UTILIZATION OF MOBILE PHONE SHORT MESSAGE SERVICE TO ENHANCE UPTAKE OF FOCUSED ANTENATAL CARE IN THARAKA NITHI COUNTY, KENYA

MAKUNYI, ELIPHAS GITONGA (MPH, MSc)

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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 ............................

Makunyi, Eliphas Gitonga
Q97/29793/2014

Supervisors Approval:

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

1. Signature ................................. Date ............................

   Dr. Jackim Nyamari, PhD
   Department of Environmental and Occupational Health,
   School of Public Health,
   Kenyatta University

2. Signature ................................. Date ............................

   Dr. Peterson Warutere, PhD
   Department of Environmental and Occupational Health,
   School of Public health,
   Kenyatta University

3. Signature ................................. Date ............................

   Dr. Anthony Wanyoro, PhD
   Department of Obstetrics and Gynaecology,
   School of Medicine,
   Kenyatta University
DEDICATION

I dedicate this thesis to my wife, Felarmine and to my children; Joy and Manuel for their great love, support and encouragement.
ACKNOWLEDGEMENTS

I give reverence to ELOHIM, the only true, sovereign and supreme God for his grace upon me in the entire academic journey from class one to and beyond PhD. To Him be blessing, glory, wisdom, thanksgiving, honour, power and might forever and ever. AMEN. I sincerely thank my supervisors; Dr. Jackim Nyamari, Dr. Peterson Warutere and Dr. Anthony Wanyoro for their technical guidance, support and mentorship. I heartily appreciate the Kenyatta University management for offering me an opportunity and ambient environment. My regards go to the entire department of population and reproductive health that supported me and hosted the programme. I owe gratitude to the office of the Dean, School of Public Health for advancing to me financial support. The success of this study would not have been possible without the support of the research assistants. I therefore acknowledge the time and devotion of Lilian, Rose Sitati, Severino Kinyua, Agusta Kamunde, Moses Kinyua and Teresa Karinga. I finally acknowledge the study participants for agreeing to participate in the study.
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### ABBREVIATIONS AND ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AIDS</td>
<td>Acquired Immunodeficiency Syndrome</td>
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<tr>
<td>ANC</td>
<td>Ante Natal Care</td>
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<tr>
<td>CRA</td>
<td>Commission for Revenue Allocation</td>
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<tr>
<td>E- Health</td>
<td>Electronic Health</td>
</tr>
<tr>
<td>FANC</td>
<td>Focused Ante Natal Care</td>
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<tr>
<td>FHI</td>
<td>Family Health International</td>
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<td>HIS</td>
<td>Health Information systems</td>
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<td>HIV</td>
<td>Human Immuno Deficiency Virus</td>
</tr>
<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
</tr>
<tr>
<td>ITU</td>
<td>International Telecommunication Union</td>
</tr>
<tr>
<td>KDHS</td>
<td>Kenya Demographic and Health Survey</td>
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<tr>
<td>KEMRI</td>
<td>Kenya Medical Research Institute</td>
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<td>KEMSA</td>
<td>Kenya Medical Supplies Agency</td>
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<td>KM</td>
<td>Kilometre</td>
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<tr>
<td>KNBS</td>
<td>Kenya National Bureau of Statistics</td>
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<td>KSHS</td>
<td>Kenya Shillings</td>
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<td>Mhealth</td>
<td>Mobile Health</td>
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<td>MMR</td>
<td>Maternal Mortality Ratio</td>
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<tr>
<td>Abbreviation</td>
<td>Definition</td>
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<tr>
<td>OR</td>
<td>Odds Ratio</td>
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<tr>
<td>SMS</td>
<td>Short Message Service</td>
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<tr>
<td>STIs</td>
<td>Sexually Transmitted Infections</td>
</tr>
<tr>
<td>UNFPA</td>
<td>United Nations Population Fund</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
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<tr>
<td>WHO</td>
<td>World Health Organisation</td>
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DEFINITION OF TERMS

Ante natal care  “The care provided by skilled health-care professionals to pregnant women and adolescent girls in order to ensure the best health conditions for both mother and baby during pregnancy. The components of ANC include: risk identification; prevention and management of pregnancy-related or concurrent diseases; and health education and health promotion” (WHO, 2016).

Effect size  The difference between groups. Absolute effect size is the difference between means or average of two groups (Sullivan and Feinn, 2012).

E-health  The utilization of information and communication technologies for health. Examples include telemedicine, mhealth, social media and electronic health records (WHO, 2016).

FANC  The Minimum number of four comprehensive personalised visits, each of which has specific items of client assessment, education and care to ensure prevention or early detection and prompt management of complications (Ministry of health, 2014).

Maternal death  Death of a woman while pregnant or within 42 days of termination of pregnancy irrespective of the duration and site of pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental causes (WHO, 2015).
Maternal health  The health of the women during pregnancy, delivery and after delivery (WHO, 2015).

Maternal mortality  The number of maternal deaths per 100,000 live births in a specified period (WHO, 2015).

mHealth  The medical and public health practice supported by mobile devices, such as mobile phones, personal digital assistants, and other wireless devices (WHO, 2011).

Short message  Information that is conveyed from a sending user to a receiving user via a short message service centre (ITU, 2009).

SMS  Service in telecommunication networks providing the served user the ability to send and receive Short Messages (ITU, 2009).

SBA  This is a delivery that is assisted by a credited health worker like a nurse or doctor in an environment with the requisite facilities and equipment for care and capacity to refer in case of unmanageable complications (Utz et al., 2013).

Telemedicine  The delivery of health care services using information and communication technologies where distance is a critical factor (ITU, 2012)
The Sustainable Development Goals targets a global maternal mortality ratio not greater than 70 maternal deaths per 100,000 live births by 2030. In Kenya, the maternal mortality ratio is high at 362 maternal deaths per 100,000 live births. Focused antenatal care approach recommends four targeted visits commencing before 16 weeks and until delivery. The utilization of focused antenatal care in Kenya, Tharaka Nithi County and Tharaka sub-county is 58%, 56% and 40% respectively. There are few studies on short message reminders on focused antenatal care in rural Kenya. This study examined the influence of short message service in enhancing utilization of focused antenatal care among pregnant women. A single blind randomized controlled trial was carried in Tharaka sub-county of Tharaka Nithi County, Kenya in three facilities that were purposively sampled; Chiakariga, Tunyai and Matiri. The final sample that was analysed was 241. Eligible participants were recruited using systematic sampling with Kth as 5. The subjects were randomly allocated through a computer application to interventional or control arm at a ratio of 1:1. The intervention was three short message reminders which were sent a week before the scheduled appointment date. The study instruments were interviewer administered questionnaires, focus group discussion guide, key informant interview guide and a checklist for desk review. The study period was December 2016 to June 2017. The inferential statistics that were used were t test, chi square, Fisher’s exact, effect size and logistic regression. Qualitative data was thematically organized and reported as narratives. The uptake of focused antenatal care for intervention and control group was 75% and 13% respectively. Short message reminders increased the probability of using focused antenatal care by 19.6 times (OR: 19.6, P<0.001, CI = 10.06 – 38.37). The effect size was very large with Cohen’s D of 1.55. Presence of a risk factor in pregnancy reduced the chances of utilizing focused antenatal care (OR = 0.485, P = 0.016, CI = 0.27 – 0.874). Antenatal profile was completed by 82% of the intervention group while 54% completed in the control group. Being in the intervention group increased the chances of completion by 3.7 times (OR: 3.7, P<0.001, CI = 2.086 – 6.708). Hindrances to attending scheduled visit included forgetting, non-prioritization, busy schedules and long distances with cost implications to the health facility. The benefits of mobile text reminders that were identified were convenience, constant memory, impression of care by the service providers and prioritization of the antenatal care. Negative perceptions on mobile SMS reminders were religious beliefs that they are demonic, that phones can cause cancer and instant deaths. However, there was no influence of socio-demographic, economic, accessibility and phone related variables on uptake of focused antenatal care. In conclusion, mobile phone short message reminders enhance utilization of focused antenatal care. This study recommends that the stakeholders in health should use short message reminders to enhance utilization of focused antenatal care. A further study should be conducted to examine the cost benefit analysis of short message reminders on uptake of focused antenatal care and outcomes of short message reminders in enhancing focused antenatal care.
CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Maternal health problems pose a major challenge in many nations. Ninety nine percent of all maternal deaths take place in the developing countries (Darrell, 2015). The maternal mortality ratio in the world, developing regions and sub-Saharan Africa is 216, 239 and 546 per 100 000 live births respectively (WHO, 2015). Maternal mortality in Kenya is high at 362 per 100,000 live births. This is deemed high by the global standard which deem a maternal mortality ratio of above 300 deaths per 100 000 live births to be high (KNBS, 2015).

Proper care during pregnancy and delivery is important for the health of both the mother and the baby. Antenatal care (ANC) has the capacity to reach large segments of the pregnant population and has interventions that can detect, treat and prevent conditions that could result in maternal mortality and morbidity. Antenatal care is one of the interventions that can improve skilled birth attendance. Skilled birth attendance is a major intervention in prevention of maternal mortality (Conrad et al. 2011).

Focused ante natal care is goal oriented approach of offering care to pregnant women. It recognizes that every pregnant woman is at risk of complications. This evidence based model has a variety of components including care from skilled attendants during the perinatal period. In addition, there is detection and early management of conditions that could complicate pregnancy like Human Immuno deficiency Virus (HIV), malaria and anaemia. Furthermore it has several preventive strategies like tetanus toxoid prophylaxis, iron and folate supplementation, intermittent preventive therapy for malaria, presumptive treatment of hookworm that cause anaemia, Vitamin A supplementation and iodine supplementation (in countries
that do not fortify salt with iodine). Counselling and health promotion is done targeting danger signs, nutrition, alcoholism, rest, family planning, breast feeding and HIV prevention (Ekabua et al., 2011).

The rapid growth of mobile technology, falling market prices of products due to free market and increasing network coverage have the potential to change health care delivery if harnessed. A wide range of medical services could be improved by providing patient-focused support and management through the health-care system (Brinkel et al., 2014). One of the services that can be improved and is targeted by this study is focused antenatal care. Short message service can improve service delivery by health workers. It can also increase health service demand among the clients (WHO, 2011). Despite the known benefits of focused antenatal care, the utilization in Kenya and Tharaka Nithi County is low. There are several studies on mhealth and short message service in health care but there are few known studies on their influence on focused antenatal care especially in rural areas. This study sought to generate information on the influence of mobile phone short message service reminders on uptake of focused antenatal care.

1.2 Problem statement

WHO recommends at least four ANC visits during a woman’s pregnancy. According to Kenya demographic and health survey 2014-15, only 58 percent of women attended four or more antenatal visits for their most recent birth in Kenya (KNBS, 2015). Rural women who attended the recommended visits were fewer than urban women (51 percent and 68 percent, respectively). In Tharaka Nithi County, about 44% of the women did not utilize focused antenatal care (KNBS, 2015). Only 40% of the respondents utilize focused antenatal care in Tharaka sub-county (DHIS, 2016). This may be partially contributing to the high burden of maternal deaths in the
county. The county is ranked among the 13 counties with high burden of maternal mortality (MEASURE Evaluation PIMA, 2016). Lack of focused ante natal care deprives the pregnant women essential services and advice that are critical for the mother and the unborn baby. Despite the continued routine safe motherhood initiatives the progress to reducing maternal mortality is still slow. The viability of mobile phone short message service (SMS) as reminder for appointment for focused ante natal care has not been tested in Kenya. It is against this background that this study intended to determine the influence of mobile phone based short message reminders on uptake of focused ante natal care.

1.3 Justification

Focused ante natal care is the approach recommended by ministry of health for offering ante natal care in Kenya (Ministry of Health, 2014). Despite there being this strategy, the uptake of focused ante care has not been to its optimum (Gitimu et al., 2015). The government has proposed innovations like mhealth as some of the interventions to increase the uptake (Ministry of Public Health and Sanitation, 2010). Majority (87%) of the women have phones that can be harnessed for health care (Carter et al., 2015). Despite known benefits of SMS in other health aspects, its influence on focused ante natal care especially in developing counties in rural locations has not been established. Socio-demographic, pregnancy related and accessibility factors are known to influence the uptake of focused ante natal care but their influence after SMS as a reminder for appointment had not been established. Therefore this study sought to determine the influence of short message service on uptake of focused ante natal care.
1.4 Research questions

1. What is the influence of short message service (SMS) reminders on uptake of focused ante natal care among pregnant women in Tharaka Nithi County?
2. What is the influence of socio-demographic factors on uptake of focused ante natal care after SMS reminders?
3. What is the influence of accessibility factors on uptake of focused ante natal care after SMS reminders?
4. What is the influence of pregnancy factors on uptake of focused ante natal care after SMS reminders?

1.5 Null Hypotheses

1. $H_0$: Utilization of mobile phone SMS reminders does not influence uptake of focused ante natal care among pregnant women.
2. $H_0$: There are no association between socio-demographic factors and uptake of focused ante natal care after using the mobile phone SMS reminders.
3. $H_0$: There are no association between accessibility factors and uptake of focused ante natal care after using the mobile phone SMS reminders.
4. $H_0$: There are no association between pregnancy related factors and uptake of focused ante natal care after using the mobile phone SMS reminders.

1.6 Objectives

1.6.1 Broad objective

To assess the utilization of mobile phone based short message reminders to enhance uptake of focused ante natal care among pregnant women in Tharaka Nithi County, Kenya.
1.6.2 Specific objectives

1. To establish the influence of mobile phone short message reminders on uptake of focused ante natal care among pregnant women in Tharaka Nithi County, Kenya.

2. To determine the influence of socio-demographic factors on uptake of focused ante natal care after mobile phone short message reminders among pregnant women in Tharaka Nithi County, Kenya.

3. To establish the influence of accessibility factors on uptake of focused ante natal care after mobile phone short message reminders among pregnant women in Tharaka Nithi County, Kenya.

4. To establish the influence of pregnancy related factors on uptake of focused ante natal care after mobile phone short message reminders among pregnant women in Tharaka Nithi County, Kenya.

1.7 Significance and anticipated output

The innovation of using short message reminders in enhancing focused ante natal care is a critical determination that will enable the county government and other service providers to integrate it in routine care. It will also inform policy formulation at national level. To the pregnant women, enhanced uptake of focused antenatal care will improve skilled birth attendance which consequently reduces maternal morbidity and mortality.

