, especially if the current recommended interventions are put in place. Antenatal care (ANC) and skilled delivery attendance (SDA) are key maternal health interventions contributing towards the achievement of SDG 3.1. It is therefore imperative, for nations and particularly Kenya, to adopt innovative approaches like Short Message Service (SMS) reminders, to fast track the achievements in adoption of both ANC and SDA as lifesaving maternal health interventions.

1.2.1 Use of short messaging service as an intervention for maternal health appointments

Mobile phone technology and popularity has grown, over the years, giving a higher advantage to programs that are adopting or planning to adopt mobile phone based digital solutions for their interventions. Short messaging service also known as text messaging, is a communication method that makes use of messages of at most 160 characters to pass information via mobile devices. According to the Pew Research Center statistics, it is currently rated as the most common method of communication that attracts 98% response from the recipients globally (Silver. L, & Huang. C, 2019).

According to the Mobile Economy Report 2015, Sub-Sahara Africa had 367 million unique subscribers and 680 million connections as of the second quarter of 2015. In 2017, ownership of mobile phones was at 90% in developing nations and 91% in developed nations, according to Deloitte and Touche global mobile consumer trends report (Deloitte & Touche, 2017). Access to mobile phones has equally improved with 95% of people worldwide living in an area with mobile network coverage (Groupe Speciale Mobile Association, 2018). Further research by Pew Research reported that mobile phone ownership is high in sub-Saharan Africa (Silver & Johnson, 2018). In Kenya, mobile phone subscription was greater than 100% by 2018/2019, with SMS as a form of communication increasing among users. Ownership is equally higher among women (47.6%) compared to men according to Communication Authority of Kenya (CA), World Bank and Kenya National Bureau of Statistics (2019), which ties in with the aim of this research, to harness these enhancements in improving maternal health. West Pokot County mobile phone penetration stands at 71% (Wyche, Densmore and Geyer, 2015).

Studies have been conducted on the use of SMS reminders to improve health care appointments and outcomes. However, these studies have been domain specific hence literature still reveals the need for further research on maternal health outcomes and in various settings to better inform feasibility (Kannisto, K., Koivunen, M., & Valimaki, M., 2014). The use of mobile phones to improve health outcomes, strengthen health systems, or increase patient engagement with the health system is relatively new, but has great potential (Dean AL *et al*., 2012; Geldsetzer P *et al*., 2016). Patient-focused mHealth interventions have been shown to increase attendance to maternal and infant care services as well as other health outcomes in other domains (Tamrat.T, & Kachnowski., S, 2012; Poorman E., *et al*, 2015). Despite this, there are knowledge gaps related to the implementation of mHealth interventions among pregnant women in many settings and detailed information on the type and structure of effective mHealth interventions is incomplete (Coleman. J., *et al*, 2020). According to Colaci Chaudhri & Vasan. (2016), more evidence from robust study set-ups would be required to inform contextual scale up.

1.2.2 Antenatal Care

Antenatal care is the terminology that describes the medical care and procedures that are carried out to and for pregnant women and their unborn babies. It includes various screening tests, diagnostic procedures, prophylactic treatments, some of which are done routinely, and others are provided to the women based on identified problems and risk factors (WHO, 2016). Over 303,000 women and adolescent girls died from pregnancy and childbirth-related complications in 2015 with approximately, 2.6 million still-born babies. Ninety nine percent of the maternal deaths and ninety eight percent of the child deaths occurred in low- and middle-income countries (Alkema, *et al*., 2016). These maternal deaths could have been prevented if the pregnant women or adolescent girls had access to quality antenatal care

(WHO, 2016). Due to the persistently high maternal and child deaths globally, particularly in developing countries, the World Health Organization (WHO) released new guidelines on access to ANC on 7th November 2016. These guidelines recommended increasing contact between the healthcare provider and the pregnant woman from four to eight. Initially, the four-visit model also known as Focused Antenatal Care (FANC), was adopted by WHO in 2002, providing goal-oriented and targeted care aimed at increasing the detection and management of complications during pregnancy. FANC model was a replacement of the traditional ANC model that was in existence in early 1900s, that assumed frequent visits and classification of pregnant women into high and low risk by predicting complications in advance. The Kenya's National Guidelines for Quality Obstetrics and Perinatal Care was based on the WHO FANC model and was still in use by the time of this research. As literature further suggests, guidelines are vital for setting required standards however, the application of global recommendations within local contexts is a challenge in many parts of the world and particularly in Africa. Several studies conducted reveal that Kenya and other developing countries are struggling to adopt the FANC model especially in low resource settings. This further reveals the need for re-evaluation and generation of sufficient information for the eight-contact model, to further contextualize it. (Vogel JP *et al* 2016; Puchalski R. L. M *et al* 2016; Wang, Norris & Bero, 2018).

According to the Maternal Health Taskforce 2019, 85% of pregnant women attend at least one ANC visit with a skilled health professional globally, while 58% attend at least four ANC visits. In regions with the highest rates of maternal mortality, such as sub-Saharan Africa and Southeast Asia, even fewer women received at least four ANC visits (Basha, 2019). To achieve universal healthcare, which is among Kenya's big four agenda, large expansions in ANC are still needed especially in developing countries (WHO, 2015). In Kenya, coverage

with at least one ANC visit was nearly universal (>91%), while coverage with at least four ANC visit was less than half (<49%) (WHO 2014). In 2017, Kenya was among the ten countries that contributed the most neonatal deaths globally (Arunda, Emmelin & Asamoah, 2017). In West Pokot County, over 92% of women attend clinic for the first ANC visit only but later turn to traditional birth attendants (TBAs) to get delivery services (KNBS *et al*, 2015). Evidence as published by the Ministry of Health (MOH), Kenya in 2016, in the Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCAH) investment framework, reveals that 73% of pregnant women in Nairobi County have over four ANC visits while in West Pokot County, only 18% had more than four visits. These disparities in maternal health indicators across different settings and counties in Kenya, slows down the overall progress towards universal health coverage of maternal healthcare services within the country.

1.2.3   Skilled Delivery Attendance

As defined by World Health Organization, skilled delivery attendance or skilled birth attendance is the management of women during normal (uncomplicated) childbirth and the immediate postnatal period as well as in the identification, management or referral of complications in women and new-borns by a trained professional such as a midwife, doctor or nurses (WHO, 2004). The proportion of births attended to by a skilled professional, is a globally recognized key indicator for assessing progress towards achieving SDG target 3.1 (WHO, 2018). Despite the rates of women delivering within the formal health care system increasing in recent years, an estimated 22% of pregnant women world-wide were delivered by a Traditional Birth Attendant (TBA), outside the formal healthcare system, in 2016 (Garces *et al*, 2019). TBAs have rendered services to pregnant women and women in labour for a long time in history. Despite being respected in the community, TBAs lack the

knowledge, capacity, and equipment to respond to maternal complications and other scenarios post-delivery. It is because of these gaps, that the WHO, the International Confederation of Midwives (ICM) and the International Federation of Gynaecology and Obstetrics (FIGO), recommended a partnership association between the skilled health workforce and the TBAs, in defining for them new roles for referral facilities (Miller & Smith, 2017). According to Nkhana- and Abdulsalam- (2018), at least half of all births in developing countries occur in the absence of skilled birth attendants. This is a much higher rate in comparison to the global rate of 22%. The highest rates of early childbearing are found in sub-Saharan African countries, where in 2018 birth rates among adolescents reached over 100 births per 1,000 girls aged fifteen to nineteen years, compared to lower rates in other regions (UNICEF, 2019). In 2019, 81% of births were assisted by skilled health professionals globally, while in sub-Saharan Africa this stands at 60% (UNICEF, 2020). This further explains why countries in Sub Saharan Africa continue to contribute to 99% of maternal mortality and morbidity. Kenya national skilled birth attendance is at 61% with 37% of the births taking place at home and contributing to the 362 MMR. In West Pokot 73.6% of the births occur at home while skilled deliveries stand at 25.8% (KNBS *et al*, 2015). The situation is particularly worse for marginalized rural communities (Rono, Maithya & Sorre, 2018).

Kenya adopted a new constitution in 2010, which decentralized the governance structure, devolving health care service delivery to the 47 counties (Republic of Kenya, 2010). The Kenya Health Policy 2012-2030 advocates for equitable provision of health care, with policy objective four provisioning for health services in an equitable manner (Ministry of Health, 2012a). With reference to the existing disparities across the different countries, much of this has not been achieved. In 2013, Kenya abolished delivery fees in all public health facilities

through a presidential directive, with an aim of promoting health facility delivery and reducing maternal mortality. In 2014, Kenya's First Lady, launched a campaign by the name "beyond Zero Campaign" with the aim to improve maternal and child health outcomes in the country. According to the Kenya Ministry of Health policy brief in 2015, an estimated 6,300 women die each year during pregnancy and childbirth (MOH, 2015). WHO trends (1990–2015) have placed Kenya among the top ten countries with the highest maternal mortality. Maternal mortality ratio and the neonatal mortality rate in Kenya have been estimated to be 362 and 52 respectively, even though maternal deaths have declined in most other parts of the world (UNFPA, 2014).

1.3 Problem statement

According to the United Nation Population Fund report, Kenya was ranked among countries with worst MMR rates at 362 out of 100,000 live births and a skilled delivery attendance of 61% with huge disparities in-country (UNFPA,2016). While urban areas seem to have shown progress, there are still maternal health gaps among marginalized communities, particularly arid, semi-arid and post conflict regions. Failure by women to utilize SDA and to adhere to the ANC appointments at the health facilities contributes to the disparities and poor progress. West Pokot County, classified among the Arid and Semi-Arid Lands (ASAL), is among the counties highly contributing to the slow progress with a Maternal Mortality Ratio of 565 out of 100,000 live births. The county is also known for the existing conflicts between itself and Turkana County especially at the borders. According to the Kenya Demographic Health Survey (2014), the first antenatal care visit in the county was at 85.2% against a national figure of 98%. The fourth antenatal care visit was at 18% and SDA was at 25.8% against the national figure of 61% (KDHS 2014). Majority of the women in the county seek the first antenatal care visit only to ascertain the pregnancy and later embrace consequent services

from the Traditional Birth Attendants contributing to the poorly performing indicators. Neonates are equally affected since they miss the initial attention, they need from skilled caregivers at birth including delayed initiation of immunization. While mobile phone penetration in West Pokot County was at 71% by 2015, generally, there is no health facility making use of SMS reminders for any appointments. All expectant women are given mother baby booklets upon which it is up to them to keep to the appointments prescribed in the booklet.

This study leveraged on the increased mobile phone penetration in Kenya to more than 100% and 71% in West Pokot County, to enhance adherence to antenatal care appointments and SDA at the health facilities by using the SMS reminders. It made use of women who had both access and ownership to mobile phones as opposed to those who necessarily owned mobile phones.

1.4 General Objective

To evaluate the effectiveness of mobile Short Messaging Service (SMS) reminders on antenatal care attendance and skilled delivery attendance among pregnant women in West Pokot County.

1.5 Specific Objectives

i. To establish association between demographic factors and antenatal care attendance among pregnant women in West Pokot County.

ii. To establish association between demographic factors and skilled delivery attendance among pregnant women in West Pokot County.

iii.   To compare antenatal care attendance among pregnant women who received SMS reminders and those who did not receive the reminders in West Pokot County.

iv.   To compare skilled delivery attendance among pregnant women who received SMS reminders and those who did not receive the reminders in West Pokot County.

v.   To identify challenges faced by pregnant women in seeking antenatal care and skilled delivery services in West Pokot County.

1.6 Hypothesis

At 95% confidence interval, the hypotheses were evaluating whether the outcome variables (antenatal care and SDA), have any association with the demographic variables and thereafter, the effect of SMS reminders on the key study outcomes. The predicto variables were age, education level, marital status, occupation, income, mobile phone ownership, parity and gravidae. Specific statistical tests employed in testing these hypotheses are presented under the methodology section in chapter three and the results and discussions under chapters four and five in subsequent sections. An outline of the study hypotheses are as follows:

i.   There is no significant association between demographic factors and antenatal care attendance among pregnant women in West Pokot County.

ii.   There is no significant association between demographic factors and skilled delivery attendance among pregnant women in West Pokot County.

iii.   There is no significant difference in ANC attendance among pregnant women who receive SMS reminders and those who did not receive the reminders in West Pokot County.

iv.   There is no significant difference in SDA, among pregnant women who receive SMS reminders and those who did not receive them in West Pokot County.

1.7 Justification of the study

Global trends in maternal mortality ratios, skilled birth attendance and antenatal care have generally improved, although the progress is too slow to achieve the goals set for 2030 in line with SDG 3.1. Sub-Saharan Africa continues to contribute to most of the maternal deaths globally, recording over 200,000 maternal deaths each year (WHO 2019). Kenya has equally been ranked among the 21 countries with high maternal mortality. The Kenyan government in partnership with other implementing partners, has made efforts, including the use of the existing community health strategy, building the capacity of health care workers and attempts to distribute some health facilities with equipment and personnel. Policies have equally been adjusted with an aim of improving maternal health indicators. Various campaigns have been launched including free delivery services in 2013 and the beyond zero campaign in 2014, following devolution of healthcare services. These efforts, however, have not yielded the desired progress with the speed desired to achieve the SGDs. The country was equally not able to achieve the previously set Millennium Development Goal (MDG) 5 by 2015. This therefore necessitates putting in place innovative interventions, which leverage on advancements in technology to enhance utilization of skilled health services for maternal health, over and above the efforts already in place (Amoakoh-Coleman M. *et al*, 1016; Feroz, Perveen &, Aftab, 2017). In the context of COVID-19 pandemic, which calls for aversion of physical contact, technology has become the most efficient tool for continued existence and functioning of many systems. Findings from this research will continue to contribute to the body of literature, that further demonstrates the feasibility of using mobile technologies in advancing healthcare services pertaining to maternal health. Of further interest are areas characterized by poor access to maternal health services, marginalized communities, arid and semi-arid regions. West Pokot County, where the study was conducted is a typical such

environment, which contributes to the in-country imbalances in accessibility of maternal healthcare services.

1.8 Scope of the study

The study aimed at evaluating the effectiveness of SMS reminders for pregnant women, on the attendance of antenatal care and skilled delivery at the health facility. To achieve this, the study was conducted in West Pokot County at the Kapenguria County referral hospital, among 462 consenting pregnant women, enrolled at their first ANC visit and followed up to delivery, in two equal sized study arms. Expectant women who did not visit the health facility for antenatal care services, or who lived outside West Pokot county, or did not have access to a mobile phone were not included in this study. SMS reminder for scheduled antenatal care and SDA appointment was the key intervention while those in the control group did not receive any SMS. A quasi-experimental prospective cohort study design was employed, following up the women for a period of three years starting in 2017, using both qualitative and quantitative data collection and analysis approaches. The data reported in this study, was generated from the Ministry of Health (MOH) antenatal care and maternity registers at the health facilities and the study-designed appointment registers that linked these two services for each pregnant woman enrolled to the study at the health facility. A detailed description of the methodology and results is captured under chapters three and four respectively.

1.9 Study Limitations

This research was conducted within the Ministry of Health (MOH) routine system of healthcare workers and the reporting structures. Therefore, it was vulnerable to possible healthcare worker strikes, commodity stock outs and common challenges in reporting at the

health facilities. To mitigate against strikes, the study broadened the scope for possible follow up of participants who were enrolled at Kapenguria County Referral Hospital but preferred to change health facilities. This was mainly observed during the healthcare worker strike that occurred in 2016. Health care workers were sensitized and mentored on reporting the key indicators before and during the study, which included appointment dates and the regular recording at the health facility. This made it easier for data capture by the research assistants. The researcher worked closely with the county health management team to ensure MOH reporting tools were availed at the health facility. While reviewing the MOH reporting registers, there were no registers to document client appointments except the mother child booklet which was stored by the client. This implied that from the health facility, no one could follow up on the appointments. If the client lost the booklet, then her appointment dates were lost. Additionally, among the regular health facility registers, there was no active follow up and linkage on clients who attend ANC and those who deliver at the health facility. Due to this, appointment registers that allowed for linkage from ANC to delivery were designed by the researcher and used in the study to follow up all enrolled pregnant women.

Confounding was foreseen to potentially take place between participants in the intervention and the control arms for those who lived in very close proximity. To minimize this effect, participants were recruited and assigned to the arms based on their sub locations of residence which were at least forty kilometres apart, as guided by the maps and further information from the county community focal persons.

West Pokot County is insecure due to cattle rustling; this was a potential threat to the study should the community wars begin. The study was conducted at a central health facility that is located away from the borders where there was likely to be cattle rustling. The heated

political environment in the country during the 2017 elections, may have affected the activities of the study and client flow, between the start and the final elections. The study employed locals from West Pokot County to collect the data and report on it as well as riding on the existing MOH structure.

1.10   Conclusion

Mobile phone subscription is already high in Kenya, at more than one 100% while maternal health disparities are still evident across the different counties and settings. In West Pokot County, mobile phone subscription is at 71%. The need to fast track achievement of SGD 3.1, requires adoption of innovative approaches by health facilities, to augment the existing efforts like working through the community health strategy, policy adjustments, campaigns and provision of personnel and equipment. Despite being highly advanced technologically and particularly on the use of mobile technology for banking and other services, Kenya has already been ranked among countries with high maternal mortality ratios hence the need for embracement of this technological edge towards improved maternal health. The following chapters of this thesis introduce the concepts discussed in this chapter in a broader sense. Chapter two, which follows immediately expounds on the literature review from other scholars while chapter three discusses the methodology applied. Results are presented in chapter four as chapter five concludes with discussions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides an overview of previous research on the use of mHealth interventions to improve maternal health outcomes, the methodologies applied and the existing knowledge gaps. It also explores the demographic factors that affect utilization of antenatal care and skilled delivery attendance. The conceptual framework that elaborates on the study variables, their inter-relationships and measurement is also described and presented in a diagram. The section is arranged as per the study specific objectives that are outlined in chapter one. For the first two objectives, it is noted that in several studies where mHealth interventions were conducted, the two outcomes were observed concurrently for the demographic factors. It is for this reason that the first section 2.2 below is describing demographic factors for both ANC and SDA under the same section.

2.2 Demographic factors associated with antenatal care attendance and skilled delivery attendance

Several studies have revealed that demographic factors have influence on maternal health outcomes even though the observed outcomes vary from place to place. In sub-Saharan Africa, mothers' education is important to achieving more utilization of maternal healthcare services and reducing maternal mortality, while women living in rural areas and of low financial strength are at a disadvantage (Akpanekpo & Umoessien, 2017).

A systematic review of both cohort and cross-sectional studies, concluded that urban residence, increasing age of the mother, low parity, being educated and having an educated partner, being employed, being married and Christian religion as predictors of ANC

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attendance and timeliness. Awareness of danger signs, timing and adequate number of antenatal visits, exposure to mass media and good attitude towards ANC utilisation made attendance and initiation of ANC in the first trimester more likely. Having an unplanned pregnancy, previous pregnancy complications, poor autonomy, lack of husband support, increased distance to health facility, not having health insurance and high cost of services negatively affected the overall uptake, timing, and frequency of antenatal visits (Okedo-Alex.IN *et al*, 2019). These studies bring out the aspect of geographic setting and further point out the disadvantage among women in rural areas. West Pokot County is largely a rural setting in Kenya characterized by women who are illiterate and whose decisions are made for them, either by their husbands, mothers, or other relatives in the community.

A study conducted in Southeast Nigeria that aimed at exploring the pattern of maternal health (MH) services utilization and the socio-demographic factors influencing it, reported parity as being associated with timing of ANC booking and number of ANC attendance ($\chi 2 = 9.49$, P $= 0.05$). Increasing maternal age and educational status were found to highly influence the tendency to seek maternal health services at a formal health care facility (Emelumadu *et al,* 2014). In Zambia, another study among 400 expectant women established that reduced income level was associated with decreased use of antenatal care (OR=0.1, P<0.05). On the other hand, increased distance to the health facility was associated with reduced health facility deliveries (OR=0.1, P <0.05) while an increase in the maternal age was associated with increased utilization of maternal health services (OR=2.1, P<0.05) (Chamileke, 2017).

