Royal Tropical Institute

Mobile health: Connecting managers, service providers and clients in Bombali district, Sierra Leone

Intervention study on mHealth for maternal and newborn health in resource-poor community and health system settings, Sierra Leone ♦ *Midline study report*

DFID New and Emerging Technologies
Research Competition, Phase 2

The project consortium partners are:

Medical Research Centre

Government of Sierra Leone

University of Sierra Leone

TEXT TO CHANGE

Royal Tropical Institute

Mannion Daniels

This publication was made possible thanks to the financial support of the UK Department for International Development (DFID) with co-funding from the Public Private Partnerships Sierra Leone programme within MDG5 Meshwork.[1]

Department for International Development

Powered by MDG5

For enquiries, contact:

Medical Research Centre (MRC)
Dr Heidi Jalloh-Vos
5 Frazier Davies Drive
Freetown
Sierra Leone
Tel +232 76 684 337
E-mail hjallohvos@mrc-sl.org

Royal Tropical Institute (KIT)
Mr Hermen Ormel
Senior Advisor
PO Box 95001, 1090 HA Amsterdam
The Netherlands
Tel +31 20 568 8578
E-mail h.ormel@kit.nl, www.kit.nl

Suggested citation: H Jalloh-Vos, K Herschderfer, AM Jalloh, H Ormel, K de Koning, SAY Kamara, L Wolmarans (2013), Mobile health: Connecting managers, service providers and clients in Bombali district, Sierra Leone. mHealth for maternal and newborn health in resource-poor community and health system settings, Sierra Leone. Midline study report. Amsterdam: KIT.

Cover photo: A traditional birth attendant making her first ever phone call, Bombali District (photo MRC).

[1] The MDG5 Meshwork for Improving Maternal Health is a cross-sector, cross-disciplinary network of more than thirty organizations based in Sierra Leone, Afghanistan and the Netherlands (www.mdg5-meshwork.org).

Mobile health: Connecting managers, service providers and clients in Bombali district, Sierra Leone

Intervention study on mHealth for maternal and newborn health in resource-poor community and health system settings, Sierra Leone ♦ *Midline study report*

DFID New and Emerging Technologies
Research Competition, Phase 2

2013

Authors

Sarian A.Y. Kamara	Kathy Herschderfer Hermen Ormel Korrie de Koning Liezel Wolmarans	Heidi Jalloh-Vos Alpha Mohamed Jalloh
Ministry of Health and Sanitation, Freetown	*Royal Tropical Institute, Amsterdam*	*Medical Research Centre, Freetown*

Acknowledgements

This report reflects the efforts of many, and all the contributions are greatly appreciated.

First, we would like to thank the health service clients who enrolled in the mHealth communication scheme and community members who agreed to being interviewed, thus bringing demand-side perspectives towards health services to life.

We are grateful to district health management team members, health facility staff and traditional birth attendants (TBAs) who took time from their busy schedules to meet with the data collectors and provide answers to the survey questions.

We also thank the team of data collectors who helped develop and pilot the surveys and who spent many hours in the field visiting facilities and collecting data:

- Henry J. Squire, lecturer, University of Sierra Leone
- Elsie Clarissa Aye-Femi Lisk, student, University of Sierra Leone
- Rodney Isaac Lambert, student, University of Sierra Leone
- Josephine M.R. Robert, student, University of Sierra Leone
- Eddison Jambah Amara, student, University of Sierra Leone
- Geraldeen Hastings-Spaine, student, University of Sierra Leone
- Alpha Thomas Ensah, student, University of Sierra Leone
- Alhaji M. Nyakoi, student, University of Sierra Leone
- Agatha Massaquoi, student, University of Sierra Leone
- Theresa Rhodes, student, University of Sierra Leone
- Grace Bangura, student, University of Sierra Leone

All consortium partners contributed to the midline report by reviewing draft versions and providing their insights and comments.

We especially would like to acknowledge the following persons:

- David Daniels, MannionDaniels Ltd, Bath
- Dr Samuel Kargbo, Ministry of Health and Sanitation, Freetown
- Dr Bailah Leigh, University of Sierra Leone, Freetown
- Dr Isaac Palmer, University of Sierra Leone Freetown
- Hajo van Beijma, Text to Change, Amsterdam

Finally, we'd like to acknowledge the financial support from main funder DFID and the co-funder MDG5 Meshwork.

Abbreviations and acronyms

ANC	Antenatal care
ANC1	First antenatal care visit
CHA	Community health assistant
CHC	Community health centre
CHO	Community health officer
CHP	Community health Post
CUG	Closed user group
DFID	UK Department for International Development
DHIS	District health information system
DHMT	District health management team
EDCU Assistant	Endemic disease control unit assistant
FHCI	Free health care initiative
FP	Family planning
HMIS	Health management information system
KIT	Royal Tropical Institute
M&E	Monitoring and evaluation
MCH	Maternal and child health
MCH aide	Maternal and child health aide
MCHP	Maternal and child health post
ML	Midline
mHealth	Mobile communication for health
MNCH	Maternal, newborn and child health
MNH	Maternal and newborn health
MoHS	Ministry of Health and Sanitation
MRC	Medical Research Centre
NATCOM	National Telecommunications Commission
NET-RC	DFID New and emerging technologies – research competition
PBF	Performance-based financing
PHU	Peripheral health unit
PNC	Post-natal care
PW	Pregnant woman/women
SECHN	State-enrolled community health nurse
SLL	Sierra Leone Leone (currency)
SRHR	Sexual and reproductive health and rights
SSI	Semi-structured interview
TBA	Traditional birth attendant
USL	University of Sierra Leone
VPN	Virtual private network

Executive Summary

Background and purpose

This intervention study 'mobile health for maternal and newborn health in resource-poor community and health systems settings, Sierra Leone' is a programme funded by DFID as part of the New and Emerging Technologies Research Competition (NET-RC). The study follows the successful implementation of a first-phase feasibility study, carried out in 2011.

The interventions over the 12-month period were divided into two stages of six months each, and were separated into 'wedges' according to differential interventions. This step-wedge approach was chosen to create an 'internal' non-intervention group (Wedge 2) to compare interventions.

Stage 1 interventions (August 2012-January 2013) consisted of the establishment of a virtual private network (VPN) to improve health worker to health worker communication; this was implemented across both wedges, i.e. in all chiefdoms of Bombali district. All 98 peripheral health units (PHUs) also received a mobile phone and sim card that allowed health workers to call numbers in the closed user group network for free. Interventions regarding health worker to client communication and TBA involvement were also started in during this first stage but only in Wedge 1 facilities (Wedge 2 will implement this intervention only during Stage 2, Feb-July 2013) – this may have influenced how both wedges deal with the VPN intervention. In addition, all PHUs in the six chiefdoms included in Wedge 1 received a solar charger for the phone as well as phone credit to call clients, to remind them of appointments; Wedge 2 PHUs did not receive these during the first stage.

In one chiefdom in Wedge 1, selected TBAs were engaged and were provided with a mobile phone as part of the intervention, to improve health worker client communication. This will only be started in the one chiefdom selected from Wedge 2 at the second stage of interventions.

This report presents the results of the midline study that took place in January-February 2013 at the end of the first stage of interventions.

Methods

Mixed methods were used for data collection. A quantitative method – consisting of a survey in all 13 chiefdoms – was used to collect background information on one part of the intervention (VPN) and one part of the outcomes (health worker job satisfaction). Qualitative methods were implemented in selected Wedge 1 chiefdoms, and consisted of semi-structured interviews with enrolled clients, TBAs, health workers and health managers, summary information from maternal death reports; and summary information from monthly PHU reports on mHealth enrolment and follow-up (Wedge 1 only).

Findings and implications for end line analysis

The most important findings relate to facilitators and barriers for accessing phones, and what helped or hindered health worker to client communication and health worker to health worker communication. The findings from the midline analysis also present some tentative trends in outcomes.

