



Exploring important factors affecting compliance, uptake and quality of ANC and Customization of mHealth intervention to improve maternal health outcomes in Rwanda: Phase 1 Key findings.

Authors:

Tunga Grace¹, Kizito Kayumba¹, Gashaija Absolomon², Imelda Iryumugabe², Isaac Nkundwamfite¹, Piero Irakiza¹, Jean Damascene Hategekimana¹, Temina Madon³, Paul Wang, Felix Sayinzoga⁴, Hassan Sibomana⁴, Noella Karusisi¹, Elizabeth Krebs¹, Jeanine Condo^{1,2,5}

¹ CIIC-HIN: Center for Impact- Innovation and Capacity building for Health Information and Nutrition, Rwanda

² University of Rwanda- School of Public Health, Rwanda

³ Agency Fund, USA

⁴ Rwanda Biomedical Center, Rwanda

⁵ Tulane University, USA

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List of Abbreviations

ANC:	Antenatal Care
CBHI:	Community based Health Insurance
CHWs:	Community Health Workers
CIIC-HIN:	Center for Impact- Innovation and Capacity building for Health Information systems and Nutrition
FANC:	Focused Antenatal Care
FGD:	Focus Group Discussion
HC:	Health Center
HCP:	Health Care Provider
HC:	Health Center
HMIS:	Health Management Information System
ICF:	Informed Consent Form
MDA:	Maternal Death Audits
MDGs:	Millennium Development Goals
MMCR:	Modified MomConnect Rwanda
MNCH:	Maternal, Neonatal and Child Health
MOH:	Ministry of Health
ODK:	Open Data Kit
OR:	Odd Ratio
PNC:	Post Natal Care
RBC:	Rwanda Biomedical Center
RCT:	Randomized Clinical Trial
RDHS:	Rwanda Demographic and Health Survey
RISA:	Rwanda Information Society Authority
WHO:	World Health Organization
SSA:	Sub Saharan Africa

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Executive summary

Rwanda has made tremendous efforts to reach Millennium Development Goals (MDGs) 4 and 5 and the use of general maternal and child health services over the past two decades. However, challenges remain in the use and completion of recommended antenatal care (ANC) and postnatal care (PNC) visits. This mixed methods cross-sectional study explores enabling and hindering factors affecting the use of ANC and PNC services, including the quality of services delivered to pregnant and lactating mothers.

We used published international and local standards of ANC and PNC care to create a multi-faceted variable to define the quality of care delivered. Depression knowledge and practices among health care providers and the quality of ANC and PNC delivered were assessed with vignettes, patient exit interviews, and focus group discussions. Depression status among pregnant and postpartum women was assessed using the PHQ-9, and patient satisfaction was assessed on a Likert scale and through focus group discussions.

Most pregnant women were satisfied with their care (73.9%); however, the quality of ANC (10%) and PNC (24.6%) was low. Higher adjusted odds of achieving ANC client satisfaction were associated with being married, higher parity, more time spent at the health center, and higher travel costs. Recommended ANC standard visits were associated with being married, having higher parity, having health insurance, and having a history of stillbirth. Receiving the recommended quality of ANC services was associated with being married, having higher parity, having health insurance, spending longer at the health center, and having a history of stillbirth. CHWs and community factors were identified as mediators to improve knowledge and information related to ANC services among pregnant women, women who stopped using ANC services, and their partners. The MomConnect digital tool was reported by respondents as likely to improve decision-support through ANC reminders of key pregnancy dates, the content of ANC visits, and expected outcomes for each visit, as well as reporting attitudes of health care workers and client satisfaction.

1. Background and Rationale

In the past two decades, Rwanda has made substantial progress in reducing maternal and neonatal mortality. 2014/15 and the 2019/20 Rwanda Demographic Health Survey (RDHS) reported neonatal mortality rates of respectively 20/1000 and 19/1000 live births, as well as maternal mortality rates of respectively 210/100,000 and 203/100,000 (1, 2), nearly achieving both related Millennium Development Goals (MDGs). Since the 2014–15 RDHS, improving outcomes has proven more challenging. New policies, programs, and interventions have been implemented with the goal of contributing to the improvement of maternal and neonatal health. However, there is evidence that these efforts have not achieved their intended impact.

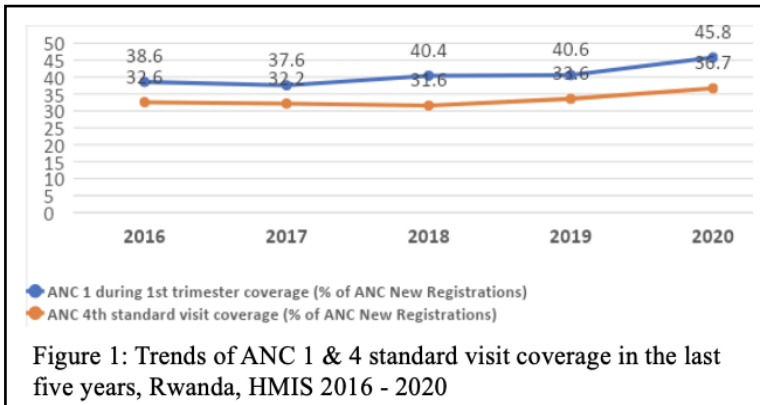
These programs and interventions include but are not limited to (1) the creation of a community-based health insurance (CBHI) system to reduce the financial burden of health services, (2) the establishment of a community health worker (CHW) program in every village of the country, (3) the implementation of maternal death audits (MDA) to provide information on causes of death, (4) the adoption of the World Health Organization (WHO) approach to support focused antenatal care (ANC) recommending four ANC visits during the pregnancy (3), (5) the implementation of RapidSMS, an innovative mobile technology tool that tracks pregnant women, newborns and children under two years of age at community and health facilities in 15,000 villages across Rwanda (4). Despite all the progress made, neonatal mortality is still a burden. Data from MDA in 2013 showed that around 43% of maternal deaths occur during the postpartum period, 21% during childbirth, and 36% during pregnancy.

Furthermore, 27 neonates out of 1,000 live births die each year within the first month (5). According to data extracted from Rwanda's Integrated Health Management Information System (HMIS) in 2020–2021, the main causes of neonatal mortality are prematurity (45.5%) and asphyxia (31.7%). Analysis of Rwanda's health management information system (HMIS) data showed that the recommended timely compliance of the ANC was 50% in 2020, and this number has barely improved over the past 5 years (Figure 1). Data and feedback limitations prevent a better understanding of why there is such poor ANC compliance in Rwanda. ANC protects the health of women and their unborn children, providing a platform for important health-care functions, including health promotion, screening and diagnosis, and disease prevention, at a critical time in a woman's life (6). Essential interventions in ANC include the identification and management of conditions such as nutritional deficiencies, anemia, preeclampsia, gestational diabetes, and depression. ANC is an opportunity to initiate intermittent preventive treatment for malaria during pregnancy.

The interactions during ANC visits give healthcare providers (HCP) the opportunity to intervene early on problems in the hopes of preventing complications that may lead to deaths, especially during the third trimester visits. Unequivocally, ANC represents a multi-faceted opportunity to improve maternal and neonatal health outcomes.

The 2016 WHO ANC model was published, and it recommended a minimum of eight ANC contacts, effectively replacing the previous four-visit focused ANC (FANC) model. The recommendation is as follows: The first contact is scheduled to take place in the first trimester (up to 12 weeks of gestation), two contacts are scheduled in the second trimester (at 20 and 26 weeks of gestation), and five contacts are scheduled in the third trimester (at 30, 34, 36, 38, and 40 weeks) (6). Piloting of the 2016 WHO ANC began in Rwanda by the Rwanda Biomedical Center (RBC) in January 2023, but validation and implementation of recommendations will take place past 2024. Thus, this project will closely follow RBC's guidelines in the implementation of the 2016 WHO ANC, consistent with current MNCH practice.

Figure 1: Trends of ANC1 and 4 standard visits:



HMIS 2016-2020 With several pilot projects in several countries that have successfully used cell phone technology as a tool to improve interventions, MomConnect was implemented in South Africa to strengthen the quality of maternal and infant health services and improve mortality outcomes (7). The rationale for the MomConnect program was to capitalize on the high mobile phone coverage in South Africa to strengthen ANC services. Specifically, MomConnect was designed to offer voluntary health promotion messaging to encourage pregnant women to attend an ANC center within the first trimester of pregnancy and to complete all recommended ANC visits in a timely manner.

The services of this mHealth solution are free to the user and provides a range of facilitated services including (1) registration of pregnant women in public health ANC facilities and enrollment into a national register of pregnant women; (2) subscription to limited weekly text messages telling pregnant women to attend a center via CHW enrollment; (3) subscription to stage-appropriate SMS messaging from the date of registration, through delivery, until the baby’s first birthday; (4) a help desk allowing pregnant women to ask additional questions, submit compliments or complaints, or rate the quality of care received; (5) a service to allow mothers to rate the quality of care received at the center (8–10). Measure Evaluation was unable to determine the impacts of MomConnect on ANC compliance in South Africa due to an insufficient sample size of enrolled users in 2017 (11).

Therefore, we will perform a high-quality randomized controlled trial (RCT) to check the ability of this tool to improve ANC compliance in Rwanda in phase 3. Additionally, CIIC-HIN could build new utilities to target improvements in ANC compliance as well as improvements in maternal nutrition, postpartum depression, and low birth weight.

Figure 1: Theories of change applied to MomConnect intervention in South Africa

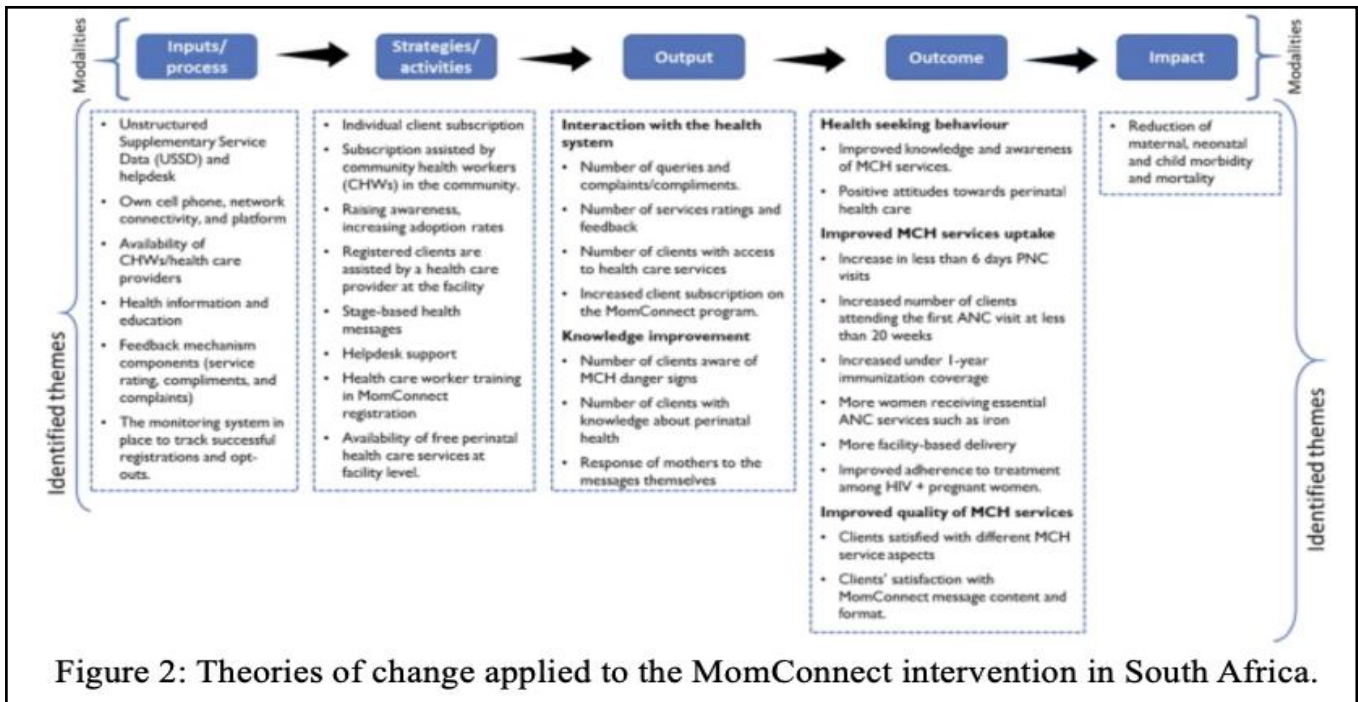


Figure 2: Theories of change applied to the MomConnect intervention in South Africa.

A 2020 review of 22 documents that described MomConnect in South Africa included Figure 2 to describe the theories of change that applied to the intervention. From this kind of analysis, we can begin to determine what to ask our informants in Rwanda that will guide adaptation of the intervention optimized for inclusion in the modified MomConnect Rwanda (MMCR) (12).

2. Aim and objectives.

2.1 Aims

This study will first explore barriers to and facilitators of ANC compliance among pregnant Rwandan women to inform the design and strategic implementation of a customized mHealth solution. This information will be collected from health providers, including CHWs, women of reproductive age, pregnant and lactating mothers, their husbands, and community health workers at the village level in charge of monitoring the general health of the population. We will consider this last group as our co-production group that will be selected to represent the views of mothers on the board of directors. Next, the iteratively designed intervention of MMCR will be implemented, and we will evaluate the impact of this mHealth solution on the uptake, compliance, and quality of ANC and other key outcomes in Rwanda.

2.2 Objectives

- To evaluate the patient experience of receiving ANC and postnatal care (PNC) in Rwanda, including an evaluation of the quality of care offered by healthcare providers (phase 1, quantitative component),
- To assess the level of client satisfaction attending ANC and PNC as well as their PHQ-9 quantified depression status and knowledge of postpartum depression.
- To assess key drivers, including barriers and facilitators of ANC uptake, compliance, and quality of ANC services in Rwanda (Phase 1: quantitative and qualitative components), Informed by the results of Phase 1, design and implement interventions embedded within digital tools based on MomConnect (Phase 2).
- To assess the impact of the phase 2 designed and modified MomConnect Rwanda (MMCR) on both structural and process quality of ANC delivery, compliance with recommended ANC, infant and maternal nutrition, and postpartum depression (Phase 3),

3. Methods

3.1 Study Description

We used mixed methods to collect data for this study, which was conducted in three phases, with the methods described here reflecting phase 1. These results are crucial to intervention and implementation strategy design in phase 2, as well as the development of the research protocol for the impact evaluation in phase 3. More specifically:

- Phase 1 documented a baseline for both ANC supply and demand sides relative to ANC compliance, quality, maternal nutrition, and postpartum depression while qualitatively exploring factors to inform the design of the content and implementation strategy of our intervention, in addition to understanding factors that hinder ANC uptake and compliance in general. This phase also established the baseline data from the targeted control and intervention sites to test the impact of MMCR in phase 3.
- Phase 2 will include iterative intervention design and piloting of MMCR using our findings from Phase 1.
- Finally, following findings from Phase 1 and the development of MMCR in Phase 2, a full protocol describing Phase 3 will be developed. Phase 3 will consist of a robust RCT comparing control (existing

standard of care) and intervention (MMCR) health facilities and the geographically associated population.

3.2 Study Design

3.2.1 Quantitative study design

We applied a cross-sectional, analytical study design aiming at exploring key drivers to impact ANC uptake and compliance using recommended ANC standard visits, and quality dimensions from the provider and beneficiary perspectives. We aimed to collect all information related to adherence to the ANC protocol, the status of depression, and nutrition.

3.2.2 Qualitative study design

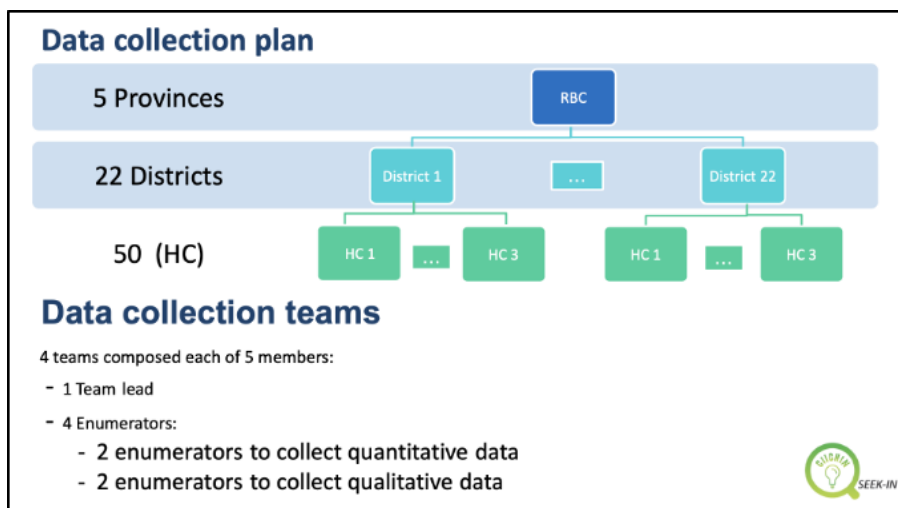
The qualitative study aimed at understanding perceptions or views and implications around drivers, facilitators, and barriers from beneficiaries, opinion leaders (CHWs), providers, and policymakers' perspectives on the improvement of ANC outcomes, maternal nutrition, and postpartum depression. In addition, we began collecting information about the type of digital health intervention that might have good uptake and be effective at supporting pregnant mothers to achieve ANC compliance and improve other pregnancy and health outcomes. At the policy level (national and global), the qualitative aspect aimed to understand perceptions and their implications around the MMCR to be applicable in Rwanda from digital health experts and policymakers. Findings from this phase will inform the research team to refine the theory of change for MMCR and inform the activities needed to design the digital health tool and an implementation strategy with good potential to add value to end users and in turn achieve improved ANC compliance and quality, maternal nutrition, and postpartum depression awareness.

3.3 Selection of study Sites

In this study, all public sites across the country that deliver routine ANC services were considered. All five provinces, including the city of Kigali, were included, from which a random assignment of the administrative districts was used based on the ANC compliance level of the health facilities. In each province, data on ANC compliance per health center was extracted from HMIS for the past 2 years (2020 - 2021).