A qualitative study in Northern Uganda among 115 participants in a post conflict setting revealed that exposure to armed conflict affects women's utilisation of reproductive health services mainly through impeding women's health seeking behaviour. The key factors

included women's fear of developing pregnancy-related complications, status of women empowerment and support at the household and community levels. From the service delivery point of view, the removal of user-fees, proximity to the health facility, and attitude of health providers were seen to be factors that will enhance utilization of the services (Chi *et al*, 2015).

A cross sectional survey study conducted in Mwingi, Kenya in 2015 revealed that expectant women with higher education levels were more likely to seek SDA services as compared to those with less. Expectant women in households earning more than the Government of Kenya (GoK) recommended minimum wage (Kshs. 13,674; USD 136.74 in 2013) were 3 times more likely to seek ANC services as recommended compared to those earning equal or less than the minimum wage. Regarding occupation, expectant women in employment as well as expectant women doing small scale business were 3.7 times more likely to seek ANC services as recommended compared to peasants. The probability that a woman with 3 or more children would seek ANC services for at least 4 times reduced by 84% compared to those with 2 children and below. Contrary to other studies, with reference to SDA, this study concluded that the probability of an expectant woman to deliver in a medical facility reduced with increase in her age. Women from households with income above a dollar per day and those in employment were 6 times more likely to deliver at the health facility. According to this study, the more children a woman had the more likely she was to deliver at home (Nzioki, Onyango & Ombaka, 2015). While increase in age and education, have been noted to increase utilization of maternal health services, this study in Kenya had some contradicting evidence where increase in some of the components above, resulted in a decrease in the use of the services.

In Busia County Kenya, unreliable transport especially at night, limited infrastructure and low socioeconomic status of the women were the key barriers to maternal health services utilization (Wafula, Arudo, & Kipmerewo, 2020). In Kajiado County, Magadi sub-county, Kenya, belonging to the highest wealth quintile, being out of a marital union and living near a health facility were positively associated with health facility delivery (Karanja *et al*, 2018). This study in Kajiado, brings out a different perspective to being in a marital union which in many other studies, derives support for maternal health services.

2.3 Comparison of antenatal care attendance among women who received SMS reminders and those who did not receive the reminders

Two of seven studies examining antenatal care attendance were RCTs (Fedha, 2014; Lund *et al*, 2014) with both studies using text message reminders and education for pregnant women. One of the studies also provided the women with mobile phone vouchers to contact their health worker, if needed (Lund *et al*, 2014). Both studies found a statistically significant increase of over 10% in the proportion of women receiving at least four ANC visits between the intervention and control groups. Another study examined antenatal care attendance before and after implementation of an M-Health intervention for improved patient records and automated appointment reminders and this study similarly found a statistically significant improvement in on-time ANC attendance (Kaewkungwal *et al*, 2014).

A study conducted in China sent text message reminders for antenatal care and health advice to an intervention group and found a statistically significant increase in ANC attendance, compared to a control group (Corpman, 2013). The remaining studies examining antenatal care attendance found some self-reported behaviour change from both patients and health workers (Lau *et al*, 2014 and Crawford *et al*, 2014). A non-randomized controlled study was

conducted in the Amhara region, Ethiopia in 10 health facilities (5 intervention, 5 control) together serving around 250,000 people. Reminders were sent for scheduled visits during antenatal care (ANC), delivery and postnatal care (PNC), and educational messages on dangers signs and common complaints during pregnancy. The medical records of 1224 women who had at least one antenatal care visit were followed in the longitudinal study. Women who had their ANC visit in the intervention health centres were significantly more likely to deliver their baby in the same health center compared to the control group (43.1% versus 28.4%; Adjusted Odds Ratio (AOR): 1.98 (95%CI 1.53–2.55). A significantly higher percentage of women who had ANC in the intervention group had PNC in the same health center compared to the control health centres (41.2% versus 21.1%: AOR: 2.77 (95%CI 2.12–3.61)) (Shiferaw *et al*, 2016).

A systematic review of literature on studies conducted using text messaging or voice to influence patient behaviours for antenatal care attendance, postnatal care attendance, or childhood immunization rates was done by Watterson, Walsh and Madeka (2015). Most of the studies (80%) that met the inclusion criteria used text or voice message reminders to influence patient behaviour change and most (80%) were conducted in African countries. All studies showed at least some evidence of effectiveness at changing behaviour to improve the three outcomes above. However, many of the studies were observational and further rigorous evaluation of mHealth programs is needed in a broader variety of settings.

2.4 Comparison of skilled delivery attendance among women who receive SMS reminders and those who d0 not receive the reminders

A cluster randomized control trial that was carried out in Zanzibar targeting women on their first ANC visit to a health facility. Two thousand, five hundred and fifty pregnant women

(1311 interventions and 1239 controls) who attended ANC at one of the selected primary healthcare facilities were included at their first antenatal care visit and followed until 42 days after delivery. The study revealed that mobile phone intervention was associated with an increase in skilled delivery attendance: 60% of the women in the intervention group versus 47% in the control group delivered with skilled attendance. The intervention produced a significant increase in skilled delivery attendance amongst urban women but did not reach rural women (Lund *et al*, 2012).

In Rwanda, an SMS-based system was developed to improve maternal and child health (MCH) using Rapid SMS, a free and open-sourced software which was customized to allow interactive communication between a community health volunteer (CHV) following mother-infant pairs in their community, a national centralized database, the health facility and in case of an emergency alert the ambulance driver. The Rapid SMS-MCH system was piloted in Musanze district, Northern Province of Rwanda over a 12-month period. A total of 432 CHVs were trained and equipped with mobile phones. A total of 35,734 SMS were sent by 432 CHV from May 2010 to April 2011 with 11,502 pregnancies being monitored. A total of 362 SMS alerts for urgent and life-threatening events were registered. An increase in facility-based deliveries was registered from 72% to 92% at the end of the twelve months (Ngabo *et al*, 2012).

According to Colaci, Chaudhri and Vasan (2016), six studies supported the use of mHealth for provider-to-provider communication and one for clinical management. Studies demonstrated promise for the use of mHealth in maternal health; however, much of the evidence came from low- and moderate-quality studies. More testing is required before scale up decisions are taken by any organization. Another study was conducted in Nairobi, Kenya

to assess the effect of short message service (SMS) communication on facility delivery, exclusive breastfeeding (EBF), and contraceptive use. Women were randomised (1:1:1) to receive one-way SMS versus two-way SMS with a nurse versus control. Weekly SMS content was tailored for maternal characteristics and pregnancy or postpartum timing. The overall facility delivery rate was high (98%) and did not differ by arm. Compared with controls, probability of EBF was higher in the one-way SMS arm at 10 and 16 weeks, and in the two-way SMS arm at 10, 16, and 24 weeks (P < 0.005 for all). Contraceptive use was significantly higher in both intervention arms by 16 weeks (one-way SMS: 72% and two-way SMS: 73%; P = 0.03 and P = 0.02 versus 57% control, respectively); however, this difference was not significant when correcting for multiple comparisons (Unger, J.A. *et al*, 2018).

A systematic review and meta-analysis of 7 randomized control studies, was aimed to determine the effectiveness of short message services (SMS) on Focused Antenatal Care (FANC) visits and the attendance of skilled birth professionals in Low-and Middle-Income Countries (LMICs). Pregnant mothers who received text messaging had a 174% increase in FANC visits (OR = 2.74 (95% CI: 1.41, 5.32) and 82% in skilled birth attendance (OR = 1.82 (95% CI; 1.33, 2.49) (Wagnew, *et al,* 2018). A randomized control trial carried out among pregnant women attending public health antenatal clinics in Migori County. Four health facilities were randomized: two as intervention and two as control. A total of 379 participants were recruited into the study. The study group participants received a verbal message on birth preparedness and a mobile phone text message reminder one month to their expected date of delivery. Follow up was done to both groups through their mobile phone contacts. The respondents in the study group who were birth prepared were 74.3% (n = 136) while those in the control group were 48.1% (n = 77) (Cheptum, Omoni & Waithira, 2019). Four health facilities were randomized: two as intervention and two as control.

Evidence for the effectiveness of mHealth (direct messaging, voice counselling, job aid applications and interactive media) approaches is growing but remains limited for many Maternal, Neonatal and Child Health outcomes. The four approaches differ in key implementation elements, which touch on frequency, length and complexity of communication, and potential for personalization. These elements influence resource allocation and are likely to impact effectiveness with respect to content and delivery approach to the local context (Mildon & Sellen, 2019). The evidence review for the recently published Digital Health Guidelines found moderate evidence that targeted client communication improves attendance at four or more antenatal care (ANC) visits, antenatal use of iron-folic acid supplements, skilled birth attendance and infant vaccination rates, but concluded that effects on other MNCH outcomes are uncertain due to limited or poor quality evidence (WHO 2019).

2.5 Challenges faced by pregnant women in seeking antenatal care and skilled delivery services

Many women in Africa face challenges when it comes to making decisions pertaining to their health. African cultural beliefs and traditions promote men's hierarchical role in sexual relationships and especially marriage (Morrell, Jewkes & Lindegger, 2012). More recent studies show that inadequate autonomy, maternal support and cultural barriers to utilising timely and appropriate maternal care have also had a significant impact on service use and is associated with maternal health outcomes. A pregnant women's ability to choose a healthcare provider, act on her preferences, and be sufficiently financially empowered to take the lead in deciding on reproductive and pregnancy care has significant effects on service utilisation outcomes. In parts of sub-Saharan African countries, decisions regarding birth location were

commonly made by the woman's husband, mother, mother-in-law or other relatives. (Amzat, 2015; Sumankuuro, Crockett, Wang, 2017; Sumankuuro *et al*, 2018). Javanmardi, *et al*, 2019, identified the main barriers to access health information during pregnancy as follows: many duties of women at home as well as out-of-home education and employment, inability to make distinction between correct and incorrect information, insufficient interactions between women and healthcare providers, failure to access to various information resources, common complaints of pregnancy, and stress and anxiety of confronting the problems during pregnancy (Javanmardi, *et al*, 2019). Nwagwu and Ajama (2011), pointed out to factors such as distance, high costs, and language differences as the barriers that pregnant women face when accessing health information. Das and Sarka (2014), stated in their study that pregnant women experienced poor quality of care provided in the hospital, long waiting time, fear and embarrassment to discussing pregnancy with a physician and shortage of time. Intimate partner violence continues to be practiced in many parts of Africa with varying levels and rates depending on how acceptable it is. It is associated with loss of pregnancy and contraction of sexually transmitted infections as well as lowering a woman's self-esteem (Durevall & Lindskog, 2015; Cools & Kotsadam, 2017). In West Pokot County, a study conducted in 2018 among ANC attendees revealed high violence rates which were associated with alcohol consumption, age and education of the partner, yet the ANC provided to the violence victims was not in line with WHO standards (Owaka, Nyanchoka & Atieli, 2017).

2.6 Conceptual framework

Three broad categories of variables that were collected in this study as described below and as presented by figure 1 below:

- Independent variable: Demographic characteristics of the pregnant women was collected during recruitment into the study at the health facility. The researcher did

not have manipulations for these variables. All of these variables were categorical except the mobile phone numbers, gestational age and client age, which were continuous variables. Apart from the mobile phone number, the other continuous variables were converted into categorical variables during analysis by regrouping them into known categories.

- Intervening variable: SMS reminder was the mediating variable between pregnant women and the outcome of the study for the intervention group. This was collected as a binary variable with a YES or NO as the options for the group that received messages and those that did not receive the messages respectively.

- Dependent variables: The dependent variables of this study were skilled delivery attendance, measured as YES or NO, and attendance of antenatal care clinics as per the appointments measured as YES or NO. Antenatal care attendance was further broken down to include the levels of attendance as: First to the fourth attendance. Any attendance above four was classified as more than four visits.

Figure 1

Conceptual Framework showing variable relationship and measurement

Independent variables ⇩	Intervening variable ⇩	Dependent variables ⇩

- Age,
- Education Level,
- Occupation,
- Income,
- Marital status,
- Marital type,
- Parity,
- Gravidae,
- Mobile phone ownership and access

Short Message Service reminder

Antenatal Care Attendance

Skilled Delivery Attendance

No Short Message Service reminder

Antenatal Care Attendance

Skilled Delivery Attendance

Source: Researcher 2022

2.7 Conclusion

From the reviewed studies, there is growing evidence for the efficacy of m-Health interventions in improving treatment adherence and appointment compliance in general. However, several scholars still acknowledge that research is still limited on the effectiveness of mHealth on maternal health outcomes. Existing literature on such trials indicates that most of these studies focused on urban set ups and for those that were conducted in low- and

middle-income countries, majority were of middle to poor quality. There is also the aspect of contextualization of development of mHealth solutions based on the context and for the target audience for which such solutions are developed for. This study was conducted in a semi-urban setting and it integrated the services offered by following up the same pregnant woman right from enrolment to 1st ANC services to the point of delivery at the health facility. Systematic review and meta-analysis study was aimed to determine the effectiveness of short message services (SMS) on Focused Antenatal Care (FANC) visits and the attendance of skilled birth professionals in Low and Middle Income Countries (LMICs). SMS reminders have a positive impact on antenatal care and skilled birth attendance however the qualities of included studies were moderate and had low risk of bias. (Wagnew *et al*, 2018). The evidence review for the recently published Digital Health Guidelines found moderate evidence that targeted client communication improves attendance at four or more antenatal care (ANC) visits, antenatal use of iron-folic acid supplements, skilled birth attendance and infant vaccination rates, but concluded that effects on other MNCH outcomes are uncertain due to limited or poor quality evidence (WHO 2019). Evidence for the effectiveness of mHealth (direct messaging, voice counseling, job aid applications and interactive media) approaches is growing but remains limited for many Maternal, Neonatal and Child Health outcomes. The four approaches differ in key implementation elements, which touch on frequency, length and complexity of communication, and potential for personalization. These elements influence resource allocation and are likely to impact effectiveness with respect to content and delivery approach to the local context (Mildon & Sellen, 2019).

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter outlines the study design, sampling techniques and sample size as well as data collection and analysis procedures that were used to achieve the study objectives and results. The section also describes the study site and how it contributed to the achievement of the objectives. It expounds on the ethical considerations that were observed in the process of implementation and the study outcomes, risks and limitations.

3.2 Study Area

West Pokot County is one of the forty seven counties of Kenya and one of the twenty nine counties classified as Arid and Semi-Arid Lands (ASAL). It is largely inhabited by Pokot community and minority community of Sengwer, in the Rift Valley region. It constitutes four sub counties of Central Pokot, North Pokot, South Pokot and West Pokot. Its capital and largest town is Kapenguria. The county covers an area of approximately 9,169.4 square kilometers and stretches a distance of 132 kilometres from North to South. As presented in figure 1 below, which shows the location of the county, West Pokot County is bordered to the north by Turkana County, to the east by Baringo County, to the southeast by Elgeyo-Marakwet County, to the south by Trans Nzoia County and to the west by Uganda. Appendix F shows the location of West Pokot in the map Kenya.

According to the 2019 Kenya Population and Housing Census, the county has a population of 621,241. The County is known for its rich cultural heritage. Agriculture and livestock sector is the backbone of the county's economy with more than 80% of the population engaging in

farming and related activities. The County is a member of the North Rift Economic Block. Other member Counties to this trading block include Elgeyo-Marakwet, Uasin Gishu, Nandi, Baringo, Turkana, Trans Nzoia and Samburu Counties. (County Integrated Development Plan, 2018 to 2022).

The study was conducted at Kapenguria district hospital which is the county's public referral health facility, serving West Pokot and the neighbouring counties. This is a level 5 health facility located along the Makutano – Kapenguria Road next to the administration police sports ground in Kapenguria. The facility uses the Ministry of Health (MOH), standard reporting registers and ministry of health reporting structures. Their summary data is keyed into Kenya Health Information System (KHIS) each month as per the facility reports. Table 1 below gives a summary of the key maternal health indicators from 2011 to 2019 as reported in the KHIS government system. The data presented in table 1 in the next page, is a summary of the indicators that have been reported in the Kenya Health Information System, from the inception of the system, 2011 to 2019. This is in exclusion of any such indicators, for maternal health outcomes that take place within the community and hence do not flow through the health facility reporting systems.

Table 1

Maternal health indicators profile at Kapenguria County Referral Hospital 2011 to 2019

Year	2019	2018	2017	2016	2015	2014	2013	2012	2011
Adolescent pregnant women (10-19 years)	36	. 34	. 32	. 34	. -	. -	. -	. -	. -
New ANC Clients	3,335	.2,983	.1,708	.2,696	.2,686	.2,213	.2,112	.1,945	.2,265
Re-visit ANC clients	5,020	.4,896	.2,170	.4,128	.3,181	.2,995	.2,713	.2,124	.2,747
ANC 4 visits	.1,085	.1,139	. 448	. 824	. 932	. 666	. 503	. 285	. 514
Normal deliveries	3,365	.3,648	.1,806	.3,339	.3,258	.2,813	.2,225	.1,738	.1,860
Assisted vaginal deliveries	. 13	. 30	. 1	. 3	. 314	. 257	. 16	. 12	. 29
Breach delivery	. 58	. 58	. 31	. 56	. 65	. 65	. 62	. 40	. 57
Caesarian sections	. 946	. 947	. 328	. 794	. 642	. 517	. 483	. 387	. 474
Fresh still birth	. 108	. 114	. 48	. 95	. 69	. 91	. 82	. 50	. 68
Live birth	.4,091	.4,518	.2,043	.3,608	.3,807	.3,236	.2,569	.2,087	.2,306
Mascaraed still birth	. 70	. 75	. 38	. 73	. 91	. 67	. 49	. 53	. 56
Deliveries among HIV +ve mothers	. 29	. 47	. 23	. 40	. 39	. 20	. 36	. 42	. 37
Babies discharged alive	.3,982	.4,502	.1,871	.3,558	.3,789	.3,269	.2,488	.1,874	.2,214
Maternal deaths 20+ years	. 12	. 16	. 4	. 11	. 2	. 6	. 9	. 10	. 7
Maternal deaths audited	. 12	. 16	. 2	. 11			. 4	. 10	. 7
Maternity referrals from other health facility	. 600	. 299	. 92	. 155	. 17	. 10	. 41	. 19	. 17
Neonatal deaths	. 108	. 72	. 59	. 87	. 70	. 61	. 61	. 52	. 70
Pre-term babies	. 446	. 201	. 73	. 211	. 106	. 73	. 73	. 125	. 163
Underweight _lt2500gms	. 707	. 559	. 214	. 425	. 434	. 395	. 268	. 192	. 234

Source: Kenya Health Information System, retrieved in October, 2020

3.3 Target Population

According to Asiamah, Mensah and Oteng-Abayie, (2017), the target population for a survey is the entire set of units for which the survey data are to be used to make inferences. For this study, these are women of reproductive age estimated at 156,190 and expectant women estimated at 23,492 by the Ministry of Health as accessed in the Kenya Health Information System.

3.4 Study Design

Quasi-experimental prospective cohort study design was applied. Quasi-experimental design is a scientific approach where study elements are recruited using random selection methods to test causal hypothesis. Assignment to each arm of the study is either done by self-selection or by the administrator or researcher (White & Sabarwal, 2014). Prospective cohort studies, observes a group of people after being exposed to a certain factor in order to investigate the outcome, following the natural sequence of time, starting with the present and looking forward in time until the outcome of interest occurs (Hammoudeh, S., Gadelhaq, W., & Janahi, I., 2018).