Facilitators and barriers to phone use

Most of the health workers indicated that they had coverage by a network all or some of the time. Reasons for lack of access were: the distance they need to walk to get into an area with coverage. In the qualitative data that covered only

two of the chiefdoms in the district, similar problems with the network coverage were confirmed.

The facility phone was available for most health workers in both wedges, while problems were noted if the phone was taken from the facility or was dysfunctional. Lack of (or irregular) electricity to charge phones remains a barrier. The solar charger was included in the scheme to address this, but technical problems with the charger caused it to work only in few of the PHUs. The provision of a solar charger created expectations in Wedge 1 facilities that were not met, which led to some dissatisfaction. Health workers and TBAs who faced non-functional chargers nevertheless were creative in finding alternative solutions.

There is a statistically significant difference in payment for phone calls and texting at midline between Wedges 1 and 2. More health workers from Wedge 2 facilities, which did not receive credit, paid than Wedge 1 staff.

The qualitative data indicate that the involvement of TBAs may overcome lack of phone ownership and confidentiality issues related to family planning.

Health workers, TBAs and (female) clients had a clear preference for calling as a means of communication rather than texting. Despite barriers mentioned, there is overall a significant increase in phone communication at midline, with variation across both wedges.

Health worker to client communication
Initiation of calls between health workers and clients increased in Wedge 1 compared to the baseline. Calls to TBAs being initiated by health workers shifted to TBAs initiating more calls to health workers. Roughly three reasons for communication between health workers and clients were identified by health worker, TBA and client respondents: appointments, health information on a range of topics and checks on their health status.

In the qualitative data, health workers, District Health Manager Team (DHMT) members, clients and TBAs all observed a trend in increased utilization of services across the continuum of care for maternal health, and some neonatal and child health services. Reasons provided for increased utilization include being better informed about the time and place of clinics. Alerting one person with a phone also reached others, who were then informed by the person with a phone thus multiplying the effect.

This was tentatively confirmed by quantitative Health Management Information System / District Health Information System (HMIS/DHIS) data which showed a higher increase in utilization of Wedge 1 facilities as compared to Wedge 2 facilities, for half of the ten service utilization indicators. However this is based on absolute client numbers and not the service coverage data that will become available during the end line study; only then will it become clear whether there is a real difference between wedges.

The headway made by the mobile phone can only be sustained at service utilization level if related supplies are consistently available.

Health worker to health worker communication
There are indications from the qualitative data that the improved communication opportunities through the mobile health interventions allow health workers to consult more timely and fully (without a time or credit constraint) with their supervisors and colleagues and to get clinical advice. This in turn might improve quality of care (including timely and correct referrals) and reduce maternal deaths.

Benefits of improved communication
Benefits of improved communication identified by respondents included: mobile phones save health worker and TBA time; increased utilization provides an incentive for health workers and TBAs, increasing job satisfaction; improved relationship and trust; improved attitudes of health workers; and, on the client side, improved continuity of family planning uptake and follow-up of treatment and improved and more timely emergency care consultations and referral.

Referral and maternal death
The health worker to health worker communication seemed useful for both ambulance referral and better indications for referral due to consultations with senior staff prior to actual referral. In addition, the facility phone is improving direct access to a person who can send the ambulance immediately, thus making referral more timely.

The number of maternal deaths reports did go up in the first half year. However, maternal deaths are underreported and increased reporting probably doesn't mean that there was an actual increase in maternal deaths. The opposite observation emerges from the qualitative data where respondents estimate a decrease in maternal deaths.

Keywords
Health communication, health systems, mHealth, mobile technology, maternal health, mobile health, newborn health, Sierra Leone

Contents

Tables

Figures

1 Introduction

The 'mHealth for maternal and newborn health in resource-poor community and health systems settings, Sierra Leone – Phase 2' research project is funded by the DFID programme on New and Emerging Technologies Research Competition (NET-RC). This programme aims to realize the potential of new and emerging technologies for poor people by identifying applications from which, directly or indirectly, they can reap tangible benefits such as improved health and reduced risk of disease.

Research under the NET-RC programme (i) focuses on the best ways to responsibly introduce and use relevant, effective and affordable new technologies in resource-poor settings; (ii) identifies and deals with barriers that prevent disadvantaged people from benefiting; and (iii) addresses possible risks in terms of undue effects on development goals.

This current study follows the successful implementation of a first-phase feasibility study, 'mHealth for maternal and newborn health in resource-poor community and health systems settings, Sierra Leone' carried out between December 2010 and August 2011.[2]

1.1 mHealth feasibility study results

The objective of the first-phase study was to assess the feasibility of introducing and operating selected mobile communication technologies for improved communication on maternal and newborn health (MNH) in a fragile health system in resource-poor settings.

The research was mainly qualitative, exploratory in nature and was implemented in two sites, Kenema district and Western Area. The main research methods included semi-structured interviews (SSIs), in-depth interviews, focus group discussions and literature review. The main research participants were health workers, health managers and community key informants from the two sites; health service clients and male, female and young community members from the districts; and key informants (health managers and experts) at national level.

Analysis workshop during Phase 1

Photo: KIT

The study found that health workers, clients and other community members alike see much potential in using mobile communication across various health care domains, to improve information, service delivery, access, quality, efficiency, responsiveness and, ultimately, health outcomes.

[2] Magbity E, Ormel H, Jalloh-Vos H, De Koning K, Sam EM, Van Beijma H, Kamara SAY, Daniels D, Kargbo S, Hessels P, Dumbuya A, Harteveld L, Kamara A, Herschderfer K, Leigh B and Konteh-Khali N (2011), *"I expect the health worker to call me". mHealth for maternal and newborn health in resource-poor community and health systems settings, Sierra Leone. Feasibility study report. DFID New and Emerging Technologies Research Competition, Phase I*. Amsterdam: Royal Tropical Institute, http://www.dfid.gov.uk/r4d/PDF/Outputs/Misc_MaternalHealth/mHealth-Sierra-Leone-Phase-1-Final-research-report-for-DFID-08Sep11.pdf.

Work-related use of mobile communication for health (mHealth) is already very common among health workers. The preferred mode of communication is voice calls, although half of the health workers also use text messaging (community members, i.e. the health service clients, do not). Barriers identified relate to external factors such as geographical coverage of the mobile network and literacy levels, but also to factors that could be addressed by the health system, including poor access to battery charging facilities, poor access to a duty phone and poor access to/payment of top-up cards.

Data confirmed that almost all health workers possess a mobile phone; however, only one third of the clients interviewed have one, although another third have conditional access to a family member's phone. Community members consistently mention MNH as the most important area that would benefit from mHealth strategies.

"I expect them to call me and check on my general welfare and to encourage me to visit the clinic frequently, so that the position of my baby can be checked on a regular basis." – Female client, Kenema

Expectations regarding mHealth among both health workers and community members were found to be high, although some health workers fear an increased workload, while confidentiality and privacy issues also raise concerns, especially in view of the practice of 'phone sharing'.

Communicating with and receiving relevant information from mobile network operators regarding coverage data, subscribers and tariffs has been challenging, and the telecommunications regulator, NatCom, has not yet been able to share relevant information. This context should be taken into account when pursuing mHealth in Sierra Leone.

While mHealth is perceived as potentially beneficial in a number of ways, health policymakers and managers may need to prepare for strains and demands on the health system. These include a possible increase in workers' workload; the consideration for establishing a 'protocol' for (mobile) communication with clients; standards and systems for an increased information flow among health workers and between them and clients; consideration of costs to health staff and clients; and governance issues surrounding ethical issues and confidentiality, public–private partnerships and sustainability.

1.2 mHealth intervention study

Building on the results from the first-phase feasibility study, the 'mHealth for maternal and newborn health in resource-poor community and health systems settings, Sierra Leone – Phase 2' project proposal was submitted and approved by DFID in July 2011. The contract for the intervention study was signed in October 2011, after which implementation preparations started, starting with an inception phase.