1.8 Delimitation

The scope of this study was among women with mobile phones, living within mobile phone network coverage and ability to read short messages. This is because in the eventuality that the intervention works it would only apply to those in possession of mobile phones. The study also targeted the pregnant women and any input from the staff was directly linked to patient care.
1.9 Limitation

This study faced some limitations. Women without mobile phones and outside mobile phone coverage were excluded. Literacy among the potential respondents was a limitation because those who were unable to read and had no relatives to assist were excluded. Presence of uncooperative husbands also posed a limitation. This is where husbands would not allow their wives to receive messages from “unknown numbers”. This group was also excluded. Interventions from other groups/individuals were beyond the control of this study. This is for example cases where a husband, a friend or an organisation would do reminders for ante natal care. This was not reported to have happened though the existence of control and experimental group would minimize its effects in case it happened.
1.10 Conceptual framework

The independent variables are socio-demographic, accessibility and pregnancy related factors. The dependent variable is uptake of focused antenatal care. Socio-demographic factors include age, level of education, marital status, religion, employment and income. Physical accessibility factors include distance, cost and means of transport to the health facility. Mobile phone related factors like duration of phone ownership, ability to read SMS and change of phone numbers. Pregnancy related factors included gravida, previous attendance of FANC and risky factors in pregnancy. It was known prior to this study that the three groups of independent variables influence uptake of FANC but their influence after using short message reminders had not been established prior to this study. The direct influence of short message service on focused antenatal care was also evaluated.

**Figure 1.1: Conceptual Framework**

(Source: Titilayo, 2015)
CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter presents the available literature on the subject of study. It outlines the global perspective and background of maternal health, the concept of focused antenatal care and its determinants. It gives the background of mobile health (mhealth), utilization of short message service in various health aspects with an emphasis on focused antenatal care. Finally the gaps identified are highlighted.

2.2 Sustainable development goals and maternal health

The sustainable development goal three aims to ensure healthy lives and promotes well being for all ages. On maternal health the goal is to reduce maternal mortality in addition to promoting sexual and reproductive health rights. The target by the year 2030 is to reduce maternal mortality ratio to less than 70 deaths per 100 000 live births. To achieve this goal, the stakeholders should focus on management of direct and indirect causes of maternal deaths (WHO, 2016).

2.3 Background on maternal health

“Maternal health refers to the health of women during pregnancy, childbirth and the postpartum period”. The indicators for measurement of maternal mortality are maternal mortality ratio, maternal mortality rate and adult life time risk of maternal death. “Maternal mortality ratio is the number of maternal deaths during a given time period per 100 000 live births during the same period while maternal mortality rate is the number of maternal deaths in a given period per 100 000 women of reproductive age during the same period. Adult life time risk of maternal death is the probability that a 15-year-old woman will die eventually from a maternal cause” (WHO, 2012).
Maternal mortality ratio is one of the indicators of reproductive health and has been the focus in international reproductive health agreements. It is also one of the indicators of the success of the countries’ economy and health system (Angela et al., 2012). Most of the maternal deaths are preventable. The life time risk of a maternal death in developing countries is 1 in 160 compared to 1 in 3700 for women in developed countries (Watterson et al., 2015). Most of maternal deaths are caused by hypertension, puerperal sepsis and haemorrhage (Conrad et al., 2011).

Globally, one woman dies of pregnancy related complication every two minutes. One maternal death is associated with 20 others that suffer life threatening complications. Majority (99%) of maternal deaths occur in low and middle income countries in sub Saharan Africa and south Asia (Makanga et al., 2016). The maternal mortality ratio is 667 per 100 000 live births in developing countries (WHO, 2015) while it is 26 per 100 000 live births in developed countries (Lamont et al., 2015). The factors associated with maternal mortality are either health or social. Health predictors of maternal death include chronic energy insufficiency, anaemia, obstetric complications and history of illness or current maternal illness (Muh and Yadi, 2015). Early marriages, adolescent pregnancies, poverty, low or no education, negative cultural beliefs, gender inequality and unmet family planning needs are social predictors of maternal death (UNFPA, 2012).

The current maternal mortality ratio in Kenya is 362 deaths per 100 000 live births. The strategies being used in Kenya to improve maternal health and avert deaths include pre-conceptual care and family planning, focused antenatal care, essential obstetric care, targeted post-partum care, and lastly post-abortion care Ministry of Health, 2014).
2.4 Ante natal care

It is an umbrella term for medical procedures and care during pregnancy. Its goals include health promotion of the mother and the baby, detection and management of complications, development of birth preparedness/complication readiness and finally preparation for breastfeeding (Ekabua et al., 2011). It was first offered in the United States of America in 1900 by nurses and social reformers. In 1914, it was found to reduce foetal mortality (Ekabua et al., 2011). Ante natal care if provided by a skilled health attendant improves the pregnancy outcomes of the mother and the newborn (Duong et al., 2015).

2.5 Focused Antenatal Care (FANC) concept

Attending four or more ante natal visits in a given pregnancy is deemed the global benchmark of adequacy of ante natal care (Duong et al., 2015). It recommends that all pregnant women without complications should have a minimum of four scheduled comprehensive ante natal visits during pregnancy. It is guided by the following five principles; emphasis on quality of care rather than quantity of visits, individualized care, disease detection instead of risk categorization, evidence based practices in ante natal care and birth/complication readiness. During their visits, women are counselled on topics such as birth preparedness, complication readiness, danger signs, nutrition, exclusive breastfeeding, and family planning. Women are also immunised against tetanus. They are tested and treated for anaemia, malaria, Human Immuno-Deficiency Virus/ Acquired Immune-Deficiency Syndrome (HIV/AIDS) and sexually transmitted infections (STIs). The FANC model suggests that visits should take place before 16 weeks, between 16-28 weeks, at 28- 32 weeks, and about 36 weeks (Ministry of Health, 2014).
2.6 Utilization of Focused Ante Natal Care

In low and middle income countries in 2013, only 52% of the women attended the recommended four ante natal visits in a pregnancy. This means almost half of pregnant women from mainly sub Saharan Africa, miss on the critical benefits of the targeted ante natal visits (Watterson et al., 2014). Kiwuwa and Mufubenga (2008) in their study in Uganda noted that only 42% of the women attended at least four ANC visits in a pregnancy. In eastern Sudan, the coverage is 11% (Ali et al., 2010). In a study done in Ethiopia, the uptake of focused ante natal care by women was 12% (Alemu, 2014).

In Kenya, the proportion of women who attended the four recommended ante natal visits is 58%. The percentage of women who attended the recommended four ante natal visits is higher in urban areas than rural areas. In Tharaka Nithi County this proportion is 56% (KNBS, 2015). The figure is lower in the Tharaka sub county at 40% (Ministry of Health, 2016a).

2.7 Factors associated with utilization of focused ante natal care

2.7.1 Socio-demographic factors

Education is one of the factors that influence utilisation of health services. Women with higher level of education were more likely to attend more ante natal care visits and earlier in their pregnancy. Education is associated with more appreciation of the importance of ante natal care (Simkhada et al., 2008). Concurring findings were found in study in Mwingi district Kenya where women with secondary level of education and above were more likely to attend ANC than those with lower levels of education (Nzioki et al., 2015). Analysis of Tanzania demographic health survey
revealed that lower level of education is negatively associated with utilization of focused antenatal care (Gupta et al., 2014).

Married women have been found to attend the antenatal visits earlier than the unmarried. Women married at ages of above nineteen years were more likely to attend antenatal clinics compared to those who married in younger years (Simkhada et al., 2008). In a study done in Ethiopia however, single or divorced mothers more likely attended focused antenatal care than mothers who were married (Alemu, 2014). Adolescents and unmarried younger women hid their pregnancy to avoid social embarrassment. This delayed their initiation of ANC (Pell et al., 2013). Being unmarried was negatively associated with utilization of focused antenatal care in Tanzania (Gupta et al., 2014).

Age has also been found to influence uptake of focused antenatal care. Women in their thirties adhere to antenatal visits more than teenagers and older women (Simkhada et al., 2008). However, a cross sectional study in Kenya found that women aged thirty one years and above were less likely to attend at least four antenatal visits compared to younger women (Nzioki et al., 2015).

The economic status of households and individuals is a determinant of uptake of health services. Cost has been found to be a prohibiting factor to use of antenatal services. This included cost of transport, consultation fee and laboratory tests costs. Women with high household economic status were noted to attend antenatal visits early and more frequently (Simkhada et al., 2008). A lower wealth index was associated with underutilization of antenatal services in Indonesia (Titaley et al., 2010). This concurs with a Kenyan survey that found that women earning more than a dollar per day were more likely to attend at least four antenatal visits than those
earning less than a dollar per day (Nzioki et al., 2015). Some women also fail to attend ante natal care because they are not aware that they are pregnant. Others also missed because they ‘did not feel sick’ (Asundep et al., 2013). In a study in Vietnam on factors that influence utilization of focused ante natal care, belonging to an ethnic minority was associated with reduced chances of attending four or more ante natal visits (Duong et al., 2015).

2.7.2 Accessibility factors

Accessibility entails physical and communication factors. Access to health facilities which encompasses distance to health facilities, means and transport network affects uptake of health services. Women living near health facilities were more likely to attend ante natal visits than those living far from health facilities. Uncomfortable transport systems, poor road networks and crossing big rivers were associated with fewer ante natal clinic visits (Simkhada et al., 2008). A study in Indonesia found that long travel distances and poor road network to health facilities reduced ante natal clinic attendance (Titaley et al., 2010). Similar findings were found in Ethiopia where mothers who travelled less than one hour to the nearest health facility were more likely to attend focused antenatal care clinics as compared to those who travelled more than one hour (Alemu, 2014). This was also established in Tanzania (Gupta et al., 2014). In a study in Timor-Leste, ownership of a mobile phone in a household was associated with high socio-economic status. It was also reported to influence on utilization of maternal and new born services. Women in households that owned mobile phones had a higher likelihood of using health services (Nie et al., 2016).
2.7.3 Pregnancy related factors

Parity also influences utilisation of ante natal care. High parity has been found in many countries to be a barrier to utilisation of ante natal services (Simkhada et al., 2008). Pregnancies occurring with interval of three years were associated with more ante natal visits. Intended pregnancies were also linked with higher utilisation of ante natal services. Unintended pregnancies were associated with late and infrequent attendance of ante natal visits (Alemu 2014). Mothers who had history of illness during pregnancy significantly attended focused antenatal care as compared to mothers who had no history of illness (Alemu, 2014).

Early booking has been reported as a determinant of the number of times one attends ante natal care. This is thought to be related to sufficient time that is available for care (Roy et al., 2013). Gupta et al (2014) found that late booking of pregnant women in Tanzania was negatively associated with utilization of focused ante natal care. Booking is expected to begin before end of sixteen weeks. An analysis of Tanzania demographic and health survey for a decade found that unwanted pregnancy was negatively associated with uptake of focused ante natal care.

2.8 Interventions to increase focused ante natal care uptake

A variety of interventions have been used to increase the uptake of focused ante natal care. Mobile clinics have been used where health workers move into rural areas with vans to offer ante natal care services. This strategy was found to improve the uptake but was expensive and not sustainable in many set ups (Edgerley et al., 2007). Culturally acceptable approaches were used in some studies. This involved use of languages that were understood by the recipients. This approach also increased the uptake of FANC but could only show results in areas where language was a barrier
(Mackerras, 2001). In Tanzania, birth plans as an intervention was found to increase the uptake of ante natal care (Magoma et al., 2013). This is also similar to Kenyan studies in Tharaka Nithi County that found that women with birth preparedness were more likely to attend FANC visits compared to those without (Gitonga et al., 2015). In rural western Kenya, promotion of FANC by community health workers was found to increase the uptake (Akinyi et al., 2015). In a study done in Kitui County, Kenya it was established that community strategy improved uptake of focused ante natal care (Nzioki et al., 2016).

**2.9 Focused ante natal care and health facility delivery**

Studies have linked focused ante natal care and health facility deliveries. A study in Tharaka Nithi County, Kenya established a positive link between focused ante natal care and health facility delivery. Chances of health facility delivery were increased by about three times by utilizing focused ante natal care (Gitonga and Muiruri, 2016). Similar findings were found in Ethiopia where attending ante natal care increased the chances of health facility delivery by seven times (Berhan and Berhan, 2014). It was also established through re-analysis of Kenya demographic and health survey of 2008-2009 that women who attended the four recommended visits were 2.5 times more likely to deliver in a health facility than those who did not attended (Obago, 2013). A combination of community systems strengthening and attendance of ante natal care was found to increase the level of health facility deliveries (Ediau et al., 2013). A combination of higher level of education and attendance of ante natal care found to increase the chances of health facility deliveries (Bako et al., 2017).
2.10 E - health

According to WHO, eHealth is “the cost-effective and secure use of information and communications technologies in support of health and health related fields, including health care services, health surveillance, health literature, health education, knowledge and research”. It is made up of four components; mhealth, health information systems (HIS), telemedicine and eLearning (Galye et al., 2013). The importance of eHealth is to improve information flow, support health service delivery and manage health systems through electronic means (WHO and ITU, 2012).

2.11 Mhealth

In 1984, before the proliferation of mobile phones, more than half of the world’s population lived in circumstances where one telephone served 100 people. Thirty years later, technology had led to billions of mobile phones being used (Hall et al., 2015). Early in its beginnings (in 2003), mobile health was defined as “wireless telemedicine involving mobile telecommunications and multimedia technologies” (Christine et al., 2011). As technological advancements moved on, the definition was broadened to be medical and public health care practices that are supported by mobile devices. These could be mobile and smart phones, tablets, patient monitoring devices and personal digital assistants. These technologies should have capabilities to create, retrieve and transmit information between users. They rely on phone utility of voice, multimedia services (MMS) and short message services (SMS). The utility could also include global positioning systems (GIS) and blue tooth technology (Odendaal et al., 2015).
Mobile health has been proposed as the solution for many challenges that are facing health care system in Africa. They include work force shortages, lack of health education, limited training of health workers, medication adherence and inefficient patient follow up systems (Watterson et al., 2014). A convergence of factors is behind rapid growth of mhealth. They include rapid growth of mobile phone users, expansion of mobile networks with decline in mobile phone costs and increased innovation in mobile technology (Lemaire, 2011). Utilization of mobile phones for health is in the increase. By 2011, there were 6 billion mobile phones and subscriptions were reaching 87% of the world’s population (Carter et al., 2015). It is estimated that half of rural population in Africa have mobile phones and an estimated total of 500 million users. The evidence on mobile health is predominantly from developed countries and is mainly on lifestyle and non communicable diseases (Lund et al., 2012).