The proposed sample design was a two-stage sample design with a sampling frame drawn from all HC offering ANC across these 5 provinces. The first stage of sampling involved health centers offering ANC and their level of ANC performance, and the second phase was the selection of pregnant women attending health centers (HCs). These HCs will constitute our cluster for the estimation of the Phase 3 sample size.

Figure 2: Data collection composition and teams



We first analyzed aggregated data from HMIS to identify 3 categories of health centers (HC) with high, medium, and low performance on ANC compliance. We then, applied probability proportional to size to select the exact number of HC per these 3 categories. The categorization was developed using IQR such as those with IQR less than 25 were grouped into low (n=99), those with IQR between >25 and IQR<75 was grouped into medium (n=309) and lastly, those with IQR above 75, are grouped into high ANC performant HC (n=109). The last

sample size was calculated using random sampling of a quantity proportional to the full population of HC. Using this method, a total of 50 health centers were selected, with 13 in low performance, 27 in medium performance, and 10 in high performance.

3.4 Study Population and sample size

For the second level of selection, we estimated the final number of respondents within each HC. Based on the current conservative estimation of composite compliance with recommended ANC at the national level (37%), with an estimated increase of 25% to achieve 46.25% after the intervention with a power of 90%, assuming an equal number of treated and controls, we selected an approximated number of 40 beneficiaries in each health center, which will give 2,139 beneficiaries across 50 HC to be selected for ANC (1,138) and PNC (1,001).

Within each health center, respondents from both intervention and control arms were interviewed during phase 1 including pregnant women, healthcare providers, women attending ANC, scheduled infant immunizations, and deliveries. Other caretakers identified by respondent women as key supporters, such as husbands, opinion leaders at the village level, and heads of health centers, were also considered during this phase. Other stakeholders, including the ones in charge of software development at the central level (RISA, RBC, Rwandan National Cybersecurity Agency, and MOH) and international maternal and digital health experts, were included in the sample to consider MMCR design aspects.

3.5

Study tools

To respond to the different objectives of this study, different tools were developed, tested, and applied throughout the data collection period which are fully described in Figure 4 below.

Figure 3: Description of data collection forms

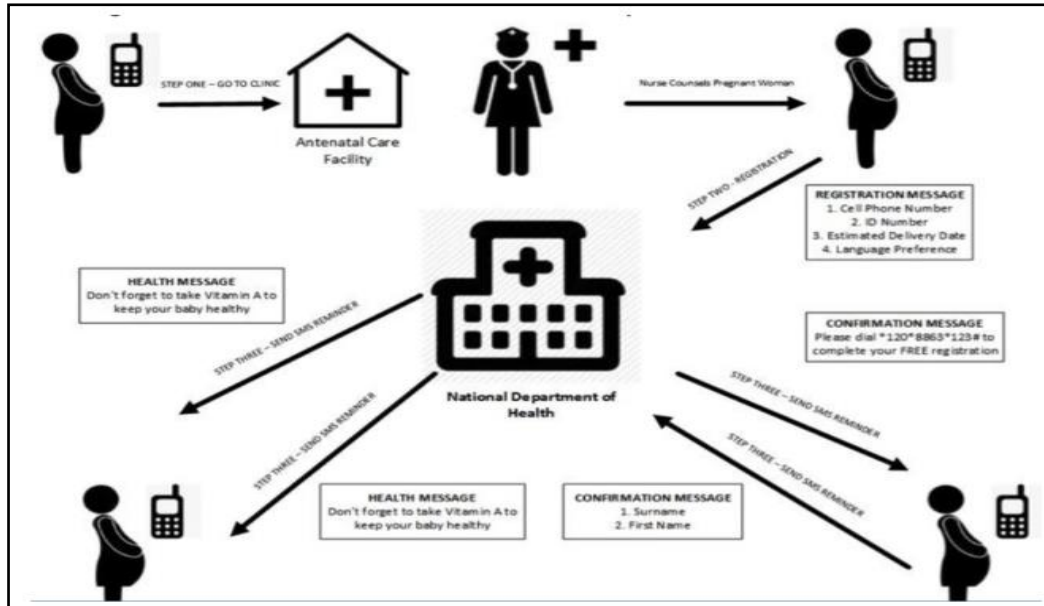
Level	Data Collection Form (DCF)	Respondent	Purpose of the DCF
Health Center (HC) and/or geographic catchment area served by the (HC) - national, randomized sample of 50 total HCs representing low (13), medium (27) and high (10) quality of ANC compliance	1. Quantitative questionnaire - Women receiving antenatal care (ANC)	Pregnant women after ANC visit - 1138	Exit interview to assess the service quality received during ANC, satisfaction, perceptions, costs, PHQ-9 depression, recalled dietary intake as well as access to a mobile phone and data/internet
	2. Quantitative questionnaire - Women receiving postnatal care (PNC)	Women after vaccination of their child - 1001	To collect information related to breastfeeding, incidence of postpartum depression, PNC quality, depression knowledge, attitudes, and practices (KAP)
	3. Quantitative questionnaire - Mental Health Officer	Mental health nurse - 48	Understand qualifications and assess the KAP related to postpartum depression
	4. Quantitative questionnaire - lead Health care professional (HCP)	Head of HC - 50	Understand the health center, the staffing, the healthcare delivery, infrastructure, staff training received, working conditions and overall satisfaction of the head of the HC.

	5. Quantitative questionnaire - HCPs providing ANC	Nurse, midwife or other HCP providing ANC services - 64	To understand their qualifications, work environments, perceptions, attitudes. Also assess structure and process quality of ANC delivery via a clinical vignette and questions evaluating HCP knowledge and practice
	6. Qualitative Focus Group Discussion (FGD) Guide Women	Pregnant or recently postpartum women, mix of ANC compliant and not - 49 FGs	To collect information on enablers and barriers to ANC compliance, feedback on MMCR and depression
	7. Qualitative FGD Guide Men	Men with pregnant wives - 48 FGs	To understand their KAP of ANC, perceptions, enablers and barriers to attend ANC with their wives
	8. Qualitative FGD Guide CHW	Community health workers (CHW) - 50 FGs	To understand scope of CHW role in ANC and collect information on enablers and barriers to ANC compliance, feedback on MMCR and depression
	9. Qualitative interview guide - Rwandan and external informants	Rwandan and external informants of strategies to improve digital health interventions and/or ANC compliance - 7	Collect experiences and advice on the implementation and design of a digital health tool like MMCR aiming to improve ANC compliance and outcomes

3.6

Proposed Intervention for Phases 2 and 3

Figure 4: MomConnect mapping process

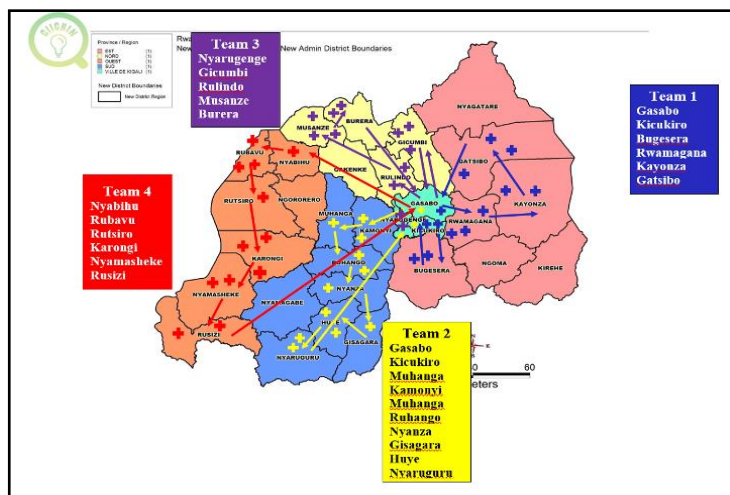


Informed by the findings of Phase 1, we intend to liaise with South African MomConnect experts and Rwandan experts in digital health and software developers to design a tool to meet the needs identified in Rwanda and optimize the implementation strategy for impact and sustainability. This process defines phase 2, which will also build the capacity of local software developers and administration teams to grow and maintain the tool heretofore referred to as MMCR. Figure 5 describes the implementation process used for MomConnect in South Africa as an example.

3.7 Data collection and management

3.7.1 Data Collection Team Training: Every team member was engaged in a three-day training activity that included the broad concepts of the overall project. Included in the training were the data collection protocol, professionalism, COVID precautions, interview and focus group techniques, team member roles and responsibilities, and in-depth reviews of the data collection tools, along with practice and piloting of the tools. The team leads were the most experienced in data collection and were responsible for managing and holding accountable the rest of the team, which included four enumerators. Each team of five was responsible for data collection from health centers in each of the regions, as indicated in the figure above.

Figure 5: Mapping of Health facilities visits



3.7.2 Data management:

All data collection tools described above were translated into the local language to reduce any bias from the tools or respondents. These tools were programmed using the Open Data Kit (ODK) installed in tablets for data collection. As enumerators entered the data into ODK, all information collected was stored on a remote server after cleaning the dataset by the supervisor while in the field. The Datasets were then de-identified and exported to STATA 17.0 for further analysis.

All planned focus group discussions (FGD) were conducted face-to-face, observing COVID-19 measures. We ensured that participants felt comfortable expressing their views on the ANC services provided at the health facilities and the discussion was audio-recorded with the consent of the respondents. FGDs were conducted at the health center or near the health center and included husbands of pregnant mothers who did not

attend ANC visits. These targeted participants were identified ahead of the planned visit by CHWs, who oversaw contacting beneficiaries to participate in the FGD. Finally, KIIs were adapted from FGDs to collect views and perceptions from policymakers, IT professionals and those working in the digital space at national and global levels.

All data was handled in a manner consistent with the new national policy related to the protection of personal data and privacy and the National Data Center's requirements.

3.8 Data analysis

Description of health care providers (ANC providers and mental health providers): Providers of ANC services were assessed to understand most of the structure dimensions, including their level of education, background, years of experience and knowledge, and attitudes toward depression. The description of these variables used simple prevalence and cumulative proportions to describe the sample.

Assessment of the main outcomes among women attending ANC: ANC compliance with the recommended standard visit, client satisfaction, and quality of ANC were assessed as dependent variables in the analysis. Covariates included demographic characteristics, use of the telephone and internet bundles, health insurance, costs and time spent at health facilities and during travels from home to HC, attendance at school, as and mid-upper arm circumference (MUAC), used to assess acute malnutrition among pregnant mothers attending ANC.

During univariate analysis, frequencies and percentages were reported for each of the covariates. We ran measures of association between covariates and the main outcomes to assess not only the existence of the association but also the strength of the association in the multivariate. We also performed Cronbach's alpha testing to assess the internal reliability of scales generated for depression and other measurements of the quality of ANC. Lastly, we performed a correlation matrix using Pearson correlation to detect any risk of collinearity during multivariate analysis. Multiple logistic regression generated odds ratios (ORs) and the strength of the relationship between covariates and outcomes. All findings were reported using ORs with significant levels of alpha at 0.05, 0.10, and 0.001. Assessment of the main outcomes among women attending PNC: as for ANC, the quality of PNC was assessed using a scale that was later grouped into good/poor PNC services. Description of the sample used simple proportions and frequencies. In bivariate analysis, chi2 was used to assess for an association between the main outcome and covariates. In the multivariate analysis, multiple logistic regression reported ORs were used to assess the strength of the association between covariates and the dependent variable in PNC.

Evaluation of postpartum depression using PHQ-9

In order to measure self-reported knowledge and attitudes of the PPD, a survey of Portugal's general population was modified after a brief literature review (15). As stated in the linked survey instrument in appendix C and D, these questions were distributed and utilized to sign up participants. The PHQ-9, a depression screening tool that has received substantial validation across the African continent, was used to evaluate enrolled mothers (women attending ANC and PNC) for depression. A PHQ-9 that had been translated for use in depression screening among Kinyarwanda-speaking Congolese refugees residing in Rwanda was recently validated by a study. The instrument was deemed to be acceptable and understood by their cognitive assessment, which was conducted on a population that was 72% female and had an average age of 41 years (SD +/- 17 years). Furthermore, the PHQ-9 featured superior internal consistency and construct validity, though diagnostic cut-off values were not established in this study (16).

Nutrition assessment: During Phase 1, information related to maternal nutrition was assessed using the 24-hour dietary recall tool, which is a structured interview questionnaire that aims at capturing information related to foods and drinks consumed the day before

the interview or 24 hours before the interview starts. Most frequently, the tools collect all intake from midnight going backward to midnight.

We also asked about food preparation methods, type of food consumed, portion size using visual aids, and time of day for eating. The analysis of this component will be presented in a subsequent paper related to nutrition. We used MUAC to assess acute malnutrition among pregnant mothers; this information is summarized in the table attached in the result section.

Focus group discussions and semi-structured interviews were conducted in the Kinyarwanda language. After completing the transcription of all FGDs, we used the discussion guides for each of the respective FGDs to develop a codebook from the transcriptions of women, men, and CHWs. We then coded and analyzed all FGDs in ATLAS-ti and exported all quotations with their corresponding sub-themes categorized into different themes. A summary of KIIs transcripts and debriefing notes was analyzed along with transcripts from digital health experts, decision-makers and global experts.

4. Inclusion and exclusion criteria

4.1 Inclusion criteria

Phase 1 of the study enrolled pregnant women, women attending PNC during the vaccination sessions, selected husbands of women who failed to attend ANC visits, and any other person deemed to be involved in the decision related to pregnancy. We also collected information among healthcare providers (ANC providers) and CHWs identified from the selected healthcare facilities.

Criteria for inclusion on the supply side include:

- Must be involved in routine ANC service delivery either as a healthcare provider or a community health worker,
- Consent to participate.
- Head of selected health centers

On the demand side, the study enrolled healthy pregnant women, lactating mothers, or women attending PEV sessions who satisfied all the following criteria:

- Consented to participate.
- Consented pregnant women and lactating mothers.
- Consented husbands of women who did not attend ANC services during the last pregnancy.

We also considered opinion leaders at the village level, and policymaker and digital health key informants were selected at the national and global levels.

4.2 Exclusion criteria

The following criteria was considered for excluding individuals on both supply and demand sides:

- Not meeting the inclusion criteria listed above.
- Not volunteering or unwilling to participate in the study.

5. Ethical Considerations

5.1 Confidentiality

The privacy of participants was not invaded. Each respondent who consented to participate in the study was interviewed within a secured and enclosed environment free from external distraction. The time for the interview was set at the convenience of the respondent. All secondary data collection received from the existing systems such as HMIS were kept in private and secure space with restricted access to key investigators team to ensure safety, security and confidentiality of the data.

The collection and processing of personal data from participants enrolled in this study were de identified and limited to those data that are necessary to fulfill the objectives of the study and compliance with applicable data privacy protection laws and regulations.

5.2 Informed Consent

A qualified member of the study staff reviewed the information sheets, and the informed consent form (ICF) with potential participants, either individually or in groups. The study information was explained in the appropriate local language, Kinyarwanda. The participant, after agreeing to consent and passing the assessment of understanding, was requested to sign the ICF.

Participants were also asked whether they were willing to be contacted for potential future follow up studies, including sample collection and storage and eventually vaccine boosters.

Participation in this study was voluntary and they were able to discontinue at any time by notifying CIIC-HIN.

5.3 Ethical Approval

CIIC-HIN received authorization from the Rwanda Biomedical Center (RBC) and Rwanda National Ethics Committee (RNEC) to conduct the study.

6. Results

6.1 Quantitative results

6.1.1 Characteristics of ANC services and providers

During the data collection, we interviewed a total of 64 ANC providers. Most of them were female (60/64) and A0 or A1 (78.13%) with more than 5 years of ANC since their graduation. ANC services are offered ANC visit days are assigned according to pregnancy

Table 1: Description of ANC providers

ANC Provider Characteristics			
Gender	n	Percent	cum.
Male	4	6.25	6.25
Female	60	93.75	100
Function			
Nurse/clinical officer	27	42.19	42.19
A0/A1/A2 nurse	14	21.88	64.06
Midwife A0/A1	23	35.94	100
Qualification			
Nurse A0/A1	27	42.19	42.19
Nurse A2	13	20.31	62.5
Midwife A0/A1	24	37.5	100
Years of experience			
< 3yrs	16	25	25
3-5 yrs	18	28.12	53.12
> 5 yrs	30	46.88	100
Days ANC offered at HC			
3-5 days/ week	24	37.5	37.5
6-7 days/week	40	62.5	100

are midwives or nurses experience working in almost every day, but term.

6.1.2 Characteristics of Mental Health providers

Table 2: Description of mental health providers

Mental Health Officer - knowledge on PPD			
	n	Percent	Cum.
Qualification			
Nurse	2	4.17	4.17
Midwife	1	2.08	6.25
Mental health officer	45	93.75	100
Gender			
Male	12	25	25
Female	36	75	100
Total	48	100	
Mental Health - Knowledge			
Appropriate knowledge on PPD	14	29.17	29.17
Moderate knowledge on PDD	16	33.33	62.5
Poor knowledge on PDD	18	37.5	100
Total	48	100	

As shown in the Table 2, there were a total of 48 mental health officers assigned at the health center level. Most of the health providers working in mental health consultation are mostly women (75%), have appropriate background in mental health and are trained in mental health. We assessed their knowledge around post-partum disorders with prompted questions, and scale was created showing that overall, only, 29% had appropriate knowledge and attitudes toward post-partum depression. Almost 63% (16/48) had poor to moderate knowledge.

Characteristics of the head of health facilities, structural quality and process quality will be analyzed in another report to assess competency score among knowledge acquired through training and experience and translated skills reflected into practice.

Description of the sample				
Province		Frequency(n)	Percent	Cum.
East		190	16.70	16.70
North		217	19.07	35.77
South		248	21.79	57.56
West		334	29.35	86.91
kigali		149	13.09	100.00
Perfomance Category				
High		231	20.30	20.30
Low		281	24.69	44.99
Medium		626	55.01	100.00
Age				
20-35 yrs		865	76.01	76.01
<=19 yrs		85	7.47	83.48
>=36 yrs		188	16.52	100.00
Cival Status				
Married		991	87.08	87.08
Divorced/Separated		16	1.41	88.49
Single		131	11.51	100.00
Number of Children				
0		472	41.48	41.48
1		248	21.79	63.27
2		202	17.75	81.02
3-4		177	15.55	96.57
>4		39	3.43	100.00
Telephone Possession				
No		146	12.83	12.83
Yes		992	87.17	100.00
Attended_school				
never attended		51	4.48	4.48
ever attended		1087	95.52	100.00
Insurance				
CBHI		1069	93.94	93.94
RSSB/RAMA		39	3.43	97.37
None/ Other private		30	2.64	100.01
Miscarriage				
No		970	85.24	85.24
Yes		168	14.76	100.00
Stillbirth				
No		1097	96.48	96.48
Yes		41	3.52	100.00

6.1.3 Antenatal care

6.1.3.1 Univariate

Table 3: Description of women attending.