The research protocol was subsequently developed, in close collaboration with all consortium partners. It was submitted in parallel to the Sierra Leonean Ethical Review Committee and the KIT Research Ethical Committee. Approval was received from both bodies by May 2012.

The baseline study was carried out prior to the start of the intervention. A separate report is available on the baseline study[3]. The baseline survey

[3] Magbity E, K Herschderfer, H Jalloh-Vos, H Ormel, SAY Kamara, AM Jalloh, K de Koning, L Wolmarans (2013), Mobile Health: Connecting managers, service providers and clients in Bombali District, Sierra Leone. mHealth for maternal and newborn health in resource-

measured the situation before the start of the Bombali district interventions in two wedges. A step-wedge approach was introduced to create an 'internal' non-intervention group to allow comparison of interventions (see next chapter for further explanation). Information was collected from 181 health workers, representing 94% of the estimated number of health workers employed at the time of the baseline study. Health workers generally reported good mobile phone network coverage, with 54% indicating coverage 'all the time' and 30% 'most of the time'. Slightly more health workers in the highest level of facility (community health centres) reported better coverage compared to health workers in lower-level facilities, but this was not statistically significant. Most of the health workers (86%) reported that they were able to initiate and receive phone calls/text messages inside the health facility. For the rest, an average walk of 28 minutes was needed to reach network coverage.

Almost none of the health worker respondents (99%) had access to a dedicated facility work phone; all indicated that they made and/or received work-related calls and messages using their personal phones. The health workers used the mobile phone almost exclusively for calling, with only a few who indicated that they also sent text messages. Baseline data showed that more than half of the health worker respondents made calls to and received calls from clients, while less than half called and received calls from traditional birth attendants.

Comparison analysis between the intervention wedges at baseline showed a large number of similar characteristics for both health facilities and health workers. Some significant differences were found that indicate that Wedge 1 respondents may have to make more of an effort to communicate by mobile phone than those in Wedge 2. This is related to the ability to make calls within the peripheral health unit and reported availability of network coverage.

The interventions over the 12-month period were divided between two stages of six months each; the first six-month stage was August 2012 to January 2013. This report presents the results of the midline study that took place in January-February 2013 at the end of this first stage of intervention.

poor community and health system settings, Sierra Leone. Baseline study report. Amsterdam: KIT, http://www.kit.nl/kit/Publication?item=3468.

2 Study design and methodology

This chapter contains a description of the overall intervention study objectives, intervention logic, methodology[4] and intervention process.

2.1 Intervention study objectives

The general research objective is to assess the effect on MNH service utilization of integrating mobile communication strategies into existing health service packages in one health district in Sierra Leone.

Specific research objectives are:

- to assess changes in MNH/family planning (FP) service utilization by female clients, associated with expanded options for client-initiated and provider-initiated mobile communication:
  - For the entire district (engaging all peripheral health units (PHUs) and through the national information line); and
  - In the selected PHU catchment areas that implement the intervention involving traditional birth attendants (TBAs);
- to assess changes in health workers' job satisfaction and control at work, and other self-reported changes due to expanded options for provider–provider communication and provider–client communication;
- to assess changes in MNH referral systems due to expanded mobile communication options;
- to assess changes in maternal death reporting
- to identify implications for the health system of mobile communication initiatives; and
- to make policy recommendations for integration of mobile communication initiatives in district-level MNH service packages.

2.2 Interventions

The intervention study contains a number of interventions that were decided on and agreed to, using information from literature review, situation analysis, the outcomes from the feasibility study and the results of an intervention options ranking exercise.

Interventions started in August 2012 and included several components, of which two (health worker to client communication and TBA involvement) were staged by time across wedges (stage 1: six months, August 2012 to January 2013; stage 2: six months, February to July 2013). The staging was designed to allow a step-wedge evaluation research methodology (see below). Table 1 summarizes the various interventions by stage and wedge. Further details on selection of chiefdoms are given in the methodology section below. Tambaka chiefdom was not part of the wedge design but benefitted from the interventions also.

[4] The overall research protocol is available on request.

Table 1: Overview Bombali district interventions by stages and wedges

Geographical location	Time period	
	Stage 1 (Aug12 – Jan13, 6 months)	**Stage 2** (Feb – Jul13, 6 months)
Wedge 1 (6 chiefdoms)	Virtual private network (VPN) Health worker to client communication Solar-powered battery charger TBA involvement (1 chiefdom)	VPN Health worker to client communication Solar-powered battery charger TBA involvement (1 chiefdom)
Wedge 2 (6 chiefdoms)	VPN - - -	VPN Health worker to client communication - TBA involvement (1 chiefdom)
Tambaka (1 chiefdom)	VPN - - -	VPN Health worker to client communication - -
National	National phone line ▪ Free Health Care Initiative (FHCI) complaints from facility management committees ▪ - ▪ -	National phone line ▪ FHCI complaints from facility management committees ▪ FHCI complaints from general public ▪ MNCH advice to general public

1. Virtual private network
(Health worker to health worker communication)

The virtual private network (VPN), also called a 'closed user group', was put in place in collaboration with Airtel, one of the four mobile network operators, for the duration of the study and across both wedges. Mobile phones and sim-cards were thus procured and distributed across all 98 Ministry of Health and Sanitation (MoHS) district health facilities and key MoHS district level management and service staff (key DHMT and hospital staff and Maternal Child Health (MCH) aide coordinator), including an ambulance driver, as well as local (city and district) council staff, at the start of stage 1. TBAs in two chiefdoms (those in one chiefdom starting in stage 1 and those in another chiefdom starting in stage 2) were also part of the VPN.

The VPN allows for unlimited calls and text messages among all members without cost to them, as the pre-paid monthly cost per phone number is paid for centrally (in this case by the project). PHUs and TBAs in Wedge 1 (six chiefdoms) also received a solar-powered battery charger to make it easier to recharge the mobile phone's battery where this would otherwise be difficult. (Wedge 2 PHUs and TBAs did not receive solar chargers during stage 1, since the introduction of solar chargers had been designed to go together with the introduction of the health worker to client communication component.)

2. Engaging with clients
(Health worker to client communication)

In August 2012 a group of 51 PHU in-charges or their representatives who worked in health facilities making up the first wedge were trained in the interventions. This included: use of phones, communication with supervisors, colleagues and selected TBAs; and the use of the registers for pregnant women and FP clients enrolling into the mHealth intervention (including informed consent) and related guidelines for subsequent engagement with clients. The registers were designed specifically for the project and were placed next to the usual registers, in two types: one for pregnant women (covering ante-natal care (ANC), delivery and post-natal care (PNC)) and one for FP (covering FP for female clients).

Wedge 1 PHU staff in August 2012 started to invite pregnant women coming for ANC and family planning clients to enrol in the mHealth scheme, ensuring full informed consent. The enrolment criteria stated they should have access to a phone (their own, a phone they had access to in their household or neighbourhood, or via a TBA; the latter only in the designated TBA-intervention chiefdom, see below) and that they should agree to be contacted by a health worker for appointment reminders and related information.

A system was put in place, including the monthly transfer of a limited amount of phone credit (2,000 units equivalent to SLL 80,000) to Wedge 1 PHUs, to allow MoHS staff to use the existing, regular mobile network to communicate with enrolled clients as per protocol. This meant that clients would be called ahead of time to remind them of their next appointment; that they would be asked if everything was fine and whether they had any questions and the clients would be provided with health education specific to their situation.

PHUs were issued with monthly report forms to report on the number of clients enrolled by type (pregnant woman or FP client, communicating via their own, someone else's or a TBA phone).

3. Expanded VPN: linking in TBAs
(Health worker to TBA communication)

In one chiefdom (Paki Masabong, one of the six chiefdoms in Wedge 1), a total of 34 TBAs were included in the VPN network during stage 1 to enable their participation in the health worker to client intervention. The TBAs received a similar training as the health workers, now also addressing the role of TBAs in identifying new clients and following up existing clients, and the use of phones for communicating with PHUs.