Mobile health is currently being used to improve quality and access to health care. Treatment support including medication compliance and appointment reminders are now possible with mhealth applications. Patient tracking using mobile phones has made follow up more efficient. In addition, mhealth is being used in supply chain management. Counterfeits are also being checked using interlinks of the suppliers and the users of products like drugs. Specific codes can be sent to check originality. Health financing using microfinance and savings purposely for health (M-tiba) is being done using mobile phones. M-pesa (mobile money application) is being used to pay health bills. Disaster and emergency alerts are also being done using mhealth. Finally there are also mobile applications that are being used to support clinical decision making in patient care (Christine et al., 2011). On health surveillance,
studies in Benin have shown that completeness and timeliness of reporting animal
and human conditions can be improved via mhealth (Haunmanou et al., 2016).

The benefits of mhealth notwithstanding, the success of its programs depend on
several factors. Country ownership and leadership is critical in set up policies and
their implementation. It also requires partnerships between public and private entities
especially communication services providers. Finally, effective coordination for the
specific programs is necessary (Galye et al., 2013). Mobile telephone technology is
currently widely used in the world to enhance health care delivery. The most
common activity is creation of call centres which respond to patient inquiries. Short
Message Service has also been used as reminder for appointments, medication timing
and in assessment of treatment compliance (Lemaire, 2011).

2.12 Utilization of short message service in health

In 2013, 1.91 trillion and 8 trillion text messages were sent in the United States of
America and worldwide respectively. This has reduced with the invention of social
media messaging services like WhatsApp and face book messenger. The first study
on short message for health was published in 2002 and other studies have followed
(Hall et al., 2015). It has been reported that 72% of mobile phone owners do texting.
Average phone users receive and send a total of 10 text messages per day (Alexandra
et al., 2012).

There is evidence of utilization of short messages in improving health behaviours.
This can be through automated text messages or interactive short messages. Common
areas where they have been used include HIV prevention, treatment adherence,
pregnancy education, smoking and substance abuse cessation, mental health, weight
management, blood pressure management and diabetes mellitus management
(Abroms et al., 2015). In a study in Nyanza, Kenya on the role of short message service on prevention of mother to child transmission, several perceived benefits were highlighted by respondents. They included linkage to health workers, protection of confidentiality, reminder and reception of health information (Jennings et al., 2013). The reasons behind increased use of short messages include phones being ubiquitous and the cost of texting being low (Alexandra et al., 2012). Short messages also can be tailored to specific needs, personalized and have capacity to create interactivity. It has also been reported that there is “addiction like effect to receive messages and unconscious pleasure of the dopamine release associated with this reward”. About 99% of the text messages are opened and 90% are read within three minutes (Hall et al., 2015).

In Kenya, a randomized trial found that a simple intervention, in which health workers received text messages on malaria case-management, produced a twenty five percent increase in the number of children with fever correctly treated for malaria (Zurovac, 2012). The WelTel randomized trial (in Kenya) found that HIV patients who received SMS support in combination with active client follow-up by an actual person were 24 percent more likely to be adherent to antiretroviral therapy (ART) and 19 percent more likely to have suppressed viral loads compared with the control individuals (Lester et al., 2010). Kenya Medical Research Institute (KEMRI) has found that mobile phone use in malaria surveillance improved data collection, client compliance to treatment and reduced complications. It was also found that mobile telephone use increased communication between clients, health workers in respect of malaria treatment adherence and also disease surveillance (Zurovac et al., 2012). Short Message reminders have also been found to increase the adherence to

2.13 SMS utilization in maternal health and focused ante natal care

Available evidence indicates that text messages have been used to improve utilization of family planning, ante natal care and health facility delivery services. In Kenya, Text to Change launched a program in family planning provision and advice that used mobile telephone technology to provide and advice on family Planning services. The service was widely accepted by clients as it reduced the distance of interaction between service providers and clients (FHI, 2010). In Rwanda, One year after the launch of RapidSMS, ANC visits increased by 25 percent, home deliveries decreased by 54 percent, while deliveries at health facilities increased by 26 percent (Gayle et al., 2014).

In Zanzibar, pregnant women in the Wired Mothers intervention group received text messages and an airtime credit voucher to communicate with their healthcare providers. Forty-four percent of pregnant women in the intervention group attended four or more antenatal care visits versus thirty one percent in the control group. Sixty percent of women in the intervention group delivered with skilled delivery attendance versus forty seven percent in the control group. The intervention increased skilled birth attended attendance among urban than rural women (Lund, et al., 2014). In Tanzania in a program named “wazazi nipendeni (parents love me), short messages were sent to mothers to promote maternal health during pregnancy. The outcome of the program was high subscription and utilization of the service (Galye et al., 2013). In randomized controlled trial in text messages with health
information were found to improve the level of post natal exercises among women (Fjeldsoe et al., 2010).

In Rwanda, text messages were used to track pregnant women and was established that with well structured community systems, it has the potential to improve emergency obstetric and neonatal care (Ngabo et al., 2012). Short messages have been used to improve ante natal attendance. In a study in Pakistan, following short message intervention, several outcomes were found. There was an increase in attendance of ante natal care, health facility deliveries and community interaction of health workers and the clients (Galye et al., 2013).

2.14 Summary of literature review and gaps identified

The sustainable development goals anticipate that the maternal mortality ratio in all nations should be reduced to below 70 deaths per 100 00 live births. This is premised to deal with the high maternal mortality especially in Asia and Africa. Sub Saharan Africa accounts for the highest burden of maternal deaths. Kenya has a maternal mortality ratio of 362 deaths per 100 000 live births. This is deemed high by WHO. Several strategies have been put in place to reduce this mortality ratio. They include focused ante natal care that indirectly reduces maternal mortality and morbidity. It does so my increasing skilled birth attendance which directly reduces mortality.

The uptake of focused ante natal care is 58% in the country while it is 40% in Tharaka Sub County. Its utilization is influenced by socio-demographic, accessibility and pregnancy related factors. In some areas race and ethnicity have also been found to play a role. Various strategies have been put in place worldwide to increase its utilization. They range from mobile clinics that were found to be expensive and unsustainable, birth preparedness, community health workers and implementation of
community strategy. These strategies have not proved satisfactory outcomes. There is potential in innovative ways like e health which hosts mhealth. This includes voice calls and short message reminders.

Mobile health has previously been used to increase utilization of health services in other specialities. This is in management of non communicable diseases, disease surveillance, HIV/AIDS drug adherence and quality of care improvement. Mhealth has been used to improve skilled birth attendance with positive results.

The uptake of focused ante natal care is lower in rural than urban areas in Kenya. The uptake of focused ante natal care is low in Tharaka Nithi County and much lower in Tharaka sub-county. This is despite utilization of a variety of interventions to improve it. Short messages have been used in a variety of health aspects but studies in rural areas in developing countries are very few. Therefore this study aims to determine the influence of mobile based short message service on uptake of focused ante natal care.
CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter outlines the design of the study, variables under study and the location of the study. It also contains the inclusion/exclusion criteria, the sampling methods, sample size determination and data collection instruments. In addition, it highlights the pre-test, validity, reliability, data collection process, data analysis, description of the intervention and the ethical considerations.

3.2 Research Design

The study design was single blind randomized controlled trial (RCT). The intervention was mobile based short message service (SMS) reminder for appointment of ante natal care. Randomized control trials are ideal in showing cause and effect through manipulation of variables. Randomization minimizes bias by balancing the known and unknown prognostic factors.

3.3 Variables of the Study

3.3.1 Dependent Variables

The dependent variable was uptake of Focused Ante Natal Care (FANC). The variable was dichotomised as “uptake or non uptake” of focused ante natal care. Uptake was defined as attendance of at least four targeted ANC visits. Non uptake was defined as attendance of less than four targeted ANC visits.

3.3.2 Independent variables

There were experimental and measurement independent variables. The experimental independent variable was a mobile phone SMS that was sent to interventional group. The measurement independent variables were socio-demographic, accessibility and
pregnancy related variables. The socio-demographic factors included age, highest level of education, religion, marital status and income. Accessibility variables included residence, distance in Kilometres (KM) to the health facility, cost of travel in Kenya shillings (Kshs) and means of transport. The pregnancy related variables included number of pregnancies (gravida), presence of a risk factor and completion of focused ante natal care in previous pregnancies.

3.4 Location of the Study

The study was be conducted in Tharaka Nithi County (Tharaka south sub-county), Kenya. Tharaka Nithi is one of the eight counties in the former Eastern province. The county at inception took over three districts; Tharaka, Meru South and Maara. It is made up of three constituencies; Tharaka, Chuka/Igamba Ng’ombe and Maara (Appendix 8). Tharaka Nithi County as at 2015 was projected to have a total population of 406, 995. The County has three sub-counties; Maara, Chuka/IgambaNg’ombe and Tharaka. Tharaka Sub County was projected to have a total population of 130,098 people among whom 67,211 are women. The number of women of reproductive age was projected to be 35,145. The number of pregnant women was projected to be 5,272 (County government of Tharaka Nithi, 2013). This was a facility based study because the number of pregnant women attending at least one ante natal visit was 98.3% (KNBS, 2015).

3.5 Target and Study Population

The target population were pregnant women while the study population was pregnant women attending ante natal clinics in Tharaka sub county, Tharaka Nithi County, Kenya.
3.6 Inclusion and exclusion criteria

3.6.1 Inclusion criteria

Eligible participants were consenting pregnant women at gestation of 16 to 28 weeks. The participants were also eligible if they were attending the ante natal clinic for their first visit in the current pregnancy. In addition, they should have owned or had access to mobile phone and living within mobile phone network coverage. Participants were also required to have capacity to read and understand a text message in any of the three languages; English, Kiswahili or Kitharaka (the native language of the respondents). Those with a close relative who could read and explain to the participants the short messages were also included.

3.6.2 Exclusion criteria

Pregnant women who were mentally or critically sick were excluded. Women whose husbands were uncomfortable with the short message reminders were also excluded after the consent.

3.7 Sampling method

Tharaka Nithi County was sampled because the uptake of focused ante natal care is low (56%) compared to most of the counties (KNBS, 2015). Tharaka Sub County was selected because the uptake of focused ante natal care is lowest compared to the other two sub counties that is at 40%. The study sites were also purposively selected because they handle the highest number of ante natal care in the sub county. They included two health centres (Chiakariga and Tunyai) and one mission maternal and child health clinic (Matiri hospital). The pregnant women were assessed for eligibility by the principal investigator and the research assistants. Systematic
sampling was used in identifying the specific subjects. The annual target for antenatal care in the sub county was 2523. The period of recruitment for the study was six months. The target for the duration was 1262 (2523/2). The sample size as shown in the next sub section is 262. The Kth was 1262/262 = 5th.

3.8 Sample size determination and distribution

The sample size was calculated according to the formula developed by Chan (2003) for comparison of two proportions (two-sided) at 5% level of significance and 80% power. In Tharaka Sub County 40% of women attend the four targeted visits for antenatal care. The study was targeting to show an interventional effect of 18% after using SMS reminders thus increasing the focused antenatal care uptake from 40% to 58%. Previous studies had effect size of 13% (Lund et al., 2014). The following is the formula for sample size calculation that was used;

\[
M = \frac{cX\pi_1(1 - \pi_1) + \pi_2(1 - \pi_2)}{(\pi_1 - \pi_2)^2}
\]

Where: \( M \) =sample size required in each group

\( C=7.9, \) a ratio from a square of the sum of Z score of 80% power (0.842) and 5% significance (1.96). That is \((1.96 +0.842)^2\) =7.9.

\( \pi_1=first\ proportion= 0.4 \)

\( \pi_2=second\ proportion=0.58 \)

\( \pi_1 - \pi_2=\)size difference of clinical importance for this study= 0.18.

Therefore

\[
M=7.9 \left\{ 0.4(1-0.4) +0.58(1-0.58) \right\}/ (0.4 - 0.58)^2
\]

\[
= 119 \text{ per group}
\]
Assuming a dropout rate of 10%, each group was projected to have 131 and a total of 262 participants. The number of each facility was proportionate to their annual target ANC visit and is illustrated in table 3.1

### Table 3.1: Sample size distribution

<table>
<thead>
<tr>
<th>No</th>
<th>Facility</th>
<th>Target ANC attendance</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chiakariga</td>
<td>744</td>
<td>77</td>
</tr>
<tr>
<td>2</td>
<td>Tunyai health</td>
<td>845</td>
<td>88</td>
</tr>
<tr>
<td>3</td>
<td>Matiri hospital</td>
<td>934</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>2523</strong></td>
<td><strong>262</strong></td>
</tr>
</tbody>
</table>

### 3.9 Research Instruments

Semi-structured questionnaires were used to collect quantitative data. The study had two questionnaires; baseline data questionnaire (appendix 2) and exit interview questionnaire. Exit interview questionnaire was used after the administration of the intervention (Appendix 3). Key informant interview guide was used in collection of qualitative data (appendix 4). Focus discussion guides were used to interview the women (appendix 5). Checklists were also used to do desk review on facility preparedness to host mhealth (appendix 6).

### 3.10 Pre-test

The pre-test was done at Kajuki health centre that is in Chuka/Igamba Ng’ombe sub-county, Tharaka Nithi County, Kenya. The area had similar characteristics with the area of study. The questionnaires were administered to 25 participants (about 10% of
the sample size). Two Key Informants were interviewed. Adjustments to ensure accuracy and completeness were done after the pre-test.

3.11 Validity

Validity is the test of degree of accuracy of a result or a test of how well the designed tool would measure what they were supposed to measure in the study. This was ensured by conducting a pre-test. The study subjects were selected randomly and using the inclusion criteria. The university supervisors also validated the data collection instruments. Random allocation and blinding enhanced the validity. To overcome contamination of the control group by the intervention arm by sharing the text reminders, a question to establish this was asked in the exit interview. Respondents who received messages and were in control group were excluded from the final analysis. The chances of contamination were also reduced by the different dates women attended the clinic, the private nature of consultation in health facilities and the different expected dates of delivery.

3.12 Reliability

Reliability is the test of repeatability/consistency of results of a study. This was done by use of well designed questionnaires. The research assistants were trained on the data collection with the research tools. Supervision was also done by the principal investigator. Test re-test method was used where previously face to face interviewed respondents were interviewed though mobile phone voice calls.