In this study, apart from the intervening variable defined as the SMS reminder, which the researcher manipulated by sending the messages at 24 hours before the appoint date, the other variables were naturally occurring. The naturally occurring variables included the demographic variables of the participants and where they stayed. Additionally, the outcomes of interest (antenatal care and skilled delivery attendance), were observed and recorded after the intervention (SMS reminders) for a period of time until the ANC and or SDA occurred in the intervention group. A control group for which no reminders were sent, was equally followed up and the ANC and SDA attendance documented. In this approach, study

participants who meet the eligibility criteria were followed up to the point of attainment of the study outcomes of interest for three years as from 2017.

Participants were recruited as they left the first antenatal care service delivery point and upon consenting into the study regardless of their gestation age. This further enabled the study to demonstrate the occurring trend at the health facility in terms of the gestation age at which women presented for their first ANC.

Self-selection into the study arm was determined by the sub location of residence and its location by distance from those in the control arm; at least 40 kilometres apart. The researcher did not have control over where study participants resided. These resident areas needed to be at least 40 kilometres apart and if that was not the case, then the participants would not be recruited into the study. Information on the sub location and the distance above was determined with the guidance of the West Pokot County Community strategy focal persons. The details on participants area of residence were collected along with the demographic information after consent. An allocation map showing the sub locations in West Pokot and the arm the study participants belonged to, was used for reference. After the groupings into either the intervention or the control arm and collection of background variables, participants would then be informed about the intervention if they belonged to the intervention arm. For both arms, key messages on the importance of keeping hospital appointments were communicated to the participants. From this point onwards, the pregnant women were followed up from the date of enrolment to antenatal care program for the first ANC attendant to be enrolled into the study, to the date of delivery at the health facility for the last ANC attendant on follow up. This was done with respect to the desired sample size and as the study key outcomes are being attained, observed, and documented over time. The

follow up was conducted as per the recommended appointments scheduled at the health facility to the point of delivery. Pregnant women in the intervention group received SMS reminders of the appointment dates and venue 24 hours before the actual appointment day while those in the control group did not receive any reminders.

Figure 2

Schematic Illustration of the study design - Prospective Cohort Quasi experimental
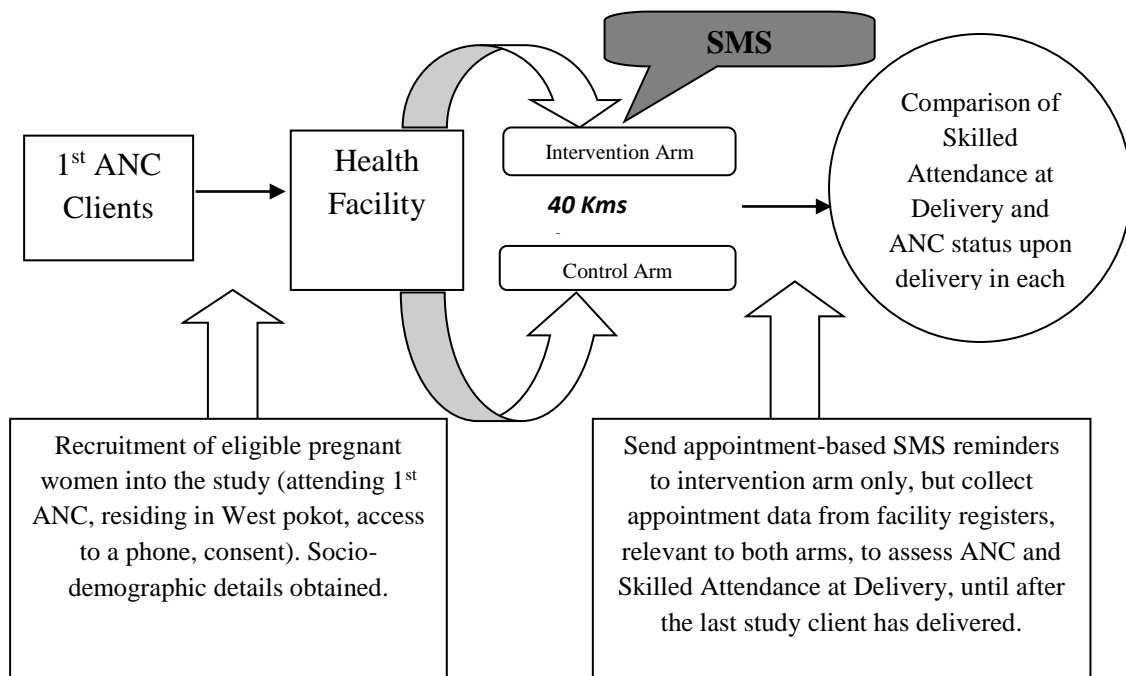
Source: Researcher 2022

3.5 Sampling frame

A sample frame is the listing of the units from which a sample is to be selected (DiGaetano, 2013). The sampling frame of this study was specific to the listing of all women who attended the first ANC visit at Kapenguria county referral hospital which was 2,696 in the year 2016 according to the Kenya Health Information System (KHIS).

3.6 Inclusion Criteria

Only first ANC attendants who consented participation in the study and were residing in West Pokot County at the time of the study were recruited. These participants needed to have had a confirmed pregnancy by a test at the health facility. Pregnant women had to have access to mobile phone SMS at least once a day, even if they did not own a mobile phone. This was either through the household head, relative, friend or any other source that was near their place of residence and that the expectant women preferred. Among the pregnant women who were minors, consent by an accompanied guardian was compulsory. However, emancipated and or mature minors were to consent as adults in line with the guidelines for conducting adolescent HIV, sexual and reproductive health research in Kenya (National AIDS and STI Control Programme (NASCOP) & Kenya Medical Research Institute (KEMRI), 2015).

Kapenguria county referral hospital was the main health facility where the study took place since it offers all maternal health services including conducting surgeries within the county and for neighbouring counties. However, as soon as the study was almost kicking off in 2016, there was a nationwide nurse's strike, and this affected the study timelines. Adjustment was therefore made to give room for the study to begin follow up at Kapenguria hospital but be able to follow up ANC attendants who decide to go to private hospitals as a result of the strike. As the study kicked off in 2017, there was no more health workers strike and therefore all ANC attendants were followed up at Kapenguria health facility.

3.7 Exclusion Criteria

Pregnant women who were not residing in West Pokot County or were planning to move out of the County within a year were not recruited into the study, even though they attended their

first antenatal care visit at Kapenguria County Referral Hospital. Also, with regard to the study design, any participant who lived below the 40-kilometre distance from their counterparts in the control group, were not recruited. Those who had made more than one visit to the health facility already and who did not have access to a mobile phone, were not recruited into the study. Health facilities that were not offering ANC or SDA, were not included in the study.

3.8 Sampling Design

Sample design refers to the plans and methods to be followed in selecting sample from the target population (Kabir, 2016). A sample is a representation of the target population. Different sampling designs were used for the data collected, depending on whether the data was quantitative and or qualitative. The sections below detail the processes and methods that were employed.

3.8.1 Quantitative Data - Sampling Design and Sampling Frame

The quantitative approach to gathering information focuses on describing a phenomenon across a larger number of participants thereby providing the possibility of summarizing characteristics across groups or relationships. This approach surveys a large number of individuals and applies statistical techniques to recognize overall patterns in the relations of processes (Rahi, 2017).

For quantitative data, systematic sampling was used to select clients' participation in the study. Systematic sampling is a process by which the sampling units are selected from an ordered sampling frame (Black, 2004). This design best fitted the study since the first ANC attendants at the facility attended services in the order of first come first served and departed

in a similar fashion: first served first leaves. The first sampling point was randomly identified through tossing a coin and a head up fall led to the selection of the first study participant, as soon as they walked out of the ANC service delivery point. Based on this first participant as the reference point, every 6th participant that left the ANC service delivery point was recruited into the study, upon consent. Participants were randomly consented or assented (with guardian consent for those less than 18 years of age) and recruited into the study.

3.8.2 Qualitative Data - Sampling Design and Frame

The qualitative approach to gathering information focuses on describing a phenomenon in a deep comprehensive manner. This is generally done in interviews, open-ended questions, or focus groups. In most cases, a small number of participants participate in this type of research (Rahi, 2017). Convenience sampling together with focus group discussions were applied. Women of reproductive age, who had delivered within a year were identified and put into a discussion upon consenting to participate. Social gathering points such as the markets, churches and women groups were used to identify and reach these women.

A focus group is a planned, facilitated discussion among a small group of stakeholders designed to obtain perceptions in a defined area of interest in a permissive, non-threatening environment. Focus groups are good for initial concept exploration, generating creative ideas, testing ideas and determining differences in opinion between various stakeholder groups (Campbell, 2008). Focus group discussions were conducted before onset of the main study to identify perceptions of the SMS system and to bring out the challenges women face when seeking ANC and SDA services at the facilities. In-depth discussions were held to understand the general understanding of the women on maternal health in general and some of the risks during pregnancy.

3.9 Sample size

Sample size is a measure of the number of individual observations used in a survey or experiment (Zamboni. 2017). The study used sample sizes defined and calculated as below.

3.9.1   Quantitative Data Sample Size

The sample size under this design was determined by the formula below that is recommended for testing the difference in proportions in the two arms with equal sizes:

$$n = [Z_{alpha/2} + Z_{beta}]^2 \times \{P_1 Q_1 + P_2 Q_2\}/ d^2 \text{ (Noordzij, 2010)}$$

Where;

- **n** is the desired sample size

- **Z** is the score under the normal curve at an alpha level of 0.05 and a study power of 80%,

- **d** is the difference the researcher wishes to detect. This will be estimated at (15%)

- **P_1** is the expected proportion of the population with characteristic of interest in the intervention arm

- **Q_1** is the proportion of the population without the characteristic of interest in the intervention group.

- **P_2** is the expected proportion of the population with characteristic of interest in the intervention arm

- **Q_2** is the proportion of the population without the characteristic of interest in the intervention group.

The study assumed no change in the control arm and adopted the prevailing skilled delivery attendance rate in West Pokot at 25.8% (P_2) as estimated by the Kenya Demographic Health Survey (KDHS), 2014. In the intervention arm, a difference of at least 12.5% was expected and thus the outcome was expected to be at 40.8% (P_1), which was determined by adding

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12.5% to the baseline value of 25.8%. Inputting these values in the formula above yields the following:

$$n= [[1.96+0.84]^2 \text{ x } [0.383(0.617) +0.258 (0.742)]/ [0.125]^2$$

$$=7.84 (0.21+0.19)/0.0156$$

$$=215$$

The sample size was therefore approximated at **215** first ANC attendants in each arm of the study with an overall sample size of **430** first ANC attendants. During data collection however, the study was able to enrol a total of **462** respondents.

Since systematic sampling was used to recruit clients into the study, the sampling interval was determined by the formula below:

Expected monthly population size over study period/Sample size=2696/430 = 6

Where the expected monthly population size referred to the number of 1st ANC attendants in 2016, before the study began as reported by the facility to be 2,696.

3.9.2 Qualitative Data Sample Size

A total of twelve focus group discussions (FGDs) were conducted for women of reproductive health who had delivered within a year. Each of the FGDs comprised of eight women of reproductive age, a moderator to regulate the discussions and a transcriber to document the information.

3.10 Data collection Methods

Study information was collected by use of structured questionnaires for quantitative data, focus group discussion guides for qualitative data, health facility regular reporting registers and a study designed appointment register, that linked first ANC attendance to subsequent ANC visits as well as delivery.

3.10.1 Structured questionnaires

Structured questionnaires were based on closed ended questions which produce data that can be analysed quantitatively for patterns and trends (Cohen, Manion, & Morrison, 2000). Appendix A5 is an attachment of the structured questionnaire that was used in the study. Questionnaires were filled on the background information of the first ANC attendants and to establish their access to a mobile phone. Further follow up questions on appointments were documented on the study appointment registers attached under appendices A6 and A7. Once a reminder was sent to a client, the health facility register was checked in comparison to the study appointment register and updates on honoured appointments documented. After the appointment date had elapsed, and the client had not shown up, the appointments were checked for a period of three days before finally updating client details as having missed the appointment. This gave room to capture clients who miss the exact appointment date by few days but still visit the facility at a later date. Client appointment information was updated continuously until the last client reached the delivery date. Hospital records were used to get information on ANC and skilled delivery before and after the onset of the SMS intervention.

3.10.2 Focus Group Discussion Guide

This is a structured guide used to obtain in-depth information from a group of people about a particular topic. It allows for gathering of more details, group interaction and thus building on

each other's responses and emergence of new topics (Gerritsen, 2011). The study applied focus group discussions as the qualitative method of gathering information; one of each in every sub county. A guide was developed and is attached as appendix A8. The study hired moderator and the transcriber, who understood and could communicate in local dialect. During the market days and the church going days women who had delivered in the last two years, were identified, approached and consented to the FGDs. Consent forms were signed at this stage and contact information of the potential participants collected. The demographic details of the participants were documented during the discussions and other questions and responses as the themes emerged. During focus group discussions with the women, guides as well as sound recorders were used to capture information. Once the sessions were over, participants were thanked, and sessions adjourned.

3.10.3 Health Facility Regular Reporting Registers

Regular MOH reporting registers were used to track pregnant women at the Health Facility. Skilled delivery attendance was recorded in the Maternity Services Health Facility Register (MOH 333) and the antenatal care attendance in the Antenatal register (ANC) MOH 405. Pregnant women were given the Mother and Child Health Handbook booklet (MOH 216) for appointments and general health monitoring, which was at the custody of the expectant women.

3.10.4 Study appointment registers

Two appointment registers were designed for the study to track all ANC and SDA appointments. Given that the MOH 216 was at the custody of the pregnant women, it was important to have the study registers handy in the event the booklets are misplaced by the clients. The ANC appointment tracker (Appendix A6) and the Maternity appointment tracker

(Appendix A7) documented the client details, appointment dates and linked clients between the two registers by assigning them unique identifiers. This enabled tracking of the same client across the two service delivery sections.

3.11 Pilot Study

This is a small-scale preliminary study conducted in order to evaluate feasibility, time, cost, adverse events, and effect size (statistical variability) in an attempt to predict an appropriate sample size and improve upon the study design prior to performance of a larger scale study (Hulley, 2007; Leona's, Davis and Kraemer, 2011). The study used 10% of the total sample size, thus 40 participants using 20 in each arm, to conduct a pilot study to test the tools and feasibility of the design. The study was done at Chepareria health facility within West Pokot County, that offers maternal health services to produce the outcome of interest for a period of three months. The same study design was employed – quasi experimental prospective cohort. The women were followed up to the point of delivery and since majority presented at advances gestation age, it was possible to follow them up within a short period. There were no major variations in the study tools or design except a mitigation for potential healthcare worker strikes. The mitigation opened room for the study to follow up clients who decide to seek services in other health facilities, especially private ones, after having been enrolled at Kapenguria County Referral hospital.

3.12 Data processing, management and analysis

Data was checked for errors and missing information at each stage of the study up to the last ANC visit and delivery of the last participant. This involved random checks between the keyed in details and confirmation with the information in the registers at the health facility as well as questionnaires. This was then fed into SPSS version 22, cleaned, and analysed.

Demographics and background details of the clients were presented using frequencies, means and modes.

Objective 1&2: To establish association between demographic factors and study outcomes (antenatal care attendance and skilled delivery attendance) among pregnant women in West Pokot County.

Predictor variables were represented by frequency tables and measures of central tendency described as the mean, mode and median. The chi square test of association was used to test the hypothesis that assumes a significant association between the predictor variables and the study outcomes, presented in chapter one. This test best fits here as it is used in circumstances where both the predictor and outcome variables are categorical in nature (Preacher, 2001; Rana. & Singhal. 2015). The predictors were the socio-demographic variables which were both categorical and continuous at collection but later all converted to categorical at analysis. Outcome variables identified as SDA and ANC were all categorical variables with two options as YES or NO. Variables that did not have any statistically significant association between themselves and the study outcome variables were dropped from further analysis. The presentation of all analysis done for all variables is presented in chapter four.

Objective 3: To compare antenatal care attendance among pregnant women who received SMS reminders and those who did not receive the reminders in West Pokot County.

ANC attendance is a binary outcome at all levels with a YES for attendance and NO for non-attendance. A summary of the study findings was presented in 2x2 contingency tables comparing incidence in the intervention and the control arms post-exposure. Relative risks were computed, which measures the probability of the study outcomes in the intervention

group in relation to the control group. This will be estimated from the log-binomial regression model (Kohlmann, 2008).

Objective 3: To compare the attendance of skilled delivery services among pregnant women who receive SMS reminders and those who do not receive them in West Pokot County

SDA was equally a binary outcome variable with YES and NO as the options and SMS with YES and NO as the options for the intervening variable. Contingency tables (2X2) were developed, incidences and relative risks were then computed as well.

Objective 4: To identify challenges faced by pregnant women in seeking antenatal care and skilled delivery services in West Pokot County.

Qualitative data was analysed thematically using framework analysis. All the data collected during the FGDs was documented word for word as was being discussed by the participants. The transcriber immersed themselves into the data to understand what they are collecting. Transcriptions were then read line by line while applying 'codes' to passages in the data according to the pre-defined themes picked from the data in line with study objectives. Any additional information that was not within the themes was identified and coded accordingly. Framework for analysis was developed based on the codes identified. The analysis framework was triangulated with any other data and information collected in the study. Data from the transcription was charted into the framework matrix in summaries other than quotes. The data was finally interpreted (Gale *et al*, 2013).

3.13 Ethical consideration

In line with the duty of researchers, this study ensured protection of the life, health, dignity, integrity, right to self-determination, privacy, and confidentiality of personal information of

the participants (World Medical Association, 2013). The study also adhered to the three key ethical principles outlined in the Belmont report 1978, with regards to respect for persons, justice and beneficence when dealing with human subjects. An outline of the ethical observations in the study included:

- **Ethical approval**: This research was reviewed and approved by Maseno University Ethical Review Committee (MUERC). Approvals were also sought and granted from the West Pokot County director of health and the County Commissioner before onset of the study.

- **Informed Consent**: Consent of participation into the study was done in written form from all women above 18 years of age, attending first ANC visits. Pregnant women were informed about the study and its objectives and asked to consent to receipt of messages via mobile phones. Participants were free to withdraw from the study at their will. Safety concerns were all addressed with all participants. This study did not expose the participants to any known adverse effects or dangers. It adhered strictly to the *"above all else do no harm"* principle.

- **Assent**: Research ethics require that a minor be included into a study only after consent from their guardian or parent and assent from the minor. However, according to the Guidelines for Conducting Adolescents Sexual and Reproductive Health Research in Kenya 2015, adolescents under 18 who are living independently may not fit the definition of "children" and are able to consent for themselves without a waiver of parental permission. According to these guidelines and for adoption in this research, the following further exceptions to parental permission were applied:

- o Research involving emancipated minors

- o Research involving mature minors

- o Research involving care related to prevention or treatment of pregnancy - an adolescent may consent, but not to sterilization or necessarily abortion

The study therefore applied the consenting for guardian and or parent for minors as applicable with the mentioned exceptions above.

- **Voluntary participation**: Participation in the study was fully voluntary and any participant who chose to decline or withdraw was excluded from the study. Participants were allowed to take part in the study without any form of coercion as well as withdraw from the study at will.

- **Privacy**: Privacy refers to an individual's right to be free from intrusion or interference by others. In this study, participants were approached as they left the service delivery point of 1st ANC. They were informed about the study in seclusion from other parties at the health facility and given the freedom to decide whether to take part or not.

- **Confidentiality**: This is the obligation of an individual or organization to safeguard entrusted information. All study information was encrypted in the form of special codes and no personal identifying information (PII) of any participant was exposed to parties other than the researcher and data collectors. These details were also only used for identification during follow up after which they were discarded. The rest of the information was left at the health facility registers.