4. National MoHS toll-free information line on sexual and reproductive health and rights (SRHR)
(Client-initiated information provision)

This component entailed the design of a national call-centre receiving complaints on the national Free Health Care Initiative (FHCI) and providing information on maternal, neonatal and child health, led by the MoHS in coordination with partners; the mHealth programme made a limited contribution in the form of assisting to design the intervention and manual and participation in the coordination meetings.

In August 2012 the pillar dealing with submission of FHCI complaints by Facility Management Committees became operational; the second pillar dealing with FHCI complaints submitted by the general public, as well as the third SRHR information line pillar became operational in January 2013. For stage 2 it is planned to promote the line among mHealth enrolled clients in Bombali District

(through little cards given to them with on one side the national phone line number and on the other side the PHU's own number) and the general public (through radio spots on the local radios in Bombali District).

A summary overview of the interventions and how they are expected to lead to expected outcomes can be found in the intervention logic diagram in Annex 1.

2.3 Methodology

Study design

The NET-RC Phase 2 intervention study has a quasi-experimental design with a mixed-methods approach (combining quantitative and qualitative research methods). A partially staged implementation and analysis was done by using a step-wedge design for the health worker to client communication and TBA interventions described above. The VPN and the national phone line were not part of the step-wedge design. The step-wedge design thus allows for a counterfactual analysis that compares outcomes between the intervention and the non-intervention parts (see Table 1). Annex 2 provides an overview of the overall study objectives in relation to research questions, research methods, data collection tools and envisaged research participants for the entire study.

Description of study district

Among several eligible districts (where no VPN or other mHealth-related interventions were in place yet), Bombali district (see Figure 1) was selected, as it is centrally located with relatively easy geographical access to most of its chiefdoms and since it has >90% mobile phone network coverage at the PHU level for at least one (same) mobile network operator. The district is divided into 13 chiefdoms and has 98 functioning PHUs and five hospitals. Access to some of the health facilities in the district is difficult due to the poor road network, especially during the rainy season. Agriculture, trading and mining are the main economic activities. Literacy levels are low, with 75% of females and 55% of males being illiterate. The main ethnic groups in the district are Temne and Limba. The district is predominantly Muslim.[5,6]

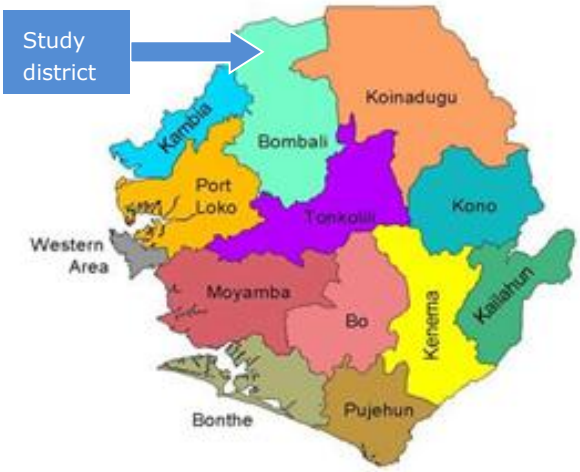


Figure 1: Map of Sierra Leone with Bombali study district

Study chiefdoms and wedge definition

In principle, all 13 of the chiefdoms in the district were to be included in the study. The intervention is implemented in two stages. Each stage involves an equal number of matched chiefdoms (six in the Wedge 1 group and six in the

[5] Thomas AC (2010), Population profile of Bombali District and Makeni Town. 2004 Population and Housing Census of Sierra Leone. *2004 Census Publication Series*, Number 3. Freetown: UNFPA/Statistics Sierra Leone, February.

[6] Statistics Sierra Leone and UNICEF-Sierra Leone (2011). Sierra Leone Multiple Indicator Cluster Survey. 2010, Final Report. Freetown, Sierra Leone: Statistics Sierra Leone and UNICEF-Sierra Leone.

Wedge 2 group)[7] based on a density ranking (number of PHUs/100,000 population). See Table 1 above and Table 2 below.

During the course of the phased intervention implementation, one chiefdom in each wedge involved TBAs in the mHealth package of interventions. The TBA pilot intervention chiefdoms were matched to non-TBA intervention chiefdoms for comparison purposes. The choice of TBA pilot chiefdoms and matched non-intervention chiefdoms was based on the PHU density ranking (described above) and on the availability of reported good mobile telephone network reception. The study team assumed on the basis of their experience in/with Bombali district that TBA/TBA comparison chiefdoms were compatible for socio-cultural context.

Table 2 shows the overview of the matched pairs of Wedge 1 and Wedge 2 chiefdoms. The TBA intervention and comparison chiefdoms are indicated. Tambaka chiefdom (PHU density 15.0) in the extreme north of Bombali district was excluded from the wedge design because of no mobile network coverage at the three PHUs during the design stage and the fact that there are only three PHUs in a very large sparsely populated very remote area.

Table 2: Overview wedges and chiefdoms by PHU density*

Wedge 1	PHU density	Wedge 2	PHU density
Safroko Limba	36.8	Libiesaygahun	32.4
Biriwa	30.8	Magbaimba Ndowahun	30
Paki Masabong**	30	Gbanti Kamaranka**	26.5
Makari Gbanti***	29.5	Sanda Tendaren***	23
Gbendembu Ngowahun	20.2	Sanda Loko	18.8
Sella Limba	13.2	Bombali Sebora (including Makeni city)	12.5

** No of PHUs/100,000 population*

*** TBA intervention chiefdom (one in each wedge)*

**** TBA comparison chiefdom (one in each wedge)*

Health facility sampling

The focus of the mHealth interventions is on primary MNH care; hospitals were not included in the intervention. All functioning health facilities – community health centres (CHCs), community health posts (CHPs) and maternal and child health post (MCHPs) – in the study district were eligible for data collection. One non-functioning facility (Fullah Town II in Bombali Sebora chiefdom) was excluded from the study, leaving a total of 98 health facilities.

Participant selection

At the time of the midline there were 202 registered maternal health workers in the district, including community health officers (CHOs), community health assistants (CHAs), state-enrolled community health nurses (SECHNs), maternal and child health aides (MCH aides), endemic disease control unit (EDCU) assistants, midwives, nursing aides and dispensers; and excluding laboratory staff, porters, cleaners, community health workers, TBAs and vaccinators. Sample size calculations showed that a sample size of 225 was needed to detect a 10% difference in outcome (see Annex 16). A 'take all' approach (data collection from the universe of health workers in Bombali) was thus decided on.

[7] Although included in the intervention, chiefdom Tambaka is excluded from the comparisons, as it is a large and sparsely populated chiefdom with only three PHUs and very poor mobile phone reception.

Midline design

The midline study was designed to respond to the overall research objectives formulated for the Phase 2 intervention study (see above) and in keeping with the overall Phase 2 research table (Annex 2). An overview of the midline data collection tools in relation to the (similar and different) data collection tools planned for the baseline and end line studies can be found in Annex 3.

The following were the planned sources of information for midline data collection, applied to both wedges unless stated otherwise:

- Qualitative information in relation to the interventions using semi-structured interviews with enrolled clients, non-enrolled eligible clients, male partners of enrolled clients, TBAs, health workers and health managers (Wedge 1 only, in two chiefdoms), in relation to mobile phone use and the mobile phone interventions from clients, TBAs, health workers and health managers
- Quantitative (survey) information about individual health workers in all chiefdoms, collected at baseline and end line to measure changes over time on respondent characteristics, mobile telephone coverage and current use of mobile communication, including initiating and/or receiving work-related phone calls and text messages to other staff in the health sector, to TBAs and to clients. Information on mobile telephone use and job-related satisfaction and communication was also collected
- Summary information from maternal death notification to the DHMT
- Summary information from monthly PHU reports on mHealth enrolment and follow-up (Wedge 1 only)
- Health service utilization data derived from the health management information system (HMIS) / district health information system (DHIS).