3.13 Data collection process

The process began with recruitment of the principal respondents (eligible pregnant women). During the recruitment process baseline information was collected using an
interviewer administered questionnaire. Every respondent provided a mobile phone number and an alternative number. The alternative number was for re-routing the text message in occasions where the respondent was unavailable due to network coverage or when the phone was off due to low charge. The participants’ language for text massage was also captured. Administration was done by the principal investigator and/or research assistants via face to face interview. Mobile phone interviews were also done to ensure reliability in the process. After the intervention, an exit interview was done both through face to face and mobile phone based interviews. Qualitative data was collected through key informant interviews and focus group discussions. Key informant interviews were done in the three facilities. The facility managers, ante natal clinic managers and experienced staff that offered care at the clinics were interviewed. Three key informants were interviewed in each of the three facilities making a total of nine key informants. The main issues that were being examined in these interviews were factors that influence uptake of focused ante natal care, how text messages can improve health of pregnant women and hindrances of short message usage. Three focus group discussions were held in each facility. Each group constituted six pregnant women attending the ANC clinic. The focus groups were targeted to bring out the factors that prevent pregnant women from attending scheduled ante natal care clinics, benefits of short message reminders and cultural beliefs on short message services. Desk review was also done using checklist to establish the background information and relevant data of the facilities and the clients served. The desk review focused on the facility preparedness to provide ante natal care and mobile health services. It also captured the catchment populations, geographical areas and facility targets for ante natal care services.
3.14 Intervention

The intervention in this study was three short message reminders. The messages were in three languages; English, Kiswahili and Kitharaka. The message was customized to specific individual, preferred language and health facility (Appendix 7). The routine reminder was a date that was written in the mother and child booklet.

The system called prenatal was used to send automated messages (appendix 12). It was created using PHP 5.6 and ran on Apache 2 servers. The intervention process began with recruitment of the respondents. Baseline information was used to create database for all subjects. The details that were included in the database were mobile phone numbers, name of the respondent, preferred language and health facility (Appendix 13). The mobile phone numbers were used to send the respondents the text message reminders of their next ANC appointment.

Using the mobile numbers of the subjects, a 1:1 computer generated computer allocation to intervention (SMS reminder to focused ante natal care visit) and control (no SMS reminder) was performed. Blinding was done to the principal investigator and the research assistants. The mobile phone numbers were put in clusters depending on location to avoid skewed selection of participants to receive SMS from the same area. The system set to automatically send the SMS to the intervention group at intervals. The SMS was sent before 28 weeks, between 28-32 weeks and one past 32 weeks. One message was sent a week to the scheduled appointment. The SMS had information on attendance of ante natal clinic and it significance to the health of the mother and the foetus. It served as a reminder for appointment of the next ANC visit. Exit interviews were done four weeks after delivery.
3.15 Consolidated Standards of Report Summary of the Study

Figure 3.1 shows the consolidated standards of reporting summary of study. During the period of study (December 2016 to June 2017), 374 pregnant women were assessed for eligibility and 112 participants was done. Random allocation was carried out on the 262 respondents. Exclusion of 21 respondents was done during the final analysis. This was due to attrition and contamination. Finally data of 241 participants was analysed.

Figure 3.1 Consolidated Standards of reporting Summary for the study
3.16 Data analysis

Data was entered into STATA Version12 software for analysis. Descriptive statistics were used to generate measures of central tendency and proportions. The dependent variable was dichotomised into uptake and non uptake of focused antenatal care. Requisite categories were generated for various variables. T test was used to assess the differences in number of ANC visits between experimental and control group. This was based on continuous data before categorisation. Chi square and Fisher’s exact were used to test association of the independent with dependent variables. Associations between socio-demographic, socio-economic, pregnancy related and accessibility variables with the focused antenatal care were tested. Variables that were significant were subjected to logistic regression.

Cohen’s D was used to measure the effect of the intervention. This is necessary to support decisions to upscale the intervention (Sullivan, 2012). It is calculated by dividing the difference in group means by either of the standard deviations. Associations, differences and effect was considered significant if P<0.05. Qualitative data was analysed using thematic content analysis.

3.17 Logistical and Ethical Considerations

The study was approved by Graduate School, Kenyatta University (Appendix 9). Ethical approval was granted by Kenyatta University Ethical and Review Committee (Appendix 10). The ministry of education granted a research permit through National commission for Science, Technology and innovation (NACOSTI) to carry out the study (Appendix 11). Before the commencement of data collection permission was granted by the Tharaka Nithi county health management. Furthermore, at the facility level, permission was also granted by the relevant health managers. Written informed
consent was sought from each respondent (Appendix 1 A and 1B). The study was registered with Pan African Clinical Trial registry (Appendix 13). A feedback in form of a report will be sent and shared with all relevant offices.
CHAPTER FOUR: RESULTS

4.1 Introduction

Chapter four presents the results of this study. They are organised according to the objectives of the study. To start with, there is general presentation of the socio-demographic, accessibility, mobile phone and pregnancy related characteristics of the respondents. Objective one is the analysis of the dependent variable and its relationship with short message reminder. It also encompasses the influence of pregnancy related factors on focused ante natal care. Objective two describes the influence of socio-demographic factors on focused ante natal care after using short message reminders. Objective three is a discussion of the influence of the accessibility factors on focused ante natal care after using short message service.

4.2 Characteristics of the Study Participants

4.2.1 Socio-Demographic Characteristics of the Respondents

Table 4.1 shows the socio-demographic and economic characteristics of the study respondents. Respondents aged below 20 years accounted for 11.5% and 7.6% in control and intervention arm respectively. A higher proportion of the participants (31.1%) in the control were aged 25 -29 years while the higher proportion of the participants (36%) in the intervention group were aged 20 -24 years. On the level of education, majority of the respondents had primary level in both control (63.9%) and intervention (53.8%) groups. Only 15.6% and 18.5% of the participants in the control and intervention arm respectively had attained tertiary level of education. Most of the participants in the control arm (89.3%) and in the intervention group (92.4%) were married. On religion, majority of the study subjects in the control arm (62.3%) and in
the intervention (68.9%) were protestant Christians. Age and level of education was different in the two arms (P<0.001). Marital status and religion in the two arms were not statistically different (P>0.001).

Table 4.1: Socio-demographic characteristics of the study participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Control arm N = 122</th>
<th>Intervention arm N = 119</th>
<th>Chi square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency (%)</td>
<td>Frequency (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in years</td>
<td>Below 20</td>
<td>14 (11.5)</td>
<td>9 (7.6)</td>
<td>$\chi^2 (16) = 372$, P&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>20-24</td>
<td>34 (27.9)</td>
<td>43 (36.1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25-29</td>
<td>38 (31.1)</td>
<td>32 (26.9)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30-34</td>
<td>19 (15.6)</td>
<td>22 (18.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>35 &amp; Above</td>
<td>17 (13.9)</td>
<td>13 (10.9)</td>
<td></td>
</tr>
<tr>
<td>Highest level of education</td>
<td>Primary</td>
<td>78 (63.9)</td>
<td>64 (53.8)</td>
<td>$\chi^2 (4) = 66$, P = 0.001</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>25 (20.5)</td>
<td>33 (27.7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tertiary</td>
<td>13 (15.6)</td>
<td>22 (18.5)</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
<td>109 (89.3)</td>
<td>110 (92.4)</td>
<td>$\chi^2 (1) = 0.04$, P = 0.84</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>13 (10.7)</td>
<td>9 (7.6)</td>
<td></td>
</tr>
<tr>
<td>Religion</td>
<td>Protestant</td>
<td>76 (62.3)</td>
<td>82 (68.9)</td>
<td>$\chi^2 (1) = 0.16$, P = 0.69</td>
</tr>
<tr>
<td></td>
<td>Catholic</td>
<td>46 (37.7)</td>
<td>37 (31.1)</td>
<td></td>
</tr>
</tbody>
</table>

4.2.2 Socio-Economic Characteristics of the Study Participants

Table 4.2 shows the socio-economic characteristics of the study participants. On employment, 44.3% of the participants in the control group and 50.4% of the intervention arm were employed. Majority of the participants earned below Kshs. 10,000 with 61.5% in the control arm and 68.9% in the intervention arm respectively. Employment status was not different in the two arms (P>0.001) while average income was different (P<0.001).

Table 4.2: Socio-economic characteristics of the study participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Control arm N = 122</th>
<th>Intervention arm N = 119</th>
<th>Chi square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency (%)</td>
<td>Frequency (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>Employed</td>
<td>54 (44.3)</td>
<td>60 (50.4)</td>
<td>$\chi^2 (1) = 0.2$, P = 0.65</td>
</tr>
<tr>
<td></td>
<td>Unemployed</td>
<td>68 (55.7)</td>
<td>59 (49.6)</td>
<td></td>
</tr>
<tr>
<td>Monthly income (Kshs)</td>
<td>Below 10000</td>
<td>75 (61.5)</td>
<td>64 (53.8)</td>
<td>$\chi^2 (1) = 119$, P&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>10000 &amp; more</td>
<td>47 (38.5)</td>
<td>55 (46.2)</td>
<td></td>
</tr>
</tbody>
</table>
4.2.3 Accessibility to the health facility characteristics of the respondents

Table 4.3 shows the accessibility characteristics of the study participants. Majority of the participants covered up to 5 KM to reach the health facility (63 % and 62% for control and intervention group respectively). It cost the participants up to Kshs. 100/- to travel with 77% and 79% respectively. The means of transport that was used by most of the participants was motorbike/public service vehicles which accounted for 70.5% of the control group and 60.9% of the intervention arm. The variables in the two groups were not statistically different (P>0.05).

Table 4.3: Accessibility to the health facility characteristics of the study respondents

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Control arm Frequency (%)</th>
<th>Intervention arm Frequency (%)</th>
<th>Chi square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Frequency (%)</td>
<td>Frequency (%)</td>
<td></td>
</tr>
<tr>
<td>Distance to the health facility</td>
<td>Within 5 KM</td>
<td>77 (63)</td>
<td>74 (62)</td>
<td>$\chi^2$ (1)= 0.002 P= 0.96</td>
</tr>
<tr>
<td></td>
<td>More than 5 KM</td>
<td>45 (37)</td>
<td>45 (38)</td>
<td></td>
</tr>
<tr>
<td>Cost of travel in Kshs. to the</td>
<td>Up to 100</td>
<td>94 (77.1)</td>
<td>94 (79)</td>
<td>$\chi^2$ (1)= 0.031 P= 0.86</td>
</tr>
<tr>
<td>health facility</td>
<td>More than 100</td>
<td>28 (22.9)</td>
<td>25 (21)</td>
<td></td>
</tr>
<tr>
<td>Means of transport to the</td>
<td>Vehicles / motorbike</td>
<td>86 (70.5)</td>
<td>76 (60.9)</td>
<td>$\chi^2$ (1)=0.32 P=0.57</td>
</tr>
<tr>
<td>health facility</td>
<td>Walking</td>
<td>36 (29.5)</td>
<td>43 (36.1)</td>
<td></td>
</tr>
</tbody>
</table>

4.2.4 Phone related characteristics of the study participants

Table 4.4 shows the phone related characteristics of the study participants. Most of the study participants (74.6% of the control arm and 62.2% of the intervention arm) owned mobile phones for a period of up to five years. Majority of them (74.6% of the control group and 74.8% of the intervention arm) never changed their mobile phone numbers within a year prior to the study. Majority (91.8% in the control arm...
and 95.8% in the intervention group) were also able to read short messages. The variables in the two groups were not statistically different (P>0.05).

**Table 4.4: Phone related characteristics of the study respondents**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Control arm Frequency (%)</th>
<th>Intervention arm Frequency (%)</th>
<th>Chi square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of phone ownership</td>
<td>Up to 5 years</td>
<td>91 (74.6)</td>
<td>74 (62.2)</td>
<td>$\chi^2 = 0.081$</td>
</tr>
<tr>
<td></td>
<td>More than 5 years</td>
<td>31 (25.4)</td>
<td>45 (37.8)</td>
<td>$P = 0.775$</td>
</tr>
<tr>
<td>Changing phone number in a year</td>
<td>Never</td>
<td>91 (75)</td>
<td>89 (74.8)</td>
<td>$\chi^2 = 0.48$</td>
</tr>
<tr>
<td></td>
<td>Ever</td>
<td>31 (25)</td>
<td>30 (25.2)</td>
<td>$P = 0.49$</td>
</tr>
<tr>
<td>Ability to read SMS</td>
<td>No</td>
<td>10 (8.2)</td>
<td>5 (4.2)</td>
<td>$\chi^2 = 0.47$</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>112 (92.8)</td>
<td>114 (95.8)</td>
<td>$P = 0.48$</td>
</tr>
</tbody>
</table>

**4.2.5 Pregnancy related factors**

Table 4.5 shows the pregnancy related characteristics of the study participants. Majority (68.9% of the control arm and 76.5% of the intervention group) had been pregnant the first or second time. Based on assessment of the research assistants (trained nurses), most of the respondents (66.4% in control arm and 75.4% in the intervention arm) did not have risk factors to pregnancy. Majority of the participants in control group (66.2%) and 55.2% in the intervention arm) did not utilize focused ante natal care in their previous pregnancies. Two of the three variables were statistically different (P<0.05).

**Table 4.5: Pregnancy related characteristics of the study participants**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Control arm Frequency (%)</th>
<th>Intervention arm Frequency (%)</th>
<th>$\chi^2$/Fishers Exact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravida</td>
<td>1-2</td>
<td>84 (68.9)</td>
<td>91 (76.5)</td>
<td>Exact = 0.027</td>
</tr>
<tr>
<td></td>
<td>3-4</td>
<td>28 (22.9)</td>
<td>24 (20.2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 and more</td>
<td>10 (8.2)</td>
<td>4 (3.3)</td>
<td></td>
</tr>
<tr>
<td>Presence of a risk factor</td>
<td>No</td>
<td>81 (66.4)</td>
<td>90 (76)</td>
<td>$\chi^2 = 28.9$</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>41 (33.6)</td>
<td>29 (24)</td>
<td>$P&lt;0.001$</td>
</tr>
<tr>
<td>Previous FANC use</td>
<td>No</td>
<td>45 (66.2)</td>
<td>32 (55.2)</td>
<td>$\chi^2 = 0.58$</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>23 (33.8)</td>
<td>26 (44.8)</td>
<td>$P = 0.45$</td>
</tr>
</tbody>
</table>
4.3 Utilization of mobile phones and E-health support services

Table 4.6 shows the facility assessment on use of mobile phones on patient care. Two of the facilities had institutional mobile phone and had money allocated for airtime. All facilities had internet network reach. Mobile reminders had been used before in all the study facilities to remind the patients attending comprehensive care clinics of their days of appointments. All health workers could send short message services with ease. None of the health workers in any of the facilities had ever been sensitized or trained on mobile health, telemedicine or e-health. There were no guidelines from the government on mobile health. All the facilities had desktop computers, were covered by both internet and mobile network. The desktop computers were mainly used in HIV/AIDS care clinics.

