EFFECT OF *m*HEALTH TECHNOLOGY IN ENHANCING POSTNATAL VISITS AMONGST MOTHERS ATTENDING MCH/FP CLINICS IN SELECTED HOSPITALS IN KAKAMEGA COUNTY, KENYA.

CHARLES KIRAGU NGIGI (MPH-EPIDEMIOLOGY)
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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

Signature .....Date 20/5/2022

Charles Kiragu Ngigi, (MPH)
Q97/37411/2016
Department of Community Health and Epidemiology

Supervisors

This thesis has been submitted with our approval as University Supervisors.

Signature.....Date 20/05/2022

Dr. Justus O.S. Osero (PhD)
Department of Community Health and Epidemiology
Kenyatta University.

Signature.....Date 20/5/2022

Prof. Anthony K. Wanyoro (PhD)
Department of Obstetrics and Gynaecology
Kenyatta University.

DEDICATION

I dedicate this thesis to my wife Wanjiru for her continuous encouragement. To my sons Ngigi, Chege, and Njoroge, you have been a source of inspiration. To my mother Mugure, you taught me patience and to remain focused.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEFINITIONS OF OPERATIONAL TERMS

Antenatal care A service given to a pregnant woman from conception to the onset of labour (WHO, 2018).

Health systems The functioning of health facilities or provision of services related to patient care and the support that is needed including staffing, availability, and accessibility, perceived quality of services and previous use of health services (WHO, 2018).

Infant mortality rates The likelihood of dying before first birthday per 1,000 live births (KNBS, 2015).

Knowledge An acquaintance or awareness of care provided in the postnatal clinic, such as counselling on HIV, breast feeding and nutrition, health checks on mother and child (Bolisani and Bratianu, 2018).

Maternal death Occurrence of death in a woman while pregnant or within forty-two days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes (WHO, 2015).

Maternal morbidity A medical complications in a woman caused by pregnancy, labour, or child delivery (MOH, 2012).

Maternal mortality The demise of a woman whereas pregnant or within forty- two days of cessation of pregnancy, irrespective of the duration and site of the pregnancy, but not from accidental or incidental causes (MOH, 2012).

Maternity Refers to the period during pregnancy and shortly after the delivery of a child (WHO, 2017).

Maternity healthcare providers These are the people charged with the responsibility of giving delivery related services to the clients in any given health facility (WHO, 2017)

***m*Health** Incorporation of mobile phone technologies in healthcare

Neonatal deaths Refer to deaths of a baby occurring during the first twenty-eight days after birth (UNICEF, 2017).

Neonatal mortality rate The possibility of dying within the first month of life per 1000 live births (KNBS, 2015).

Postnatal care Care provided to the mother and baby following birth, and offers the opportunity to assess the mother for any medical, mental, emotional and social issues, and assessment of the health status of the baby (WHO, 2015).

Preterm birth Babies born alive before 37 weeks' gestation are completed (UNICEF, 2017).

Woman of reproductive age Women aged 15-49 years (WHO, 2012).

ABBREVIATIONS AND ACRONYMS

AIDS	Acquired immunodeficiency syndrome
ANC	Antenatal Care
EPNC	Early Postnatal Care
FP	Family Planning
FGD	Focus Group Discussion
HIV	Human Immunodeficiency Virus
KNBS	Kenya National Bureau of Statistics
KDHS	Demographic Health Survey
KII	Key Informant Interview
LLITN	Long Lasting Insecticide Treated Nets
MCH/FP	Maternal Child Health and Family Planning
MOH	Ministry of Health
MMR	Maternal Mortality Ratio
NMR	Neonatal Mortality Rate
NACOSTI	National Council of Science, Technology and Innovation
OR	Odds Ratio
PNC	Postnatal Care

PP	Postpartum
PPC	Postpartum Care
RCT	Randomized Controlled Trial
SDG	Sustainable Development Goals
SPSS	Statistical Package of Social Sciences
SMS	Short Message Services
STI	Sexually Transmitted Infections
UNFP	United Nations Population Fund
UNICEF	United Nations Children's Fund
WHO	World Health Organization

ABSTRACT

Postnatal care is the provision of health services to the mother and newborn after delivery. It offers the opportunity to assess the mother for any medical, mental, emotional and social issues, and early assessment of risk factors and physical problems with the baby. Postnatal care services are offered by skilled health care workers during the postnatal visits. In Kenya mothers are expected to attend a minimum of four postnatal visits spread across the postnatal period though only a few do that. Globally, very few postnatal mothers seek postnatal services within two days. High maternal and neonatal mortality rate is observed during the first forty two days after child birth. This trend continues throughout the first year of the neonate. The main goal of the study was to determine the effect of mobile health technology in enhancing postnatal visits among postnatal mothers in Maternal Child Health and Family Planning (MCH/FP) clinics in designated health facilities in Kakamega County, Kenya. The study was designed as a cluster Randomized Controlled Trial (RCT) that involved four arms. In control arm the participants received only the routine written and verbal communication whereas in intervention arm 1, participants received routine verbal and written communication and mobile SMS, in arm 2 they received written and verbal communication and a voice call whereas in arm 3, the participants received written/verbal communication and combination of voice call plus Short Text Messages sent to remind them to visit the postnatal clinic. The reminders were packaged together with postnatal (PN) educational health messages. The research involved a study population of 320 postnatal mothers attending MCH/FP clinics. The study sites were purposively selected from four Sub Counties in Kakamega County. Study subjects were selected using a systematic sampling technique until the target was achieved. Quantitative and qualitative data was collected using interview, FGD and KII guides. Data was entered into Microsoft Access data base and analysed using SPSS version 24. At the baseline it was observed that 27% of the participants adhered to 2nd and 3rd postnatal clinic visits. After the intervention there was significant difference (χ^2=28, df=3, p=0.001) between control and intervention arm. Majority of participants (82%) had no/low knowledge on postnatal care before the intervention, however there was significant difference in knowledge between control and study arms (χ^2=113, df=9, p=0.000) after sending health messages. This study concluded that postnatal mothers in Kakamega County have low or no knowledge on postnatal care and only a few attend postnatal clinic within two weeks. This is likely to affect the uptake of postnatal services. Postnatal mothers had a positive attitude on use of mobile health technology in health care. There is a significant relationship between mobile phone reminders and adherence to 2nd and 3rd postnatal visit. Kakamega County government should integrate use of mobile telephone services packaged together with postnatal educational health messages in the provision of health services.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Early postnatal care is the provision of targeted services to both the neonate and postnatal mother. The care start immediately after delivery and continues for the next six weeks that follow and further extends to six months (UNICEF, 2018). This provides a good opportunity to the health workers to do evaluation of risk situations and possible health challenges to the baby and the mother. The mother is examined holistically (physically, psychologically and socially) for issues which may be a threat to her health. The postnatal period is described to start from third stage of labour immediately after delivery of placenta and continues for the next six weeks (WHO, 2015a). Postnatal care services are offered during the postnatal visits and Kenya recommend a minimum of four postnatal visits (Kenya Ministry of Health, 2017). World Health Organization (WHO) recommend that all postnatal mothers should have a minimum of four postnatal visits in order to get skilled postnatal care services (WHO, 2015b). Globally, only less than 50% of the postnatal mothers attend postnatal clinics within two days (WHO, 2019). In Sub Saharan Africa (SSA), only 13% of the postnatal women who are not attended by skilled attendants during delivery access postnatal clinic at 48 hours (WHO, 2015a). In Kenya 53% of mothers attend postnatal clinic within two days (KNBS, 2015).

It is an important and lifesaving practice for the mother and her neonate to receive health services for the first six months after delivery. This prevents the occurrence of death by treating complications arising from mother and neonate (World Bank and UNICEF,

2017). Offering this crucial support to the other family members and the community remains a key objective in achieving postnatal care as the health sector continues to promote and maintain the health of the mother and her neonate (WHO, 2019).

Failure to receive postnatal services may increase morbidity and mortalities to both mother and neonate (Timilsina and Dhakal, 2015). During the first seven days after delivery, approximately 870,000 neonates and 125,000 postnatal mothers lose their lives (WHO, 2018). The uptake of postnatal care is low and approximately 40% of postnatal mothers develop complications after child birth where 15% of them end up with near fatal life threatening outcomes in Low and Middle Income Countries [LMIC] (Langlois *et al.*, 2015). About 34% of crude deaths are due to maternal mortalities caused by antepartum and postpartum haemorrhage. Severe pre-eclampsia and eclampsia is likely to occur to the mother within 72 hours following delivery of the baby (Lin *et al.*, 2018). Throughout the postnatal period, about 10% of maternal mortality is caused by complications of sepsis (Ngozi *et al.,* 2016). During the first six weeks after delivery, neonatal sepsis caused by contamination is very prevalent (Francesca *et al*., 2016). These complications and other pregnancy related problems contributes to the high mortalities where maternal mortality rate in Kenya is estimated to be at 362:100, 000. Furthermore, neonatal death rate is at 22:1000 and infant mortality is 39:1000 (KNBS, 2015). The Sustainable Development Goal (SDG) three proposes to reduce the global maternal mortality to 70:100,000 by 2030 and reduce neonatal mortality to 12 per 1000 live births (United Nations General Assembly, 2015).

Many postnatal women are reluctant to visit postnatal clinic due to assumption that their own health and that of the neonate is not at risk among other reasons such as cultural practices, distance to health facility and lack of knowledge (Wanjala 2015). According to KNBS (2015), 96% of the women visited antenatal clinic where they were attended by skilled attendants whereas 61% of them delivered in a health facility. The same survey shows a national proportion of 53% of postnatal mothers attended postnatal clinic within 2 days after delivery whereas a relatively lower attendance of 36% was reported postnatal clinic within the same period in Kakamega County (KNBS, 2015). Many interventions have been studied with an aim of improving uptake of postnatal services which remains relatively low in many countries among LMIC including Kenya (Djeulloli *et al,*. 2016). This study purposed to come up with an intervention to remind postnatal mothers about their postnatal appointment dates with an intention of increasing uptake of postnatal services.

Kenya is experiencing a rapid mobile telephone infiltration in many areas including rural and urban settlements (Communications Authority of Kenya, 2017). Many people use the mobile phone to communicate but it can also be used in health care to accelerate the uptake of services (GSMA, 2019). Globally, there were 4.68 billion mobile phone subscribers by 2019 (Technology and Telecommunication, 2020). Use of mobile phone in health care has many benefits including early detection of health problems and subsequent treatment follow ups and can therefore save life and prevent complications. Many *m*health strategies have shown evidence of creating awareness on various health issues and even increasing the uptake of health services (Mbuthia *et al.,* 2019). Challenges related with m-health use in provision of health services include security,

usability, data storage and poor connectivity (Gurupur and Wan, 2017). This study aims to improve uptake of postnatal services using simple intervention of SMS and voice call reminders.

1.2 Statement of the Problem

Kakamega County has poor maternal health indicators. Only 36% of postnatal mothers receive check-up within the first two days after delivery. This is a low attendance compared to the other counties such as Nairobi and Kiambu which have 71% and 72% of postnatal mothers attending postnatal clinic after 2 days respectively. A proportion 47% of mothers did not attend any postnatal visit in Kenya whereas 61% of them had no postnatal check-up in Kakamega County in 2014. According to KDHS, 2014 About 62% of newborn babies in Kenya did not have an opportunity to be assessed by health workers within seven days after delivery whereas 70% of them in Kakamega County had no check-up within seven days (KNBS, 2015). Even though there are many strategies being employed to increase the utilization of postnatal services, the uptake of services remains low. Only 28% of postnatal mothers who gave birth in the hospitals in the county received postnatal care within 14 days (KNBS, 2015). Kenya's Ministry of Health (2018) has adopted the WHO recommendations that all postnatal mothers should receive postnatal care. However, according to KNBS (2015), only 53% of postpartum women were offered postnatal care at 48 hours compared to 96% of them attending antenatal clinics indicating a big discrepancy. The situation is not better among the newborn because very few neonates had a check-up by a skilled attendant within two weeks after delivery. Only less than 20% of the neonates receive check-up within 42 days (KNBS, 2015).

The maternal mortality rate in Kenya has continued to be expressively high at 362:100,000 live births (KNBS, 2015) which is not in line with the WHO acceptable statistics of 140:100, 000 (WHO, 2015c). Majority of the deaths happen during the postnatal period and a timely care would result in better outcomes (Alkema *et al.*, 2016). The continued increase of maternal and neonatal morbidity/mortality rates in Kenya are caused by failure to access health services during antenatal period, delivery and postnatal period of which such outcomes are avoidable by adopting a timely healthy seeking behaviour (Kenya Ministry of Health, 2017a). Low birth weight, tetanus and sepsis are the main causes of neonatal deaths that occur in the first 42 days after delivery (Liang, 2018). These are preventable conditions and furthermore manageable if detected early during the postnatal visits.

Kakamega county has poor maternal health indicators where the maternal mortality rate is 316:100,000 live births and is fifth among the counties with high burden of maternal mortalities (Kenya Ministry of Health, 2017b). It has been observed that many of these deaths occur in the postpartum period, which is unacceptably high (KNBS, 2015). The county is from a region which is second among those considered to have the lowest levels of postnatal visits. Just like many other counties in Kenya, Kakamega county has high antenatal clinic attendance (96%) and yet the postnatal attendance is low (36%) with a fast decline (KNBS, 2015). This signals a weak postnatal care programme in the county. In the process of exploring an intervention that may improve the uptake of the postnatal services, this study aims at using the mobile phone reminders to increase the postnatal visits among mothers.

1.3 Justification

A solution was conceptualized by the researcher to come up with possible interventions that can reduce the discrepancy between the low postnatal clinic attendance (34%) at Kakamega County and the high (96%) antenatal clinic visits. If 90% of the routine care offered to postnatal mothers can be achieved, then 10-27% of newborn mortalities and even more maternal mortalities could be prevented (WHO, 2015). The Sustainable Development Goal (SDG) 3 targets to guarantee health lives and encourage wellbeing of every person who is vulnerable with a focus to reduce maternal and neonatal mortality (United Nations General Assembly, 2015). This calls for approaches which would establish intervention which can help improve the wellbeing of the mother and neonate.

Kenyan government recommends four postnatal visits, but this policy is partially implemented in some hospitals where the first, second and fourth postnatal visit are the most affected with very low levels of attendance. This study focused on implementation of the postnatal visits in totality which was expected to increase the postnatal attendance in the health facilities. Postnatal clinics are appropriate entry points in order to achieve good maternal indicators after delivery. Embracing early postnatal care (EPNC) can enhance early detection and treatment of postpartum complications and therefore reduce maternal and neonatal morbidity/mortality (WHO, 2018). An intervention that would improve postnatal visits and eventually increase postnatal services can reduce maternal mortality by 33% (Kenya Ministry of Health, 2017b). Reduction of neonatal and maternal morbidities is likely to decrease the heavy financial burden to the families arising from health care cost.

The introduction of an *m*health intervention to supplement the routine communication (written and verbal) in assigning appointment dates to postpartum women contributes significantly to this study. The effect of combination of short text messages and voice call to improve postnatal clinic attendance has not been adequately investigated in Kenya and in particular Kakamega county. The County has poor maternal indicators and is fifth among 15 counties with heavy burden of high maternal mortality rates (KHIS, 2018), and thus being a suitable study area for such an intervention due to its better mobile phone network coverage compared to other counties with similar poor maternal health indicators.

According to Uddin *et al*., (2017) mobile phone technology can improve health status, improve uptake of health services and determine behaviour outcome. Many studies have focused more on reminders but this study explored on impact of mobile telephone reminders combined with postnatal educational health messages which had not been investigated before in Kakamega County. The study evaluated reasons that contribute to failure to attend postnatal clinic among postpartum women. This study sought to determine a strategy that may increase postnatal visits and maximize utilization of postnatal services. The county has a low uptake of postnatal services which is occasioned by low postnatal visits compared to the high antenatal clinic visits. However, approximately 47% of the mothers deliver their babies in the health facilities (KNBS, 2015).

1.4 Research Questions

1. What is the level of attendance of scheduled postnatal visits among mothers seeking postnatal services in Kakamega County?

2. What is the level of knowledge on postnatal visits among the postnatal mothers attending MCH clinics in Kakamega County?

3. What is the attitude of postnatal mothers on postnatal visit among participants attending MCH Clinics in Kakamega County?

4. What is the postnatal mothers' attitude on mobile technology use in delivering health messages in Kakamega County?

5. What is the effect of SMS, voice call and SMS plus voice call on postnatal visits among mothers seeking postnatal services in Kakamega County?

1.5 Null hypotheses

1. There is no significant difference in postnatal mothers' level of knowledge on postnatal care among participants after sending postnatal educational health messages in control and intervention arms.

2. There is no significant difference in adherence to second and third postnatal visit after making voice call reminders in control and intervention arms.

3. There is no significant difference in adherence to second and third postnatal visit after sending SMS reminders among postnatal mothers in control and intervention arms.

4. There is no significant difference in adherence to second and third postnatal visit after making voice call combined with SMS reminders among mothers in control and intervention arm.

1.6 Objectives of the Study

1.6.1 Main objective

To determine the effect of mobile health technology in enhancing scheduled postnatal visits amongst mothers attending MCH in selected hospitals in Kakamega County.

1.6.2 Specific objective

1. To determine the level of attendance of scheduled postnatal visit among mothers seeking postnatal services in Kakamega County.
2. To establish the level of knowledge on postnatal visits among postnatal mothers attending MCH clinics in Kakamega County.
3. To find out the attitude of postnatal mothers towards postnatal visit among participants attending MCH clinics in Kakamega County.
4. To evaluate postnatal mothers' attitude on use of mobile phone technology in health care among mothers seeking postnatal services in Kakamega County.
5. To assess the effect of mobile phone SMS alone, voice call , and combination of voice call plus SMS on scheduled postnatal visits among mothers seeking postnatal services in Kakamega County.

1.7 Significance of the study

The intervention studied has clearly demonstrated that use of a mobile telephone reminders can significantly increase postnatal visits and eventually improve the utilization of postnatal services. The results therefore offer evidence of using SMS and voice call in enhancing postnatal visits and eventually increase the uptake of postnatal services and consequently improve maternal and neonatal indicators. The study provides

baseline data on attendance of postnatal clinics at the study sites in Kakamega County. This findings can help the policy developers to design policies and guidelines on such intervention that can be implemented and eventually increase postnatal visits in the health facilities. The information and evidence generated from this study can be used by various stakeholders such as government, non-government organizations and private institutions to increase postnatal clinic attendance. The intervention provides an opportunity for mothers to be reminded about the postnatal clinic appointment when going on with their lives. It also contributes to the existing pool of knowledge in matters of *m*health and postnatal care. The study reveals a new understanding that mobile telephone reminders and postnatal health educational messages can be combined to improve patients knowledge and increase postnatal visits which eventually lead to utilization of postnatal care. This study also explored reasons that bars postpartum women from participating fully in postnatal care even when the government has ensured the maternal services are offered at no cost in public health facilities. These reasons can help the health workers to design interventions to improve the postnatal visits. The study provides a strategy for health workers to improve the postnatal mothers' knowledge levels on postnatal care.

1.8 Limitations, delimitations and assumptions

1.8.1 Limitations

Occasionally there was a network failure which prompted the researcher to call the participants severally within the reminder period. Some participants reported having power challenges which made it difficult to be reached after making the first call which necessitated to call the alternative number. The research relied on self-reported data

collection and participants who were of unsound mind were not recruited for the study. Women who did not own a mobile phone were left out because they would miss reminders sent to them. A number of mothers had challenges in their residence with mobile phone network coverage and this made it difficult to contact them. Postnatal mothers who could not read messages were excluded from the study as they would not be able to respond to the reminders sent. Some women who expressed concerns that their husband would not be comfortable with messages and calls made in their mobile phone were not recruited in the study.

Those who opted out of the study continued to receive reminders as the SMS was not automated with option of 'stop'. Mothers who indicated a probability of migrating to another area outside the study sites were not recruited to participate in the study and this prevented high number of drop outs. Pre-testing of the data collection tools was done and errors corrected accordingly. Editing of data collection tools by close of each day's work was carried out to ensure data quality was maintained. Participants with medical conditions were not included in the study. It was assumed that the health workers entered the information correctly every time the participants visited the postnatal clinics.

1.8.2 Delimitations

The study was restricted to the postnatal mothers with access to mobile phone. It focused on utilization of mobile telephone technology in sending reminders to postnatal mothers through Short Text Messages, mobile voice call, mixture of SMS and voice call

including routine way of passing of information. The scope of this study covered only mothers who were willing to attend postnatal visits at the study sites.

1.12 Conceptual framework

Figure 1.1 shows the relationship between independent variables (socio-demographic factors, knowledge/attitude on postnatal care and postnatal mothers' attitude on use of mobile phone in health and the intervening variable on the influence to dependent variable. It is evident from many studies that postnatal health messages can influence uptake of postnatal services (Mbuthia, 2019).

The search for an intervention to improve uptake of services has led many researchers to explore the suitability of mobile health technology. Mobile health interventions are progressively being acknowledged as tools for the delivery of health education and prompting behaviour change. According to Perrier *et al.* (2015) *m*health interventions are practicable and suitable for communicating information about health. In this study, mobile phone was the intervening variable used to communicate to participants reminding them about postnatal visits. The mobile phone reminders were short text messages and voice calls. The reminders were packaged together with postnatal educational health messages. An assessment was done to determine how the reminders influenced adherence to second and third postnatal visits as a dependent variable.

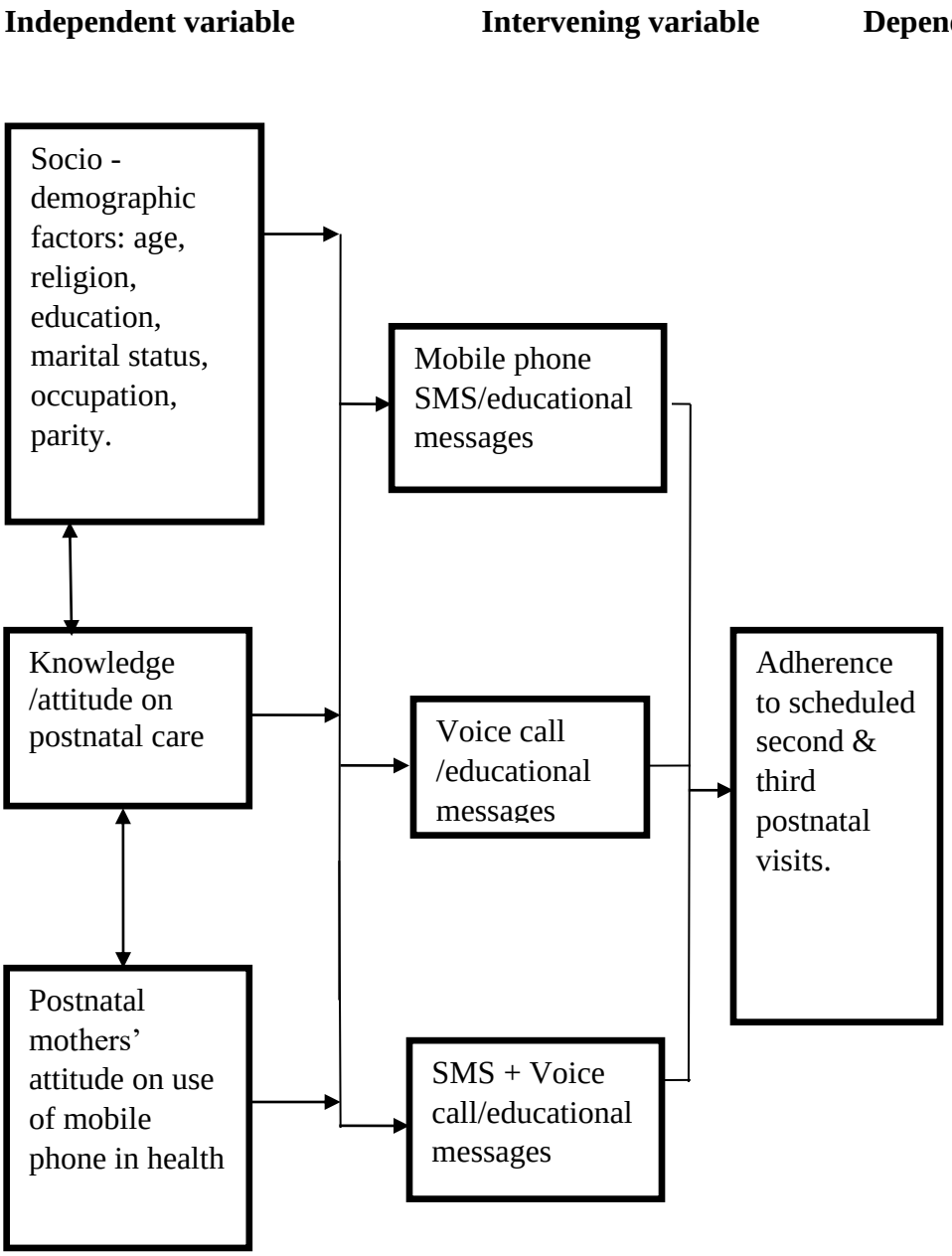

Figure 1.1 Conceptual framework modified from Ndlovu *et al.* (2021)

1.13 Theoretical framework

A theory is set of interrelated concepts which postulate a certain view on a phenomenon or predicting an event. A theoretical framework uses theories in a research to communicate the ideals of the researchers and how the study will process the new

knowledge (Christopher and Stockton, 2018). Many behavioural models such as the health belief model, cognitive theory, trans-theoretical model and theory of reasoned action have been used in the past to change behaviour and more important to improve health seeking behaviour (Choo *et al.*, 2018). The foundation of philosophy contributes to theoretical framework to influence the research process (Pranas, 2017). Theories constructed through experiments, study designs and interventions can be assured by deriving support from scientific explanations (Ridder, 2017). In this study there are variables that contribute to level of knowledge and consequently influence the dependant variable on adherence to second and third postnatal visit. This study borrows heavily from health belief model. The outcome is based on behaviour change after empowering the postnatal mothers with postnatal educational health messages.