6.1.3.1.1 Description of the sample

There was a total of 1,138 women interviewed for the survey across 50 health facilities categorized as high (20.3%), medium (55.0%), and low (24,7%) performance (distributed across provinces of Rwanda, including the city of Kigali, with most women interviewed during the ANC residing in the West and South. Nearly half of the women who were interviewed visited the health center during their first ANC visit (46%). The age of pregnant mothers was grouped into 3 categories, with 76% aged between 20-35 years, and most women were married (87%). Only 7.5% of all women in the sample were aged 19 or below. Less than half of all women in the sample did not have any children (41.48%). Most of the women in the sample had some level of education with 96% reporting having attended school.

Almost all women interviewed were insured (94%) using CBHI, a community-based health insurance in Rwanda, and only 3% did not have any health insurance or paid privately.

Miscarriage and stillbirth were reported in this assessment, with a prevalence of 15% and 4% respectively.

Description of the sample			
Travel_time	Frequency(n)	Percent	Cum.
<=15 min	27	2.37	2.37
16-30 min	137	12.04	14.41
31-60 min	285	25.04	39.45
61-120 min	414	36.38	75.83
>120 min	275	24.17	100.00
Time_with_provider			
<=15 min	824	72.41	72.41
16-30 min	289	25.40	97.81
31-60 min	25	2.20	100.01
HF_time			
<=15 min	21	1.85	1.85
16-30 min	73	6.41	8.26
31-60 min	254	22.32	30.58
61-120 min	397	34.89	65.47
>120 min	393	34.53	100.00
Medical_services_cost			
<= 200 Frw	162	14.24	14.24
201-350 Frw	774	68.01	82.25
351-1000 Frw	152	13.36	95.61
> 1000 Frw	50	4.39	100.00
Travel_cost			
<= 200 Frw	374	32.86	32.86
201-350 Frw	13	1.14	34.00
351-1000 Frw	443	38.93	72.93
> 1000 Frw	308	27.07	100.00
MUAC			
Normal	418	36.86	36.86
underweight	46	4.06	40.92
Overweight	617	54.41	95.33
Obese	53	4.67	100.00
ANC_visit			
ANC Visit1	520	45.69	45.69
ANC Visit2	272	23.90	69.59
ANC Visit3	231	20.30	89.89
ANC Visit4	115	10.11	100.00
Pregnancy term			
First term	321	28.21	28.21
Second term	391	34.36	62.57
Third term	426	37.43	100.00
Depression_Severity			
none-minimal	653	57.38	57.38
mild	293	25.75	83.13
moderate	122	10.72	93.85
moderately severe	56	4.92	98.77
severe	14	1.23	100.00

Table 4: Description of the sample: Time spent and costs of services and other important covariates.

We recorded time spent as reported by pregnant women traveling to reach health facilities, time spent within HC across services, and time spent with the provider (ANC provider).

As shown in the Table 4, 24% (275/1,138) and 37% (414/1138) still walk for more than 2 hours and between 1-2 hours consecutively. Additionally, almost 70% of pregnant women spent between 1 and 2 hours or more before being seen by an ANC provider. Unfortunately, most of the pregnant mothers are seen for only 15 minutes or less with an ANC provider (72%) after spending 1 hour to more than 2 hours

doing registration and fulfilling all other requirements needed at the health center.

6.1.3.1.2 Depression among women attending ANC services.

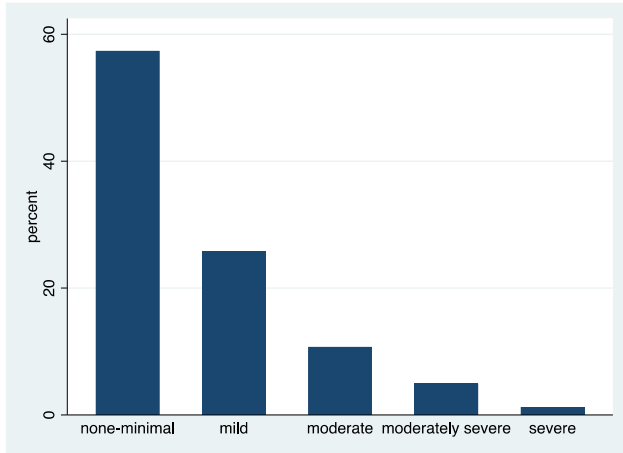


Figure 6: Depression status among women attending ANC services.

Depression was found to be severe or moderately severe in 6.15% of women attending ANC. and moderate depression was found in almost 11%.

6.1.3.1.3 Main ANC Outcome: Client satisfaction – compliance of ANC standard visit and quality of ANC delivered.

There were 3 main outcomes considered as main components from the supply or demand sides to assess ANC components. The identification of these components is crucial to prepare for phase 2 implementation. We consider beneficiary or client satisfaction as the foundation to proposing current or future services. We also considered compliance with the four ANC recommended standard visits and the quality of ANC services delivered.

Most women interviewed during the exit interview were mostly satisfied (74%) by the ANC services they received. Of all 1,138, almost 67% (757/1,138) received standard ANC visits up to the time of the interview. However, less than 10% of pregnant women received the recommended quality of ANC, as shown below in the Table 5.

Table 5: Description of key dependent variables

Description of the sample			
Client Satisfaction	Frequency(n)	Percent	Cum.
Not Satisfied	297	26.10	26.10
Satisfied	841	73.90	100.00
ANC standard visit			
No	381	33.48	33.48
Yes	757	66.52	100.00
Recommended ANC quality			
No	1028	90.33	90.33
Yes	110	9.67	100.00

6.1.3.2 Bivariate Analysis

As explained in the method section, before running any bivariate analysis, we run a Pearson correlation test to check for any potential collinearity within covariates and between covariates and the main outcomes. There was an association between pregnant women living in the West and East provinces and client satisfaction with ANC services received at the health facilities. However, those living in Kigali, the south, and the north provinces reported fewer ANC standard visits as opposed to pregnant women coming from the north and south (Pearson $\chi^2 = 14.101$; $p = 0.080$) but received a good quality of ANC services as opposed to those living in the west and eastern provinces.

Additionally, having one or more children and not being married were associated with client satisfaction at 10% and 5% respectively.

The telephone possession among women attending ANC, a key variable to inform phase 2, was associated with the satisfaction of clients among women who received ANC services (Pearson $\chi^2 = 4.159$; $p = 0.017$) and with the recommended ANC standard visit (Pearson $\chi^2 = 6.073$; $p = 0.035$).

Table 6: Association between covariates and main outcomes (a)

Client Satisfaction			ANC Standard Visit			ANC Quality			
	No	Yes		No	Yes	No	Yes		
Province	Frequency (% [95%CI])	% [95%CI]	Frequency (% [95%CI])	% [95%CI]	% [95%CI]	Frequency (n % [95%CI])	% [95%CI]	% [95%CI]	
East	190	18.4[10.9,29.4]	81.6[70.6,89.1]	190	36.8[29.9,44.4]	63.2[55.6,70.1]	190	84.2[73.5,91.1]	15.8[8.9,26.5]
North	217	33.2[22.0,46.7]	66.8[53.3,78.0]	217	28.1[18.1,40.9]	71.9[59.1,81.9]	217	92.2[81.6,96.9]	7.8[3.1,18.4]
South	248	30.2[19.2,44.1]	69.8[55.9,80.8]	248	26.6[22.2,31.5]	73.4[68.5,77.8]	248	98[93.4,99.4]	2[0.6,6.6]
West	334	15.9[9.0,26.6]	84.1[73.4,91.0]	334	37.2[30.9,44.0]	62.8[56.0,69.1]	334	85.3[77.8,90.5]	14.7[9.5,22.2]
kigali	149	41.6[23.1,62.8]	58.4[37.2,76.9]	149	40.3[33.5,47.5]	59.7[52.5,66.5]	149	94[85.9,97.6]	6[2.4,14.1]
Total	1,138	26.1[20.3,32.9]	73.9[67.1,79.7]	1,138	33.5[29.8,37.4]	66.5[62.6,70.2]	1,138	90.3[86.5,93.2]	9.7[6.8,13.5]
Pearson: $\chi^2(4) = 50.3691$ Pr = 0.030**			Pearson: $\chi^2(4) = 14.1012$ Pr = 0.080*			Pearson: $\chi^2(4) = 37.4381$ Pr = 0.007**			
HF Performance Category									
High	231	30.7[20.4,43.4]	69.3[56.6,79.6]	231	32.9[26.1,40.5]	67.1[59.5,73.9]	231	95.7[90.4,98.1]	4.3[1.9,9.6]
Low	281	21.7[9.4,42.5]	78.3[57.5,90.6]	281	37.4[29.6,45.8]	62.6[54.2,70.4]	281	86.8[77.1,92.8]	13.2[7.2,22.9]
Medium	626	26.4[19.7,34.3]	73.6[65.7,80.3]	626	32[27.2,37.2]	68[62.8,72.8]	626	89.9[84.4,93.6]	10.1[6.4,15.6]
Total	1,138	26.1[20.3,32.9]	73.9[67.1,79.7]	1,138	33.5[29.8,37.4]	66.5[62.6,70.2]	1,138	90.3[86.5,93.2]	9.7[6.8,13.5]
Pearson: $\chi^2(2) = 5.4058$ Pr = 0.638			Pearson: $\chi^2(2) = 2.5997$ Pr = 0.464			Pearson: $\chi^2(2) = 11.5939$ Pr = 0.130			
Age									
20-35 yrs	865	26.5[20.1,34.0]	73.5[66.0,79.9]	865	30[26.1,34.2]	70[65.8,73.9]	865	89.5[85.2,92.6]	10.5[7.4,14.8]
<=19 yrs	85	25.9[16.6,38.0]	74.1[62.0,83.4]	85	40[29.2,51.9]	60[48.1,70.8]	85	95.3[88.3,98.2]	4.7[1.8,11.7]
>=36 yrs	188	24.5[18.1,32.2]	75.5[67.8,81.9]	188	46.8[38.6,55.2]	53.2[44.8,61.4]	188	92[85.6,95.7]	8[4.3,14.4]
Total	1,138	26.1[20.3,32.9]	73.9[67.1,79.7]	1,138	33.5[29.8,37.4]	66.5[62.6,70.2]	1,138	90.3[86.5,93.2]	9.7[6.8,13.5]
Pearson: $\chi^2(2) = 0.3244$ Pr = 0.835			Pearson: $\chi^2(2) = 21.4800$ P<0.001 ***			Pearson: $\chi^2(2) = 3.7308$ Pr = 0.147			
Civil Status									
Married	991	27.3[21.3,34.2]	72.7[65.8,78.7]	991	32.3[28.3,36.6]	67.7[63.4,71.7]	991	90.2[86.1,93.2]	9.8[6.8,13.9]
ivorced/Separate	16	18.8[5.6,47.2]	81.2[52.8,94.4]	16	37.5[20.8,57.9]	62.5[42.1,79.2]	16	81.2[55.2,93.8]	18.8[6.2,44.8]
Single	131	18.3[11.3,28.3]	81.7[71.7,88.7]	131	42[32.3,52.4]	58[47.6,67.7]	131	92.4[85.9,96.0]	7.6[4.0,14.1]
Total	1,138	26.1[20.3,32.9]	73.9[67.1,79.7]	1,138	33.5[29.8,37.4]	66.5[62.6,70.2]	1,138	90.3[86.5,93.2]	9.7[6.8,13.5]
Pearson: $\chi^2(2) = 5.2325$ Pr = 0.068*			Pearson: $\chi^2(2) = 5.0002$ Pr = 0.106			Pearson: $\chi^2(2) = 2.1487$ Pr = 0.318			
Number of children									
0	472	24.6[17.8,32.9]	75.4[67.1,82.2]	472	25.8[21.9,30.3]	74.2[69.7,78.1]	472	91.7[87.0,94.8]	8.3[5.2,13.0]
1	248	31.9[24.5,40.3]	68.1[59.7,75.5]	248	30.2[24.1,37.2]	69.8[62.8,75.9]	248	90.3[85.0,93.9]	9.7[6.1,15.0]
2	202	26.7[19.5,35.4]	73.3[64.6,80.5]	202	39.6[31.3,48.6]	60.4[51.4,68.7]	202	87.1[81.4,91.3]	12.9[8.7,18.6]
3-4	177	25.6[18.9,33.6]	74.4[66.4,81.1]	177	44.9[36.1,54.1]	55.1[45.9,63.9]	177	89.2[81.2,94.1]	10.8[5.9,18.8]
>4	39	7.7[2.6,20.9]	92.3[79.1,97.4]	39	64.1[46.9,78.3]	35.9[21.7,53.1]	39	94.9[81.7,98.7]	5.1[1.3,18.3]
Total	1,138	26.1[20.3,32.9]	73.9[67.1,79.7]	1,138	33.5[29.8,37.4]	66.5[62.6,70.2]	1,138	90.3[86.5,93.2]	9.7[6.8,13.5]
Pearson: $\chi^2(4) = 11.7622$ Pr = 0.008**			Pearson: $\chi^2(4) = 43.2227$ Pr <0.001***			Pearson: $\chi^2(4) = 4.5924$ Pr = 0.316			
Telephone Possession									
No	146	19.2[12.8,27.8]	80.8[72.2,87.2]	146	42.5[32.8,52.7]	57.5[47.3,67.2]	146	91.1[82.6,95.7]	8.9[4.3,17.4]
Yes	992	27.1[21.2,34.0]	72.9[66.0,78.8]	992	32.2[28.5,36.1]	67.8[63.9,71.5]	992	90.2[86.3,93.1]	9.8[6.9,13.7]
Total	1,138	26.1[20.3,32.9]	73.9[67.1,79.7]	1,138	33.5[29.8,37.4]	66.5[62.6,70.2]	1,138	90.3[86.5,93.2]	9.7[6.8,13.5]
Pearson: $\chi^2(1) = 4.1588$ Pr = 0.017**			Pearson: $\chi^2(1) = 6.0726$ Pr = 0.035**			Pearson: $\chi^2(1) = 0.1114$ Pr = 0.770			
Attended school									
never attended	51	29.4[16.2,47.3]	70.6[52.7,83.8]	51	54.9[40.5,68.5]	45.1[31.5,59.5]	51	92.2[80.4,97.1]	7.8[2.9,19.6]
ever attended	1,087	26[20.1,32.9]	74[67.1,79.9]	1,087	32.5[28.9,36.3]	67.5[63.7,71.1]	1,087	90.2[86.4,93.1]	9.8[6.9,13.6]
Total	1,138	26.1[20.3,32.9]	73.9[67.1,79.7]	1,138	33.5[29.8,37.4]	66.5[62.6,70.2]	1,138	90.3[86.5,93.2]	9.7[6.8,13.5]
Pearson: $\chi^2(1) = 0.3039$ Pr = 0.646			Pearson: $\chi^2(1) = 11.0020$ Pr = 0.002**			Pearson: $\chi^2(1) = 0.2032$ Pr = 0.628			

Table 8: Association between covariates and main outcomes (c)