- **Justice**: All study procedures were administered in a reasonable, non-exploitative, and systematic manner. The study participants were not subjected to any additional costs by allowing them to operate in their normal way of life except for their permission to receive text messages. Both the intervention and the control arm participants were given general education about pregnancy, potential risks, and the benefits of keeping health facility appointments.

- **Beneficence**: Participants of this study benefited from continuous education at the health facilities on the importance of keeping the scheduled appointments. For those who complied, there was the added value of eventually carrying and having a healthy outcome for both the baby and the mother. Pregnant women in both control and intervention arms of the study were given ANC and skilled delivery services whenever they visited the health facility.

3.14 Expected outcomes of the study

The main outcomes of this research were adherence to antenatal care appointments and skilled delivery attendance at the health facility. Based on the baseline, which was in reference to these indicators both in the Kenya Demographic Health Survey (KDHS) 2014 and the Kenya Health Information System (KHIS) 2015 data, the study considered an increment of 15% in either or both of these indictors as a successful outcome. From 25.8%, SDA rate is expected to be at least 40.8%, from 1st ANC of 85.2% it is expected to be at least 100% and the 4th ANC is expected to be at least 50% from 34% from the 2015 KHIS data.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter outlines the findings of the study in line with the general and specific objectives. It describes both the qualitative and quantitative findings with respect to general characteristics of study participants, evaluating demographic variables and their association with the two study outcomes and comparing study outcomes between the two study arms, following administration of the intervention. The first section describes the study enrolment and the demographic variables in univariate analysis format, followed by testing of the study hypotheses and deducing inferences by taking care of confounding variables using the binary logistics regression model.

4.2 Geographic distribution of study participants by ward

A total of 462 first ANC clients were enrolled into the study with 231 in the intervention and 231 in the control arm. Distribution of the study participants by ward is represented in table 2 below. Study participants were enrolled as they attended routine ANC services. Therefore, the pattern in table 2 below was naturally determined as clients sought services. Seven wards therefore had representation.

Table 2

Number of first antenatal care attendants by Ward

Name of Ward	Study Arm		Total
	SMS Reminders (Intervention)	No Reminder (Control)	
Chepareria	0	2	2
Kabichbich	0	3	3
Kapenguria	174	27	201
Mnagei	47	147	194
Riwo	4	2	6
Sigor	0	1	1
Siyoi	6	49	55
Total	**231**	**231**	**462**

4.3 Geographic distribution of study participants by sub location

Based on the sub locational distance within the wards, the women would fall into either the intervention or the control arms of the study. The sub locations that fell either in the control or the intervention arm, are represented in table 3 below from each of the wards and these were approximately 40 kilometers apart.

Table 3

Number of first antenatal care attendants by Sub Location

Area of residence		Study arm		Total
Ward	**Sub Location**	**SMS reminder (Intervention)**	**No reminder (Control)**	
Chepareria	Chepareria		1	1
	Kachemwoken		1	1
Kabichbich	Chorok		2	2
	Simotwo		1	1
Kapenguria	Chepkechir	4		4
	Chewoyet		4	4
	Kamatira		17	17
	Kaprom	116		116
	Komol	43		43
	Ngoleyo	11		11
Mnagei	Cheptuya		13	13
	Keringet		50	50
	Kishaunet	35		35
	Lityei	10		10
	Lokomoi		8	8
	Mnagei		21	21
	Mortome		20	20
	Psigirio		41	41
	Sukut	2		2
Riwo	Kanyarkwat		1	1
	Katikomor		1	1
	Kitela Kapel	1		1
	Serewo	3		3
Sigor	Sigor		1	1
	Talau	6		6
Siyoi	Siyoi		49	49
Total		**231**	**231**	**462**

4.4 Demographic information of enrolled first ANC attendants

At the first ANC visit, the following demographic details were collected for all pregnant women: gestation age at the first visit to ANC clinic, age of participants, number of children, marital status, level of education, occupation, income, mobile phone ownership, parity, and gravidae. The sections that follow, give detailed breakdown of the demographic information.

4.4.1   Gestation age at enrollment

Gestation age is the period between conception and birth, measured in weeks, from the first day of the woman's last menstrual cycle to the current date. A normal pregnancy can range from 38 to 42 weeks. Infants born before 37 weeks are considered premature while those born after 42 weeks are considered postmature (Mongelli & Gardosi, 2016). Early initiation of first ANC is recommended to begin before the 12th week of gestation age, to allow for the detection of any issues with the mother and or the unborn child and for early medical intervention (WHO, 2007). The gestation age of each participant was documented from the antenatal register, found at the Kapenguria referral hospital, and used to register clients who attend ANC services at MOH facilities. The classification below, is informed by the four levels as described in the WHO FANC model (WHO, 2016). Table 4 below gives a breakdown of the gestation age for all study participants.

Table 4

Participant gestation age in weeks

Variable	Category	Number (n)	Proportion (%)
Gestation age	12 weeks and below	31	7
	Up to 26 weeks	220	48
	Up to 34 weeks	205	44
	Up to 40 weeks	6	1
	Total	**462**	**100**

As seen in table 4 above, only 7% of the pregnant women turned up for first ANC and fell within the recommended 12 weeks by WHO. Majority of the women appeared for their first ANC between 12 and 26 weeks (48%) and between 26 and 34 weeks (44%), thus showing missed opportunities for medical intervention. As depicted by literature, majority of women turn up late for the first ANC and later turn to TBAs for delivery services. This research however, had interesting findings which changed this earlier trend by seeing more women adhering to subsequent appointments as shown in the sections that follow, when SMS reminders for the appointments are applied.

4.4.2 Age

Maternal age is an important factor that could affect pregnancy outcome. Many studies have reported an association between advanced maternal age and preterm delivery, low birth weight, perinatal death, and caesarean section deliveries (Kenny L.C. *et al*, 2013; Laopaiboon M *et al*, 2014 and Dietl A. *et al*, 2015). The date of birth of the pregnant women was collected by interrogation on the year of birth which then was calculated to give the age. This was later classified by five-year interval classification in line with the Kenya national census classification (KPHC, 2019).

Table 5

Age of study participants

Variable	Category	Number (n)	Proportion (%)
Age	15 – 19	91	20
	20 – 24	157	34
	25 – 29	100	22
	30 – 34	65	14
	35 – 39	35	8
	40 – 44	12	3
	45+	2	0
	Total	**462**	**100**

Table 5 above demonstrates, out of all women who visited the health facility for the first ANC service, the youngest was 15 years of age while the oldest was 45 years of age. Majority of the women were between the age of twenty to twenty-four years (34%) followed by those between the age of twenty-five to twenty-nine years (22%) then those who were teenagers at 20%. Generally, majority of the clients were below thirty years of age.

4.4.3   Number of children

Majority of the clients had between one to three children (47%), 32% of the clients did not have any children while 16% had between 4 to 6 children. Only 5% had more than seven children, majority of whom were not yet married. Table 6 below shows the breakdown of the number of children.

Table 6

Number of children by the study participants

Variable	Category	Number (n)	Proportion (%)
Number of Children	None	147	32
	1-3	220	47
	4-6	72	16
	More than 7	23	5
	Total	**462**	**100**

4.4.4 Marital status and type of marriage

Being in a marital union, has been known to have an association with positive maternal health outcomes while the contrary, generally increases maternal stress which could result in pre-term birth (Merklinger-Gruchala, Kapiszewska, 2019). The study collected the marital status of the clients attending the first ANC as either married or not married. Table 7a shows the breakdown of marital status for the study participants.

Table 7a

Marital status of study participants

Variable	Category	Number (n)	Proportion (%)
Marital status	Married	275	60
	Not married	187	40
	Total	**462**	**100**

As depicted in table 7a above, 60% of all women who participated in the study were married. Further, the type of marriage was also inspected as whether monogamous or polygamous. Table 7b shows the breakdown of the marriage type.

Table 7b

Type of marriage

Variable	Category	Number (n)	Proportion (%)
Type of marriage	Monogamous	236	86
	Polygamous	39	14
	Total	**275**	**100**

As represented in table 7b, out of all the married women, a majority (86%) were in monogamous marriages while the other 14% were in polygamous marriages.

Out of all who were married, the number of years they had been in marriage was also collected. As shown in figure 3 below, a majority of the study participants (47%) had been married for more than five years while 27% had been marriage for less than two years. The remaining 26% have been in marriage between 3 to 5 years.

Figure 3

Number of years in marriage
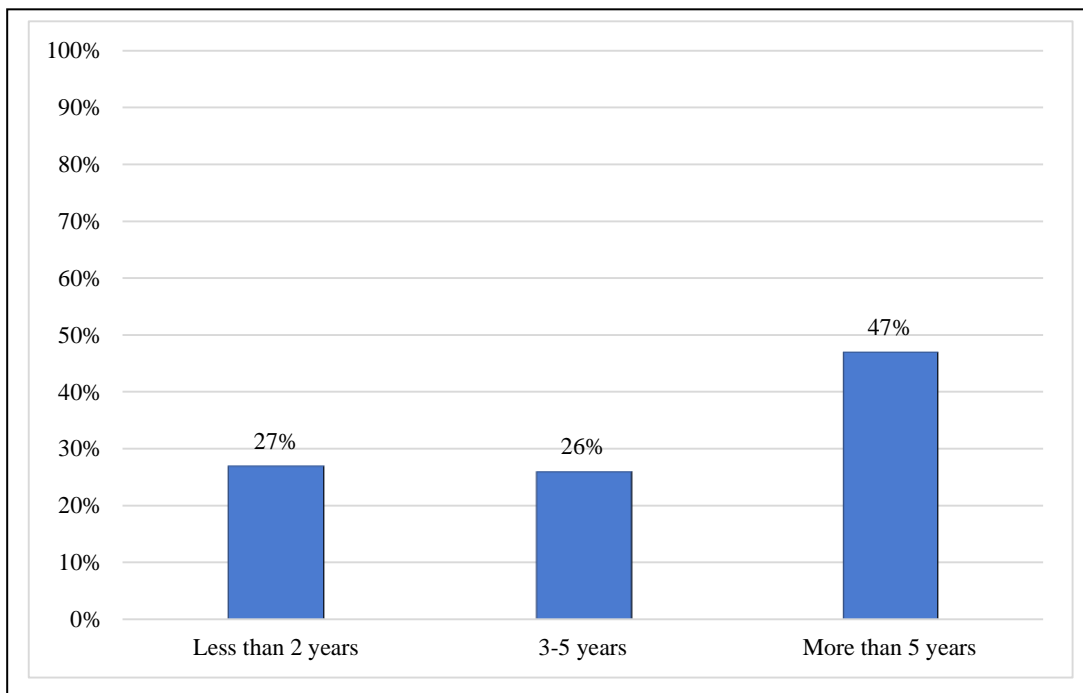
4.4.5   Education Level

Education is an avenue through which women get empowered by acquiring information. Mother's education is thought to be important for both preventing and treating poor health outcomes and illness (Demeny, McNicoll & Hodgson, 2003). The study collected data on the highest education level of the clients as well as their husbands for those who were married. As depicted in table 8 below, majority of the participants had secondary school education (36%) as the highest level of education and upper primary education level as the second most

frequent education level at 35%. Five percent of the participants had attained no level of education while another 6% had lower-level primary school education. Higher levels at university (6%) and tertiary college (13%) were also scarce. Table 8 below shows the breakdown.

Table 8

Highest education level for study participants

Variable	Category	Number (n)	Proportion (%)
Education	None	23	5
Level	Primary 1-4	26	6
	Primary 5-8	161	35
	Secondary	165	36
	Tertiary College/Institution	60	13
	University	27	6
	Total	**462**	**100**

As demonstrated in figure 4 below, for the married pregnant women (represented in blue), the highest level of education was the upper primary (41%). Comparative with their partners, highlighted in the orange bars, the husbands to these married women had secondary school as the highest level of education (24%). At university level, slightly more of the husband were educated compared to their wives while at the lower primary level, slightly more women registered this as their highest level of education.

Figure 4

Highest Education Level for married couples
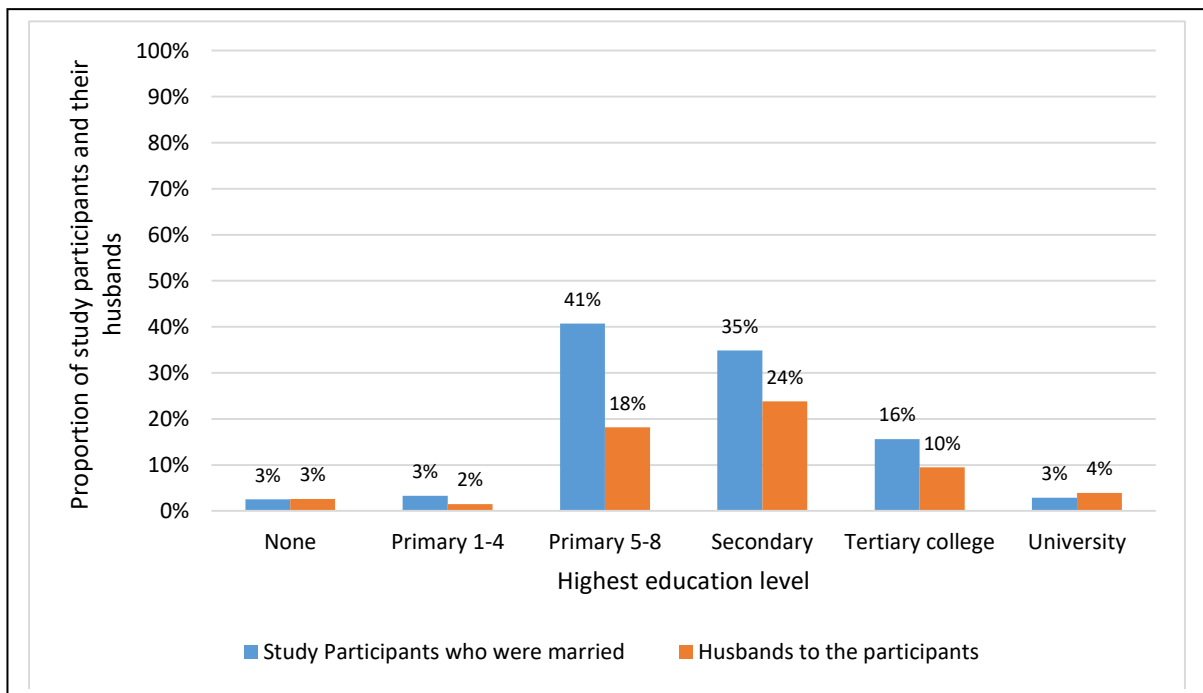
4.4.6 Occupation

Occupation is the activity that one pre-occupies themselves with, to earn a living. Employment during pregnancy is associated with a reduction in the risk of preterm birth and working in certain occupations may affect pregnancy outcomes (Casas, *et al* 2015).

As per table 9 below, majority of the clients (48%) were engaging in farming activities followed by those who were students (22%). Twenty one percent were businesswomen while 3% were housewives. Only 6% were in salaried employment as depicted in table 8 below.

Table 9

Occupation for study participants

Variable	Category	Number (n)	Proportion (%)
Occupation	Athletes	1	0.2
	Business	97	21
	Farmer	223	48
	Salaried employment	26	6
	Student	101	22
	Housewife	14	3
	Total	**462**	**100**

The table 10 below shows the occupation of the husbands for the married women. Most of the husbands were farmers (22%), businesspeople (16%) or in salaried employment (16%), in ranking by the top three. While there was a proportion of the expectant women as housewives, we do not have any of the men as husbands or without a form of occupation.

Table 10

Husband Occupation

Husband Occupation	Number (n)	Proportion (%)
Athletes	1	.2
Business	74	16
Driver	10	2
Farmer	101	22
Masonry	4	.9
Police Administration	2	.4
Salaried employment	72	16
Security	1	.2
Student	9	2
Taylor	1	.2

4.4.7 Income

The approximate income for each client was collected. This was for both salaried and unsalaried first ANC attendants who were able to provide actuals or approximate monthly income. A quarter (25%) of the participants did not have any form of income while another 36% were earning less than ten thousand shillings per month. As the income categories increase, the number of women falling in these ranges decreases significantly. This points to the purchasing power of the women attending first ANC clinics. Table 11 below shows the income ranges and the proportion of study participants.

Table 11

Income ranges for study participants

Variable	Category	Number (n)	Proportion (%)
Income	No income	116	25
	<10000	166	36
	10001 – 20000	65	14
	20001 – 30000	51	11
	30001 – 40000	46	10
	More than 40000	18	4
	Total	**462**	**100**

4.4.8 Gravidae

Gravidity also termed as gravidae is defined as the number of times that a woman has been pregnant regardless of the outcome (Gary, 2005). A primagravida is in her first pregnancy while, a multigravida has been pregnant more than once while grand multigravida has been pregnant five times or more. As per table 12 below, majority of the first ANC attendants have had multiple pregnancies before (between 2-4) at 40%, followed by those who have had one pregnancy at 29%. Those who have not had any pregnancy before were at 18% while those with more than five pregnancies before were 12%.

Table 12

Gravidae of study participants

Variable	Category	Number (n)	Proportion (%)
Gravidae	Nulligravida (not been pregnant before)	84	18
	Primigravida (first pregnancy)	136	29
	Multigravida (2-4 pregnancies)	187	40
	Grand multigravida (more than 5 pregnancies)	55	12
	Total	**462**	**100**

4.4.9   Parity

Parity is the number of times that a woman has given birth to a foetus with a gestational age of 24 weeks or more, regardless of whether the child was born alive or was stillborn (Gaillard, *et al*, 2014).   A woman who has never carried a pregnancy beyond 24 weeks is nulliparous and is called a nullipara or para 0. A woman who has given birth once before is primiparous and is referred to as a primipara or primip. A woman who has given birth two, three, or four times is multiparous and is called a multip. Grand multipara describes the condition of having given birth five or more times (Cunningham, 2005). Depending on the type, parity has different effects on pregnancy outcomes. In terms of obstetric complications, neonatal morbidity, and perinatal mortality, subjects can be classified into 3 groups according to parity: nulliparity, low multiparty (parity 1, 2, and 3), and grand multipara (parity 4 to 8). Compared with low multiparty, mothers and babies of null parity and grand multipara are at higher risk (Bai. *et al*, 2002).

Table 13

Parity of study participants

Variable	Category	Number (n)	Proportion (%)
Parity	Nulliparous (0)	218	47
	Primiparous (1)	82	18
	Multiparous (2-4)	108	23
	Grand multipara (4-8)	54	12

4.4.10 Mobile phone ownership and access

Mobile phone ownership including collection of the mobile number was done at enrollment into the study. This information was obtained only after consent or assent from minors at the health facility and was limited for purposes of the study only – relaying appointment reminders. According to table 14 below, out of the 462 clients enrolled into the study, 89% (411) owned mobile phones while the remaining 11% (51) did not own mobile phones.

Table 14

Mobile phone ownership for study participants

Variable	Category	Number (n)	Proportion (%)
Phone ownership	Yes	411	**89**
	No	51	**11**
	Total	**462**	**100**

Those who did not own mobile phones were asked whether they had access to a mobile phone through which the message would be relayed. Figure 5 below, shows the alternative access to mobile phones.