Behavioural intentions are indications that a person will do a certain action. Many theorists postulate that if one has knowledge, and strong conviction to do something with no environmental constraints towards performing the behaviour, then there is a high probability of changing the behaviour. Intension to change behaviour is influenced by attitude, perceived norm and self-efficacy (Sheeran *et al.*, 2016). This study focus to empower participants with knowledge on postnatal care and change the attitude.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter outlines the global perspective on postnatal care, Africa perspective on postnatal care, postnatal care in Kenya, knowledge of postnatal care and use mobile health in postnatal care.

2.2 Overview of postnatal care and visits

Postnatal period is considered as the duration occurring immediately after delivery of placenta and extending to six months (WHO, UNICEF, World Bank, 2018). Postpartum period denotes to the mother alone and postnatal when referring to both mother and neonate. Postnatal care services are services given to the postnatal mother during this time and also extended to the baby. The aim of offering postnatal services is to promote physical development to the neonate, promote maternal health, prevent morbidities and mortalities. During this time mothers also acquire nutritional knowledge and other essential skills required to nurture the baby. High maternal and neonatal mortality rates are reported during the first six weeks and continue to be elevated throughout the period that follow (WHO, 2019).

It is recommended that postnatal mothers should attend a minimum of one postnatal visit within 48 hours after delivery (MOH, 2017b). Failure to utilise postnatal services has grave consequences which could be abated if mothers visit postnatal clinics (Timilsina and Dhakal, 2015). Every year about three hundred thousand women die due complications of labour such as bleeding, mostly in developing countries (WHO, 2015). In Sub-Saharan Africa, the postpartum maternal deaths are above the acceptable levels

of 140:100,000 (Kassebaum *et al.,* 2014). The same report shows that over 90% of antenatal mothers attend more than four antenatal visits. Failure to attend postnatal clinic is significantly associated with high maternal morbidity and mortality rates and thus reverses the good achievements of antenatal care (WHO, 2015). Approximately 21% of postnatal women who are illiterate attend postnatal clinic within 48 hours after delivery (KNBS, 2015). This exposes the mother and baby to near fatal risks for failing to go for medical check-up. Illiterate postnatal mothers may not have many sources of information compared to the educated lot.

In Africa, about 10% of the maternal deaths are due to septicaemia though majority of mothers die due to haemorrhage (WHO, 2015). Approximately 75% of the postnatal deaths are associated with complications such as haemorrhage, hypertension and sepsis (WHO., 2019). A big proportion of the 196,000 HIV/AIDS related maternal deaths globally are found in Sub Saharan Africa (WHO, 2019). It is reported in many studies that various complications are likely to occur during the postnatal period. Postnatal mothers should be provided with emotional and psychological support in order to prevent mental health problems such as depression which are likely to occur before and during puerperium.

In a situation where the mother and baby are vulnerable it is important to detect the problems early and offer appropriate interventions to treat postnatal conditions in order to decrease maternal and neonatal morbidities and mortalities. The interventions can best be given during the postnatal visits. Therefore, there is a need to create awareness about benefits of postnatal care services for babies (Appiah *et al.*,2021) so that mothers can embrace the concept of Early Postnatal Care (EPNC). Girls under 15 years old are at risk

of maternal mortality than other age groups (WHO, 2019). There is a low attendance of second postnatal visit in Kenya even if the general uptake of postnatal services has marginally improved from 47% in 2009 to 53% in 2014 (KNBS, 2015). Factors associated with low uptake of postnatal services include; lack of awareness, health service responses and social cultural beliefs (Probandari *et al*., 2017).

2.3 Global perspective on postnatal care

The wellbeing of the mother and child is considered as a significant challenge (UNDP, 2015). There are variations in levels of utilization of postnatal services in various countries all over the world. Developed countries reports high postnatal clinic attendance but developing countries record low utilization of postnatal (Akibu *et al.,* 2018). Whether mothers deliver their babies in health facilities or at home, it is important for women to visit postnatal clinic for assessment of both the mother and neonate. The utilization of postnatal care in LMIC is low where approximately 40% of the women develop various maternal complications whereas 15% of them end up with fatal complications (Langlois *et al.,* 2015). A lot of effort has been done to improve maternal and neonatal indicators in LMIC but this fell short of achieving MDG 5 of 2015 (WHO, 2015). However more is being done all over the world in order to achieve SDG 3 and improve maternal health outcomes to acceptable levels (United Nations, 2015).

Globally, during the postnatal period approximately 295,000 women died in 2017 as result of postnatal-induced problems. During first seven days of life about 75% neonates die across the world (WHO, 2019). Children are confronted with the highest risk of

dying in their first 28 days of life at an average global rate of 17 deaths per 1,000 live births in 2020 (UNICEF, 2021a). It is therefore important for postnatal mothers to attend postnatal clinics so that complications arising from the mother and the baby can be detected. In 2017 the global Maternal Mortality Ratio (MMR) was 211 per 100 000 live births whereas in developing countries the MMR was 239:100,000 with Sub-Sahara alone accounting to 62% of these deaths (WHO, 2018). From 2000 to 2017 the maternal mortality has reduced globally by thirty eight percent from 340 to 211 (UN Inter Agency Estimates, 2018).

Many more deaths are reported during postnatal period for example in South Asia, the MMR was 163:100,000 live births per year with more than 1,000,000 mothers developing varieties of medical conditions, whereas approximately 1,000,000 newborns die annually (UNICEF, 2019). The Sustainable Development Goal 3 targets to reduce Maternal Mortality Rate globally to less than 70:100,000 by the year 2030 (WHO, 2018). Many countries globally are working on a plan to increase the number of postnatal mothers attending postnatal visits and eventually improve on the health of the mother and neonates (WHO, 2015). The Maternal Mortality Rates in developed countries such as Ireland, France and Spain are 5, 8 and 4 per 100,000 live births respectively (UNICEF, 2017).

2.4 Africa perspective on postnatal care

Uptake of postnatal care in Africa remains relatively low. A study done by Wudineh *et al.* (2018) in Ethiopia reported a general prevalence of utilization of postnatal services at 57% while Miteku *et al.* (2016) reported earlier that only 33.5% of postnatal mothers

utilized postnatal care services. In Sub Saharan Africa (SSA), only 13% of mothers who deliver at home seek postnatal services within 48 hours (WHO, 2015). Shockingly more than 68% of the global maternal deaths are found in Sub Saharan Africa (UNICEF, 2019) which occur during the postnatal period. Uganda has an infant mortality rate of 32:1000 and a neonatal mortality of 19: 1000 (UNICEF, 2019). The MMR in Uganda is 336:100,000 live births caused mainly by septicaemia, unsafe abortion, obstructed labour, haemorrhage and pregnancy induced hypertension (UBOS and ICF, 2018). Only 56% of postnatal mothers took their new-born for check-up within two days (UNICEF, 2017).

Many countries in the SSA were reported to have high proportions of MMR where Zambia, Mozmbique and Lesotho had 213,289 and 544 per 100,000 respectively (UNICEF, 2017). Generally, a significant proportion of maternal mortality in Africa is due to HIV/AIDS related conditions (Calvert *et al.*, 2020). With this in mind it is prudent then to persuade mothers to adhere to postnatal visits so that any opportunistic infection likely to affect their health can be detected early by health workers. The consequences that follows non adherence to postnatal visit is increased maternal and neonatal morbidity and mortalities. In 2019 the MMR in South Africa and Sub-Sahara Africa was estimated to be 119:100,000 and 130:100,000 live births respectively (WHO, 2019). Maternal Mortality rate in Malawi was 349:100,000 live births, a higher rate than other countries in that region (WHO, 2019). The MMR in Ethiopia was 401:100,000 live births while neonatal mortality was at 59:1000 (WHO, 2019).

Approximately 67% of postnatal mothers attend postnatal clinic in South East Asia while 48% of them visit in Sub Sahara Africa, an indication that a significant number does not receive services from skilled attendants (UNICEF, 2017). Ndugga *et al*. (2020) reported only 50% of postnatal mothers received early postnatal care within the first 48 hours after delivery of the baby in Uganda. In Malawi, 88% mothers take their newborn for check-up within two days while in Congo 86% do have a contact with skilled health provider within the same postnatal period (UNICEF, 2017). Izudi & Amongin (2015) reported that only 15.4% of mothers attend the early post-natal care in Uganda. However in Ethiopia, the proportion of postnatal mothers who utilized postnatal services within two days after delivery was 35% with a maternal mortality of 401:100, 000 live birth (UNICEF, 2017).

2.5 Postnatal clinic attendance in Kenya

About 53% of postnatal mothers in Kenya and 36% of them in Kakamega County attended postnatal clinic within two days of birth to seek postnatal services according to KNBS (2015). About 30% of mothers in the low economic class visited postnatal clinic compared to 71% among those who are financially stable. The main contributing factors to non-adherence to clinic visits in Kenya include forgetting appointment dates (Makunyi, 2018), some mothers are not aware of postnatal visits and some were reported to have low knowledge (Konje, 2021), hospital delivery, ANC visits and status of neonate (Dessie *et al.,* 2021). Lack of compliance to postnatal visits has impacted heavily on maternal and newborn mortality ratio in Kenya. The MMR in Kenya can be termed to be high but because of the interventions being implemented it is estimated to be 362:100,000 live with HIV/AIDS related conditions claiming 14% of maternal deaths

(UNICEF, 2017). Kenya's proportion of mothers seeking postnatal services within two days after delivery is better than other East African countries (WHO, 2019). Maternal deaths contributes 14% to the crude death rate. The perinatal mortality rate and neonatal mortality rate is at 29:1000 and 22:1000 respectively (KNBS, 2015).

2.6 Knowledge of postnatal services

KNBS (2015) reported that 70% of the participants with secondary education had a high postnatal clinic attendance whereas 21% of them with no formal education had a low postnatal visit. This indicates that those with higher education have a better understanding and conceptualize the importance of postnatal care visits and adherence. The counselling sessions given to mothers contribute significantly to the quality of care offered by service providers during this crucial period. Postnatal care encompasses basic assessment of blood pressure, temperature, uterine involution, and haemoglobin level. The neonates should be evaluated for temperature, weight, status of the umbilical cord, exclusive breast feeding practises and presence of yellow colour in the eyes (WHO, 2018).

Postnatal mothers should be empowered with such information to enable them make informed decisions about postnatal visits. In a study done by Beraki *et al*. (2020) in Eriteria reported low levels of knowledge among postnatal mothers regarding baby bath, umbilical care, significance of immunization and duration of exclusive breast feeding. This is a basic intervention which would really benefit mothers in the provision of neonatal care if they could be knowledgeable about it. Postnatal mothers who have one child are two times more likely to have poor knowledge of newborn care practices

compared to postnatal mothers who are multiparas (Berhan and Gulema, 2018). A study done in Ethiopia by Obioha *et al.* (2021) reported that only 6% of postnatal mothers had good knowledge on signs of depression following delivery. Amolo *et al*. (2017) observed in a study done in Kenya that only 18% of postnatal mothers identified Bacillus Calmette-Guérin (BCG) and Oral Polio Vaccine (OPV) were birth vaccines.

2.7 Effects of lack of postnatal care

Significant therapeutic services may not be accessed by the mother and baby due to failure to attend postnatal clinics. Several maternal health problems are likely to affect the mother during postnatal period such as anaemia, post-partum haemorrhage, puerperal psychosis, puerperal sepsis, pre-eclampsia and eclampsia. These problems if not discovered early could be fatal. Many complications are likely to occur during the postnatal period that may be due missed opportunities to promote healthy behaviours and delay in making diagnosis. Kikuchi *et al*. (2018) reported failure to attend postnatal clinic is likely to lead to various maternal and neonatal complications. Inadequate postnatal care occasioned by failure to attend postnatal clinic may result in maternal and neonatal mortalities (Timilsina and Dhakal, 2015). In sub-Sahara Africa the prevalence of exclusively breastfeeding is only 30%. Good neonatal care especially protecting the child from cold, poor feeding practices, and weight monitoring are enhanced during postnatal visits by informing mothers about importance of such basics.

2. 8 Recommended postnatal visits

The targeted postnatal care is a package of services offered during the postnatal period spread within the six months and implemented in at least four visits by the mother at a

postnatal clinic. The WHO recommend that postnatal visits be done within two days, two weeks, six weeks, and six months after the delivery of the baby. Various countries are supposed to tailor make their protocol based on this guideline depending on their own health needs and health indicators. Kenya recommend four postnatal visits; at 48 hours for those who deliver at home, (but those who deliver in the health facility may still be in the ward and assessments done there) a second assessment is recommended at 14 days, at 42 days and 4 to 6 months (Kenya Ministry Health, 2019). The goal of postnatal visit is to maintain and promote of health of the mother and the newborn. Several services are offered to postnatal mothers during the postnatal visit (See a summary of the services in page 23).

2.9 Factors that influence postnatal visits

Postnatal visits by the mother are influenced by various factors. Poor decision making and hard economic challenges contribute significantly to postnatal adherence (WHO, 2018). A study done by Chaka *et al.* (2019) showed that those mothers living in urban areas, rich, utilized antenatal care and received care from skilled service providers are more likely to visit postnatal clinic. Miteku *et al.* (2016) reported that awareness of maternal complications, place of delivery, and delivery complications are factors likely to influence postnatal visits. Children at home with their many demands are likely to occupy the mother and eventually miss the clinic. A study done by Adane *et al.* (2020) showed that postnatal mothers married to a husband with secondary education are more likely to adhere to postnatal clinic.

Table 2.1 Services offered in the postnatal clinics

Postnatal visit	Time	Maternal services	Neonatal services
1st visit	24 to 48 hours	.Screening for TB .Pain management. .Vitamin A (200 000 iu) .Iron/folic acid supplements . LLITN .Appropriate FP method .HIV testing	.Advice on providing warmth. .Encourage skin-to-skin care .Encourage early initiation of, and exclusive breastfeeding. .Tetracycline eye ointment 1%. .Vitamin K .Immunization (BCG & birth Polio)
2nd visit	Within 1-2 weeks	.Vitamin A supplementation. .Haematinics .LLITN. .Treatment.	.Vitamin A . .Immunisations. .Treatment. .Referrals. .Birth registration.
3rd visit	4- 6 weeks	.Family Planning. .HIV Screening. .Cervical/breast examination. .Screening for STI/ .RTI .Screen for TB .Treatment	.Immunizations. .Treatment. .Referral .Early infant diagnosis (EID) for HIV
4th visit	4-6 months	.Family Planning .Screening for RTI /STI .Screening for cervical cancer, TB .Clinical Breast examination, .HIV testing. .Treatments.	.Vitamin A supplementation. .Immunizations. .Treatments. .Referral. .Birth registration

Source: Ministry of Health, 2012

In Ethiopia, a study revealed that ANC follow up, maternal occupation and awareness about postnatal problems were factors that determined utilization of postnatal services (Abota and Atenafu, 2018). It was reported in study done in Benin that mothers who

deliver in private hospitals are likely to attend postnatal clinics (Dansou and Adekunie, 2017). Another study revealed that distance from health facility, means of transport and poor reception by service providers are likely affect postnatal visits by mothers (Balde *et al.,* 2021).

Urban health facilities are easily accessible due to good transport mode and road network (Gu *et al,* 2019) which is likely to enhance utilization of maternal health services due to the improved infrastructure as compared to rural areas. Women who deliver their babies in the hospitals are more likely to attend postnatal clinic than those who deliver at home (Somefun and Ibsomi, 2016). According to a study done by Shrestha *et al.* (2021), the perception of women is likely to influence utilization of postnatal services. Ayodo *et al.* (2021) reported that Kenya's public health facilities have been tainted by complaints of mothers being harassed by staffs and inadequate supplies/equipments at the health facilities.

2.10 Sources of information on postnatal care services

In this era, where the world is so advanced in communication there are many sources of information. Some of the sources may not be reliable in providing health care information to patients. Guerra-Reyes *et al*. (2017) reported that mothers obtained postnatal information from health workers, internet and mobile phone applications. Information posted to the internet may not be authentic and such may confuse the patients. Information obtained from the friends may have many gaps and give rise to rumours.

2.11 Mobile health in postnatal care

*m*health is the process of integrating mobile telephone in the provision of health care services. Mobile phone companies were licensed to operate in Kenya in 1999 (Oteri, Kibet & Ndung'u, 2015). Mobile ownership in Kenya is fast increasing with a mobile phone penetration at 90% in 2017 (Communication Authority of Kenya, 2017). Mobile health has attracted a lot of interest among the experts in the medical field just to evaluate whether it's use can improve treatment compliance (Sondaal *et al.,* 2016) and health indicators of community members. Frost and Sullivan (2018) in their analysis reported that mobile health has a potential of transforming the health care sector. All over the world, mobile phone technology has been used to improve quality of care. Digital communication technologies such as mobile phones are used to develop, store, retrieve, and distribute information among users so as to improve healthcare system (Odendaal *et al.*,2015).

Many postnatal mothers have several activities in their daily programs. This makes it difficult to remember every appointment date given. A study done in Kenya by Oramisi *et al.* (2019) reported the main reason mothers fail to attend postnatal clinic is forgetting their appointment dates. Many countries are exploring whether mobile health can improve the health indicators. Mobile telephone technology is one of the fastest channels of communication. Approximately 80% of the people live in settlement with good mobile phone coverage which has enabled more than 3.5 billion people to use mobile phone globally (GSMA, 2019).

The wide use and penetration of mobile telephone has resulted in proliferation of mobile phone based health promotion programs where majority of them target the health of the mother and her neonate. Though the efficacy of mobile telephone is limited in certain areas, many health service providers are using the technology to pass health messages to their patients (Marcolino *et al.*, 2018). These mobile phone services comprise of voice messaging, text messaging (SMS), multi-media messaging, mobile phone data collection and information retrieval.

2.12 Effects of voice call and SMS

Researchers have been assessing several *m*health interventions to help improve maternal indicators and eventually save the lives of mothers and their neonates in ill-equipped health systems (WHO, 2015). Makunyi (2018) observed that sending reminders in form of SMS was more likely to increase attendance in antenatal clinic by mothers. According to a study done by Cheptum (2018) in Kenya, mobile phone messages through SMS were more effective in enhancing birth preparedness than verbal messages. Over 90% of Kenya territory is covered by mobile phone network, It is believed that the mobile use coverage in Kenya is a significant technology which can be used to promote the health of people (Kemibaro, 2016). A cluster-randomized study done by Hackett *et al.*(2018) in Tanzania, reported that smart phone intervention significantly increased facility delivery. Feroz *et al.* (2017) did meta-analysis and reported *m*health is more effective in enhancing antenatal and postnatal care services.

Many *m*health interventions aim at changing behaviour or develop skills that will promote individual health. Mbuthia *et al.* (2019) found *m*health can be used to influence

intensions, skills and environmental constraints as predictors of postnatal care uptake. In a quasi-experiment study, Olajubu *et al.* (2020) reported that SMS reminders and educational health messages were able to improve utilization of postnatal care services in the four postnatal visits. In another study, it was observed that after receiving SMS reminders, postnatal mothers were able to utilize family planning services 1.8 times (Jones *et al.,* 2020). *m*health has also been investigated in enhancing uptake of non-communicable diseases. A study done in Kenya by Theuri *et al* (2020) showed mobile phone communication is effective in improving adherence in the management of type 2 diabetes mellitus. Wanyoro *et al.* (2015) reported SMS reminders were effective in increasing uptake of cervical screening.

2.13 Attitude on use of mobile health technology in health care

A study done by Alameddine *et al.* (2020) showed majority of the participants said that mobile phone can improve health delivery. In the same study health workers agreed that mobile phone can be used to enhance communication with clients. Most health workers opined that *m*health can be used to improve the quality of services and it saves time. Some patients find mobile phone communication as an appropriate way of receiving instructions from health workers (Nabovati *et al*., 2020). Hitti *et al*. (2021) reported that health workers were of the opinion that mobile phone was good in coordinating health care activities and was also beneficial to the patients.

2.14 Summary and gaps identified in literature review

The poor maternal indicators found in many developing countries occasioned by low utilization of postnatal services globally demand for strategies that may increase

postnatal visits and enhance uptake of services. There are no sound strategies that offers continuum of maternal care from preconception, antenatal, delivery and postnatal period. There is a disconnect between peri-natal care and postnatal care which is ignored by mothers. In many countries, mobile phone technology has not been embraced by both health workers and the patients. There are good efforts to integrate mobile phone in various disciplines of medicine, however its use in postnatal care is still wanting. Reports in many studies indicate that participants are knowledgeable in some aspects of postnatal but not aware of complications that may arise during postnatal period both to the baby and to the mother.

There is no much information on effectiveness of SMS combined with voice call in enhancing postnatal visits. More data is needed to determine the effectiveness of mobile telephone technology when using SMS combined with voice call. The high uptake of antenatal services, low hospital deliveries and low postnatal visits in our clinics are yet to be understood by the stakeholders. Many studies have focused more on plain remainders inform of SMS or voice call. Packaging the reminders together with postnatal health messages has not been broadly studied. This study targets to investigate these gaps.

CHAPTER THREE: MATERIALS AND METHODS

3.1 Introduction

This chapter presents the details of design used, area of the study, variables studied, sample size determination, pretesting of study tools, techniques used in sampling, analysis of data, how data was presented and the approach used in ethical consideration.

3.2 Research design

A prospective longitudinal experimental research design was used where a cluster Randomized Controlled Trial (RCT) was used that involved four study arms. The study involved a mixed approach of qualitative and quantitative method to achieve the objectives. Randomization of health facilities was done to avoid contamination that could have occurred at individual level. This type of study enables participants to be located in different health facilities far away from each other. Facility based randomization prevents bias and shows effects of the intervention in each arm used. It also enables manipulation of the variables. Cross over from one arm to the other was not possible because study sites were located in different places from each other. The study subjects were controlled by accurately registering them in each arm and ensured only allocated interventions were applied in respective arms.

This design enables the researcher to assign intervention in a quite controlled way. It is effective to compare one intervention arm with another. An experimental approach is appropriate in prospective longitudinal research that involves longer period where subjects can be followed up in different environmental set up. However, study

participants may be aware of the experiment and change behaviour but with concealing the hypotheses, the risk is reduced. Validity may require many sites which may prove difficult to run. This type of design enabled the researcher to explore, compare the baseline/endline data and evaluate the impact of the intervention.