Midline instruments

The quantitative health worker survey targeting all 202 maternal health workers in the 98 primary health care facilities in Bombali district gathered information about the health worker, mobile phone use for initiating and receiving calls and text messages, barriers to the use of mobile phones and job satisfaction and communication. Development and reliability analysis of the job satisfaction and communication sections of this questionnaire were described in the baseline report[8].

The health worker midline questionnaire (see Annex 4) was kept as identical to the baseline questionnaire as possible, and was therefore only adapted at the two points that were derived from the baseline analysis (refer to baseline report for details):

- Inclusion of a new answer category (never) for two questions
- Deletion of the unreliable question in the domain *communication with clients*.

The baseline analysis and Wedge 1 supervision findings and field experiences were used to generate contents for the design of the midline semi-structured interview topic guides. There are five midline topic guides:

- Topic guide enrolled client (see Annex 5)
- Topic guide TBA (see Annex 6)

[8] Magbity E, K Herschderfer, H Jalloh-Vos, H Ormel, SAY Kamara, AM Jalloh, K de Koning, L Wolmarans (2013), Mobile Health: Connecting managers, service providers and clients in Bombali District, Sierra Leone. mHealth for maternal and newborn health in resource-poor community and health system settings, Sierra Leone. Baseline study report. Amsterdam: KIT

- Topic guide health worker (see Annex 7)
- Topic guide DHMT (see Annex 8)
- Topic guide non-enrolled eligible client (see Annex 9)

Sampling for the midline qualitative interviews aimed for maximum variation; Annex 10 contains the sampling frame.

Two planned data sources were not pursued at midline:

- PHU data on gestational age at ANC1 were not collected, as baseline data analysis had shown that data were unreliable[9] (see baseline report for details)
- The start of the relevant components of the national phone line was delayed; therefore data collection in relation to this intervention will only be included in the end line study and reported on in the final report.

Data collector training

Data collectors were trained during two training workshops conducted by the principal investigator (MoHS) supported by MRC and KIT staff. Based on the research protocol, the data collectors received training in survey and interviewing techniques, discussed ethical issues, field-tested the data collection tools and adapted them where needed. Organizational and quality assurance issues were also addressed.

Data collection

Data were collected nearly according to plan during January and February 2013. Informed consent was obtained from all research participants.

Despite huge efforts of the data collectors' team, no clients could be interviewed who fulfilled the eligibility requirements to participate in the client scheme but had declined enrolment.

Overall, data collection took longer than planned because, in some cases, the data collectors needed to return to facilities to obtain data from health workers who were absent during the initial visit.

Data entry

Data entry screens were slightly adapted for the midline health worker survey in EpiData version 3.1, followed by data entry by people trained previously for the baseline data entry. The EpiData files were cleaned, validated and exported into Intercooled STATA version 9 for analysis by MRC staff.

Other quantitative data (from DHIS/HMIS, number of maternal death notifications to the DHMT, PHU monthly reports) were entered and quality controlled in Excel, and were analysed using Excel by MRC staff.

The qualitative interviews were recorded in the field, and transcribed upon return by three of the researchers, with quality control and subsequent coding of the transcripts in Atlas Ti version 6.1. Analysis was done using Atlas Ti.

As for DHIS/HMIS data, limited staff capacity and limited supervision at PHU and district level of the data entry was observed; data was often only single-entered and not cross-checked. This may have influenced data quality.

Data analysis

Descriptive statistics were compiled for the health worker data collected, and they were reviewed for cross-checking and validation purposes. After further

[9] Data collected on the last day of menstruation, needed to calculate the gestational age at ANC1, were not uniformly noted at the PHU level; the alternative data, noting the height of fundus at ANC1, proved to be unreliable during the quality check.

cleaning (involving consistency checks of skip patterns, missing and invalid data), new variables were created for questions with multiple responses, and open-ended questions were coded.

In addition, a comparison analysis of health worker and health facility characteristics was carried out between the chiefdoms designated for Wedge 1 and Wedge 2, to determine whether the wedges are comparable.

Statistical testing for the relationship between two categorical variables was carried out using the Chi-squared test or z-test. An independent samples t-test (two categories) and analysis of variance test (ANOVA, three or more categories) were used to compare the means of continuous variables. A 0.05 (95%) level of significance was used.

The qualitative data were analyzed by allocating themes and subthemes on the basis of topic guides, objectives and issues emerging from the data. All transcripts were coded in ATLAS.ti version 7.1.6. How common an issue was reported was based on the qualitative data if triangulation was possible. Otherwise, the findings were reported as 'most', 'many' or 'common' if half or more of the respondents mentioned similar issues and 'some' or 'few' if mentioned by less than half of the respondents.

Quality assurance

To ensure that the data collected were of an acceptable quality, the following measures were taken:

- Oversight for field-testing and finalizing the data collection instruments and the training of data collectors rested with the highly experienced principal investigator, who worked closely with expert colleagues from MRC and KIT.
- Only enumerators with previous experience of field data collection were recruited, and these were thoroughly trained in data collection, the importance of respectful attitudes etc.
- Data collectors were supervised during fieldwork, where quality assurance procedures were applied that included checking coding on questionnaires against responses and reviewing surveys for completeness.
- The health worker survey and the qualitative interview guides were designed in English and, during the researchers' training, translated and back-translated into Krio using a participatory process, until all terms were understood in the same way by all.
- The midline instruments were field-tested and adapted prior to data collection.
- Researchers were supervised during data entry and data transcribing, using validation and other quality assurance techniques to ensure correct and complete data.
- The specially designed data entry screens were developed to accommodate the skipping pattern of the surveys and to ensure that all questions were entered. Some questions were developed to accept only probable answers, which reduced entry mistakes.
- A coding framework was developed in a participatory manner to guide the coding of qualitative data in Atlas Ti. The coding framework was based on a combination of topic guides and grounded methodology.

Research capacity strengthening

A secondary objective of the intervention study is to strengthen research capacity in Sierra Leone with a focus on intervention, action research and realist approaches, as well as on dissemination and effective use of research

results. The midline study provided the opportunity to (further) train a dedicated group of (largely the same) researchers from the University of Sierra Leone, who could also collect data for the end line data collection.

Study limitations
The following study limitations were identified:

- Data were collected from one district which was purposefully selected from among only a few eligible districts, and so cannot be taken as representative of the current situation in other districts or in the country.
- Chiefdoms (each consisting of different numbers of PHUs of varying levels) were taken as the unit of analysis, as opposed to individual PHUs. While this possibly conceals variation at PHU level, it was a pragmatic decision taken to align data collection activities with the normal supervision channels used by the DHMT and the CHO (in charge of the CHC, who supervises the lower-level facilities within the chiefdom).
- With a small, finite number of chiefdoms in the district, the wedges were not determined by random sampling but, rather, by PHU density (number of PHUs/100,000 population) matching, to reflect the effect of the intervention on service utilization (assuming that low PHU density indicates a larger distance to the facility).
- A counterfactual was constructed for two of the intervention components only (health worker to client communication and TBA interventions), allowing for a double-difference analysis (net effect) between the intervention and the non-intervention parts. The VPN intervention can only be analysed in terms of pre- and post-intervention
- Information collected relating to gestational age at ANC1 could not be used, as data proved unreliable, as described already in the baseline report. This implies no conclusions can be drawn on the effect of the interventions on shortening gestational age at ANC1.
- Since data collectors were not able to identify non-enrolled eligible clients, this will be considered when finalizing the design of the end line sampling framework.
- Although data collectors probed better than during the baseline for cost of phone top-ups and phone charging, obtaining reliable data remained difficult in some cases. Some respondents may have provided relatively high figures, anticipating (more) financial support through the project.
- DHIS and HMIS data obtained were of limited quality due to problems with the DHIS soft/hardware.
- HIS/HMIS data also were difficult to obtain as the national and district MoHS levels were experiencing severe technical problems in 2012 and 2013, combined with key staff turnover at the beginning of 2013. In the end data were obtained for the periods April 2011 to July 2012 (pre-intervention data to establish trend), and August - December 2012 (covering all but one month of the stage 1 intervention phase). We are still awaiting data for January 2013 (last month of stage 1 intervention).
- Other interventions could influence service utilization for ANC, delivery, PNC and family planning. Even though mapping of such interventions will be done at end line, it cannot be ensured that all other interventions that may influence outcomes and their actual influences are correctly identified.

