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High-risk Pregnancy Referral Cards Project

Assessing effectiveness of using high-risk pregnancy referral cards; identification of pregnancies at risk and referral to primary health care facilities

REPORT BY: IRENE ADEMA
PHILIPS R&D AFRICA.

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Project implementation and research work

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Research Reports

This report was compiled and written by Irene Adema and reviewed by Sarah Kedenge (Philips Africa Innovation Hub), Koen Joosse (Philips Foundation), Simona Rocchi (Philips Design), Dorothy Anjuri and Kenneth Kamande (KRCS).

ABBREVIATIONS

AMREF	Arica Medical and Research Foundation
ANC	Antenatal Care
BCS	Birth Companions
CHA	Community Health Assistant
CHS	Community Health Strategy
CU	Community Unit
CHA	Community Health Assistant
CHMT	County Health Management Teams
CHVS	Community Health Volunteer
CHW	Community Health Worker
CHEWS	Community Health Extension Worker
ESRC	Ethics and Scientific Review Committee
FGD	Focus Group Discussion
HRP	High Risk Pregnancy
ICBE	Internal Committee for Biomedical Ethics
ICC	Intra Cluster Correlation Coefficient
ICCM	Integrated Community Case Management
IDI	In Depth Interview
IEC	Information Education and Communication
KRCS	Kenya Red Cross Society
MCH	Maternal and Child Health
MNCH	Maternal Neonatal and Child Health
MMR	Maternal Mortality Ratio
MOH	Ministry of Health
MDG	Millennial Development Goal
MTM	Mother to Mother Support Group
NACOSTI	National Commission for Science, Technology and Innovation
PHC	Primary Health Care
SCHMT	Sub County Health Management Team
SDG	Sustainable Development Goal
TB	Tuberculosis
UNFPA	United Nations Population Fund
WHO	World Health Organization

EXECUTIVE SUMMARY

Background

The Maternal mortality ratio in sub Saharan Africa still remains high at 542 maternal deaths per 100 000 live births. Kenya is among the countries with high maternal mortality ratio in sub Saharan Africa (3). Despite the national decline in maternal mortality, the numbers are still high, and Kenya falls short of achieving the Sustainable Development goal of 70 maternal deaths per 100,000 live births. More efforts are required to address existing gaps in strategies aimed at tackling maternal mortality. Early detection and timely referral of at risk pregnancies enables proper management and is key in reducing maternal mortality. Lack of awareness on the risk factors and early signs of at risk pregnancies among women of reproductive age is a risk in itself and possess a challenge to achieving this. Equipping the community with knowledge on identifying at risk pregnancies can be achieved by strengthening the first level of contact of individuals, the family, and community. To this end, the International Committee of the Red Cross (ICRC), Philips Design and the Philips Foundation joined forces to help both lay and professional healthcare workers in providing better services to pregnant mothers with complications in fragile environments which often have limited to no access to electricity and connectivity. One of the results of this cooperation was the High Risk Pregnancy (HRP) Referral Cards: a portable set of tear-resistant cards, which is part of a more comprehensive toolkit aiming to support early detection of high risk pregnancies, and to encourage referral to health facilities for safe delivery. Though initially developed for fragile environments, we hypothesized that it would be of great benefit even in underserved communities in more stable environments where maternal and neonatal mortality is still high.

Study Objectives

The primary objective was to assess the effectiveness of the use of HRP cards in identifying and referring at-risk pregnancies at community and primary health care level. Specifically, we aimed to:

- To determine the proportion of new pregnancies correctly identified to be at-risk pregnancies using the high-risk pregnancy referral cards at community level.
- To determine the effect of the use of high-risk pregnancy referral cards on awareness of healthy pregnancy among community health volunteers and women of reproductive age.
- To determine the association between the use of high-risk pregnancy referral cards and utilization of ante natal care services at primary health care level

Methods

We adopted a pre and post-test clustered quasi-experimental design. A mixed methods approach was used in which qualitative and quantitative methods were combined in the design, data collection and data analysis methods. Study sites comprised of two intervention and two control

sub counties selected from two counties, Bomet and Siaya. To determine the number of at risk pregnancies identified using HRP cards, baseline and end line data was abstracted from registers at the health facilities in the study sites and analyzed. To assess the effect of HRP cards on community awareness of healthy pregnancy habits and risks and danger signs in pregnancy, quantitative surveys among women of reproductive age and qualitative interviews including in depth interviews and focus group discussions were conducted among community health volunteers, health workers and health management teams. Multilevel mixed effects ordered logistic regression models, were used to determine the association between knowledge of healthy habits in pregnancy among community members and use of HRP cards. Difference in difference estimation analysis was used to analyze the association between use of HRP cards and utilization of ANC services.

Research Scope

This research study focused on the outcomes of the use of HRP cards is not considered a research impact evaluation but an initial assessment of the effect of the HRP cards. Comprehensive monitoring and measurement of the research impact is a complex undertaking requiring the involvement of many actors evaluating changes brought about by the intervention over a period of time. As such, impact was not assessed. Mention of impact by study participants interviews loosely refers to the immediate effect observed. The study focused on assessing the immediate effect of the use of the HRP cards by community health volunteers, guided by the specific study objectives.

The use of the HRP cards was embedded within activities of the community health volunteers as defined in the community health strategy. Use of the cards was linked to other interventions within the health system such as promotion of NHIF and Linda Mama insurance and mother to mother support groups. As a result, other non-specific secondary effects not defined in the study objectives but observed during implementation are also reported.

This specific report details the findings of the study conducted in Siaya county. The report consist of eight chapters:

Summary of high level key learnings

The overall project touched about 265,000 lives across all 4 counties. We explored four themes during the research implementation. Learnings from these are summarized below:

Knowledge Transfer

- We detected a marked increase in knowledge on healthy habits, danger signs and risks in pregnancy among CHVs, Birth ambassadors, pregnant women and community members in general.
- However, we detected positive association between increase in knowledge of healthy habits and risks in pregnancy and use of HRP cards in the intervention site.

- Although not initially planned, utilization of the cards in Mother-to-mother support group and during male involvement fora contributed towards raising awareness on HRP cards.

Behavior Change

- The reorientation and equipping of traditional birth attendants with HRP cards facilitated change of roles and adoption of new practices. As a result, we realised a reduction of home deliveries conducted by or assisted by traditional birth attendants during the study period.

Increased ANC utilization

- We detected a notable increase in the number of referrals of at-risk pregnancies to the health facilities in the intervention site; from zero referrals of at-risk pregnancies at baseline to a total of 197 new referrals from the community to the four link health facilities during the study period. This was 4.6% of new pregnancies recorded in the intervention site during the study period.
- Health workers reported observing a reduction in the number of high-risk complications in pregnancy which they attributed to the timely referrals linked to use of the HRP cards.

Enhanced link between CHVs and primary health facilities

- Both health workers and community health volunteers reported an improved way of working with better feedback loop between health facilities and CHVs resulting in better follow up and completed referrals.

Chapter 1 : INTRODUCTION:

This chapter provides the broader context of this research study and presents an overview of the main themes addressed therein. It includes the statement of the problem focusing on the specific issues and research questions to be addressed by the research.

The World Health organization (WHO) classifies any death of a woman while pregnant or within 42 days of termination of pregnancy irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management as a maternal death (1). Global statistics on maternal mortality, approximated that 295,000 women died from preventable causes related to pregnancy and childbirth in 2017 (1). In the same year about 66% of all global maternal deaths occurred in Sub Saharan Africa (2) in where maternal mortality is higher in settings with women living in rural areas and poor communities. The global maternal mortality ratio (MMR) is estimated at 211 maternal deaths per 100 000 live births which represents a 38% reduction since 2000. The MMR in sub Saharan Africa still remains high at 542 maternal deaths per 100 000 live births.

At the time of adoption of the Sustainable Development Goals (SDGs,), the maternal mortality ratio in developing countries was 239 per 100 000 live births versus 12 per 100 000 live births in developed countries. As of 2017, the lifetime risk of maternal death in high-income countries such as Europe and North America is 1 in 4,800, compared to 1 in 56 in least developed countries, an indication that a substantial proportion of maternal deaths are preventable. Maternal mortality ranked highly among the top causes of death among women of reproductive age in Africa, see figure 1 below.

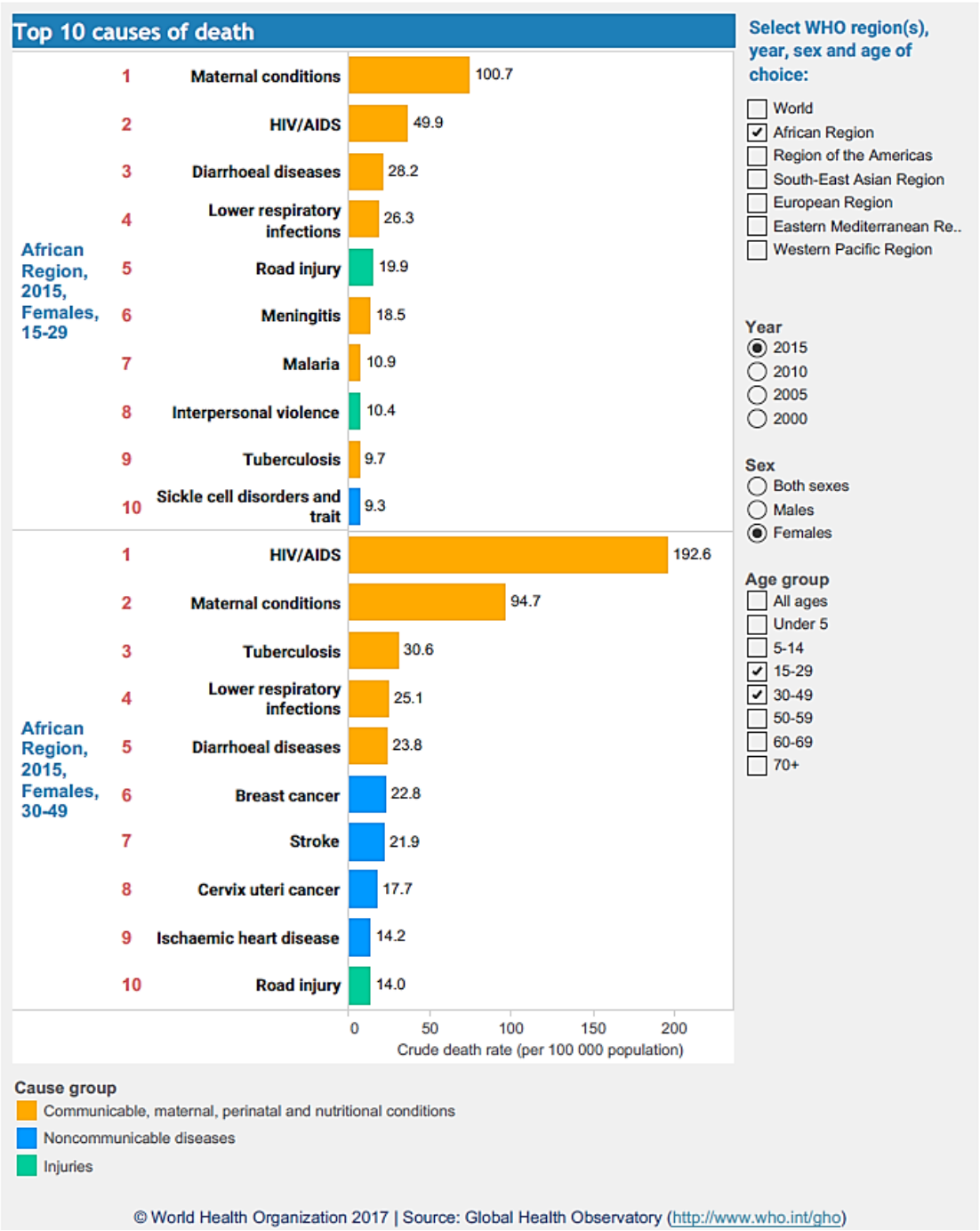


***Figure 1**: Summary of top ten causes of death among women of reproductive age in Africa in 2015*

Kenya is among the countries with high maternal mortality ratio in Africa (3). Recent statistics indicate that maternal mortality ratio in Kenya has fallen from 315·7 deaths per 100 000 in 1990 to 257·6 deaths per 100 000 in 2016 (4). Despite the national decline in maternal mortality, the numbers are still high compared to other neighboring countries. More regional disparities exist

within country. Reports by UNFPA showed that about 15 counties accounted for 98% of the country's maternal mortalities (UNFPA, 2016).

More efforts are required to address existing gaps in strategies aimed at tackling maternal mortality. Through the use of simple, clear and concise job aids and visual aids, at the community level by community health volunteers (CHVs) and increasing the knowledge amongst both the community members and birth assistants, better health seeking behavior can be embedded at the lowest levels for better maternal health outcomes.

Problem statement:

Deaths from medical complications that arise during pregnancy and after delivery are preventable and manageable if detected in time and attended to by skilled health workers . A gross proportion of these cases are found in Sub-Saharan Africa to which Kenya contributes. As a build-up on the momentum generated by the fifth Millennium Development Goal (MDG 5), a transformative new agenda for maternal health was laid out as part of the Sustainable Development Goals (SDGs) to reduce the global MMR to less than 70 per 100,000 live births by 2030 (5).

Advocacy campaigns and other health system improvement measures aimed at mitigating the rate of maternal deaths have been established. However, despite the existing political support and an enabling policy environment for maternal health, inadequate access to quality maternal health services, including ante-natal, delivery, and post-natal services continues to be a challenge. Many women still live long distances from health facilities and face other barriers to accessing quality care. Deaths of women from pregnancy related causes in Kenya remains unacceptably high and at the current rate, Kenya falls short of achieving its mortality reduction target.

Early detection and timely referral of at-risk pregnancies enables proper management and is key in reducing maternal mortality. Lack of awareness on the risk factors and early signs of at-risk pregnancies among women of reproductive age is a risk in itself and poses a challenge to achieving this. Equipping the community with knowledge on identifying at-risk pregnancies can be achieved by strengthening the first level of contact of individuals, the family, and community with the national health system and leveraging on already existing platforms such as community health strategy in Kenya.

In a bid to contribute to addressing this gap, The International Committee of the Red Cross (ICRC), Philips Design and the Philips Foundation joined forces to help both lay and professional healthcare workers in providing better services to pregnant mothers with complications in fragile environments which often have no or limited access to electricity and connectivity. One of the results of this cooperation was the High Risk Pregnancy (HRP) Referral Cards: a portable set of tear-resistant cards, which is part of a more comprehensive toolkit aiming to support early detection of high risk pregnancies, and to encourage referral to health facilities for safe delivery. The cards also aim to raise awareness on healthy pregnancy habits and importance of regular antenatal check-ups and safe delivery at healthcare care facilities. **We hypothesized that use of the cards in Kenya, a less fragile environment but with relatively high maternal mortality will also improve the identification of at-risk pregnancies, promote timely referrals and increase utilization of ANC services at primary health care facilities, resulting in better maternal outcomes and in turn contributing to reducing maternal mortality. To test this hypothesis, an evaluation of the effectiveness of the cards was required**.