3.3 Variables

3.3.1 Independent variable

The independent variables were demographic and economic characteristics which included religion, age, level of education, occupation, income, marital status, means of transport, time taken to reach health facility and mobile phone ownership. Other independent variables investigated included utilization of postnatal services, services offered, clients' attitude and knowledge on postnatal services. The intervening variables included postnatal health educational messages, utilization of mobile telephone voice call, SMS, and mixture of mobile phone voice call together with Short Text Messages as reminders.

3.3.2 Dependent variable

Dependent variable was adherence to second and third postnatal visit. The dependent variable was further dichotomised into adherence and non-adherence. Study participants who consistently attended second and third postnatal visit were considered to have adhered to second and third visits in the study sites. Attending only one postnatal visit was considered as non-adherent. Hypotheses tests were carried out to establish any significant difference between independent and dependent variables.

3.4 Location of the study

The study was carried out in four Sub Counties of Kakamega County in Western Kenya region which have low postnatal clinic attendance. Kakamega County has twelve Sub Counties namely Lugari, Likuyani, Malava, Lurambi, Navakholo, Mumias West, Mumias East, Mutungu, Butere, Khwisero, Shinyalu and Ikolomani. The study sites were: Butere Sub County Hospital (Butere), Shibwe Sub County Hospital (Ikolomani), Malava Sub County Hospital (Malava) and Navakholo Sub County Hospital (Navakholo) which were selected from the twelve Sub Counties (Kakamega County Government, 2020). According to the 2019 census the population of Kakamega County was 1,867,579 with an area of 3,033.8 km². Females are majority (52%) compared to males who are 48%. The total fertility rate of the county is at 4.7 (KNBS, 2019). The county hosts 16 hospitals, 123 dispensaries, 9 health centres and 43 clinics found in both public and private facilities. Despite the many health facilities, the county has poor maternal and neonatal health indicators with postnatal visits being as low as 36% (KNBS, 2015). The county maternal mortality rates (316:100,000) has remained high above the acceptable levels of 140:100,000 live births (WHO, 2015).

3.5 Target and study population

Women of reproductive age were the target population while the study population was postnatal mothers recruited immediately after delivery in the postnatal wards of the study sites and followed up in the Maternal and Child Health/ Family Planning Clinics (MCH/FP).

3.6 Inclusion and exclusion criteria

3.6.1 Inclusion criteria

Inclusion criteria included postnatal mothers who were literate, those who consented and residents of the selected Sub Counties. Women who delivered their neonates in the study sites and those willing to attend postnatal clinics at the sites were selected to participate in the study. It was mandatory for the study participants to have a mobile phone that was well charged and with reliable network coverage to enable them receive appointment reminders.

3.6.2 Exclusion criteria

The study excluded mothers whose neonates died before discharge from hospital, those who had prolonged hospital admission and women who had delivered once because information of previous delivery was needed. In addition, women of unsound mind, sick mothers during the time of recruitment and those with complications due to delivery were excluded. Women or partners who felt uncomfortable with health messages being sent to their mobile phones were not eligible for recruitment.

3.7 Sample size

The following formula was used to determine the sample size for comparison between more than two groups as suggested by Broman (2012):

$$\text{Sample size determination} = \frac{2(z_{\alpha/2}+z_{\beta})^2\, p(1-p)}{(p_1-p_2)^2}$$

Where:

$z_{\alpha/2}$ is level of confidence at 95% which is 1.96

z_β is standard normal variance for power of 80% which is 0.8

p is average of the present postnatal compliance among postnatal mothers.

p_1 is proportion in intervention group

p_2 is proportion in control group

$$\frac{2(1.96+0.8)^2\ 0.47(0.53)}{(0.22)^2}$$

= 70

It was assumed that dropout rate was to be 15% = 10. The 10+70 = 80 participants per arm. The work load was not considered because of the design of the research. A total of 320 participants were sampled.

3.8 Sampling technique

Purposive sampling was applied to select Kakamega County due to good mobile phone network and low postnatal clinic attendance despite high antenatal clinic visits. Each sub county was considered a cluster along administrative boundaries and using simple random sampling, four Sub Counties were selected by a computer random sampling from the 12 clusters. The public health facilities were purposively selected because they offer free maternity services. A public hospital from each sub county with a high volume was purposively selected. Systematic sampling was used due to the distribution of the study population. The technique was applied to identify the participants from the postnatal wards in each study site. The average daily admission from labour ward in each study site was approximately 6 postnatal mothers. The duration of recruitment was expected to be two months. Each study arm was assigned 80 participants. To calculate the numbers of mothers to be recruited daily, the total number of participants (80) was divided by the duration (60 days) of the recruitment (80/60 which was approximately 2

postnatal women per day). To calculate k^{th}: The daily number of postnatal mothers was divided by daily estimated sample as 6/2= 3. This meant that every third postnatal mother who was eligible was recruited. To identify the first study participant in each day, a rotary technique was used according to admission numbers allocated in postnatal ward. The recruitment took place until the sample size was achieved.

Among 432 mothers who were screened only 320 were recruited. Out of the 112 postnatal mothers who were not eligible 43 of them did not have mobile phones, 36 did not consent, 8 developed complications after delivery, 13 were not willing to attend postnatal clinics at the study sites whereas 12 were not residents of the study area. Key informants recruited from MCH were purposively sampled. Simple random sampling was used to select postnatal mothers for the FGD. The participants mobile phone numbers from each study arm were entered into a rotary method using a computer program to select ten participants.

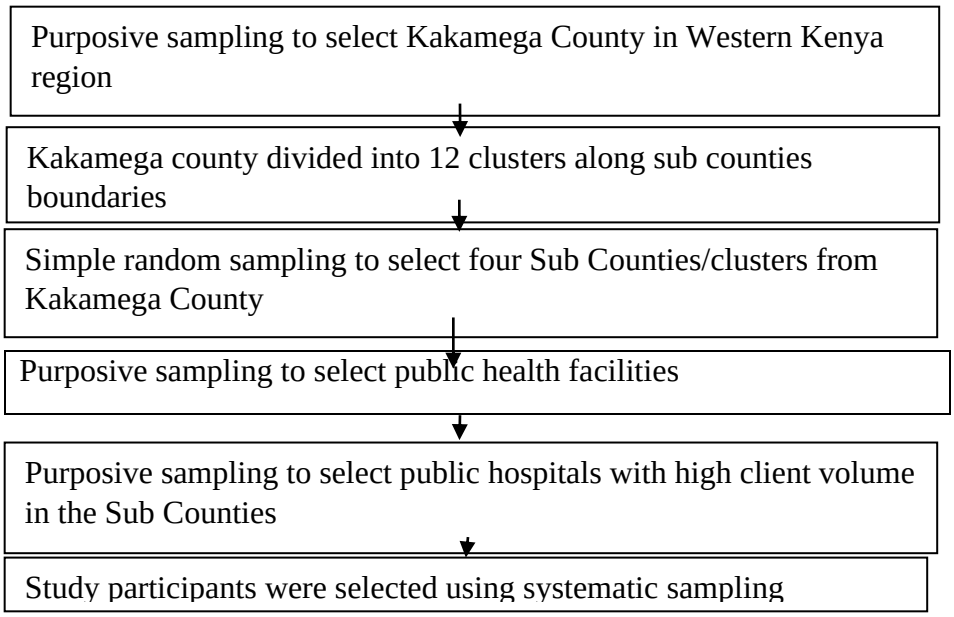

Figure 3.1 Diagrammatic representation to sampling techniques

Table 3.1 Health centres and sub county hospitals at the study areas

Sub Counties	Health centres	Sub County hospitals
Butere	7	2
Ikolomani	4	2
Malava	4	1
Navokholo	3	1

3.9 Research Instruments

The research instruments were designed in line with specific objectives of the study. Key Informant Interview guides (appendix 5) and focus group discussion guides (appendix 6) were used to collect qualitative data from key informants and focus groups discussion respectively. Interview guides are not self-administered as the researcher uses the tools to interview the participants and enter the responses unlike in a questionnaire where respondents enter the responses on their own.. They were used to collect data which comprised of several components such as socio demographic characteristics, postnatal visit, reasons for postnatal visit, knowledge on postnatal care and sources of postnatal information (appendix 4). This was used to collect quantitative data from postnatal mothers with a specific tool collecting data at baseline and another one at end line.

3.10 Pretesting of data collection tools

The pretesting of data collection tools was done at Manyala Sub County hospital which had similar characteristics of study participants though a different site from those sampled for the study. A sample of 32 postnatal mothers (10%) was used in pretesting

the data collection tools which were amended and adjusted for exactness, comprehensiveness, language and any typing errors.

3.10.1 Validity

Validity was determined by pretesting of the instrument which involved 32 (10%) postnatal mothers selected randomly. Contamination was avoided by use of cluster randomization. The instruments were submitted to the two academic supervisors for review on whether the content was in agreement with specific objectives and research question. The tools were checked for any grammatical errors, ambiguity in the questions and any unclear item were corrected before making the final copy.

3.10.2 Reliability

The instruments were pretested while the study assistants were trained on how to communicate with study participants, data collection, checking on completeness of tools and safety of the data collection tools. The research assistants were nurses working at the study sites. Supervision of research assistant was done by the principal researcher. Test-retest method was used where the test was conducted within the same group in different point in time and acceptable correlation results obtained. Sampling techniques were followed to give every study subject a chance to participate in the study and therefore guarantee representativeness of the data collected.

3.11 Description of control and interventions

There were four arms comprising of 80 participants each. The description of the study arms were as follows:

3.11.1 Control arm

This arm was designated as control arm where postnatal mothers were recruited from Butere Sub County hospital after facility randomization. The appointment date was verbally communicated to the mother and by writing in the ‘mother and child clinic booklet’ as is the routine practice in postnatal clinics. No mobile phone reminders were sent to participants.

3.11.2 Intervention arms

The interventions were carried out by sending two reminders, 48 hours and 24 hours prior the postnatal visit. Just in case the mother’s mobile phone number could not go through, they were instructed to provide another mobile telephone number of a close relative which was used as alternative number. There were three intervention arms.

3.11.2.1 Intervention arm one

Intervention arm one was Shibwe Sub County hospital. The appointment date was indicated in the ‘mother and child clinic booklet’ and later the participants received two voice calls (reminders) accompanied by a health message (appendix 10) 48 hours and 24 hours prior to the postnatal visit.

3.11.2.2 Intervention arm two

Malava Sub County hospital was designated as arm two, the appointment date was indicated in the ‘mother and child clinic booklet’ and later two short text messages (reminders) accompanied by a health message (appendix 10) sent 48 hours prior to the visit and another 24 hours before the postnatal visit.

3.11.2.3 Intervention arm three

The third intervention arm was Navokholo Sub County hospital. The appointment date was indicated in the 'mother and child clinic booklet', a mobile phone voice call done and SMS sent to remind the postnatal mother of the postnatal clinic appointment date packaged with a health message on postnatal care (appendix 10). This was done 48 hours prior the visit and 24 hours before the postnatal visit.

3.11.3 SMS and voice calls

The SMS and the voice call were similar to all the participants in the intervention arms. The voice calls and SMS were done 48 hours and 24 hours prior to the visit. For the second postnatal visit the first reminder was accompanied by a health message on the recommended postnatal visits and likely maternal health problems whereas second reminder informed mothers on recommended postnatal visits and neonatal health problems. In the third postnatal visit, the first reminders were accompanied by messages of the recommended postnatal visits and services offered in the postnatal clinic while the second reminder had message covering health problems that are likely to affect the mother and the baby. In the fourth postnatal appointment date, the two reminders were accompanied by messages of the recommended postnatal visits and services offered in postnatal clinics (see appendix 10).

3.12 Randomization

This was a cluster Randomized Control Trial (RCT) where four facilities were randomly assigned to four-study arms: control arm, arm 1 (SMS reminders), arm 2 (voice call reminders) and arm 3 (combination of SMS and voice call reminders). Randomization

was done by computer generated ratio (1:1:1:1) with the help of a statistician as shown in table 3.2. The interventions used in the study were not revealed to the participants in other sites, health workers in study sites and the research assistants.

Table 3.2 Health facilities randomization

Sub County	**Facility**	**Control arm**	**Arm 1**	**Arm 2**	**Arm 3**
Butere	Butere hospital	✓			
Ikolomani	Shibwe hospital		✓		
Malava	Malava hospital			✓	
Navokholo	Navokholo hospital				✓

3.13 Recruitment of study participants

The principal researcher and research assistants screened 432 mothers immediately after delivery in the postnatal wards for eligibility according to the inclusion and exclusion criteria. Systematic sampling was used to include every third postnatal mother who was

eligible until 80 participants were achieved per study site and an overall sample of 320. Thereafter, the participants were consented and interviewed using the interview guide.

3.14 Data collection

Data was collected using a semi-structured interview guides. The participants were explained the nature of the study and what was expected of them throughout the study. The researcher and two research assistants from each study sites collected data using the interview guides. Baseline data was collected using the interview guides. In all the four arms, data was collected in three phases where phase one was the baseline survey. After the intervention, qualitative data was collected by principal researcher from four focused group discussion and four key informant interviews in each study site where the responses were recorded. One FGD were held in each arm. Quantitative data was also collected at endline after participants received postnatal services.

3.15 Data analysis

Data was coded and entered into Microsoft Access data base and analysed using Statistical Package of Social Sciences (SPSS) software version 24. Knowledge levels were determined by categorizing participants who got no right response as having no knowledge on postnatal care. Participants who had one right response were categorized as having low knowledge whereas those who got more than three responses classified as having adequate knowledge (appendix 9). Descriptive statistics such as mean, frequencies, percentages were used in analysis and data presentation. To establish association between independent and dependant variables, chi-square calculation was performed using SPSS version 24. Variables that had a p-value of < 0.05 were taken as

statistically significant and further ran binary logistic regression to determine the strength of association using the Odds Ratio (OR). T-test was used to compare means of the groups in postnatal visits. Open ended questions were analysed using qualitative content analysis. Qualitative data from FGD and KII were thematically organized, transcribed verbatim and translated. Results were presented in tables and graphs.

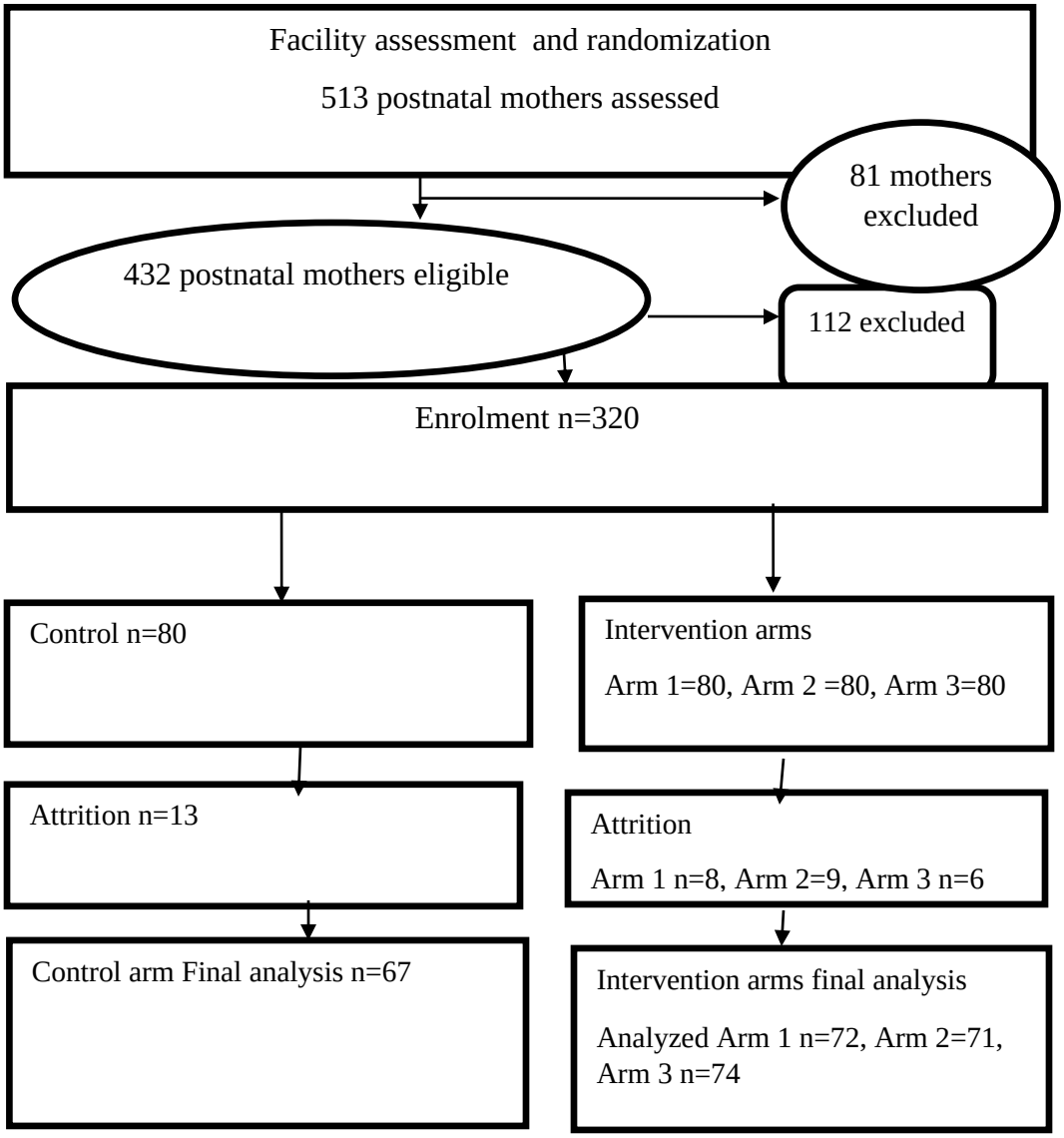

Figure 3.2 A consort diagram showing recruitment to analysis

3.16 Ethical Considerations

The Kenyatta University graduate school approved the study (appendix 11). Ethical clearance was granted by Kenyatta University Ethics Review Committee (appendix 12). Research permit was given by the National Council of Science, Technology and Innovation (appendix 13). The county administration allowed the study to be done in the county (appendix 14). The hospital administrators of Butere, Shibwe, Malava and Navakholo sub county hospitals, granted permission for the study to be carried out in their facilities. The study participants were explained and informed consent obtained (appendix 1).

CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter shows the results of data collected from participants of the four study arms: control arm (Butere hospital), intervention arm 1 where participants received voice calls (Shibwe hospital), intervention arm 2 where participants received SMS (Malava hospital) and intervention arm 3 that had combination of SMS plus voice call (Navokholo hospital). This was a longitudinal design where 320 participants (baseline) were recruited but 284 (90%) of them were successfully followed up for six months (endline). The drop out was considered acceptable with no significant effect on the strength of the study power. In the control arm 67 participants completed the follow up, whereas 72, 71 and 74 study subjects managed to participate in the study to the end in intervention arm 1, 2 and 3 respectively.

4.2 Socio demographic and economic characteristics of study participants

4.2.1 Socio-demographic characteristics of participants

Table 4.1 shows socio-demographic characteristics of the study participants. Majority of participants (37%) in control arm were 26 to 30 years old compared to 38% and 34% of them in intervention 1 and 2 respectively. A big proportion of participants (43%) had attained primary education in control arm compared 56% and 47% in intervention arm 1 and 3 respectively while only a few of them (6%) of them in control arm had attained university education compared to 9% and 5% in intervention arm 2 and 3 respectively. Many participants (87%) in control arm were married compared to 88% and 85% of

them in intervention 1 and 3 respectively. There was no significance difference in socio-demographic characteristics between control arm and interventions arms.

Table 4.1 Socio demographic characteristics of study participants

Variables	Control n=67 Frequency /%	Arm 1 n=72 Frequency/ %	Arm 2 n=71 Frequency /%	Arm 3 n=74 Frequency /%	Significance
Age (in years)					
<25	18(27%)	23(32%)	16(23%)	35(47%)	χ^2=18, df=15, p=0.238
26-30	25(37%)	27(38%)	24(34%)	20(27%)	
31-35	22(32%)	15(21%)	23(32%)	14(19%)	
>36	9(13%)	7(10%)	8(11%)	5(7%)	
Education					
No formal education	2(3%)	4(6%)	4 (5%)	7 (10%)	χ^2=14, df=9, p=0.104
Primary	29(43%)	41(56%)	31(44%)	35 (47%)	
Secondary	32(48%)	22(31%)	29(41%)	29(39%)	
College /university	4(6%)	5(7%)	7(9%)	3(5%)	
Marital status					
Married	58 (87%)	63 (88%)	62 (87%)	63(85%)	χ^2=2, df=6, p=0.954
Single	9(13%)	8(11%)	9(13%)	11(16%)	

4.2.2 Socioeconomic characteristics of study participants

The socioeconomic characteristics of the study participants are presented in table 4.2. Majority of the participants (67%) in control arm were not employed compared 65% of them in intervention arm 3, whereas arm 1 and 2 had slightly lower proportions. Many participants (79%) in control arm had an income of less than KShs 10,000 per month compared to 77% and 85% in intervention arm 1 and 2 respectively. A bigger proportion

of participants (63%) in control arm used a motor cycle to reach the hospital compared to 54% and 62% of them in intervention arm 2 and 3. Many participants (over 33%) across the arms took 21-40 minutes to reach the hospital. There was no significance difference in economic characteristics of the participants between control and intervention arms.

Table 4.2 Economic characteristics of study participants

Variables	**Control arm n=67** **Frequency /%**	**Arm 1 n=72** **Frequency /%**	**Arm 2 n=71 Frequency/ %**	**Arm 3 n=74 Frequency /%**	**Significa-nce**
Occupation					
Employed	7(10%)	4(6%)	6(9%)	2(8%)	
Self employed	15(22%)	39(54%)	26(37%)	24(32%)	χ^2=20, df=6, p=0.502
Unemployed	45(67%)	29(40%)	39(55%)	48(65%)	
Income					
<10,000	53(79%)	55(77%)	65(85%)	72(90%)	χ^2=27, df=9, p=0.101
10,001-20000	7(10%)	15(21%)	6(9%)	2(5%)	
>20,000	6(9%)	3(4%)	4(6%)	2(5%)	
Means of transport					
PSV	9(13%)	18(25%)	20(28%)	12(16%)	χ^2=51, df=12, p=0.700
Motor cycle	42(63%)	33(46%)	38(54%)	67(62%)	
Bicycle	4(6%)	5(7%)	3(5%)	5(7%)	
Walking	12(18%)	10(14%)	5(7%)	4(6%)	
Time (in minutes) taken to hospital					
<20	33(49%)	24(33%)	23(32%)	32(43%)	χ^2=18, df=9, p=0.138
21-40	22(33%)	34((47%)	27(37%)	32(40%)	
>41	6(9%)	10(14%)	13(18%)	15(17%)	

Key: PSV –Public Service Vehicle

4.3 Level of attendance of scheduled postnatal visits among postnatal mothers

4.3.1 Baseline and endline postnatal visits among study participants

At baseline there was no significant difference in level of postnatal attendance between control and intervention arms. The second postnatal clinic attendance in arm 1 increased from 26% to 53%, arm 2 increased from 29% to 48% and arm 3 increased from 25% to 62% compared to control arm which increased from 24% to 25%. At the end line the proportion of second postnatal attendance in control arm increased from 25% to 53%, 48%, and 62% in arm 1, 2, and 3 respectively. The same was noted for third postnatal visit where attendance reduced from 69% to 67% in control but increased from 68% to 78%, 61% to 76% and 64% to 82% in arm 1, 2, and 3 respectively. The fourth visit showed a similar trend of improvement from 13% to 16% in control 6% to 35%, 8% to 31% and 11% to 38% in arm 1 and 2 respectively. There was statistically significant differences between control arm and intervention arms ($p<0.05$) as shown in table 4.3.