3 Intervention process evaluation

This chapter presents our assessment of the intervention process, identifying what went well as well as challenges.

The mHealth interventions started with the launch of the district VPN system as part of the regular PHU in-charges meeting on 4 August 2012. This was followed by a training of PHU in-charges and MCH aides from Wedge 1 PHUs in the health worker to client reminder scheme the next day. The following week there was a training of TBAs in Paki Masabong chiefdom on the same scheme, including the issuing of phones (to all PHUs in the district, TBAs in Paki Masabong chiefdom and district level contacts) and solar chargers (to PHUs and TBAs in Wedge 1).

Supervision was done through various channels:

1. Phone supervision by MRC (monthly)
2. Field supervision by MRC, DHMT staff, national MOHS staff and KIT staff
3. Regular summarizing of reported problems to MRC (either directly or through DHMT)
4. Supervision through attendance of PHU in-charges meetings (MRC and DHMT staff), including checking of monthly PHU reports, and occasionally also, PHU registers
5. Regular summarizing of received reports (PHU reports, DHMT reports on maternal death notification, TBA reports)

Implementation of the interventions generally went well, as health staff, TBAs and clients realized the opportunities offered by the mobile communication. Below we address various intervention aspects and related challenges.

Phones

There was a short delay in giving out phones to the MCH aide coordinator and the ambulance driver at the hospital (both persons are not members of the DHMT, but considered to be key district level contacts); both received their phones in September 2012. Phones for district and city council health contacts were only delivered by the DHMT after the elections (November 2012), after newly elected people were installed.

The majority of the phones functioned well over the period, with only minor problems that mostly had to do with lack of knowledge and experience by participants on how to place batteries, how to place sim-cards, how to set the phone to dual sim, why the report "no service" showed on the phone etc.

At the end of phase 1 there were 87 functional phones in the facilities. The reasons for the 10 non-functioning phones were as follows: two phones not retaining the charge, one phone could not be charged except when the battery was placed in an external charger, five phones were in poor condition or not in (good) working order, including one phone that had a blurred screen due to being sat on, one phone was missing and one phone had a non-functioning second sim. Most of the TBA phones were well-functioning.

It appeared that the facility phone was sometimes removed from the facility and this issue was taken up by the DHMT.

> *"…Even though we have two or three workers in the clinic, the in-charge is the one that takes care of the phone. But it is the property of the facility. Sometimes when the in-charge is travelling she goes with the phone though there are other people at the facility. …We warn them the phone is not their personal property and that they should*

leave it at the facility when they are going out or travelling out of the centre". (ML P2 District level respondent)

The action was reflected in the supervision data– all health workers included in the midline interviews confirmed that they and other staff had access to the facility mobile phone, as is illustrated by the following quotes:

"*Yes, my colleague whom I work with here has access to the phone. He uses it, because we don't take it out of the facility. If I am away, the phone will be with the one who is at the centre at that moment*" (ML P16 Health worker, TBA intervention chiefdom)

"*Well no other person uses this phone other than us staff at this hospital. The porter and vaccinator also use the phone to call pregnant women they know in order to come to the clinic*". (ML P30 Health worker, non-TBA intervention chiefdom)

Solar chargers

The distributed solar chargers did not perform well. In the first month of the intervention, it was apparent that many of them were not charging or not charging effectively. By the end of the first stage, 44 solar chargers out of the 53 distributed were either damaged, not working or not effectively functioning; only nine were still functioning. The other 44 PHUs (wedge 2 and Tambaka) did not receive solar chargers, as their introduction had been designed to go together with the introduction of the health worker to client communication component (however by that time the experiences with solar chargers led to the decision to not distribute additional solar chargers).

VPN and network coverage

Initial problems with facility/TBA phones not accessing the VPN were solved through ensuring registration of all sim-cards with Airtel and working together with Airtel to remove all the sim blocks. Initially, a few PHUs reported deduction of credit for calls within the group but this issue was solved within the first weeks of implementation. No major problems were reported, except for problems with network coverage (for example, having to walk some distance to have network reception). At the end of stage 1, one PHU reported problems with the VPN as the sim-card had become blocked, one PHU lost its sim-card and 13 PHUs (of 98) reported network coverage problems.

Airtel credit for health worker to client

After major problems during the first months of Wedge 1 implementation with the provision of credits to the facility phones, it was decided to change the credit provider from Airtel to a sub-provider of Airtel; with the change, all the credit problems were solved. At the end of stage 1, four PHUs mentioned delay in receiving Airtel credit, possibly due to their phones being off at the time the credit was sent. The other PHUs in Wedge 1 indicated that they received the complete credit on time. Some PHUs noticed that credit was disappearing for other calls (for example, personal calls of facility staff) and through the "me-to-you" system of Airtel (that transfers credit from one phone to another phone).

Registration of pregnant women and female family planning clients

During stage 1, 54 PHUs in wedge 1 sent monthly PHU reports on the mHealth scheme for at least one month. On average 45% of PHUs (25 PHUs) submitted a monthly mHealth report during this period (however also reflecting clients 'enrolled' even though they failed to provide a telephone number, see below). In total, information about 2,181 pregnant women and 1,593 female family planning clients who enrolled in the intervention was received through these PHU reports.

Details on enrolled clients are displayed in the figures 2-5 below, by type of clients and by month and cumulative. The cumulative figures show an ongoing registration of new clients with no levelling off until the end of stage 1.