Table 4.6: Utilization of mobile phones and E-health support services

<table>
<thead>
<tr>
<th>Indicator/Facilities</th>
<th>Chiakariga</th>
<th>Tunyai</th>
<th>Matiri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership of hospital mobile phone</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Previous use of phone reminders</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Ability of health workers to send SMS</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sensitization on mhealth, e-health or telemedicine</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Presence of government guidelines on M-health</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Ownership of desktop computers</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Mobile network coverage</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Internet coverage</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
4.4 Objective 1: Influence of mobile phone short message reminders on uptake of focused ante natal care

4.4.1 Utilization of Focused ante natal care

Figure 4.1 shows the utilization of focused ante natal care. In the intervention group, 74.8% of the study participants utilized focused ante natal care. Only 13.1% utilized focused ante natal care among the control group.

![Utilization of Focused Ante Natal Care](image)

**Figure 4.1:** Utilization of focused ante natal care
4.4.2 Association and influence of short message service on Focused ante natal care

Table 4.7 shows the association and influence of short message reminders on focused ante natal care utilization. There was highly significant association between short message service reminders and utilization of focused ante natal care ($\chi^2 (1) = 93.1, P<0.001$). Utilization of focused ante natal care was increased by 19.6 times through use of short message reminders (OR 19.6, $P<0.001$ CI: 10.06 – 38.37).

<table>
<thead>
<tr>
<th>Association of SMS reminders on Focused ante natal care</th>
<th>Uptake of FANC</th>
<th>Non uptake of FANC</th>
<th>$\chi^2$</th>
<th>DF</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control N = 122</td>
<td>16 (13.1%)</td>
<td>106 (86.9%)</td>
<td>93.1</td>
<td>1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Intervention (N = 119)</td>
<td>89 (74.8%)</td>
<td>30 (25.2%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Influence of SMS reminders on Focused ante natal care (logistic regression)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>No SMS (Reference)</td>
</tr>
<tr>
<td>SMS reminder</td>
</tr>
</tbody>
</table>

4.4.3 The differences between the means and proportions of ante natal visits between control and interventional arms

Table 4.8 shows the differences between the means and proportions of number of ante natal visits between the control and the interventional arms. There was a highly significant difference in the utilization between the two groups ($P<0.001$). The mean number of visits in the intervention group was 4.0 ±0.097. The mean number of visits among the respondents that did not receive short message reminder was 2.5 ± .087. Further analysis was done to establish the effect size of the intervention. Difference
in proportions of 61.7% was highly significant (P<0.001). Cohen’s D was used to quantify the effect size which was 1.55. This is deemed very large effect (above 1.3).

**Table 4.8: The differences between the means and proportions of the ante natal visits between the control and interventional arms**

<table>
<thead>
<tr>
<th>Differences in the means of the number of ante natal visits</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group</strong></td>
<td><strong>Mean</strong></td>
<td><strong>Standard error</strong></td>
<td><strong>T</strong></td>
<td><strong>DF</strong></td>
</tr>
<tr>
<td>Control N= 122</td>
<td>2.5</td>
<td>0.087</td>
<td>11.5</td>
<td>239</td>
</tr>
<tr>
<td>Intervention N= 119</td>
<td>4.0</td>
<td>0.097</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Difference in proportions of ante natal</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group</strong></td>
<td><strong>Difference</strong></td>
<td><strong>χ²</strong></td>
<td><strong>DF</strong></td>
<td><strong>P value</strong></td>
</tr>
<tr>
<td>Control N= 122</td>
<td>61.7%</td>
<td>92.9</td>
<td>1</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>Intervention N= 119</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 4.4.4 Services provided during Focused ante natal care

Table 4.9 shows the association and influence of SMS reminders on services offered during ante natal care. There was no statistical association (P>0.05) between SMS reminders and the following; iron/folate intake, use of alcohol in pregnancy and use of un-prescribed drugs. Majority of the participants (82%) in the intervention group completed their ante natal profile compared to 54% of the control arm. There was a highly significant association (χ² (1) = 20.68, P<0.001) between short message reminders and completion of ante natal profile. Ante natal profile entails various laboratory tests that are done to pregnant women. They investigate haemoglobin levels, blood grouping, Human Immuno-deficiency Virus, malaria (only done in
malaria endemic zones) and syphilis. The chances of completion are increased by short message reminders by 3.7 times (OR = 3.7, P<0.001, CI = 2.086 – 6.708).

Table 4.9: Association and influence of SMS reminders on services offered during ante natal care

<table>
<thead>
<tr>
<th>Service</th>
<th>Group</th>
<th>Use</th>
<th>Non use</th>
<th>Chi square</th>
<th>DF</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron and folate</td>
<td>Control</td>
<td>21 (17%)</td>
<td>101 (83%)</td>
<td>2.59</td>
<td>1</td>
<td>0.107</td>
</tr>
<tr>
<td></td>
<td>Intervention</td>
<td>12 (10%)</td>
<td>107 (90%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol use N = 241</td>
<td>Control</td>
<td>107 (88%)</td>
<td>15 (12%)</td>
<td>1.5</td>
<td>1</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>Intervention</td>
<td>110 (92%)</td>
<td>9 (8%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of un-prescribed drugs N = 241</td>
<td>Control</td>
<td>108 (89%)</td>
<td>13 (11%)</td>
<td>1.86</td>
<td>1</td>
<td>0.173</td>
</tr>
<tr>
<td></td>
<td>Intervention</td>
<td>112 (94%)</td>
<td>7 (6%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANC profile completion N = 241</td>
<td>Control</td>
<td>56 (46%)</td>
<td>66 (54%)</td>
<td>20.68</td>
<td>1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Intervention</td>
<td>22 (18%)</td>
<td>97 (82%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Influence of SMS reminders on ante natal profile (logistic regression)

<table>
<thead>
<tr>
<th>Completion of ante natal profile</th>
<th>Odds ratio</th>
<th>P Value</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short message reminder (N =241)</td>
<td>3.7</td>
<td>&lt;0.001</td>
<td>2.086 – 6.708</td>
</tr>
</tbody>
</table>

4.4.5 Hindrances to attendance of scheduled ante natal visits

Qualitative data from focus group discussions and key informant interviews highlighted some hindrances of not utilizing focused ante natal care. In the focus groups, the participants indicated that despite there being a scheduled visit, there are barriers to attending the clinics. They included forgetting the scheduled date, being busy with income generating activities, distance to the health facility and lack of fare.

“At times I forget my date of appointment”. The health facility is far and the charges by motorbikes are high and so at times I miss my clinics day”.

The cost of transport especially using motor bikes (locally referred to as boda boda) is also high that one cannot afford to do several visits.
“To travel to Tunyai (the health centre) from Gakurungu using a motorbike can cost Kshs. 400 which is a lot of money”.

Key informants reported that some women take pregnancy lightly. One cited a client who said

“Pregnancy is not sickness; you do not have to come to hospital several times”.

Another key informant reported that some clients have never known that the four scheduled visits were introduced. This makes them to do ante natal booking late, in fear of attending very many routine visits. It was also reported that facility reputation hinders some clients from attending. Women reported that they avoid re-visits in facilities where the staffs are unwelcoming.

4.4.6 Benefits and beliefs towards mobile phones and short message reminders

In focus group discussions, women expressed several benefits of mobile phones and short messages. The main thing that was unanimously said in all focus groups is that the short message served as a reminder.

“The text message was a good reminder of my ante natal clinic date”.

They indicated that a short message reminder enabled one to prioritize the ante natal visit amidst other competing engagements.

“When I received the reminder message on my phone, I rescheduled my other activities to attend the ante natal clinic”.

Short messages could also be read in any convenient time. One woman reported that
“I usually leave my phone at home when I go to the river to fetch water. When I come back I am able to read any message that could have been sent. I also can re-read it.

Key informants put it that short message reminders can improve uptake of health services. One noted that

“You know a short message creates confidence in the clients and diffuses any negative rumours towards a facility. A reminder from a health facility also shows that the health workers care for the clients and are concerned with their health”.

However, there are also negative beliefs on mobile phones. Women believed that phones may cause cancer. Women of a religious sect (kabonokia) in the area believe that phones are “demonic” and are “foreign”. They discourage their members from using them. There was also a belief that messages from some unknown numbers can cause death. They put it that

“Once you receive a message from unknown numbers, do not read them. Because once you read, you will instantly die”.

The key informants identified lack of mobile network, lack of sources of power to charge the phones and illiteracy as the barriers to using mobile phone based reminders. They also noted that sustainability of such initiatives is not easy because of insufficient funding.

“Despite the benefits of SMS reminders, this area has hindrances to its use like poor mobile network coverage, lack of continuous source of power to charge phones and illiteracy from some pregnant mother. Sustainability of such a program is also difficult because of low funding and lack of requisite infrastructure”.

4.5 Objective 2: Influence of socio-demographic factors on uptake of focused ante natal care after using mobile phone short message reminders

4.5.1 Association of socio-demographic factors on utilization of focused ante natal care

Table 4.10 show the association of socio-demographic factors and utilization of focused ante natal care. There was no association between the socio-demographic variables and the dependent variable (P>0.05).

Table 4.10: Association of socio-demographic factors to focused ante natal care utilization

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Uptake</th>
<th>Non Uptake</th>
<th>Chi²/Fisher’s exact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control arm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in years N = 122</td>
<td>Below 20</td>
<td>1 (7%)</td>
<td>13 (93%)</td>
<td>Fisher’s exact = 0.37</td>
</tr>
<tr>
<td></td>
<td>20-24</td>
<td>2 (6%)</td>
<td>32 (94%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25-29</td>
<td>8 (21%)</td>
<td>30 (79%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30-34</td>
<td>2 (89%)</td>
<td>17 (11%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>35 &amp; above</td>
<td>3 (18%)</td>
<td>14 (82%)</td>
<td></td>
</tr>
<tr>
<td>Highest level of education N = 122</td>
<td>Primary</td>
<td>9 (12%)</td>
<td>69 (88%)</td>
<td>χ²(2) = 3.65 P = 0.161</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>2 (8%)</td>
<td>23 (92%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tertiary</td>
<td>5 (26%)</td>
<td>14 (74%)</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
<td>14 (13%)</td>
<td>95 (87%)</td>
<td>Fisher’s exact = 0.68</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>2 (15%)</td>
<td>11 (85%)</td>
<td></td>
</tr>
<tr>
<td>Religion N = 122</td>
<td>Protestant</td>
<td>7 (10%)</td>
<td>65 (90%)</td>
<td>χ²(1) = 0.33 P = 0.57</td>
</tr>
<tr>
<td></td>
<td>Catholic</td>
<td>5 (11%)</td>
<td>41 (89%)</td>
<td></td>
</tr>
<tr>
<td><strong>Intervention arm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in years</td>
<td>Below 20</td>
<td>7 (78%)</td>
<td>2 (22%)</td>
<td>Fisher’s exact = 0.62</td>
</tr>
<tr>
<td></td>
<td>20-24</td>
<td>33 (77%)</td>
<td>10 (23%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25-29</td>
<td>26 (81%)</td>
<td>6 (19%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30-34</td>
<td>15 (68%)</td>
<td>7 (32%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>35 &amp; above</td>
<td>5 (38%)</td>
<td>8 (62%)</td>
<td></td>
</tr>
<tr>
<td>Highest level of education</td>
<td>Primary</td>
<td>46 (72%)</td>
<td>18 (28%)</td>
<td>χ²(2) = 0.64 P =0.73</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>26 (79%)</td>
<td>7 (21%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tertiary</td>
<td>17 (77%)</td>
<td>5 (23%)</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
<td>83 (75%)</td>
<td>27 (25%)</td>
<td>Fisher’s exact = 0.69</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>6 (67%)</td>
<td>3 (33%)</td>
<td></td>
</tr>
<tr>
<td>Religion</td>
<td>Protestant</td>
<td>62 (76%)</td>
<td>20 (24%)</td>
<td>χ²(1) = 0.094 P= 0.76</td>
</tr>
<tr>
<td></td>
<td>Catholic</td>
<td>27 (73%)</td>
<td>10 (27%)</td>
<td></td>
</tr>
</tbody>
</table>
4.5.2 Association of socio-economic factors on utilization of focused ante natal care

Table 4.11 shows the association between socio-economic factors to utilization of focused ante natal care. There was no association between socio-demographic variables and the dependent variable after using short message reminders (Fisher’s exact and P>0.05).

Table 4.11: Association of socio-economic factors to focused ante natal care utilization

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Uptake</th>
<th>Non Uptake</th>
<th>(\chi^2)/Fisher’s exact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control Arm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>Employed</td>
<td>6 (11%)</td>
<td>48 (89%)</td>
<td>(\chi^2(1) = 0.34)</td>
</tr>
<tr>
<td>N = 122</td>
<td>Unemployed</td>
<td>10 (15%)</td>
<td>58 (85%)</td>
<td>P = 0.56</td>
</tr>
<tr>
<td>Family income (Kshs.)</td>
<td>Below 10000</td>
<td>65 (87%)</td>
<td>10 (13%)</td>
<td>(\chi^2(1) = 0.008)</td>
</tr>
<tr>
<td>N = 122</td>
<td>10000 and above</td>
<td>41 (87%)</td>
<td>6 (13%)</td>
<td>P = 0.93</td>
</tr>
<tr>
<td><strong>Intervention arm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>Employed</td>
<td>11 (18%)</td>
<td>49 (82%)</td>
<td>(\chi^2(1) = 3.03)</td>
</tr>
<tr>
<td>N = 119</td>
<td>Unemployed</td>
<td>19 (32%)</td>
<td>40 (68%)</td>
<td>P= 0.08</td>
</tr>
<tr>
<td>Family income (Kshs.)</td>
<td>Below 10000</td>
<td>18 (28%)</td>
<td>46 (72%)</td>
<td>(\chi^2(1) = 0.62)</td>
</tr>
<tr>
<td>N = 119</td>
<td>10000 and above</td>
<td>12 (22%)</td>
<td>43 (78%)</td>
<td>P= 0.43</td>
</tr>
</tbody>
</table>
4.6 Objective 3: Influence of accessibility factors on uptake of focused ante natal care after using mobile phone short message reminders

4.6.1 Association of accessibility factors on utilization of focused ante natal care

Table 4.12 illustrates the association between accessibility factors and utilization of focused ante natal care. There was no association between the accessibility factors and the utilization of focused ante natal care.