Chapter 2 REVIEW OF LITERATURE:

This chapter discusses in detail the literature and previous research conducted in relation to identification and referral of at risk pregnancies to the health system. We detail a review of current evidence and gaps present which provide a justification leading up to the current study

- **High-risk pregnancies**

Maternal deaths are caused by complications during pregnancy or after childbirth most of which are, if detected in time, preventable or treatable. Other complications may exist before pregnancy but are worsened during pregnancy, especially if not managed as part of the woman's care. Determining the specific medical causes of maternal deaths is a challenge given that some of the births take place at home and go undocumented. A pregnancy is considered at-risk if there are medical conditions that may affect maternal or fetal health or life of the mother, fetus or both. High-risk pregnancies account for nearly 75% of maternal deaths due to risk factors such as pre-existing health conditions (hypertension, diabetes), overweight and obesity, multiple births, young maternal death, pre-eclampsia and infectious diseases (6).

- **Management of High-risk pregnancies**

It is particularly important that skilled health professionals attend all births, as timely detection and management of at-risk pregnancies can make the difference between life and death for both the mother and the baby. Other factors that prevent women from receiving or seeking care during pregnancy and childbirth include poverty, distance, lack of information, inadequate services and cultural practices. To improve maternal health, barriers that limit access to quality maternal health services must be identified and addressed at all levels of the health system.

- **Barriers to proper referrals**

Geographical and financial accessibility are well-documented reasons for abstaining or delaying obstetric referral at the community level. The decision for or against referrals often depends on the balance between effort, resources needed and subsequent treatment and the perceived benefit of the treatment in hospital (7). Other reasons that hospital care is avoided include poor interpersonal skills and attitudes and incompetence of health workers, stigmatization and discrimination and

especially to rural women who are afraid of unfamiliar environment and deeply rooted in tradition and mostly use traditional birth attendants (8).

Efforts to strengthen the health referral system through utilization of community health volunteers (CHVs) have been made through various interventions in majority of the low-income regions. In Kenya, the community health strategy remains a key component to the attainment of Universal Health Coverage that will lead to reduction of maternal mortality in an effort to attaining SDG 3. Currently the community health strategy stipulates that high-risk pregnancies identified at the community level be referred to the nearest immediate primary health care facility (9). Community health volunteers work closely with the primary health care facilities however most referrals are made based on severity. The CHVs often miss out on detecting early signs of high-risk pregnancies, a gap that we hope to address by equipping the CHVs with the necessary knowledge to detect high-risk pregnancies at an early stage and make referrals in good time to allow for timely interventions.

- **Use of information, education, and communication (IEC) materials and job aids**

Job aids are cost effective instruments used on the job, in several fields including health, to improve human performance by enhancing the knowledge and/or skills of performers (10). There are three main types of job aids in healthcare namely: reminders including process flowcharts; picture aids; and pocket manuals most of which have been digitized recently (11). They enhance performance by reducing errors caused by poor recall and faulty decision making, promoting compliance with standards, and reducing costs of training and retraining (12). Studies have also shown improvement in client performance after use of job aids. Although job aids have been introduced to community health workers in a large number of international health projects, the literature available on the actual use by such workers is very limited. We envision that use of visual teaching/job aids will enable CHVs to easily share their health messages and for the women to remember the content by the use of graphics.

The high-risk pregnancy referral card is a basic teaching/job aid concept designed to identify at-risk pregnancies at the earliest possible and facilitate timely referrals from the community level to the health facility. The cards are also designed to raise awareness among the community as regards healthy and unhealthy habits in pregnancy.

The High-Risk Pregnancy referral cards comprise of a portable and durable set of cards which double up as a teaching aid, showing a range of high-risk symptoms during pregnancy. The pictures represented on each card have been tested in health centers in Africa, and local-language versions of the cards specifically designed for communities in the selected study sites.

The cards (Figure 2 below) are intended to aid in to identifying high-risk pregnancies for earlier referral to healthcare facilities and to educate & raise awareness on practices for healthy pregnancies. The cards were initially designed to help both lay and professional healthcare workers in providing better services to pregnant mothers with complications in fragile environments which often have no or limited access to electricity and connectivity. However, we hypothesize that it will be of great benefit even in underserved communities in more stable environments where maternal and neonatal mortality is still high.

Figure 2: *High Risk Pregnancy (HRP) referral cards*

Chapter 3 : RESEARCH OBJECTIVES

This chapter provides a detailed overview of the research objectives and the conceptual framework. The main research questions and study hypotheses are also expounded.

Primary objective:

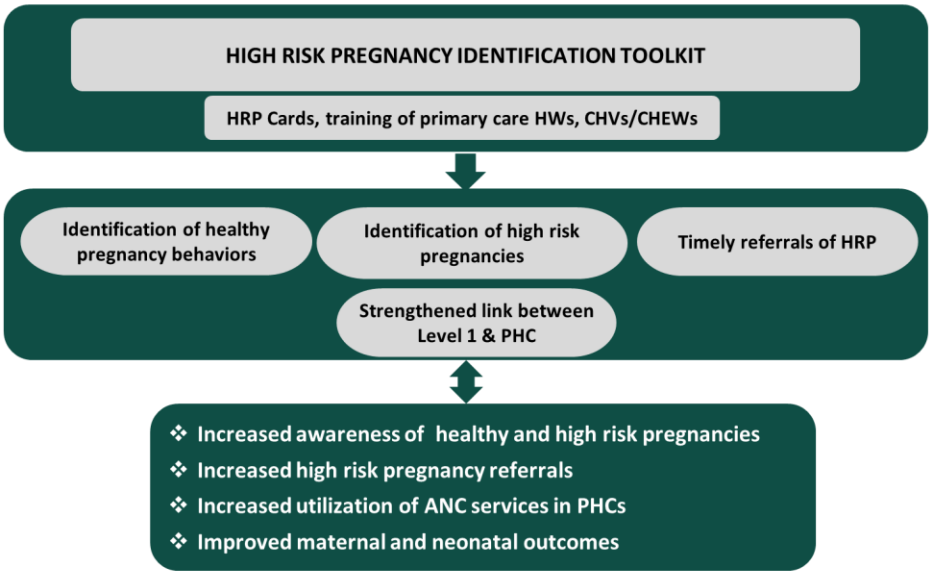
The primary objective of the study is to assess the effectiveness of the use of HRP cards in identifying and referring at-risk pregnancies at community and primary health care level.

Secondary objective(s):

The secondary objectives of this study are:

- To determine the number of at-risk pregnancies correctly identified using the high-risk pregnancy referral cards at community level.
- To determine the effect of the use of high-risk pregnancy referral cards on awareness of healthy pregnancy among community health volunteers and women of reproductive age.
- To determine the association between the use of high-risk pregnancy referral cards and utilization of ante natal care services at primary health care level

Conceptual Framework



Research Questions and Hypotheses

Research Questions:

The primary research question was : **are HRP cards effective in identification and referral of high risk pregnancies from the community to primary health care facilities?**

This question was further broken down into five sub-questions, as follows:

1. what is the effect of the high risk pregnancy cards on awareness of healthy and at risk pregnancies among CHVs and women of reproductive age?
2. What proportion of at risk at risk pregnancies can be identified and referred using the HRP cards information?
3. Is there an association between use of HRP cards and utilization of ANC services at primary health care facilities?

Study Hypotheses:

The sub-questions resulted in five study hypotheses outlined below:

- The HRP cards will increase awareness of healthy and at risk pregnancies among CHVs and women of reproductive age.
- Knowledge from the HRP cards will enable CHVs to identify at risk pregnancies
- Knowledge from the HRP cards will enable CHVs to refer at risk pregnancies to primary health care facilities.
- There is an association between use of HRP cards and utilization of ANC services at primary health care facilities
- Use of the HRP cards will increase the referrals of at risk pregnancies to PHC facilities.

Chapter 4 METHODS:

This chapter describes the design of the research study and the methods that were used in implementing the research. We provide details of the study setting, study participants, inclusion and exclusion criteria and a sample size justification.

Study Design

This study is not considered a research impact evaluation but an initial assessment of the effect of the HRP cards. The study adopted a pre and post-test clustered quasi-experimental design with a mixed methods approach utilizing both quantitative and qualitative data collection methods.

Study site

The study is part of a broader project implementing the use HRP cards in the community. The research was conducted in Bomet and Siaya counties in Kenya. This report details finding from the study in Siaya County

Siaya County was randomly selected from a list of counties which contribute to high maternal mortality in Kenya and supported by the fact that it has fully functional community units. Two sub counties were selected from the county, Rarieda and Ugenya sub counties. Selection of the sub counties was conducted by the County Health Management Team (CHMT) in collaboration with the research team and was based on the sub-county maternal mortality indicators, presence of functional community units, absence of similar parallel donor activities in the research sub-counties and the physical distance between the sub counties.

Study population

The study participants were broadly categorized into three:

1. Community health assistants and community health volunteers (CHAs & CHVs) from the community unit attached to the health facilities in the Rarieda county.
2. Primary health care workers working at the selected facilities in Rarieda sub county.
3. Women of reproductive age in the community units in Rarieda and Ugenya sub counties

The characteristics of the study participants, inclusion and exclusion criteria are described below.

- **Community Health Volunteers**

  Inclusion Criteria

  1) Living and offering service in the study catchment areas
  2) Aged between 18- 65 years.
  3) Provision of written informed consent.
  4) Willingness to use HRP cards and submit usage data

  Exclusion criteria

  1) Inconsistency in offering services to the community
  2) Refusal to provide consent to participate

- **Primary health care providers**

  Inclusion Criteria

  1) Working in the selected health facilities
  2) Provision of written informed consent.
  3) Willing to use the HRP cards.

  Exclusion criteria

  1) Refusal to give informed consent.
  2) Unavailability during the study period

1. **Women of reproductive age**

   Inclusion Criteria

   1) Women aged 18-49 years
   2) Visited by the community health volunteers
   3) Provision of written consent

   Exclusion criteria

   1) Inability to communicate in English or Swahili or local language.
   2) Residing outside the health facility catchment area.
   3) Refusal to consent to participate.

Sample Size and Justification

The study was based on a multistage sampling design. The first stage was purposive sampling of the study counties. Counties were selected based on their maternal mortality rates and the national community health strategy implementation status.

Selected counties were in the process of implementing the national community health strategy. The second stage of sampling was the selection of sub-counties in the research counties. This was done based on guidelines from the county health management teams.

The third stage of sampling was selection of clusters represented by CHVs in the study. Estimates for the calculation of the final sample size for the surveys were derived from a previous quasi experimental study aimed at assessing effectiveness of CHVs in promotion of health services in a rural community in Kenya. The intra-cluster correlation coefficient (ICC) was obtained from the 2005 WHO global survey on maternal and perinatal health. Using the previous ANC utilization estimates, an estimated cluster size of 100 in both the intervention and comparison arms, an ICC of 0.161 and a 95% confidence level to obtain power of 0.90, a minimum sample size of 900 participants in each arm was required. Considering the attrition rate of 40% and a non-response rate of 25%, the sample size was optimized to 1500 participants per study arm.

Ethical Considerations

Ethical approval was provided by the Internal Committee Biomedical Experiments (ICBE) of Philips Company (ICBE-2-32190, August 23, 2019) the AMREF Ethics and Scientific Review Committee (ESRC) in Kenya (ESRC P701/2019, September 27, 2019) and the National Commission for Science, Technology & Innovation (License No: NACOSTI/P/19/1996, October 23,2019). The study was conducted following the ethical considerations of the protocol.

Informed consent was asked of all respondents and participants of the study who were informed that they could refuse to answer questions and could stop the participation at any time without any repercussions. Data collection was done in safe and comfortable environments. Only the research team had access to the data and identifiers were removed from the transcripts. The research team included male and female research assistants who spoke the language of the study area where necessary. Prior to data collection, the research team was trained on ethical issues to ensure that guidance on ethical conduct was clearly understood and implemented.

Research study procedures

This chapter provides a detailed account of procedures and processes followed during the running of the research study. The study comprised of three main phases, a baseline survey phase, an implementation phase and an end line survey phase. Details of activities conducted in each of the phases are elaborated below.

Project preparations

Prior to commencement of the research, National engagement meetings were held with the division of community health and division of reproductive health at the Ministry of health to get a buy in. The project objectives were presented and approval to proceed granted.

Figure 3:*Siaya CHMT engagement meeting and HRP cards TOT Training*

County level engagement meetings were held with the county health management teams. Identification of specific sub counties and community units to involve in the study were decided by the county health management teams.

Baseline data collection

Baseline data collection was conducted before the implementation of the interventions. After selection of the community units, community health assistants and community health volunteers from both the intervention and comparison sub counties, a listing of all households visited by the CHVs was developed. The women of reproductive age in these households were visited by field staff and asked for consent to participate in the survey. A questionnaire to collect demographic details, details of their knowledge on healthy and at-risk pregnancies, contact with CHVs among other relevant questions was administered.

We also conducted a baseline data abstraction exercise from the facilities for the year prior to the study. The data was abstracted from records from the public health facilities to which the area CHVs are linked. We abstracted the data from the Ministry of Health tools; MOH 100, MOH 514, MOH 513. The main indicators collected included data on number of pregnant women referred for ANC and ANC defaulters referred and data on referrals of high-risk pregnancies from MOH 100 referral forms.

Implementation phase

Implementation phase began after completion of baseline surveys. The CHAs, CHVs and the primary health care workers from Rarieda the intervention sub-county, were trained on the use the high-risk pregnancy cards. All participants were given a refresher training on in addition to the usual iCCM training, identifying healthy pregnancies and high-risk pregnancies using the cards as a guide as well as a module on Hybrid Maternal Infant and Young Child Nutrition (MIYCN). Reorientation sessions for the traditional birth attendants (TBAs) to birth companions within their area of jurisdiction were conducted with about 20 TBAs.

Upon successful completion of the trainings, CHAs, CHVs and TBAs were issued each with a set of the HRP cards to carry alongside their usual tools in the field during their household visits as stipulated in the community strategy. CHVs were instructed to note down any referrals of at-risk pregnancies that occur as a result of the knowledge gained from the HRP cards on their normal CHV referral forms (MOH 100) which are used to refer women to the health facility.

The CHAs, CHVs and the primary health care workers from sub counties selected for the comparison arm received only the standard iCCM training that is provided to lay and professional health workers according to the community health strategy. After the refresher training, CHAs and CHVs in the comparison/control arm sub counties continued with their usual. Study implementation lasted for a period of 13 months with periodic interruptions in study activities due to COVID-19 mitigation measures.

End line data collection

At end line, a quantitative survey similar to that conducted at baseline was carried out. Qualitative interviews were also held. In depth interviews were conducted with health workers and county

health management teams. Focus group discussions were held with CHVs, TBAs, mothers from mother to mother support groups and men from the male sensitization fora. In each FGD, study participants were seated in a semi-circle with the PI and notetaker. Before the discussion, each participant was given an identification number to be used throughout the discussion. All FGDs were recorded using digital voice recorders. Before recording, participants written consent was requested. The FGDs were conducted in either Swahili, English, Luo or Kipsigis language as per the participant's preferences. FGS were moderated by the PI a notetaker and the Kenya Red Cross Project Officer . each FGD lasted between 45 and 60 minutes. The study PI conducted all in depth interviews following similar procedure by first requesting written consent then recording the interview on a digital recorder.