Figure 5

Mobile phone access
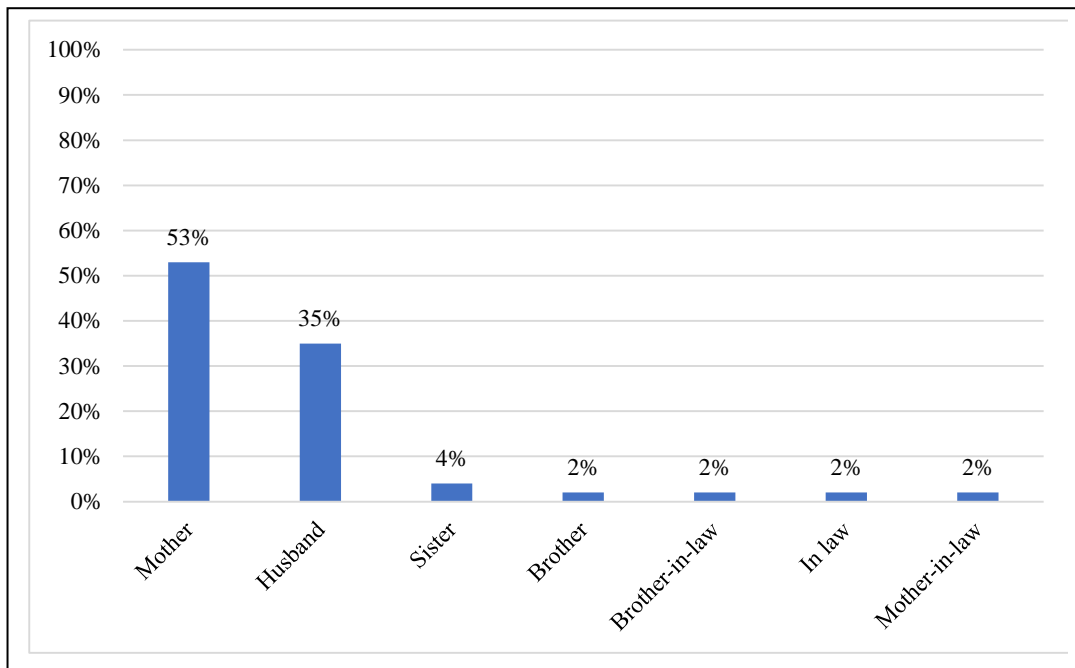
Figure 5 above shows that more than half of pregnant women who did not have a mobile phone, preferred to be reached through their mothers (53%). Another thirty five percent preferred their husbands. Only 4% preferred their sisters while the rest preferred either brother or in-laws at 2%.

4.5 Test of association between demographic factors and antenatal care attendance among pregnant women in West Pokot County

Chi square test of association was used to check whether there was any association between demographic factors and ANC attendance at all levels from the second ANC to the fourth plus ANC. The data presented had some categories, whose content could be collapsed and still retain the desired meaning (McDonald, 2014). For cases where the data could not be meaningfully collapsed, and the expected frequency was less than 5 in more than 20% of the

observations, the Fisher's exact test was used (Kim, 2017). The sections that follow, present the findings for these two tests across the study demographic variables and outcomes.

4.5.1 Second antenatal care appointment

Hypothesis 1

- **Null hypothesis:** There is no significant association between attendance of the second ANC appointment and the demographic factors.

- **Alternative hypothesis:** There is a significant association between attendance of the second ANC appointment and the demographic factors.

Table 15 below shows all the computed p-values and conclusion based on reference to the levels of significance by the chi-square test. All p-values that are less than the significant level of 0.05 are considered significant while those that are higher than 0.05 are considered not significant.

Table 15

Association between second antenatal care attendance and demographic factors

Variable	Statistical Test	P value	Alpha	Observation	Inference
Gestation age at 1ˢᵗ ANC – *1-12; 13-26; 27-32; 33-38; above 38 weeks*	Chi square	0.159	0.05	Greater than alpha.	Not significant
Age - *Adult and minor.*	Chi square	0.182	0.05	Greater than alpha.	Not significant
Number of children – *None, more than 1*	Chi square	0.155	0.05	Greater than alpha	Not significant
Marital Status - Married*; Not married*	Chi square	0.002	0.05	Less than alpha	Significant
Marital type – *Monogamous, polygamous*	Chi square	0.544	0.05	Greater than alpha.	Not significant
Education level - *Educated and No education.*	Chi square	0.475	0.05	Greater than alpha.	Not significant
Occupation – *Student, Occupation*	Chi square	0.306	0.05	Greater than alpha.	Not significant
Income - *Income; No income*	Chi square	0.306	0.05	Greater than alpha.	Not significant
Mobile phone ownership - *Yes; No*	Chi square	0.447	0.05	Greater than alpha.	Not significant
Gravidae	Chi square	0.000	0.05	Less than alpha	Significant
Parity	Chi square	0.026	0.05	Less than alpha	Significant

According to the results of the chi square test in table 15 above, only three variables (marital status of p-value 0.002<0.05, gravidae of p-value 0.000 and parity of p-value 0.026<0.05) have a statistically significant association with attendance of the second ANC at the health facility. Even though marital status had a statistically significant association with second ANC attendance, the type of marriage (p-value 0.544>0.05) classified as either polygamous or monogamous did not have any association with the second ANC attendance. Whether the first ANC attendants were adults or minors (p-value 0.182>0.05), had children or not (p-value 0.155>0.05), had any form of education or not (p-value 0.475>0.05), had occupation or not (p-value 0.306>0.05), owned mobile phones or not (p-value 0.447>0.05) and whether

they earned any form of income or not (p-value 0.306>0.05), do not have any statistically significant association with the second ANC attendance. Based on the findings above, the null hypothesis is rejected at 0.05 level of significance for marital status, gravidae, and parity. It is concluded that there exists significant association between these three demographic factors and the second ANC attendance.

4.5.2   Third antenatal care appointment

Hypothesis 1

- **Null hypothesis:** There is no significant association between attendance of the third ANC appointment and the demographic factors.

- **Alternative hypothesis:** There is a significant association between attendance of the third ANC appointment and the demographic factors.

Table 16 below shows all the computed p-values and conclusion based on reference to the levels of significance of 0.05 by the chi-square test. All p-values that are less than 0.05 are considered statistically significant.

Table 16

Association between third antenatal care attendance and study predictor variables

Variable	Statistical test	P value	Alpha	Observation	Conclusion
Gestation age at 1st ANC – *1-12; 13-26; 27-32; 33-38; above 38 weeks*	Chi-Square	0.001	0.05	Less than alpha	Significant
Age – *adult and minor.*	Chi-Square	0.326	0.05	Greater than alpha	Not significant
Number of children – *None, more than 1*	Chi square	0.247	0.05	Greater than alpha	Not significant
Marital Status – *Married; Not married*	Chi-Square	0.000	0.05	Less than alpha	Significant
Marital type – *Monogamous, polygamous*	Chi-Square	0.364	0.05	Greater than alpha	Not significant
Education level - *Educated and No education.*	Chi-Square	0.080	0.05	Greater than alpha	Not significant
Occupation – *Student, Occupation*	Chi-square	0.106	0.05	Greater than alpha	Not significant
Income – *Any income, no income*	Chi-Square	0.065	0.05	Greater than alpha	Not significant
Mobile phone ownership – *Yes; No*	Chi-Square	0.366	0.05	Greater than alpha	Not significant
Gravidae	Chi square	0.000	0.05	Less than alpha	Significant
Parity	Chi square	0.010	0.05	Less than alpha	Significant

Table 16 above shows a statistically significant association between four demographic factors and attendance of the third ANC. These include gestation age (p-value 0.001<0.05), marital status (p-value 0.000<0.05), gravidae (p-value 0.000<0.05) and parity (p-value 0.010<0.05). All the remaining seven variables do not have a statistically significant association with attendance of third ANC appointment: age (p-value 0.326>0.05), education status (p-value 0.08>0.05), marital type (p-value 0.364>0.05), mobile phone ownership (p-value 0.366>0.05) and income (p-value 0.065>0.05). Based on the four-study predictor variable p-values, which

are all less than alpha at 0.05, the null hypothesis is rejected. We therefore conclude that at 0.05 level of significance there is a statistically significant association between third ANC and the gestation age, marital status, gravidae, and parity.

4.5.3 Fourth antenatal care appointment

Hypothesis 1

- **Null hypothesis:** There is no significant association between attendance of the fourth ANC appointment and the demographic factors.

- **Alternative hypothesis:** There is a significant association between attendance of the fourth ANC appointment and the demographic factors.

Table 17 below shows all the computed p-values and conclusion based on reference to the levels of significance of 0.05 by the chi-square test.

Table 17

Association between fourth antenatal care attendance and study predictor variables

Variable	Statistical test	P value	Alpha	Observation	Statistical significance
Gestation age at 1st ANC – *1-12; 13-26; 27-32; 33-38; above 38 weeks*	Chi-Square	0.181	0.05	Greater than alpha	Not significant
Age - *adult and minor.*	Chi-Square	0.362	0.05	Greater than alpha	Not significant
Number of children – *None, more than 1*	Chi-Square	0.448	0.05	Greater than alpha	Not significant
Marital Status - *Married; Not married*	Chi-Square	0.009	0.05	Less than alpha	Significant
Marital type – *Monogamous, polygamous*	Chi-Square	0.451	0.05	Greater than alpha	Not significant
Education level -*Educated and No education.*	Chi-Square	0.384	0.05	Greater than alpha	Not significant
Occupation – *Student, Occupation*	Chi-Square	0.104	0.05	Greater than alpha	Not significant
Income – *Any income, no income*	Chi-Square	0.053	0.05	Greater than alpha	Not significant
Mobile phone ownership - *Yes; No*	Chi-Square	0.396	0.05	Greater than alpha	Not significant
Gravidae	Chi square	0.000	0.05	Less than alpha	Significant
Parity	Chi square	0.121	0.05	Greater than alpha	Not significant

From table 17 above, all the demographic factors do not have a statistically significant association with the fourth ANC attendance except the marital status (p-value 0.009<0.05) and gravidae (p-value 0.000<0.05). Age (p-value 0.362>0.05), number of children (p-value 0.448>0.05), educations status (p-value 0.384>0.05), marital type (p-value 0.451>0.05), mobile phone ownership (p-value 0.396>0.05), occupation (p-value 0.104>0.05), parity (0.121>0.05) and income (p-value 0.053>0.05) all have p values of greater than 0.05 hence are not statistically significant. Therefore, the null hypothesis is rejected for fourth ANC for marital status and gravidae. For the rest of the demographic factors the null hypothesis is not

rejected. It is therefore concluded that there is a significant association between fourth ANC and marital status and gravidae.

4.5.4 Fourth plus antenatal care appointments

Fourth plus ANC appointments refers to more than four ANC visits attended.

Hypothesis

- **Null hypothesis:** There is no significant association between attendance of the fourth plus ANC appointments and the demographic factors.

- **Alternative hypothesis:** There is a significant association between attendance of the fourth plus ANC appointments and the demographic factors.

Table 18 below shows all the computed p-values and conclusion based on reference to the levels of significance of 0.05 by the chi-square test.

Table 18

Association between fourth plus antenatal care appointment and study predictor variables

Variable	Statistical test	P value	Alpha	Observation		Conclusion
Gestation age at 1st ANC – *1-12; 13-26; 27-32; 33-38; above 38 weeks*	Fisher's exact	0.373	0.05	Greater than alpha		Not significant
Age - *adult and minor.*	Chi-Square	0.197	0.05	Greater than alpha		Not significant
Number of children – *None, more than 1*	Chi-Square	0.983	0.05	Greater than alpha		Not significant
Marital Status - *Married; Not married*	Chi-Square	0.003	0.05	Less than alpha		Significant
Marital type – *Monogamous, polygamous*	Chi-Square	0.451	0.05	Greater than alpha		Not significant
Education level -*Educated and No education.*	Chi-Square	0.434	0.05	Greater than alpha		Not significant
Occupation – *Student, Occupation*	Chi-Square	0.113	0.05	Greater than alpha		Not significant
Income – *Any income, no income*	Chi-Square	0.063	0.05	Greater than alpha		Not significant
Mobile phone ownership - *Yes; No*	Chi-Square	0.408	0.05	Greater than alpha		Not significant
Gravidae	Chi square	0.000	0.05	Less than alpha		Significant
Parity	Chi square	0.033	0.05	Less than alpha		Significant

From table 18 above, for clients who came for more than four ANC appointments, the marital status (p-value 0.003<0.05), gravidae (0.000<0.05) and parity (0.033<0.05) had a significant association with this outcome. Gestation age (p-value 0.373>0.05), age (p-value 0.197>0.05), number of children (p-value 0.983>0.05), education level (p-value 0.434>0.05), marital type (p-value 0.451>0.05), occupation (p-value 0.113>0.05), mobile phone ownership (p-value 0.408>0.05) and income (p-value 0.063>0.05), did not have a statistically significant association with attendance of more than four ANC attendance. For marital status p-value 0.003<0.05, the null hypothesis is rejected at 0.05 level of significance, and we conclude that marital status has a statistically significant relationship with more than four ANC attendance.

4.6 Test of Association between skilled delivery attendance and demographic factors

Chi square test of association was applied on all categorical variables which were grouped to form two by two contingency tables that meet the assumptions under the test. This was done together with the Fisher's exact test where applicable.

Hypothesis 1

- **Null hypothesis:** There is no significant association between skilled birth attendance and the study predictor variables.

- **Alternative hypothesis:** There is a significant association between skilled birth attendance and the study predictor variables.

Table 19 below shows all the computed p-values and conclusion based on reference to the levels of significance of 0.05 by the chi-square test/Fisher's exact test as applicable.

Table 19

Association between skilled birth attendance and study predictor variables

Variable	Statistical test	P value	Alpha	Observation	Statistical significance
Gestation age at 1ˢᵗ ANC; *1-12; 13-26; 27-32; 33-38; above 38 weeks*	Chi-Square	0.000	0.05	Less than alpha	Significant
Age - *adult and minor.*	Chi-Square	0.062	0.05	Greater than alpha	Not significant
Number of children – *None, more than*	Chi-Square	0.221	0.05	Greater than alpha	Not significant
Marital Status - *Married; Not married*	Chi-Square	0.000	0.05	Less than alpha	Not significant
Marital type – *Monogamous, polygamous*	Chi-Square	0.469	0.05	Greater than alpha	Not significant
Education level - *Educated and No education.*	Chi-Square	0.002	0.05	Less than alpha	Significant
Occupation – *Student, Occupation*	Chi-Square	0.907	0.05	Greater than alpha	Not significant
Income – *Any income, no income*	Chi-Square	0.498	0.05	Greater than alpha	Not significant
Mobile phone ownership - *Yes; No*	Chi-Square	0.000	0.05	Less than alpha	Significant
Gravidae	Chi-square	0.000	0.05	Less than alpha	Significant
Parity	Chi-square	0.000	0.05	Less than alpha	Significant

According to table 19 above, skilled delivery attendance has a significant association with the study participant's marital status (p-value 0.000<0.05), education status (p value 0.002<0.05), mobile phone ownership (p value 0.000<0.05), gravidae (p-value 0.000<0.05) and parity (p value 0.000<0.05). The null hypothesis for these variables is therefore rejected at 0.05 level of significance. Age (p-value 0.062>0.05), number of children (p-value 0.221>0.05), marital type (p-value 0.469>0.05), occupation (p-value 0.907>0.05) and income (p-value 0.498>0.05) do not have a significant association with skilled delivery attendance. The null hypothesis for these variables is therefore not rejected at 95% CI. We conclude however that

there exists a significant association between gestation age at first ANC, marital status, gravidae and parity and skilled delivery attendance.

4.7 Comparison of antenatal care attendance among pregnant women who receive SMS reminders and those who did not receive SMS reminders in West Pokot County

This section was analysed by computing the incidence of the outcome of interest in the exposed (got SMS) and the unexposed (did not get SMS), groups from contingency tables. The general formula used is as below.

Table 20

General incidence formula

Study group	Outcome	No outcome	Total
Exposed (SMS)	a	B	**(a+b)**
Unexposed (no SMS)	c	D	**(c+d)**
Total	**(a+c)**	**(b+d)**	**(a+b)(c+d)(a+c)(b+d)**

- Incidence in the exposed = a / (a+b)

- Incidence in the unexposed = c / (c+d)

- Overall incidence = (a+c) / (a+b)(c+d)(a+c)(b+d)

- Odds rato = ad/bc

The risk ratio (RR) will then be determined by calculating the ratio of the incidence between the exposed and the unexposed groups. The formula is as below.

RR = { a / (a+b)}/{ c / (c+d)} (Bovbjerg, 2020).

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In the section 4.4 above, the chi square test of association was used to assess the relationship between predictor variables and the study outcomes, and some had statistically significant associations. For these, the binary logistics regression model was fitted to demonstrate the level to which the affect the outcomes observed. Binary logistic regression model is the best way to estimate relative risk of the exposed in comparison to the unexposed groups in cohort studies for common outcomes, while taking care of the confounding variables (McNutt *et al* 2003; Schreiber-Gregory, 2018).

4.7.1 Second antenatal care attendance incidence rates, odds ratio, and risk ratios

Table 19 below, is the contingency table for the second ANC attendance among the exposed and unexposed groups.

Table 21

Contingency table – second ANC

Study arm * Second ANC Cross tabulation				
		Second ANC		**Total**
		Yes	**No**	
Study arm	Intervention	230 (99.6%)	1 (0.4%)	231
	Control	142 (61.5%)	89 (38.5%)	231
Total		**372**	**90**	**462**

- Incidence (probability of returning for second ANC, with SMS reminder) = a/(a+b) = 230/231=99.7%

- Incidence (probability of returning for second ANC, minus SMS reminder) = a/(a+b) = 142/231=61.5%

- Overall incidence = 372/462 = 80.5%

- Odds ratio = (230x89)/(142x1) = 144.1549

- Risk Ratio/Relative risk = 99.7%/61.5% = 1.6195

Women who received SMS reminders are 144.1549 times more likely to attend the second ANC. 1.62 times more likely to return for second ANC appointment in comparison to those who did not receive SMS reminders.

Table 22

Variables in the Equation second antenatal care attendance

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	marital_client(1)	-.115	.347	.110	1	.740	.891	.452	1.759
	parity_adjusted	.044	.349	.016	1	.900	1.045	.527	2.072
	gravidity_adjusted	-1.317	.347	14.411	1	.000	.268	.136	.529
	Constant	.894	.548	2.661	1	.103	2.446		
a. Variable(s) entered on step 1: marital_client, parity_adjusted, gravidity_adjusted.									

Table 22 above represents all the variables that had a significant association with the second ANC (section 4.4, table 15) and have been included in the binomial logistic regression model. These were marital status of the expectant women, gravidae, and parity. According to this table (Exp B column), the probability of returning for the second ANC is 0.891 times more likely for married women, 1.045 more likely for women who have never given birth before and 0.268 more likely for women who have never been pregnant before.

4.7.2   Third antenatal care attendance incidence rates, odds ratio, and risk ratios

The contingency table 23 below represents a two-by-two table for the third ANC appointment

for the intervention and the control arms of the study.

Table 23

Contingency table – third antenatal care attendance

Study arm * Third ANC Cross tabulation				
		Third ANC		
		Yes	**No**	**Total**
Study arm	Intervention	182 (78.8%)	49 (21.2%)	231
	Control	102 (44.2%)	129 (55.8%)	231
Total		**284**	**178**	**462**

- Incidence (probability of returning for second ANC, with SMS reminder) = a/(a+b) =
  182/231=78.8%

- Incidence (probability of returning for second ANC, minus SMS reminder) = a/(a+b)
  = 102/231=44.2%

- Overall incidence = 284/462 = 61.5%

- Odds Ratio = (182x129)/(102x49) = 4.6975

- Risk Ratio/Relative risk = 78.8%/44.2% = 1.7828

Women who received SMS reminders are 1.7828 times more likely to return for third ANC

appointment in comparison to those who did not receive SMS reminders.

Table 24

Variables in the Equation – Third Antenatal Care attendance

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1ᵃ	gestation_first	.474	.126	14.182	1	.000	1.606	1.255	2.056
	marital_client(1)	-.039	.279	.019	1	.889	.962	.557	1.661
	parity_adjusted	-.203	.276	.541	1	.462	.816	.475	1.402
	gravidity_adjusted	-1.467	.318	21.281	1	.000	.231	.124	.430
	Constant	1.307	.565	5.352	1	.021	3.694		

a. Variable(s) entered on step 1: gestation_first, marital_client, parity_adjusted, gravidity_adjusted.