Table 4.3 Baseline and endline postnatal visits

Postnatal visits		**Control arm Frequency/%**	**Arm 1 Frequency/ %**	**Arm 2 Frequency/ %**	**Arm 3 Frequency/ %**	**Significance (χ^2)**
Baseline		n=80	n=80	n=80	n=80	
Endline		n=67	n=72	n=71	n=74	
2ND	**Base**	19(24%)	22(26%)	23(29%)	20(25%)	p=0.527 χ^2=2.2
	End	18(25%)	38(53%)	34(48%)	46(62%)	p=0.000 χ^2=23.7
3RD	**Basel**	55(69%)	54(68%)	49(61%)	51(64%)	p=0.070 χ^2=7.05
	End	48(67%)	56(78%)	54(76%)	61(82%)	p=0.012 χ^2=5.66
4TH	**Base**	10(13%)	5(6%)	6(8%)	9(11%)	p=0.124 χ^2=5.76
	End	11(16%)	25(35%)	22(31%)	28(38%)	p=0.029 χ^2=10.6

Key: base=baseline, End= Endline

4.3.2 Baseline and endline adherence to second and third postnatal visit

Table 4.4 shows baseline and endline adherence to second and third postnatal visit. Adherence to second and third postnatal visit was defined as consistently attending postnatal clinic at two and six weeks. Adherence to 2nd and 3rd postnatal visit was not significantly different at baseline (χ^2=2.6, df=3 p=0.440). However after the intervention, the proportion of adherence in arm 1 increased from 26% to 56% while in intervention arm 2 adherence increased from 32% to 49% with intervention arm 3 increasing from 29% to 62% compared to control arm which decreased from 21% to 18%. Statistically, after the intervention there was a significant difference in adherence to second and third postnatal visit between the control arm and the three intervention arms (χ^2=28, df=3, p=0.001).

Table 4.4 Baseline and endline adherence to second and third postnatal visit.

		Control Frequency/%	Arm 1 Frequency/%	Arm 2 Frequency/%	Arm 3 Frequency/%	Significance (χ^2)
Baseline		**n=80**	**n=80**	**n=80**	**n=80**	
Endline		**n=67**	**n=72**	**n=71**	**n=74**	
Adherence	**Baseline**	17(21%)	21(26%)	26(32%)	23(29%)	χ^2=2.6, df 3, p=0.440
		63(79%)	59(74%)	54(68%)	57(71%)	
	Endline	12(18%)	32(56%)	36(49%)	46(62%)	χ^2=31, df 3 p=0.000
		55(82%)	32(44%)	36(51%)	28(38%)	

4.3.3 Baseline and endline reasons for attending postnatal visits among study participants

Table 4.5 shows baseline and endline reasons for attending postnatal visits among study participants**.** Before the intervention majority of participants (32%) in the control arm gave the reasons for attending second postnatal visit was to be treated compared to 36% of them in arm 1, 35% in arm 2 and slightly lower proportion in arm 3. After the intervention the proportions in control arm reduced from 32% to 20% compared to decrease from 36% to 8% in arm 1 and from 35% to 6% in arm 2. At endline, few participants (18%) in the control arm reported they attended third postnatal visit because of the appointment given to them compared to 32% of them in intervention arm 1, 43% in arm 2 and 33% in arm 3.

Table 4.5 Baseline and endline postnatal reasons for attending second and third postnatal visits

Reasons		Control arm Frequen-cy/%	Arm 1 Frequency/ %	Arm2 Frequency/ %	Arm 3 Frequency/ %	Significance (χ^2)
Second postnatal visit						
	Baseline	**n=19**	**n=22**	**n=23**	**n=20**	**p=0.192**
	Endline	**n=18**	**n=38**	**n=34**	**n=46**	**p=0.010**
Sent a reminder	Baseline	-	-	-	-	
	Endline		14(37%)	11(32%)	19(41%)	
To be treated	Baseline	6(32%)	8(36%)	8(35%)	4(20%)	
	Endline	3(20%)	3(8%)	2(6%)	3(7%)	
Child to be treated	Baseline	5(26%)	6(27%)	8(35%)	3(15%)	
	Endline	5(33%)	2(5%)	3(9%)	3(7%)	
Child immunization	Baseline	1(5%)	3(14%)	2(9%)	1(5%)	
	Endline	1(7%)	2(9%)	2(6%)	4(9%)	
Given appointment	Baseline	7(37%)	5(23%)	6(26%)	13(65%)	
	Endline	6(40%)	18(47%)	16(47%)	16(38%)	
Third postnatal visit						
	Baseline	**n=55**	**n=54**	**n=49**	**n=46**	**p=0.845**
	Endline	**n=48**	**n=56**	**n=54**	**n=60**	**p=0.000**
Given appointment	Baseline	11(19%)	5(9%)	9(19%)	9(18%)	
	Endline	12(18%)	17(32%)	23(43%)	20(33%)	
Sent mobile reminder	Baseline	-	-	-	-	
	Endline	0(0%)	23(43%)	13(25%)	26(43%)	
To be treated	Baseline	5(9%)	4(7%)	3(6%)	4(8%)	
	Endline	6(13%)	3(5%)	4(7%)	4(7%)	
Child to be treated	Baseline	9(26%)	3(10%)	4(11%)	3(12%)	
	Endline	4(7%)	5(9%)	3(6%)	6(12%)	
Child immunization	Baseline	37(65%)	40(74%)	33(70%)	31(62%)	
	Endline	11(24%)	10(18%)	7(13%)	4(7%)	

4.3.4 Baseline and endline reasons for attending fourth postnatal visits

After the intervention, majority of participants (52%) in intervention arm 1 reported the reason for attending postnatal clinic was because they received a reminder in a mobile phone whereas in arm 2 a similar proportion (61%) and (57%) of them in arm 3 cited the same reason. No reminders were sent in control arm as shown in table 4.6.

Table 4.6 Baseline and endline reasons for forth PN visit among participants

Reasons		**Control arm Frequency/%**	**Arm 1 Frequency/%**	**Arm 2 Frequency/%**	**Arm 3 Frequency/%**	**Significance (χ^2)**
	Baseline	n=10	n=5	n=6	n=9	p=0.934
	End line	n=11	n=25	n=22	n=28	p=0.044
Given appointment	Baseline	1(10%)	1(17%)	2(29%)	3(27%)	
	End line	2(20%)	4(17%)	4(18%)	4(17%)	
Reminder	End line		13(52%)	14(61%	16(57%	
To be treated	Baseline	1(10%)	1(17%)	0(0%)	1(9%)	
	End line	2(20%)	2(8%)	1(4%)	2(7%)	
Child to be treated	Baseline	2(20%)	1(17%)	1(14%)	1(11%)	
	End line	5(50%)	2(9%)	2(9%)	2(7%)	
Family planning	Baseline	5(50%)	2(33%)	4(57%)	6(55%)	
	End line	1(10%)	2(8%)	1(5%)	2(7%)	
Screening for Ca cervix	Baseline	2(10%)	2(40%)	1(17%)	1(11%)	
	End line		2(8%)	1(5%)	2(7%)	

4.3.5 Baseline and endline reasons for not attending second, third and fourth postnatal visit.

Figure 4.1 shows baseline and endline reasons for not attending second postnatal visits. At baseline the reasons provided by participants on why they failed to attend postnatal visits were not significantly different across the arms (χ^2=29, df =9, p>0.05). However after the intervention the reasons for not attending postnatal visits were significantly different across the arms (χ^2=37, df =7, p<0.05). Before the intervention, many participants (36%) said they failed to attend second postnatal visit because they forgot appointment date compared to 34% of them in intervention 1, 31% in arm 2 and 31% in arm 3. At the endline, few participants (6%) in arm 1, 5% in arm 2 and 14% in arm 3 said they forgot the appointment date compared to 34% of them in control arm. At the baseline many study participants (30%) in the control arm said the reason why they failed to attend third postnatal visit was that they were not aware of the visit compared to 26% of them in intervention arm 1, 24% in arm 2 and 24% in arm 3. At the endline, there was a significant change in proportions of participants whereas in control arm 27% of participants said they were not aware compared to 6% in intervention arm 1, 8% in arm 2 and 6% in arm 3. The proportion of participants who failed to attend fourth postnatal visit increased from 38% to 43% in the control arm compared to decrease from 16% to 6%, 18% to 2% and 25% in intervention arm 1, 2 and 3 respectively.

From the FGD, participants cited various reasons why mothers did not attend postnatal clinic such as ignorance, lack of bus fare and some reported they forgot the postnatal appointment because of being busy. The following are some of the sentiments expressed

by participants in FGD about reasons for not attending postnatal clinic and supported by two key informants:

A respondent from FGD 1 said *"Some mothers are just ignorant. We usually ignore the appointment given by doctor"*. A respondent from FGD 2 commented *"some of us mothers come from very far and at times we don't have money for transport".* Another respondent from FGD 4 had this to say "*Sometimes we forget the appointment date due to the many activities we do every day".* Two Key Informant Interview (KII) had these to say pertaining reasons for not attending postnatal clinic: KII working in one of the health facilities stated that *"some mothers may be having challenges in transport especially those who come from far. It is also important to note there are many mothers who just ignore the appointment"*. Another KII said "*some of the reasons why a good number of mothers don't attend clinic is they forget the appointment date while some report being harassed by health workers and some cultural practices such as religious beliefs that prohibit people from seeking medical care*".

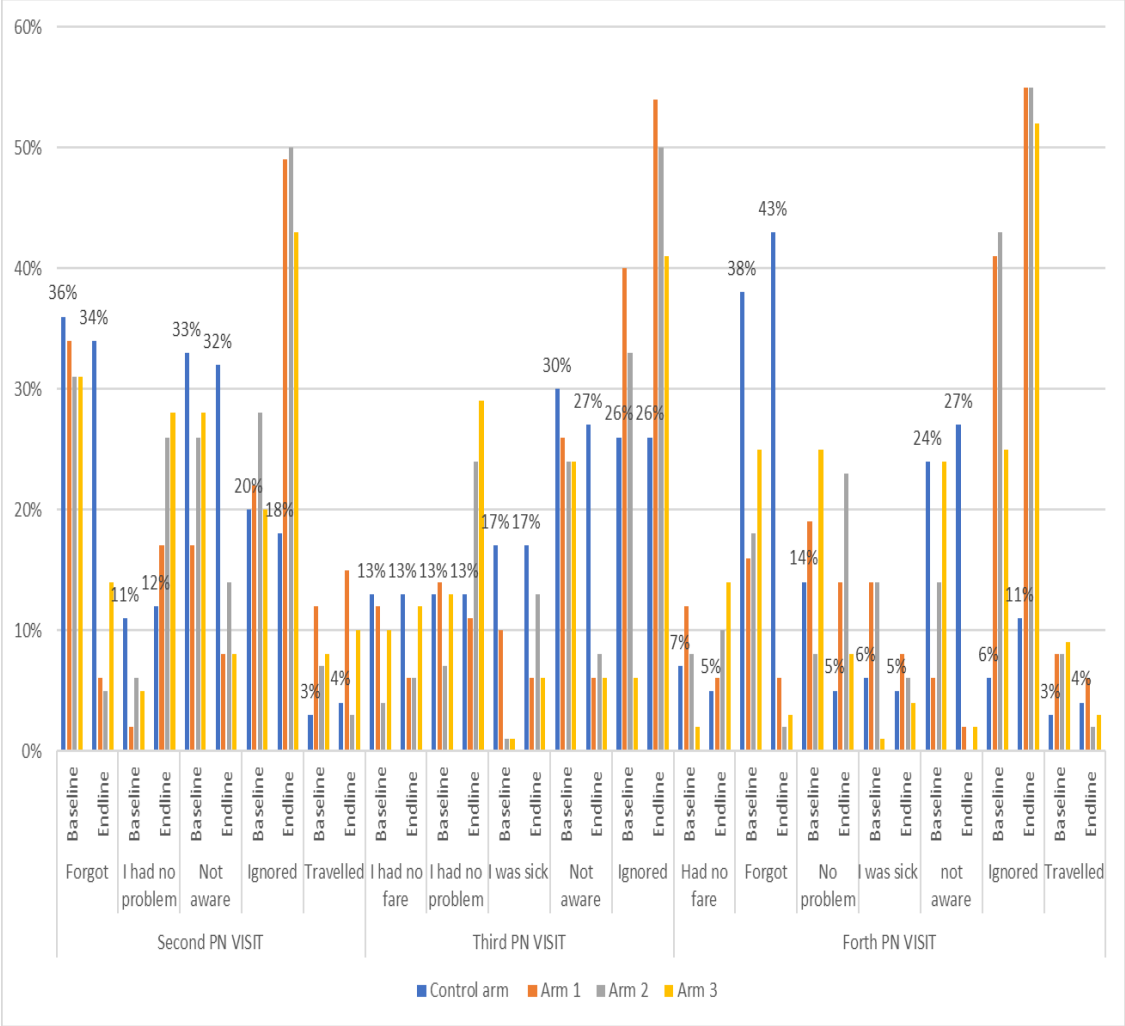

Figure 4.1 Baseline and endline reasons for not attending second PN visits

4.4 Level of knowledge and attitude on postnatal visits among study participants.

4.4.1 Baseline and endline knowledge on postnatal care among participants

Table 4.7 shows baseline and endline level of knowledge among study participants on what is postnatal care, the recommended postnatal visits and when the visits are supposed to be done. The Knowledge level was determined by using a knowledge score matrix (appendix 8). At the baseline the level of knowledge was not significantly

different between the control arm and intervention arms. Before the intervention, many participants (41%) in the control arm had low knowledge on what is postnatal care compared to 40% of them in intervention arm one, 36% in arm 2 and 35% in arm 3. There was no significant difference between the control and intervention arm (χ^2=14, df=9, p=0.120). After the intervention there was no much change in level of knowledge in control arm (from 41% to 36%) among participants who had low knowledge of what is postnatal care while intervention arm 1, proportions of participants with low knowledge decreased from 40% to 21%, arm 2 reduced from 36% to 11% and arm 3 decreased from 35% to 10%. There was a significant difference in level of knowledge between control and intervention arms (χ^2=39, df=3, p=0.000). It was also noted that participants who had adequate knowledge on when the mother is supposed to attend postnatal visits, proportion of participants with adequate knowledge remained constant to 3% in control compared to 18% in intervention arm 1, 24% in intervention arm 2 and 28% in intervention arm 3. The other levels of knowledge (moderate and adequate) showed a similar trend in improvement in knowledge in the intervention arms and there was significant difference across the arms ($p<0.05$).

From the FGD a participant expressed that some mothers have low postnatal knowledge resulting in low understanding on importance of postnatal care, an opinion supported by a Key Informant Interview.

A participant from FGD 4 said *"majority of us mothers don't know the importance of visiting clinic after delivery. We only take our children to the clinic to be immunized. We don't know when to visit or even the number of visits to be attended".* From FGD 2 "*many of us have very little knowledge on importance of postnatal care and therefore*

consider it less important". A key informant had this to say: "*many mothers don't know the importance of postnatal care or even what is postnatal care".*

Table 4.7 Baseline and endline knowledge on postnatal care and visits among study participants

PN knowledge		**Control Frequency/%**	**Arm 1 Frequency/%**	**Arm 2 Frequency/%**	**Arm 3 Frequency/%**	**Significance (χ^2)**
	Baseline	**n=80**	**n=80**	**n=80**	**n=80**	
	End line	**n=67**	**n=72**	**n=71**	**n=74**	
Knowledge on postnatal care						**Baseline** χ^2=14, p=0.120 **Endline** χ^2=39, p=0.000
No	Baseline	33(29%)	32(40%)	29(36%)	37(46%)	
	Endline	21(30%)	20(28%)	14(20%)	12(16%)	
Low	Baseline	33(41%)	32(40%)	29(36%)	28(35%)	
	Endline	22(36%)	15(21%)	8(11%)	7(10%)	
>Moderate	Baseline	19(24%)	16(20%)	19(24%)	12(15%)	
	Endline	20(25%)	37(51%)	49(69%)	55(74%)	
Knowledge on the recommended postnatal visits						
No	Baseline	32(40%)	38(48%)	35(44%)	34(43%)	**Baseline** χ^2=8.3, p=0.501 **Endline (χ^2)**=32, p=0.000
	Endline	21(31%)	19(26%)	15(21%)	13(18%)	
Low	Baseline	29(36%)	27(34%)	33(41%)	26(33%)	
	Endline	22(33%)	16(22%)	14(20%)	8(11%)	
>Moderate	Baseline	19(24%)	16(20%)	11(15%)	20(25%)	
	Endline	24(36%)	37(51%)	42(59%)	53(72%)	
Knowledge on when the mother is supposed to make recommended						
No	Baseline	39(49%)	42(53%)	46(58%)	44(55%)	**Baseline** χ^2=4, p =0.905 **Endline** χ^2=27, p=0.000
	Endline	33(49%)	24(33%)	22(31%)	19(26%)	
Low	Baseline	33(41%)	32(40%)	27(34%)	26(33%)	
	Endline	26(39%)	15(21%)	10(14%)	7(10%)	
Moderate	Baseline	6(8%)	2(3%)	3(4%)	5(6%)	
	Endline	6(9%)	20(28%)	22(31%)	27(37%)	
Adequate	Baseline	2(3%)	4(5%)	5(6%)	5(6%)	
	Endline	2(3%)	13(18%)	17(24%)	21(28%)	

4.4.2 Baseline and endline knowledge of study participants on maternal, neonatal health problems and services offered in the postnatal clinics.

Table 4.8 shows baseline and endline knowledge of study participants on services offered. Before the intervention, many participants (48%) in control arm had no knowledge on services offered in health facilities compared to 49% in intervention arm 1, a proportion of 46% in arm 2 and 41% in arm 3. There was no significant difference between control arm and intervention arms (χ^2=4, df=9, p=0.893). After the intervention, there was a minimal change in proportion in the level of knowledge on services offered in control arm but the proportion of participants reduced from 48% to 47% compared to intervention arm 1 reduced from 49% to 7%, arm 2 decreased from 46% to 9% and arm 3 reduced from 41% to 9%. There was a significant change in proportions in level of knowledge across the arms (χ^2=113, df=9, p=0.000).

The proportion in participants with more than moderate level of knowledge on services offered in postnatal clinics in the control arm increased from 9% to 16% compared to intervention arm 1 that improved from 9% to 58%, arm 2 changed from 13% to 69% and arm 3 increased from 14% to 69%. This trend repeated itself in the other levels of knowledge across the arms. After the intervention proportion of participants who had no knowledge on which maternal health problems likely to occur during postnatal period in the control arm increased from 40% to 42% compared to a decrease from 43% to 7%, 48% to 6% and 51% to 5% in intervention 1, 2 and 3 respectively.

Table 4.8 Baseline and end line knowledge among participants.

Knowledge level		**Control Frequency /%**	**Arm 1 arm Frequency/%**	**Arm 2 Frequency /%**	**Arm 3 Frequency/%**	**Significance (χ^2)**
	Baseline	**n=80**	**n=80**	**n=80**	**n=80**	
	Endline	**n=67**	**n=72**	**n=71**	**n=74**	
Services offered in postnatal clinics						
No knowledge	Baseline	38(48%)	39(49%	37(46%	33(41%)	Baseline p=0.763 Endline p=0.000
	Endline	31(47%)	5(7%)	6(9%)	7(9%)	
Low	Baseline	30(38%)	36(45%)	33(41%)	33(42%)	
	Endline	27(40%)	14(19%	16(23%	16(20%)	
>Moderate	Baseline	7(9%)	7(9%)	10(13%)	11(14%)	
	Endline	11(16%)	52(58%	49(69%	51(69%)	
Maternal health problems likely to occur during PN period						
No	Baseline	32(40%)	34(43%)	38(48%)	41(51%)	Baseline p=0.657 Endline p=0.000
	Endline	28(42%)	5(7%)	4(6%)	4(5%)	
Low	Baseline	28(48%)	31(39%)	34(43%)	30(38%)	
	Endline	30(44%)	23(32%)	23(32%)	16(22%)	
Moderate	Baseline	10(13%)	15(21%)	14(18%)	9(11%)	
	Endline	11(14%)	44(55%)	44(62%)	54(73%)	
Neonatal health problems likely to occur during PN period						
No	Baseline	40(50%)	33(41%)	35(28%)	41(51%)	Baseline p=0.433 Endline p=0.000
	Endline	33(49%)	1(2%)	2(3%)	4(5%)	
Low	Baseline	31(39%)	26(33%)	28(35%)	26(33%)	
	Endline	29(43%)	21(30%)	23(32%)	24(33%)	
>Moderate	Baseline	9(11%)	19(24%)	17(19%)	13(16%)	
	Endline	7(10%)	50(69%)	46(65%)	55(69%)	

4.4.3 Baseline and endline sources of postnatal information among mothers.

Before sending the postnatal educational messages, it was observed at baseline that majority of study participants (65%) in the control arm said their source of information on postnatal issues was health workers compared 73%, 63% and 58% in arm 1, 2, and 3 respectively as shown in table 4.9. There was no significant difference across the arm at baseline. After the intervention, the proportion in the source of information in the control arm increased slightly from 65% to 66% whereas arm 1 proportion increased from 73%

to 82%, arm 2 increased from 63% to 77% and arm 3 changed from 58% to 70%. There was a significant difference in source of information between control and intervention arms at the endline (χ^2=37.8, df=12, p=0.000).

Table 4.9 Baseline and endline sources of information

Sources		**Control arm Frequency/%**	**Arm 1 Frequency/%**	**Arm 2 Frequency/%**	**Arm 3 Frequency/%**	**Significance (χ^2)**
	Baseline	**n=80**	**n=80**	**n=80**	**n=80**	p=0.565
	Endline	**n=67**	**n=72**	**n=71**	**n=74**	p=0.000
Health worker	Baseline	52(65%	55(73%)	50(63%)	46(58%)	
	Endline	44(66%)	59(82%)	55(77%)	56(70%)	
Electronic media	Baseline	10(13%	8(10%)	7(9%)	6(8%)	
	Endline	3(5%)	4(6%)	2(3%)	4(5%)	
Books/print media	Baseline	4(6%)	4(5%)	3(4%)	6(8%)	
	Endline	5(8%)	2(1%)	2(3%)	4(5%)	
Friend	Baseline	5(6%)	4(5%)	8(10%)	8(10%)	
	Endline	6(8%)	4(5%)	4(5%)	3(4%)	
Internet	Baseline	4(5%)	5(6%)	7(9%)	4(5%)	
	Endline	4(6%)	2(3%)	4(5%)	3(4%)	
Never heard	Baseline	5(6%)	4(5%)	5(6%)	11(14%)	
	Endline	5(6%)	2(3%)	4(5%)	4(5%)	

4.4.4 Baseline and endline general level of knowledge on postnatal care information among postnatal mothers.

Table 4.10 shows baseline and endline general level of knowledge on postnatal care information among postnatal mothers. Before the intervention only a few of postnatal mothers (20%) in the control arm had moderate level of knowledge on postnatal information compared to 16%, 19% and 14% in intervention arm 1, 2 and 3 respectively. There was no significant difference in general level of knowledge between control and

intervention arms before sending postnatal educational health messages (χ^2=3.3, df=6, p=0.264). After the intervention, proportion of moderate knowledge in control arm improved from 20% to 25% compared to 16% to 49%, 19% to 51%, and 14% to 51% in intervention arm 1, 2, and 3 respectively. There was a significant difference in level of knowledge on postnatal information between control and intervention arms (χ^2=94, df=6, p=0.000). After further calculation using Mann-Whitney U test the null hypothesis stating that there is no significance difference in level of knowledge on postnatal care information between control arm and intervention arms was rejected.