Data analyses

All quantitative data was analyzed and summarized in tables and/or graphs to support the interpretation of the overall results. To test for baseline differences between intervention and control sites, chi-square tests for categorical variables was used. Multilevel ordinal logistic regression models were estimated on the likelihood of increased knowledge associated with use of the HRP cards as a function of sociodemographic and ANC utilization variables. While were primarily interested in the effects of the interventions, sociodemographic characteristics and prenatal care utilization can confound the relationship between the interventions and awareness of healthy habits and dangers signs in pregnancy. Therefore, we controlled for their effects and the effect of clustering by community unit in the analysis. In all analyses, $P<0.05$ was taken to indicate statistical significance. Variables which exhibited a high degree of multicollinearity were examine and one excluded from the analysis.

Digitally recorded FGDs were transcribed verbatim and later translated to English to facilitate analysis. Data were analyzed manually using qualitative thematic analysis approach. The analysis started by getting familiar with the data through reading the transcriptions several times to obtain a sense of the whole discussion. The PI and other researchers familiar with the context of the topic manually did independent coding. Thereafter, a preliminary coding structure was agreed upon and a codebook was created. The additional codes which emerged during coding process were added concurrently. Saturation was achieved after reviewing and coding emerging themes from all interviews when there was no more new information obtained.

Chapter 5 RESULTS

This chapter presents the results of the research study, we describe how the scientific questions were tested and detail the findings. The chapter is divided into three sections. The first section expounds on the results from the operational aspects of the implementation. The second section details the findings from the surveys conducted among women of reproductive age. The third section presents results from the analysis of ANC utilization data abstracted from health facility registers.

Section 1: HRP cards implementation operational results

Summary

This section describes the operational results obtained from the qualitative data (in depth interviews and focus group discussions with CHVs and health workers). We detail how the HRP cards intervention was fit within the existing community health strategy and health system, the enablers of the use and uptake of the interventions by the different study participants. An overview of the highlights below.

Key Highlights

- A total of 210 CHVs were trained and equipped with HRP cards for use in raising awareness, identifying and referring at risk pregnancies to the health system.
- Use of the HRP cards was incorporated into the CHV roles as directed in the community health strategy. The cards enhanced CHVs roles by adding the task of educating the community members on healthy habits in pregnancy, risks and danger signs in pregnancy, identifying at risk mothers and referring them to health facilities for management.
- Use of the HRP cards was further optimized by incorporating 20 TBAs who were reoriented from the traditional role of conducting home deliveries to the role of raising awareness using the HRP cards, identifying and referring at risk pregnancies to the health facilities for delivery.
- All participants were impressed by the HRP cards content, color, size, material and weight. The use of pictorial illustrations and local language in the cards was a key highlight of the design.
- A total of 33 mother to mother support groups with a reach of 781 women were formed in the intervention sub county. The mother to mother support groups focused using the HRP cards with the expectant women in the community.
- CHAs experienced challenges in raising awareness of the HRP cards among men in Rarieda county.

CHV roles in maternal health

CHVs and TBAs were the main groups targeted to use the HRP cards in the community. As such we endeavoured to evaluate the roles of these individuals in the community before and after the introduction of HRP cards. We held six FGDs, four with CHVs and two with TBAs. CHVs mentioned that their responsibilities included health promotion, tracing defaulters in ANC, TB treatment and immunization, promotion of community sanitation and hygiene, education of community members on prevention of communicable diseases during household visits and dialogue days, creating awareness of disease outbreaks, updating household registers, referring ill community members to health facilities, conducting iCCM and communicating ministry of health directives on community health to the community. One of the CHVs had this to say about their roles :

> *"My work is to go visit clients in the community and if I find they have any problem with regards to health, I advise them. The one that is serious I am forced to write for them a referral and I refer them to the health centre"* ***CHV Ochienga Siaya***

The most predominant role mentioned was 'acting as a link between the community and the health facilities and referring sick members of the community to the health facility. This was reiterated in interviews with the health workers and members of the sub county health committee. Health workers felt that the CHVs played a critical role in the health system commenting that the CHVs lived among the people and knew the community members 'in and out'. This ensured that the community members trusted and respected them. One nurse in Rarieda commented:

> *"CHVs are critical to our work with women…I think we are privileged to have them work with us because they connect us, they link us with the community so that when we receive these clients, these patients from the community one can understand where they come from…. And we are able to deal with them as individuals…"* ***Nurse Rarieda Siaya***

In matters maternal health, CHVs from Siaya had an added role of screening women in the community using pregnancy test kits with the aim referring women for 1st ANC on time. Pregnancy test kits were provided by the county government. Due to this intervention the baseline proportion of women attending first ANC in Siaya was relatively high.

Following the introduction of HRP cards, CHVs roles were expanded with the addition of the task of educating the community members on healthy habits, risks and danger signs in pregnancy, identifying at risk mothers and referring them to health facilities for management.

TBA roles in maternal health

At baseline, the role of TBAs at was majorly to conduct home deliveries. To optimize the use of the HRP cards, we sought to reach all traditional birth attendants in the project sites and reorient them from their traditional role of home deliveries to the role of raising awareness using the HRP cards and referring (sometimes accompanying) pregnant women to the health facilities for delivery.

During FGDs, TBAs narrated how they previously handled pregnant women and conducted deliveries. They acknowledged that before reorientation, they ignored the risks and sometimes maternal and neonatal deaths occurred due to their negligence. One of the TBAs reported:

> "*… we would help them deliver without gloves because you had to buy gloves, or an organization must have trained you then supply you and there was none. And without them, you touch the baby with your hands…" Indeed, it was risky, a mother would come to you and you think she is okay but after delivery, there is bleeding, and she just dies."*
> ***TBA Rarieda subcounty, Siaya.***

Figure 4: *Collage of TBAs from Rarieda reoriented to Birth Companions*

A total of 20 TBAs from Rarieda were reoriented and re-branded "Birth Companions" (BCs). As birth companions, they were asked to refer women to the CHVs for pregnancy testing. For those they found pregnant, they were to sensitize them on the healthy habits to adhere to and risks and danger signs to look out for using the HRP cards and refer them to a health facility for management. In case they encountered women who required assistance in delivery, the new BCs were asked to refer them to the health facilities for delivery. The new BCs in the project embraced their new roles wholeheartedly. They understood the risks involved in delivering at home and one of the BCs had this to say:

> *"…and they did well by telling us to stop delivering women at home because sometimes we are helping deliver a woman who is not strong and she can die in your hands. She might bleed a lot and maybe she has other conditions like swelling feet or things you can't see, and she cannot deliver at home."* ***TBA Rarieda sub county Siaya***

Below is an excerpt of some of their testimonies in their capacity as birth companions during FGDs:

> *"since I was given a book to train pregnant women, when she comes to me to check her stomach, I open the book and show her what is inside. Like if a baby is lying the wrong way, you go to the hospital, even if your stomach hurts and it's not yet time you go to the*

hospital. now they have been coming to me am I take some of them to hospital" ***TBA Rarieda sub county Siaya***

Health workers in the intervention community units appreciated the reorientation of the TBAs and reported in interviews noticing a difference in the TBA operations. A community health assistant summarized it as below:

"…before the clients or the mothers would just go to the BCs or the TBAs and then they give birth there in their homes. But after the training, the TBAs became BCs and then they could work well with the CHVs. the mothers still had confidence in the new BCs. So they could still visit them, but after the training the BCs could now accompany the mothers to the health facilities, they call the CHVs of the village and then they accompany these mothers to the health facilities." ***CHA Madiany CU, Siaya***

The link between the CHVs, BCs and health workers was also enhanced with all three working together to ensure the mothers had safe pregnancies and successful delivery. The reproductive health coordinator had this remark:

"So when this project came, we were able bring them together so that we work with them as partners, and it has been good. There is a day the birth companion came here and said I want a referral tool; she was demanding here. So that tells you they were brought on board as partners. "***RH coordinator, Siaya county***.

HRP cards Training

A total of 210 CHVs and 20 traditional birth attendants from twenty community units in Rarieda sub county were trained on the use of HRP cards. A one day training was conducted in each of the community units by the reproductive health coordinators working together with the community health focal persons and CHAs who had been sensitized as the trainer of trainers. CHVs were happy with the training and reported that it was very thorough and comprehensive. However, majority felt that the duration was short and felt rushed and suggested adjustment of the training duration to more than one day with periodic refresher sessions. One of the CHVs had this to say about the training:

"The training itself was good and there was nothing wrong, but we wanted to be added time to... So we are requesting if you can provide a refresher course on this booklet." ***CHV Akom CU Siaya***

On request, refresher trainings were conducted by the CHAs for specific community units in the course of the implementation period as explained by some of the CHVs and CHAs in the focus group discussions.

Figure 5: *CHV training session on HRP cards in Rarieda*

Figure 6:*CHV training session in Rarieda*

HRP card content and quality

We asked participants about their first impressions towards the HRP cards and recorded mixed views. Majority of the health workers were happy with how well summarized the cards were. One of the nurses in the link facilities reflected on the cards as below :

"…This is for education to the pregnant lady, right? A good tool, it's a summarized way of giving the maternal health education depending on the trimester." ***Nurse Madiany CU, Siaya***

This was echoed by most of the health workers and county health team members. One of the nurses initially thought the HRP cards were just a duplication of the content they already had but later reported that the cards were more informative:

"so initially we were like oh, this is like duplication of information because we already have this thing in the ANC booklet you know. Even when you were telling the CHVs to use the card we were like no… that information is in this book that we normally counsel the mothers. Then as they started using it, we all saw the essence of the card, way more content on risks in the HRP card" ***Nurse Rarieda, Siaya.***

The CHVs also expressed enthusiasm when they first received the cards. Majority were impressed by the pictures and color of the cards. The quality of the cards was commended by all respondents. The material of the card was applauded for being tear proof and waterproof. All the HRP cards given to CHVs were in good condition at end line. An elated CHV remarked on the design of the card:

"…you know we really learn a lot from hearing, but we learn much more when we are able to hear and also see. Because whatever we are able to see really is imparted in our mind. And of course it is difficult for it to be erased from the mind it really stays in the mind longer, after longer period, that is the case of this HRP cards" ***CHV Rarieda, Siaya.***

The color design was well understood with most associating the red color with danger and green with safety as mentioned by a health worker in an in depth interview:

"I want to appreciate the fact that the people who are doing this book decided to use different colors. So these colors you can see red, green… so red on this side, these ones are the harmful, like the bad, the high risk, the bad side. Then the green side now has the good, after you tell a mother this is bad, you can also be able to tell them the good ones" ***Sub County Nurse, Rarieda Siaya***

CHVs were pleased with the size of the card explaining that it was portable and not bulky. The use of pictorial illustrations resonated as a key highlight in the design of the cards in all CHV focus group discussions.

Figure 7: *A group of CHVs attending a refresher on HRP cards*

We also examined the participant's views on the content of the HRP cards. At the national and county management level, the teams approved the content and messaging in the HRP cards and granted approval to use the card in the communities. Health workers pointed out that in addition to the risks and danger signs present in the mother to and child booklet which has seven risks, the HRP cards offered more information which was previously only privy to the health workers. They termed the card a very informative tool.

> *"…they have realized that there were new danger signs that were not in the former mother-to-mother child booklet or the former guidelines. Like for example by just a mother carrying twins, it was not known that that one is a high-risk pregnancy. And then just maybe another one is a short mother who could put on size four shoes. That one most of the people never knew that one is risk in pregnancy"* ***CHA Rarieda, Siaya***

The sentiments were reiterated by both the CHVs and TBAs as expressed by one of the TBAs who likened the HRP cards to a bible which guides then on risks in pregnancy. An excerpt during an FGD says:

> *"when a pregnant woman comes to me, this is the book I use to teach her. I use this bible that we were given to teach her. I open and we talk about it… that is the teaching I can give her and this bible, my HRP card, is what helps me talk to her about how she should behave during pregnancy."* ***CHV Rarieda, Siaya.***

The use of pictures was mentioned as a big advantage and some of the participants reported that they actually identified with the illustrations.

> *"…You see this page, this is just me. I thought that these people had taken a photo of me. [Laughter] I have given birth to 14 children. By myself. 14 children, there was a period I could not go to functions at our home. I had one on my back, I was carrying another one, and one in my stomach …I could not go far because how was I going to carry them? I couldn't. So I thought this book was about me."* ***TBA Rarieda , Siaya****".*

Mother to Mother support groups

To ensure maximum impact of the HRP cards in reducing complications in pregnancy and averting maternal deaths, with the guidance of the community health assistants and Kenya Red Cross project officers, CHVs went a step further and targeted the actual pregnant women within their communities. This was done by seeking out expectant women and lactating mothers within the community units in small groups and providing them with a platform to discuss health problems, pass on important health information as well as sensitize them on healthy habits, risks and danger signs in pregnancy using the HRP cards. These forums of women were referred to as mother to mother support groups (MTM). A total of 33 mother to mother support groups with a reach of 781 women were formed in Rarieda sub county. Mother's whose children were above 3 months were allowed to exit the group. In addition to lessons on the HRP cards, mothers were taught how to develop a birth plan, registered to "Linda Mama", a pregnancy cover, and to the national insurance scheme NHIF.

***Figure 8**: Pregnant women attending a mother to mother support session*

Through these platforms, the mothers were also able to start saving schemes called "merry go round" within their villages which benefited them financially. The effect of the mother to mother support groups was felt by mothers who even became ambassadors to other women in the community. Two of the mothers had this to say about the MTM support groups:

> *"since I started coming here, I have learnt a lot such that if I meet a pregnant mother who has not started attending clinic, I can talk to her about the good things to do when pregnant and benefits of attending clinic and the dangers of just staying home..."* ***Mother-MTM Rarieda, Siaya***

> *"the teaching in this book has helped me because I know that if I get pregnant, I should attend clinic early and before I saw that book I would wait for long, up to six months before going for clinic. That book has taught me that there could be risks and dangers and I know that I should go start going to the clinic immediately"* ***Mother-MTM forum Rarieda, Siaya***

Male involvement in pregnancy

Due to the patriarchal social system and the influence of the men and husbands in the household and community, it was deemed necessary to involve the men in the HRP project as some of the decisions affecting the women's pregnancy were decided by the men. To ensure the men in the community were on board, male sensitization fora were planned. Male sensitization fora were meetings that were to be organized by the community CHAs and the CHVs where men of mixed ages would be invited to discuss health matters particularly on the HRP cards. However, despite

planning for these fora, due to COVID-19 restrictions, CHAs were not successful in conducting them. The men were also not easy to reach as explained by the CHA.