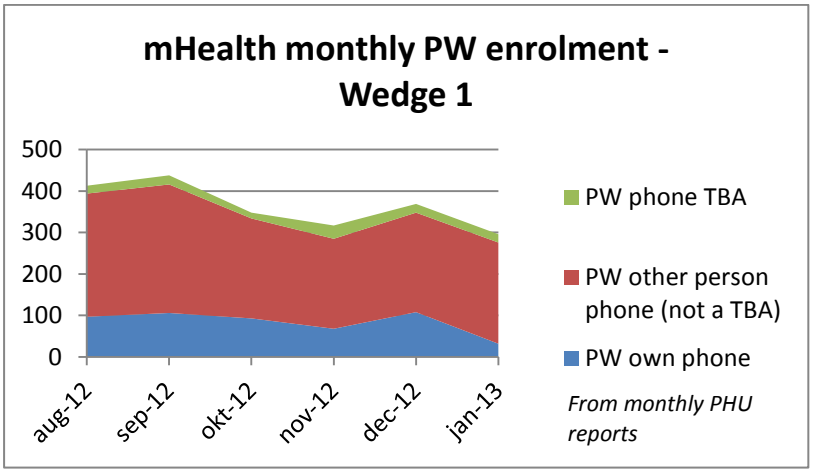


Figure 2: mHealth monthly PW registration – Wedge 1

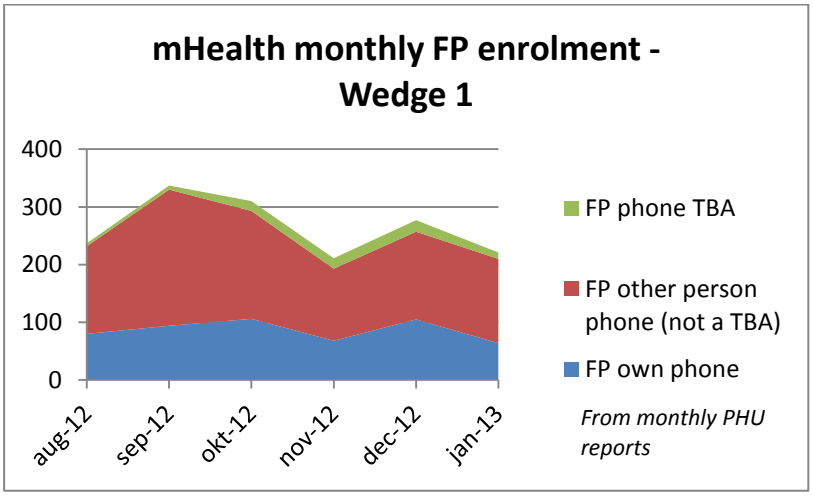


Figure 3: mHealth monthly FP registration – Wedge 1

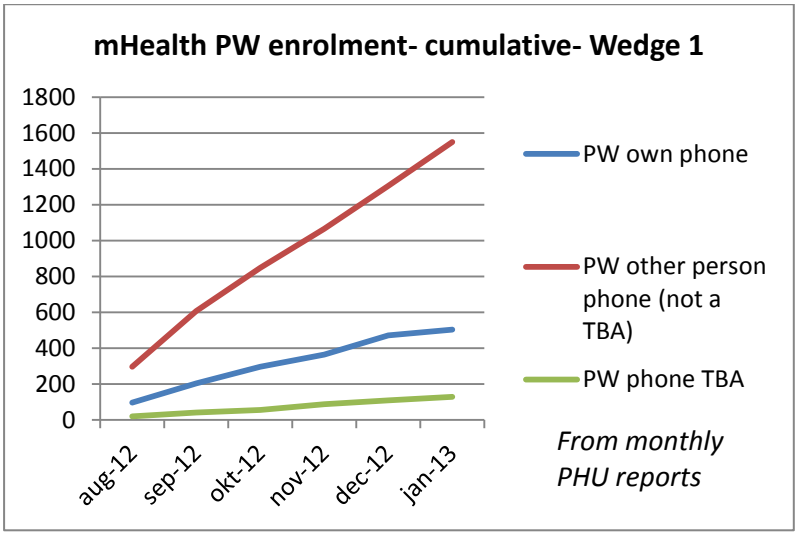


Figure 4: mHealth cumulative PW registration – Wedge 1

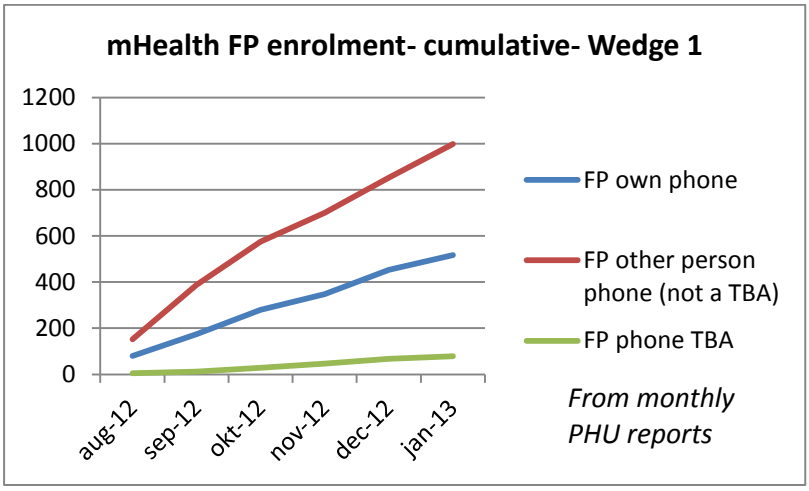


Figure 5: mHealth cumulative FP registration – Wedge 1

Data monitoring showed that the PHUs were reporting the number of all clients *registered*, even if no phone number had been provided. Having no number would imply that a client didn't actually fulfil enrolment criteria, as health workers could not call the clients and thus could not implement the full intervention. This, combined with the fact that monthly reports were missing from a large number of PHUs, led to a decision to collect data directly from PHUs during field supervision in January 2013. These data exclude clients without a phone number. At the end of stage 1, PHUs reported registration of 1,860 pregnant women (field supervision data of 51 out of 54 PHUs) and 1,355 female family planning clients (field supervision data of 50 PHUs). These figures, even though coming from a much larger number of PHUs (50/51 PHUs respectively) than the PHU reports (average 25 PHUs), show a much lower number of clients that actually can be reached as they have a phone number provided. More detailed information will come from data collected directly from the mHealth registers at end line.

Some challenges were noted during enrolment of clients for the mHealth intervention. These included clients wanting to take part but without (access to) a phone, limited network coverage at some PHU locations (implying clients couldn't call there) and at various client locations, clients enrolling but never providing a phone number (did not know the phone number of partner or other person(s) they wanted the call to pass through). Specific follow-up challenges were minor, with main problems being clients' phone being off, not being answered and/or being out of network coverage area. Some spouses/owners of phone were not close to the clients, so these had to call back. A few PHUs indicated that they circumvented the "no number" problem by calling through a TBA phone or a chief's phone.

Special constraints existed in the area of enrolment of female family planning clients, who stated various reasons for either not joining family planning or not joining the mHealth scheme (but still joining the family planning programme). The most common reason for this mentioned during supervision was that they did not want their partner (or parents or other close people) to know about their use of family planning methods. Other reasons reported were (Muslim) religion and spouses not allowing the use of family planning. A few PHUs mentioned that they did not have enough family planning supplies to cater for the clients.

Several PHU responses during the January 2013 supervision mentioned an improvement in health communication and referred to the mobile phones as being a great help for communication. PHUs also mentioned receiving positive feedback from clients and communities, stating that clients appreciated the

calls, turn-out in the clinic has increased and that clients were happy for the reminder calls as they could now rely on the nurse to remind them about their appointments.

TBA involvement

There were multiple challenges and problems encountered in the chiefdom with TBA interventions. Communication proved to be difficult because of poor network coverage in many TBA locations and because of phone charging problems due to non-functioning solar chargers. Several TBAs continued to have problems in operating their phones. These observations prompted changes to the TBA training and supervision in stage 2.

Most TBAs had problems with filling in the TBA reporting forms and some had their children assist them. The majority of TBAs did not return these forms to PHUs, who in turn mostly did not submit them to the DHMT.

Small case study on TBAs

Derived from the midline qualitative research data (interviews with clients, health workers, TBAs and managers), the following case study could be developed on some of the constraints TBAs experienced when using the mobile phones.

The responses by two TBAs from the intervention chiefdom showed that some TBAs did not feel able to use the phone and carry out activities as expected. Even though they reported that they had received an orientation prior to the start of the intervention, they had difficulties using the phone and getting through to others for the following reasons: they did not understand how the phone worked, did not know how to unlock the phone, did not carry the phone all the time and were not always successful in calling the health workers when referring clients.

The related health worker interviewed indicated that coverage of the network was sometimes an issue, but he also felt that for some TBAs the orientation provided was insufficient.

The above is illustrated by the quotes from TBA 1, TBA2 and a health worker from the intervention district.

> *"They* [the health workers] *often ask me what is wrong with my phone, because they call me but they don't get me. And I tell them that I also tried to call them but I did not get them… I don't call to inform her about our coming, because sometimes even if we try to call her we will not get her. So that is why we just take the patient to the clinic… Sometimes the phone locks, and I don't know how to open it. I sometimes want to talk to the nurse but the phone is locked… I use it. I told you that I use it, except when it was locked for two to three weeks I was not be able to use it… I take the phone along with me to the bush. But sometimes I forget it in my pocket and leave it in the heat."* (ML P6 TBA, TBA intervention chiefdom[10]) (Note: this TBA stated that her solar charger worked)

[10] The respondent ID of qualitative research quotations included in this report consist of the timing of data collection (ML = Midline, EL = Endline), the unique interview number (e.g. P6), an indication of the type of respondent (e.g. TBA, health worker) and the location (TBA chiefdom or non-TBA chiefdom). A TBA chiefdom is a chiefdom that engages TBAs in the VPN for the health worker to client communication intervention.