Table 4.10 Baseline and endline overall level of knowledge on postnatal care among participants

Level		**Control arm Frequency/%**	**Arm 1 Frequency/%**	**Arm 2 Frequency/%**	**Arm 3 Frequency/%**	**Significance (χ^2)**
	Baseline	**n=80**	**n=80**	**n=80**	**n=80**	p=0.264
	Endline	**n=67**	**n=72**	**n=71**	**n=74**	p=0.000
Low	Baseline	61(78%)	64(80%)	64(80%)	68(85%)	
	Endline	47(70%)	12(17%)	8(11%)	6(8%)	
Moderate	Baseline	16(20%)	13(16%)	15(19%)	11(14%)	
	Endline	17(25%)	34(49%)	37(51%)	38(51%)	
Adequate	Endline	3(5%)	24(34%)	26(37%)	30(41%)	

4.4.5 Baseline and endline attitude of postnatal mothers towards postnatal visit

Table 4.11 shows baseline and endline attitude of postnatal mothers towards postnatal visit. Before the intervention many participants (56%), in intervention arm 1, arm 2 (59%), arm 3 (69%) said it is important to attend postnatal clinic compared to 51% of them in control arm. This was not significantly different between the control and intervention arm ($p>0.05$). At the endline, proportion of participants decreased from 51% to 45% in control arm compared to an increase from 56% to 65% in intervention arm 1, arm 2 increased from 59% to 68% and arm 3 improved from 69% to 73%. There was a significant difference in proportions of attitude of postnatal mothers on importance of postnatal visit between control and intervention arms ($p=0.004$).

Table 4.11 Baseline and endline attitude of postnatal mothers on whether PN visit is important

	Control arm Frequen-cy/%	**Arm 1 Frequen-cy/%**	**Arm 2 Frequency %**	**Arm 3 Frequency /%**	**Significa-nce (χ^2)**
Baseline	**n=80**	**n=80**	**n=80**	**n=80**	
Endline	**n=67**	**n=72**	**n=71**	**n=74**	
Baseline	41(51%)	45(56%)	47(59%)	55(69%)	p=0.147
Endline	30(45%)	47(65%)	48(68%)	54(73%)	p=0.004

From the FGD, participants gave their views on the importance of postnatal care. A respondent from FGD 3 said *"Postnatal care services are important because the health worker is able to assess the health of mother and baby and give treatment".*

Another respondent from FGD 4 commented *"Postnatal care is important because mothers are taught how to take care of their babies and those who are sick are treated. Those mothers who are in need of family planning are served".*

4.4.6 Post intervention reasons on importance of postnatal visits.

Table 4.12 shows post intervention reasons why postnatal visit are important. Many participants (37%) in intervention 3 said they attended postnatal for their children to be immunized compared to 27% in control arm. There was a significant association between the reasons of visit and the study arms (p=0.003). The key for the reasons is indicated below the table.

Table 4.12 Post intervention on importance of postnatal visits.

Reasons	**Control arm n=30 Frequency %**	**Arm 1 n=47 Frequency %**	**Arm 2 n=48 Frequency %**	**Arm 3 n=54 Frequency %**	**Significance (χ^2)**
1.	4(12%)	6(13%)	4(8%)	3(6%)	χ^2=43, df=21, p=0.003
2.	4(13%)	8(17%)	8(17%)	6(11%)	
3.	3(9%)	7(15%)	6(13%)	2(6%)	
4.	3(9%)	3(6%)	3(6%)	4(7%)	
5.	3(6%)	4(9%)	6(13%)	3(6%)	
6.	3(10%)	7(15%)	7(15%)	12(22%)	
7.	8(27%)	9(19%)	10(21%)	20(37%)	
8.	2(7%)	3(7%)	4(8%)	4(7%)	

Key: *1. Check wellbeing of mother and baby 2. Early detection of health problems 3. Treatment of any health problems 4. For counselling on breastfeeding 5. Reduce mother and child health problems 6. Family planning 7. Child immunization 8. For clinic follow up.*

4.4.7 Baseline opinions on why study participants thought postnatal visit is not important.

Table 4.13 presents baseline opinions on why participants think postnatal visits are not important. There was no significant difference in opinion across the arms ($p>0.05$). The results revealed 56% of study participants in control arm strongly agreed that they had no problem and therefore no need to attend postnatal care compared to 44%, 47%, 48% in intervention arm 1, 2 and 3 respectively. Many participants (44%) in control arm strongly agreed that they attended antenatal clinic and therefore postnatal clinic attendance was not important, compared to 58%, 50%, 40% in intervention 1, 2, and 3 respectively.

Table 4.13 Baseline opinions on why participants think postnatal visits are not important

Opinions	Control arm n=39 Frequency %	Arm 1 n=36 Frequency %	Arm 2 n=32 Frequency %	Arm 3 n=25 Frequency %	Significance (χ^2)
I had no problem					
Strongly agree	22(56%)	16(44%)	15(47%)	12(48%)	χ^2=11.5, df=12, p=0.0486
Slightly agree	13(33%)	14(39%)	18(44%)	7(28%)	
Not sure	2(5%)	2(6%)	2(5%)	3(12%)	
Slightly disagree	2(5%)	2(6%)	2(5%)	2(8%)	
Strongly disagree	2(5%)	2(6%)	2(5%)	2(8%)	
Child had no problem					
Strongly agree	19(49%)	16(44%)	15(47%)	13(52%)	χ^2=7.9, df=9, p=0.545
Slightly agree	15(39%)	14(38%)	11(34%)	6(24%)	
Not sure	2(5%)	2(6%)	2(5%)	2(8%)	
Slightly disagree	2(5%)	2(6%)	2(5%	2(8%)	
Strongly disagree	2(5%)	2(6%)	2(5%)	2(8%)	
I delivered in hospital					
Strongly agree	15(38%)	19(52%)	19(60%)	10(40%)	χ^2=18.8, df=12, p=0.091
Slightly agree	18(45%)	11(31%)	7(22%)	6(24%)	
Not sure	2(5%)	2(6%)	2(6%)	4(16%)	
Slightly disagree	2(5%)	2(6%)	2(5%)	3(12%)	
Strongly disagree	2(5%)	2(6%)	2(5%)	2(8%)	
I attended ANC					
Strongly agree	17(44%)	21(58%)	16(50%)	10(40%)	χ^2=19.7, df=12, p=0.073
Slightly agree	16(41%)	7(19%)	9(28%)	6(24%)	
Not sure	2(5%)	4(11%)	3(9%)	4(16%)	
Slightly disagree	2(5%)	2(6%)	2(5%)	2(8%)	
Strongly disagree	2(5%)	2(2%)	3(9%)	3(12%)	

4.4.8 Post intervention opinions on why mothers think postnatal is not important

Figure 4.2 shows post intervention opinion on why mothers think postnatal care is not important. Majority of the postnatal mothers (62%) in control arm strongly agreed that there was no need of attending postnatal because they had no problem compared to 12%, 13% and 20% in intervention arm 1, 2 and 3 respectively. A greater proportion of 56% participants from control arm said that their children had no problem compared to 20%, 13% and 13% of them in intervention arm 1, 2 and 3 respectively. Many participants (41%) in control arm said they delivered their children in hospital and therefore no need of postnatal visits compared to 12%, 17% and 10% of them in the intervention 1, 2, and 3 respectively. All the reasons given by mothers were statistically different between the control and intervention arms at the endline (χ^2=15.9, $p<0.05$).

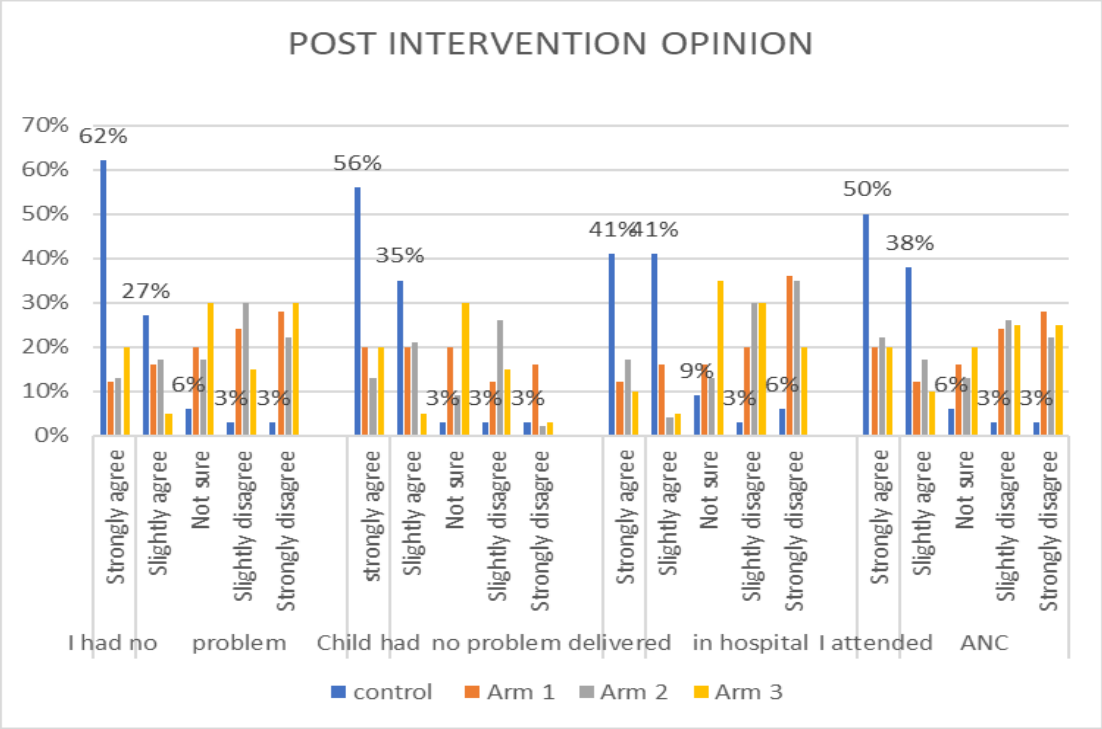

Figure 4.2 Post intervention opinions on why mothers think postnatal is not important

4.4.9 Baseline opinion on whether postnatal visits can reduce maternal and neonatal health problems

Table 4.14 presents the opinion of study participants on whether postnatal visits can reduce maternal and neonatal health problems. A proportion (33%) of study participants in control arm strongly agreed that postnatal visits can reduce maternal and neonatal problems compared to 37%, 41% and 41% of them in intervention 1, 2 and 3 respectively. There was no significant difference in opinion between control and intervention arms (χ^2=7.5, df=12, p=0.821). Majority of postnatal mothers agreed that postnatal visits can reduce maternal and health problems. This is a positive attitude.

Table 4.14: Baseline opinion on whether postnatal visits can reduce maternal and neonatal health problems.

Opinion	Control arm n=80 Frequency/%	Arm 1 n=80 Frequency/%	Arm 2 n=80 Frequency/%	Arm 3 n=80 Frequency/%	Significa-nce
Strong-ly agree	26(33%)	29(37%)	32(41%)	33(41%)	χ^2 = 7.5, df=12, p=0.821
Slightly agree	8(10%)	7(10%)	10(13%)	13(16%)	
Not sure	22(28%)	20(25%)	14(18%)	18(23%)	
Slightly disagree	14(18%)	12(15%)	12(15%)	10(13%)	
Strong-ly disagree	10(13%)	11(14%)	11(14%)	6(8%)	

4.4.10 Post intervention opinion of study participants on whether postnatal visits can reduce maternal and neonatal health problems

The table 4.15 shows post intervention opinion of study participants on whether postnatal visits can reduce maternal and neonatal health problems. A proportion of 25%

of participants in control arm strongly agreed that postnatal visits can reduce maternal and neonatal health problems compared to 46%, 41% and 54% of them in intervention arm 1, 2 and 3 respectively. After the intervention, there was a significant difference in opinion of mothers on postnatal care visits across the control and intervention arms (p= χ^2=27.5, df=12, p=0.006).

Table 4.15 Post intervention opinion on whether postnatal visits can reduce maternal and neonatal health problems

Opinion	Control arm n=67 Frequency/%	Arm 1 n=72 Frequency/%	Arm 2 n=71 Frequency/%	Arm 3 n=74 Frequency/%	Significance (χ^2)
Strongly agree	17(25%)	33(46%)	29(41%)	40(54%)	χ^2=27.5, df=12, p=0.006
Slightly agree	5(8%)	8(11%)	12(17%)	13(18%)	
Not sure	18(27%)	14(19%)	12(17%)	8(11%)	
Slightly disagree	11(16%)	12(17%)	9(13%)	7(10%)	
Strongly disagree	16(24%)	5(7%)	9(13%)	6(8%)	

4.5 Postnatal mothers' attitude and practices on mobile phone technology in health care.

4.5.1 Ownership of mobile phone

Table 4.16 presents participants' ownership of mobile phone. Majority of them (91%) in control arm own mobile phone compared 85%, 83% and 88% in intervention 1, 2 and 3 respectively. There was no significance difference in mobile ownership between control and intervention arms (χ^2=12.3, df=6, p=0.056).

Table 4.16 Ownership of mobile telephone

	Control arm n=67 Frequency /%	Arm 1 n=72 Frequency/ %	Arm 2 n=71 Frequency/ %	Arm 3 n=74 Frequency /%	Significa-nce (χ^2)
Owned	61(91%)	61(85%)	59(83%)	65(88%)	χ^2=12.3, df=6, p=0.056
Borrowed	3(5%)	2(3%)	2(2%)	1(1%)	
Shared	3(4%)	9(13%)	10(14%)	8(11%)	

4.5.2 Time postnatal mothers propose to be reminded.

Table 4.17 shows the time postnatal mothers proposed to be reminded. Majority of the participants (48%) in control arm said they would like to receive mobile phone reminders in the morning compared to 49%, 38%, and 34% of them in intervention arm 1, 2 and 3 respectively. There was no significant difference between control and intervention arms (χ^2=41, df=9, p=0.756).

Table 4.17 Time mothers propose to be reminded

Time	Control arm n=67 Frequency/%	Arm 1 n=72 Frequency/ %	Arm 2 n=71 Frequency/ %	Arm 3 n=74 Frequency/ %	Signifi-cance
Morning	32(48%)	35(49%)	27(38%)	28(34%)	χ^2=41, df=9, p=0.756
Afternoon	7(10%)	7(10%)	9(14%)	12(16%)	
Evening	17(25%)	18(26%)	22(31%)	19(26%)	
Any time	11(16%)	10(14%)	13(18%)	18(24%)	
Would you like to receive SMS/Voice call to remind you postnatal visits?					
Yes	62(93%)	68(96%)	62(87%)	67(91%)	χ^2=25 p=0.273
No	5(7%)	4(6%)	9(13%)	7(9%)	

4.5.3 Mobile phone use among postnatal mothers

Table 4.18 shows pattern of mobile phone use among postnatal mothers. A proportion 43% of respondents in control arm said they use mobile phone many times per day in various ways compared to 36%, 62%, and 60% of them in intervention arm 1, 2, and 3

respectively. Many participants (67%) in control arm used voice calls many times a day compared to 58%, 63% and 62% in intervention arm 1, 2 and 3 respectively.

Table 4.18 Pattern of mobile phone use among postnatal mothers.

	Control arm n=67 Frequency/%	**Arm 1 n=72 Frequency/ %**	**Arm 2 n=71 Frequency/ %**	**Arm 3 n=74 Frequency/%**
Mobile phone use				
Once a day	14(21%)	23(33%)	4(6%)	5(7%)
Twice a day	15(22%)	8(12%)	5(7%)	5(7%)
Thrice a day	5(8%)	13(19%)	13(18%)	17(23%)
Many times	29(43%)	25(36%)	44(62%)	44(60%)
Once a week	4(6%)	4(5%)	5(7%)	4(5%)
SMS				
Once a day	11(16%)	19(28%)	4(6%)	4(5%)
Twice a day	3(4%)	4(5%)	5(7%)	5(7%)
Thrice a day	7(10%)	11(16%)	9(13%)	9(12%)
Many times	37(56%)	28(45%)	44(62%)	47(64%)
Once a week	5(6%)	4(5%)	4(5%)	5(7%)
Rarely	5(8%)	4(5%)	4(6%)	4(5%)
Voice calls				
Once a day	5(8%)	10(15%)	4(5%)	4(5%)
Twice a day	4(6%)	4(5%)	6(9%)	4(5%)
Thrice a day	4(6%)	5(7%)	7(10%)	14(19%)
Many times	45(67%)	42(58%)	45(63%)	46(62%)
Once a week	5(7%)	4(5%)	4(6%)	4(5%)
Rarely	4(6%)	5(7%)	5(7%)	4(5%)

4.5.4 Baseline and endline opinion on whether reminders can improve postnatal visits.

Table 4.19 shows baseline and endline opinion on whether reminders can improve postnatal visits. After the intervention, the proportion of participants who strongly agreed that combination of SMS and voice call can improve postnatal visits in control arm increased from 11% to only 13% compared to an increase from 10% to 43%, 11% to 47%, and from 18% to 58% in intervention arms 1, 2 and 3 respectively. The proportions of respondents who strongly agreed that use of voice call can improve postnatal visits decreased from 13% to 9% in the control arm compared to an increase from 11% to 39%, 10% to 18% and 9% to 30% in intervention arm 1, 2 and 3 respectively. Proportion of participants who strongly disagreed that *m*health is educative increased from 34% to 35% in control arm compared to a decrease from 41% to 8%, 39% to 6% and 47% to 5% in intervention arms 1, 2 and 3 respectively. After the intervention, majority of participants (51%) from the arm 3 strongly agreed *m*health is educative while 6% of them in control arm strongly agreed with this opinion. There was no significant difference in opinions expressed by participants between control arm and intervention arm ($P>0.05$) at baseline. However, after the intervention there was significant change in opinion expressed by participants between control and intervention arms ($p<0.05$). The opinion was similar at baseline but different at endline.

FGD and KII said the following concerning opinion on reminders improving postnatal visits. Many participants were positive that reminders can improve postnatal visits, views that were in line with a Key Informant Interview's opinion.

A respondent from FGD 2 said, *"I think sending reminders to the mothers can improve the postnatal visits".*

Table 4.19 Baseline and end line Opinion on whether reminders can improve PN visits

Opinion		Control	Arm 1	Arm 2	Arm 3	Signf χ^2
	Baseline	**n=80**	**n=80**	**n=80**	**n=80**	
	Endline	**n=67**	**n=72**	**n=71**	**n=74**	
Use of combination of SMS & voice call can increase PN visits						
Strongly agree	Baseline	9(11%)	8(10%)	9(11%)	14(18%)	**Baseline p=0.221 End-line p=0.000**
	Endline	10(13%)	31(43%)	33(47%)	43(58%)	
Slightly agree	Baseline	8(10%)	6(8%)	8(10%)	5(6%)	
	Endline	9(13%)	16(22%)	11(16%)	10(14%)	
Not sure	Baseline	17(21%)	19(24%)	17(21%)	6(8%)	
	Endline	12(18%)	13(18%)	16(23%)	4(5%)	
Slightly disagree	Base line	12(15%)	12(15%)	15(19%)	10(13%)	
	Endline	9(11%)	6(8%)	4(6%)	4(5%)	
Strongly disagree	Baseline	34(43%)	35(44%)	31(39%)	45(56%)	
	Endline	28(42%)	6(8%)	7(10%)	13(18%)	
Use of voice only can increase PN visits						
Strongly agree	Baseline	10(13%)	9(11%)	8(10%)	7(9%)	**Baseline p=0.438 End-line p=0.000**
	Endline	6(9%)	28(39%)	13(18%)	22(30%)	
Slightly agree	Baseline	12(15%)	15(19%)	14(17%)	15(19%)	
	Endline	15(22%)	15(21%)	14(20%)	25(34%)	
Not sure	Baseline	24((30%)	20(25%)	17(21%)	23(29%)	
	Endline	25(37%)	17(24%)	36(51%)	14(19%)	
Slightly disagree	Baseline	10(13%)	9(11%)	8(10%)	5(6%)	
	Endline	10(15%)	9(13%)	6(9%)	9(12%)	
Strongly disagree	Baseline	25(31%)	27(34%)	33(41%)	30(38%)	
	Endline	11(16%)	3(4%)	2(3%)	4(5%)	
Use of SMS only can increase PN visits						
Strongly agree	Baseline	11(14%)	7(9%)	10(13%)	8(10%)	**Baseline p=0.184 End-line p=0.004**
	Endline	6(9%)	14(19%)	23(32%)	21(28%)	
Slightly agree	Baseline	20(15%)	17(21%)	19(24%)	17(21%)	
	Endline	21(31%)	33(46%)	20(29%)	26(35%)	
Not sure	Baseline	18(23%)	22(28%)	17(21%)	13(15%)	
	Endline	24(36%)	17(24%)	16(23%)	21(28%)	
Slightly disagree	Baseline	7(9%)	9(11%)	8(10%)	4(5%)	
	Endline	7(10%)	4(6%)	8(11%)	2(3%)	
Strongly disagree	Baseline	24(30%)	25(31%)	26(32%)	38(48%)	
	Endline	9(13%)	4(6%)	4(6%)	4(5%)	
***m*-health is educative**						
Strongly agree	Baseline	7(15%)	8(10%)	10(13%)	15(19%)	**Baseline p=0.412 End-line p=0.000**
	Endline	4(6%)	28(39%)	34(48%)	36(49%)	
Slightly agree	Baseline	14(18%)	13(16%)	11(14%)	14(18%)	
	Endline	8(12%)	20(28%)	13(18%)	19(26%)	
Not sure	Baseline	19(24%)	18(23%)	15(19%)	8(10%)	
	Endline	19(28%)	15(21%)	17(24%)	11(15%)	
Slightly disagree	Baseline	12(14%)	8(10%)	13(16%)	5(6%)	
	Endline	13(19%)	3(4%)	3(4%)	4(5%)	
Strongly disagree	Baseline	29(34%)	33(41%)	31(39%)	38(47%)	
	Endline	23(35%)	6(8%)	4(6%)	4(5%)	

Another respondent from FGD 4 commented, *"the mobile phone reminders can be of help to improve the postnatal visits though not all mothers have the phones"*

This was supported by a respondent from FGD 3, *"I think we mothers have so many things to do which lead to forgetting the clinic appointment and therefore the mobile phone reminders can help us to remember the postnatal appointment"*.

A Key Informant Interview said *"mobile phone reminders can possibly improve postnatal visits when reminders are sent to mothers who are likely to forget postnatal appointments. SMS and voice calls may indicate to the mothers that somebody is following them and therefore it's not good to ignore the appointment".*

4.5.5. Post intervention level of satisfaction

Table 4.20 shows post intervention level of satisfaction. Majority of the participants (73%) in intervention arm 3 were satisfied with the use of mobile telephone reminders while 55% and 72% of them were equally satisfied in arm 2 and 3 respectively. This indicate that participants were satisfied with the mobile telephone services in provision of health services. It also means participants were comfortable with the language and the two way mobile phone reminders. Majority of the postnatal mothers (80%) in intervention arm 3 said that the reminders were helpful whereas 62% of them in intervention 2 agreed with that suggestion. Participants from arm 3 had a higher proportion possibly because they received two types of reminders.

Table 4.20 Level of satisfaction.

	Arm 1 n=72 **Frequency/%**	**Arm 2 n=71** **Frequency/%**	**Arm 3 n=74** **Frequency/%**
Very satisfied	28(39%)	25(35%)	31(42%)
Slightly satisfied	24(33%)	14(20%)	23(31%)
Neutral	8(11%)	18(25%)	11(15%)
Slightly dissatisfied	8(11%)	6(9%)	5(7%)
Very dissatisfied	4(6%)	8(11%)	4(5%)
Whether the reminders helpful to study participants			
Yes	47(65%)	44(62%)	59(80%)
No	25(35%)	27(38%)	15(20%)

4.5.6 Negative Social effects of using short text messages /voice call on health

From table 4.21, a proportion of 48% of the study participants from control arm said that sending reminders may cause family conflicts compared 14%, 15% and 8% of them in intervention arms 1, 2 and 3 respectively. Few study participants (14%) in the control arm said use of mobile in health may lead to lack of privacy and confidentiality in case the message go to wrong destination compared to 36%, 32% and 36% of them in intervention arms 1, 2 and 3 respectively. There was a significant difference in responses on negative social effects between control and intervention arms (χ^2=103, df=15, p=0.000).