Client Satisfaction				ANC Standard Visit				ANC Quality			
		No	Yes		No	Yes		No	Yes		
HF time											
<=15 min	21	14.3[4.3,38.1]	85.7[61.9,95.7]	21	33.3[18.0,53.2]	66.7[46.8,82.0]	21	81[58.3,92.8]	19[7.2,41.7]		
16-30 min	73	16.4[8.4,29.5]	83.6[70.5,91.6]	73	26[17.1,37.4]	74[62.6,82.9]	73	89[76.9,95.2]	11[4.8,23.1]		
31-60 min	254	13.4[7.7,22.5]	86.6[77.5,92.3]	254	32.8[26.6,39.7]	67.2[60.3,73.4]	254	87.7[81.2,92.2]	12.3[7.8,18.8]		
61-120 min	397	22.4[16.5,29.8]	77.6[70.2,83.5]	397	31[25.8,36.7]	69[63.3,74.2]	397	88.2[81.8,92.5]	11.8[7.5,18.2]		
>120 min	393	40.5[32.6,48.8]	59.5[51.2,67.4]	393	37.9[31.5,44.8]	62.1[55.2,68.5]	393	94.9[91.4,97.0]	5.1[3.0,8.6]		
Total	1,138	26.1[20.3,32.9]	73.9[67.1,79.7]	1,138	33.5[29.8,37.4]	66.5[62.6,70.2]	1,138	90.3[86.5,93.2]	9.7[6.8,13.5]		
Pearson: $\chi^2(4) = 71.1377$ Pr < 0.001***				Pearson: $\chi^2(4) = 6.4748$ Pr = 0.227				Pearson: $\chi^2(4) = 15.7063$ Pr = 0.018**			
Medical services cost											
<= 200 Frw	162	35.8[25.3,47.9]	64.2[52.1,74.7]	162	33.3[25.6,42.0]	66.7[58.0,74.4]	162	93.8[85.2,97.6]	6.2[2.4,14.8]		
201-350 Frw	774	21.7[16.2,28.4]	78.3[71.6,83.8]	774	32[27.7,36.5]	68[63.5,72.3]	774	90.2[85.3,93.6]	9.8[6.4,14.7]		
351-1000 Frw	152	38.8[24.3,55.6]	61.2[44.4,75.7]	152	36.8[30.5,43.7]	63.2[56.3,69.5]	152	86.8[76.6,93.0]	13.2[7.0,23.4]		
> 1000 Frw	50	24[13.2,39.7]	76[60.3,86.8]	50	48[33.5,62.8]	52[37.2,66.5]	50	92[82.5,96.6]	8[3.4,17.5]		
Total	1,138	26.1[20.3,32.9]	73.9[67.1,79.7]	1,138	33.5[29.8,37.4]	66.5[62.6,70.2]	1,138	90.3[86.5,93.2]	9.7[6.8,13.5]		
Pearson: $\chi^2(3) = 28.51$ Pr = 0.013**				Pearson: $\chi^2(3) = 6.3607$ Pr = 0.101				Pearson: $\chi^2(3) = 4.5662$ Pr = 0.432			
Travel cost											
<= 200 Frw	374	16.9[11.3,24.5]	83.1[75.5,88.7]	374	35.1[30.3,40.2]	64.9[59.8,69.7]	374	90.9[85.8,94.3]	9.1[5.7,14.2]		
201-350 Frw	13	23.1[7.1,54.1]	76.9[45.9,92.9]	13	30.8[11.2,61.1]	69.2[38.9,88.8]	13	92.3[58.9,99.0]	7.7[1.0,41.1]		
351-1000 Frw	443	31.8[23.6,41.4]	68.2[58.6,76.4]	443	31.2[26.0,36.8]	68.8[63.2,74.0]	443	89.8[83.9,93.7]	10.2[6.3,16.1]		
> 1000 Frw	308	29.2[22.9,36.5]	70.8[63.5,77.1]	308	35.1[28.7,42.0]	64.9[58.0,71.3]	308	90.3[83.8,94.3]	9.7[5.7,16.2]		
Total	1,138	26.1[20.3,32.9]	73.9[67.1,79.7]	1,138	33.5[29.8,37.4]	66.5[62.6,70.2]	1,138	90.3[86.5,93.2]	9.7[6.8,13.5]		
Pearson: $\chi^2(3) = 25.7638$ Pr = 0.001***				Pearson: $\chi^2(3) = 1.8708$ Pr = 0.625				Pearson: $\chi^2(3) = 0.3244$ Pr = 0.965			
MUAC											
Normal	418	19.2[14.4,25.2]	80.8[74.8,85.6]	418	35.7[30.1,41.8]	64.3[58.2,69.9]	418	88.7[82.8,92.8]	11.3[7.2,17.2]		
underweight	46	30.4[16.0,50.1]	69.6[49.9,84.0]	46	30.4[17.3,47.7]	69.6[52.3,82.7]	46	100	0		
Overweight	617	29.7[22.6,37.8]	70.3[62.2,77.4]	617	31.9[27.4,36.8]	68.1[63.2,72.6]	617	90.9[86.9,93.8]	9.1[6.2,13.1]		
Obese	53	37.7[23.7,54.2]	62.3[45.8,76.3]	53	34[22.0,48.4]	66[51.6,78.0]	53	86.8[70.6,94.7]	13.2[5.3,29.4]		
Total	1,134	26.2[20.4,33.1]	73.8[66.9,79.6]	1,134	33.4[29.7,37.2]	66.6[62.8,70.3]	1,134	90.3[86.4,93.1]	9.7[6.9,13.6]		
Pearson: $\chi^2(3) = 18.6771$ Pr = 0.003**				Pearson: $\chi^2(3) = 1.7371$ Pr = 0.695				Pearson: $\chi^2(3) = 7.0974$ Pr = 0.190			
ANC Visits											
ANC Visit1	520	22.9[16.7,30.4]	77.1[69.6,83.3]	520	40.8[35.8,45.9]	59.2[54.1,64.2]	520	78.8[71.6,84.7]	21.2[15.3,28.4]		
ANC Visit2	272	30.1[22.4,39.2]	69.9[60.8,77.6]	272	28.7[23.1,35.0]	71.3[65.0,76.9]	272	100	0		
ANC Visit3	231	29.1[20.2,40.0]	70.9[60.0,79.8]	231	39.6[33.3,46.2]	60.4[53.8,66.7]	231	100	0		
ANC Visit4	115	25.2[15.5,38.3]	74.8[61.7,84.5]	115	0	100	115	100	0		
Total	1,138	26.1[20.3,32.9]	73.9[67.1,79.7]	1,138	33.5[29.8,37.4]	66.5[62.6,70.2]	1,138	90.3[86.5,93.2]	9.7[6.8,13.5]		
Pearson: $\chi^2(3) = 6.1540$ Pr = 0.254				Pearson: $\chi^2(3) = 76.7322$ Pr < 0.001***				Pearson: $\chi^2(3) = 144.7195$ Pr < 0.001***			
Pregnancy Months											
First term	321	22.7[16.3,30.7]	77.3[69.3,83.7]	321	0	100	321	76.6[68.6,83.2]	23.4[16.8,31.4]		
Second term	391	26.4[19.4,34.8]	73.6[65.2,80.6]	391	45.9[36.8,55.3]	54.1[44.7,63.2]	391	91.8[87.1,94.9]	8.2[5.1,12.9]		
Third term	426	28.4[20.7,37.6]	71.6[62.4,79.3]	426	47.4[41.7,53.2]	52.6[46.8,58.3]	426	99.3[97.9,99.8]	0.7[0.2,2.1]		
Total	1,138	26.1[20.3,32.9]	73.9[67.1,79.7]	1,138	33.5[29.8,37.4]	66.5[62.6,70.2]	1,138	90.3[86.5,93.2]	9.7[6.8,13.5]		
Pearson: $\chi^2(2) = 3.0615$ Pr = 0.377				Pearson: $\chi^2(2) = 225.2828$ Pr < 0.001***				Pearson: $\chi^2(2) = 109.1503$ Pr < 0.001***			

6.1.3.3 Multivariate Analysis

After controlling for other covariates, pregnant mothers who were married tended to be less likely to be satisfied with ANC services than those who were single or divorced. However, they were more likely to follow the recommended 4 standard ANC visits. Women with one or more children were more likely to be satisfied by the ANC services (aOR: 1.149, 95% CI [1.04-1.264]) and tended to receive quality ANC services (aOR: 1.326, 95% CI [1.084, 1.622]), but they were less likely to follow ANC the standard visit (aOR: 0.716, 95% CI [0.62, 0.83]). Depression was a key factor in predicting the level of satisfaction among the clients who received ANC services. Women with depression tended to be less likely to be satisfied with the ANC services (aOR: 0.711, 95% CI [0.66, 0.83]).

Finally, key variables that had a positive or negative effect on the outcomes of the study include (a) ANC client satisfaction: marital status, number of children, the level of depression, time spent at HC, and travel costs to HC and MUAC.

(b) Recommended ANC standard visit: marital status, number of children, health insurance, having ever had a stillbirth, level of depression, cost of medical services, and type of ANC visit.

(c) Recommended quality of ANC services: number of children, health insurance, having ever had a stillbirth, amount of time spent at HC, and trimester of pregnancy

Table 9: ANC- Multivariate Analysis

	ANC -Client Satisfaction			ANC - standardized Visit			ANC - quality of care		
	aOR	P-value	95% CI	aOR	P-value	95% CI	aOR	P-value	95% CI
Province									
South	1.000			1.000			1.000		
North	0.431	0.032	[0.200 0.929]	1.773	0.197	[0.736 4.273]	0.326	0.135	[0.074 1.433]
South	0.422	0.018	[0.207 0.856]	2.503	0.01	[1.252 5.005]	0.265	0.066	[0.064 1.093]
West	0.657	0.323	[0.283 1.529]	0.615	0.214	[0.283 1.338]	11.139	0	[4.102 30.247]
Kigali	0.457	0.114	[0.172 1.215]	1.034	0.931	[0.475 2.254]	0.578	0.631	[0.059 5.651]
Age_group									
20-35 yrs	1.000			1.000			1.000		
<=19 yrs	0.736	0.291	[0.413 1.311]	0.576	0.241	[0.226 1.465]	0.460	0.141	[0.162 1.307]
>=36 yrs	0.900	0.71	[0.513 1.582]	1.037	0.901	[0.577 1.863]	0.483	0.156	[0.175 1.333]
Marital_status									
Married	1.000			1.000			1.000		
Divorced/Separated	3.052	0.216	[0.511 18.233]	1.583	0.596	[0.280 8.939]	3.081	0.15	[0.655 14.490]
Single	2.486	0.006	[1.322 4.676]	0.350	0.015	[0.153 0.805]	1.713	0.375	[0.512 5.729]
Number of Children									
0	1.000			1.000			1.000		
1	0.726	0.155	[0.465 1.134]	0.440	0.002	[0.263 0.737]	1.952	0.181	[0.726 5.250]
2	0.867	0.492	[0.572 1.313]	0.408	0.002	[0.234 0.711]	3.546	0.012	[1.330 9.452]
3_4	1.135	0.614	[0.686 1.878]	0.258	0	[0.141 0.474]	1.409	0.567	[0.426 4.662]
>4	7.442	0.003	[2.068 26.773]	0.187	0.001	[0.073 0.480]	1.388	0.698	[0.257 7.497]
Miscariage									
No	1.000			1.000			1.000		
Yes	1.309	0.275	[0.802 2.137]	1.305	0.26	[0.816 2.086]	1.674	0.225	[0.721 3.885]
Stillbirth									
No	1.000			1.000			1.000		
Yes	1.005	0.988	[0.525 1.924]	0.5200023	0.032	[0.287 0.942]	0.657	0.514	[0.182 2.372]
School Attended									
never attended	1.000			1.000			1.000		
Ever attended	1.717	0.258	[0.664 4.434]	1.425	0.474	[0.531 3.827]	0.433	0.181	[0.125 1.495]
Education level									
Primary completed	1.000			1.000			1.000		
Primary not completed	1.247	0.242	[0.857 1.815]	1.052	0.794	[0.716 1.546]	1.280	0.565	[0.543 3.017]
Secondary completed	1.328	0.301	[0.769 2.292]	0.951	0.864	[0.532 1.702]	0.686	0.477	[0.238 1.974]
Secondary not completed	1.390	0.163	[0.871 2.217]	1.162	0.528	[0.722 1.871]	0.452	0.072	[0.189 1.077]
TVET	4.279	0.379	[0.159 115.134]				6.169	0.025	[1.265 30.077]
Tertialy	0.408	0.026	[0.186 0.896]	1.961	0.168	[0.746 5.160]	1.590	0.552	[0.336 7.532]
Insurance									
CBHI	1.000			1.000			1.000		
RSSB/RAMA	1.092	0.856	[0.413 2.892]	1.778	0.254	[0.653 4.838]	3.966	0.022	[1.233 12.752]
None/ Other	1.017	0.976	[0.337 3.071]	1.133	0.776	[0.470 2.727]	7.953	0.056	[0.947 66.758]

Telephone Ownership									
No	1.000				1.000				1.000
Yes	1.230	0.267	[0.850 1.779]		0.773	0.234	[0.503 1.188]		1.365 0.285 [0.765 2.436]
Telephone with Internet									
No	1.000				1.000				1.000
Yes	1.817	0.244	[0.657 5.026]		1.048	0.911	[0.452 2.433]		0.201 0.109 [0.028 1.450]
Smartphone									
No	1.000				1.000				1.000
Yes	0.394	0.07	[0.143 1.084]		1.431	0.432	[0.577 3.551]		3.681 0.111 [0.733 18.484]
Travel cost									
<= 200 Frw	1.000				1.000				1.000
201-350 Frw	0.946	0.954	[0.138 6.502]		1.686	0.542	[0.305 9.286]		6.358 0.002 [2.074 19.488]
351-1000 Frw	0.622	0.046	[0.390 0.990]		1.001	0.996	[0.619 1.619]		2.541 0.002 [1.414 4.565]
> 1000 Frw	0.615	0.02	[0.409 0.924]		1.054	0.847	[0.612 1.814]		2.772 0 [1.793 4.285]
Medical Cost									
<= 200 Frw	1.000				1.000				1.000
201-350 Frw	1.781	0.077	[0.938 3.384]		0.837	0.576	[0.444 1.578]		2.008 0.112 [0.846 4.765]
351-1000 Frw	1.025	0.959	[0.396 2.654]		0.383	0.066	[0.138 1.066]		1.133 0.882 [0.211 6.086]
> 1000 Frw	2.444	0.085	[0.879 6.793]		0.180	0.006	[0.055 0.595]		1.994 0.356 [0.450 8.829]
Time Spend with Provider									
<=15 min	1.000				1.000				1.000
16-30 min	1.711	0.018	[1.102 2.659]		1.052	0.845	[0.627 1.765]		3.115 0.01 [1.336 7.259]
31-60 min	1.188	0.736	[0.427 3.312]		1.042	0.943	[0.330 3.290]		0.458 0.27 [0.112 1.869]
Time Spend at Health facility									
<=15 min	1.000				1.000				1.000
16-30 min	1.759	0.479	[0.3579843 8.640522]		2.654	0.279	[0.443 15.902]		0.149 0.01 [0.036 0.624]
31-60 min	1.806	0.439	[0.394 8.281]		2.097	0.303	[0.502 8.757]		0.107 0 [0.033 0.345]
61-120 min	1.065	0.929	[0.260 4.366]		1.702	0.492	[0.364 7.962]		0.046 0 [0.013 0.161]
>120 min	0.424	0.227	[0.104 1.735]		1.282	0.728	[0.307 5.360]		0.009 0 [0.002 0.047]
Traveling Time									
<=15 min	1.000				1.000				1.000
16-30 min	0.706	0.544	[0.225 2.217]		4.707	0.029	[1.183 18.733]		2.806 0.293 [0.398 19.764]
31-60 min	0.665	0.438	[0.233 1.896]		1.975	0.331	[0.491 7.949]		1.675 0.636 [0.190 14.734]
61-120 min	0.733	0.532	[0.272 1.973]		2.451	0.169	[0.673 8.923]		2.045 0.402 [0.373 11.203]
>120 min	0.834	0.733	[0.289 2.408]		2.923	0.116	[0.760 11.238]		2.396 0.367 [0.348 16.460]
Current Pregnancy term									
First term	0.618	0.092	[0.352 1.085]		1.099	0.633	[0.739 1.634]		0.511 0.14 [0.208 1.255]
Second term	0.516	0.034	[0.281 0.950]						0.501 0.126 [0.205 1.224]
MUAC									
Normal	1.000				1.000				1.000
underweight	0.535	0.074	[0.269 1.065]		1.093	0.863	[0.390 3.067]		
Overweight	0.458	0	[0.338 0.620]		1.046	0.812	[0.715 1.532]		0.928 0.802 [0.512 1.684]
Obese	0.571	0.141	[0.270 1.213]		0.898	0.788	[0.405 1.993]		0.548 0.456 [0.110 2.741]

Depression Severity										
none-minimal	1.000				1.000				1.000	
mild	0.893	0.603	[0.580 1.378]		0.997	0.986	[0.681 1.458]		0.878	0.738 [0.403 1.912]
moderate	0.416	0	[0.264 0.656]		0.698	0.162	[0.420 1.161]		0.930	0.892 [0.322 2.692]
moderately severe	0.525	0.088	[0.250 1.104]		0.811	0.649	[0.324 2.033]		4.841	0.069 [0.878 26.699]
severe	0.134	0.004	[0.035 0.511]		0.159	0.202	[0.009 2.780]			

6.1.4 post-natal care

6.1.4.1 Univariate

Table 10: Description of women attending PNC (a)

	Frequency(n)	Percent	Cum.	[%[CI 95%]]
Province				
East	179	17.9	17.9	17.9[9.2,31.8]
North	194	19.4	37.3	19.4[10.4,33.3]
South	227	22.7	60	22.7[12.7,37.2]
West	259	25.9	85.9	25.9[15.0,40.9]
kigali	142	14.2	100	14.2[6.7,27.6]
Age				
20-35 yrs	748	74.7	74.7	74.7[71.7,77.5]
<=19 yrs	57	5.7	80.4	5.7[4.4,7.4]
>=36 yrs	196	19.6	100	19.6[17.0,22.4]
Number of children				
<=3 Children	789	78.8	78.8	78.8[75.9,81.5]
4/6 Children	200	20	98.8	20[17.4,22.9]
7 and more Children	12	1.2	100	1.2[0.7,2.2]
Number of children under 5				
<= one US child	630	62.9	62.9	62.9[59.3,66.4]
>=2 children US	371	37.1	100	37.1[33.6,40.7]
Place of birth				
at HF	980	97.9	97.9	97.9[96.9,98.6]
at home or others	21	2.1	100	2.1[1.4,3.1]
Assisted delivery for the last born				
skilled person	980	97.9	97.9	97.9[96.9,98.6]
CHW	4	0.4	98.3	0.4[0.2,1.0]
unskilled person	17	1.7	100	1.7[1.0,2.8]
Baby Time checking				
Less than 24 hours after birth	764	76.3	76.3	76.3[71.7,80.4]
More than 24 hours after birth	16	1.6	77.9	1.6[0.9,2.7]
never checked	221	22.1	100	22.1[18.4,26.2]
Following the birth of your last child, did any health care				
checked for PNC	780	77.9	77.9	77.9[73.8,81.6]
not checked for PNC	221	22.1	100	22.1[18.4,26.2]

There was a total of 1,001 women who were interviewed during their PNC visits across all 5 regions including the city of Kigali. The majority was relatively young, between 20-35 years old and only 6% and 20% were either too young (<=19 years old) or above 36 years respectively. Many women attending PNC had children who are 3 years or less (78.8%), delivered at HC (97.9%). As shown in table 10, 22.1 % of the mothers confirmed that their babies at birth were never checked for PNC.

Table 11: Description of women attending PNC (b)

We also consulted their vaccination card, 6.6% of babies who were born to women who attended PNC had less than 2,500 grams at birth. Most women who brought their children to vaccination sessions were aged from 0 months to 15 months.

On the assessment of depression, 27.7% had a mild to severe form of depression. Knowledge about post-partum depression (PPD) and the quality of PNC received at birth were assessed and found to be 21% and 24.6% respectively.