> *"Male involvement is a big problem in this area. I don't know, maybe it's because they are next to the lake and night they are at the lake and during the day, they are sleeping. So interacting with them is quite a challenge."* ***CHA Rarieda, Siaya.***

Section2: HRP CARDS KNOWLEDGE SURVEY

Summary

This section addresses the objective which seeks to determine whether the use of the HRP cards increases the awareness and knowledge about healthy habits and risks /danger signs in pregnancy among women of reproductive age. To determine the effect of the use of high-risk pregnancy referral cards on awareness of healthy habits and risks in pregnancy among women of reproductive age in the community, we conducted surveys before and after the intervention in both intervention and control sub counties and compared the results. The section is divided into three parts: a description of survey participant sociodemographic characteristic, the results of analysis of knowledge of healthy habits in pregnancy and results of analysis of knowledge on risks and danger signs in pregnancy.

Study timelines

The baseline survey was conducted in October 2019 followed by an implementation period of thirteen months from November to December 2020 when CHVs moved in the community raising awareness using the cards. End line surveys were conducted in December 2020. The survey targeted CHVs, health workers and women of reproductive age in the two sub counties.

Part 1: Survey Participant Demographic characteristics

Rationale: To determine the actual association of the HRP cards and women's knowledge in intervention sites, we sought to account for the effect of variables most likely to contribute towards differences in knowledge level among participants in both intervention and control sites. These factors include socio-demographic characteristics such as age, education level, marital status, number of children, income and employment status to understand the population dynamics and control for these variables in the analysis. In addition, we collected data on factors which affect access to healthcare and knowledge on community health services. These factors are likely confounders in our study. In this section we provide a detailed overview of the participant characteristics which are later included in the downstream analysis.

Key highlights:

- A total of 6,285 women of reproductive age consented to the survey and were interviewed: about 3,142 women at baseline and 3,143 women at end line.
- We detected some differences in the selected survey participants' age, education level, marital status, family composition and employment status at baseline compared to end line. These variables were factored during in the analysis

Survey participants were selected from ten community units in two sub-counties, Ugenya and Rarieda as the control and intervention sub-counties respectively. A total of 6,285 women of reproductive age consented to the survey and were interviewed: about 3,142 women at baseline and 3,142 women at end line.

Age: All participants were above 18 years and overall median age was 30 years. Majority (40%) of the participants in both study sites at baseline and end line were aged between 25 and 35 years. We detected differences in participant age profile by study site at both baseline and end line. There were more women below 25 years and between 25-35years participating in the survey at end line compared baseline in the intervention site. The reverse was observed in the control site with less women below 25 years and between 25-35 years participating at end line. (see table 2 below). Overall, about 7% of the participants were above 45 years.

Education: The proportion of participants with no formal schooling was similar at baseline and end line, one third of whom were below 35 years . In total, 97% of respondents had attended primary school 42% had completed secondary school and only 2% had received graduate training. Overall, about 15% more women had attended secondary school at end line across all study sites. See table 1 below for more details on participants' education profile. Figure 9 shows the comparison of level of education at baseline and end line in intervention and control sub counties.

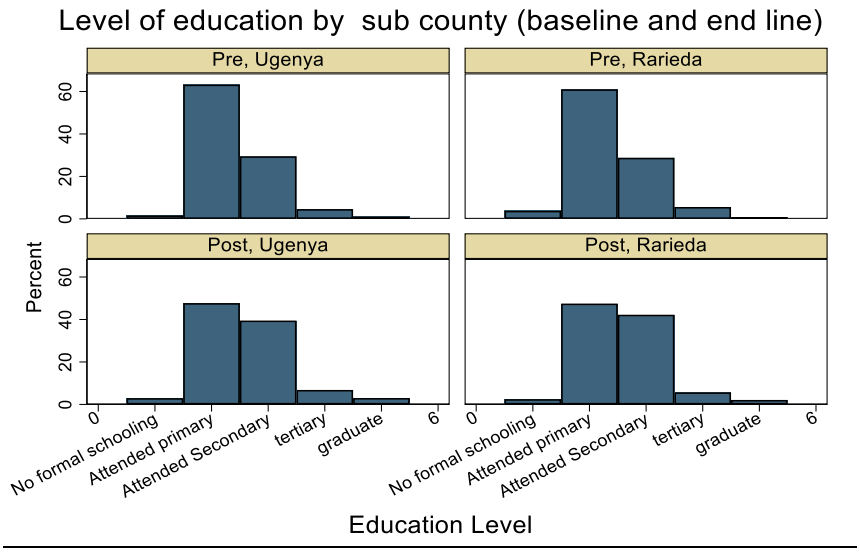


Figure 9: *Survey participants' education level*

Marital status and family composition: On average, four out of every five participants belonged to a nuclear family. Respondents who were married and living with their husbands made up about 60% of the participants. The proportion of single women at end line was higher in both study sites. We detected statistically significant differences in marital status profile at end line compared to baseline in both sites. In general 8% of the women in the survey were widowed. Of those women who were married, more than half got married between 18 and 30 years with about 20% getting married before they turned 18 years. This proportion was similar across both study sites.

Household size (number of people living and eating from same pot) among the participants ranged from 1 (living alone) to 18 family members with a median and mean of 5 family members. The number of children per participant ranged between 1 -12 children . Only 13% of the respondents had no children. Half of the study participants had between one and three children with only 1% of the participants having more than ten children. The distribution of children per participant was similar at baseline and end line in the intervention site. Differences were detected in the control site.

Table 1: *Survey participants' demographic characteristics*

Characteristic	Intervention (Rarieda)			Control (Ugenya)		
	Pre	**Post**	**P value***	**Pre**	**Post**	**P value***
Age						
<25 years	493 (32)	471 (29)		426 (27)	420 (28)	
25-35 years	673 (42)	622 (38)		563 (36)	610 (40)	
35 - 44 years	322 (20)	409 (25)		4141 (27)	371 (24)	
>45 years	100 (6)	117 (7)	0.003	151 (10)	123 (8)	0.004
Highest Education						
No formal schooling	26 (2)	40 (2)		59 (4)	45 (3)	
Attended Primary	1,004(63)	769 (48)		948 (61)	727 (48)	
Attended secondary	468 (29)	684 (42)		447 (29)	602 (40)	
Tertiary	73 (5)	92 (6)		87 (6)	104 (7)	
Graduate	17 (1)	34 (2)	<0.001	13 (1)	46 (3)	<0.001
Family composition						
Alone	58 (4)	91 (3)		117 (4)	50 (3)	
Nuclear	1288 (81)	2507 (80)		2524 (80)	1181 (77)	
Extended	242 (15)	545 (17)	0.07	501 (16)	293 (19)	0.012
Occupation						
Student	26 (2)	25 (2)		15 (1)	49 (3)	
Employed	150 (9)	80 (5)		91 (6)	104 (7)	
Casual	8 (1)	3 (0)		5 (0)	1 (0)	
Self employed	474 (30)	425 (26)		306 (20)	378 (25)	
Unemployed	930 (59)	1085 (67)	<0.001	1136 (73)	992 (65)	<0.001
Marital status						
Single	258 (16)	321 (20)		269 (17)	337 (22)	
Married-living with husband	1045 (65)	989 (61)		915 (59)	877 (58)	
Married not living with husband	130 (8)	168 (10)		207 (13)	184 (12)	
Divorced	20 (12)	8 (0)		27 (2)	10 (1)	
Widowed	135 (9)	133 (8)	<0.001	136 (9)	116 (8)	<0.001

*Chi square test was conducted

Employment and income More than 65% of the respondents across both study sites were unemployed with less than 30% having a family income of more than ten thousand shillings per month. Average monthly income was significantly lower at end line in both sites. 15% of all respondents did not know their monthly income.

Table 2: *Survey participants' demographic characteristics, (Cont...)*

Characteristic	Intervention (Rarieda)			Control (Ugenya)		
	Pre	Post	P value	Pre	Post	P value
Number of children						
No children	154 (10)	252 (16)		205 (13)	265 (17)	
1-3 children	837 (52)	800 (49)		778 (50)	751 (49)	
4-9 children	585 (37)	557 (34)		559 (36)	497 (33)	
>10 children	12 (1)	10 (1)	<0.001	12 (1)	11 (1)	0.009
Family income						
0–10,000	1170 (74)	1180 (73)		1209 (78)	1079 (71)	
10,001–20,000	152 (10)	86 (5)		131 (8)	89 (6)	
20,001–30,000	68 (4)	32 (3)		38 (3)	29 (2)	
30,001–50,000	17 (10	7 (0)		11 (1)	11 (1)	
>50,000	4(0)	3 (0)		1 (0)	2 (0)	
Don't know	177 (11)	311 (20)	<0.001	164 (11)	314 (21)	<0.001
Disability (yes))						
Hearing disability	8 (1)	7 (0)		4 (0)	2 (0)	
Visual disability	36 (2)	19(1)		11(1)	16 (1)	
Physical disability	24(2)	32 (2)		24 (2)	43 (3)	
Mental disability	0 (0)	4 (0)		1 (0)	3 (0)	
Speech disability	1 (0)	2 (0)		3 (0)	2 (0)	
No disability	1516 (95)	1555 (96)	0.414	1505 (97)	1458 (96)	0.085

Access to health care indicators.

Nearest health facility: Out of all respondents 2,590 (42%) lived near a government dispensary. Nearly a third of the respondents listed a government health center as the nearest health facility. Level four and five government facilities were only easily accessible to 21% of the participants majority from the control site. A significantly higher proportion of women interviewed at end line could easily access a level 2 or 3 facility.

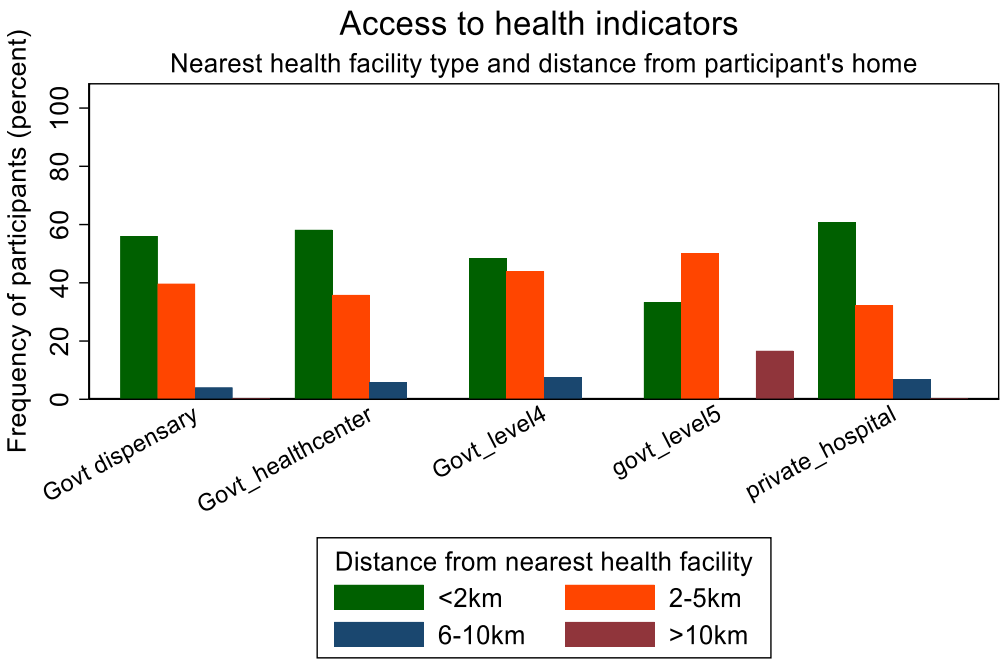


Figure 10:*Graph showing distance from participant's home to nearest health facility*

Distance to health facility: Participants were also asked about the distance to the nearest health facility. Of all participants who resided near a government dispensary, 1452 (56%) reported living less than 2 kilometers from the health facility, 1027 (40%) lived 2-5 kilometers away and only 4% had to cover more than six kilometers to get to the dispensary. Women in Ugenya, the control site had to cover more distances to access health facilities in comparison to those in the intervention site. Details of the distance and type of transport means used are shown in figure 11 below.

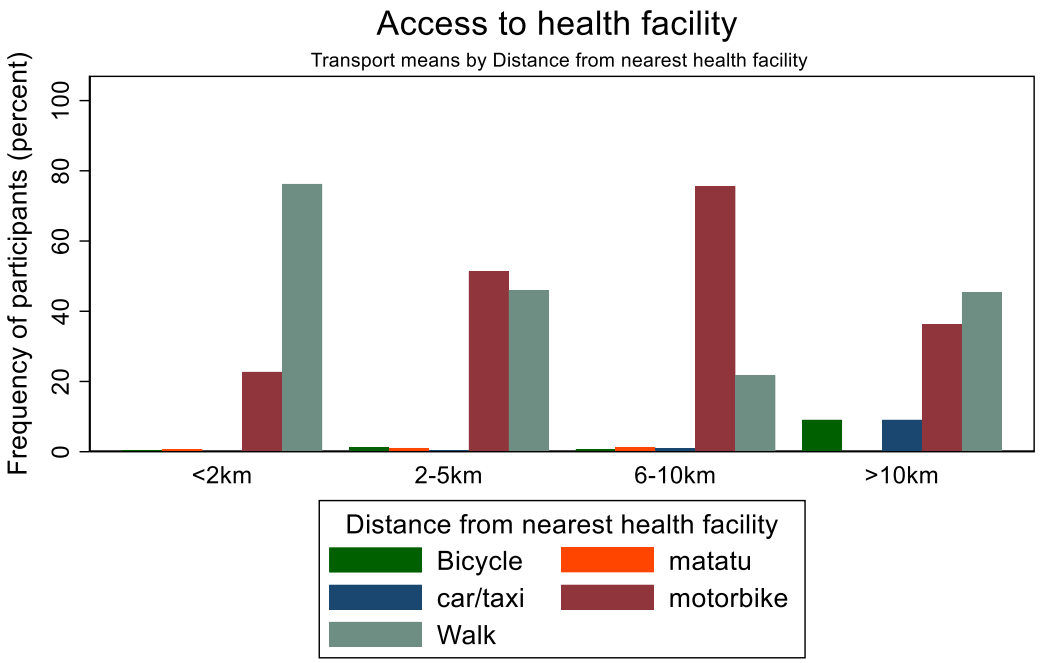


Figure 11: *Graph showing transport means used for each distance category*

Table 3*: Comparison of participants access to health facility indicators between intervention and control sites*

Characteristic	Intervention (Rarieda)			Control (Ugenya)		
	Pre	Post	P value	Pre	Post	P value
Nearest health facility						
Gov't Dispensary	983 (62)	857 (53)		330 (21)	420 (28)	
Gov't health center	240 (15)	466 (29)		589 (38)	588 (39)	
Gov't level 4	164 (10)	147 (9)		557 (36)	452 (30)	
Gov't level 5	1 (0)	0 (0)		2 (0)	3 (0)	
Private hospital	200 (13)	149 (9)	<0.001	-	61(4)	<0.001
Registered for NHIF/Linda Mama						
No	1301 (81)	1201 (74)		1068 (69)	1001(66)	
Yes	287 (18)	418 (26)	0.001	486 (31)	523 (34)	<0.072
Distance to nearest HF						
<2km	878 (55)	945 (58)		767 (49)	893 (59)	
2-5km	662 (41)	602 (37)		621 (40)	557 (37)	
6-10km	39 (2)	71 (4)		166 (11)	73 (5)	
>10km	9 (1)	1 (0)	<0.001	0 (0)	1 (0)	<0.001

To assess the preparedness and ability to pay for health services, we inquired whether participants were registered by any of the available insurance schemes in this case, Linda-Mama and NHIF.