According to table 24 above, women who attend ANC within the first 12 weeks are more likely to return for the third appointment (1.606 times) than those married (0.962). Those who have not given birth before are more likely to return for the third appointment (0.816 times) compared to those who have not been pregnant before (0.231).

4.7.3 Fourth antenatal care attendance incidence rates, odds ratio and risk ratios

Table twenty-five below represents the contingency table for the fourth ANC.

Table 25

Contingency table – fourth ANC

Study arm * Fourth ANC Cross tabulation				
		Fourth ANC		
		Yes	No	**Total**
Study arm	Intervention	146	85	231
	Control	59	172	231
Total		205	257	462

- Incidence (probability of returning for second ANC, with SMS reminder) = a/(a+b) = 146/231=63.2%

- Incidence (probability of returning for second ANC, minus SMS reminder) = a/(a+b) = 59/231=25.5%

- Overall incidence = 205/462 = 44.4%

- Odds ratio = (146x172)/(59x85) = 5.0074

- Risk Ratio/Relative risk = 63.2% / 25.5% =2.4784

Table 26: Binomial logistic regression model – Fourth Antenatal Care attendance

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1ᵃ	marital_client(1)	-.050	.223	.051	1	.821	.951	.614	1.472
	gravidity_adjusted	-1.165	.316	13.601	1	.000	.312	.168	.579
	Constant	2.398	.548	19.166	1	.000	11.004		
a. Variable(s) entered on step 1: marital_client, gravidity_adjusted.									

For the fourth ANC appointment, whose findings are represented in tables 25 and table 26 above, column Exp(B), married women are 0.951 times more likely to return for the fourth ANC while those who have never been pregnant before are 0.312 more likely to return for the fourth ANC.

4.7.4 Fourth plus antenatal care attendance incidence rates, odds ratio and risk ratios

Table twenty-seven below represents the contingency table for the fourth plus ANC appointment.

Table 27

Contingency table – fourth plus antenatal care attendance

Study arm * Fourth plus ANC Cross tabulation				
		Fourth ANC		
		Yes	No	Total
Study arm	Intervention	142	89	231
	Control	37	194	231
Total		179	283	462

- Incidence (probability of returning for second ANC, with SMS reminder) = a/(a+b) = 142/231=61.5%

- Incidence (probability of returning for second ANC, minus SMS reminder) = a/(a+b) = 37/231=16.0%

- Overall incidence = 179/462 = 38.7%

- Odds Ratio = (142x194)/(37x89) = 8.3656

- Risk Ratio/Relative risk = 61.5%/16.0% = 3.8438

Table 28

Variables in the Equation – Fourth plus antenatal care attendance

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1ª	marital_client (1)	-.098	.264	.139	1	.709	.906	.541	1.520
	gravidity_adjusted	-1.131	.346	10.666	1	.001	.323	.164	.636
	parity_adjusted	-.100	.253	.155	1	.694	.905	.551	1.487
	Constant	2.763	.618	19.987	1	.000	15.842		
a. Variable(s) entered on step 1: marital_client, gravidity_adjusted, parity_adjusted.									

According to column Exp (B) in table 28 above, married women are 0.906 more likely to return for the appointment, those who have been pregnant before 0.323 while those who have given birth before 0.905 more likely to return for more than four ANC visits.

4.7.5 Computing adjusted relative risk for antenatal care attendance

When the incidence of an outcome of interest is greater than 10%, the computed risk ratio and odds ratio, overestimate the actual values. As a result, Zhang and Yu. (1998), recommended the formula below to arrive at a more realistic estimate for the relative risk. To further interpret these findings, the odds ratio was adjusted to compute relative risk using the formula below by Zhang (1998);

RR = OR/ {(1-Po) + OR (Po) where

- **RR** = Relative Risk

- **OR** = Odds ratio from logistic regression/computed

- **Po** = Prevalence of outcome in the unexposed group (among those who did not receive SMS reminders). The findings from both the logistic regression and conversion to relative risks are presented in the table 29 below.

Table 29

Adjusted Relative Risks and Relative Effect for antenatal care attendance

ANC Appointment	Variable	ANC prevalence in unexposed group	Odds Ratio	Adjusted RR	(1-RR)%
Second	Study group	61.5%	144.1549	144.1549/((1-61.5%)+144.1549(61.5%)=1.6190	-61.9%
	Marital status	61.5%	0.891	0.891/((1-61.5%)+0.891(61.5%)=0.9550	4.5%
	Gravidae	61.5%	0.268	0.268/((1-61.5%)+0.268(61.5%)=0.4874	51.3%
	Parity	61.5%	1.045	1.045/((1-61.5%)+1.045(61.5%)=1.0169	-1.7%
Third	Study group	44.2%	4.6975	4.6975/((1-44.2%)+4.6975(44.2%)=1.7832	-78.3%
	Gestation age at first ANC	44.2%	1.606	1.606/((1-44.2%)+1.606(44.2%)=1.2667	-26.7%
	Marital status	44.2%	0.962	0.962/((1-44.2%)+0.962(44.2%)=0.9784	2.2%
	Gravidae	44.2%	0.231	0.231/((1-44.2%)+0.231(44.2%)=0.3499	65%
	Parity	44.2%	0.816	0.816/((1-44.2%)+0.816(44.2%)=0.8882	11.1%
Fourth	Study group	25.5%	5.0074	5.0074/ ((1-25.5%) +5.0074(25.5%) =2.4766	-147.7%
	Marital status	25.5%	0.951	0.951/ ((1-25.5%) +0.951(25.5%) =0.9630	3.7%
	Gravidae	25.5%	0.312	0.312/ ((1-25.5%) +0.312(25.5%) = 0.3783	62.2%
Fourth Plus	Study group	16.0%	8.3656	8.3656/ ((1-16.0%) +8.3656(16.0%) = 3.84	-284%
	Marital status	16.0%	0.906	0.906/ ((1-16.0%) +0.983(16.0%) = 0.9198	8%
	Gravidae	16.0%	0.323	0.323/ ((1-16.0%) +0.323(16.0%) = 0.3622	63.8%
	Parity	16.0%	0.905	0.905/ ((1-16.0%) +0.905(16.0%) = 0.9189	8.1%

For table 29 above, the details presented for each variable include the odds ratio, adjusted relative risk using Zheng. (1998) formula and the last column which represents the impact of the variables to the outcome of interest, also known as relative effect of the intervention and demographic variables. Relative effect is the relative change in the risk of an adverse event in the exposed group compared to the unexposed group. This is computed by the formula below by Rothman, (2012).

$$\textbf{Relative effect = (Ie-Iu/Iu)}$$

According to table 29 and referring to the last column, for second ANC, SMS reminders and having not given birth before reduces the chances of missing second ANC by 61.9% and 1.7% respectively. Being in a marital union and having not been pregnant before increased the chances of attending second ANC by 4.5% and 51.3%. For the third ANC, SMS reminders reduces the chances of missing these appointments by -78.3% while attending first ANC within the first 12 weeks decreases the chances of missing third ANC appointments by 26.7%. Marital status, gravidae and parity increase the chances of attending third ANC appointments by 2.2%, 65% and 11.1%. For the fourth ANC appointments, SMS reminders reduce the chances of missing fourth ANC appointment by 147.7%. Marital status and gravidae on the other hand increase the attendance of these appointments by 3.7% and 62.2% respectively. For more than four ANC appointments, SMS reminders reduce the chances of missing these appointments by 284%. Marital status, gravidae and parity increase the chances of attending these appointments by 8%, 63.8% and 8.1% respectively.

4.8 Comparing skilled delivery attendance among pregnant women who receive SMS reminders and those who did not receive them in West Pokot County

Table thrity represents a contingency table of the study outcome (SDA) for the intervention and the control arms.

Table 30

Cross tabulations for skilled delivery attendance

Study arm * SDA				
		SDA		
		Yes	No	Total
Study arm	Intervention	185	46	231
	Control	82	149	231
Total		267	195	462

- Incidence (probability of returning for second ANC, with SMS reminder) = a/(a+b) = 185/231=80.0%

- Incidence (probability of returning for second ANC, minus SMS reminder) = a/(a+b) = 82/231=35.5%

- Overall incidence = 267/462 = 57.8%

- Odds Ratio = (185x149)/(82x46) = 7.3078

- Risk Ratio/Relative risk = 80.0%/35.5% = 2.2535

Table 31

Variables in the Equation – Skilled delivery attendance

Variables in the Equation									
								95% C.I. for EXP(B)	
		B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**	**Lower**	**Upper**
Step 1ᵃ	gestation_first	-.534	.144	13.726	1	.000	.586	.442	.778
	marital_client(1)	-.746	.290	6.629	1	.010	.474	.269	.837
	client_educ1	-.625	.612	1.043	1	.307	.535	.161	1.776
	mobile_own	-1.441	.458	9.902	1	.002	.237	.096	.581
	gravidity_adjusted	-2.584	.443	34.011	1	.000	.075	.032	.180
	parity_adjusted	.300	.289	1.084	1	.298	1.350	.767	2.377
	Constant	8.589	1.533	31.379	1	.000	5373.749		

a. Variable(s) entered on step 1: gestation_first, marital_client, client_educ1, mobile_own, gravidity_adjusted, parity_adjusted.

According to table 31 above, with reference to column Exp (B), women who present for the first ANC within the first 12 weeks of gestation age are 0.586 times more likely to deliver at the health facility. Women who are in a marital union are 0.474 times more likely to deliver at the health facility while educated women are 0.535 more likely. For women who have not been pregnant before are 0.075 more likely to deliver at the health facility while those who have not delivered before are 1.35 times more likely to deliver at the health facility.

4.8.1 Computing adjusted relative risk for Skilled delivery attendance

Using Zhang's formula, the adjusted relative risks for SDA were computed as per the table 30 below as well as the effect of the various study variable and the intervention to the study outcome.

Table 32

Adjusted Relative Risks for skilled birth attendance outcome

Variable	SDA in group	prevalence unexposed	Odds Ratio	Adjusted RR	(RR-1)%
Study group	35.5%		7.3078	7.3078/((1-35.5%)+7.3078(35.5%)=2.256	125.6%
Gestation age at first ANC	35.5%		0.586	0.586/((1-35.5%)+0.586(35.5%)=0.6870	-31.3%
Marital status	35.5%		0.474	0.474/((1-35.5%)+0.4474(35.5%)=0.5828	-41.7%
Education status	35.5%		0.535	0.535/((1-35.5%)+0.535(35.5%)=0.6408	-35.9%
Mobile phone ownership	35.5%		0.237	0.237/((1-35.5%)+0.237(35.5%)=0.3250	-67.5%
Gravidae	35.5%		0.075	0.075/((1-35.5%)+0.075(35.5%)=0.1117	-88.8%
Parity	35.5%		1.350	1.350/((1-35.5%)+1.350(35.5%)=1.2008	20.1%

According to table 32 above, appearing for first ANC within the first 12 weeks reduces the chances of missing SDA by 31.3%, being in a marital union reduces missing SDA by 41.7%, being educated by 35.9%, owning a mobile phone by 67.5% and not having been pregnant before by 88.8%. SMS reminders on the other hand increase attendance of SDA by 125.6% while not having given birth before increases SDA chances by 20.1%.

4.9 Identification of challenges faced by pregnant women in seeking antenatal care and skilled delivery attendance in West Pokot County

Twelve focus group discussions were held among 94 women who had delivered within a year. According to Guest. Namey & McKenna (2017), three focus group discussions are sufficient to bring out 90% of the themes in the study. These women were identified through the various community social gatherings like the churches, women groups, youth groups and such like community fora. Meetings were scheduled and questions administered using the focus group discussion guide in appendix A. The key areas of focus in the discussions included general awareness of skilled delivery and antenatal care and its importance, reasons as to why women avoid delivery at the health facility and how this can be mitigated. Given that the study was being conducted in a patriarchal society, the women were asked to express what their men would think about these messages and the best time to send the messages. Table 31 below represents the demographic characteristics of the woman who consented to take part in the discussions.

4.9.1   Demographic profile of Focus Group Discussion participants

For all women who participated in the focus group discussions, their age, marital status, level of education, income and number of children they had was collected. These details are presented in the tables that follow.

Table 33

Age of Focus Group Discussion participants

Variable	Category	Number (n)	Proportion (%)
Age	15 - 19	2	2
	20 - 24	22	23
	25 - 29	35	37
	30 - 34	18	19
	35 - 39	9	9
	40 - 44	5	5
	45+	5	5
	Total	**96**	**100**

The youngest woman who attended the FGD discussions was 18 years of age while the oldest was 59 years of age. As represented in table 33 above, majority of the participants are aged between twenty to thirty-four years of age. Above 45 years of age and between 40 to 44 years were both 5%, in proportion. Another 9% were between 35 and 39 years of age and only 2% were between 15 to 19 years of age.

Table 34a

Marital Status of Focus Group Discussion participants

Variable	Category	Number (n)	Proportion (%)
Marital status	Married	83	87
	Not married	13	13
	Total	**96**	**100**

Majority of the participants (87%) were in a marital union while 13% were not married as shown in table 34a above.

Table 34b

Type of marriage of Focus Group Discussion participants

Variable	Category	Number (n)	Proportion (%)
Type of marriage	Monogamous	64	77
	Polygamous	19	23
	Total	**83**	**100**

Most of the women who were married were in monogamous unions (77%) as represented in table 34b above.

Table 35

Number of children by Focus Group Discussion participants

Variable	Category	Number (n)	Proportion (%)
	1-3	48	50
	4-6	34	35
	More than 7	14	15
	Total	**96**	**100**

The highest number of children was 12 and the lowest was 1. Looking at table 35 above, half of the participants had between one to three children while 35% had between four to six children. The remaining 15% have more than seven children.

Table 36

Education level of Focus Group Discussion participants

Variable	Category	Number (n)	Proportion (%)
Education Level	None	2	2
	Primary 1-4	9	9
	Primary 5-8	41	43
	Secondary	26	27
	Tertiary College/Institution	13	14
	University	5	5
	Total	**96**	**100**

Two percent of the participants did not have any form of education while 5% had the highest level of education at university. Majority of the participants (43%) had upper primary education level at standard five to standard eight. Twenty seven percent had secondary school education while 14% had tertiary education. Only 9% had lower primary education as presented in results in table 36 above.

Table 37

Occupation of Focus Group Discussion participants

Variable	Category	Number (n)	Proportion (%)
Participant occupation	Farmer	46	48
	Student	6	6
	Business	40	42
	Salaried employment	3	3
	Other	1	1
	Total	**96**	**100**

According to table 37 above, majority of the FGD participants are either farming (48%) or in business engagements (42%). Students are six percent, those in salaried employment are 3% and other occupation is at 1%. The occupation of the husbands for those who were married was also collected and is represented in table 38 below.

Table 38

Occupation of husbands to Focus Group Discussion participants

Variable	Category	Number (n)	Proportion (%)
Husband occupation	Farmer	38	45
	Student	2	2
	Business	26	31
	Salaried employment	16	19
	Other	2	2
	Total	**84**	**100**

Most of the husbands were farmers (45%), followed by businessmen (31%) and those engaged in salaried employment at 19%. Students were at 2% while those under other occupations were 2% as well.

4.9.2 Summary of Focus Group Discussion discussions and key themes

Distance between the health facilities and the mothers' homes as well as lack of fair to cover the distance was a common reason as to why they did not seek care at the health facilities. When seeking alternative health facilities closer to their homes, a number of the health facilities, do not offer antenatal care services leaving the women with minimal options. Some also expressed fear of the HIV tests, injections and the questions normally asked at the health facilities. A few others stated that they feared stigmatization, felt shy and practiced some cultural activities like female genital mutilation that kept them away from the health facilities.

"We are afraid of HIV tests and the questions asked at the hospitals"

"Fear of HIV results and stigma from community"

During childbirth, the presence of male doctors and nurses at the health facilities caused women to shun hospital deliveries. Others feared the operation during delivery while others stated high poverty levels that curtailed their movement to the health facilities. After delivery, women did not return for care at the health facilities mostly due to ignorance and believing that if they did not have any complications there was no need to visit the health facilities. High levels of poverty, distance and general laziness were other contributing factors.

"Women do not have money to fund their journey to and from the health facilities. Some depend on their husbands."

"Some women are lazy"

Despite the reasons raised above, most of the mothers understand the importance of hospital deliveries and care at ANC generally. Ignorance and level of illiteracy are high among

women in West Pokot, and some do not see the need to visit health facilities when they do not have a specific health condition or symptom even when they were pregnant.

" Without a problem, I do not see a need to visit the health facility"

"We do not know the importance of clinic"

When asked what their first step would be in case of emergency, all of them said they would rush to the health facilities. Some of the dangers they identified of home deliveries included over bleeding, infections, and death from different forms of complications. Placenta retention was one of the key complications identified by the women. Others acknowledged that home delivery lack the equipment to intervene in case of underweight babies and or emergency surgery in the event it is required. When asked whether antenatal care is important, most mothers seem to know that vitals are taken, education on general care during pregnancy is given, child monitoring is done and the general health of the mother taken into account.

"By teaching them e.g telling them about good health and teaching them about balancing the diet"

"To identify twins or single pregnancies"

"They also give out some medicine to increase more blood in the body"

"Mothers can get health card to their babies"

Many mothers felt that the community is largely not aware of these important reasons for adopting hospital care while pregnant. Therefore, they proposed educating the community on the need for antenatal care and hospital deliveries. They also said it was important to tell

women that the services are free of charge. They were very appreciative of the SMS reminder initiative.

"Other women don't know importance of clinic"

Many said that "if am in a good health now, why go to hospital"

When asked about their men's reaction to the SMS reminders, majority of them felt that men will freely support their transportation to and from the health facilities, and some may accompany their women to the health facility. A few others mentioned that some men may be suspicious of the messages and others would be concerned why doctors are too much concerned with their wives. Others felt that there will be moral support and their husbands will be compelled to step up to their supportive roles as partners. Majority of the women also felt that sending the text message 24 hours before the appointment date will be very beneficial. The specific time varied between 8am to 6pm for majority of them.

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1   Introduction

The purpose of this study was to test the efficacy of SMS reminders as an intervention to improve the utilization of maternal health services during pregnancy (antenatal care) and at delivery (skilled delivery attendance). This section outlines the study key findings under discussions in relation to the literature, conclusions from the study findings, recommendations, and areas for further research. It has been arranged as per the objectives starting with predictor variables (demographic variables), relationship between the predictor variables and the study outcomes then comparisons between intervention (SMS) and the control groups (no SMS) for both ANC and SDA.

5.2   Discussions

This section outlines the findings of this study in relation to the existing literature and the study specific objectives.

5.2.1   Demographic characteristics of study participants

A total of 462 first ANC attendants were enrolled into the study, after consenting or assenting as applicable, with each arm having 231 participants. Out of the 462, a majority (89%) owned mobile phones while the rest had access to a mobile phone either through their husbands, mothers, or close relatives. This further demonstrates that there are alternative ways to reach expectant women even though they did not own mobile phones.

At recruitment, the lowest gestation age was 6 weeks while the highest was 39 weeks with 93% of the pregnant women attending first ANC after 12 weeks gestation age. Late or no

presentation for antenatal care services is consistent with challenges experienced in other parts of the world for both urban and rural set ups. In line with several scholars, women mentioned lack of awareness, fear including fear to test for HIV, distance to health facility and poverty as key reasons. The need to keep pregnancy a secret in case the women end up miscarrying was mentioned in other studies as one of the reasons behind late presentation for antenatal care (Wolde, Tsegaye & Sisay, 2019; Ebonwu. *et al*, 2018; Jinga. *et al*, 2019).