6.1.4.2 Bivariate

	Frequency(n)	Percent	Cum.	[%[CI 95%]]
Baby's weight at birth				
>=2500 gr	926	93.4	93.4	93.4[91.4,95.0]
< 2500 gr	65	6.6	100	6.6[5.0,8.6]
Person who weighted baby at birth				
skilled person	989	98.8	98.8	98.8[97.9,99.3]
CHW	2	0.2	99	0.2[0.0,1.5]
none	10	1	100	1[0.6,1.8]
Age of last Born				
0 mths	223	22.3	22.3	22.3[15.7,30.6]
1.5 mths	160	16	38.3	16[11.8,21.3]
2.5 mths	189	18.9	57.2	18.9[14.9,23.7]
3.5 mths	162	16.2	73.4	16.2[12.2,21.1]
6 mths	42	4.2	77.6	4.2[2.3,7.6]
9 mths	124	12.4	90	12.4[8.6,17.5]
15 mths	101	10.1	100.1	10.1[7.1,14.1]
Depression				
Normal	357	35.7	35.7	35.7[30.9,40.7]
Have Depression	644	64.3	100	64.3[59.3,69.1]
Depression severity				
None-minimal	724	72.3	72.3	72.3[69.0,75.4]
Mild	187	18.7	91	18.7[16.6,21.0]
Moderate	61	6.1	97.1	6.1[4.6,8.0]
Moderately severe	23	2.3	99.4	2.3[1.5,3.5]
Severe	6	0.6	100	0.6[0.2,1.5]
PPD Knowledge				
Good Knowledge of postpartum depression	213	21.3	21.3	21.3[18.8,24.0]
Moderate Knowledge of postpartum depression	509	50.8	72.1	50.8[47.8,53.9]
Poor Knowledge of postpartum depression	279	27.9	100	27.9[24.7,31.3]
Quality birth				
No	755	75.4	75.4	75.4[70.8,79.5]
Yes	246	24.6	100	24.6[20.5,29.2]

Table 12: Association between covariates and quality of PNC

PNC Quality			
Province	Frequency(n)	No	Yes
		% [95%CI]	% [95%CI]
East	179	86[75.4,92.5]	14[7.5,24.6]
North	194	69.6[61.0,77.0]	30.4[23.0,39.0]
South	227	59[52.9,64.9]	41[35.1,47.1]
West	259	85.7[79.9,90.0]	14.3[10.0,20.1]
kigali	142	77.5[70.2,83.4]	22.5[16.6,29.8]
Total	1,001	75.4[70.8,79.5]	24.6[20.5,29.2]
Pearson: $\chi^2(4) = 62.4608$ Pr < 0.001			
Age			
20-35 yrs	748	74.5[68.7,79.5]	25.5[20.5,31.3]
<=19 yrs	57	70.2[55.1,81.9]	29.8[18.1,44.9]
>=36 yrs	196	80.6[74.8,85.4]	19.4[14.6,25.2]
Total	1,001	75.4[70.8,79.5]	24.6[20.5,29.2]
Pearson: $\chi^2(2) = 4.0644$ Pr = 0.189			
Number of children			
<=3 Children	789	74.8[69.6,79.4]	25.2[20.6,30.4]
4/6 Children	200	77.5[71.9,82.2]	22.5[17.8,28.1]
7 and more Children	12	83.3[49.6,96.2]	16.7[3.8,50.4]
Total	1,001	75.4[70.8,79.5]	24.6[20.5,29.2]
Pearson: $\chi^2(2) = 1.0475$ Pr = 0.554			
Number of children under 5			
<= one US child	630	77.3[72.8,81.2]	22.7[18.8,27.2]
>=2 children US	371	72.2[65.5,78.1]	27.8[21.9,34.5]
Total	1,001	75.4[70.8,79.5]	24.6[20.5,29.2]
Pearson: $\chi^2(1) = 3.2309$ Pr = 0.058			
Birth Area			
at HF	980	76.6[71.8,80.8]	23.4[19.2,28.2]
at home or others	21	19[7.8,39.7]	81[60.3,92.2]
Total	1,001	75.4[70.8,79.5]	24.6[20.5,29.2]
Pearson: $\chi^2(1) = 36.7804$ Pr < 0.001			
Assistant person on last children			
skilled person	980	76.6[71.8,80.8]	23.4[19.2,28.2]
CHW	4	25[3.1,77.7]	75[22.3,96.9]
unskilled person	17	17.6[6.4,40.3]	82.4[59.7,93.6]
Total	1,001	75.4[70.8,79.5]	24.6[20.5,29.2]
Pearson: $\chi^2(2) = 36.8749$ Pr < 0.001			
Baby Time checking			
Less than 24 hours after birth	764	98.8[97.6,99.4]	1.2[0.6,2.4]
More than 24 hours after birth	16	0	100
never checked	221	0	100
Total	1,001	75.4[70.8,79.5]	24.6[20.5,29.2]
Pearson: $\chi^2(2) = 953.0176$ Pr < 0.001			
PNC checking rate			
checked for PNC	780	96.8[95.1,97.9]	3.2[2.1,4.9]
not checked for PNC	221	0	100
Total	1,001	75.4[70.8,79.5]	24.6[20.5,29.2]
Pearson: $\chi^2(1) = 870.4495$ Pr < 0.001			

Table 13: Association of quality of PNC

Potential factors to be associated with the quality of PNC care were assessed. The region of residence, number of under-five children, place of birth, early PNC assessment, skilled provider at PNC checkup, and place of birth were associated with good quality of care during PNC.

Other factors related to weight at birth, age of the last child, depression among mothers, or knowledge about PPD were not associated with the quality of PNC received by mothers attending PNC.

PNC Quality			
Baby's weight at birth		No	Yes
		>=2500 gr	926
< 2500 gr	65	80[67.9,88.3]	20[11.7,32.1]
Total	991	76.2[71.6,80.3]	23.8[19.7,28.4]
Pearson: $\chi^2(1) = 0.5578$ Pr = 0.477			
Person who weighted baby at birth			
skilled person	989	76.2[71.6,80.3]	23.8[19.7,28.4]
CHW	2	50[50.0,50.0]	50[50.0,50.0]
none	10	0	100
Total	1,001	75.4[70.8,79.5]	24.6[20.5,29.2]
Pearson: $\chi^2(2) = 31.7421$ Pr < 0.001			
Age of last Born			
0 mths	223	74.9[66.0,82.1]	25.1[17.9,34.0]
1.5 mths	160	73.1[63.5,81.0]	26.9[19.0,36.5]
2.5 mths	189	73.5[67.1,79.2]	26.5[20.8,32.9]
3.5 mths	162	76.5[68.0,83.4]	23.5[16.6,32.0]
6 mths	42	81[70.2,88.5]	19[11.5,29.8]
9 mths	124	78.2[70.1,84.6]	21.8[15.4,29.9]
15 mths	101	76.2[63.0,85.8]	23.8[14.2,37.0]
Total	1,001	75.4[70.8,79.5]	24.6[20.5,29.2]
Pearson: $\chi^2(6) = 2.2140$ Pr = 0.890			
pnc_depression			
Depression			
Normal	357	77[71.9,81.4]	23[18.6,28.1]
Have Depression	644	74.5[68.8,79.6]	25.5[20.4,31.2]
Total	1,001	75.4[70.8,79.5]	24.6[20.5,29.2]
Pearson: $\chi^2(1) = 0.7724$ Pr = 0.406			
Depression severity			
None-minimal	724	75.4[70.4,79.8]	24.6[20.2,29.6]
Mild	187	75.4[68.1,81.5]	24.6[18.5,31.9]
Moderate	61	77[65.3,85.7]	23[14.3,34.7]
Moderately severe	23	69.6[47.5,85.2]	30.4[14.8,52.5]
Severe	6	83.3[33.5,98.0]	16.7[2.0,66.5]
Total	1,001	75.4[70.8,79.5]	24.6[20.5,29.2]
Pearson: $\chi^2(4) = 0.7154$ Pr = 0.935			
PPD_Knowledge			
Good Knowledge of postpartum depression	213	74.6[68.4,80.0]	25.4[20.0,31.6]
Moderate Knowledge of postpartum depression	509	76[70.1,81.1]	24[18.9,29.9]
Poor Knowledge of postpartum depression	279	74.9[67.7,81.0]	25.1[19.0,32.3]
Total	1,001	75.4[70.8,79.5]	24.6[20.5,29.2]
Pearson: $\chi^2(2) = 0.2102$ Pr = 0.906			

6.1.4.3 Multivariate

After checking for any collinearity, two factors remain in the full model and are influencing the outcome of PNC. Women who delivered at HC were 4 times more likely to receive good quality PNC than their counterparts (OR=4.329,95%CI [2.106, 8.893]) and babies who were checked at birth by a skilled provider were more likely to receive a full package of PNC than those checked by CHWs or who were not attended at all. Babies who were not weighted by a skilled professional were 15% less likely to receive a good quality of care than those who were not checked, weighted, or checked by the CHWs (OR= 0.155, 95% CI [0.037, 0.648]).

Table 14: Determinants of quality of PNC in Rwanda

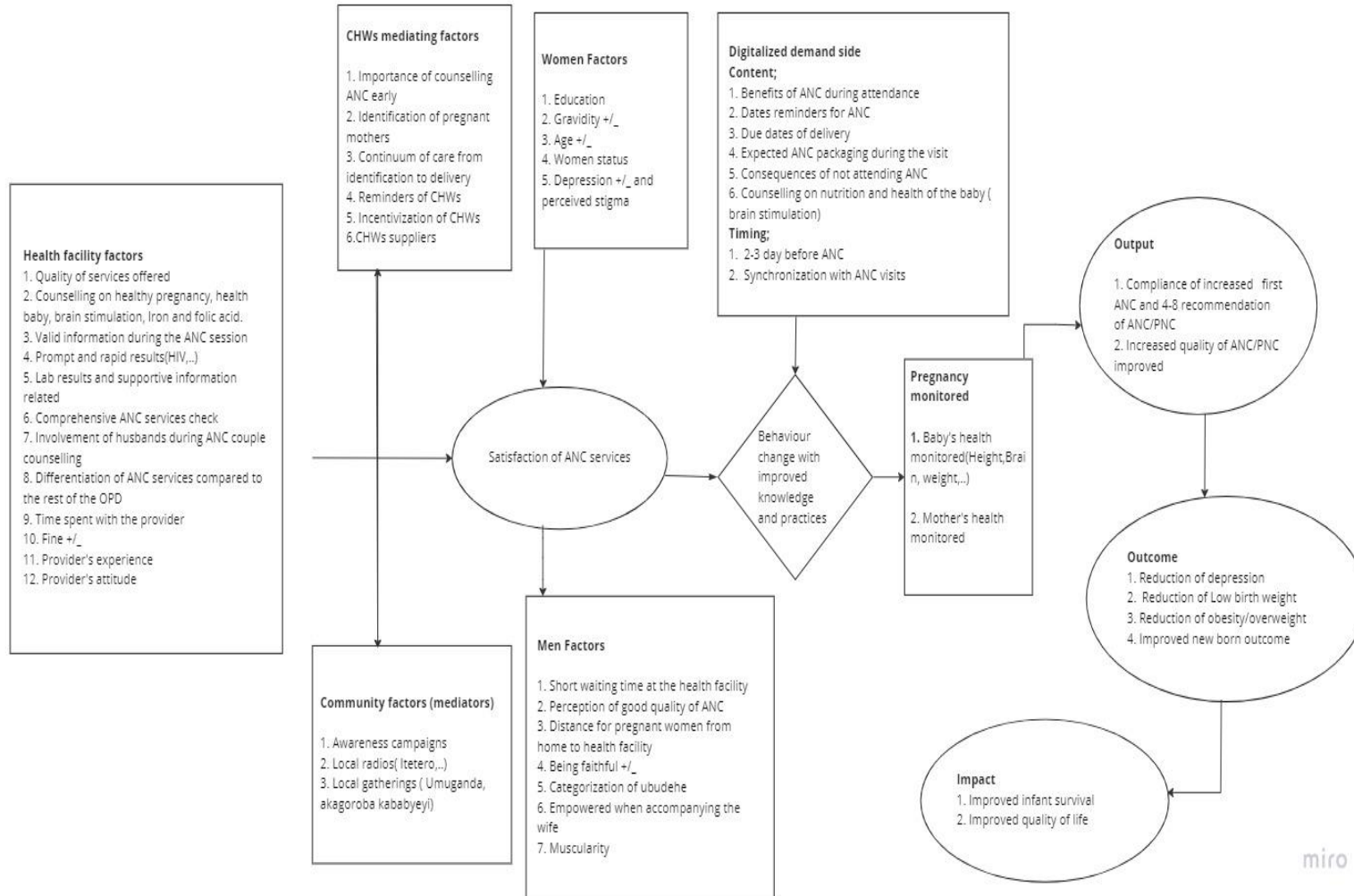
PNC-quality of care at birth				
	aOR	P-value	95% CI	
Assisted delivery	4.328	<0.001	2.106	8.893
Number of U5 children	1.249	0.104	0.953	1.638
Weight at birth	0.689	0.251	0.361	1.312
Who weighted the baby at birth	0.155	0.012	0.037	0.648
Vaccines schedule	0.975	0.537	0.901	1.056
PNC depression	0.204	0.481	0.791	1.631
PPD- knowledge	0.975	0.838	0.766	1.241
Cons.	0.287	<0.001	0.185	0.445

6.2 Qualitative results

6.2.1 Summary of key findings from Qualitative component

Key participants from FGD and KIIs included pregnant mothers, lactating mothers, husbands of pregnant mothers who did not attend ANC or PNC, CHWs, and national and international experts on the digitalization of health services. Most participants alluded to key factors that include **health center factors** (attitude of HCP, quality of ANC provided, feedback to pregnant mothers and their partners), **enabling or mediating factors by CHWs and other community factors** (such as identification of pregnant mothers, reminders of key dates during pregnancy, incentivization of CHWs, community awareness platforms), **geographic access and time spent at health center**, **digitalization of services** with direct contact with mothers to improve the interaction between parents and health care providers as well as the **demand side factors** (parity of the mother, medical health insurance process of registration, age, level of depression and perceived satisfaction and value of feedback from HCP). These findings are summarized below in Figure 8.

Figure 7: Summary of qualitative key findings (FGD and KII)



miro

6.2.2 Description of the sample

The qualitative aspect of our study design aimed to understand perceptions and their implications around the modified MomConnect Rwanda digital health tool from mothers, fathers, community health workers (CHWs), digital health experts, and policymakers towards improvement of ANC compliance and quality of services offered, maternal nutrition, and postpartum depression. There was a total of 7 key informant interviews, of which 3 were nationals working in health policy or the digital space and 4 were internationals working in maternal digital health. The description of this sample includes the mean age (43 years), mainly male, for the national informants, whereas the international informants' mean age was 56 years, with 2/4 being female.

There was a total of 147 FGDs, representing 50 health center catchment areas, including 49 FGDs with a mix of women, especially those who did not attend ANC, 48 FGDs of men married to women who attend ANC, and 50 FGDs with CHWs. These FGDs were conducted during the study period, and the descriptions of study participants in the FGDs are described in Table 15 below.

Table 15: Description of the sample (qualitative components)

	Women	Men	CHW
Variables	n(%)	n(%)	n(%)
Age range	364	363	402
16-26	133(36.5%)	65(17.9%)	15(37%)
27-37	170(46.7%)	179(49.3%)	70(17.5%)
38-48	60(16.47%)	96(26.4)	152(37.9%)
49+	1(0.27%)	23(6.3%)	165(40.9%)
Level of education	364	363	402
Non Educated	25(6.87%)	17(4.7%)	0(0%)
Primary Level	251(68.96%)	233(64.2%)	232(57.7%)
Secondary Level	60(16.48%)	67(18.5%)	119(29.6%)
Advanced Level	26(7.14%)	37(10.2%)	36(9%)
University Level	2(0.55%)	6(1.7%)	1(0.2%)
TVET	0(0)	3(0.8%)	14(3.5%)
Civil status	364	363	
Married	202(55.49%)	269(74.1%)	0
Unmarried	161(44.23)	94(25.9%)	0
Divorced/separate	1(0.27%)	0(0)	0
Widow/er	0(0)	0(0)	0

Most women who accepted to be part of the qualitative sample were relatively young. More than 85% of women who consented to participate were aged between 16 and 37 years. Many men were aged between 27 and 48 years. However, CHWs were a bit older than women interviewed, the majority was aged 38 years or older (78.8%). Across all samples, women, men or CHWs have at least primary level of education (6 years of primary education). and very few have an advanced degree or university degree. More than 55% and 74% of

women and men were married respectively.

In the following sections, we present the data collected through FGDs of women, men, and CHWs, and it is intended to be comprehensive, with the most important themes highlighted in bold. We intentionally allowed some redundancy in the quotes and themes expressed to assure that the views of the respondents were comprehensively expressed.

6.2.3 Factors facilitating ANC attendance.

6.2.3.1 Enabling factors for women to attend ANC

In this section, participants from both FGDs and KIIs recognized the importance of ANC in saving mothers lives. Among participants interviewed, many participants revealed that they were very pleased with the health **information provided, the good reception, the quality and rapidity of the services, as well as the advice from the healthcare providers.**

A good perception of the services they received encourages women to come back for the following appointments. Apart from educating, the quality services provided at the health center motivates women, and they feel urged to attend every time they are pregnant.

Most of our respondents confirmed that they were satisfied by the services received at the health center and reported that satisfaction with the **provided services** was the most important enabler for seeking ANC services. The description of the provided services includes laboratory **tests that are performed** by the healthcare provider and information **provided about their health and the baby's health status.**

“Attending is good, when you get there, they will perform HIV tests for you and your husband, they inform you about your status regarding HIV, and provide respective behavioral recommendations during the pregnancy. They will further test for other diseases, measure weight, take blood examinations, test urine, measure blood pressure, examine how your baby's position is in the pelvis, if necessary, do ultrasound, and they will ask you to attend all the time so that they can monitor you until you give birth”. FGD with women, Kiziguro HC

“Most importantly, when you go to the doctor, they will measure the baby's weight as he/she grows and they will give you advice on what to do so that the baby grows well and you will give birth to a baby with a normal acceptable range of weight” FGD with women, Kiziguro HC

Sometimes, pregnant mothers recognized efforts that **health facilities strive to change bad behaviors from selected health providers** with poor knowledge, attitudes, and practices to approach pregnant mothers, which were appreciated by most mothers in the interview.

“From my point of view, currently mothers are satisfied with the services they get at 80% because things have changed now before mothers were claiming a lot. Specifically, at this health center, they changed the healthcare providers who

used to give bad services now the newly recruited are offering good services...”
FGD with women Gahanga HC

In addition, health providers check all blood tests, and they advise on women's health status. They will give pregnant mothers iron tablets, and vitamins when they find that your blood level of hemoglobin is low, they will advise you to rest enough and to eat a balanced diet including green vegetables and energy giving food and they will educate you on how to stimulate the brain of the fetus.