The overall proportion of participants with insurance was higher at end line. The proportion of participants who had registered for insurance significantly higher at end line compared to baseline in the intervention site (OR=1.58, 95%CI 1.33-1.87).

Community awareness of CHV work and maternal health services.

Rationale: Since the information in the HRP cards reached the community though community health volunteers, knowledge of one's area community health volunteer and interaction with them is a key factor in determining whether the women will see or interact with the HRP card. We collected data on this indicator and included it in the downstream analysis. This data helps to explain why some of the women did not see or interact with the HRP cards.

Key highlights:

- Knowledge of the existence and work of community health volunteers increased over the study period in intervention site from 90% to 93% participants sensitized on CHV work in the community.
- The main reasons reported for attending ANC during their current pregnancy in both sites was for checkup (84%), for a follow up visit (28%) or due to illness(18%). Similar reasons were reported at baseline and end line.
- Despite living near health facilities 448 (8%) women who had previously been pregnant delivered at home. There was a 6% decrease in proportion of women assisted by a TBA during delivery at end line.
- In the intervention site, the likelihood of having received advice on complications in pregnancy was 50% higher at end line compared to baseline. (OR-1.50, 95%CI: 1.31-1.72, P=0.001). The likelihood of having received advice on complications in pregnancy in the control site did not change at end line compared to baseline (OR: 0.95 95%CI: 0.76-1.20 P=0.680).

Knowledge of area CHVs: We sought to establish the participants' level of knowledge concerning CHVs work in the community. About nine in every ten (88%) participants interviewed had heard about community health volunteers in general. Majority knew their specific area CHV and only 12 % of those who knew about CHV work (representing 10% of all participants) did not know their specific area CHV. The odds of having heard about CHVs and knowing the specific area CHV were greater among participants from Rarieda (intervention site) compared to Ugenya sub county overall (OR =1.83 95%CI 1.56 – 2.15). At baseline, about four in every five participants (88%) interviewed had heard about community health volunteers in general. Knowledge of the existence and work of community health volunteers increased over the study period in intervention site from

90% to 93% participants sensitized on CHV work in the community. The proportion was lower in the intervention site. There was a significant difference in CHV knowledge in both sites at end line.

The odds of knowing one's area CHV were 1.48 times higher in the intervention group at end line compared to baseline. At baseline, 46% of the participants in control site had received a visit within the last quarter from their area CHV. The proportion was 12% lower in the intervention site. At end line, there was a statistically significant difference with the proportion increasing in both the intervention and the control site. At end line, the proportion of participants who had never been visited by their area CHV reduced by about 50% in both the intervention and control sites. Table 4 below details the proportions in the study sites.

Previous pregnancy and ANC attendance: We detected no significant difference in the proportion of women who were pregnant or had attended ANC during their current and previous pregnancy at end line and baseline in both sites. Majority of the participants at end line (56%) reported accessing ANC services at a government health center. At end line, the main reasons reported for attending ANC during their current pregnancy was for checkup (84%), for a follow up visit (28%) or due to illness(18%). Similar reasons were reported at baseline with few participants reporting attending ANC due to advice received from a CHV, a TBA or a family member. About half of the women who had not attended ANC during their current pregnancy reported being healthy as the main reason. About 17% thought it was unnecessary, 6% reported the health facility as being too far and 4% were scared to go for ANC. See more details in table 4 below

Table 4: *Comparison of knowledge of CHVs services and maternal healthcare utilization among women of reproductive age in intervention and control sites*

Characteristic	Intervention (Rarieda)			Control (Ugenya)		
	Pre	Post	P value	Pre	Post	P value
Heard of CHVs						
No	156 (10)	111 (7)		233 (15)	206 (14)	
Yes	1432 (90)	1508 (93)	0.002	1321 (85)	1318 (87)	0.001
Know area CHV						
No	104 (7)	107 (7)		216 (17)	162 (12)	
Yes	1328 (93)	1401 (92)	0.861	1105 (83)	1156 (88)	0.003
Pregnancy status						
Not pregnant	1469 (93)	1488 (91)		1431 (92)	1401 (91)	
Currently Pregnant	119 (7)	131 (8)	0.528	123 (8)	123 (8)	0.873

Attended ANC (current pregnancy)						
No	25 (21)	18 (14)		36 (29)	29 (24)	
Yes	94 (79)	113 (86)	0.128	87 (71)	94 (77)	0.311
Previous pregnancy						
No	173 (11)	300 (19)		231 (15)	297 (19)	
Yes	1415 (89)	1319 (81)	<0.001	1323 (85)	1227 (80)	0.001
Attended ANC (Previous pregnancy)						
No	26 (2)	25 (2)		38 (3)	30 (2)	
Yes	1389 (98)	1294 (98)	0.911	1285 (97)	1197 (98)	0.503
Place of last delivery						
Home	143 (10)	83 (6)		143 (11)	79 (6)	
Health Centre	535 (38)	577 (44)		302 (23)	322 (26)	
Sub County Hospital	321 (27)	399 (30)		583 (44)	545 (44)	
Private/Mission	252 (18)	183 (14)		169 (13)	160 (13)	
County Referral	96 (7)	64 (5)		112 (8)	106 (9)	
Miscarriage	8 (1)	13 (1)	<0.001	14 (1)	15 (1)	<0.004
Previous complications in pregnancy						
Yes	437 (31)	275 (20)		469 (35)	346 (27)	
No	996 (70)	1083 (80)	<0.001	878(65)	913 (73)	<0.001

Overall, 5,834 women (84%) had been pregnant at least once before with 98% of them having attended ANC at least once during their pregnancy. The proportion of women who had attended ANC during their previous pregnancy was similar in both study sites. Four out of every five participants who had previously been pregnant reported having completed at least four ANC visits during their pregnancy.

Despite living near health facilities 448 (8%)women who had previously been pregnant delivered at home. The proportion of women who delivered their last pregnancies at home in both sites was similar and significantly lower at end line. The pie chart below (figure 13) shows a comparison of the nearest health facilities and the facilities the women had delivered during their last pregnancy.

Majority of the women who delivered at home were assisted by a relative or friend. 28% of those who delivered at home in the intervention site were assisted by TBA. This was a 6% decrease from the proportion at baseline. Table 5 below shows details of those who assisted women who delivered at home.

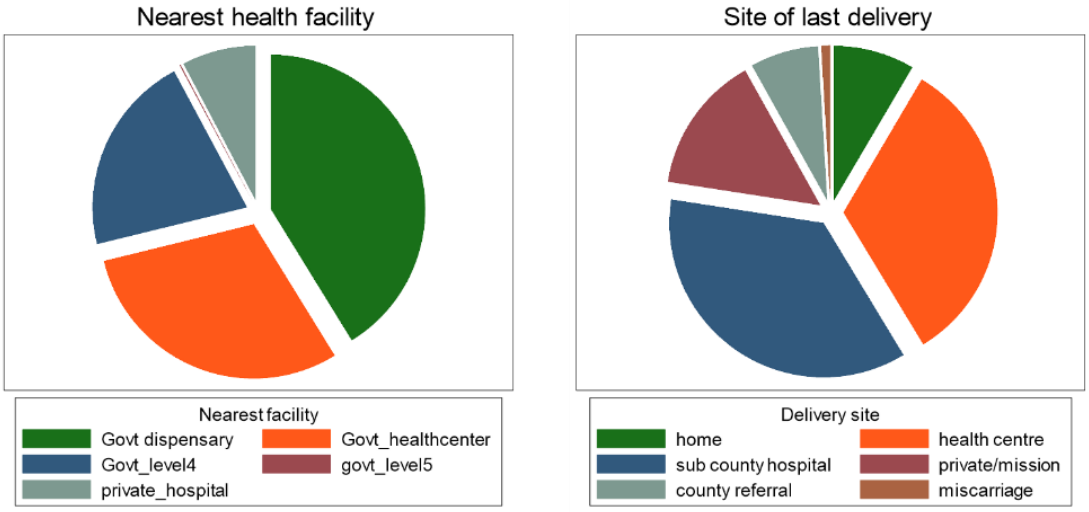


Figure 12: Charts comparing nearest health facility and facility of last delivery

Table 5: *Comparison of proportion of participants who received advice on complications in pregnancy between intervention and control sites*

Characteristic	Intervention (Rarieda)			Control (Ugenya)		
	Pre	Post	P value	Pre	Post	P value
Home Delivery Assistance						
Relative/Friend	34 (24)	21 (25)		45 (31)	16 (20)	
TBA	48 (34)	24 (28)		20 (14)	20 (25)	
Health worker	24 (17)	12 (14)		18 (13)	5 (6)	
Self-delivery	37 (26)	26 (31)	0.766	60 (42)	38 (480	0.040
Received advice on risks and complications in pregnancy						
No	836 (53)	689 (43)		726 (47)	687 (45)	
Yes	753 (47)	930 (57)	<0.001	828 (53)	837 (55)	0.361
Advice on pregnancy complications						
Nurse at health facility	606 (81)	746 (80)	0.849	699 (84)	722 (86)	0.288
Advised by CHV	177 (24)	386 (42)	<0.001	186 (22)	181 (22)	0.680
Advised by family	55 (7)	46 (5)	0.042	54 (7)	43 (5)	0.228
Advised by TBA	34 (5)	14 (2)	<0.001	3 (0)	14 (2)	0.008
Heard from media	52 (7)	56 (60	0.457	87 (11)	66 (8)	0.064
Read about it	36 (5)	45 (5)	0.961	59 (7)	62 (7)	0.825

Among all the participants who had ever been pregnant, 1527 (28%) had experienced complications during their pregnancy. There was a significant difference in proportion of women who had experienced complications at baseline and end line in both study sites. Infections and high blood pressure were the most common complications experienced by study participants. Other complications reported include diabetes, infections preterm birth, miscarriages, and still birth. We

detected a difference in the proportion of women who experienced high blood pressure, diabetes, infections and miscarriages at end line in comparison to baseline with more women reporting complications at end line. **Upon experiencing a pregnancy complication, majority of the women visited a health facility immediately**.

Overall, the odds of having received advice on complications in pregnancy were higher at end line compared to baseline (OR-1.27, 95%CI 1.15-1.40, *P*<0.001). The odds were higher in the intervention site (OR-1.50, 95%CI: 1.31- 1.72, *P*=0.001). The likelihood of having received advice on pregnancy complications from a CHV at end line was 2.31 times the odds at baseline in the intervention sites. (OR: 2.31 95%CI: 1.86 - 2.85, *P*<0.001). There was no significant difference in the odds in the control site at end line (OR: 0.95 95%CI: 0.76-1.20 *P*=0.680) More details on proportion of women who received advice on complications in pregnancy are shown in table 5 above.

Part2: Effect of High-Risk Pregnancy Cards on knowledge of healthy habits in pregnancy

Summary

This section describes results from the analysis conducted to determine the effect of the use of HRP cards on the knowledge on healthy habits, in pregnancy among women of reproductive age in the study sites. We include insights from both in depth interviews with CHVs and interviews with women of reproductive age in the community.

Key highlights

- The odds of having received advice on healthy habits in pregnancy were 5.7times higher among women who had seen the HRP cards compared to those who had not seen the cards (OR: 5.74 CI: 4.42-7.47 P<0.000) in the intervention site.
- Overall, the adjusted odds of increased knowledge in healthy habits in pregnancy after the implementation of HRP cards was 2.15 times the odds before the implementation of HRP cards.
- About 74% of the participants received advice on healthy habits from a CHV
- At end line, the five most commonly mentioned healthy habits in both intervention and control sites were healthy eating, sleeping under a mosquito net, drinking clean water, avoiding carrying heavy weights and attending ANC.
- The average number of healthy habits mentioned by participants who has seen the HRP cards was significantly higher compared to those who had not seen or interacted with the HRP cards (t = -8.6791 df=3141, p = <0.001, 95%CI = -0.89 -0.56).

Use of the HRP cards enhanced CHV's and TBAs' ability to identify multiple risks and danger signs in pregnancy. During training, majority of the CHVs could only identify the seven risks and danger signs present in the MOH mother and child booklet. At end line, CHVs across all FGDs reported gaining new knowledge and that the HRP cards enabled them to differentiate between a normal pregnancy and a high risk pregnancy as expressed by a respondent:

> *"There had been no proper classification of a pregnancy in the community. So a pregnant mother has just been a pregnant woman because she is pregnant. But now with HRP it become a clear classification that for example if this is a teenager who is pregnant for the first time. Then that is a high risk pregnancy. If she is too short, that is a risk and so on... If this is a mother of 45 years of age who has become pregnant, then that one is also still classified as a risk pregnancy. we did not know these things."* ***CHV Rarieda, Siaya***

We also observed increase in knowledge on healthy habits, risks and danger signs in pregnancy

among the community members during the community surveys. In the survey, we examined and compared the participants' knowledge on healthy habits in pregnancy before and after the introduction of the HRP cards. About 44% of the participants interviewed at end line had seen the and interacted with the HRP cards. The odds of having received advice on healthy habits in pregnancy were 5.7times higher among women who had seen the HRP cards compared to those who had not seen the cards **(OR: 5.74 CI: 4.42-7.47 *P*<0.000)** . **Participants in the control site were 0.81 times less likely to have received advice on healthy habits in pregnancy at end line (OR: 0.81 CI:0.69-0.94 *P*<0.007).**

Generally, most of the participants were advised on healthy habits in pregnancy by a health worker specifically a nurse, however, fewer respondents in the intervention site received advice from the health workers at end line. Nonetheless, we detected a significant increase in proportion of participants who received advice on healthy habits in pregnancy from CHVs in the intervention site, see table 5 above.

Use of the HRP cards was implemented in Rarieda sub county, the intervention site. **About 45% of respondents from intervention site reported having seen and interacted with the HRP cards**. **More than two thirds (74%) received information on the HRP card from a CHV**. A further 42% received the information from a nurse at the health facility, and 2% from a TBA, a friend or from the media.

We examined the awareness of healthy habits in pregnancy before and after the introduction of the HRP cards in intervention and control sites. **The five most commonly mentioned healthy habits in both intervention and control sites were healthy eating, sleeping under a mosquito net, drinking clean water, avoiding carrying heavy weights and attending ANC**. The least mentioned habits were, using proper latrine/toilet, washing hands, attending health education group talks, taking all prescribed medicine and giving birth at a health facility.