**Table 4.12 Association of accessibility variables on focused ante natal care utilization**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Non Uptake</th>
<th>Uptake</th>
<th>Fisher’s exact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control arm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance in KM</td>
<td>Within 5</td>
<td>66 (86%)</td>
<td>11 (14%)</td>
<td>$\chi^2(1) = 0.25$</td>
</tr>
<tr>
<td>N=122</td>
<td>More than 5</td>
<td>40 (89%)</td>
<td>5 (11%)</td>
<td>P= 0.62</td>
</tr>
<tr>
<td>Cost of travel in Kshs.</td>
<td>Up to 100</td>
<td>79 (84%)</td>
<td>15 (16%)</td>
<td>Fisher’s exact=0.074</td>
</tr>
<tr>
<td>N = 122</td>
<td>More than 100</td>
<td>27 (96%)</td>
<td>1 (4%)</td>
<td></td>
</tr>
<tr>
<td>Means of transport</td>
<td>Vehicles or motorbike</td>
<td>31 (86%)</td>
<td>5 (14%)</td>
<td>$\chi^2(1) = 0.026$</td>
</tr>
<tr>
<td>N = 122</td>
<td>Foot</td>
<td>31 (89%)</td>
<td>4 (11%)</td>
<td>P= 0.87</td>
</tr>
<tr>
<td>Interventional arm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance in KM</td>
<td>Within 5</td>
<td>16 (22%)</td>
<td>58 (78%)</td>
<td>Fisher’s exact= 0.28</td>
</tr>
<tr>
<td>N=122</td>
<td>More than 5</td>
<td>14 (31%)</td>
<td>31 (69%)</td>
<td></td>
</tr>
<tr>
<td>Cost of travel in Kshs.</td>
<td>Up to 100</td>
<td>23 (24%)</td>
<td>71 (76%)</td>
<td>$\chi^2(1) = 0.13$</td>
</tr>
<tr>
<td>N = 122</td>
<td>More than 100</td>
<td>7 (28%)</td>
<td>18 (72%)</td>
<td>P= 0.72</td>
</tr>
<tr>
<td>Means of transport</td>
<td>Vehicle or motorbike</td>
<td>20 (26%)</td>
<td>56 (74%)</td>
<td>$\chi^2(1) = 0.14$</td>
</tr>
<tr>
<td>N = 122</td>
<td>Walking</td>
<td>10(26%)</td>
<td>33 (74%)</td>
<td>P= 0.71</td>
</tr>
</tbody>
</table>
4.6.2 Association of phone related factors on utilization of focused ante natal care

Table 4.13 shows the association of accessibility factors on utilization of focused ante natal care among the intervention group. There was no association between the accessibility factors and the utilization of focused ante natal care.

Table 4.13: Association of Phone related factors on utilization of focused ante natal care

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Non Uptake</th>
<th>Uptake</th>
<th>Fisher’s exact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Control arm</td>
<td>Interventional arm</td>
<td></td>
</tr>
<tr>
<td>Duration of Phone ownership</td>
<td>Five years &amp; less</td>
<td>81 (89%)</td>
<td>10 (11%)</td>
<td>(\chi^2(1) = 1.42) P= 0.23</td>
</tr>
<tr>
<td></td>
<td>More than five</td>
<td>25 (81%)</td>
<td>6 (19%)</td>
<td></td>
</tr>
<tr>
<td>Change of phone number in a year</td>
<td>Never</td>
<td>80 (88%)</td>
<td>11 (12%)</td>
<td>(\chi^2(1) = 0.33) P= 0.57</td>
</tr>
<tr>
<td></td>
<td>Ever changed</td>
<td>26 (100%)</td>
<td>5 (0%)</td>
<td></td>
</tr>
<tr>
<td>Ability to read a text message</td>
<td>No</td>
<td>8 (80%)</td>
<td>2 (20%)</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>98 (88%)</td>
<td>14 (12%)</td>
<td></td>
</tr>
</tbody>
</table>

4.7 Objective 4: Association of pregnancy related factors on utilization of focused ante natal care among the control group

Table 4.14 shows the association of pregnancy related factors on utilization of focused ante natal care. Risk was assessed by health workers and then documented in the maternal and child health booklet. In the intervention group, there was also a significant association (\(\chi^2 = 5.32\), DF = 1, P = 0.021) between presence of a risk
factor and utilization of FANC. Presence of risk factor decreased the chances of utilizing focused ante natal care (OR: 0.485, P = 0.016, CI = 0.370-0.874).

**Table 4.14: Association and influence of pregnancy related factors on utilization of focused ante natal care after using**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control arm</th>
<th>Intervention arm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of pregnancies</strong></td>
<td><strong>Number of pregnancies</strong></td>
<td><strong>Number of pregnancies</strong></td>
</tr>
<tr>
<td>N = 122</td>
<td>1-2</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td>73 (87%)</td>
<td>21 (23%)</td>
</tr>
<tr>
<td></td>
<td>11 (13%)</td>
<td>70 (77%)</td>
</tr>
<tr>
<td></td>
<td>3-4</td>
<td>3 (11%)</td>
</tr>
<tr>
<td></td>
<td>24 (86%)</td>
<td>2 (50%)</td>
</tr>
<tr>
<td></td>
<td>4 (14%)</td>
<td>17 (71%)</td>
</tr>
<tr>
<td></td>
<td>5 and more</td>
<td>5 and more</td>
</tr>
<tr>
<td></td>
<td>9 (90%)</td>
<td>2 (50%)</td>
</tr>
<tr>
<td></td>
<td>1 (10%)</td>
<td>2 (50%)</td>
</tr>
<tr>
<td><strong>Presence of a risk factor</strong></td>
<td><strong>Presence of a risk factor</strong></td>
<td><strong>Presence of a risk factor</strong></td>
</tr>
<tr>
<td>N = 122</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>70 (86%)</td>
<td>18 (20%)</td>
</tr>
<tr>
<td></td>
<td>11 (14%)</td>
<td>72 (80%)</td>
</tr>
<tr>
<td></td>
<td>11 (14%)</td>
<td>72 (80%)</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>36 (88%)</td>
<td>12 (41%)</td>
</tr>
<tr>
<td></td>
<td>5 (12%)</td>
<td>17 (59%)</td>
</tr>
<tr>
<td></td>
<td>36 (88%)</td>
<td>3 (13%)</td>
</tr>
<tr>
<td><strong>Utilization of focused ANC in previous pregnancies N= 68</strong></td>
<td><strong>Utilization of focused ANC in previous pregnancies N= 68</strong></td>
<td><strong>Utilization of focused ANC in previous pregnancies N= 68</strong></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>38 (84.4%)</td>
<td>3 (13%)</td>
</tr>
<tr>
<td></td>
<td>7 (15.6%)</td>
<td>24 (89%)</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>20 (87%)</td>
<td>10 (32%)</td>
</tr>
<tr>
<td></td>
<td>3 (13%)</td>
<td>21 (68%)</td>
</tr>
</tbody>
</table>

**Influence of pregnancy related factors to FANC uptake after using SMS reminders**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Odds ratio</th>
<th>Confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of a risk factor</td>
<td>No (reference)</td>
<td>0.485</td>
<td>0.270</td>
<td>0.874</td>
</tr>
</tbody>
</table>
4.8 Multivariate analysis using logistic regression

Table 4.15 shows the multivariate analysis using logistic regression. Using short message reminders increased the chances of utilizing focused ante natal care (OR 19.6 P<0.001, CI: 10.06 – 38.36). This was examining objective one. This led to rejection of the null hypothesis one. The other variables had no influence on focused ante natal care uptake after using short message reminders. The null hypotheses two and three were therefore accepted.

**Table 4.15: Multivariate analysis using logistic regression**

<table>
<thead>
<tr>
<th>Group</th>
<th>Variable</th>
<th>Category</th>
<th>OR</th>
<th>P Value</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMS</td>
<td>Use of SMS</td>
<td>No (Ref)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>19.6</td>
<td>&lt;0.001</td>
<td>10.06 – 38.36</td>
</tr>
<tr>
<td>Socio-demographic factors after using SMS</td>
<td>Age in years</td>
<td>Below 20 (Ref)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20-25</td>
<td>0.76</td>
<td>0.76</td>
<td>0.12 - 4.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25-30</td>
<td>1.06</td>
<td>0.95</td>
<td>0.16 - 6.76</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30-35</td>
<td>0.51</td>
<td>0.49</td>
<td>0.07 - 3.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35 and Above</td>
<td>0.37</td>
<td>0.33</td>
<td>0.52 - 2.76</td>
</tr>
<tr>
<td>Highest level of Education</td>
<td></td>
<td>Primary (Ref)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Secondary</td>
<td>1.5</td>
<td>0.45</td>
<td>0.52 - 4.33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tertiary</td>
<td>1.25</td>
<td>0.71</td>
<td>0.38 - 4.09</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td>Married (Ref)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Single</td>
<td>0.51</td>
<td>0.39</td>
<td>0.11 - 2.39</td>
</tr>
<tr>
<td>Accessibility factors after using SMS</td>
<td>Distance to health facility</td>
<td>Within 5 KM (Ref)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>More than 5 KM</td>
<td>0.6</td>
<td>0.29</td>
<td>0.23 - 1.53</td>
</tr>
<tr>
<td></td>
<td>Cost to health facility</td>
<td>Up to Kshs. 100 (Ref)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>More than Kshs.</td>
<td>1.07</td>
<td>0.89</td>
<td>0.35 - 3.28</td>
</tr>
<tr>
<td></td>
<td>Means of transport to health facility</td>
<td>Walking (Ref)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PSV/Motorbikes</td>
<td>0.95</td>
<td>0.92</td>
<td>0.38 - 2.42</td>
</tr>
<tr>
<td>Phone related factors after using SMS</td>
<td>Duration of phone ownership</td>
<td>Less than 5 years (Ref)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 years and more</td>
<td>1.06</td>
<td>0.88</td>
<td>0.43 - 2.58</td>
</tr>
<tr>
<td></td>
<td>Change of phone number in a year</td>
<td>No (Ref)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>1.77</td>
<td>0.29</td>
<td>0.61 - 5.08</td>
</tr>
</tbody>
</table>
CHAPTER 5: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter has the discussion of the research findings. They are arranged to flow in tandem with the objectives and the results. Conclusions, recommendations and areas of further research are also included in this chapter.

5.1 Characteristics of study participants

Among the participants, teenagers accounted for 11.5% and 9% in the control and intervention arms respectively. These proportions were lower than the national prevalence at 18%. It was still lower than the regional (eastern) and the County proportions which are 14.4% and 13.7% respectively (KNBS, 2015). The difference could be due to the selection using the eligibility criteria and that the study was hospital based contrary to community based site.

On the highest level of education, 64% and 54% of the participants in the control and intervention groups had attained primary education. This left a smaller proportion that is included in the secondary and tertiary levels of education. This proportion is similar to the national percentage of women who have attained primary education (50%) and higher than the county prevalence which is 36% (KNBS, 2015). Ninety percent (90%) of the respondents were married. This means the group that was not married was quite small. This proportion is higher than the national percentage of 61% (KNBS, 2015). All the respondents were Christians with (62% and 69% in control and intervention groups respectively being Protestants and (37% and 31% in control and intervention groups respectively being Catholics). The Protestants were almost a similar proportion with the national percentage (71%) while the proportion of Catholics was lower than the national proportion at 35% (KNBS, 2015).
Forty four percent (44%) of the respondents in the control group and 50% in the intervention arm were unemployed. The level of employment of women was lower than the national and regional (Eastern) levels, 61% and 66% respectively (KNBS, 2015). Seventy five percent (75%) and sixty two (62%) percent of the participants in the control and intervention groups respectively owned mobile phones for at least five years. This proportion is lower than the national proportion which is 86%. It is estimated that 94% of Kenyans in urban areas and 80% in rural areas have mobile phones (KNBS, 2015). Ninety one percent (91%) and 95% of the participants in the control and intervention groups respectively could not read a text message in any language. A close relative was able to read for them the text messages. This means that the proportion that can read is higher than the county percentage (71%) and the national proportion of 66% (CRA, 2011). This however could have been due to the inclusion criteria of this study which required the participants to have mobile phone.

On facility capacities to support mobile health, most of the facilities in the area of study were having the requisite indicators. The facilities were within mobile phone and internet coverage, staffs were able to send SMS, some facilities had previously used mobile phone reminders for other health services and one facility had an institutional mobile handset. However, sensitization on mobile health had never been done in any of the facilities and there were no government policies/guidelines on mobile health. These findings mean that with input from the relevant stakeholders, the health facilities can host mobile phone SMS reminders for FANC.
5.2 Objective 1: Influence of short message service on utilization of focused ante
natal care

5.2.1 Influence of short message service on utilization of focused ante natal care

World health organization has established that mobile short message services are the
most common types of reminder for appointments. It has also noted that missed
appointments have high financial and operational costs (WHO, 2011). Mhealth
health facilitates remote access to services that were conventionally geographically
inaccessible (Opoku et al., 2017). It also enhances decision making on health care
(Angela et al., 2015). In this study, mobile phone reminders increased the uptake of
focused ante natal care. This was evidenced higher proportion in uptake among the
intervention group, very large effect size, higher mean number of visits among the
interventional group and significant difference in proportions of uptake of FANC
between the two arms of study. The results meant that with the SMS reminders the
uptake can significantly be increased. They also meant that with the routine practice,
the uptake is quite low. Without SMS reminder (as exemplified by the control
group), the uptake of FANC is lower than the national level which is 58% and the
regional level which is 56% (KNBS, 2015). The intervention improves the uptake to
a level above the proportion of the FANC uptake in developed countries which is
52% (Watterson et al., 2014).