“For me, I appreciated the advice they gave to me which motivated me to come back to this health center anytime” FGD with Women -Kabarondo HC

Not only do health providers give pregnant mothers advice related to their pregnancy, but also the fact of checking their unborn child early was revealed by many participants as an important factor that motivated them to always go back to the health center. **The child's health status** was found to be paramount in attending the ANC program. Most women feel that attending ANC is to check whether the fetus is okay or doing well. They are curious and, at the same time, worried about their babies. They want their healthcare provider to continue monitoring their baby's health status so that they do not face any problems during pregnancy, which will help them give birth safely.

Of particular attention, **women who tested positive for HIV** are requested to follow-up on the process of preventing HIV transmission from mother to child. HIV seropositive mothers readily attend ANC so that their babies can be prevented from HIV contamination. The benefit of an ANC visit for the mother is to know her health status and the child's status and then be advised on how to behave and conduct herself for the sake of the baby's wellness. The child can be treated as well if a disease is identified.

“They checked me and told me that the child's lungs are not good, and they told me that they have to treat me so that I will be well, and my child will be well. This encouraged me to come back and check the health status of myself and my baby”
FGD with Women-Muyumbu HC

“ANC providers do their best for our services and don't talk to us roughly. They communicate with us in an honest manner, and we feel satisfied with that.”
FGD with Women-Kabgayi HC

Perceived **encouragement packages such as incentives** to attract women during pregnancy were seen as enabling factors for attendance at the ANC. About 99% of mothers return because there is some additional support they get. This support is perceived by women as stimulating factors for them to attend early ANC visits. Support comes in the form of traditional garments (IGITENGE) and an umbrella, stimulating mothers to comply with the attendance of ANC; some others are the ongoing enrollment into the SHISHA KIBONDO program, milk, or porridge flour. In some places, pregnant women are provided with monetary incentives for attending ANC earlier.

“Apart from SHISHA KIBONDO, some women are being provided with monetary incentives for attending ANC earlier. A project provides the money (the project's name is not mentioned).” FGD with women Byimana HC

“Another motivation, mothers used to get incentivized with is the traditional garment (IGITENGE) and an Umbrella this caused the mothers to comply with the attendance of ANC...” FGD with CHW Kiziguro HC

Other important factors include living conditions and education levels among pregnant women. It was commented by a few women in the FGD that pregnant mothers living in urban areas have better opportunities than those living in rural areas. CHWs play an important role in improving awareness and knowledge among pregnant women.

“The difference in attendance comes from the difference in our living conditions. Women in the city have better living standards compared to us in rural areas, this is no secret. They too have charges, but not as many as in the countryside. Those who live in the city are more civilized, and they attend more than those who are based in the countryside” FGD with women Byimana HC

“For me, those who live in the countryside attend more than those in the city because the community health workers keep encouraging those in the urban to reduce their low level of consciousness so that they keep valuing the importance of attending ANC visits at the health center” FGD with women Kiziguro HC

“Uneducated women are not able to read the dates written on their ANC forms for the upcoming visits and sometimes they miss their visits. However, educated mothers do not tolerate the queue at public health centers and prefer the private clinics.” FGD with women Byimana HC

Another important factor that motivates pregnant women is that they go to the healthcare provider that **they trust** for proper follow-up of the unborn child during pregnancy, which gives them confidence that if the congenital problem occurs, it will be solved early, and they will give birth to a healthy baby.

“Yes, I was very encouraged, the information they give us is good because they encourage us to participate in the four regular ANC visits as it is appropriate so that we can continue to know how the pregnancy is evolving” FGD with women Kiziguro HC

“They monitor you until the time of delivery so that no further problems arise because you have followed the healthcare provider’s advice” FGD with women Busanza HC

“The process we go through when we get here, after they have done with their meeting, the healthcare providers start to receive one by one, and they don’t delay us here at the health center...FGD with women Gashora HC

“For me, I was satisfied with 60%. But it depends again on the healthcare providers offering services on the day you attended ANC, often it’s because if you meet the criteria because if you don’t meet the criteria, they won’t do anything for you” FGD with Rugarama HC

Some participants declared that they were motivated by having the **Community Based Health Insurance** (mutuelle). They confirmed that if they have mutuelle nothing else can be a barrier for them to attend ANC. The cost of the ANC services doesn’t matter for those who have mutuelle insurance. This narrative is reinforced by the answer of one of the participants who did not attend ANC, yet she is pregnant.

“Yes, they treated me well before and now I don’t know if it’s still the case today I didn’t attend ANC because I don’t have insurance” FGD with women Busanza HC

6.2.3.2 Enabling factors for men to attend ANC.

Most husbands who accompanied their wives to ANC revealed that they were motivated by **their satisfaction with the services received previously**. Previous experience with ANC visits is important to stimulate women and their husbands to continue with ANC standard visits. Most husbands who accompanied their wives revealed that their satisfaction with the services provided previously was high. and therefore, they continue to attend ANC visits with their wives.

“I was motivated by the good service provided during my ANC service visit because the health service provider gave me good service, which encouraged me to return” FGD with men Bigogwe HC

During their FGDs, husbands indicated that they were impressed and motivated by the **useful information they were provided during ANC visits**. They were interested in the **health benefits of ANC**. When they accompanied their wives to the health center, they were advised on how to take care of their wives during pregnancy, how long a child should live in 1000 days, about hygiene and sanitation. They were encouraged to have a kitchen garden, eat a healthy, balanced diet, sleep under a treated mosquito net, learn about the importance of ANC in reducing death and they learned how to play with the fetus in the uterus.

“Now when my wife forgets to cook a healthy diet, I remind her” FGD with men Busigari HC

“Attitudes have changed now. When my wife is pregnant, I immediately accompany her to the health center” another participant declared” FGD with men Busigari HC

Men also recognize that if **the services provided during ANC are good, they and their wives tend to return for ANC visits**. During the ANC visits, good health providers do health examinations to see the health status of the couple, understand the importance of blood investigations aimed at testing whether either or both parents might have a disease that might affect the health of the fetus, and seek to offer treatments that can prevent contamination of the

fetus with the diseases. And they were impressed by the fact that their wives were enrolled in follow-up by healthcare providers from their visit until the delivery.

They continue to report that **the distance** between the health center and their home is not an obstacle to accompanying their wives to ANC services. The participation rate among men living far and near to the health center is estimated to be equal, as they all know the benefits of attending ANC services.

“The distance between the health center and my home is long, but I can't be discouraged by it because I know the benefits of attending ANC services” FGD with men Rubengera HC

The positive consequence of husbands attending ANC goes beyond the service provision. Few husbands declared having attended ANC services to **improve relationships between them and their wives**. They mentioned that attending ANC with their wives shows people in the community that they are living well with their wives. The other component is that people appreciate the husbands who feed their pregnant wives in accordance with the recommendations from ANC providers, and they can be criticized if the pregnant wife lacks adequate nutrition. They revealed that a wife doesn't feel happy when she attends ANC alone and she may refuse to go there.

“Ee attend with them to give them courage and to be provided with disease testing at the Health Centre and we return home discussing the pieces of advice from the healthcare providers” [FGD with Men Save HC]

The **role played by CHWs** in encouraging husbands to attend ANC was overwhelmingly recognized as a very important factor in the involvement of men in the ANC program. Several men in FGD indicated that they did not understand why they should accompany their wives for ANC services, but there were a lot of campaigns carried out by community health workers who explained to them the benefits of participating in ANC services and encouraged them to accompany their wives. They thought it would be difficult because of their previous attitudes, but now they understand that accompanying wives to the health center is beneficial to both parties and the family.

“CHWs always teach us the benefits of attending ANC services, so rumors, cultural and religious beliefs, myths, and relatives are not problems; they cannot change our attitude.” FGD with men Busigari HC

The CHW conducts regular home visits, and they encourage couples to attend ANC through regular home visits. When the time is approaching, they come and remind husbands to accompany their wives. They remind them on the provided dates to avoid that they may forget the dates and miss their ANC appointment.

Another facilitator is that partners attending ANC together are seen as exemplary in the community.

This has led to neighbors taking it upon themselves to ask if one has attended ANC as soon as a pregnancy is announced.

Both for men and women attending ANC, **cultural and religious beliefs were not associated with the attitude or decision to attend ANC visits**. Most participants recognized the role of awareness campaigns through radio, CHWs, group sessions at the HC and a few churches – except for one religion group that did not support the use of ANC services.

“Even if a woman and her man may be part of different religious movements, attending ANC is beyond their religious aspirations, but from their own decision regarding their health...” FGD with men Save HC

6.2.3.3 Awareness and mobilization activities to enhance ANC.

Within the health center or within its population, mobilizations are done by CHWs during their program of identifying women within their respective villages that can get pregnant (women 15 years to 49 years). They do a monthly household-by-household screening activity, teach households through the screening, and mobilize women suspected of pregnancy to attend ANC. They mobilize women by telling them the consequences a pregnant woman may face if she doesn't attend an ANC service. When they find out about pregnant women, they accompany them or give them a transfer to attend ANC services. They visit pregnant women often to see whether they have iron tablets, and we encourage their consumption. They encourage mothers and their partners to attend ANC together because it is beneficial to them when they safely deliver a healthy baby at the health center.

Awareness campaigns for ANC services are also conducted through community meetings by CHWs. Community health workers encourage pregnant women to attend social gatherings (Like UMUGANDA). Women are encouraged to visit the health center in their first three months of amenorrhea for pregnancy testing and ANC services and are reminded to return for ANC at the specified dates of ANC follow-up visits as written on their ANC forms.

At health centers, awareness campaigns are also done through mass education during ANC visits. This is done every day at the health center because different pregnant women attend ANC services every day. Healthcare providers begin with mass education on ANC services.

The **radios also** provided information that encouraged husbands to attend ANC with their wives. Radios broadcasts information that explains the benefits and advantages of attending ANC services for pregnant women and how husbands should accompany their wives to encourage them to attend ANC service.

“I got information about ANC visits from the radio; and I knew that I should go there with my wife”. FGD with men Gatsibo HC

Different information related to ANC is broadcast on radios through special emissions like URUNANA sketch and ITETERO which are broadly followed by the population. These radio broadcasts enormously educate pregnant women and encourage them to attend ANC services. Messages on the reasons why husbands should accompany their wives, the importance of HIV

testing. These different channels, especially followed by men in the village, motivate husbands to attend ANCs with their wives.

“I have also heard announcements on the radio that attending the ANC program is important and that everyone should participate.” [FGD with Women -Gahanga HC]

“A woman that lives with her partner will likely attend ANC from the motivation of her partner than a woman that does not live with her partner. The married women feel proud of being accompanied by their husbands and get to know their health status together and that increases their trust”. FGD with women Kabgayi HC

6.2.3.4 CHW role in the community

The role of CHWs is very important in the community. There was a very low level of awareness among pregnant women, but CHWs were very useful in reducing maternal and child deaths. CHW work goes with the follow-up dates for pregnant mothers, but they also work in any case of emergency. Most of the participants among pregnant mothers who were interviewed during our visit, related to the role of CHWs, agreed that the **support and encouragement from CHWs** is an important factor facilitating attendance to ANC. There are community health workers in every village. CHWs encourage women to attend ANC as soon as they suspect the woman might be pregnant, and after the woman is confirmed pregnant at the health center, they encourage them to return for their visits. CHWs do urine pregnancy tests for women, and they offer pregnant women a transfer document for ANC visits at health center.

“I agree with other participants that if it wasn't for them (CHW) we would not attend due to the poor quality of the services, but they keep pushing us and motivating us to attend the next visit.” FGD with Women-Muyumbu HC

CHW are responsible for **monitoring pregnant women, postpartum women, and children** below the age of 5 years. They encourage pregnant women to attend their first ANC visit before 3 months of the gestational period, their second visit between 5 and 6 months, their third visit at 7 months, and her fourth visit at 8 months. They encourage men to accompany their wives on the first visit. They encourage them to begin early preparations for giving birth, such as purchasing clothing for the mother and her new child. After giving birth, they visit the mother and her child after 3 days, 7 days, and 14 days to monitor their health status and encourage the mother to attend PNC visits as required and to breastfeed exclusively up to 6 months.

The **first identification of a pregnant woman** happens at the community level, with community health workers. The process described by the women who attended FGD explains the step-by-step process that an CHW will do register a pregnant mother: (1) To get to know a new pregnant woman, CHWs work as a team. When one finds out that a woman is pregnant, (2) They communicate with each other. Then (3) CHWs encourage a woman to attend ANC when she loses her menstrual period to check if she is pregnant. In some cases, (4) CHW perform urine tests to confirm pregnancy and refer to health center. For pregnant women, they use the form

given at the health center, (5) then they weigh them, (6) they measure their nutrition status using MUAC, (7) they measure again their height, (8) they send a rapid SMS to the Ministry of Health. Finally, once the woman is confirmed to be pregnant, (9) they continue to monitor her and encourage her to attend a maximum of 4 ANC visits. Finally, they encourage them to breastfeed exclusively and to attend PNC services.

“CHWs often come to visit us and explain to us all signs of pregnant women towards birth. They also explain signs of other diseases such as malaria... when you have malaria – it can cause stillbirth...” Women FGD, Busigari HC

They also treat children and adults for diseases such as malaria, diarrhea, pneumonia, and a mild cough. They encourage pregnant women to pay their health insurance early, to have good hygiene, to stimulate the child's brain in the womb, and to prepare a healthy, balanced diet for children. They are responsible for preventing and fighting malnutrition among the children.

Their responsibility includes encouraging mothers to engage in family planning as well. There are condoms that are provided to men through integrated health care that includes treatment, nutrition, and family planning.

Some strategies used are to make sure they create a friendly relationship with a mother so that she feels free to ask for any help.

In addition to these responsibilities, they always stand by because mothers can seek support at any time of the day, morning, or evening.

CHWs also recognize the **role of incentivization in the program** such as SHISHA KIBONDO program, milk, porridge flour, mosquito nets.

“Women under the first and second categories can attend even without us reminding them because of the porridge and monetary motivation. For the third category ones that does not work.” [Byimana HC_FGD_ CHWs]

“Due to the provision of Shisha Kibondo and money provided with the ANC services, some women come to us for advice regarding their regular ANC attendance so that they can be inscribed to the system for the incentives.” [FGD with CHWs Save HC]

6.2.4 Barriers to ANC service attendance

6.2.4.1 Barriers of not attending ANC among women

Although most women expressed their level of satisfaction related to the information provided, laboratory exams performed, and appropriate management of their pregnancy and their health status, as well as their unborn child, there are still several challenges preventing women from attending ANC at the health center.

A good number of women presented their complaints about waiting for a long time or **queuing at the health center and poor services at the health centers.** which discouraged them from complying with ANC attendance because pregnant women are quickly tired of how long they will stand in line due to their conditions. Most health centers lack systems to prioritize pregnant women by reducing waiting times, which contributed to low compliance to attend ANC services.

“It is a bit impossible to receive the services early Because HCP do not care that we are queuing outside so HCP can hold on using their phone, we then ended up delaying the ANC services”
FGD with women, Busanza HC

Other reasons provided by those who tried to find out why pregnant women delay at the health facilities- healthcare providers explained that this is due to the laboratory tests with delays in giving back the results.

“They return very late at home but as CHWs we ask healthcare providers the reason for queuing, they explain that the only reason is to get test and wait for the turnaround time for each exam taken” FGD with CHW, Muyumbu HC

Additionally, most participants expressed different views about the issue of **distance between the health center and their home.** Most of them think that women living closer attend at a higher rate because women living farther have issues accessing fees for transportation to the health center for their ANC visit. However, a few respondents revealed that women living further away attend at a higher rate compared to women who have a habit of shifting their visits just because they think the health center is much closer.

“.. women who live far away health facilities are more likely to miss appointments. The distance discourages them from attending ANC. FGD with women, Busigari HC

Nevertheless, most women reported that even when the distance is far, the benefits they receive from attending ANC are worth it.

The number of pregnancies or children (Gravidity) was also highlighted to having a negative impact on ANC attendance. Most participants indicated that the first, second, and third pregnancies were very different in terms of attendance. For the first pregnancy, pregnant women attend at a higher rate and attend early due to their keen need for a baby. They are still in a good relationship with their husbands, and they are very proud to attend together. As the number of pregnancies increases, attendance to ANC decreases. For the first pregnancy, they attend due to curiosity but as they continue to give birth, they become familiar with the process and start reducing the visits for the ANC.

“There is a big difference as you continue to give birth. Healthcare providers keep discouraging you that you should stop getting pregnant and even at some HC, they address you in rough way without politeness. at the end we feel ashamed to go to ANC. They even sometimes say that the more a pregnant mother continues to get pregnant- HC won't receive them for any assistance”. FGD with women, Kiziguro HC

Not only are women tired or used to getting ANC, but they are also too embarrassed to go for ANC because they are asked why they don't go for family planning. When you are an old pregnant woman with many children, people start gossiping about you, and even they laugh at you, saying that you should have stopped giving birth.

Old women most of the time give birth at home to prevent people from gossiping about them, which stops them from attending ANC as they should. Even though many women who attended ANC visits were in their first or second pregnancy, this shouldn't be the case because as the mother gets older and continues to give birth, she is exposed to the risk of developing cancer and other non-communicable diseases; therefore, she should be monitored often to make sure that her pregnancy is not at high risk.

On the contrary, age in pregnant women is among the enabling factors; most participants declared that older mothers attend more ANC visits because they know what they are doing and value their lives. An older pregnant woman is likely to be more informed about the importance of attending and the risks associated with not attending properly. Those who are young are still teens, and sometimes they may have been impregnated accidentally, and it becomes shameful to even attend ANC.

Teenage pregnant women decide not to attend ANC to avoid people who will see them, as they may come to inform their parents about their pregnancies. Younger women don't attend, especially those who don't live with their husbands; they are shy to attend alone.

"I was advised by the community health worker to attend ANC because I had denied attending due to the shyness, I had of having the baby at an early age then she kept insisting then I attended ANC at the health center". FGD with women in Muyumbu HC.

Other opinions state that younger and more stable women (e.g., married) are more likely to attend ANC visits than older women because younger mothers are more curious about any signs they may have as they are not used to the process.

Some beliefs and cultural norms of not sharing with CHWs, HCPs or even the neighbor that a mother becomes pregnant were revealed by post participants in the FGD. Women are afraid of being poisoned by their neighbors or other people with whom they have conflicts after revealing that they are pregnant.