According to Sauer (2015), age is an important determinant of pregnancy outcomes with advanced maternal age as a risk factor for female infertility, pregnancy loss, fetal anomalies, stillbirth, and obstetric complications. Majority of the study participants fell between the ages of 15 years to 29 years of age. Sixty percent of the women who were recruited into the study were married and out of those married 86% were in monogamous marriages and had been married for more than five years.

The main occupation was farming activities (48%) while most of the participants had achieved either secondary school (24%) or upper primary (Standard 5-8) (41%) education level. In comparison to their husbands, for those who were married, 22% practice farming, 16% were businessmen while 16% were in salaried employment. Economically, women who were in marriages were better than those who were not in marriages. Generally, the women had lower education levels as well as economic stamina. A quarter of the study participants did not have any form of income while many were carrying their first pregnancies. The West Pokot County Integrated development plan equally acknowledges the general low level of education in the county and plans to increase access, retention and completion levels in pre-primary education, primary, secondary, and post-secondary education by at least 100 percent by 2022 (CIDP 2018).

5.2.2 Demographic factors associated with ANC and SDA attendance among pregnant women in West Pokot County.

The following demographic variables were identified as potential predictors of ANC and SDA: Age, Education Level, Occupation, Income, Marital status, Marital type, parity, gravidae, mobile phone ownership and access. Chi square test of association was used to examine the relationship between the study demographic variables and the study outcomes defined as ANC and SDA attendance.

For the second ANC appointment, marital status (p-value $0.002 < 0.05$), gravidae (p-value $0.000 < 0.05$) and parity ($0.026 < 0.05$) had a statistically significant association with this outcome. Women who were in a marital union, those who had never given birth before and those who had never been pregnant before, were more likely to return or the second ANC appointment. For the third ANC appointment, gestation age at first ANC (p-value $0.001 < 0.05$), marital status ($0.000 < 0.05$), gravidae ($0.000 < 0.05$) and parity ($0.010 < 0.05$) had a statistically significant association with the attendance. Women who had never given birth before or who had not been pregnant before were more likely to return for the third ANC appointment. Marital status was not significant for this third appointment. For the fourth ANC, marital status (p-value $0.009 < 0.05$) and gravidae (p-value $0.000 < 0.05$) were significant. For visits higher than four, gestation age at first ANC, marital status, gravidae and parity had a significant association with attendance.

Across all the levels of ANC attendance marital status, gravidae and parity are cross cutting as being statistically significantly associated with ANC outcomes. Gestation at first ANC had significant association with the third and four plus ANC appointments. Many studies have found relationship between mother's education where the more educated they were the more

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likely they were to attend ANC (Okedo-Alex.IN *et al*, 2019). For this study, formal education did not have a statistically significant association with all the ANC levels. This is likely to have been because informal education enabled women to know the importance of ANC. Increasing age, setting and parity affect the timing of ANC attendance and booking in different parts of sub-Saharan Africa (Emelumadu *et al*, 2014; Chamileke.N, 2017). Unlike this study, Nzioki. Onyango, R. and Ombaka (2015) found income and education as factors associated with antenatal care attendance.

With reference to SDA, gestation age at first ANC (p-value $0.000 < 0.05$) , marital status (p-value $0.000 < 0.05$), education level (p-value $0.002 < 0.05$), mobile phone ownership (p-value $0.000 < 0.05$), gravidae (p-value $0.000 < 0.05$) and parity (p-value $0.000 < 0.05$) had a significant association with the outcome. These findings are consistent with most findings presented in the literature review of this study. In Busia County Kenya, low socioeconomic status of the women was a key barrier to maternal health services utilization (Wafula, Arudo, Kipmerewo, 2020). In Kajiado County, Magadi sub-county, Kenya, belonging to the highest wealth quantile, being out of a marital union and living near a health facility were positively associated with health facility delivery (Karanja. *et al*, 2018).

Given these findings, pregnant women in West Pokot County should be encouraged to get children within marital unions. This will further enable them to get additional moral support they need during pregnancy. More targeted efforts are needed towards women who have been pregnant before or who have given birth before as the study demonstrates they are likely not to adhere to hospital appointments for both ANC and SDA.

5.2.3 Comparison of ANC attendance among pregnant women who receive SMS reminders and those who did not receive the reminders in West Pokot County

With reference to the demographic variables that were confirmed to have a statistically significant association between themselves and ANC at different levels from second to the fourth plus, binomial (or binary) logistics regression was used to determine the odds ratio. Binomial logistic regression accounted for the predictor variables which in addition to the intervening variable, had a causal effect on antenatal care at different levels as described in section 5.2.2 above.

5.2.3.1 Second antenatal care appointments

For the second ANC appointment, marital status (p-value $0.002 < 0.05$), gravidae (p-value $0.000 < 0.05$) and parity ($0.026 < 0.05$) had a statistically significant association with this outcome. The binomial logistics regression model was fitted for these variables, to determine the odds ratios, relative risks and relative effect of the variable to the outcome of interest.

With reference to the relative risk, second ANC was more occurrent among married women than the unmarried, 0.4874 more occurrent among women who have been pregnant before than those who have and 1.0169 more occurrent among women who have given birth before. Being in a marital union increases the chances of occurrence of second ANC by 4.5% while having not been pregnant before increases the occurrence of second ANC by 51.3%. Not having given birth before and receiving the SMS reminders reduce the chances of missing the second ANC appointments by 1.7% and 61.9%.

5.2.3.2 Third antenatal care appointments

For the third ANC appointment, gestation age at first ANC (p-value 0.001 < 0.05), marital status (0.000 < 0.05), gravidae (0.000 < 0.05) and parity (0.010 < 0.05) had a statistically significant association with the attendance.

With reference to relative risk, third ANC appointment adherence was more occurrent 1.2667 more among those who were within their early gestation age than those who presented much later or first ANC. Those who were married were 0.9784 more likely to have attended this appointment. Those who had never given birth before and those who had never been pregnant before were 0.3499 and 0.8882 more seen to have attended this appointment. Receiving the reminders made the attendance of this appointment more likely by 1.7832 more for those in the intervention group. Attending the first ANC past twelve weeks of gestation decreases the chances of missing third ANC by 26.7% while the SMS reminders decrease missing the third ANC appointment by 78.3%. Being in a marital union, having not been pregnant before and not having given birth before, all increase the chances of attending the third ANC by 2.2%, 65% and 11.1% respectively. This is consistent with other findings in the literature.

5.2.3.3 Fourth antenatal care appointments

For the fourth ANC, marital status (p-value 0.009 < 0.05) and gravidae (p-value 0.000 < 0.05) were significant. SMS reminders decreases the chances of missing the fourth ANC 147.7% times. The incidence of Fourth ANC attendance is reported more among married women (0.9630), women who have never been pregnant before (0.3783) and women who receive reminders (2.4766). Being in a marital union increases attendance of the fourth ANC by 3.7%, having not been pregnant before by 62.2% and SMS reminders by 147.7%.

5.2.3.4 Fourth plus antenatal care appointments

For visits higher than four, gestation age at first ANC, marital status, gravidae and parity had a significant association with attendance. The incidence of more than four ANC is 0.9198 more among married women, 0.3622 more among those who have not been pregnant before, 0.9189 more among women who have not given birth before and 3.84 more among women who received SMS reminders. Being in a marital union increases the attendance of more than four ANC visit by 8%, having not been pregnant before by 63.8% and having not given birth before by 8.1%. SMS reminders reduce the chances of missing more than four ANC appointments by 284%.

5.2.4 Comparison of skilled delivery attendance among pregnant women who receive SMS reminders and those who did not receive the reminders in West Pokot County

With reference to relative risk, incidence of skilled birth was 0.6870 more among women who attended first ANC within the first 12 weeks, 0.5828 among married women and 0.6408 more among educated women. Women who owned mobile phones had 0.3250 incidence of SDA, those who have never been pregnant before had 0.1117 incidence more than any other category while those who have never given birth before had 1.2008 more incidence. Those who received SMS reminders were at 2.256 more likely. Attending first ANC within the first 12 weeks reduces missing of SDA by 31.3%, being married reduces missing SDA by 41.7%, being educated reduces missing SDA by 35.9% while owning a mobile phone reduces missing of SDA by 67.5%. Having not been pregnant before reduces the chances of missing skilled delivery by 88.8% while having not given birth before increases attendance of skilled delivery by 20.1%. SMS reminders increased deliveries at the health facility by 125.6%.

The findings above are consistent with the findings from other scholars. Nzioki. Onyango, and Ombaka. 2015, revealed the more children a woman had the more likely she was to deliver at home. However, income and increasing age demonstrated increase in the usage of ANC and SDA. In the current study, the researcher did not find income and increasing age to be significant in determining utilization of maternal health services in West Pokot County given that most of the mothers were of young age while a quarter did not have any form of income. For those who were married, they depended on their husbands for provision and support. The general education level of the women in West Pokot was very low and even in comparison to their partners, many women had lower-level education. As the education level increased, then the marital status changed from married to single which affects the general moral support and income support from their partners.

The findings above are consistent with what other researchers experienced in different regions. In Rwanda, an SMS-based system resulted in an increase in facility-based deliveries was registered from 72% to 92% at the end of the twelve months (Ngabo *et al*, 2012). Another study was conducted in Nairobi, Kenya to assess the effect of short message service (SMS) communication on facility delivery, exclusive breastfeeding (EBF), and contraceptive use. The overall facility delivery rate was high (98%) and did not differ by arm. (Unger. *et al*, 2018). A systematic review and meta-analysis of 7 randomized control studies, was aimed to determine the effectiveness of short message services (SMS) on Focused Antenatal Care (FANC) visits and the attendance of skilled birth professionals in Low- and Middle-Income Countries (LMICs). Pregnant mothers who received text messaging had a 174% increase in FANC visits (OR = 2.74 (95% CI: 1.41, 5.32) and 82% in skilled birth attendance (OR = 1.82 (95% CI; 1.33, 2.49) (Wagnew *et al*, 2018).

5.2.5 Challenges faced by pregnant women in seeking antenatal care and skilled delivery services in West Pokot County

As one of the findings in the study, male involvement and support was one of the pillars behind marital status affecting the study outcomes. This was expressed in the focus group discussions as the male partners continued to offer financial support for transport to the health facilities and to accompany the women to the health facility. The reminder from the health facility brought the sense of awareness to some husbands triggering them to step up to their supportive roles. Pressure to give birth early, limited autonomy, and little knowledge about reproductive health issues make married adolescents vulnerable to risky pregnancies. Early-married women face a range of barriers to use existing health services including work overload, transport and distance to health care facilities, qualities of services, verbal abuse by health care providers, and shyness and embarrassment (Maharjan, Rishal and Svanemyr, 2019). A study conducted in Malawi between July and December 2010, identified distance from service delivery points and lack of integration as reasons contributing to poor uptake. In addition, community opinion leaders were not empowered with knowledge. (Gombachika, *et al*, 2012).

Huge distances to be covered to the health facilities and high poverty levels were regularly raised by women as reasons behind failure to seek care during pregnancy in West Pokot County. Maternal health services are offered in few health facilities which further contributes to the distance. Ignorance and level of illiteracy are high among women in West Pokot and some do not see the need to visit health facilities when they do not have a specific health condition both during pregnancy and after. During childbirth, the presence of male doctors and nurses at the health facilities caused women to shun hospital deliveries. Others feared operation, questions at the health facilities and HIV tests. Several scholars identified

autonomy and household chores as one of the reasons behind lack of utilization of services. However, in West Pokot County, women appreciate the support they get from their husbands and relatives in accessing healthcare. Therefore, both autonomy and household chores were not among the key reasons for non-use.

Despite the reasons raised above, most of the mothers understand the importance of hospital deliveries and care at ANC generally. Many mothers felt that the community is largely not aware of these important reasons for adopting hospital care while pregnant. Therefore, they proposed educating the community on the need for antenatal care and hospital deliveries. They also said it was important to tell women that the services are free of charge.

5.3   Conclusions

The study made the following conclusions from the findings.

5.3.1   Demographic factors influencing antenatal care attendance

There is a significant association between antenatal care attendance and the woman's marital status across all levels. Gestation age at first antenatal care visit had a significant association with the third and four plus antenatal care attendance. This means that as the pregnancy continued growing, it became more important if the women started off the first antenatal care appointment early. Many women (93%), presented at the health facilities at more than 12 weeks of gestation age. For the remaining demographic variables, there is no significant association between antenatal care and age, education, marital type or income.

5.3.2 Demographic factors influencing skilled delivery attendance

The study further concludes that there is a significant association between skilled delivery attendance and the woman's education status, marital status and mobile phone ownership. Women who had any form of education, existed in marital unions, and who owned mobile devices were more likely to deliver at the health facility. There is also no significant association between skilled birth attendance and age, marital type or income.

5.3.3 Comparison of antenatal care and skilled delivery attendance between intervention and the control group

SMS reminders are an effective mechanism to promote improved care seeking behavior for maternal health services based on the findings. The SMS reminders, increased ANC appointment adherence by 61.9% (RR=1.6190); 78.3% (RR=1.7830) and 147.7% (RR=2.477) for 2nd, 3rd and 4th ANC appointments. For more than four ANC appointments, adherence was increased by 284% (p-value 0.000, RR=3.84). SDA is increased by 125.6% (RR=2.256). From these findings, SMS reminders become even more significant further along the pregnancy and the continuum of care as the effectiveness increases at each higher level of engagement.

5.3.4 Challenges faced by pregnant women while seeking antenatal care and skilled delivery services at the health facility

Financial challenges, distance from the health facilities and lack of general awareness on the importance of seeking health facility care were among the key challenges experienced by women in the county, while seeking care during pregnancy and at delivery. It is further noted that the gender of healthcare workers is a key contributor to women shying away from maternal health services during pregnancy.

5.4   Recommendations

Based on the study conclusions, the following are the recommendations from the study.

5.4.1 Demographic factors influencing antenatal care and skilled delivery attendance

Marital status and gestation age at first antenatal care appointment, proved to be key predictors for the first antenatal care appointment. Maternal marital status specifically, continued to be significant in determining the usage of maternal health services across the entire continuum from the first antenatal care visit to the point of delivery. Women and young girls should be encouraged to get children in marital unions as much as possible. As soon as a woman suspects or is known to be pregnant, they should be encouraged to visit the health facility. During this visit, they will get further education on the need to regularly attend the clinics and to deliver at the health facility. To enhance these, maternal health programs can use community health structures to reach out and create more awareness among the male counterparts and how their involvement could save maternal lives. For women who get pregnant out of marriage, they could be given special attention and additional support, while increasing the contacts between themselves and the healthcare workers for better outcomes. Education level, marital status and mobile phone ownership were significantly associated with skilled delivery attendance. Women could be engaged in activities that will support their generation of income to boost their economic status. Generally, parents could be encouraged to educate the girl child as much as the boy child. Access to information that could further enhance decision making should be availed for the women through the women groups, encouraging women to read and to enlighten themselves.

5.4.2 Comparison of SMS reminders in the control and intervention groups

SMS reminders are proving to be effective in improving maternal health outcomes in West Pokot County. The approach should be incorporated as part of routine care for pregnant women in addition to the existing strategies. This method coupled with additional recommendations below, should continue to be evaluated and improved to determine the best timing and frequency of messages. SMS reminders as an intervention is affordable and easy to implement.

5.4.3 Challenges faced by women while attending antenatal care and skilled delivery attendance

Many women during the focussed group discussions expressed the main reason they shun health facility services was due to having male nurses and doctors at the health facility. Given this concern, and with an aim of saving lives, the government can consider posting more female workers to these regions as much as possible. During community dialogue meetings, women who have been attended to by male doctors can share their experiences to enlighten the other women within their units.

Pregnant women need health information to increase their empowerment while practicing preventive health behaviours, boosting self-care capabilities, and reducing anxiety in case of new health issues or stressful situations (Chalak & Riahi, 2017). According to the general findings from the focus group discussions, many women gave the feedback that they did not see the need to go to hospital especially without any complications. For those who presented at the health facilities, the tendency is to appear late for the first ANC. There is therefore need to continue educating women on the importance of visiting the health facilities during

pregnancy and demystify the belief that caesarean delivery is compulsory for anyone who visits the facilities.

More dispensaries and clinics could be equipped with staffing and equipment that can enable basic care during pregnancy to be offered. Improved rapport between healthcare workers and clients could create additional avenues for passing more information and awareness on the maternal health services.

5.5 Suggestions for Further Research

As represented by most of the literature, there is still need for more research to generate information on the use of mobile phones systems to enhance maternal health services. Many other services like vaccination, immunization, cancer treatment have had several studies conducted. However, evidence is still scarce for maternal health services. As more information is being generated, there is need to focus on adolescents and the youth. Looking at the trend in Kenya, with the hit of the COVID19 pandemic, many schools were closed. As a result, a number of school-going girls were reported as having been pregnant over the break. The question to answer is whether they utilize maternal health services and the challenges they face especially with stigmatization in the community due to their status.

In this research, only 93% of the expectant women showed up for the first ANC visit within 12 weeks as recommended by WHO. There is need to conduct further research and identify key contributors to late presentation for ANC in the county and among the communities living in arid and semi-arid regions. This will further support the development of interventions that will encourage mothers to start attending clinics early. Though it did not come out clearly during FGDs, those who cited discomfort to be attended by male doctors

could have likely fallen back to the traditional birth attendants as they are all female. Many women expressed that due to their low financial status, they needed support from their husbands, both emotional and financial to successfully utilize maternal health services, this being a patriarchal community. Further research needs to be conducted to assess the impact of male involvement in enhancing maternal health services utilization at the health facility and at community level.

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A: Data Collection Tools

1. Informed Consent form for participation in the study

This Form is for women who attend 1ˢᵗ ANC clinic, and who will be invited to participate in research on use of mobile SMS to enhance adherence to ANC program and uptake of skilled birth attendance services. The title of the research project is:

Principal Investigator: Alexia Wadime Mshambala

Organization: Maseno University

Sponsor: Self

Proposal and version: "*Effectiveness of mobile SMS reminders on antenatal care and skilled delivery attendance among pregnant women in West Pokot County, Kenya*

PART I: Information Sheet

Introduction

As a student of Maseno University, I will be conducting research on use of SMS reminders to enhance uptake of ANC and skilled delivery services among pregnant women in West Pokot County. West Pokot County is one of the counties contributing to poor maternal health indicators for Kenya as a country that seems to have started improving in these indicators. This research will involve sending SMS reminders one day to your appointment date to remind you to return to the facility for the services until you deliver. The study is targeting all expectant women attending 1ˢᵗ ANC clinic at the health facilities and residing in West Pokot Sub-County. The research will continue for a period of 6 months to allow follow up of the final client to delivery.

The information that will be collected from this research project will be kept confidential. All information will be stored in password protected databases and will have special codes for identification for each client. Your participation in this research is entirely voluntary and whether you choose to participate or not, all the services you receive at this clinic will continue and nothing will change. The knowledge that we get from conducting this research will be shared with you through community meetings before it is made widely available to the public.

If you have any questions, you may ask them now or later, even after the study has started. If you wish to ask questions later, you may contact the principal investigator on:

Alexia Wadime Mshambala

0725 356 131

alexiawadime@gmail.com

This proposal has been reviewed and approved by the Maseno Ethical Review Board which is a committee whose task is to make sure that research participants are protected from harm.

PART II: Certificate of Consent

I have read the aforementioned information, or it has been read to me. I have had the opportunity to ask questions about it and I have been answered to my satisfaction. I consent voluntarily to participate in this research as a study participant.

Print Name of Participant_____

Signature of Participant _____

Date (dd/mm/yyyy)_____

If illiterate

A literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb-print as well.