This study agrees with several other studies on mhealth across the globe. In Thailand,
a pre and post interventional study, it was established that short message reminders
increased the utilization of ante natal care (Sondaal et al., 2016). In a study in Njoro,
Nakuru County, Kenya, on use of mobile health to increase the uptake of focused
ante natal care, the uptake was increased by use of the reminders (Fedha, 2014). In a
randomized controlled trial in Zanzibar, short message intervention increased the chances of uptake of focused ante natal care (Lund et al., 2014). Similar results were found in studies in China (Fang and Li, 2010), South Africa (Lau et al., 2014) and Thailand (Kaewkungwal, 2010). The implications of these findings are that with effective use of mobile SMS reminders the uptake of FANC in rural areas among developing countries can be significantly improved. The unique finding in this study is SMS are effective appointment compliances enhancers among women in rural areas.

### 5.2.2 Hindrances to attending scheduled ante natal visits

The hindrances of attendance of scheduled ante natal visits were forgetting, perception that pregnancy is not sickness, long distances to health facilities, cost of reaching the health facilities especially using motorbikes and non prioritization of the ante natal visits. It also included poor staff receptivity of the clients and misinformation on the number of ante natal visits one should make in a pregnancy. These findings mean that despite the benefits of ANC visits and care, there are several inherent perceptions, reasons and drivers of not attending the scheduled visits. These could be personal or institutional factors.

### 5.2.3 Benefits of mobile phone SMS reminders on ante natal visits

It was generally noted by the clients and the health care providers that the mobile phone SMS reminders were convenient and enhanced prioritization of FANC services for users, confidence on health services was established and the facilities were deemed to be achieving positive concern for the clients. These responses imply that the SMS reminders can be accepted by both the service providers and their
clients. This agrees with findings of Lau et al., 2014 that found SMS reminders to be a positive motivation, welcome reminders and care from health care workers.

5.2.4 Beliefs against and hindrances to use of mobile phone reminders

Beliefs that would potentially hinder uptake of the mobile service reminders were noted among the pregnant women. There were perceptions of cancer causation by mobile phones and religious perceptions of mobile phones being “demonic and foreign”. The hindrances that were identified were poor network coverage in some areas, illiteracy and sustainability of a similar project. This implies that despite the benefits of mobile SMS reminders, there are barriers and hindrances that should be addressed in order for women to attend the requisite number of visits.

5.2.5 Service utilization during focused ante natal care

The chances of completion of ANC profile was increased by SMS reminders for FANC though it was mentioned directly in the text message. The completion of the profiles could be associated with long exposure to services in the four visits. Follow up is also possible when the women go to the facility for the required times. In other studies, women who attended fewer than four visits occasionally do not collect their results because they do not adhere to their next scheduled visits. In Tanzania, studies found that a serology test for HIV was positively associated with utilization of focused ante natal care (Gupta et al., 2014). There was however no significant influence of FANC uptake to other services that is folate/ferrous use, avoidance of alcohol in pregnancy and use of un-prescribed drugs. This could be explained by the fact that most of them do not need a repeat visit for one to use them. This study disagrees with a study in Cape Town, South Africa that established that SMS reminders improve healthy behaviour in pregnancy (Lau et al., 2014).
5.3 Objective 2: Influence of Socio-demographic and economic factors on uptake of FANC after using SMS reminders

The study identified no significant association between age, level of education, religion, marital status, employment status and average monthly income with uptake of focused ante natal care. This finding disagrees with a study done in Malindi, Kenya that established association between socio-demographic factors and uptake of FANC (Dorah et al., 2016). This however was not a randomized controlled trial and its focus was rural-urban differences.

5.4 Objective 3: Influence of accessibility factors on uptake of FANC after using SMS reminders

Distance to the health facility, means and cost of transport to the health facility were found to have no influence on FANC uptake after using SMS reminders. This means that the SMS reminders are capable of overcoming the influence of the accessibility factors that have been established on uptake of health services. This is different from what was established by a study in western Kenya that identified distance as a barrier to completion of scheduled ante natal visits. However this was a qualitative cross sectional survey.

5.4 Objective 4: Influence of pregnancy related factors on uptake of FANC after using SMS reminders

The number of pregnancies a woman ever had and previous attendance of FANC was did not have any influence on uptake of focused ante natal care. It was established that presence of a risk factor decreased the chances of utilizing FANC after using SMS reminders. There was no significant influence of the presence of the risk factor
in pregnancy and uptake of FANC in the control group. The findings on the number of pregnancies implies that an increase or decrease of pregnancies does not necessarily alter health practices. On the issue of previous FANC use, the findings could have influenced by the low number of respondents who had been pregnant before and much lower number that had used FANC. On the influence of risk factor and uptake of FANC, the finding was unexpected. The usual expectation is because of the existence of the risk factor, women would frequent the health facilities for close monitoring. The non uptake may be due to communication breakdown between the clients and the service providers where an emphasis of the need for adherence to the scheduled visits could have not been done. This study is in agreement with another study by Yeoh et al., (2016), that found disproportionate uptake of focused ante natal care by women with high risk conditions/circumstances compared to those in low risk category in pregnancy.

5.5 Conclusions

On objective one, mobile phone SMS reminders have influence on uptake of focused ante natal care among pregnant women. The reminders improve the chances of attendance and the effect size was large enough for up scaling of the intervention to a larger population. Presence of a risk factor decreased the chances of using FANC. There was no influence of previous attendance and number of pregnancies a woman ever had. Use of focused ante natal care increased the chances of completing ante natal profile but had no influence on use of folate/ferrous, alcohol in pregnancy and un-prescribed drugs in pregnancy.

On objective two, there was no influence of socio-demographic and economic factors on uptake of focused ante natal care.
On objective three, there was no influence of accessibility factors on uptake of focused ante natal care.

5.6 Recommendations

1. Mobile phone short message reminders should be integrated in provision of focused ante natal care.
2. The policy makers should develop guidelines on mobile phone short message reminders.

5.7 Areas of further research

1. The influence of SMS reminders on outcomes of focused ante natal care.
2. Utilization of mobile phone reminders among women with risk factors in pregnancy.
3. The cost benefit analysis of using text message reminders to enhance uptake of focused ante natal care.
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APPENDICES
APPENDIX 1A: CONSENT FORM

My name is ……………………………. I am a PhD student from Kenyatta University. I am conducting a study on “Utilization Of Mobile Phone Short Message Service To Enhance Uptake Of Focused Ante Natal Care In Tharaka Nithi County, Kenya”. The information will be used by the County and Ministry of Health.

Procedures to be followed

Participation in this study will require that you fill in a questionnaire. You have the right to refuse participation in this study. Please remember that participation in this 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.

Risks

There are no risks whatsoever for participating in this study.

Benefits

If you participate in this study you will help the Ministry of Health to know how to address the uptake of focused ante natal care using mobile phone short message service in Tharaka Nithi County, Kenya.

Confidentiality

You will fill the questionnaire on your own and your name will not be recorded on the questionnaire. The questionnaire will also be kept safe and everything will be kept private.
Contact information

If you have any questions you may contact Mr. Eliphas Gitonga on 0721406609, Dr. J. Nyamari on 0722589335, Dr. A. Wanyoro on 0722747903, or Dr. P. Warutere on 0721993833 or the Kenyatta University Ethical Review Committee Secretariat on kuerc@ku.ac.ke.

Participant’s statement

The above information on my participation 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 will be entirely voluntary. I understand that my records will be kept private and that I can stop participation at any time.

Name of the participant ……………………………………………

------------------------------------------------------------------

Signature                                                                        Date

Investigators statement

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

Name of the interviewer:

-----------------------------------------------------------------------------

Interviewer signature                                                                        Date
APPENDIX 1A : FOMU YA IDHINI

Jina langu ................................. 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 wajawazito katika Kaunti ya Tharaka Nithi”. 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 utakayota 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 Eliphas Gitonga on 0721406609 au uandike barua pepe kwa Kenyatta University Ethical Review Committee Secretariat on kuerc@ku.ac.ke.
Sahihi

Tarehe

Jina la msaindizi wa utafiti:

_____________________________________________

Sahihi

Tarehe
APPENDIX 2: BASELINE QUESTIONNAIRE

Serial Number ...........................................................................................................

Mobile Phone Number (Own)..................................................................................

Mobile Phone Number (Significant other)............................................................

Name.......................................................................................................................

Baseline date...........................................................................................................

Health facility...........................................................................................................

Section A: Socio-Data

Q1. Age in completed Demographic years..............................................................

Q2. Marital status

1  Married  

2  Single  

3  Divorced  

4  Separated  

5  Widow  

6  Cohabiting  

Q3. The highest level of education attained

1  No formal education 

2  Primary education 

3  Secondary education 

4  Tertiary college  

Q4. Religion

1 Protestant □
2 Catholic □
3 Muslim □
4 Others (specify) ..............................................

Q5. Employment (own)

1 Employed □
2 Self Employed □
3 Casual □
4 Unemployed □

Q6. Employment (spouse)

1 Employed □
2 Self Employed □
3 Casual □
4 Unemployed □

Q7. Monthly family income (KShs.) ..............................................

Q8. Residence

1 Rural □
2 Urban □

Q9. Estimated distance (KM) to the health facility .............................
Q10. Common mode of transport to the health facility

1. Public transport
2. Private car
3. Motorbike
4. Bicycle
5. On foot

Q11. Estimate time in hours spent to the health facility

Q12. Estimate cost (KShs.) spent for transport to the health facility

Section B: Pregnancy related Data

Q13. How many times have you been pregnant?

Q14. How many children have you delivered?

Q15. Did you get a complication in any of your deliveries?

0. No
1. Yes

Q16. If yes in Q15, specify

Q17. How many times did you attend ante natal clinic in your LAST pregnancy?

Q18. Where did you deliver your LAST child (where applicable)

0. Home
1. Health facility
Section C: Focused Ante natal care for the CURRENT pregnancy

Q19. Date of last menstrual period-LMP (first day) ................................................

Q20. Expected date of delivery (EDD)...........................................................................

Q21. Date of first ANC visit in the current pregnancy (date in ANC card)......................

Q22. Number of ante natal visits attended for this pregnancy (number in ANC card)........

Q23. Next scheduled visit............................................................... 

Q24. Existence of any medical or obstetric condition or risk

0  No

1  Yes

Q25. If yes Q24, specify................................................................................................

Section D: Use of mobile phone

Q26. How long (years) have you had a phone..............................................

Q27. Are you able to read SMS?

0  No

1  Yes

Q28. If no in Q28, is there a family person that reads SMS for you?

0  No

1  Yes
Q29. Can your privacy be interfered with by sending you SMS reminders for your ante natal visits?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>1</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Q30. When your phone goes off charge, how long do you take to charge it?

Q31. How many times have you changed your mobile number over the last one year?
APPENDIX 3: EXIT QUESTIONNAIRE

Name............................................................................................................................

Mobile Phone Number (Own).......................................................................................  

End line date................................................................................................................

Q1. Number of ante natal visits done .................................................................  

Q2. ANC profile

<table>
<thead>
<tr>
<th>(tick yes if done and no if not)</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemoglobin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMTCT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syphilis test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urinalysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaria test</td>
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<td></td>
</tr>
</tbody>
</table>

Q3. Date of delivery..............................................................................................

Q4. Specific place of delivery

0. Home

1. Health facility

(name) ........................................................................................................................
Q5. Date of the first post natal visit..............................

Q6. Birth weight of the baby..............................................

Q7. Did you experience any maternal complications?
   0. No
   1. Yes

Q8. If yes in Q7 above (specify)..............................................

Q9. Did your baby develop or have any complications at birth?
   0. No
   1. Yes

Q10. If yes in Q9 (specify)......................................................

Q11. Are you aware of any danger signs that would call for emergency action during pregnancy?
   0. No
   1. Yes

Q12. If yes, name some

..........................................................................................................
..........................................................................................................
..........................................................................................................

Q13. Did you receive SMS about pregnancy?
   0. No
   1. Yes

   GO TO Q17
   PROCEED TO Q14
Q14 Did you find the SMS useful?

0. No
1. Yes

Q15. Can SMS be used to improve health of women?

0. No
1. Yes

Q16. Can you recommend SMS reminders to pregnant women to improve attendance?

0. No
1. Yes

Q17. If NO in Q13, did any of your friends whom you attended ante natal clinic with share a health related SMS with you?

0. No
1. Yes

Q18. Health promotion assessment

<table>
<thead>
<tr>
<th>Tick appropriately</th>
<th>Yes</th>
<th>No</th>
<th>Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is it important to attend clinic when you are pregnant?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you take folic acid and iron during your pregnancy?</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Did you drink alcohol during your pregnancy?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you eat healthily during your pregnancy?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you take drugs without prescription?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 4: KEY INFORMANT INTERVIEW GUIDE

1. Which factors influence uptake of focused ante natal care (drivers and barriers) in this community?

2. How can mobile phone SMS reminders influence uptake of focused ante natal care?

3. What are the potential benefits of using SMS for health services?

4. What are the potential barriers of utilization of mobile phone messages by the clients?

5. What are the potential barriers of utilization of mobile phone messages by the facility?

6. What are the social cultural beliefs associated with SMS reminders to pregnant mothers?
APPENDIX 5: FOCUS GROUP DISCUSSION GUIDE

1. Are there benefits you would get by attending ante natal care?

2. If yes, please list them.

1. How can SMS reminder help you in attending the scheduled ante natal visits?

2. Do you know of any cultural beliefs against mobile phones and short messages?

3. If yes, please list them.
## APPENDIX 6: FACILITY ASSESSMENT CHECKLIST

1. **Facility/Staff details**

<table>
<thead>
<tr>
<th>Aspect (tick appropriately)</th>
<th>Yes</th>
<th>No</th>
<th>Comment if any</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the facility offer all ante natal profile tests?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the facility offer regular delivery services?</td>
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<tr>
<td>Does the facility have a medical doctor?</td>
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<tr>
<td>Does the facility do regular outreach clinics?</td>
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</tr>
<tr>
<td>Does the facility have desktop/Laptop computers?</td>
<td></td>
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<tr>
<td>Does the facility have a mobile phone?</td>
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<tr>
<td>Does the facility have budgetary allocation for airtime?</td>
<td></td>
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<tr>
<td>Does the facility have mobile phone network coverage?</td>
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</tr>
<tr>
<td>Does your facility have access internet connection?</td>
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</tr>
<tr>
<td>Does the facility have a trained records officer?</td>
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</tr>
<tr>
<td>Is there a member of staff ever been trained or sensitized on mhealth, telemedicine, e-medicine or electronic medical records?</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Are there county or national policy/guidelines of mobile health/telemedicine/e-medicine within the facility?</td>
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<td></td>
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<tr>
<td>Besides this study, has the facility ever reminded any of the clients using a mobile phone of any of the services that were due?</td>
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</tbody>
</table>
APPENDIX 7: SHORT MESSAGE SERVICE CONTENT

English Version

How are you............... , name....... This is Chiakariga/Tunyai Health Centre reminding you of your next ante natal visit. The date is written on the clinic card. Please attend because the services are beneficial to you and the unborn baby. Thanks

Kiswahili Version


Kitharaka Version

Muga.......................Riitwa...... Ino i kiriniki ya Chiakariga/Tunyai igikuririkania tugu yaku ya kiriniki. Tariki yaku ya kiriniki nimbandike kandinini yaku. Itu chu kliniki nuntu kliniki hii na utethio gwaku na kiri mwana waku ura ukamatite. Ibwega
APPENDIX 8: MAP OF THE AREA

Map of Tharaka-Nithi County Showing the Location of the Study Sites i.e. Health Facilities.
APPENDIX 9: GRADUATE SCHOOL APPROVAL

KENYATTA UNIVERSITY
GRADUATE SCHOOL

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

FROM: Dean, Graduate School
TO: Mr. Makumyi E. Gitonga
     C/o Department of Population & Reproductive Health
     Kenyatta University

DATE: 9th August, 2016
REF: Q97/29798/14

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that Graduate School Board at its meeting of 27th July, 2016 approved your Research Proposal for the Ph.D. Degree, entitled “Utilization of Mobile Phone Short Message Service to Enhance Uptake of Focused Ante Natal Care in Tharaka Nithi County, Kenya”.