Rumors and religious beliefs exist here; there are members of some religion who do not like to participate in government programs because their religion does not allow them. They do not attend any services from a health center and prefer to use local medicine only" FGD with women, Gisenyi HC

Finally, among women who did not attend ANC, they reported the issue of being challenged to pay health insurance on time and fines for those who present themselves late to ANC visits. Not knowing exactly when they got pregnant, especially during the first trimester, generates fear of

attending ANC visits. This double financial burden due to “not paying health insurance on time and to cover the unborn baby” and additional fines because they did not present themselves on time at HC, made them fear the whole process and decided not to initiate ANC visits at all. In addition, the ID system (NIDA) is not complete, making some of them who were already at the health center return home without being served and yet they might be given a fine too, regardless of efforts to reach health facilities.

“The reason why I attended with a delay was that my age in the database of Mutuelle de Sante was different from the age on my physical ID; I presented myself 3 times to ANC services without attending ANC services due to that error and I am not sure whether they charge me some fines and yet this is not my fault. FGD with women, Save HC

6.2.4.2 Barriers of not attending ANC from men’s perspective

Men's perspectives related to barriers to attending ANC were also explored. Almost the same challenges as those presented by women are repeated in this section. However, there are additional challenges that were not specified by women, as they were clearly stated by men.

The **categorization of the new Ubudehe** was one of the factors hindering access to ANC services. Most families classified as “category 3 is not able to afford related health insurance fees. “Most men, will decide not to present themselves to the health facilities during ANC visits, and their wives will not be allowed to attend ANC services.

“. Every people feel threatened whenever a pregnant woman is provided a referral to the hospital because they will pay a huge amount of money and will be requested to buy supplemental medications from outside the hospital at their own full expense, yet they have paid for Mutuelle de santé.” FGD with men, Gahunga HC.

*“When a man doesn't have money to pay for medical insurance, it can prevent them from attending ANC services”. FGD with men, Nkungu HC
The first I attended ANC; my wife requested me to pass by Mutuelle de santé and we were requested to make a kind of payment. We argued about that, and I now need some clarification on that”. FGD with men, Gahunga HC*

Another barrier related to the inability to pay for services or to get the family covered by health insurance includes **financial inaccessibility**. During and post COVID 19, the price of goods increased in an unexpected manner. Households struggled every day and lived in situations that were financially hard. Losing the job, especially during the period of sowing, made it almost impossible to stop working and accompany their wives to conduct ANC.

Most of the families reported that they could not afford to skip a day of working to accompany their wives during ANC. It became clear during the interview that men, face additional financial hardships and cannot afford to attend an ANC appointment if they have conflicting **work planned for the same day**. Though they have been highly sensitized and understand the benefits of accompanying their wives, they prefer to go and work for money and food instead of spending time at the HC. The situation becomes more difficult if the ANC visit requires transport fees for

both parents to attend. Sometimes a woman gets pregnant when her husband is not around. For job reasons, some husbands live far from their families and come back home only over the weekend.

“For me, the challenge that prevented me from attending the ANC visit was that when my wife got pregnant, when I was not around, which made her wait for me.”
[FDG FOR MEN-BUSIGARI HC]

Other barriers associated with delay or not attending ANC were provided in the women’s group. These include long distances to the health center. Most husbands in the FGD discussion across HCs agree that the long distance discourages them from attending ANC services.

“. I am sometimes discouraged by the distance between the health center and my home place because the health center is far from my home. I walk a long distance.” [FDG FOR MEN_BUSHENGE HC]

Other barriers include long **waiting times at the health facilities combined with previous experience at health center which was not successful due to the same reason of delay in receiving ANC services**. One of the participants reported that they could come in the morning and return home in the evening. Others reported that they may arrive at 7:00 a.m. and wait until 1:00 p.m. before receiving the service. There are some ANC providers that can spend 30 minutes on their phones. and getting to wait for them for that is a challenge with our work. The balance between many pregnant women with limited or insufficient healthcare providers’ mismatch. The long waiting time combined with poor services and the inability to communicate respectfully to the clients worsen these barriers to not wanting to attend ANC services.

“Poor quality of ANC services like delayed receptions and badly communicating ANC providers can be a barrier to men’s attendance” FGD with men, Save HC

“Sometimes you ask permission on work for 2 hours and go with your wife and wait a whole day or arrived at morning and served at afternoon then we refuse to accompany them for the next times for keeping our jobs.”
[KABUSUNZU HC_FGD_MEN]

“The bad provision of service here is what makes men not attend; sometimes you can come without medical insurance, it’s difficult to get a without medical insurance even if you are going to die.” FGD Men, Gihundwe HC

“I am not satisfied with the service provided, because when we attend, we always spend many hours at pay and consultation points. You can come in the morning and go back late because of the small number of healthcare providers.”
“FGD with men Nkungu HC

“For me too, I won’t say that I am satisfied with the services I received because of the delay, I was satisfied with 40%.” FGD with men Rugarama HC

“or me, I can say that I am satisfied with 30% of the services provided by the health center, the delay in receiving services is a big challenge. I reached here at 6:00 AM but I returned home at 4:00 PM.” FGD with men Rugarama HC

Many men in the FGD reported other new factors that are now hindering family cohesion, such as conflict in the family or disagreements between husbands and wives. Most men reported that conflicts and bad relationships in the family are among the major obstacles to their husbands attending ANC. This situation is aggravated when women get pregnant without the prior consent of their husbands. In this case, women refuse to use any family planning method because of suspicion of cheating, polygamy, or prostitution. Therefore, men tend to deny attending ANC with their wives, avoiding conflicts that may surge with her legally acknowledged wife when she is informed of his attendance at ANC with a different wife.

“Men do not attend ANC when they have family conflicts with their wives.” [Byimana HC_FGD_MEN]

An additional consequence is the fact that husbands fear being suspected of having HIV infection. The other barrier that prevents men from attending ANC services is that **they cheat on their wives** and are afraid to go to the health center because they think that the wife will find out that they are infected with HIV. They feel afraid of being tested for HIV during ANC when they have cheated on their wives. A man thinks that he is infected with AIDS and then refuses to accompany his wife because of his doubt.

“Some men can't accompany their wives because they cheat on them and are afraid to go to the health center because they think that the wife can find out that he is infected with HIV” [FDG FOR MEN_NKUNGU]

“The first challenge that prevents men from accompanying their wives is being suspected of each other for cheating which leads to denying taking responsibility as husbands causing conflicts due to doubting that he might not be the one who impregnated her”.
FGD with men Hanika HC

Additionally, a few men still think that ANC service **is impersonal or not applicable to them, only to women**. They have a poor mindset that prevents men from accompanying their wives because they say that the child that will be born belongs to the wife, and they think that it is up to women to attend ANC. These men have not yet understood the core objectives of the ANC program and do not know the clear purpose of the services.

This belief that ANC services are only appropriate for women coupled with existing fines, when men do not accompany their wives to the health center makes men feel that ANC services are not just for them.

“For me, women who have husbands participate at a higher rate compared to women without husbands because women who come with their husbands when they come to the ANC service are the ones who receive the services first, while those who do not come

with their husbands wait until they finish serving couples, which makes them discouraged to attend the ANC service.” FGD with men Gisenyi HC

Some beliefs and culture norms around the use of traditional healers that prevent men from using ANC services.

“In our area, it often happens that men prevent their wives from going to a health center for a pregnancy test and even attending ANC because they have traditional healer who follow them during pregnancy because they are often afraid that they be bewitched and then that are followed by the traditional healer as he or she is the one they trust. FGD with Men-Rugarama HC

“People have been worse nowadays and most of us women try to avoid any people from knowing that they are pregnant. We prefer to keep it to our husbands and will avoid communicating this information to CHWs to avoid witchcraft and wizard, to protect the baby.” FGD with men in Mukura HC

6.2.5. Opinions on MMCR Interventions

6.2.5.1 Content preferences

During the FGD, we asked participants how they would like to receive information and which information they would like to receive to support their decision to attend ANC visits. Participants in the FGDs expressed that the key information should be the exact date of the ANC visit, a recap of the importance of the service, and the date of the visit, so that she cannot miss her visit. Additional important messages include the schedules for subsequent visits and their related ANC packages, the expected delivery date, messages encouraging pregnant mothers on how to take care of the baby before delivery, such as stimulating the brains of infants, couple ANC encouragement, polite reminders with a few greetings and the introduction of the person who is reaching the mothers, the benefits of attending ANC per age group, the consequences of not attending ANC, and nutrition.

The majority specified a **text message with reminders of the date of ANC visits and what to expect at each stage of the pregnancy**. They continued insisting that even when a friend or a neighbor does not have a telephone, these **messages could be shared easily**.

6.2.5.2 Perceived impact and benefit of intervention (SMS)

Directly receiving a message to improve their ANC adherence, satisfaction, compliance with ANC visits, and their husbands' participation in ANC visits was positively reviewed by women. Currently, these messages are sent to CHWs, and the CHWs will send them the key dates for visits or deliveries.

“It would be very helpful for them to receive information by telephone because even for those who don't own a telephone their friends do.” FGD with CHW Busanza HC

“If the SMS is provided to a pregnant woman, the woman can communicate the information to her fellow women. “ FGD with women Byimana HC

“An ASM CHW recently informed a pregnant woman that there is a program of 7 days of waiting for an expectant mother/woman at the health center preceding her expected date of delivery: she was very happy with this new waiting program, and she communicated to another woman. Thought it can be the same case for that SMS if provided.” FGD with women Byimana HC

“Since it helped me when the SMS was sent to the CHW, there is no way it cannot help me if addressed directly to me, it can help pregnant women.” FGD with women Byimana HC

“Most participants expect that It would be useful to get a message because sometimes your husband may refuse to accompany you, but if you show him the message they sent reminders to you, he will agree to accompany you.” FGD with women Gahanga HC

“It would be beneficial to send text messages to pregnant women reminding them to attend ANC because before, we were receiving rapid SMS, and it was so helpful for them to attend ANC services on time. If it happens again, it will motivate them to attend ANC services and help them prepare early for giving birth.....” FGD with CHW Murunda HC

It can also help community health workers with easy communication and remind them of their appointments. It would be helpful to the mother because she would value the advice from the community health worker and the health care provider. A reminder message would be a solution. In addition, these **messages could also be sent to the husbands** of the pregnant mothers, which will help keep the reminders of the ANC visits and importance of attending ANC visits. The majority reported that **SMS would be a solution to give importance to medical and ANC appointments.**

6.2.5.3 Feasibility

The feasibility of working with women themselves could be challenged by the fact that some women in the village are not able to read these messages. But women reported that this is not a big challenge as **the message can be read by their children or neighbors.**

Most women responded that the implementation of the SMS program “Modified MomConnect Rwanda” will help and will add to current mobilization activities for the ANC. This activity should be well coordinated well with a fixed day to send and receive messages to the general population.

“And the good thing is that mothers would be stimulated to participate in attending ANC I would recommend that it should start.” FGD with CHW Kabarondo HC

“Yes, every woman would have access to the information sent to them because for those who don’t even own a cell phone, their family members do, or their neighbors do so. A reminder message would be very helpful.” FGD with CHW Nyamata HC

6.2.5.4 Timing preferences

The recommended time to receive messages would be between **2-3 days before the ANC visit date**. The timing of the message should be at the very beginning, between 5- 6 months and 7- 8 months, in accordance with the timing of ANC visits. This will help mothers to prepare well for delivery.

“They should start sending SMS starting with the first visit.” FGD with CHW Nkungu HC

*“A **reminder message would be very helpful** to remind her to not forget the due date of her next appointment.” FGD with CHW Kabarondo HC*

“If they could send SMS to men they won’t value it as they should so women would be the ones to receive SMS at all stages of age specifically those who are in the period of childbearing” FGD with CHW Nyagasambu HC

“The best time is that she would receive the message before she was going to give birth and before she went to attend ANC.” FGD with Rugarama HC

*“We need the message at the **first month of gestation** so that we attend for the second month.” FGD with women Byimana HC*

6.2.5.5 Design, implementation, and evaluation of MMCR in Rwanda

5/7 respondents emphasized the importance of robust initial discovery followed by the incorporation of continuous, end-user-experience-informed monitoring and evaluation (M&E) of our design and implementation processes. This will assure that we create MMCR iteratively, making it responsive and therefore maximally impactful.

Some respondents brought up ways to consider technology in the MMCR implementation and M&E plans aimed at making the MMCR more effective and the evaluation more precise and valuable. Consider the example of USSD and SMS messaging., If we don’t investigate the success of message delivery and getting through the entire USSD thread to access the appropriate resource, we will never know that the tech failed, and the end users never got the message intended to change behavior. **If we only look at the outcome, we will be left with a black box regarding specific content elements and delivery strategies were effective and which failed.**

Similarly, in the case of voice messaging that could be used, we need to monitor the number of seconds that were listened to; just looking to see if a link was clicked or a file was accessed will not tell you that a 40 second piece of audio was listened to for only the first 7 seconds, so the important message was never delivered. If we **collect data on all intermediate processes**, we will know that what failed was getting the listener to access the message, and that we don’t know if the message itself would have any impact on behavior change.

Rwandan informants shared stories of using technology in other health promotion contexts, both to spread a message and to collect data that helps the health system fully understand the impact

of programs like offering fortified blended foods to combat malnutrition and stunting. They decided to begin collecting data and supplying this food as early as the first ANC visit and continue with follow-up through postnatal care to look for impacts. When asked about the completeness of the data set for this impact evaluation, the informant was not sure, citing that the childhood development agency had taken over responsibility for the program. This highlights a common challenge in impact evaluations of any intervention: missing data and siloed institutions. We know that the proportion of pregnant women complying with recommended ANC timing and quantity is low, so the use of data collected at ANC visits is inherently problematic as the population represented is not representative of the general population intending to be assessed. Similarly, opportunities to improve implementation strategies and integrate intervention impact data collection with other digital health initiatives are missed when institutions fail to communicate with others about their work.

Part of a thorough examination of the end-user experience should include ethnographic studies of the different populations we hope to reach and feasibility studies specific to the intervention, creating a roadmap that ends in the achievement of the desired impact. In one mHealth intervention, they found that mobile phones were controlled by husbands, and the women they hoped to empower to attend ANC could only access their SMS messages if their husbands decided to share them with her. Knowing this, the team could adapt the content of the message appropriately to both show husbands the importance of ANC and encourage sharing with their wives. The team had data on mobile phone ownership rates per household, but without the ethnographic study, they would not have been aware of the dynamic related to who controls the phone. Similarly, mobile phone ownership does not equate to the willingness to purchase the airtime needed to access WhatsApp content and SMS. Rwandan policymakers and digital health experts echoed this advice from our external informants based on their experiences managing sometimes competing priorities of funder-determined factors, their desire for rapid implementation, and achieving impact for the population they aim to serve.

Feasibility studies were cited as the element that most profoundly contributed to the success of previous digital health interventions, providing leadership to well-intentioned development partners who can inadvertently complicate efforts to achieve impact by proposing multiple different solutions all targeting small areas of focus. **Therefore, our discovery phase leading to version 1.0 of MMCR must be robust to avoid these types of costly design errors in our implementation plans,** not only design for the end-users to help facilitate their use but also design of the data systems that are generated from these digital health interventions in order to optimize their usefulness to the institutions aiming to improve health outcomes that can be addressed through improved ANC compliance.

Systems should not be duplicated and fragmented whenever possible, and the data they generate for M&E must not be counterproductive. An example was cited in the RapidPro SMS alerts generated by community health workers (CHWs) when a pregnant mother begins to labor in Rwanda. The primary intent is to alert the mother's associated health center or district hospital so that transport, physical space, and human resources can be mobilized quickly, and preventable complications can be mitigated. To facilitate accountability for their performance, many other levels of leadership receive the same SMS messaging in real time. Often, these leaders are

responsible for dozens of programs and supervise many other staff members who also send SMS updates, which can quickly become overwhelming. The resultant numbing to the alerts is like alarm fatigue experienced commonly by intensive care unit staff due to overexposure, and the system fails to perform its intended duty. Therefore, we must carefully consider these end-users related to MMCR in addition to mothers.

5/7 Respondents described the importance of inspiring love in the end users of MMCR, that we should consider how to add value to their ANC experience and give end users a clear incentive related to their use of the tool. One of our female external informants shared her own perspective related to being requested to share her experience with pregnancy; her immediate reaction was to refuse unless she could clearly determine what the benefit to her was associated with this. Inputting data into an app requires time and energy and sometimes has direct financial burdens if you must pay for the data or SMS to do so. Further, we learned from our surveys and focus groups with Rwandan women that their desire for privacy was a driver of their failure to attend ANC, wanting to avoid the judgment of others, and even being concerned about direct harm should someone try to poison them. Additionally, we must consider the perspectives of accessory users of a digital health tool like MMCR. CHWs, or staff at health centers, have been commonly utilized to enroll mothers and help them access the tool, both to promote uptake and to assure the correct data reflecting the timing of the pregnancy and other clinical factors is included in the registration so the correct messaging gets to the mother.

We will fail in our implementation if we don't use the lessons of behavioral economics to identify and incorporate positive or negative incentives that encourage appropriate use of digital health tools. Fortunately, this is not a new nor unique challenge for MMCR and efforts to improve ANC compliance through digital health interventions, and our Rwandan and external informants had some specific advice to share. In Rwanda, public servants who are responsible for ministry-led programs are commonly overwhelmed with a diverse set of tasks and have limited ability to delegate to colleagues. Development partners frequently support these programs, attempting to adapt programs used in other contexts to Rwanda, but due to their lack of local integration and contextual understanding, they often create high-level and theoretical frameworks that require substantial contributions from Rwandan Ministries to be operationalized. Informants suggested that this type of partnership could be more successful if the development partners were deeply and longitudinally embedded in the Ministries such that their contributions are more specific and require less effort to become useful and streamlined with existing work. This is an example of aligning incentives for mutual benefits.

Other informants shared perspectives from the pregnancies of their wives and how they discovered **a service that would send an email with engaging illustrations and detailed descriptions of the development of their fetus during the weeks of pregnancy.** They were delighted to discover that the emails continued after birth and helped them learn about ways to ensure their infant got proper nutrition and why that nutrition is crucial to the child's growth. Moving into young childhood, the emails shifted to developmental stages like language and motor skills, including of tips for parents to engage their children and assess their progress. We did receive similar feedback from the mothers and fathers we asked to tell us what would be useful to include in MMCR via surveys and focus groups. **It is important that we ask the right**

questions in the right way to understand which elements of MMCR will be valued by the end users and will make our implementation effort successful.