Table 4.21 Negative effects of using short text messages /voice call on health

	Control arm n=67 Frequency/ %	**Arm 1 n=72 Frequency/ %**	**Arm 2 n=71 Frequency/ %**	**Arm 3 n=74 Frequency/ %**	**Signifi-cance (χ^2)**
Family conflicts	33(48%)	10(14%)	11(15%)	6(8%)	χ^2=103, df 15, p=0.000
Dependence on mobile reminders	5(8%)	7(10%)	5(7%)	32(43%)	
Poor message interpretation	6(9%)	10(14%)	17(24%)	9(13%)	
No privacy	10(14%)	26(36%)	23(32%)	27(36%)	
Has no bad effects	1(2%)	14(19%)	11(16%)	11(15%)	
I don't know	4(6%)	5(7%)	4(6%)	6(8%)	

From FGD, participants said there could be negative effects of using mobile phone in health as well as challenges such as family conflicts, mothers giving wrong mobile phone numbers, illiteracy while others may not have the mobile phones.

A respondent from FGD 3 said "*I think using mobile phone reminders can cause family conflicts because the partners may be suspicious of the messages".*

Another respondent from FGD 3 commented *"some people may not have mobile phones and some may not be able to read the messages and interpret accordingly".*

Two Key Informant Interviews expressed their opinion on negative effects of mobile phone.

A Key Informant Interview from Shibwe hospital stated that *"some mothers who share mobile phones with their partners may cause a breach of privacy and confidentiality ".*

Another Key Informant Interview from Navokholo hospital said "*there are mothers who don't know how to read and this may cause a challenge when SMS are sent. Some*

mothers might give a wrong mobile phone numbers meaning messages sent to them may never get to target but end up in another person's mobile".

4.6 Effect of mobile phone SMS alone, voice call alone, and combination of voice call and SMS on postnatal visit.

4.6.1 Effect of SMS, voice call and combination of SMS/voice call.

Figure 4.3 shows comparison of SMS, voice call and combination of both. After the intervention, voice call increased level of second postnatal clinic attendance by 29% compared to an increase of 26% and 40% by SMS and combination of SMS plus voice call respectively. There was a significant difference in postnatal visits between control and intervention arms (χ^2=23.7 d=3 p=0.000). Odds ratio (logistic regression) proved that voice call increased second postnatal visit by 2.31 times (95% CI, 1.32- 4.87) as shown in table 4.22. SMS increased second postnatal visit by 2.18 times (95% CI, 1.07- 4.65), while combination of SMS together with voice call increased postnatal visits by 2.81 times (95% CI, 1.54 -- 5.84). In the third postnatal visit, voice call increased postnatal level of clinic attendance by 12% compared to 10% and 16% in SMS arm and combination of SMS plus voice call respectively. Odds ratio (logistic regression) proved that third postnatal visit voice call increased the attendance by 1.2 times (95% CI, 0.93- 3.41), SMS by 1.15 times (95% CI, 0.83 – 3.26), and combination of SMS together with voice call by 1.24 times (95% CI, 0.86- 3.47).

After the intervention, voice call increased the fourth postnatal visit level of attendance by 21% compared to 16% and 23% in SMS arm and combination of SMS plus voice call respectively. Pearson chi-square indicate a significant difference in postnatal visit

between the control arm and intervention arms (χ^2=10.7, df=3, p=0.029). Calculation of odds ratio (logistic regression) indicated that voice call increased the fourth postnatal visit by 2.38 times (95% CI, 1.17- 4.13), SMS by 2.12 times (95% CI, 0.93- 3.98), and combination of SMS and voice call by 2.47 times (95% CI, 1.82- 5.73).

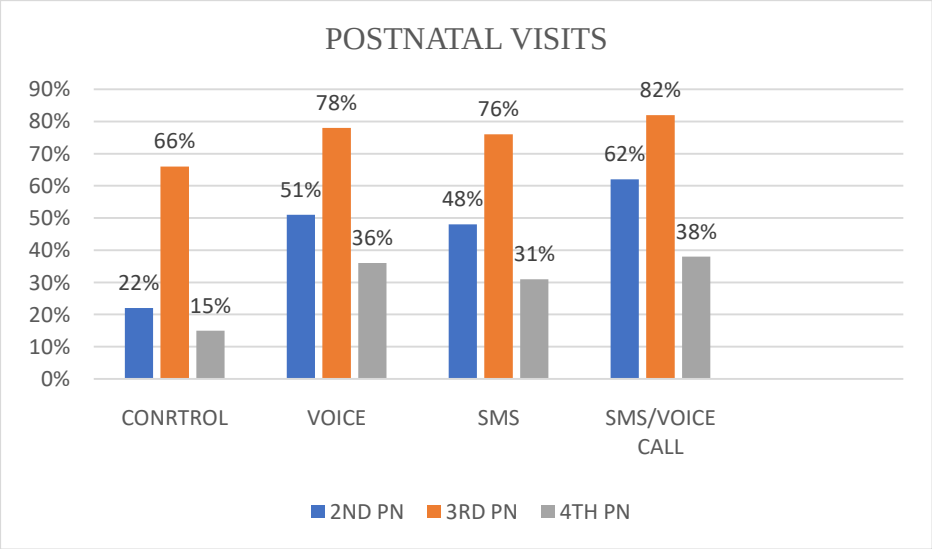

Figure 4.3: Comparison of SMS, voice call and combination of SMS/voice call.

4.6.2 Adherence to second and third postnatal visit

Figure 4.4 shows how the study participants adhered to second and third postnatal visit. After the intervention, adherence to second and third postnatal clinic attendance decreased by 3% in control arm compared to increase of 30%, 17% and 33% in intervention arm 1, 2 and 3 respectively. There was a significant difference in adherence to second and third postnatal visit between control arm and intervention arms (χ^2=31.9 df=3 p=0.000). After running logistic regression, Odds Ratio proved postnatal adherence increased by 3.16 times (95% CI, 1.85- 5.23) by voice call, 2.67 times (95% CI, 1.09- 4.17) by SMS and 3.37 times (95% CI, 2.19- 5.68) thorough combination of SMS together with voice calls. The following null hypotheses were

therefore rejected after calculation using Mann-Whitney U test; a) there is no significant difference in adherence to second and third postnatal visit after sending SMS reminders between control and intervention arms, b) there is no significant difference in adherence to second and third postnatal visit after making voice call reminders between control and intervention arms and lastly c) there is no significant difference in adherence to second and third postnatal visit after using combination of SMS and voice call reminders between control and intervention arms.

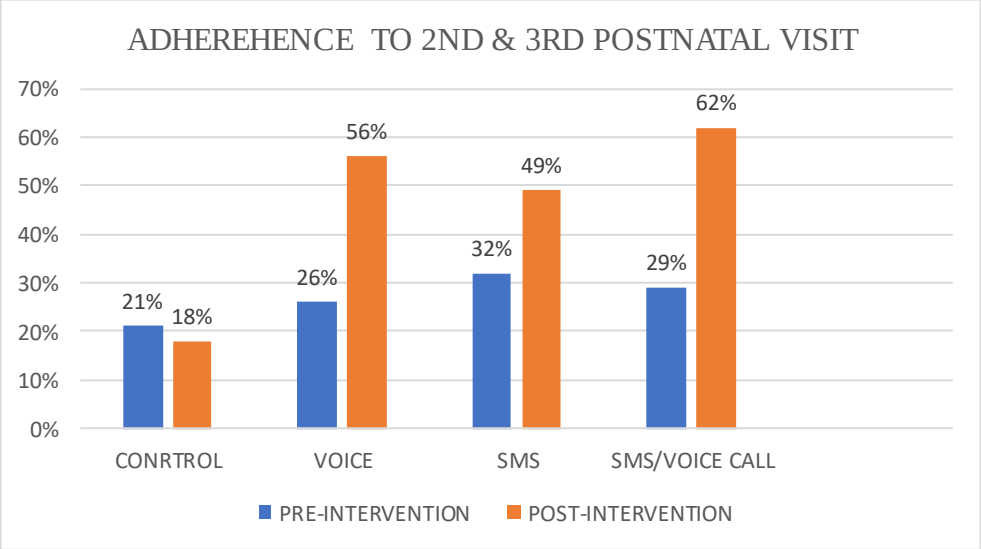

Figure 4.4: Pre intervention and post intervention comparison of adherence to second and third postnatal visits.

4. 6.3 Post intervention comparison of second, third and fourth visit

Figure 4.5 presents a comparison pre-intervention and post-intervention postnatal visits. of postnatal clinic attendance. The proportion of participants who attended second

postnatal visit increased from 24% to 25% in control arm compared to increase from 26% to 53%, 29% to 48% and 25% to 62% in intervention 1, 2, and three respectively (Pearson χ^2 test, p=0.000). The proportion of respondents who ateended fourth postnatal visit increased from 13% to 16% in control arm compared to an increase from 6% to 35%, 8% to 31%, and 11% to 38% in intervention arm 1, 2 and 3 respectively (Pearson x^2 test, p=0.029).

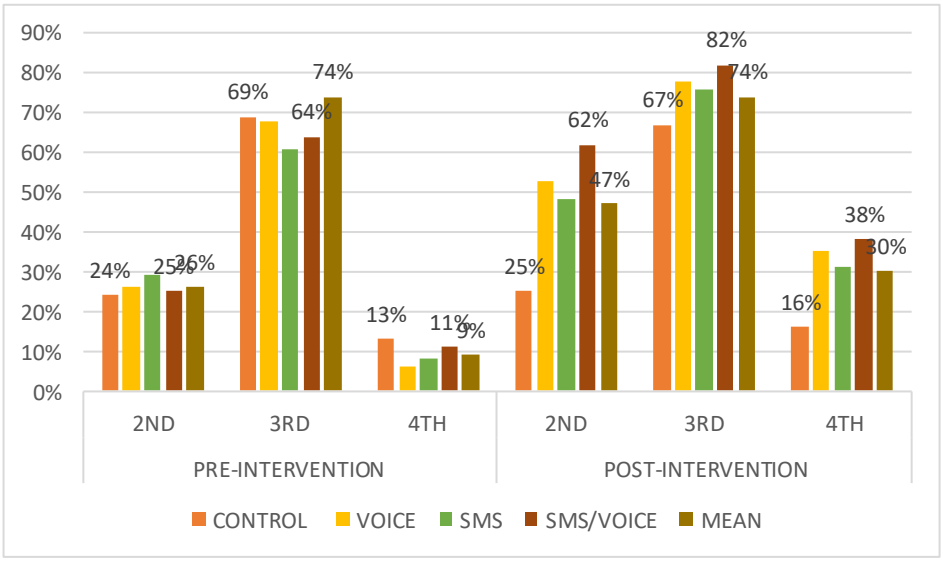

Figure 4.5 Comparison of pre-intervention and post- intervention postnatal visits

4.6.4 Binary logistic regression

Table 4.22 shows binary logistic regression. Voice call was able to increase second postnatal clinic attendance by 2.31 times whereas combination of SMS and voice call increased second postnatal visit by 2.81 times.

Table 4.22 Binary logistic regression

	2nd PN		**95% CI**		**3rd PN**		**95% CI**	
	B	**E**	**OR**	**p value**	**B**	**E**	**OR**	**p value**
Control	24%	25%			69%	67%		
Voice call	26%	55%	2.31	0.001	68%	78%	1.15	0.000
SMS	29%	48%	2.18	0.037	61%	76%	1.15	0.012
SMS+ Voice Call	25%	62%	2.81	0.024	64%	82%	1.24	0.029

Key: B =Baseline E=Endline

CHAPTER FIVE: DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

This chapter is organized into discussion, conclusion and recommendations. The discussion is arranged according to the study objectives. The study characteristics were significantly similar at baseline across the arms. The interventions increased the postnatal clinic attendance with variations being observed across the intervention arms.

5.2. Discussion

5.2.1 Socio-demographic characteristics of participants

Majority of mothers (38%) in arm 1 were aged between 26 to 30 years. Maternal age is a significant factor in child birth. A high proportion of mothers (90%) were below the age of 35 years. A study done by Montori *et al*. (2021) reported that maternal risks were significantly associated with advanced age among mothers more than 35 years.

A proportion of 87% of the participants were married in all the four arms indicating a higher proportion than the national statistics that reported 61% (KNBS, 2015). Being married is positive thing for social support as suggested by Cheptum (2018). This proportion is consistent to a study done by Wudineh, *et al.* (2018) in Ethiopia and Makunyi (2018).

Many mothers (48%) had attained primary education. Majority of the residents have basic education. People who have attained education are able to read and understand many concepts given to them as health message and be able to apply the information

appropriately. This is consistent with findings of Cheptum (2018) who found similar findings among postnatal mothers who had completed primary education. It has been observed in many other studies that majority of girls don't proceed with education after primary level due to various challenges such as financial difficulties and cultural practices such early or forced marriages (UNICEF, 2021b). About six percent of the participants had no formal education. This agrees with a study done by Harrington *et al.* (2019) in Kenya where a proportion of only 6% of participants were illiterate. Lack of education affects mothers' understanding of various postnatal messages and communications.

Majority of the postnatal mothers (55%) in arm 3 were not employed. This implies that majority of participants were people of low social economic status. This is consistent with the findings of KNBS (2015) which reported a national proportion of 61%. There was no statistically significant difference in socio-demographic variables between the control and intervention arms ($p>0.05$). This is consistent to a study by Kebede *et al.* (2019) who found similar findings. The reason for majority of the participants being of lower socio economic status is due to the geographical rural setup where various economic activities such as employment opportunities are few compared to urban areas. In urban setup there are many opportunities that improve economic status such as employment, businesses and manufacturing plants among many others.

Many participants (57%) used motorcycles, a finding consistent with a study done by Matiang'i (2018) in Kisii where 60% of mothers used a motorbike and 1% used personal

cars. In Kenya, motor cycle transport is growing rapidly in both rural and urban areas. Motor cycles are commonly used because they are able to penetrate areas with rough terrain or even where roads are impassable. However, the big proportion of using motor cycle in this study disagrees with Wanjala (2015) and Almaz *et al* (2019) who observed that 76% and 82% of the participants walked to the health facility.

A proportion of 43% of the participants in arm 3 took less than 20 minutes to reach the hospital. This is possibly for the reason of the short distance covered and availability of health facilities within reach. This finding agrees with Ettarh and Kimani (2016) who observed an acceptable distance to get to hospital. There was no significant difference at baseline in time taken to reach the facility between control and intervention arms ($p>0.05$). Mothers may be discouraged to visit postnatal clinic if they take a lot of time due to distance being covered.. Kikuchi *et al.* (2018) reported that distance affected negatively continuum of care. About 14% of postnatal mothers took more than 41 minutes to the hospital. This means a bigger proportion of mothers were able to get to hospital in satisfactory time and be given the appropriate intervention to prevent complications and save life. However, for those living in far places from the hospital it is important for facilities to embrace community midwifery to enable the mothers to get the services at home. Long distance is a deterrent to utilization of health facilities (Titus, Adebisola & Adeniji, 2015).

Majority of postnatal mothers accounting to over 93% of the participants in all study arms were Christians. This agrees with KNBS (2019) which also reported a high proportion of Christians. Kakamega County is dominated by people who profess Christian faith.

5.2.2 Level of attendance of scheduled postnatal visit among mothers seeking postnatal services in Kakamega County

Mobile telephone reminders sent to postnatal mothers significantly ($p<0.05$) increased the postnatal visits. This is good evidence that mobile phone technology can be used to promote health and increase uptake of services (Bangal *et al.,* 2017). At baseline only 26% of participants attended second postnatal visit which is lower than the national attendance at 53% (KNBS, 2015). This implies that postnatal care was not well utilized. The national attendance is slightly higher than the global postnatal attendance of 50% (WHO, 2015). The proportions of participants who attended postnatal visits in all intervention arms were more than the control arm. This is mostly attributed to the mobile phone interventions that comprised of SMS and voice call reminders. After the intervention, majority of participants (82%) attended third postnatal clinic in arm 3 which was higher than the national attendance at 53% (KNBS, 2015). There was an increase in attendance in second postnatal visit between the control arm and intervention arm 2 by 23% after sending the SMS reminders.

The increase in postnatal attendance is a good indicator of interaction between the mother and the health worker. This interaction provides an opportunity to health worker to diagnose a problem and give appropriate intervention. This agrees with Jones *et al.* (2020) in a study done in Nigeria. A proportion difference of 28% in attendance was

observed between the control arm and intervention arm 1 (voice call) during the second postnatal visit. A much bigger difference (37%) was noted between control arm and intervention arm 3 after sending combination of SMS and voice call reminders during the second postnatal visit. Postnatal mothers who consistently attended second and third postnatal visits were deemed to have adhered to postnatal clinic attendance. After the intervention a relatively higher adherence rate (62%) was observed in arm 3 possibly because this arm had advantage of receiving both SMS and voice call reminders. The two reminders sent to postnatal mothers during second, third and fourth postnatal visit could have motivated them to adhere to the postnatal visits.

The reason for voice call being effective than SMS reminders could be due to the direct interaction with the participant as opposed to SMS where it was uncertain to confirm immediately whether the recipient read the SMS and understood it. This eventually increased the utilization of postnatal services. The educational postnatal health messages (appendix 10) sent to mothers to improve their postnatal knowledge could also have played a significant role in increasing the postnatal clinic attendance. In this study SMS reminders increased third postnatal visit by 15% which is consistent with a study done by Munira (2018) in Kenya that increased third postnatal clinic attendance by 15%. Many participants (47%) adhered to second and third postnatal visit. This agrees with a study done by Oramisi *et al.* (2016) in Kenya among postnatal mothers. Lower adherence to postnatal visits may hinder health workers from detecting maternal and neonatal health problems early enough and even make necessary interventions.

However, this study may imply that for participants who adhered to second and third postnatal visits, it was a good opportunity for them to prevent maternal and neonatal

health problems as well as utilize available services. When we compare the two arms, intervention arm 1 (voice call) had higher proportions (56%) of participants adhering to the postnatal visit whereas intervention arm 2 (SMS) had 49% of study participants adhered to second and third postnatal visit. Yadav *et al*. (2022) found that mobile phone reminders were able to improve uptake of postnatal services. Munira (2018) reported increased postnatal attendance after SMS and voice call reminders in a study done in Kenya. A study done in Kenya by Oramisi *et al* (2016) observed significant rise in attendance among mothers who received SMS.

At baseline survey, many study participants (69%) cited the reason for attending 3rd postnatal visit was immunization of their babies, which is in line with work done by Belachew *et al.* (2016). Most of the participants (65%) in arm 3 said the reason for attending second postnatal visit was the appointment given by the health workers. This disagrees with findings of Miteku *et al* (2016) where mothers expressed that no appointment date was given by health workers. However, Belachew *et al.* (2016) reported that 38% of participants had been advised by the health worker to attend the postnatal clinic.

From the FGD, many participants cited ignorance as a reason for not attending postnatal visit. A proportion of study participants in arm 3 said they were not aware (50%). This agrees with Miteku *et al.* (2016) and Almaz *et al* (2019) who reported that participants did not have information. This study also revealed that lack of bus fare for transport was a hindrance to visit postnatal clinic which is in line with Ochieng and Odhiambo (2019). Some participants (5%) said they had no health problem and therefore no need to attend

postnatal clinic. This is a common mentality with many people who think being healthy is when they don't have any discomfort or injury.

5.2.3 Level of knowledge and attitude on postnatal visits among postnatal mothers attending MCH clinics in Kakamega County

Before the intervention majority of study participants (76%) had no/low knowledge on postnatal care which agrees with a study done by Maharjan (2017) in Kenya who found a bigger proportion of the postnatal mothers had inadequate knowledge on postnatal care. The findings on knowledge gap among postnatal mothers agrees with a study done by Beraki *et al.,* (2020) and Belachew *et al.* (2016) who also observed similar knowledge gaps among postpartum mothers. The study established that majority of the postnatal mothers (45%) could not tell when the scheduled postnatal visits are supposed to be done. From the FGD, many participants reported they did not know when to attend postnatal visits or even the recommended number of postnatal visits. This inadequate information and knowledge on postnatal schedule may affect the postnatal visits and utilization of postnatal services. It's apparent that with such a knowledge gap, mothers may not be able to make important decisions on postnatal visits. Many participants had a moderate knowledge on services offered in the postnatal clinics. This knowledge gap is consistent with Beraki *et al*. (2020) who reported considerable knowledge gaps. The study revealed that transport and income were significantly associated with knowledge on postnatal care. Majority (73%) of the mothers in arm 1 obtained their postnatal information from health workers. This is credible source of information that is able to

prevent rumours and speculation. Guerra-Reyes *et al*. (2017) reported similar finding where health workers were the major sources of information.

After the intervention of sending reminders packaged together with postnatal health messages, there was a significant improvement in the level of knowledge among the mothers. This can be catalyst of behaviour change which is likely improve postnatal visits and provide health workers an opportunity to detect complications and give appropriate interventions. The increase in postnatal knowledge is important as it enables mothers to undergo the postnatal period successfully (Mirzaee and Taghi, 2015) as well as make important medical decision on when and where to visit. Jones *et al*. (2020) reported that there was increase in knowledge after sending SMS to mothers. There was a significant difference in level of knowledge on postnatal care between the control and intervention arms ($p<=0.05$). Many postnatal mothers (44%) increased their postnatal care knowledge to moderate level after the intervention. This agrees with a study by Maharjan *et al.* (2017) who found similar proportions among postnatal mothers with average knowledge on postnatal care. A further proportion of 30% of mothers had adequate knowledge which agrees with Sandhya *et al.* (2015).

After the intervention there was a significant difference in knowledge of services offered in postnatal clinic between control and intervention arms. This agrees with a study done by Jones *et al.* (2020) that proved a significant increase of knowledge and improved uptake of services after sending reminders with educational messages. From the baseline survey majority of the participants (73%) from study arms said their source of information on postnatal care was from health workers which is consistent with the

findings (68%) of Belachew *et al.* (2016). There are concerns of low knowledge on postnatal care considering the high proportion of source of information being health workers. Possibly the delivery of health messages is not well packaged. A proportion of 73% of the study participants from intervention arm 3 said it was important to attend postnatal clinic. This is a positive attitude which is likely to help the mother change and improve her health seeking behaviour. This agrees with a study done by Mbuthia *et al*. (2019) where participants had a positive attitude on postnatal care.

5.2.4 Postnatal mothers' attitude and practices on use of mobile phone technology in health care among mothers seeking postnatal services in Kakamega County

More than 83% of the participants in each arm owned a mobile. This finding is similar to the national proportion of 86% (KNBS, 2015). This observation is consistent with Nabovati *et al*. (2020) who observed a higher proportion (85%) of mobile ownership in South Africa. High proportion of mobile ownership enables good maintenance of privacy and confidentiality of client as there is no sharing of phones. For effective and efficient mobile phone interventions, mobile phone ownership is an important factor (Khatuna *et al.*, 2016). However, this finding is inconsistent with Marron *et al.* (2020) who observed only 59% of participants owned a mobile phone. Many study participants (55%) use mobile phone many times a day. This agrees to a study by Jimmy *et al.* (2019) who observed that majority of participants used the mobile phone many times a day. However, this is contrary to findings by Subramani *et al*. (2017) who reported 27% of participants were inconvenienced by mobile phone use.

Majority (58%) of participants use SMS many times a day, a proportion lower than what Endehabtu *et al*. (2018) reported. This finding disagrees with Domek *et al.* (2018) who found some participants could not use SMS. However, SMS are commonly used because they are cheaper than voice calls.

Majority of postnatal mothers (>87%) accepted to receive reminders until they complete the visits. This finding agrees with Adanikin *et al.* (2015) who also observed a high acceptance of *m*health (90%). From the FGD, many participants and also a key informant reported that mobile phone reminders can improve postnatal visits. Majority of postnatal mothers (43%) strongly agreed that reminders can improve postnatal visits. This agrees with Kebede *et al.* (2019) who reported that reminders can enhance postnatal visits and uptake of services. Majority of the study participants (80%) in intervention 3 said that the reminders were helpful. This is consistent with a study done by Kebede *et al.* (2019) who reported 90% of participants said the reminders were helpful.

After participants received reminders there was a significant difference in change of attitude between control and intervention arm. Mbuthia *et al.* (2019) reported positive change of attitude among mothers towards postnatal care. After intervention higher proportions were realised which improved postnatal visits and eventually increased postnatal service utilization with a target to reduce maternal and neonatal health problems. This agrees with Limenih *et al.* (2016) and Oliver *et al.* (2017).