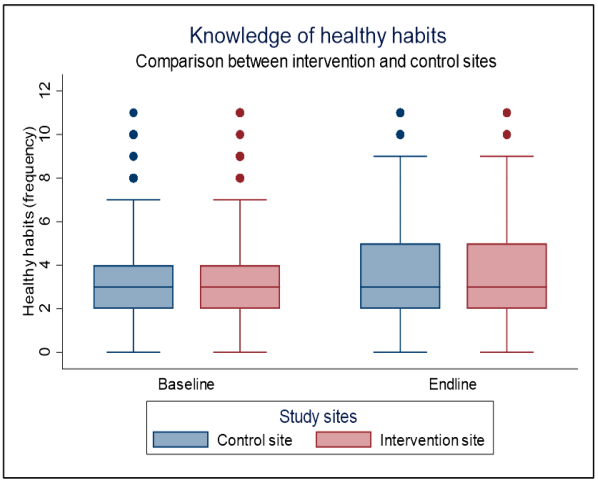
The average number of healthy habits mentioned by participants who has seen the HRP cards was significantly higher compared to those who had not seen or interacted with the HRP cards (t = -8.6791 w/ df=3141, p = <0.001 95%CI =-0.89 -0.56. Except for healthy eating and avoiding carrying heavy weights, there was a significant increase in the proportion of women who could identify each of the other healthy habits in the HRP cards at end line in the intervention

site . Comparison of other healthy habits mentioned at baseline and end line in both sites is detailed in table 6 below.

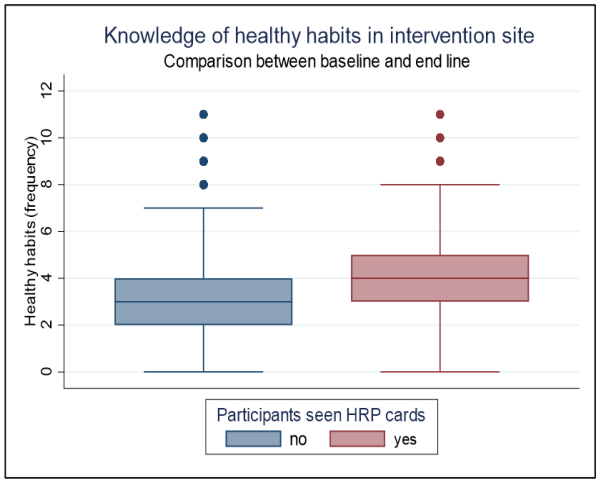
***Table 6**: Known healthy habits in pregnancy*

Characteristic	Intervention (Rarieda)			Control (Ugenya)		
	Baseline	**End line**	**P value**	**Pre**	**Post**	**P value**
Healthy eating	1092 (69)	1159 (72)	0.081	1037 (67)	1094 (72)	0.002
Sleep under a mosquito net	758 (48)	837 (51)	0.025	787 (51)	725 (48)	0.088
Drink clean water	493 (31)	619 (38)	<0.001	427 (27)	607 (40)	<0.001
Do not carry heavy weights	608 (38)	613 (38)	0.805	527 (34)	499 (33)	0.491
Attend ANC	564 (36)	684(42)	<0.001	628 (40)	596 (39)	0.460
Good hygiene	349 (22)	484 (30)	<0.001	457 (29)	427 (28)	0.394
Wash hands	128 (8)	276 (17)	<0.001	172 (11)	264 (17)	<0.001
Use a proper latrine	169 (11)	295 (18)	<0.001	138 (9)	248 (16)	<0.001
Give birth at a HC with a midwife	126 (8)	263 (16)	<0.001	232 (15)	207 (14)	0.285
Take all prescribed medicine	179 (11)	260 (16)	<0.001	191 (12)	246 (16)	0.002
Attend health educatio group talks	105 (7)	293 (18)	<0.001	160 (10)	212 (14)	0.002
Other Habits	168 (11)	87 (5)	<0.001	287 (18)	115 (8)	<0.001

There was an overall increase in participant knowledge of healthy habits at end line in comparison to baseline in both sites. The change in knowledge level as indicated earlier was more pronounced in the intervention site among women who had seen an interacted with the HRP cards. Figure 14 below shows the median and distribution of number of healthy habits mentioned by study participants at baseline and end line in control and intervention sites. proportions of participant for each level of knowledge.



Graph A: showing no difference in median number of healthy habits mentioned by study participants at baseline and end line in intervention and control sites.



Graph B: showing a higher median number of healthy habits mentioned by study participants who had seen the HRP cards compared to those who had not seen the HRP cards in the intervention site

Figure 13: *Comparison of number of healthy habits in pregnancy mentioned by study participants across both sites before and after implementation of HRP cards*

Part 3: Effect of High-Risk Pregnancy Cards on knowledge of risks and danger signs in pregnancy

Summary:

This section describes results from the analysis conducted to determine the effect of the use of HRP cards on the knowledge on risks and danger signs in pregnancy among women of reproductive age.

Key highlights

- About three in every five participants across all sites were aware of at least one risk or danger sign in pregnancy at end line.
- The mean number of risks/danger signs identified after implementation of HRP cards was significantly higher in the intervention site compared to the control site.
- After controlling for confounders, the odds of increased knowledge in healthy habits in pregnancy was higher in the intervention site (OR =2.39, 95%CI 2.15-2.67 P<0.001) compared to the control site (OR=1.38, 95% CI: -1.16 – 1.66, P<0.001)
- The odds of having increased knowledge in risks and danger signs in pregnancy among participants who had received advice and counselling on risks and complications in pregnancy using the HRP cards were four times the odds at baseline (OR=3.98 95% CI: 3.07-5.18, P<0.001).

We also queried participants' knowledge on signs of risks or complications in pregnancy. About 1,979 (63%) participants across all sites were aware of at least one risk or danger sign in pregnancy at end line. To test if there was a significant difference in the mean number of risks identified at baseline and end line in control and intervention sites, we applied a difference in difference model. The mean number of risks/danger signs identified after implementation of HRP cards was significantly higher in the intervention site compared to the control site.

Table 7: *Difference in difference model for average number of risks identified in intervention and control sites*

	Baseline			End line			
Outcome	Control (Ugenya)	Intervention (Rarieda)	Diff	Control (Ugenya)	Intervention (Rarieda)	Diff	Diff-In-Diff
Mean number of risks identified	2.967	2.671	-0.297 (*P*<0.01)	3.485	3.983	0.498 (*P*<0.01)	0.794 (*P<0.01**)
*inference p<0.01							

Out of the twenty-three risks/danger signs found in the HRP card, excessive vomiting, fever, vaginal bleeding in pregnancy, anemia and absence of fetal movement were the most mentioned risks at both baseline and end line.

Table 8: *Identified risks and danger signs in pregnancy*

Characteristic	Intervention (Rarieda)			Control (Ugenya)		
	Pre	Post	P value	Pre	Post	P value
Shortness (<160cm)	21 (2)	153 (15)	<0.001	22 (2)	81 (8)	<0.001
Pelvic malformation	42 (4)	98 (10)	<0.001	28 (3)	86 (9)	<0.001
Chronic diseases	73 (7)	170 (17)	<0.001	200 (21)	167 (17)	0.026
Malnourishment	68 (7)	176 (18)	<0.001	115 (12)	139 (14)	0.171
Short interval between pregnancies	61 (6)	141 (14)	<0.001	65 (7)	105 (11)	0.003
High multigravida	39 (0	135 (13)	<0.001	39 (4)	93 (10)	<0.001
Previous uterine scar	33 (3)	101 (10)	<0.001	26 (3)	81 (8)	<0.001
Previous labor complication	100 (10)	116 (11)	0.335	50 (5)	132 (13)	<0.001
Fever	473 (48)	417 (42)	0.003	373 (39)	396 (41)	0.582
Vomiting	397 (41)	399 (40)	0.726	342 (36)	371 (38)	0.379
Diarrhea	137 (14)	218 (22)	<0.001	115 (12)	219 (22)	<0.001
Anemia	172 (18)	283 (28)	<0.001	223 (24)	274 (28)	0.023
Edema/Pre-eclampsia	75 (8)	117 (12)	0.003	80 (8)	85 (9)	0.832
Eclampsia	42 (4)	51 (5)	0.403	17 (2)	32 (2)	0.039
Premature onset of labor	84 (9)	89 (9)	0.817	79 (8)	89 (9)	0.542

Premature rupture of membranes	87 (9)	107 (11)	0.182	84 (9)	76 (8)	0.394
Vaginal bleeding	343 (35)	462 (46)	<0.001	480 (51)	411 (42)	<0.001
No fetal movement	98 (10)	232 (23)	<0.001	195 (21)	190 (19)	0.546
Twins	24 (2)	53 (5)	0.001	36 (4)	30 (3)	0.383
Fetal mal presentation	67 (7)	168 (17)	<0.001	123 (13)	134 (14)	0.626
Prolonged labor	129 (13)	117 (12)	0.307	101 (11)	94 (19)	0.457
Harmful habits during pregnancy	93 (10)	147 (15)	<0.001	112 (12)	97 (10)	0.186
Young age	21 (2)	41 (4)	0.013	34 (4)	23 (2)	0.112

Details of the other risks mentioned are presented in table 8 above. Knowledge on risks and danger signs in pregnancy was rated on a scale where respondents who mentioned less than seven risks in pregnancy (number of risks present in the ANC booklet) were considered to have little knowledge whereas respondents who could mention between 7 to 14 risk signs were considered to have average knowledge. Participants who could state more than 15 risk signs in pregnancy were considered to have adequate knowledge. After the implementation of HRP cards, we detected an association (χ 2=14.64, *P*=0.002) between the level of knowledge of risks in pregnancy and the participant's study site. Figure 16 and table 9 below show a comparison of the level of knowledge of risks in pregnancy between the study sites at baseline and end line.

Table 9: *Detail of scoring of knowledge of risks and danger signs among study participants*

Characteristic	**Intervention (Rarieda)**			**Control (Ugenya)**		
	Pre	**Post**	**P value**	**Pre**	**Post**	**P value**
Knowledge in risks and danger signs in pregnancy						
No Knowledge	610 (38)	617 (38)	<0.001	605 (39)	547 (36)	<0.001
Little knowledge	913 (57)	794 (49)		865 (56)	828 (54)	
Average knowledge	65 (4)	200 (12)		81 (5)	137 (9)	
Adequate/high knowledge	0(0)	8 (1)		3 (0)	12 (1)	

Level of knowledge of risks in pregnancy between the study sites at baseline and end line

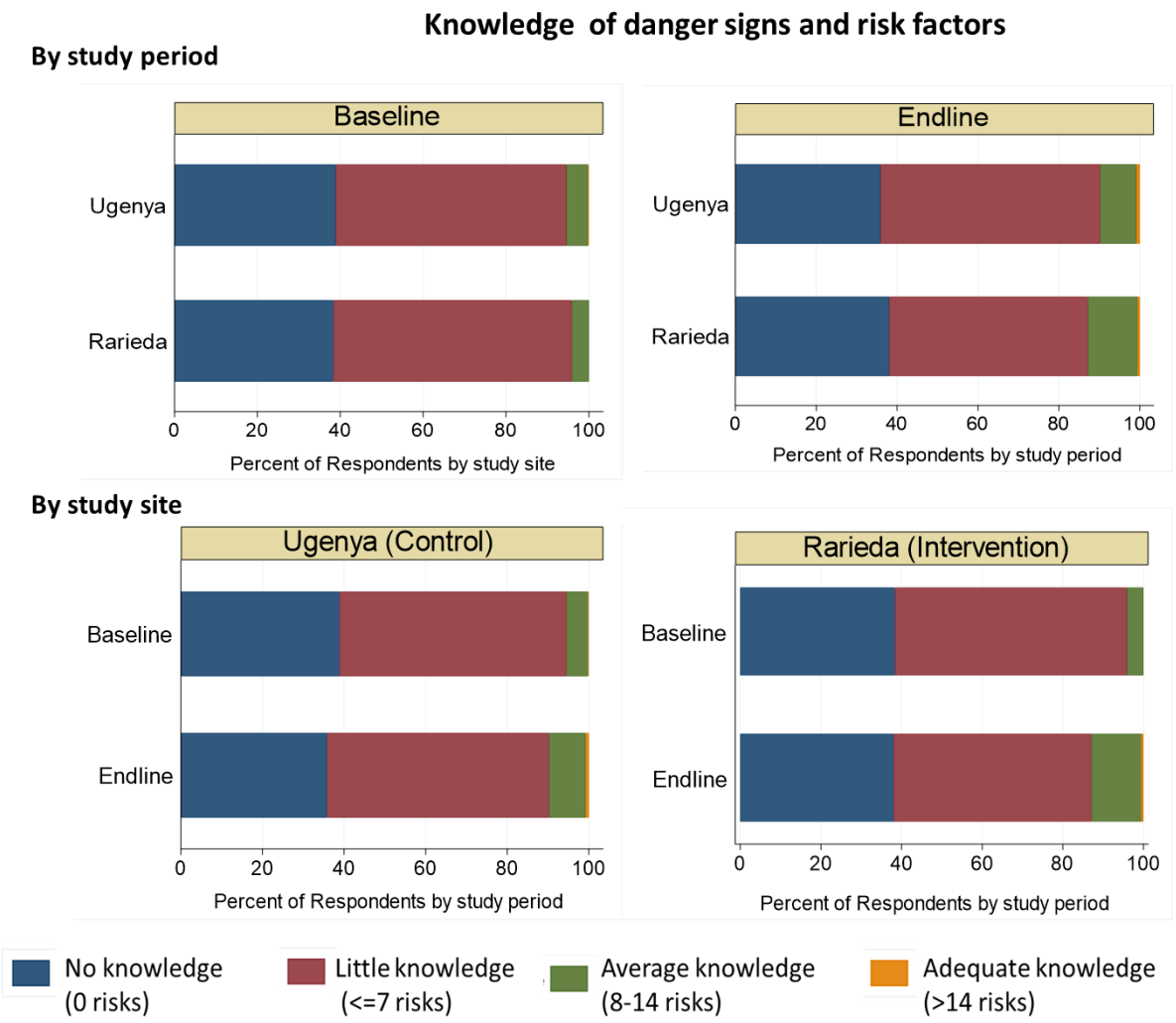


***Figure 14**: Graph showing a comparison of level of knowledge of risks in pregnancy between control and intervention sites and between study periods (baseline and end line).*

Generally 97% of all respondents indicated that they would immediately go to a health facility for assistance upon experiencing any of the risks mentioned above.

"Complications in pregnancy" was identified by respondents from both sites as the main cause of maternal deaths. The proportion of deaths reported to be caused by complications in pregnancy though verbal autopsy was significantly lower in Rarieda at end line in comparison to Ugenya sub county. About 9% on of all respondents felt that some of the maternal deaths occurred as a result of negligence by health workers at the facility. One in every five women could not identify the specific cause of the maternal deaths.

Multilevel ordered logistic regression models

Analysis of effect of the use of the HRP cards on the knowledge of healthy habits and risks/danger signs in pregnancy.

We sought to determine the overall effect of the use of the HRP cards on the knowledge of healthy habits and risks in pregnancy after accounting for the effect of confounders and clustering at the community health unit level in the study. Using multilevel mixed effects ordered logistic regression models, we determined the association between knowledge of healthy habits in pregnancy and use of HRP cards accounting for other exposure variables, results are presented in table 11 below.

We detected crude associations between increased knowledge of healthy habits in pregnancy and participant's education level, knowledge of CHVs, having received advice on healthy habits and risks from the HRP cards (see table 11 below). From the site specific multilevel ordered logistic regression models, the adjusted odds of increased knowledge in were significantly higher at end line compared to the baseline. After adjusting for other predictor variables, we report statistically significant association between the use of HRP cards, denoted by the study period and healthy advice variables, and increase in knowledge of healthy habits in pregnancy. We reject the null hypothesis that there is no association between use of HRP cards and increase in knowledge in healthy habits in pregnancy.