Robust interoperability between MMCR and other public and digital health initiatives is another example of aligning incentives that was cited by several external and Rwandan informants. **Our team was advised to study and map all the actors and programs ongoing, those that failed, and those that are forthcoming, so that we have a comprehensive understanding of the landscape of both ANC compliance and digital health in Rwanda.** We must study the history of these initiatives lest we be doomed to repeat mistakes from the past. Failure to appreciate programs under development and being planned for implementation can lead to wasted resources and duplication of efforts. This effort can be focused on ensuring intelligent design and successful implementation of MMCR, but it can also be a use case that informs guidelines for a broader national initiative aimed at improving transparency, communication, and accountability among all concerned development partners and ministries.

Finally, **most of our informants illustrated the importance of governmental ownership and having a stake in the success of an initiative like MMCR.** Rwanda continues to achieve impressive rates of growth over the past two decades that span economics, educational achievement, and myriad health outcomes. This rapid rate of development means that the system architects, ministry leaders, and policymakers, are quite busy, and all available financial resources are utilized to continue progressing. Therefore, donor funding and human resource support are valuable, especially when closely aligned to the national strategy for transformation. One of our strengths at CIICHIN is our history of deep integration within the public sector spanning government and academia, which can help us successfully achieve true commitment and not just involvement from the Government of Rwanda, so that once implemented, MMCR can persist as a valuable contribution to the health system. **MMCR should leverage other Rwandan digital resources, such as the association of all mobile phone numbers with national identification numbers which also link with community-based health insurance records.** As we refine the theory of change that will inform the design of MMCR and the implementation strategy, we will actively seek contributions from our advisory board on how to embed our team within concerned ministries to add value and assure they have a sense of ownership for MMCR.

7 Discussions

Antenatal care and postnatal care visits' compliance and quality are still very low in low-income countries. Compliance with PNC is important to promote the delivery of health babies while supporting mothers during the pregnancy journey to reduce risks during pregnancy and childbearing. PNC (according to WHO) is defined as care given to the mothers and newborn immediately after the birth of the placenta and for the first six weeks of life. It is estimated globally that most pregnancies result in normal births; however, 15% of pregnancies could become complicated and therefore cannot be predicted.

Detection of complications or any life-threatening condition during pregnancy and after birth should be done early, and appropriately through standard ANC and PNC visits. In most countries, pregnant and lactating mothers face challenges with access to ANC services that are delivered without good quality, which has an impact not only on low ANC and PNC uptake but also on health outcomes of the mother and her baby. In addition, women face a lack of decision-support (lack of women's empowerment tools) of their own health and the health of their newborn, leading to delay or late identification of risks during the entire pregnancy period.

The objectives of this study were to assess (1) the drivers of ANC uptake and compliance among women attending ANC and PNC visits, (2) assess the quality of ANC and PNC visits; , (3) assess the client's satisfaction among women attending ANC visits, (4) analyze key important variables such as depression knowledge among health care providers and depression status among women attending PNC and pregnant mothers. Finally, the last objective was to assess the potential use of digital tools (mHealth tools) to support women in their journey of ANC visits.

Our findings show that most health care providers (ANC providers and mental health providers) are women, have on average 3 years of experience, and are equipped with skills to deliver assigned services. Among ANC providers, 36% (n = 64) were midwives, while others were clinical officers or A2/A1 nurses. The assessment of mental health care officers revealed that less than 30% had appropriate knowledge and attitudes related to postpartum depression, calling for more capacity building in preservice and post service.

Challenges to comply with and key drivers of PNC and ANC uptake and quality are summarized into 2 groups: health center factors, including CHWs, and a lack of women / partner decision-support skills or devices to empower them during the pregnancy journey and after birth.

Overall, ANC compliance is increasing, but at a very low scale. Our findings show an increase in pregnant women who attended the recommended ANC visits from 47% in the recent DHS 2020 to 66% (n = 757/1,138). However, this difference could be due to the different methodological approaches applied in these two studies. Women included in the DHS were sampled from all women of childbearing age (15-49 years) from community whereas this study used an exit interview questionnaire from women coming from ANC services in different health facilities. In the same DHS in Rwanda, 59% of pregnant women had their first ANC visits in their first

trimester of pregnancy, while for PNC visits, 25% of newborns did not receive their postnatal checks. (1)

Another important finding is the poor quality of ANC services delivered, which was estimated at 10%. Almost similar results were found in Rwanda using a secondary analysis of DHS. (2) Different studies conducted in Rwanda showed a varied range of issues that include providers' lack of knowledge (34-43%) and skills to deliver quality ANC services, lack of essential drugs and supplies in all health facilities. (3) Other studies conducted in Africa and Asia found that important supply side factors include the low level of training of health providers and the lack of organization of ANC services, including the length of time spent at the health clinics as the most common barriers that prevented women from attending ANC services. (4)

(5) Additional key findings from the qualitative component, include specific behaviors among health providers, often noticed while delivering ANC services, that were among the factors that could limit women's willingness to attend ANC services. Participants attending ANC suggested increasing the number of health care providers at health centers or health posts and bringing on board ANC specific provider who would only provide ANC services to improve the quality of care while reducing the burden of waiting time. Bad behaviors among healthcare providers should be corrected, and the supervising authority should be asked to limit chatting and phone calls during delivery of care for their patients or clients and they can refer to their phones during their break hours. Health facilities should organize themselves and minimize the movements of women coming for ANC by providing ANC services in a separate place out of contact with other patients at the health center.

On the demand side, factors related to the education of mothers, parity, financial and geographic access, and expectations of quality indicators during ANC services by expectant mothers were key to complying with the recommended number of visits. (6,7)

In our study, most women interviewed in our sample were married (87%, n = 1,138), had attended school (98%), were insured, and 87% of them reported having their own cell phones. However, 15% of women during ANC visits reported having had a miscarriage in their life and 7.47% of women who attended ANC visits were 19 years old or less. Findings from Ethiopia and Bangladesh indicated that age of the mother (≤ 25 years), age at marriage, pregnancy recognition using urine tests, decision power to use ANC, costs of services and transport, among other factors, were found to be associated with timely ANC visits in quarter 1.

(8) (9) In the current study, geographic access and time spent reaching or at health facilities are still very high. More than 60% of women who were pregnant at the time of the survey reported spending 1 hour or more to reach health facilities, and around 24% of women spent 2 hours walking before reach health facilities. These findings corroborate those found in most African countries. (10) Nearly 70% of women who were pregnant spent an additional 60 minutes or more in the administration or doing registration requirements before they were received by a health provider and spent less than 15 min in the consultation room. (72.4%).

The prevalence of overweight or obesity was high in our population (59%) compared to those who were undernourished (4%). Overall satisfaction among women attending ANC was 74%.

The overall depression rate was estimated at 11% among women who were pregnant during our visit.

In the PNC assessment, findings show that 6.6% of newborns had low birth weight, and 37% of women attending PNC had more than 2 children who were under 5 years old. Overall, 22% of all newborns did not receive a post neonatal check, although almost all women delivered (97.9%) at the health facilities. However, knowledge related to postpartum depression was very limited among women attending PNC (21.3%).

In the qualitative assessment, our findings revealed some misconceptions around ANC services, especially among pregnant mothers' partners. Barriers generated by health care providers, such as fines for not attending ANC, the perceived quality of ANC, and expected health benefits to both pregnant mothers and their husbands, were key drivers of ANC compliance. Key mediating factors such as integrating campaigns and mobilization activities at the community level to increase positive behavior, door-to-door visits of CHWs to support pregnant mothers with reminders, and improvement of perceived benefits among partners were key factors that stimulated women and their husbands to attend ANC services.

Finally, the suggestion of using digital health tools was recommended as an innovative approach to improving awareness, time for ANC visits, due or expected delivery dates, as well as expected outcomes from ANC visits. (11) The integration of these interventions, especially the digital tool with built-in M&E indicators and timely feedback to health providers related to their knowledge and behaviors during ANC visits, quality of contents, and reminders to ANC visits, would push health providers to adopt positive attitudes as well as reduce the time spent by pregnant women waiting to be received or to receive feedback from laboratory results.

Other important benefits of digital tools include the ability to detect potential risks and intervene early in time to achieve long-term goals such as reducing neonatal and maternal mortality. In South Africa, the use of digital tools to prospectively monitor pregnant mothers but also support early detection was tested among 98,734 pregnant women from 2014 to 2017. The potential use of MomConnect in the western province of South Africa shows that identifiers, including telephone numbers, were more updated than records at the health facilities in the existing system and empowered women in the co-production and co-development processes, with functions that allow interoperability with other existing systems. (11–13)

A study conducted by Wajeaha Belal et al. found that the utilization and impact of digital health should be considered to remove barriers to accessing maternal health services and reduce maternal mortality and mobility. (14) He also suggested that implementation challenges should be explored before scaling of any digital health tool to understand expected short- or long-term goals, organizational factors, as well as political and legislative aspects. (15)

Digital health is not new in Africa Rwanda. Appreciation of its potential impacts in improving (1) early detection of pregnancies and potential complications, and (2) improving collaboration and reassurance between CHWs and beneficiaries were among the key factors found in Burkina Fasso. (16)

However, the introduction of digital health tools on the demand side has gained attention in the last two decades. The use of messaging to the beneficiaries has become popular in low-, middle-, and high-income countries, including India, Bangladesh (Aponjon), Tanzania (17), and South Africa. MomConnect in South Africa reached over 60% coverage among the target population (pregnant mothers). However, there were identified challenges that the team from MomConnect recognized as critically important for any digital platform implementation team to consider. These include, among others, high-level buy-in from leadership and partners, platforms to be used, an M&E framework to understand points of failure, and financial and content strategies to be used for optimum results. (18)

The issue of compliance with recommended ANC services would be automatically solved because the value, content, and quality of ANC would be improved as beneficiaries would be exposed to the information and content of ANC as well as expected outcomes from each of the ANC or PNC visits. However, pregnant women living very far from HC could be consulted within health posts for ANC visits, as currently implemented using the new ANC guidelines of 8 ANC visits, of which half are delivered at health posts and the remaining half are delivered at health centers. Other recommended strategies include incentivization of activities that showed potential to attract women and husbands to adhere to ANC services, digitalization of the entire health system where some IDs were not well registered in the national ID database, and the need for a complete interoperable tool capable of data synchronization from the demand side to the supply side.

The importance and use of CHWs and their perceived value as expressed by the beneficiaries of ANC services were overwhelmingly pointed out by many participants. They mentioned how this program is important to them and have stated that they are willing to perform their responsibilities to protect the public's health in their community. However, they claimed that it is difficult to fulfill their predetermined responsibilities due to a lack of facilities such as bags, pregnancy tests, boots, umbrellas, rain cloths, and torches during the night for either reminding mothers about their visits or checking their health status. Their catchment areas are too large, which makes them challenged by transport fees during the home visit and enrollments, but they think that digital tools can help solve this issue, including the removal of registries to be replaced by digital tools for the registration of mothers, children, and families. These challenges expressed by the CHWs offer an opportunity to reduce walking time while reaching pregnant mothers and their families by using a digitalized mobile phone.

Women who participated in the focus group discussions expressed that depression is a serious problem during pregnancy and postpartum. And most of them said that depression is more common in postpartum women compared to pregnant women. And yet, this issue has not been tackled yet during this period of pregnancy or during the post-partum period in Rwanda or in the region. The pain endured was because of financial hardships, such as not being able to pay for medical insurance, food etc., which are factors that reinforce the persistence of depression. Almost 11% of women were depressed during the data collection period.

All these challenges, once well identified and addressed with tailored content for pregnant or lactating mothers, can elevate the burden among health care providers and improve not only short term outcomes (ANC or PNC compliance) but also long-term outcomes such as healthy

babies and mothers.

8 Conclusion and Recommendation

There have been improvements in maternal and child health in Rwanda over the past few decades. However, ANC and PNC attendance, compliance, and quality are still challenging in LICs, and Rwanda is no exception.

Strategic and focused interventions to improve the quality of ANC and PNC at the health center level combined with a digitalized and accountable tool to support women's decisions should be considered to reach 4 traditional ANC visits or 8 newly recommended ANC visits while involving women and partners as co-developers and producers during the process of implementation. High-level penetration of mobile and digital instruments offers a unique opportunity to support women's or parents' decisions toward their health, increase patient's satisfaction, and improved quality of care with the goal of improving key long term health outcomes such as maternal depression, infant and maternal morbidity, and mortality.

With the new knowledge generated through phase 1, we are excited to begin the process of further discovery and design of the intervention of MMCR and to avoid reinvention of the wheel. We at CIICHIN are fortunate to have existing working relationships with Jembi Health Systems (instrumental in the design and continuous operations and improvements of MomConnect South Africa) as well as QT Software a Rwandan computer engineering firm contracted by the government to collaboratively lead the development of implementation of the digital health information exchange and government service systems. Our work with the American Centers for Disease Control technical assistance platform (that aims to potentiate the value of global goods development experiences by uniting digital health efforts from around the world to share resources) has helped us more deeply integrate with the chief digital officer and their team within the Ministry of Health and the Rwandan Information Security Authority (RISA). Additionally, we have organized a few interdisciplinary digital health stakeholder meetings to share updates broadly and collect new ideas to create roadmaps and coordinate processes to avoid duplication of effort and improve the interoperability of digital health initiatives.

The Agency Fund aims to support people in the navigation of their own choices, humbly accepting that knowing the best course of action for another human is rarely obvious. This inconvenient approach rejects prescriptive efforts to incite behavior change in a population, and embraces investing in building the right conditions that lift populations up, empowering them with more and better choices. Reach Digital Health (formerly Praekelt) leverages their 15 years of experience to live this philosophy, building and implementing digital health solutions that respond to the specific needs of clients. Our approach to MMCR aims to incorporate elements from each of these partners, combined with our experience, connections, and newly gained understanding of the experiences of Rwandan mothers related to ANC, PNC, nutrition, and depression.

Considering all of the lessons we've learned in the past year and the new partnerships we've forged that share our goals, we suggest spending the next year creating 'living' digital tools that provide end users with more and better choices about how to improve their own lives in the topical areas we are focused on. Considerations include, but are not limited to:

- Creation of living digital tools: these tools should take in, process, and put out data in forms that are valuable to the end users. Through this capacity, the tools will have the power to learn. As such, and in the spirit of granting agency to our end users, progressive iteration will define MMCR. What we learned from our respondents last year about barriers and enablers of mothers' attendance at ANC in Rwanda will not be the focal point of what MMCR offers to its users. For example, if MMCR responds to the reported barrier of low-quality service delivery by ANC providers as a barrier to ANC attendance and the quality improves this year, then by next year MMCR will have become obsolete. Instead, we can build into MMCR a mechanism by which to collect feedback from mothers that will allow continuous quality improvement and data collection to identify ANC providers who are providing great quality service and can be rewarded and serve as models for other ANC providers. Finally, by tracking the pace of changes inspired by MMCR, we learn how to optimize the effectiveness of different responses to newly identified challenges, ultimately creating something that is infinitely adaptable and scalable as it grows more adept at responding to different conditions.
- Avoiding reinvention of the wheel: partners like Reach Digital Health, Jembi Health Systems, and the Agency Fund have deep experience from other contexts, and we intend to assure that MMCR honors this and grows from it. Therefore, the activities of CIICHIN related to the development and implementation of MMCR will consistently converge on engagement and facilitation of co-production between Rwandan stakeholder institutions, these experienced partners, and MMCR end users (mothers, fathers, CHWs, direct ANC providers, and mental health officers from the communities). If we are successful, we will assure that MMCR is fully integrated into other systems used by stakeholders and responds directly to the needs and pain points of the end users.
- Rwandan capacity building: CIICHIN will strive to find an appropriate balance between leveraging the experience of our partners and supporting Rwandan individuals and institutions to lead the development and implementation of MMCR. If done well, we assure mutual benefits to all involved parties, as the experienced partners can trial approaches that have been successful in other contexts in a new one. Meanwhile, our new effort in Rwanda benefits from the opportunity to grow up on the foundation of successful digital health efforts to bring agency to mothers in other African countries.

How do we achieve this?

Collaboratively. Grounded in evidence; from published literature and unpublished data collected from the health system and efforts like this phase one report. **Iteratively,** by

tirelessly pursuing a deep understanding of the end user experience with the MMCR intervention and assuring that the basic build of our digital tool can accommodate rapid and significant change when indicated. **Through continuous monitoring and evaluation** so that we are always confident that what we think we understand truly reflects the experience of the end user (and therefore the true impact of our intervention, not the impacts of an intermediary process that is only a part of the intervention). As we complete the final report from phase one, we propose the following activities to inspire discussions with partners and stakeholders:

- Establishment of a small leadership consortium to include CIICHIN, Reach Digital Health, the Agency Fund, the Division of Maternal and Child Health in the Rwandan Ministry of Health, Jembi Health Systems, and QT Software to begin **bi-weekly meetings and collaboratively design a theory of change** for MMCR in Rwanda (inclusive of integration within the HIE/HIS, the existing CHW and digital ambassadors programs, determining how to best engage end-users in co-production, being realistic about the costs and availability of necessary digital infrastructure, considering sources of funding that assure government ownership and skin in the game but also sustainability of MMCR, etc.
- **Designation of an MMCR champion from Reach Digital Health** who will spend 1-2 weeks with us working intensively in Rwanda to fully understand the current capacity, and interest, share their experience, and inspire new directions that may not have been fully evaluated or considered. She will be paired with a CIICHIN teammate who will introduce her to all the resources to consider in Rwanda.
- **Utilizing the theory of change to plot a roadmap and timeline for MMCR**, inclusive of the activities needed to inform specific objectives and stakeholder group composition. To consider hosting a launch event of a multi-faceted MMCR design challenge with teams that unite government officials, remotely located foreign collaborators, healthcare professionals, ICT professionals, MMCR end-users, and students to consider how to bridge the digital divide, maintain an excellent UI/UX, develop a 'living' digital tool that continuously learns and can adapt to changing conditions, integrate with existing digital health systems, and more.
- **Convene an MMCR stakeholder conference** to present the drafted theory of change, roadmap, and timeline and collect additional feedback as well as necessary regulatory authorizations and support from governmental institutions.
- Consider in the design of our phase three evaluation methods that the indicators collected in phase one are considered to allow re-evaluation post-intervention to assess the impacts achieved.

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