5.2.5 Comparison of the effectiveness of mobile phone voice call, SMS, and combination of voice call plus SMS.

There was significant increase of postnatal visits in the intervention arms. This study is consistent to observations by Sondaal *et al.* (2016) who reported that mobile phone reminders can improve postnatal visits and eventually increase utilization of services. Postnatal mothers in intervention arm 3 had a higher proportion of postnatal visits, 62% in second visit and 82% in third visit than other arms possibly because of the combination of SMS and voice call reminders. Few study participants (47%) attended second postnatal visit. This clearly indicates that there are missed opportunities for the health worker to detect maternal and neonatal health problems during this very crucial period. This also deduces that there is low utilization of postnatal services.

A proportion of 82% of the postnatal mothers in arm 3 attended third postnatal visit which was a significant increase compared to control arm. This finding agrees with Watterson *et al.* (2015) who reported that reminders can improve postnatal attendance. Olajubu *et al.* (2020) also reported that there was a signicant increase in all postnatal attendnce in the intervention arm compared to control arm. This propotion is above the national proportional of 53% (KNBS, 2015). Third postnatal visit had higher propotions than the second and fourth visits posssibly due to other reasons such as the need of child vaccination which occurs during the third postnatal visit. This finding is higher than what Tesfahun *et al.* (2014) reported among mothers (68%) who had utilized postnatal care.

A proportion of 38% of the postnatal mothers in intervention arm 3 attended fourth postnatal visit while 16% of them in the control arm. In the post intervention results, there was a significant difference in postnatal visits between control and intervention arm (χ^2=10.7, df=3, p=0.014). After running binary logistic regression, higher odds of attending postnatal clinics were observed in intervention arms compared to the control arm. The odds of attending postnatal clinic in intervention arm 1 (voice call) was 2.38 times higher compared to control arm whereas that of SMS increased by 2.12 times and combination of SMS and voice call by 2.47 times. This agrees with Kebede *et al.* (2019) who reported similar finding. There are usually low attendance in fourth postnatal visits across the health facilities. With the increase of postnatal visit observed in this study it shows that the mobile phone intervention is effective and it can be used to achieve the sustainable development goal 3 by improving utilization of postnatal care. This is in line with Olajubu *et al*. (2020) who reported that reminders were effective in increasing postnatal visits with forth postnatal having the the lowest attendance.

In this study there was a significant increase in postnatal visit between control and intervention arm 1 by 28% attendance while in arm 2 attendance increased by 23% with arm 3 having 37% higher. This showed that the mothers had a change of attitude and behaviour after receiving the educational health messages. There was a significant increase in attendance ($p<0.05$) contrary to a study by Noroton *et al*. (2014) where there was no increase despite sending the SMS reminders. This study agrees with a study done Oramisi *et al.* (2016), who reported an increase in postnatal attendance in a group that received SMS compared to the control group. Upon sending SMS reminders, Harrington

et al. (2019) in Western Kenya reported a significant increase in uptake of services among postpartum women. However the attendance of fourth postnatal visit was lowest compared to second and third postnatal visit. This is consistent to observations by Kikuchi *et al.* (2018) who reported discontinuation of care being highest in the postnatal care. It is clear from this study that postnatal mothers were able to visit at least three postnatal visits which is contrary to findings by Sharma *et al.* (2014) in Ethiopia where only 2% attended four postnatal visits. There was a positive healthy seeking behaviour in utilization of services after sending SMS reminders (Olajubu *et al.*, 2020).

There was an increase in second visit between control and voice call combined with SMS by 40%, This shows that combination of SMS and voice call improved postnatal attendance than when each is used alone. This is consistent with a study done by Harrington *et al.* (2019). The mobile telephone reminders increased the postnatal visits in all the intervention arms though with variations. This study agrees with work done by Munira (2018) that reported increased postnatal attendance after sending SMS and voice call reminders. However he reported that participants who received SMS had a high postnatal retention at 6 weeks than voice call. The intervention arm 2 (voice call) had higher proportions than the intervention arm 1 (SMS) in all postnatal visits and even in adherence. This agrees with a study done by Munira (2018) who found voice calls were more effective than SMS at 48 hours and at two weeks. This could be due to the possibility of voice calls directly getting the target receiver whereas it is uncertain to confirm immediately whether the recipient who received the SMS, read the SMS and understood it. Simple and cost effective interventions are likely to impact greatly in improving utilization of postnatal services. This study focused on engaging postnatal

mothers in a simple intervention to change attitude and eventually health seeking behaviour.

5.3 Conclusion

i. Only very few postnatal mothers attend postnatal clinics in Kakamega County. This is a low performance compared to other counties in Kenya. A low postnatal attendance denies health workers an opportunity to detect neonatal and maternal health problems and apply necessary interventions.

ii. The postnatal mothers knowledge on postnatal care is low. Low knowledge on postnatal care is a pointer to the low postnatal visit. Mothers don't know the importance of postnatal visit, when they are scheduled and how many visits should be done.

iii. There is a high acceptance of the use of mobile phone reminders packaged together with postnatal educational messages among postnatal mothers in Kakamega County. This has a potential of bridging the postnatal knowledge gap.

iv. Postnatal mothers have a positive attitude on use of mobile phone which is good motivation on use of mobile phone technology in health.

v. There was a significant association between the mobile phone reminders and adherence to second and third postnatal visits. Combination of voice call and SMS is more effective in increasing postnatal visits than when the routine communication is used alone. This is a technology that can be used to accelerate uptake of postnatal services in the health facilities.

5.4 Recommendations

5.4.1 Recommendations from the study

i. The findings of this study show the attendance of postnatal visit is low but significantly increased after the intervention. Fourth postnatal visit occurs when the mother and the baby are already stable, however a lot of emphasis should be put to mothers so that they may consider it equally important. All service providers should ensure that they give postnatal appointments to all the mothers as recommended. Very few mothers in control arm reported having been given an appointment to attend fourth postnatal visit.

ii. The health workers in the county should combine the mobile phone reminders together with relevant educational health messages to improve the level of knowledge on postnatal care among the mothers.

iii. Kakamega County government should integrate mobile phone technology in provision of health services in order to improve the uptake of services. From this study use of telephone reminders were effective in improving postnatal visits and therefore the intervention can be adopted by the Kakamega County and other stakeholders in health care to help achieve SDG 3.

5.4.2 Recommendations for further research

i. Cost implication on implementation of mobile telephone technology in provision of postnatal services in Kakamega County.

ii. Assessment of acceptance of mobile telephone technology among healthcare workers in enhancing postnatal services in Kakamega County.

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APPENDICES

Appendix 1: Informed consent

My Name is *Charles Kiragu*. I am PhD student from Kenyatta University. I am conducting a study on ``*Effect of mHealth technology in enhancing postnatal visits amongst mothers attending MCH clinics in selected hospitals in Kakamega County''.* The information will be used by the Ministry of Medical Services and Ministry of Public Health and Sanitation to improve postnatal visits and quality of postnatal care of mothers and their neonates in the hospitals as well as in other regions of Kenya.

Procedures to be followed

Participation in this study will require that I ask you some questions and also examine you in order to obtain information. I will record the information from you in an interview guide.

You have the right to refuse participation in this study. You will get the same care and medical treatment whether you agree to join the study or not and your decision will not change the care you will receive from the clinic today or that you will get from any other clinic at any other time

Please remember that participation in the study is voluntary. You may ask questions related to the study at any time.

You may refuse to respond to any questions and you may stop an interview at any time. You may also stop being in the study at any time without any consequences to the services you receive from this clinic or any other organizations now or in the future.

Discomforts and risks

Some of the questions you will be asked are on intimate subject and may be embarrassing or make you uncomfortable. If this happens, you may refuse to answer these questions if you choose so. You may also stop the interview at any time. The interview may add approximately half an hour to the time you wait before you receive your routine services

Benefits

If you participate in this study you will help us to learn how to provide effective postnatal care services that can improve the maternal child health and reduce the risk of increased morbidities and mortalities during postnatal period by use of mobile telephone short message service and voice call. You will also benefit from being assessed and if you are found to have a problem you will be advised on treatment.

Reward

There is no reward or token offered as a result of participating in this study.

Confidentiality

The interviews and examinations will be conducted in a private setting within the clinic. Your name will not be recorded on the interview guide. The interview guide will be kept

in a locked cabinet for safe keeping at Kenyatta University. Everything will be kept private.

Contact information

If you have any questions you may contact Mr Charles Kiragu on 0727411769, Dr. Justus Osero on 254-020-8703768, Prof. Anthony Wanyoro on 254-020- 8710901 ext 3335or the Kenyatta University Ethical Review Committee Secretariat on chairman.kuerc@ku.ac.ke ,

Participant's statement

The above information regarding my participants in the study is clear to me. I have been given a chance to ask questions and my questions have been answered to my satisfaction. My participation in this study is entirely voluntary. I understand that I will still get the same care and medical treatment whether I decide to leave the study or not and my decision will not change the care I will receive from the clinic today or that i will get from any other clinic at any other time.

Code of participant…….

…… ……

Signature or thumb print Date

Investigator`s statement

I, the undersigned, I have explained to the volunteer in a language she/he understands, the procedures to be followed in the study and the risks and benefits involved.

Name of interviewer……..

……. …….

Interviewer signature Date

Appendix 2 : Fomu ya Idhini

Jina langu Charles Kiragu. Mimi ni Mwanafunzi katika Chuo Kikuu cha Kenyatta. Tunafanya utafiti kuhusu “Utumishi wa ujumbe wa simu za rununu kwa wanawake wajawazito ili kuongeza utumizi wa kliniki za waliojifungua katika eneo ya Kaunti ya Kakamega. Utafiti huu utatumika na wizara ya afya ili kuboresha afya ya wanawake wajawazito.

Utaratibu

Utaratibu ni wa kuwahoji akina mama wajawazito kuhusu utumizi ujumbe wa simu za rununu na kuhudhuria kiliniki ya wanawake wajawazito. Majibu yako yatanakiriwa kwa kijitabu.

Madhara

Utafiti huu hauna madhara yeyote yanayoyurikana.

Manufaa

Kuhusika katika utafiti huu hakuna manufaa ya kibinafsi. Matokeo ya utafiti huu yatatumika na wizara ya afya kuboresha afya ya wanawake wajawazito.

Usiri wa habari

Majibu utakayotoa kwa maswali yatakuwa ya usiri. Majina au nambari zako za kitambulisho au za simu hazitajumuishwa katika ripoti ya utafiti. Vijitabu vitararuriwa mwaka mmoja baada ya utafiti kukamirika.

Mawasiliano

Ukiwa na swali lolote uliza, Bwana Charles Kiragu on 0727411769, Dr. Justus Osero kwa 020-8703768, Dr. Anthony. Wanyoro kwa 8710901 Ext 3335 au uandike

barua pepe kwa Mwenye Kiti, Kenyatta University Ethical Review Committee Secretariat on

kuerc@ku.ac.ke.

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Sahihi Tarehe

Jina la msaindizi wa utafiti:

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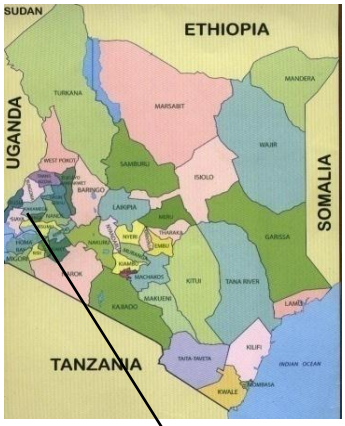
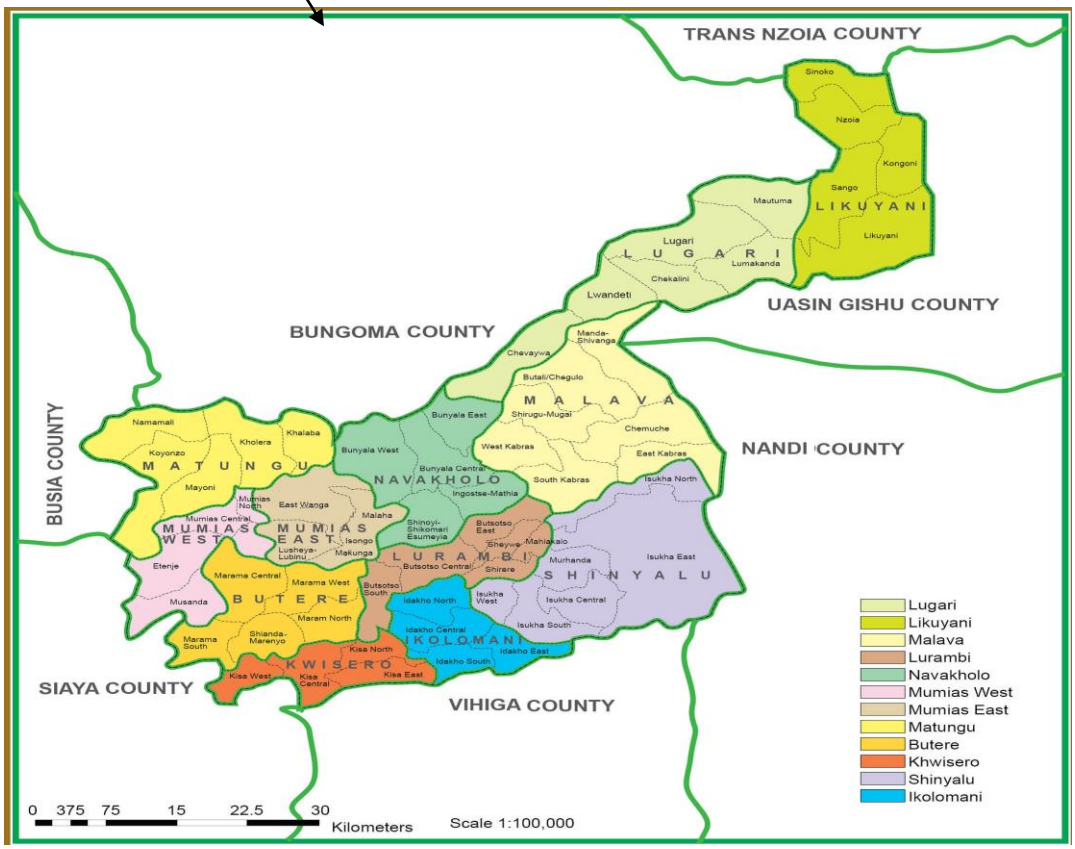
Sahihi Tarehe

Appendix 3: A map of study area





Appendix 4: Baseline Interview guide

A study on ‘Effect of m-Health technology in enhancing postnatal visits amongst mothers attending MCH clinics in selected hospitals in Kakamega County’’.

Interview guide No …….

Mobile number……

Alternative number ……..

Health facility name ……..

Date ……

SOCIODEMOGRAPHIC AND ECONOMIC CHARACTERISTICS

1. What is your age .....
2. What is your marital status? A. Married B. Unmarried. C. Separated D. Widow
3. Your level of education? A. No formal education B. Primary C. Secondary D. College/ University
4. Your Occupation? A. Unemployed B. Self Employed C. Employed (Specify……..)
5. How many children have you given birth to?. ……..
6. Mode of transport A. Matatu B. Motor cycle C. Bicycle D. Walking E. Any other
7. Distance from your home to the this health facility ……
8. Average income per month? A. Below 10,000 B. 10, 001-20,000 C. 20, 001-30000 D. above 30,000
9. Your religion? A. Christian B. Muslim C. Hindu D. Any other

10. Have you been attending antenatal clinic prior to this delivery? Yes …….. No ……

    If yes, how many antenatal visits did you attend? ……..

11. Why did you attend? …….

    If no, why? ……

PREVIOUS POSTNATAL VISITS

12. When was your previous delivery? ……
13. Place of previous delivery? ……..
14. What was your mode of previous delivery? A. Normal vaginal delivery B. Caesarean section
15. Did you visit postnatal clinic during your previous postnatal period? Yes……. No … (PROCEED TO Q18)
16. If yes Q15 when did you make your postnatal visits? A. Within 48 hours B. within two weeks C. at six week. D. Any other ….
17. State reasons for attending the previous postnatal visit. (tick)
    A. Given postnatal appointment B. I was sick. C. My child was sick. D. For my child to be immunized. E. Any other (specify) …….
18. If no Q 15 state reasons for not visiting ……

KNOWLEDGE ON POSTNATAL

19. What is postnatal care…….
20. What are the recommended postnatal visits? A. one B. two B. three. D. four E. I don't know
21. When is a mother supposed to make the:

    First post natal visit? …….

    Second postnatal visit…….

    Third postnatal visit ……

    Forth postnatal visit ……..

22. What services are supposed to be provided in the postnatal clinic? (you can tick more than one)

    a. Physical examination
    b. Child assessment
    c. Family planning
    d. Health education
    e. Nutritional education
    f. Immunization
    g. Breastfeeding
    h. Treatment of illnesses from the child and mother
    i. Others (specify) …….

23. From whom did you know about postnatal visit?

    A. A health worker (specify .....)

    B. Media (specify .....)

    C. Books

    D. Friend

    E. Any other ……..

24. What maternal health problems are likely to occur during the postnatal period?

    A. High blood pressure

    B. Headache

    C. Per vaginal Bleeding

    D. Breast inflammation

    E. Infections in reproductive organs

    F. convulsions

    G. Any other specify ……..

25. Did you develop any health problems during your previous delivery? Yes .. No …..

    If yes (25) specify…..

26. What neonatal health problems are likely to occur during the postnatal period?

    A. Neonatal sepsis

    B. Convulsions

    C. Fever

D. Malnutrition

E. Any other …….

27. Did your previous new-born develop any health problem? Yes ….No ….

If yes (27) specify ……

ATTITUDE TOWARDS POSTNATAL VISIT

28. Is it important to attend postnatal visit? Yes ……. ……... No …….(PROCEED TO Q29)

If yes state reasons……..

29. If no Q28 why do you think postnatal is not important, (tick the response against the statement)

Variable					
I had no problem.	Strongly agree	Slightly agree	not sure	Slightly disagree	Strongly disagree
Child had no problem.	Strongly agree	Slightly agree	not sure	Slightly disagree	Strongly disagree
Delivered in hospital	Strongly agree	Slightly agree	Not sure	Slightly disagree	Strongly disagree
Attended Antenatal care	Strongly agree	Slightly agree	not sure	Slightly disagree	Strongly disagree

30. Postnatal visits are helpful in reducing mother and child health problems. (tick your response)

A. Strongly Agree B. slightly agree C. Not Sure D. Slightly disagree E. Strongly agree

ATTITUDE TOWARD MOBILE TELEPHONE

31. How do you access mobile telephone?

A. Owned B. Borrowed C. Shared D. Others (specify ……..)

32. How often do you use mobile phone?

A. Once a day B. Twice a day C. Thrice D. Once a week. E. Others (specify)

……..

33. How often do you use short text messages and voice call?

    A) Always B). Once a day C). Twice a day D) Three times a day E). Once a week. Others (specify) ……..

34. Could you accept to receive a text message/voice call or both to remind you to visit postnatal care?

    Yes …… No ……. (IF NO PROCEED TO Q36)

35. If yes (Q34) at what time could you wish to be reminded?

    A. Morning B. Afternoon C. Evening D. any other (specify) …….

36. If no (Q34), what are the reasons for not wishing to receive text message/voice call or both ? …….

37. Could you wish to receive either text messages/voice call or both until you complete your postnatal visits? Yes ….. No …..

38. If no what are the reasons for not wishing to continue with text message or voice call or both? ……

39. Could you recommend use of text messages or voice/both voice call to your friends? Yes …. No ……..

40. If yes, why? …….

41. If no what are the reasons for not recommending short text message/voice call or both combined text message and voice call? ……

42. What are the negative effects of using short text messages /voice call or using the two combined on postnatal visits? …….

43. What do you think of using m-health in increasing postnatal visits? (tick)

i. Use of combination of voice call and SMS will increase of postnatal visit	Strongly agree	Slightly agree	Not sure	Slightly disagree	Strongly disagree
ii. Use of voice call only will increase of postnatal					

visit					
iii. Use of SMS only will increase of postnatal visit					
iv. Use voice or SMS won't increase postnatal visit					
v. Use of m health is educative					

44. If you agree Q43 above how do you think use of text message, voice or both will increase uptake of postnatal visit? ……

45. If you don't agree (Q43) why do you think use of text message, voice or both will not increase uptake of postnatal visit? ……

Appendix 5: Key Informant interview

Interview guide No …….

A study on *'Effect of m-Health technology in enhancing postnatal visits amongst postnatal mothers attending MCH clinics in selected hospitals in Kakamega County'.*

1. Your occupation ……..
2. How long have worked since completion of training …… .
3. When is the last time you were trained on postnatal care?
4. Is there a postnatal guideline in your department? Yes……. No ……..
5. If yes, is it being followed? ……..
6. Do you use mobile telephone services to communicate to your patients in this facility?
7. Is there network connectivity problem in this area.
8. Can mobile reminders be used in improving postnatal visit?
9. If yes which one? …… (probe)
10. In your own opinion, what are the barriers of postnatal visits? …….
11. What do you think may improve postnatal visits? …….
12. What is the mode of communication used by health workers to clients?
13. Do you think there are challenges of using mobile phone in health by clients? Yes … No…..
14. Are there challenges in using mobile technology by health workers in a health facility? Yes .. No…..

    If yes which ones……..

Appendix 6: Focused group discussion schedule

a. Welcoming the participants.
b. Introduction of the researcher and participants.
c. Explain the purpose of the study and the group discussion.
d. Reassure participants of confidentiality and urge them to express themselves freely.
e. State the group norms.
f. Thank the participants for availing themselves for the discussion.

TOPICS

1. Is postnatal care important to mother and baby?
2. Do mothers have challenges in attending postnatal clinic? What are challenges?
3. What do you think can be done to improve postnatal visits in the health facilities?
4. What is your perception in mobile phone use in improving postnatal visits?
5. Did you experience any challenges when you received messages and calls as a reminder?
6. If yes what were the challenges?.....

Appendix 7: Post intervention interview guide

A study on 'Effect of m-health technology in enhancing postnatal visits amongst mothers attending MCH clinics in selected hospitals in Kakamega County''.

Interview guide No …….
Mobile number……
Alternative number ……..
Health facility name ……..

POSTNATAL VISITS

1. When was your delivery? ……
2. What was your mode of delivery? A. Normal vaginal delivery B. Caesarean section
3. Did you visit postnatal clinic during your postnatal period? Yes……. No … (if No, **proceed to** Q5)
4. If yes Q3 when did you make your postnatal visits? A. Within 48 hours B. within two weeks C. at six week. D. any other ….
5. What are reasons why you attended postnatal clinic?

Reasons	Two weeks	Six weeks	Six months
Given appointment			
Mobile reminder			
Developed a health problem			
Child immunizations			
Child was unwell			
Any other			

6. What are reasons why you did not attend postnatal clinic?

Reasons	Two weeks	Six weeks	Six months
Forgot			
Travelled			
Not aware			

Ignored			
Was sick			
Child died			
No money for transport			
Had no problem			
Any other			

KNOWLEDGE ON POSTNATAL

7. What is postnatal care…….
8. What are the recommended postnatal visits? A. One B. Two B. Three D. Four
9. When is a mother supposed to make the:

   First postnatal visit? …….

   Second postnatal visit…….

   Third postnatal visit ……

   Forth postnatal visit ……..

10. What services are supposed to be provided in the postnatal clinic? (you can tick more than one)

    A. Physical examination
    B. Child assessment
    C. Family planning
    D. Health education
    E. Nutritional education
    F. Immunization
    G. Breastfeeding demonstration /advice
    H. Treatment of illnesses from the child and mother
    I. Others (specify) …….

11. From whom did you know about postnatal visit?

    A. Health worker

    A. Media (specify .....)

    B. Books

    C. Friend

D. Any other

12. What maternal health problems are likely to occur during the postnatal period?

A. High blood pressure

B. Headache

C. Per vaginal Bleeding

D. Breast inflammation

E. Infections in reproductive organs

F. Convulsions

G. Any other specify ……..

13. Did you develop any health problems during your previous delivery? Yes .. No …..

If yes (13) specify…..