You may now proceed with your Data collection, subject to 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 MURUKI
FDR: DEAN, GRADUATE SCHOOL

cc: Registrar (Academic) Attn: Mr. Likam
Chairman, Department of Population & Reproductive Health

Supervisors:
1. Dr. Jackim Njamari
   C/o Department of Env. & Occupational Health
   KENYATTA UNIVERSITY
2. Dr. Peterson Warutere
   C/o Department of Env. & Occupational Health
   KENYATTA UNIVERSITY
3. Dr. Anthony Wanyoro
   C/o Department of Obstetrics & Gynaecology
   KENYATTA UNIVERSITY

RM/cao
APPENDIX 10: ETHICAL REVIEW CLEARANCE

KENYATTA UNIVERSITY
ETHICS REVIEW COMMITTEE

F. O. Box 43844,
Nairobi, 00100
Tel: 8710071/12

Our Ref: KU/R/COMM/51/812

Date: 6th October, 2016

Makuuski Elijah Githonga
Kenya University
P.O. Box 43844 – 00100
Nairobi

Dear Makuuski

APPLICATION NUMBER PKU/563/1652—“UTILIZATION OF MOBILE PHONE SHORT MESSAGE SERVICE TO ENHANCE UPTAKE OF FOCUSED ANTE NATAAL CARE IN THARAKA NITHI COUNTY, KENYA”

1. IDENTIFICATION OF PROTOCOL
The application before the committee is with a research topic “Utilization of Mobile Phone Short Message Service to Enhance Uptake of Focused Ante Natal Care in Tharaka Nithi County, Kenya” received on 27th July, 2016 and discussed on 27th September, 2016.

2. APPLICANT
Makuuski Elijah Githonga

3. SITE
Tharaka Nithi County, Kenya

4. JURISDICTION
The committee has considered the research protocol in accordance with the Kenyatta University Research Policy (Section 3.2.1.3) and the Kenyatta University Ethics Review Committee Guidelines and APPROVED that the research may proceed for a period of ONE year from 6th October, 2016.

5. AFFIRMATION/CONDITIONS
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 the board 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, filled in and attach all the conditions given please sign in the space provided below and return to KUERC a copy of this page.

DR. TITUS KAHIGA
CHIEF EXECUTIVE OFFICER

12 OCT 2016

Accept the advice given and will fulfill the conditions therein.

Signature………………………………. Dated this day of 12th 2016.

cc. Vice Chancellor
DVC Research Innovation and Outreach
APPENDIX 11: NACOSTI RESEARCH PERMIT

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471, 2241349, 3310571, 2219420
Fax: +254-20-3183215, 3183240
Email: dpo@nacost.go.ke
Website: www.nacost.go.ke
when replying please quote

Ref. No. NACOSTI/P/16/37075/15003

7th December, 2016

Eliphas Gitonga Makunyi
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on “Utilization of mobile phone Short Message Service to enhance uptake of focused Ante Natal Care in Tharaka Nithi County, Kenya,” I am pleased to inform you that you have been authorized to undertake research in Tharaka Nithi County for the period ending 6th December, 2017.

You are advised to report to the County Commissioner and the County Director of Education, Tharaka Nithi County before embarking on the research project.

On completion of the research, you are expected to submit two hard copies and one soft copy in pdf of the research report/thesis to our office.

Boniface Wanyama
FOR: DIRECTOR-GENERAL/CEO

Copy to:
The County Commissioner
Tharaka Nithi County.
The County Director of Education
Tharaka Nithi County.

APPENDIX 12: PRENATAL SYSTEM DESCRIPTION

PRE/ANTE-NATAL

CLIENT MESSAGE REMINDER NOTIFICATION SYSTEM

SYSTEM DESCRIPTION DOCUMENT

INTRODUCTION

SMS reminder system hereby referred to as the system is an application developed to send text messages to pregnant women or new mothers, hereby referred to as the client/clients, registered with the system. It is a custom made system designed to send automated or on demand messages. Such messages is determined by the researcher.

Definition of terms used

Blinding is the concept of concealing reminder reception status of clients. It hides from the researcher the knowledge of who is set to receive the reminders.

Unblinding is revealing such knowledge which was blinded as explained above. This was set to happen at the end of the research.

Array: A term referring to a 'bucket' of items in a computer program usually arranged in a certain manner.

SYSTEM OVERVIEW

System definition and dependencies

The system has been created using PHP 5.6 and runs on Apache2 server. It requires MySQL 5.5 and higher. The system must run on a publicly accessible server. It
requires at least 1GHz 1-core server with 1 GB RAM and 40 GB hard-drive for optimal performance. A keyword, **prenatal**, was acquired from Africa's Talking Ltd, a communication company based in Nairobi, Yaya center. The keyword enabled the system to send out messages through number **20880**. The system had 2 main modules; administration and SMS

1. **Administration (Admin)**

This module is responsible for general system administration. The admin could perform the following tasks:

- Set up the message to be sent
- Add clients to the system
- Set the proportion to receive messages
- Set data unblinding date
- Send message on demand to a client, group or all the clients.
- Add other admins though this was not necessary since we had one researcher

2. **SMS module**

This module is responsible for sending automated messages to clients. It kept track of expected date of delivery, the last time the message was sent to a particular client and the status of each message that is whether delivered or failed to send. The clients had provided their phone number and an alternative one as a fail-over number. The system the would send the message to the initial number and resend it to the second number in-case the first one failed to deliver.

**SYSTEM FUNCTIONALITY**

The researcher first collected data of the women under research. The system needed:
Due to the different collection time, data was keyed in 4 blocks (cohorts). The system then randomly selected those to send reminders in each block according to the proportion set. These were then blinded such that the researcher couldn't ascertain who could or couldn't receive the reminders. The unbinding was done at the end of the research period.

**Randomization**

Selection of the test group clients was done randomly. This selection helped create a test group to check their responsiveness to text reminders and a control group. The system would first compute the number of clients in the test group according to the proportion given. The below PHP function was used in the randomization process.

\[ \text{Rand}(\text{min}, \text{max}) \]

where:

- **min** is the lowest number
- **max** is the highest number.

Link: [https://www.w3schools.com/php/func_math_rand.asp](https://www.w3schools.com/php/func_math_rand.asp). The system put all the numbers in each particular group and put them in a 'bucket' usually referred to as an **array** in programming terms. The array is usually indexed with the first number assigned index 0 and the highest assigned the number of elements less 1, \((n - 1)\), where \(n\) is the number of clients. This array held the unselected clients. The system then created another array of selected clients which was empty initially. The system
then would take the index of the first number, 0, and assign it as the min, and the last number, n – 1, and assign it as the max, from the unselected array. It would then execute the function, rand (min, max). The client in the index selected would be removed from the initial array and moved to the selected clients array. The initial array is then re-indexed such that the min number is 0 and the max is now n – 2. This is to prevent having a non-existent index in the array usually referred to as a null item. This is illustrated below:

*Initial array (Unselected clients)*

<table>
<thead>
<tr>
<th>0</th>
<th>Client 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Client 2</td>
</tr>
<tr>
<td>2</td>
<td>Client 3</td>
</tr>
<tr>
<td>3</td>
<td>Client 4</td>
</tr>
<tr>
<td>N - 1</td>
<td>Clients n</td>
</tr>
</tbody>
</table>

If index 1 is selected, the array would look as shown below after re-indexing:

*Initial array (Unselected clients)*

<table>
<thead>
<tr>
<th>0</th>
<th>Client 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Client 3</td>
</tr>
<tr>
<td>2</td>
<td>Client 4</td>
</tr>
<tr>
<td>N - 2</td>
<td>Clients n</td>
</tr>
</tbody>
</table>

*Second array (Selected clients)*

| 0    | Client 2 |
This process was repeated until the size of the test group as stipulated by the set proportion was achieved.

**MESSAGING**

The prenatal reminders to pregnant women were sent within a week to the expected appointment day. The messages had been set in the following languages:

- Kiswahili
- English
- *Kitharaka*

Messages were then sent to the recipients in the language they were most efficient in as they had indicated in the questionnaire.
APPENDIX 13: EXCERPT OF THE RANDOMIZATION FROM COHORT 1

The first letter of each name is included in the table for confidentiality. Both phone numbers are also omitted for the same reason. N is No, Y is Yes while N/A is Not applicable; the control group did not receive SMS message delivery success was not applicable.

<table>
<thead>
<tr>
<th>First Name</th>
<th>Other Names</th>
<th>Phone Number</th>
<th>Alt Number</th>
<th>Health Facility</th>
<th>Language</th>
<th>Messaging Notification Reception Status</th>
<th>Message Delivery Success Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>M</td>
<td>TUNYAI</td>
<td></td>
<td>KITHARAKA</td>
<td>N</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>K</td>
<td>TUNYAI</td>
<td></td>
<td>KITHARAKA</td>
<td>Y</td>
<td>100.00%</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>K</td>
<td>TUNYAI</td>
<td></td>
<td>KISWAHILI</td>
<td>N</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>N</td>
<td>CHIAKARIGA</td>
<td></td>
<td>KISWAHILI</td>
<td>Y</td>
<td>100.00%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>A</td>
<td>TUNYAI</td>
<td></td>
<td>KISWAHILI</td>
<td>N</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>M</td>
<td>CHIAKARIGA</td>
<td></td>
<td>KISWAHILI</td>
<td>Y</td>
<td>100.00%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>M</td>
<td>CHIAKARIGA</td>
<td></td>
<td>KITHARAKA</td>
<td>N</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>K</td>
<td>TUNYAI</td>
<td></td>
<td>KISWAHILI</td>
<td>Y</td>
<td>100.00%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>K</td>
<td>TUNYAI</td>
<td></td>
<td>KITHARAKA</td>
<td>Y</td>
<td>100.00%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>M</td>
<td>CHIAKARIGA</td>
<td></td>
<td>KISWAHILI</td>
<td>Y</td>
<td>100.00%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>K</td>
<td>CHIAKARIGA</td>
<td></td>
<td>KISWAHILI</td>
<td>N</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>M</td>
<td>CHIAKARIGA</td>
<td></td>
<td>KITHARAKA</td>
<td>Y</td>
<td>100.00%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>M</td>
<td>TUNYAI</td>
<td></td>
<td>KISWAHILI</td>
<td>Y</td>
<td>100.00%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>K</td>
<td>CHIAKARIGA</td>
<td></td>
<td>KISWAHILI</td>
<td>N</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>M</td>
<td>CHIAKARIGA</td>
<td></td>
<td>KISWAHILI</td>
<td>Y</td>
<td>100.00%</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>K</td>
<td>CHIAKARIGA</td>
<td></td>
<td>KISWAHILI</td>
<td>N</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>K</td>
<td>CHIAKARIGA</td>
<td></td>
<td>ENGLISH</td>
<td>N</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>M</td>
<td>TUNYAI</td>
<td></td>
<td>KISWAHILI</td>
<td>N</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>K</td>
<td>TUNYAI</td>
<td></td>
<td>KISWAHILI</td>
<td>N</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>M</td>
<td>TUNYAI</td>
<td></td>
<td>KISWAHILI</td>
<td>Y</td>
<td>100.00%</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>K</td>
<td>TUNYAI</td>
<td></td>
<td>KISWAHILI</td>
<td>Y</td>
<td>100.00%</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 14: TRIAL REGISTRATION

15 January 2018

To Whom It May Concern:

RE: Utilization of Short Message Service to Enhance Uptake of Focused Ante-natal Care among Women in Tharaka Nithi County, Kenya

As project manager for the Pan African Clinical Trial Registry (www.pactr.org) database, it is my pleasure to inform you that your application to our registry has been accepted. Your unique identification number for the registry is PACTR201801002231314

Please be advised that your trial is registered under an initiative within our system that allow us to capture data of trials that are already in progress or completed. As such, your trial registration may not adhere to the mandates set forth by the International Committee of Medical Journal Editors for registration requirements, and it is your duty to be transparent to any journal that may ask about the retrospective status of your registration.

Please note you are responsible for updating your trial, or for informing us of changes to your trial. Additionally, please provide us with copies of your ethical clearance letters as we must have these on file (via email or post) at your earliest convenience if you have not already done so.

Please do not hesitate to contact us at +27 21 938 0835 or email epieniaar@mrc.ac.za should you have any questions.

Yours faithfully,

Elizabeth D Pienaar
www.pactr.org Project Manager
+27 021 938 0835

THE SOUTH AFRICAN MEDICAL RESEARCH COUNCIL
Cochrane South Africa | PO Box 19070, Tygerberg, 7505
Tel: +27 (0)21 938 0439 | Email: cochrane@mrc.co.za | Web: www.southafrica.cochrane.org