Table 10: *Factors associated with knowledge of healthy habits in pregnancy (Multilevel ordered logistic regression model)*

Exposure		Crude odds	P value	Adjusted odds ratio	P value
Study Period	**Before HRP cards**	1		1	
	After HRP cards	2.39	<0.001	2.15	**<0.001**
Education	**No schooling**	1		1	
	Some schooling	1.33	<0.001	1.24	**0.001**
Heard of CHVs	**No**	1		1	
	Yes	1.75	<0.001	1.24	0.693
Advice on healthy habits	**No**	1		1	
	Yes	2.57	<0.001	1.60	**<0.001**
Advice on complications	**No**	1		1	
	Yes	3.20	<0.001	2.22	**<0.001**
Community unit clustering	**Var (_cons)**	0.26		0.24	**0.0078**

*

The odds of high knowledge in healthy habits in the control group at end line was lower than in the control site at 1.38 times the odds at baseline (95% CI:-1.16 – 1.66, *P*<0.001) with the predictor

variables in the model remaining constant. We conducted a similar analysis for the associations between independent variables and knowledge on risks and danger signs in pregnancy. Crude associations were obtained and variables with significant associations included in the final model. Table 12 below shows those variables which were associated with increase in knowledge on risks and danger signs in pregnancy in the intervention site.

Table 11: *Factors associated with knowledge of risks and danger signs in pregnancy(Multilevel ordered logistic regression model)*

Exposure		Crude odds	P value	Adjusted odds ratio	P value
Study Period	**Before HRP**	1		1	
	After HRP	1.24	0.001	1.13	<0.434
Age	**<25 yrs.**	1		1	
	25-34 yrs.	1.55	<0.001	1.05	0.452
	35-44 yrs.	1.58	<0.001	1.19	<0.001
	>45 yrs.	1.84	<0.001	1.49	0.004
Education	**No schooling**	1		1	
	Primary	2.05	<0.001	1.78	**<0.001**
	Secondary	2.05	<0.001	2.00	
	Tertiary	2.9	<0.001	2.60	
	Graduate	11.18	<0.001	5.86	
Occupation*	**Occupation type**	0.79	<0.001	0.86	**0.027**
Income	**0–10,000**	1		1	
	10,001–20,000	1.40	0.014	1.10	0.628
	20,001–30,000	2.52	<0.001	1.52	0.040
	30,001–50,000	2.59	0.023	1.36	0.004
	>50,000	1.91	0.015	1.61	0.580
Heard of CHVs	**No**	1		1	
	Yes	2.79	<0.001	1.86	**0.001**
Previous pregnancy	**No**	1		Omitted	
	Yes	2.87	<0.001		
Attended ANC previously	**No**			1	
	Yes	2.59	0.001	1.38	**0.002**
Healthy habits advice	**No**	1		1	
	Yes	5.41	<0.001	2.32	**<0.001**
Advice on risk & complications using HRP cards	**No**	1		1	
	Yes	6.45	<0.001	3.98	**<0.001**
Community unit clustering	**Var (_cons)**	0.26		0.003	

Most sociodemographic variables including age, education level, occupation status income level and knowledge of CHV work showed crude association with knowledge of risks in pregnancy., we also detected positive association between increase in knowledge or risks and danger signs and predictor variables such as attending ANC, receiving advice on healthy habits and risks and complications from the HRP cards. We adjusted for confounders using multilevel ordered logistic

regression accounting for clustering ta the community unit. At end line, in the intervention site, the **odds of having increased knowledge in risks and danger signs in pregnancy among participants who had received advice and counselling on risks and complications in pregnancy using the HRP cards were four times the odds at baseline (OR=3.98 95% CI: 3.07-5.18, *P*<0.001).**

Overall , although not statistically significant, participants in the intervention site were 1.13 times more likely to have average and high knowledge in risks in pregnancy at end line in comparison to baseline (OR=1.13 95% CI: 3.07-5.18, *P*=0.434). This estimate was similar in the regression model for the control site (OR 1.27, 95%CI: 0.90 - 1.80, *P*=0.175). However, the odds related to having received advice on risks and complications in pregnancy were lower in the control site (OR= 3.16 95% CI: 2.75 – 3.65, *P*<0.001).

Section 3: Effect of HRP cards on ANC attendance and referrals

Summary

This section addresses the objective which seeks to determine whether the use of the HRP cards promotes referral of at-risk pregnancies to the health facilities and increases the utilization of maternal health services. To estimate the effect of the use of the HRP cards on ANC attendance, we compared the mean number of first and fourth ANC visits before and after the intervention in link health facilities in both the intervention and control groups.

Key highlights

- After introduction of the HRP cards, there was a statistically significant increase in the mean number of first ANC visits in the intervention sites compared to the control sites.
- 197 new referrals of at-risk pregnancies to the health facilities from the birth companions and community health volunteers were recorded in the intervention site after introduction of HRP cards.

We abstracted data from ANC registers in all facilities one year before the intervention and compared it to the data obtained during the implementation period of the HRP cards project. For this analysis, we applied a difference in difference model which relies on the difference in

difference estimator defined as the difference in average outcome in the treatment group before and after treatment minus the difference in average outcome in the control group before and after treatment. Table 13 below shows the result of the models.

Table 12: *Difference in difference model for analysis of ANC data*

	Baseline			End line			
Outcome	Control	Intervention	Diff	Control	Intervention	Diff	Diff-In- Diff
Mean 1st ANC	78.750	50.646	-28.104 (*P*<0.001)	88.756	69.900	-18.856 (*P*<0.001)	9.249 (*P*=0.084*)
Mean 4th ANC	26.583	17.854	-8.729 (*P*<0.001)	28.089	22.63	-5.456 (*P*=0.002)	3.274 (*P*=0.194)

*inference p<0.1

The difference in difference estimator shows an increase in the mean number of first ANC visits in the intervention sites significant at 10%. A visual inspection confirms the data meets the parallel trend assumption for both models (see figure 17 below). However the increase in fourth ANC visits was small, albeit statistically insignificant.

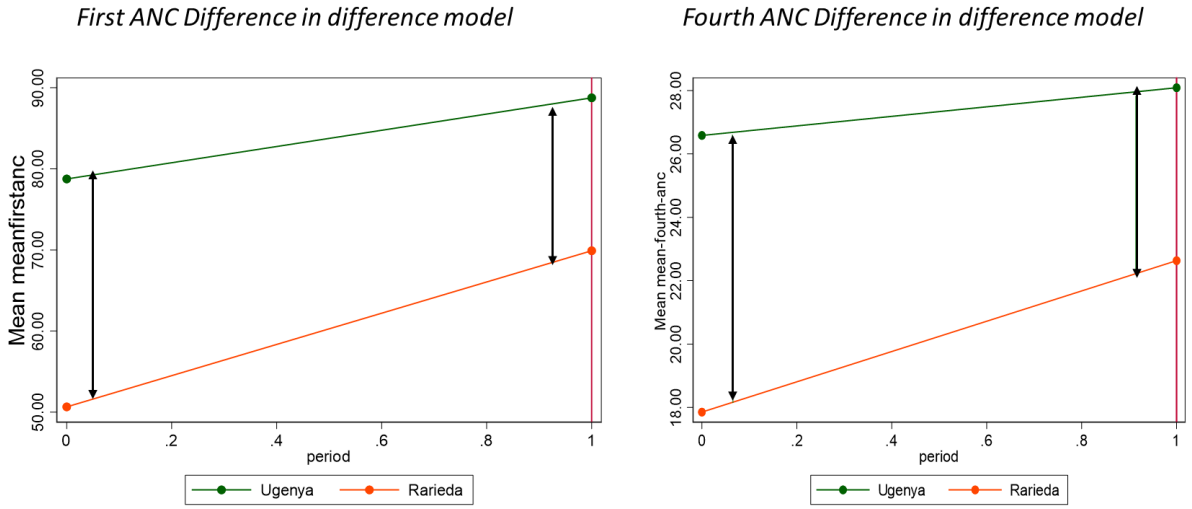


Figure 15: *comparison of ANC visits at baseline and end line in both sites.*

To track the number of women identified in the community by both CHVs and birth companions as having at risk pregnancies as a result of new information in the HRP cards, participants were each provided with a referral from to present at the health facility. Health workers from each of the link facilities had been sensitized on the project procedures and provided with a HRP project

specific files where they stored the referral forms. Each correct referral of at risk pregnancy was specially marked with a code to avoid mixing with other referrals. **We tallied 197 referrals from both the Birth companions and community health volunteers to the 4 link facilities in the study intervention site. This represented 4.6% of all new pregnancies during the study identified by summing up all 1st ANC visits.** Figure 18 below shows the number of referrals of at risk pregnancies identified during the project period in addition to the usual referrals by CHVs.

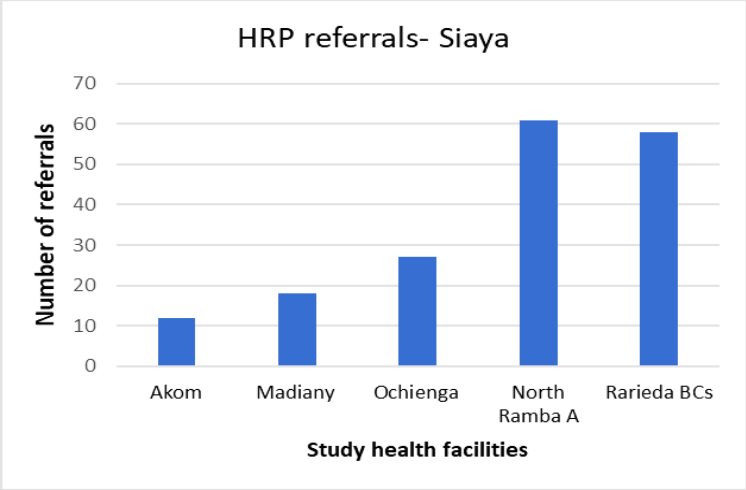


Figure 16: *New referrals of at risk pregnancies identified by CHVs in Rarieda during the study period. No new referrals identified in control site at they did not have the intervention*

Chapter 6 DISCUSSION

This chapter reviews the main findings of the research and provides an interpretation within the broader context of the literature of similar work previously published. In this section we reflect on the three study objectives and examine whether all study questions were answered. Through the discussion, the experimental results have been summarized and reasonable conclusions drawn from the scientific data. We also discuss factors which contributed to the success of the research and limitations that could have influenced the results, such as sources of error or bias in interpretation. The significance of the results is addressed and remaining scientific questions and/or potential future experiments examined.

Lack of adequate knowledge about healthy pregnancy habits, risks and danger signs in pregnancy has been identified as a key contributing factor to delays in seeking obstetric care and in turn to maternal morbidity and mortality especially in low and middle income countries (2,13,14). With improved awareness, women, CHVs and community members at large are more likely to identify risks in pregnancy early enough for timely action. Majority of the women in LMICs receive information related to danger signs in pregnancy through health workers during ANC visits (15). In comparison to those who do not attend ANC, these women relatively were more aware of risks in pregnancy (16). However, studies have shown that despite attending antenatal care, women generally had low awareness of danger signs and obstetric complications (13,15,17,18). This was also related to the women's perception of risks where most perceive a 'normal pregnancy' without severe complications as a normal state not needing specific medical care. (13,19–21). In settings with limited number of health workers limited time is allocated to proper counseling on ante natal care, good habits, risks and dangers associated with pregnancy (22).

Particularly in facilities where health personnel are either understaffed, such as one clinician responsible for all services at a health centre or where they have multiple clinical responsibilities, an alternative may be to explore the feasibility and effectiveness of task shifting and expanding the role of community health volunteers to fill this gap . In this backdrop, we conducted the current study to assess the effectiveness of using the HRP cards, an intervention aimed at facilitating the sharing of information on healthy pregnancy habits and risks and danger signs, by community health volunteers to ensure identification of risks at the earliest possible and timely

referral to the health facilities for management. HRP cards were initially designed as paper-based booklet to serve in fragile environments with poor (digital) infrastructure, we aimed to demonstrate its value even in more stable and varied settings such as rural Kenya where maternal morbidity and mortality was still a concern. Our study addressed all the study objectives.

Knowledge on healthy habits, risks and danger signs in pregnancy

An initial assessment of the awareness and knowledge on pregnancy risks and dangers signs before implementing the intervention revealed poor knowledge of risks in pregnancy. Results were homogenous across study sites representing most rural communities in Kenya. Only three out of every five (60%) women of reproductive age interview could correctly identify at least one risk in pregnancy. Up to three quarters of these women could identify only three risks or danger signs in pregnancy at baseline. This is a common picture across sub Saharan Africa and South Asia with several studies reporting poor, unevenly distributed and inconsistent knowledge on risks in pregnancy among women (14,16,23–27). In line with the findings from other studies across Africa, vaginal bleeding was most commonly identified risk in pregnancy explained by the fact that it was one of the most noticeable odd signs (17). Women performed better in knowledge of healthy habits in pregnancy with 94% overall identifying at least one healthy habit in pregnancy. There is a paucity of evidence on the knowledge on healthy habits in pregnancy. At baseline we also estimated level of knowledge on healthy habits in our study. About a fifth of the 3,142 women of reproductive age interviewed at baseline knew at least three healthy habits. After implementation of the high risk pregnancy referral cards, results from our study show significant increase in women's knowledge of both healthy habits and risks in pregnancy in the intervention site. Statistically significant improvements in knowledge of risks and danger signs in pregnancy were observed. Overall we had a crude 8% increase in the proportion of women with average knowledge in risks and dangers signs in the intervention site. This was in tandem with the estimates on women who received advice on risk and possible complications in pregnancy which was significantly higher at end line. These results were in line with a study on women's awareness of obstetric complications and danger signs in Tanzania (28) . No difference was detected in the control site where we had no direct interventions on increasing women's awareness. Evidence studies on factors associated with awareness of risks in pregnancy in Ethiopia, Egypt and Tanzania indicated a positive association between maternal age (25,27)

obstetric history, higher education levels, previous pregnancy and attendance of ANC (13,17,21,23,24). We present similar results; however, we still have positive associations between the use of the HRP cards and women's awareness of risks in pregnancy after adjusting for these predictor variables. Unlike the control site where most women received brief advice from health workers, women in the intervention site reported increased engagement with the CHVs who took time to educate them on the risks and danger signs in detail.

HRP cards as a Visual aid

Job aids have been used in many settings to enhance the performance of health workers(15). visual aids offer an even simplified form of a job aid. Research has shown that the effectiveness of health communications can be significantly increased by including pictures in the design of health education materials (29,30) these studies show that appropriately designed visual aids are often highly effective, transparent, and ethically desirable tools for improving decision making, changing attitudes, and reducing risky behavior. When we present information on risks visually is considered easier to understand and recall and requires less viewing time overall (31,32). The HRP cards is one such visual aid (33). The cards were designed through a complimentary design process between teams from ICRC and Philips design sponsored by Philips Foundation (34,35). An inclusive design approach was taken where all stakeholders were engaged in collaborative workshops to gather insights and shape the prototype. The card was tested in Somalia, Nigeria, South Sudan and DRC with ICRC's healthcare professionals and beneficiaries. It was deployed in six other African countries. Our study provides scientific evidence if the effectiveness of the use of simple visual aids in communicating on risks to communities. The simple text and graphics used on each card are easily adapted to different languages and audiences. It is interesting to note that some health workers indicated that the images actually reduced the time needed for explanation, allowing them to increase the number of messages and utilize their time efficiently.