14. What neonatal health problems are likely to occur during the postnatal period?

A. Umbilical discharge

B. Convulsions/ fits

C. Fever

D. Malnutrition

E. Any other (specify) ……

15. Did your previous new-born develop any health problem? Yes ….No ….

If yes (15) specify ……

ATTITUDE TOWARDS POSTNATAL VISIT

16. Is it important to attend postnatal visit? Yes ……. ……... No ……. (PROCEED TO Q17)

If yes state reasons……..

17. If no Q16 why do you think postnatal is not important, (tick the response against the statement)

Variable					
I had no problem.	Strongly agree	Slightly agree	not sure	Slightly disagree	Strongly disagree
Child had no problem.	Strongly agree	Slightly agree	not sure	Slightly disagree	Strongly disagree

Delivered in hospital	Strongly agree	Slightly agree	Not sure	Slightly disagree	Strongly disagree
I attended Antenatal care	Strongly agree	Slightly agree	not sure	Slightly disagree	Strongly disagree

18. Postnatal visits are helpful in reducing mother and child health problems. (tick your response)

    A. Strongly Agree B. slightly agree C. Not Sure D. Slightly disagree E. Strongly agree

ATTITUDE TOWARD MOBILE TELEPHONE

19. What are the possible social effects of using short text messages /voice call or using the two combined on postnatal visits? …….

    A) Family conflicts B. Enhance behaviour change C. Overdependence on mobile reminders D. Has no effects E. I don't know

20. What do you think of using m-health in increasing postnatal visits? (tick)

i. Use of combination of voice call and SMS will increase of postnatal visit	Strongly agree	Slightly agree	Not sure	Slightly disagree	Strongly disagree
ii. Use of voice call only will increase of postnatal visit					
iii. Use of SMS only will increase of postnatal visit					
iv. Use voice or SMS won't increase postnatal					

visit					
v. Use of m health is educative					

21. If you agree Q20 i,ii,iii above how do you think use of text message, voice or both will increase uptake of postnatal visit? ……

22. If you disagree (Q20) iv why do you think use of text message, voice or both does not increase uptake of postnatal visit? ……

23. What was your level of satisfaction on the reminders?

    A. Very Satisfied … B. Satisfied… C. neutral …. D. dissatisfied …E. very dissatisfied ….

24. Were the reminders helpful?

    Yes …… Why…….

    No … why …….

25. Would you recommend mobile phone reminder in your future health care?

    Yes ……. Why……

    No … why …….

UPTAKE OF SERVICES

26. Utilization of services (tick one or more)

	Yes	No		
Received ITN				
Weight taken				
BP Checked				
Baby weight taken				
Baby received vaccines				
Family planning				
Vitamin a supplementation				
Treatment				

PMTCT services				
Any other …….				

27. What do you think are barriers of using mobile phone technology to improve postnatal visits?

    A. No source of power

    B. No network

    C. Not able to read text message

    D. Lack of mobile phone

    E. Any other ……..

Appendix 8: Level of attendance Interview guide

A study on 'Effect of m-Health technology in enhancing postnatal visits amongst mothers attending MCH clinics in selected hospitals in Kakamega County''.

Interview guide No …….
Health facility name ……..

POSTNATAL VISITS

1. When was your delivery? ……
2. What was your mode of delivery? A. Normal vaginal delivery B. Caesarean section
3. Did you visit postnatal clinic during your postnatal period? Yes……. No … (if No **proceed to** Q5)
4. If yes Q3 when did you make your postnatal visits? (tick all visits done). A. Within 48 hours B. within two weeks C. at six week. D. 4-6 Months E. any other ….
5. What are reasons why you attended postnatal clinic?

Reasons	Two weeks	Six weeks	Six months
Given appointment			
Mobile reminder			
Developed a health problem			
Child immunizations			
Child was unwell			
Any other			

6. What are reasons why you did not attend postnatal clinic?

Reasons	Two weeks	Six weeks	Six months
Forgot			
Travelled			
Not aware			

Ignored			
Was sick			
Child died			
No money for transport			
Had no problem			
Any other			

Appendix 9: Tool for analysis of knowledge on postnatal care

Level of Knowledge	**Score per response**
No knowledge	No right response
Low knowledge	One right response
Moderate knowledge	Two right response
Adequate knowledge	More than three right response
Total score 18 Low knowledge <6 Moderate 7-11 Adequate 12-18	

Appendix 10: Content of health messages in the reminders

Second postnatal visit reminder

First health message

'*Hallow Madam, this is to remind you that your postnatal visit will be on ……., Postnatal care is an important service offered to mother and baby where they are assessed. Visits are done within 2 days, 2 weeks, 6 weeks and 4-6 months after delivery. Maternal health problems that may occur includes: vaginal bleeding, anaemia, high blood pressure, breasts sores, fits, fever, headache etc'.*

Kiswahili version

Habari yako, nakukubusha ya kwamba siku yako ya kliniki ni……., huduma ya kliniki ni muhimu ambapo mama na mototo kuangaliwa na daktari baada ya kujifungua. Unastahili kwenda baada ya wiki mbili, wiki sita na baada ya miezi nne kujifungua. Shida ambazo zinaweza kuba mama ni kama: kuvunja damu njia ya uzazi, upungufu wad amu,blood pressure kuwa juu, shida ya matiti, kupoteza fahamu, joto mwilini…

Second health message

'*Hallow Madam, this is to remind you that your postnatal visit will be on ……., Postnatal care is an important service offered to mother and baby where they are assessed. Visits done within 2 days, 2 weeks, 6 weeks and 4-6 months after delivery. Neonatal health problems that may occur include umbilical infection, fever, chest infections, refuse to feed, yellow eyes, failure to add weight'.*

Kiswahili version

Habari yako, nakukubusha ya kwamba siku yako ya kliniki ni……., huduma ya kliniki ni muhimu ambapo mama na mototo kuangaliwa na daktari baada ya kujifungua. Unastahili kwenda baada ya wiki mbili, wiki sita na baada ya miezi nne kujifungua. Shida ambazo zinaweza kuba mototo ni kama: shida ya kitovu, joto mwilini, homa ya mapavu, kukataa kunyonya, langi majano kwa mach, utapiamlo, kukosa kuongeza uzito…

Third postnatal visit reminder

First message

'*Hallow Madam, this is to remind you that your postnatal visit will be on ……., Postnatal care is an important service offered to mother and baby where they are assessed. Visits are done within 2 days, 2 weeks, 6 weeks and 4-6 months after delivery. Services offered: immunization, family planning, BP check, treatment, breastfeeding advice, nutritional counselling, cervical cancer screening, HTC'.*

Kiswahili version

Habari yako, nakukubusha ya kwamba siku yako ya kliniki ni……., huduma ya kliniki ni muhimu ambapo mama na mototo kuangaliwa na daktari baada ya kujifungua. Unastahili kwenda baada ya wiki mbili, wiki sita na baada ya miezi nne kujifungua. Huduma ambazo hupeanwa kwa kliniki: chanjo, kupanga uzazi, kupimwa BP, kutibiwa, kupimwa matiti, ushauli wa kunyonyesha na chakula, kupimwa cancer na ukimwi …….

Second health message

‘*Hallow Madam, this is to remind you that your postnatal visit will be on ……., Postnatal care is an important service offered to mother and baby where they are assessed. Visits done within 2 days, 2 weeks, 6 weeks and 4-6 months after delivery. Maternal health problems that may occur includes: vaginal bleeding, anaemia, high blood pressure, breasts sores, fits, fever, headache etc Neonatal health problems that may occur include umbilical infection, fever, chest infections, refuse to feed, yellow eyes, ’.*

Kiswahili version

Habari yako, nakukubusha ya kwamba siku yako ya kliniki ni……., huduma ya kliniki ni muhimu ambapo mama na mototo kuangaliwa na daktari baada ya kujifungua. Unastahili kwenda baada ya wiki mbili, wiki sita na baada ya miezi nne kujifungua. Shida ambazo zinaweza kuba mama ni kama: kuvunja damu njia ya uzazi, upungufu wad amu,blood pressure kuwa juu, shida ya matiti, kupoteza fahamu, joto mwilini… Shida ambazo zinaweza kuba mototo ni kama: shida ya kitovu, joto mwilini, homa ya mapavu, kukataa kunyonya, langi majano kwa mach, utapiamlo, kukosa kuongeza uzito…

Fourth postnatal visit reminder

First health message

‘*Hallow Madam, this is to remind you that your postnatal visit will be on ……., Postnatal care is an important service offered to mother and baby where they are assessed. Visits done within 2 days, 2 weeks, 6 weeks and 4-6 months after delivery. Services offered: immunization, family planning, BP check,*

treatment, breastfeeding advice, nutritional counselling, cervical cancer screening, HTC'.

Kiswahili version

Habari yako, nakukubusha ya kwamba siku yako ya kliniki ni……., huduma ya kliniki ni muhimu ambapo mama na mototo kuangaliwa na daktari baada ya kujifungua. Unastaahili kwenda baada ya wiki mbili, wiki sita na baada ya miezi nne kujifungua. Huduma ambazo hupeanwa kwa kliniki: chanjo, kupanga uzazi, kupimwa BP, kutibiwa, kupimwa matiti, ushauli wa kunyonyesha na chakula, kupimwa cancer na ukimwi …….

Second health message

'*Hallow Madam, this is to remind you that your postnatal visit will be on ……., Postnatal care is an important service offered to mother and baby where they are assessed. Visits are done within 2 days, 2 weeks, 6 weeks and 4-6 months after delivery. Services offered: immunization, family planning, BP check, treatment, breastfeeding advice, nutritional counselling, cervical cancer screening, HTC'.*

Kiswahili version

Habari yako, nakukubusha ya kwamba siku yako ya kliniki ni……., huduma ya kliniki ni muhimu ambapo mama na mototo kuangaliwa na daktari baada ya kujifungua. Unastahili kwenda baada ya wiki mbili, wiki sita na baada ya miezi nne kujifungua. Huduma ambazo hupeanwa kwa kliniki: chanjo, kupanga uzazi, kupimwa BP, kutibiwa, kupimwa matiti, ushauli wa kunyonyesha na chakula, kupimwa cancer na ukimwi …….

Appendix 11: Graduate school approval

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 57530

Internal Memo

FROM: Dean, Graduate School

DATE: 11th June, 2019

TO: Mr. Charles K. Ngigi
C/o Department of Community Health & Epidemiology
Kenyatta University

REF: Q97/37411/16

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

We acknowledge the receipt of your revised Research Proposal entitled **"Effect of Mobile Telephone Technology in Enhancing Postnatal Visits Amongst Mothers Attending MCH Clinics in Selected Hospitals in Kakamega County, Kenya"** as per recommendations raised by the Graduate School Board of **22nd May, 2019.**

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission for Science Technology & Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed supervision Tracking Forms per semester. The form has been developed to replace the progress Report Forms. The Supervision Tracking Forms are available at the University's Website under Graduate School webpage downloads.

By copy of this letter, the Registrar (Academic) is hereby requested to grant you substantive registration for your Ph.D. studies.

Thank you

REUBEN MURIUKI
FOR: DEAN, GRADUATE SCHOOL

KENYATTA UNIVERSITY OFFICE OF DEAN 17 JUL 20.. GRADUATE SCHOOL P.O. Box 43844

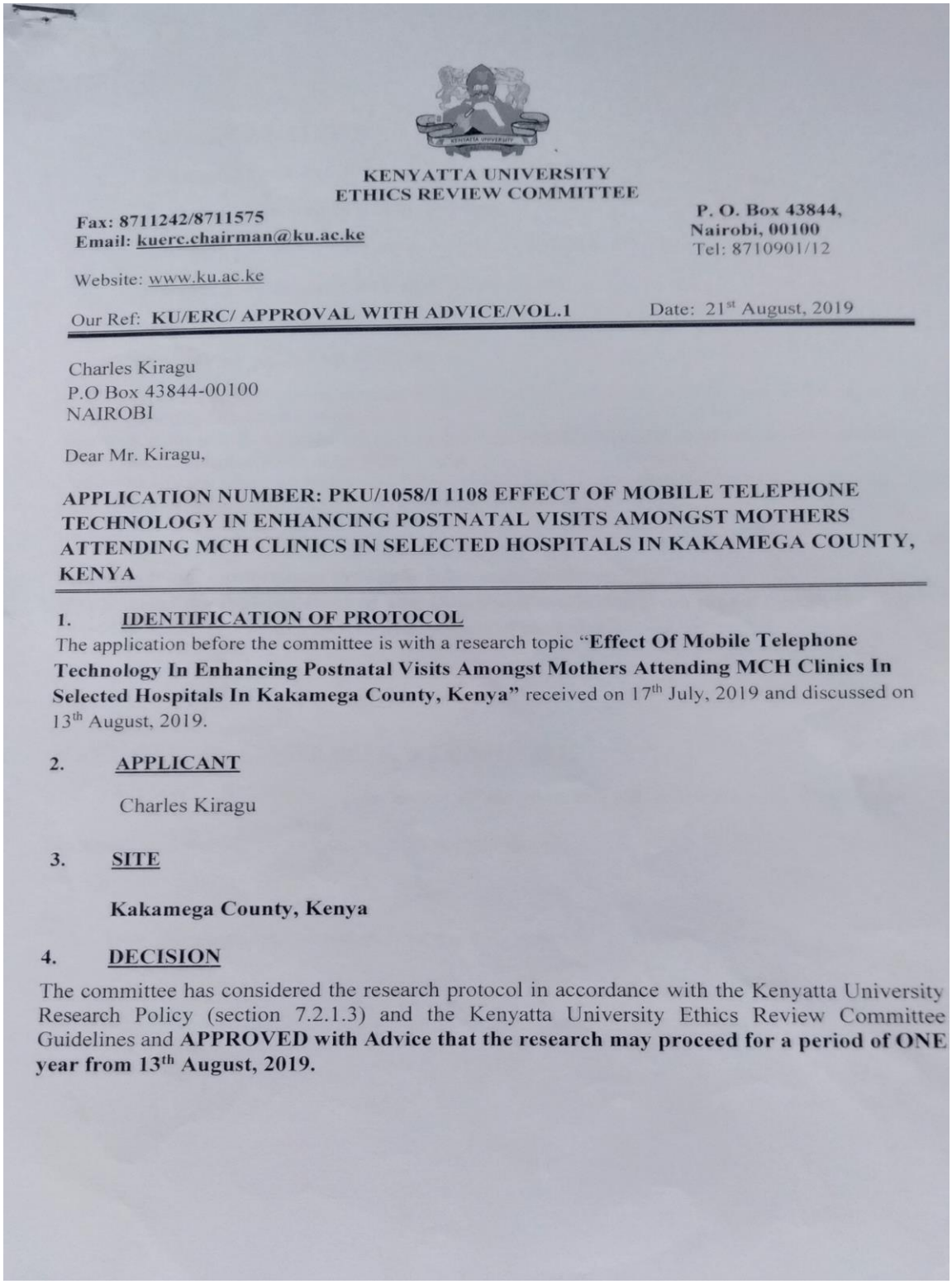
c.c. Registrar (Academic) Att. Mrs. Lucy Njenga
Chairman, Department of Community Health & Epidemiology

Supervisor

1. Dr. Justus Osero
   C/o Dept. of Community Health & Epidemiology
   Kenyatta University
2. Dr. Anthony Wanyoro
   C/o Dept. of Obstetrics & Gynaecology
   Kenyatta University

RM/cao

Appendix 12: Ethical review clearance



KENYATTA UNIVERSITY
ETHICS REVIEW COMMITTEE

Fax: 8711242/8711575
Email: kuerc.chairman@ku.ac.ke

P. O. Box 43844,
Nairobi, 00100
Tel: 8710901/12

Website: www.ku.ac.ke

Our Ref: **KU/ERC/ APPROVAL WITH ADVICE/VOL.1** Date: 21st August, 2019

Charles Kiragu
P.O Box 43844-00100
NAIROBI

Dear Mr. Kiragu,

APPLICATION NUMBER: PKU/1058/I 1108 EFFECT OF MOBILE TELEPHONE TECHNOLOGY IN ENHANCING POSTNATAL VISITS AMONGST MOTHERS ATTENDING MCH CLINICS IN SELECTED HOSPITALS IN KAKAMEGA COUNTY, KENYA

1. **IDENTIFICATION OF PROTOCOL**

The application before the committee is with a research topic "**Effect Of Mobile Telephone Technology In Enhancing Postnatal Visits Amongst Mothers Attending MCH Clinics In Selected Hospitals In Kakamega County, Kenya"** received on 17th July, 2019 and discussed on 13th August, 2019.

2. **APPLICANT**

Charles Kiragu

3. **SITE**

Kakamega County, Kenya

4. **DECISION**

The committee has considered the research protocol in accordance with the Kenyatta University Research Policy (section 7.2.1.3) and the Kenyatta University Ethics Review Committee Guidelines and **APPROVED with Advice that the research may proceed for a period of ONE year from 13th August, 2019.**

5.

i. Progress reports are submitted to the KU-ERC every six months and a full report is submitted at the end of the study.
ii. Serious and unexpected adverse events related to the conduct of the study are reported to this committee immediately they occur.
iii. Notify the Kenyatta University Ethics Committee of any amendments to the protocol.
iv. Submit an electronic copy of the protocol to KUERC.

When replying, kindly quote the application number above.
If you accept the decision reached and advice and conditions given please sign in the space provided below and return to KU-ERC a copy of the letter.

KENYATTA UNIVERSITY
P. O. BOX 43844 - 00100 NAIROBI
APPROVED
★ 04 SEP 2019 ★
OFFICE OF THE CHAIRMAN
ETHICS REVIEW COMMITTEE

Dr. Peterson Warutere
AG. CHAIRMAN - ETHICS REVIEW COMMITTEE

I CHARLES KIRAGU .....accept the advice given and will fulfill the conditions therein

Signature..... Dated this day of 4/9/..... 2019.

cc.
DVC-Research Innovation and Outreach

Appendix 13: NACOSTI research permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 560777

Date of Issue: 24/September/2019

RESEARCH LICENSE

This is to Certify that Mr.. Charles Ngigi of Kenyatta University, has been licensed to conduct research in Kakamega on the topic: EFFECT OF MOBILE TELEPHONE TECHNOLOGY IN ENHANCING POSTNATAL VISITS AMONGST MOTHERS ATTENDING MCH CLINICS IN SELECTED HOSPITALS IN KAKAMEGA COUNTY, KENYA for the period ending : 24/September/2020.

License No: NACOSTI/P/19/1400

560777

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix 14: Permission from Kakamega County administrator

REPUBLIC OF KENYA

THE PRESIDENCY

MINISTRY OF INTERIOR & CO-ORDINATION OF NATIONAL GOVERNMENT

Office Mobile No: 0707 085260
Email-cckakamega12@yahoo.com

When replying please quote

COUNTY COMMISSIONE
KAKAMEGA COUNTY
P O BOX 43-50100
KAKAMEGA.

Ref No: ED/12/1/VOL.V/46

Date: 8th Jan, 2020

MR CHARLES NGIGI
KENYATTA UNIVERSITY
NAIROBI

RE: RESEARCH AUTHORIZATION

Following your authorization vide letter Ref: NACOSTI/P/19/1400/560777 dated 24th September, 2019 by NACOSTI to undertake research on ***"Effect of mobile telephone technology in enhancing post-natal visits amongst mothers attending MCH clinics in selected hospitals in Kakamega County, Kenya."*** I am pleased to inform you that you have been authorized to carry out the research on the same.

COUNTY COMMISSIONER
KAKAMEGA COUNTY

P.K. MARACHI
FOR: COUNTY COMMISSIONER
KAKAMEGA COUNTY

Appendix 15: Publication papers

Paper 1

8 *International Journal of Nursing Care, January-June 2021, Vol. 9, No. 1*
https://doi.org/10.37506/ijonc.v9i1.13994

Impact of *m*Health to Improve Postnatal Visits among Postpartum Mothers in a Rural Community in Kakamega County, Kenya

Charles K. Ngigi, [1] Justus O. Osero[2] Anthony K. Wanyoro[3]
[1]Research Scholar, PhD (Epidemiology) Department of Community Health and Epidemiology, Kenyatta University,
P.O Box 332 Kalimoni, Kenya, [2]Lecturer, Department of Community, Kenyatta University, Professor, [3]Department of Obstetrics and Gynaecology, Kenyatta University

Abstract

Background: There is an increase of mobile phone use globally with Kenya being among countries with increased usage both in rural and urban areas. Despite the widespread use of mobile phone, its use in health delivery services such as enhancing postnatal clinic (PNC) attendance is quite low. Countries such Kenya are exploring various interventions such as use of *m* health to improve the uptake of postnatal care. Postnatal visits have been reported in many studies to be low in many countries, and this has eventually affected the utilization of postnatal services. During the postnatal period the health care providers get opportunity to detect maternal and neonatal health problems in order to curb morbidities and mortalities.
Objective: This study aimed to determine the effect of mobile phone in enhancing postnatal visits among postnatal mothers in Kakamega County, Kenya.
Methods: This was an experimental longitudinal and a facility based randomized control trial with a quantitative data. It was carried among 284 eligible postnatal mothers. Systematic sampling technique was used to recruit the study subjects. Data was analysed using SPSS version 21.
Results: There was a significant increase in attendance between control arm and intervention arm 3 (combination of SMS and voice call) by 40% in second PN, third 14% and 23% in fourth postnatal visit. There was a significant difference in adherence to second and third postnatal visit between control and intervention arms. We concluded that combination of voice call and SMS is 3.37 times more effective than voice call or SMS alone. The Kakamega County government should integrate use of mobile phone in delivery of health care services.

Key words*: m Health; Mobile phone technology; Maternal; postnatal mother; postnatal visits.*

Paper 2

African Journal of Midwifery and Women's Health Vol. 15, No. 4

Factors influencing women's knowledge at scheduled postnatal visits: a multi-centre study in Kakamega, Kenya

Charles Kiragu Justus SO Osero Anthony K Wanyoro

Published Online:22 Dec 2021https://doi.org/10.12968/ajmw.2020.0044

Abstract

Background/aims

Postnatal care is offered to mothers and their babies from birth and across the postnatal period. Visits are spread over the postnatal period, and a minimum of four visits is recommended. In many studies, postnatal visits in Africa have been reported to be low compared to antenatal visits. As a result of low postnatal visits, mothers are not able to utilise postnatal care services, resulting in delayed detection of and interventions for maternal and neonatal health problems, leading to high rates of maternal and neonatal morbidity and mortality. In Kenya, only 53% of mothers attend postnatal clinics; in Kakamega county, only 34% of mothers attend. This study aimed to establish factors influencing postnatal knowledge among mothers in selected hospitals in Kakamega, Kenya.

Methods

The study was a descriptive cross-sectional study involving 320 postnatal mothers recruited from four sub-counties. Systematic sampling was used to select eligible study participants. Data were collected using questionnaires that assessed the participants' knowledge of postnatal care in terms of what postnatal care is, recommended postnatal care, when to attend a clinic and the services offered at postnatal care clinics. The data were entered into a database and analysed using the Chi-squared test to assess how sociodemographic and socioeconomic characteristics were associated with knowledge of postnatal care.

Results

The majority of participants (73.1%) had poor or no knowledge of postnatal care and 89.7% had poor or no knowledge on when postnatal visits should be carried out. Most postnatal mothers (71.9%) received postnatal health information from health workers. Occupation (P<0.000), income (P<0.000), transport (P<0.000) and time taken to travel to hospital (P=0.034) were significantly associated with postnatal knowledge.

Conclusions Knowledge on postnatal care is poor among postnatal mothers in Kakamega. The majority of participants obtained postnatal care information from health workers, and so it is recommended that Kakamega establishes other strategies for giving information on postnatal care, such as pamphlets to mothers

Paper 3

Ngigi CK., Wanyoro AK., Osero JO., (2022). Mobile phone use among mothers seeking postnatal services in Kakamega County, Kenya. (awaiting publication *accepted for publication on 1/12/2020, AJMW*)

Paper 4

Ngigi CK., Wanyoro AK., Osero JO., (2021). Determinants of utilization of postnatal services among mothers in selected hospitals in Kakamega County. *IJRS*I