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness: **AND Thumb print of participant**

_____

Signature of witness _____

Date (dd/mm/yyyy) _____

2. Assent form for Women less than 18 years of age

This Informed Consent Form is for women who attend ANC clinic but have not yet attained 18 years of age and who will be invited to participate in research on use of mobile phone SMS to enhance adherence to ANC program and uptake of skilled birth attendance services. The title of the research project is:

Principal Investigator: Alexia Wadime Mshambala

Organization: Maseno University

Sponsor: Self

Proposal and version: "Effectiveness of mobile SMS on uptake of Maternal Health services among pregnant women in West Pokot County", Final Draft.

PART I: Information Sheet

Introduction

As a student of Maseno University, I will be conducting research on use of SMS reminders to enhance uptake of ANC and skilled delivery services among pregnant women in West Pokot County. West Pokot County is one of the counties contributing to poor maternal health indicators for Kenya as a country that seems to have started improving in these indicators. This research will involve sending SMS reminders one day to your appointment date to remind you to return to the facility for the services until you deliver. The study is targeting all expectant women attending 1st ANC clinic at the health facilities and residing in West Pokot Sub-County. The research will continue for a period of 6 months to allow follow up of the final client to delivery.

The information that will be collected from this research project will be kept confidential. All information will be stored in password protected databases and will have special codes for

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If you have any questions you may ask them now or later, even after the study has started. If you wish to ask questions later, you may contact the principal investigator on:

<p align="center">**Alexia Wadime Mshambala**</p>

<p align="center">**0725 356 131**</p>

<p align="center">**alexiawadime@gmail.com**</p>

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PART II: Certificate of Consent

I have read the aforementioned information, or it has been read to me. I have had the opportunity to ask questions about it and I have been answered to my satisfaction. I consent voluntarily to participate in this research as a study participant

Print Name of Participant_____

Signature of Participant _____

Date (dd/mm/yyyy) _____

If illiterate

A literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb-print as well.

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness_____ AND Thumb print of participant

Signature of witness _____

Date (dd/mm/yyyy): _____

3. Statement by the researcher/person taking consent or assent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

    1. Mobile number of other details will be collected at enrollment to the study

    2. SMS will be sent to the participant periodically and in line with the hospital appointment dates 24 hours to the appointment date

    3. These reminders will be forwarded to the client until they deliver at the health facility

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

  A copy of this ICF has been provided to the participant.

Print Name of Researcher/person taking the consent:

_____

Signature of Researcher /person taking the consent_____

Date (dd/mm/yyyy) _____

4. Guardian Authorization Form

Your child is invited to participate in a research study conducted by Alexia Wadime Mshambala from Maseno University the department of public Health. The study's aim is to improve uptake of maternal health services among pregnant women in West Pokot County and your daughter has randomly been selected. If you allow your child to participate, details about her age and access to mobile phone will be collected. This will be used to offer further assistance to your child during her pregnancy through sending of short messages to remind her of her hospital appointments. The study will take place at the selected health facilities.

Your child's participation is voluntary. If you decide to allow your child to participate, you and/or your child are free to withdraw your consent and discontinue participation at any time without penalty.

If you have any questions about the study, please feel free to contact:

Alexia Wadime Mshambala

0725 356 131

alexiawadime@gmail.com

Your signature indicates that you have read and understood the information provided above, that you willingly agree to allow your child to participate in the study.

Print name of guardian _____

Guardian Signature _____ **Date:** _____

Witness signature _____**Date:** _____

5. Demographic information form

This form should be filled for every eligible client as per the study criteria. Apart from questions on marital status, occupation, income and mobile phone ownership, the rest should be obtained from the MOH 405 ANC register

#	Question	Response	Tick the response
1	Age in years (Write age in years)	_____	N/A
2	Marital status	a) Single	
		b) Married	
		c) Widow	
		d) Separated	
		e) Divorced	
3	Age at marriage (Write age in years)	_____	N/A
4	Husband education	a) None	
		b) Primary 1-4	
		c) Primary 5-8	
		d) Secondary	
		e) Tertiary College/Institution	
		f) University	
		g) Others (Specify)	
5	Husband Occupation	a) Farmer	
		b) Student	
		c) Business	
		d) Salaried employment	
		e) Others specify _____	
6	Type of marriage	a) Monogamous	
		b) Polygamous	
7	Education Level	a) None	
		b) Primary 1-4	
		c) Primary 5-8	
		d) Secondary	
		e) Tertiary College/Institution	
		f) University	
		g) Others (Specify)	
8	Occupation	a) Farmer	
		b) Student	
		c) Business	
		d) Salaried employment	
		e) Others specify _____	
9	Income (Ask the average amount of	Enter amount in figures: _____	N/A

	money earned per month)		
10	Number of children (Enter number in Figures. If none write zero)		**N/A**
11	Mobile Phone ownership? (Ask whether the client has a functional mobile phone of their own)	a) Yes	
		b) No	
12	**If no, in 11 above**, do you have access to a mobile phone at least once a day	a) Yes	
		b) No *(Terminate study and move to next client)*	
13a	**If yes in 12 above,** whose mobile phone do you access	a) Husband b) Neighbour c) Relative (Specify)_____ d) Other (Specify) _____	
13b	Does the person stay close to you where you can be reached easily?	a) Yes	
		b) No	
13c	Please provide us with the mobile phone number above	*Write the mobile number (Record mobile phone number here. Should client access more than one phone, probe for the most accessed)* _____	

6) ANC Appointment Tracker

ANC APPOINTMENT TRACKER													
#	ANC Number	Phone Number	Date of first ANC visit (dd/mm/yyyy)	1st appointment date (dd/mm/yyyy), *check date from the mother baby booklet or exercise book*	Date client came for 1st appointment (dd/mm/yyyy) *Refer to revisit date in the ANC register*	2nd appointment date (dd/mm/yyyy), *check date from the mother baby booklet or exercise book*	Date client came for 2nd appointment (dd/mm/yyyy) *Refer to revisit date in the ANC register*	3rd appointment date (dd/mm/yyyy), *check date from the mother baby booklet or exercise book*	Date client came for 3rd appointment (dd/mm/yyyy) *Refer to revisit date in the ANC register*	4th appointment date (dd/mm/yyyy), *check date from the mother baby booklet or exercise book*	Date client came for 4th appointment (dd/mm/yyyy) *Refer to revisit date in the ANC register*	Any other client visit for **ANC** above 4 (YES/NO), refer to ANC revisit column in ANC register	Number of additional Visits (How many more ANC appointments did they come for after the 4th appointment)
1													
2													
3													
4													
5													
6													
7													
8													

7) **Maternity Appointment Tracker**

SN	ANC Number	Phone Number	Date of delivery (dd/mm/yyyy)	Gestation age at birth (weeks)	Mode of delivery	Baby weight	Sex of baby (M/F)	Baby dead or alive? (*Refer to maternity register and confirm*)	Mother condition after birth	Condition of baby on discharge
MATERNITY APPOINTMENT TRACKER										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										

8) **FGD Guide for women who delivered in the last 12 months**

This is a guide for the FGD discussion for women who delivered in the last 12 months. The moderator should let the respondents know that there is no right, or wrong answer and that the information provided will be used for research and in making maternal health services better for women in West Pokot County. Before the discussions begin, moderator should be keen to collect demographic details of the respondents.

SECTION A: Background Variables

1. Age_____ (Write the ages of the participants in Years)

2. Education Level

a) None	
b) Primary 1-4	
c) Primary 5-8	
d) Secondary	
e) Tertiary College/Institution	
f) University	
g) Others (Specify)	

3. Marital Status

a) Single	
b) Married	
c) Widow	
d) Separated	
e) Divorced	

4. Age at marriage (Write ages of the participants)

_____

5. Husband's occupation if married

a) Farmer	
b) Student	
c) Business	
d) Salaried employment	
e) Others specify _____	

6. Husband education if married

a) None	
b) Primary 1-4	
c) Primary 5-8	
d) Secondary	
e) Tertiary College/Institution	
f) University	
g) Others (Specify)	

7. Type of marriage if married

   a) Polygamous _____

   b) Monogamous _____

8. Income of the mother (Ask the average amount of money earned per month and enter the

   amount in figures) _____

9. Occupation of the mother

a) Farmer	
b) Student	
c) Business	
d) Salaried employment	
e) Others specify _____	

10. Number of Children _____

SECTION B: Discussion Questions

11. What are some of the reasons that make mothers not to seek skilled care at the facility

   a) during pregnancy

   b) during child birth

   c) After delivery / child birth

12. What is your feeling about delivering at the health facility? How do you take delivering at

   the health facility?

13. What do you know about dangers of home delivery? What are those dangers?

14. What should you do in case of those dangers?

15. What do you know about antenatal care? Why do you think it is important?

16. What can be done to help more mothers in your community to seek skilled care during pregnancy and delivery?

17. How do you think the men (husbands) will react to SMS reminders from the facility to return for care during pregnancy?

18. What time would be appropriate to send the reminders?

Summarize the key points and ask if there are any questions. Otherwise thank the team and close the meeting.

B. Maseno University School of Graduate Studies Approval

MASENO UNIVERSITY

SCHOOL OF GRADUATE STUDIES

Office of the Dean

Our Ref: PG/MPH/00079/2012

Private Bag, MASENO, KENYA
Tel:(057)351 22/351008/351011
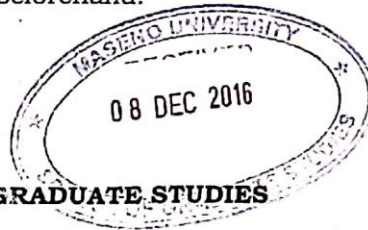FAX: 254-057-351153/351221
Email: sgs@maseno.ac.ke

Date: 8/12/2016

TO WHOM IT MAY CONCERN

**RE: PROPOSAL APPROVAL FOR ALEXIA WADIME MSHAMBALA —
PG/MPH/00079/2012**

The above named is registered in the Master of Public Health programme, in the School of Public Health and Community Development, Maseno University. This is to confirm that her research proposal titled **"Effectiveness of Mobile SMS Reminders on Antenatal Care and Skilled Delivery Attendance among pregnant Women in West Pokot County, Kenya"** has been approved for conduct of research subject to obtaining all other permissions/clearances that may be required beforehand.

08 DEC 2016

Prof. J.O. Agure
DEAN, SCHOOL OF GRADUATE STUDIES

Maseno University   *ISO 9001:2008 Certified*

C. Maseno University Ethics Review Board Approval (i)

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE

Tel: +254 057 351 622   Ext: 3050
Fax: +254 057 351 221

Private Bag – 40105, Maseno, Kenya
Email: muerc-secretariate@maseno.ac.ke

FROM: Secretary - MUERC

DATE: 22nd March, 2017

TO: Alexia Wadime Mshambala
PG/MPH/00079/2012
Department of Public Health
School of Public Health and Community Development
Maseno University
P. O. Box, Private Bag, Maseno, Kenya

REF:MSU/DRPI/MUERC/00366/17

RE: Effectiveness of Mobile SMS Reminders on Antenatal Care and Skilled Delivery Attendance among Pregnant Women in West Pokot County, Kenya. Proposal Reference Number: MSU/DRPI/MUERC/00366/17

This is to inform you that the Maseno University Ethics Review Committee (MUERC) determined that the ethics issues raised at the initial review were adequately addressed in the revised proposal. Consequently, the study is granted approval for implementation effective this 22nd day of March, 2017 for a period of one (1) year.
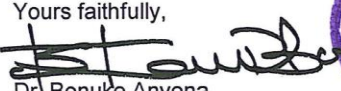
Please note that authorization to conduct this study will automatically expire on 21st March, 2018. If you plan to continue with the study beyond this date, please submit an application for continuation approval to the MUERC Secretariat by 22nd February, 2018.

Approval for continuation of the study will be subject to successful submission of an annual progress report that is to reach the MUERC Secretariat by 22nd February, 2018.

Please note that any unanticipated problems resulting from the conduct of this study must be reported to MUERC. You are required to submit any proposed changes to this study to MUERC for review and approval prior to initiation. Please advice MUERC when the study is completed or discontinued.

Thank you.

Yours faithfully,

Dr. Bonuke Anyona,
Secretary,
Maseno University Ethics Review Committee.

Cc: Chairman,
Maseno University Ethics Review Committee.

C. Maseno University Ethics Review Board Approvals (ii)

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE

Tel: +254 057 351 622   Ext: 3050
Fax: +254 057 351 221

Private Bag – 40105, Maseno, Kenya
Email: muerc-secretariate@maseno.ac.ke

FROM: Secretary - MUERC

DATE: 23rd November, 2017

TO: Alexia Wadime Mshambala
PG/MPH/00079/2012
Department of Public Health
School of Public Health and Community Development
Maseno University
P. O. Box, Private Bag, Maseno, Kenya

REF: MSU/DRPI/MUERC/00366/17

RE: Effectiveness of Mobile SMS Reminders on Antenatal Care and Skilled Delivery Attendance among Pregnant Women in West Pokot County, Kenya. Proposal Reference Number: MSU/DRPI/MUERC/00366/17

The Maseno University Ethics Review Committee (MUERC) received your proposed amendments deliberated and determined that the issues presented were appropriate and do not change the aims of the approved research study. In addition, the changes do not expose study participants to increased risk or harm. Consequently the study is granted amendment approval effective this 23rd day of November, 2017. Please note that approval for the study was granted on the 22nd day of March, 2017 for a period of one (1) year.

Please note that authorization to conduct this study will automatically expire on 21st March, 2018. If you plan to continue with the study beyond this date, please submit an application for continuation approval to the MUERC Secretariat by 22nd February, 2018.

Approval for continuation of the study will be subject to successful submission of an annual progress report that is to reach the MUERC Secretariat by 22nd February, 2018.

Please note that any unanticipated problems resulting from the conduct of this study must be reported to MUERC. You are required to submit any proposed changes to this study to MUERC for review and approval prior to initiation. Please advice MUERC when the study is completed or discontinued.

Thank you.

Dr. Bonuke Anyona,
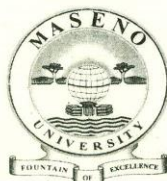Secretary,
Maseno University Ethics Review Committee.

Cc: Chairman,
Maseno University Ethics Review Committee.

DIRECTORATE OF RESEARCH PUBLICATION & CONSULTANCIES — 2 3 NOV 2017 — MASENO UNIVERSITY

MASENO UNIVERSITY IS ISO 9001:2008 CERTIFIED

C. Maseno University Ethics Review Board Approvals (iii)

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE

Tel: +254 057 351 622   Ext: 3050
Fax: +254 057 351 221

Private Bag – 40105, Maseno, Kenya
Email: muerc-secretariate@maseno.ac.ke

FROM: Secretary - MUERC

DATE: 26th October, 2018

TO: Alexia Wadime Mshambala
PG/MPH/00079/2012
Department of Public Health
School of Public Health and Community Development
Maseno University
P. O. Box, Private Bag, Maseno, Kenya

REF: MSU/DRPI/MUERC/00366/17

RE: Effectiveness of Mobile SMS Reminders on Antenatal Care and Skilled Delivery Attendance among Pregnant Women in West Pokot County, Kenya. Proposal Reference Number: MSU/DRPI/MUERC/00366/17

The Maseno University Ethics Review Committee (MUERC) considered your valued application for extension of ethics approval of your study. The Committee commended the progress made and granted an **approval for continuation** of the study effective this 26th October, 2018 for a period of one (1) year.

Please note that authorization to conduct this study will automatically expire on 26th October, 2019. If you plan to continue with the study beyond this date, please submit an application for continuation approval to the MUERC Secretariat by 15th September, 2019.

Approval for continuation of the study will be subject to successful submission of an annual progress report that is to reach the MUERC Secretariat by 15th September, 2019.

Please note that any unanticipated problems resulting from the conduct of this study must be reported to MUERC. You are required to submit any proposed changes to this study to the MUERC for review and approval prior to initiation. Please advice MUERC when the study is completed or discontinued.

Thank you.

Yours faithfully,

Dr. Bonuke Anyona,
Secretary,
Maseno University Ethics Review Committee.

Cc: Chairman,
Maseno University Ethics Review Committee.

MASENO UNIVERSITY IS ISO   9001:2008 CERTIFIED

D. Ministry of Interior and Coordination of National Government Approval

THE PRESIDENCY
MINISTRY OF INTERIOR AND COORDINATION
OF NATIONAL GOVERNMENT

Telegrams: "**DISTRICTER**"	The County Commissioner's Office
COUNTY COMMISSIONER	West Pokot County,
Telephone	P.O BOX 1-30600,
Email: ccwestpokot@gmail.com	**KAPENGURIA.**

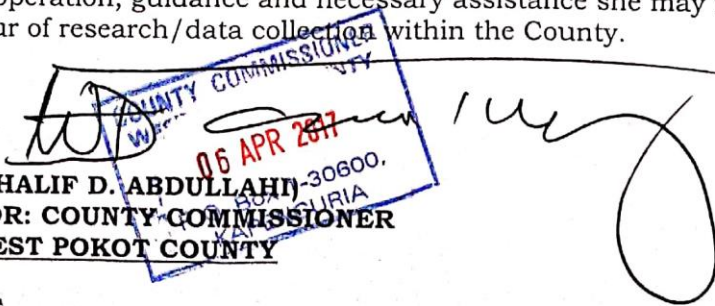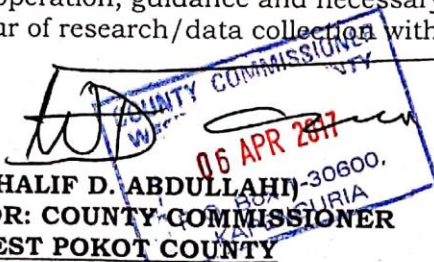**REF: OOP.CC.ST.15/14 VOL.I/93**   **6TH APRIL, 2017**

TO WHOM IT MAY CONCERN

RE: **RESEARCH/DATA COLLECTION AUTHORIZATION**
 ALEXIA WADIME MSHAMBALA – PG/MPH/00079/2012

Reference is made to the Dean, School of Graduate Studies letter NO. PG/MPH/00079/2012 dated 8th December, 2016 on the above subject.

The above named person has been dully authorized to carry out research/data collection in this County on *"Effectiveness of Mobile SMS Reminders on Antenatal Care and Skilled Delivery Attendance among pregnant Women in West Pokot County, Kenya"* for a period of six months from the date of this latter.

The purpose of this letter, therefore, is to request you to accord her your cooperation, guidance and necessary assistance she may require during her tour of research/data collection within the County.

(KHALIF D. ABDULLAHI)
FOR: COUNTY COMMISSIONER
WEST POKOT COUNTY

CC

County Director of Health
WEST POKOT COUNTY

156

E. Ministry of Health West Pokot County Approval

MINISTRY OF HEALTH

Telephone: 0708615348
E-mail: wpcountyhealth@gmail.com

When replying please quote.

MINISTRY OF HEALTH,
WEST POKOT COUNTY
P.O BOX 63-30600,
KAPENGURIA

REF: **MOH/CDH/HRM/VOL.I (17)**

11th April, 2017.

TO WHOM IT MAY CONCERN

RE: RESEARCH/DATA COLLECTION AUTHORIZATION: ALEXIA WADIME MSHAMBALA – PG/MPH/00079/2012

Reference is made to your authorization Letter Ref No; **OOP.CC.ST.15/14 VOL.1/93** dated **6th April, 2017** on the above subject.

The above named person has been dully allowed to carry out research/data collection in this County in the department of Health and Sanitation on "Effectiveness of Mobile SMS Reminders on Antenatal Care and Skilled Delivery Attendance among pregnant women in West Pokot County, Kenya" for a period of six months from the date of this letter.

Thank you.

1 3 APR 2017

Geoffrey Lokong,
For: County Director of Health,
WEST POKOT COUNTY.

F. Appendix: Map of Kenya showing location of West Pokot County

Location of West Pokot County