HRP cards enhancing link between CHVs and health workers

In addition to improving the knowledge and awareness in the community, the use of the HRP cards also impacted the work of the CHVs. The trainings conducted contributed towards capacity building by equipping the CHVs with skills to identify women who were at risk very early in

their pregnancies. We observed a general acceptance of the intervention by both health workers and community member. Uptake in the use of the visual aids was high among health care providers and the county health management teams. The master training on the use of the cards involved the health facility in-charges (head nurse-midwife) regardless of the extent of their involvement in usual antenatal communication. The community health assistants were involved as actual trainers of the community health volunteers. This was done to facilitate the link between the CHVs, and the health facility needed to improve communication, particularly for referrals of women to the facility and back to the community and ensuring adequate feedback mechanisms. Evidence shows that involving the leadership in the health system enhances the implementation of new practices which is consistent with the programmatic experience of this study. Excerpts from the focus group discussions show the enthusiasm of the CHVs and BCs. Recognition is key in motivating CHVs in the community.

Utilization of ANC services.

Adherence to antenatal-care schedules and facility based delivery is generally poor across sub Saharan Africa and Kenya is not an exception (36). In our study we analyzed data on ANC visits. In line with estimates in other countries, first ANC visits were significantly higher than the 4th ANC visits in both intervention and control sites. Figure 19 and 20 above shows the upward trends in the numbers of women accessing ANC services in the study sites. Despite the Covid situation in the country, we realized an increase in both the first and 4th ANC visits across all link facilities in the intervention sites. With more awareness, among women in the community, health workers reported an increase in both self-referrals and CHV initiated referrals. The study was also enriched by the involvement of women at all levels. The cards targeted all women of reproductive age while pregnant women were specifically engaged in the mother to mother support groups an initiative with the potential of addressing issues around knowledge, attitude, behaviors and norms around pregnancy on its own.

Male involvement in matters maternal health

There is a little of evidence on men's awareness of risks and danger signs in pregnancy across Africa. Results from a study conducted in Ethiopia in 2014 assessing factors associated with men's awareness of danger signs in pregnancy showed low levels of awareness of obstetric danger signs among men. As key decision makers in the home in most African contexts, their

decisions can affect access to health services by pregnant women. We aimed to raise awareness among men in the community as well. Special meetings where men were sensitized on the beneficial habits and risks in pregnancy using the HRP cards contributed to the overall success of the project. Health workers reported an observable increase in the proportion of women who were accompanied by their husbands to ANC.

Research Implications

- A range of policy and programmatic implications emerge from the study findings. Our study demonstrates the positive effect of using the simple yet comprehensive HRP cards in raising awareness about healthy habits, risks and danger signs in pregnancy. It also strengthens existing literature on use of visual aids to promote health literacy among community members. Hinging on the already existing structures to engage community health volunteers in the extra task of educating women as they visit households in their usual routine has proved a practical strategy in reaching majority of the community members and impacting them with the information necessary for early identification of risks and timely action. The thousands of recently trained CHVs across the Kenya by the Kenya Red Cross Society provide an opportunity and platform for scale up of the intervention for maximum impact.
- The research demonstrates the intervention's direct effects on maternal knowledge, which provides important insight on programmatic strategies to improve health outcomes. The visual aids have great value in their design as a practical tool in communication to the community, which plausibly is crucial in empowering the women to safeguard their pregnancies.
- Another factor relates to implementation of the intervention. Acceptance and utilization of the visual aids was high among both the health workers and health management. Engagement of the county health leadership and the cascaded training formula ensured all actors within the maternal health space were on board. This was done to facilitate the link between the CHVs and the health facility which was greatly enhanced.

Study strengths and limitations

A key strength of our study was the use of both quantitative and qualitative methods. We had a large sample size used in the surveys and the very close monitoring of the study activities by the Kenya Red Cross project officers. The intervention was also implemented in four counties across the country representing different cultural contexts, varied socioeconomic and economic modalities improving the generalizability of our study.

Our study may have suffered some limitations. Firstly, the study was conducted during the Covid-19 pandemic which heavily affected the CHV activities and interfered with the study timelines. Restrictions in movement both within the community and fear of spreading the disease may have reduced the ability of CHVs to reach more women with the cards.

Efforts to only implement cards in intervention sites were executed. However, it is possible that cross contamination may have occurred in the study sites owing to the fact that CHVs across the county may have had some common meeting especially during training on infection prevention and control of Covid -19 and shared information on the cards. Slight contamination was detected in the survey results where some of the participants in control sites mentioned having seen the HRP cards. This could have led to an underestimation of the relative effect of the HRP cards in intervention site.

In addition, effect of the cards may have been underestimated due to the confounding effect of a county intervention where CHVs were equipped with pregnancy test kits to screening women and refer those found pregnant to the health facilities. This could explain the low differences in ANC attendance between the study sites.

Due to the nature of the intervention , it was not operationally possible to blind the data collection team regarding the intervention or control status of participating sites. Some reporting bias may have occurred. However, the questionnaires were designed robustly to allow the participants to self-report the knowledge on the risks in pregnancy with little no assistance from interviewers.

Chapter 7 CONCLUSIONS

Findings from our study show that use of a visual aid focused intervention is a practical and relatively efficient approach to improve the awareness of healthy habits, risks and danger signs among women of reproductive age in the community. Appropriately designed visual aids are highly effective, transparent, and ethically desirable tools for improving decision making, changing attitudes, prompting good habits and reducing risky behavior. the inclusive design of the HRP cards aided in adoption by the CHVs and acceptability by health workers and community members. Use of the cards was positively associated with an increase in healthy habits, risks and danger signs knowledge among women or reproductive age and men in the community. Appropriate and sustainable mechanisms for scale-up of this intervention are required. Further studies are needed to assess the retention of the knowledge among the women.

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Chapter 9 Supplementary material

Study participants opinions and suggestions on the HRP cards

The HRP cards were appreciated in Rarieda sub county, however, we received a few suggestions on the content of the HRP cards. Some of the comments are discussed below.

- Suggestion to transfer the card titled *" Do not carry heavy weight"* from the green side with healthy habits to the red side with risks and danger signs. One of the respondents commented as below:

  > *"The way I see it that is a very dangerous habit because this woman is pregnant, she has two children, she is going to carry water and she has a bag on her side. Now this woman is in danger because when she tries to carry all these things, she is using all her strength and she can lose the child and it is not good."* ***Mother-MTM forum Rarieda.***

- Participants requested inclusion of pictures of men in both the green and red cards to support male involvement and engagement. They explained that men had a big influence on decisions affecting the woman's pregnancy specifically in the risk "*high multigravida*" and healthy habits "*healthy mother and child*", "*visit health centre for antenatal care*", and "*health education group talk" cards*. Views from the focus group discussions were complimented by reports from the communitywide survey. About 24% of the women interacted with the HRP cards suggested changes to the card. Majority (33%) suggested inclusion of pictures of men.

- Health workers proposed the addition of a card on the healthy habits requesting for at least one ultrasound during the pregnancy. They felt that if it was on the card, the women would be easily convinced. One of the nurses gave the remark below:

  > *"I don't know whether ultrasound issues can be included in the card, because most often when mothers are referred for ultrasound they don't go. And then you find that a mother goes to a dispensary for like six ANC visits, she's been sent to go for that photo and told very well that for delivery go to a big hospital and they don't go"* ***Nurse Rarieda Siaya***.

- Mothers and pregnant women interviewed in FGDs suggested the inclusion of infections such as UTIs as risk in the red side of the booklet. They felt that it was one of the very common occurrences and a number of women in the community were not keen on the issue.

  > *"when I was pregnant, I had back pains and stomachache; when I went to the hospital, I was told that I had a UTI infection. I have not seen it described in the book that we are*

trained with. So during training the CHVs should teach us about the UTI because it is a common case in many pregnant women", ***Mother-MTM forum Rarieda, Siaya***

Knowledge on causes of maternal mortality

We investigated the respondent's knowledge on maternal mortality through verbal autopsy. About 3% of the participants in Siaya indicated knowing at least one woman who had died during pregnancy or delivery. Table 9 below lists some of the causes of death reported by the women.

Table 13: *Known Causes of maternal death*

Characteristic	Intervention (Rarieda)			Control (Ugenya)		
	Pre	Post	P value	Pre	Post	P value
Pregnancy complications	238 (39)	150 (33)		193 (34)	192 (35)	
Illness	70 (11)	142 (32)		85 (15)	200 (37)	
Negligence at HF	79 (13)	-	<0.001	125 (22)	-	<0.001
Long distance to HF	40 (7)	31 (7)		58 (10)	45 (8)	
Accidents	9 (1))	16 (4)		29 (5)	19 (4)	
Other Cause	179 (29)	110 (25)		76 (13)	87 (16)	

**HF = Health facility

Trends in ANC attendance pre and post HRP cards

As part of the project monitoring and evaluation, we monitored the monthly trend of ANC attendance during the implementation of the HRP project and compared these two trends from the previous year. The monthly trends of ANC visits in link health facilities is shown below.

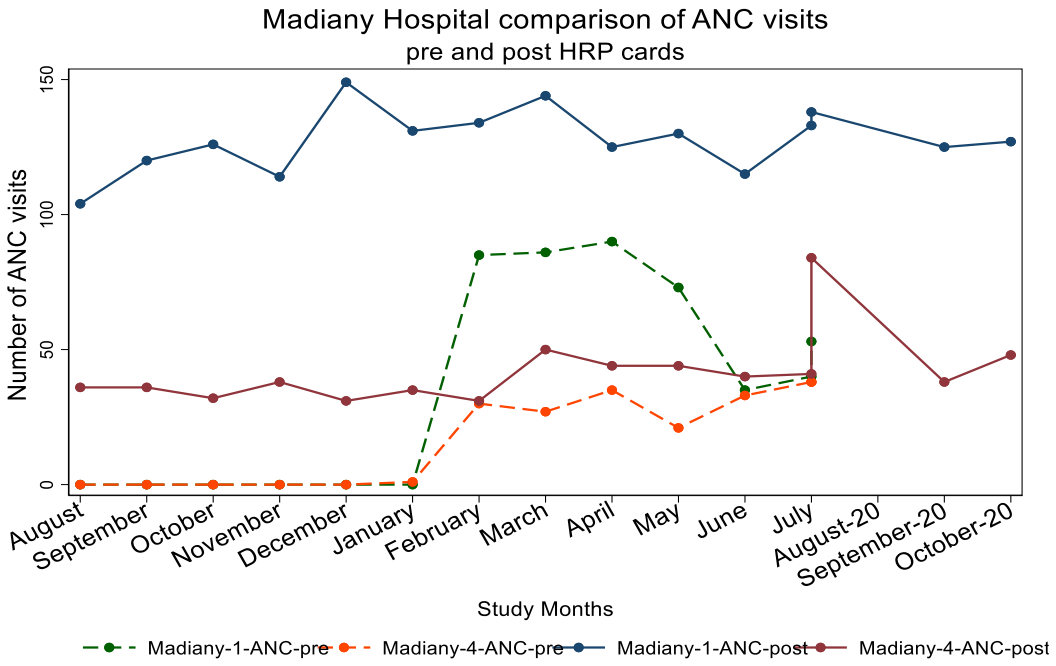

Figure 17: 1st and 4th ANC visit trends before and during study period in Madiany Sub county hospital

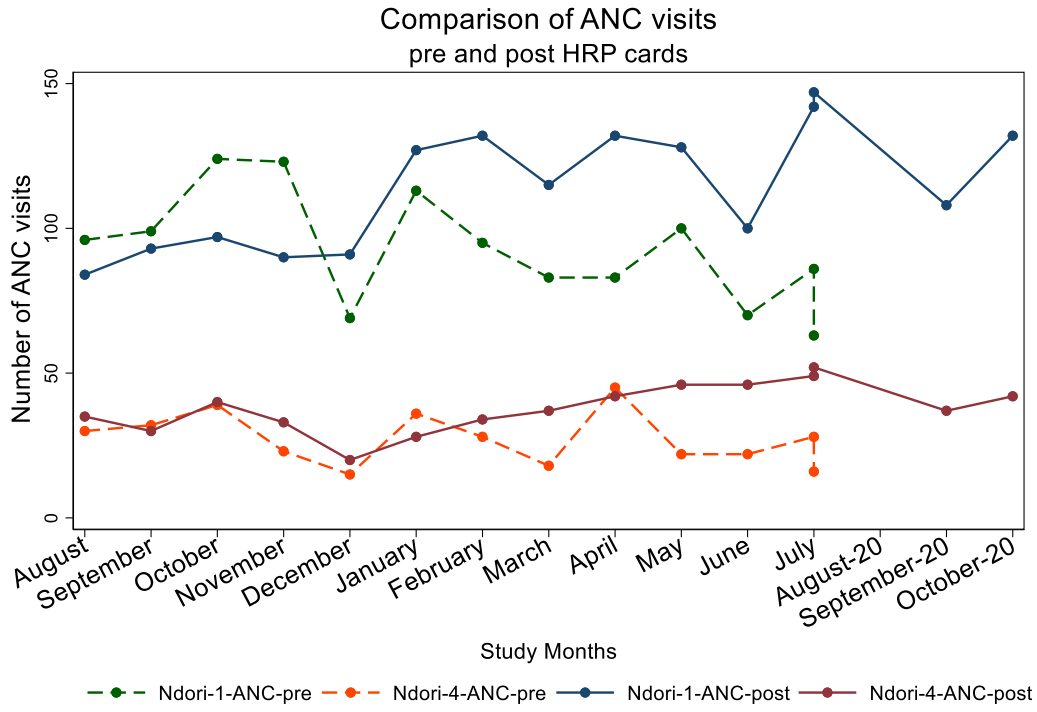

Figure 18:*1st and 4th ANC visit trends before and during study period in Ndori health Centre*

Unintended effects of HRP cards on motivation

As an IEC material, the HRP cards contributed toward the CHVs and TBAs motivation. Health workers reported an increase in enthusiasm among CHV work. In addition to providing a tool to ease their work of advising community members, the HRP cards increased CHV recognition in the community. Though not their main aim, the HRP cards enhanced the motivation among CHVs with most gaining a sense of importance, pride and community respect which is essential in engaging the community. A very interesting quite by one of the CHVs highlights some of the unintended effects.

"This HRP card, it has given me a big name that when someone sees me with this book, they pull you over, "Ei, the daughter of Awiti, nowadays you are on top our teacher!" I am on top. I am very grateful to you for getting this book. If I show it to someone, they think I am on top, I have become someone important from this book" ***CHV Akom CU, Rarieda Siaya***