The responses from a second TBA in this chiefdom indicate that she was having similar problems. The TBA was confused and unhappy about why the phone was not working although sometimes she seemed able to call.

> *"She* [the nurse] *said when she calls me, the number does not ring… No, even the other nurse in* [PHU location] *has not called me on that phone…. I have to go and visit her… Maybe* [the nurse] *doesn't know my number…. I am thinking that she doesn't know me that is why she doesn't call me…." (*ML P18 TBA, TBA intervention chiefdom)

The response of the health worker from this chiefdom indicated that the problems in communication with TBAs lie with coverage and charging, but also with the TBAs not being sufficiently oriented in how to use phones.

> *"I do not have any problem in calling my colleague workers yet. The only problem is with the TBAs who stay at this other end. I call them but I do not get them because of the coverage… you call them and they do not answer the phone, until they see the missed call then they call back… They don't know much about phones. They always say they were not close to the phone… For those close to this clinic, I sent for them, so that they will come to meet me. They don't even know how to use the phone. They told me the phone is not in working order, but when they brought the phone I used my own charger to charge the phone and it worked… They trained them how to work with the phone, how to charge it, and how to answer calls, and make calls…. But they should teach them better how to use the phone."* (ML P4 Health worker, TBA intervention chiefdom)

Other respondents also echoed the need for more training, however some health workers went a step further:

> *"For me it is not necessary to give phones to TBAs, because they don't understand how to use them, it is just with them without any use. The other one gave the phone to her grandson, and the other brought the phone as the sim has been blocked, and I have it here now."* (ML P16 Health worker, TBA intervention chiefdom)

Administration of the scheme (registers, reports)

The administration of the enrolment of clients and subsequent communication (including documentation of consent procedure, recording of planned and actual visits and reminder/follow-up calls and the monthly PHU reports to district level) remained a problem during the stage 1 period. The main constraints appeared to be workload, type of staff, capacity of staff, frequent staff changes and limited communication/dissemination of information on the scheme to other staff in the facility (for example, staff who did not attend the launch/training or who were new to the PHU). At the end of stage 1, 44 PHUs (out of 52 PHUs where registers were seen) had a correct consent procedure and recorded data correctly in registers and reports, however only 29 PHUs correctly recorded visits and calls. These observations prompted changes to the PHU training and supervision for phase 2.

Other

Phone supervisions were used to obtain an insight in the functioning of the scheme in between field visits but they had several constraints including some PHU phones being switched off or out of coverage area frequently (possibly due to not being charged, no network coverage). Other challenges were the workload of PHU staff (reachable but too busy to either pick the phone and/or

talk for a longer time on the phone) and some facilities not picking the phone when it rang. Some PHUs promised to call back with information or to discuss issues/problems but never did.

4 Findings

This chapter presents the results of the midline research, based on the sources as indicated in the methodology chapter.

We use the data derived from these sources to present findings regarding facilities, participants and the interventions, before focusing on the results for each of the first four research objectives. The discussion and implications chapter cover the fifth objective of the study.

In addition, this chapter presents comparisons between (i) the chiefdoms that are part of the two implementation wedges at midline and (ii) baseline and midline (overall and by wedge). An overview of all the similarities and differences is given in Annex 13. The TBA implementation and comparison chiefdoms are also part of this comparison. These comparisons take into account health worker and health facility characteristics, mobile phone coverage and use, job satisfaction and communication.

4.1 Health facility information

There are three types of PHUs in Bombali district: community health centres (CHCs) are the highest level; community health posts (CHPs), the middle level; and maternal and child health posts (MCHPs), the lowest level.

There are 99 primary health facilities in Bombali District, of which one is not functioning (Fullah Town II in Bombali Sebora chiefdom). Information on the 98 facilities was obtained through the health worker survey[11], Wedge 1 field supervisions and the DHMT.

The staff size of the study facilities in Bombali varied from one to seven clinical staff members, with an average of two clinical staff members per PHU. Figure 6 shows the distribution of facilities by staff size. 40% of the PHUs have one clinical health worker, while 60% have a staffing level of two or more health workers.

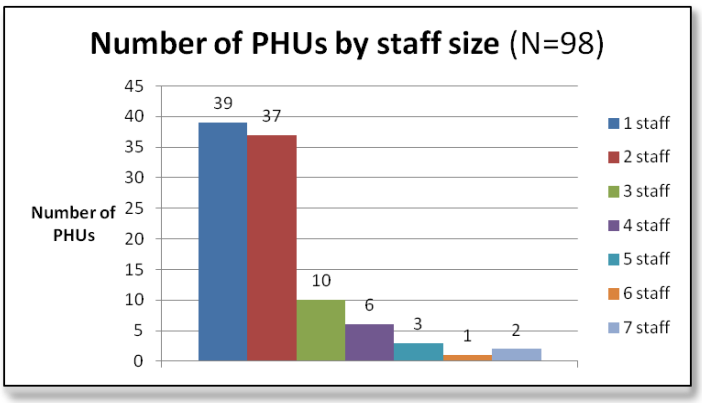


Figure 6: Facility staff size

Figure 7 shows the breakdown of the staffing size by type of facility. CHCs and CHPs have the highest staffing levels, as expected. Most of the MCHPs (87%) have two or fewer clinical staff members. Masuba clinic (the clinic next to the midwifery school) is now a CHP with seven staff members[12].

[11] The survey covered 97 of the 98 facilities, as for one facility no data were obtained due to absence of staff. This gap in information was covered by means of the additional sources mentioned (supervision, DHMT).

[12] The Masuba clinic was mentioned in the baseline report as a PHU with many members of staff, housed in the same compound as the DHMT and next to the midwifery school. It

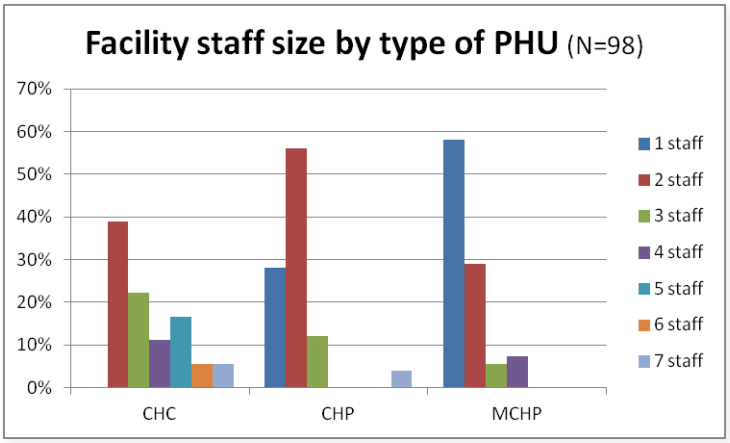


Figure 7: Facility staff size by PHU type

The health facilities are located at an average distance of 28.8 km (range 2 – 88) to the district headquarter town Makeni, where the DHMT has its offices. The average distance in Wedge 1 is 24.4 km and in Wedge 2 31.2 km. Tambaka chiefdom is located farthest from Makeni. A summary of the distances by chiefdom is given in Table 3, with detail by PHU provided in Annex 14.

Table 3: Average PHU distance in km to District Headquarter Town

Chiefdom	Wedge	Nr PHUs*	Average distance of chiefdom PHUs (km)
Sella Limba	1	8	61.5
Makari Gbanti	1	14	10.4
Paki Masabong	1	6	19.2
Biriwa	1	10	29.3
Gbendembu Ngowahun	1	7	22.4
Safroko Limba	1	9	12.6
Sanda Loko	2	6	58.0
Gbanti Kamaranka	2	8	41.1
Libiesaygahun	2	5	42.4
Magbaimba Ndowahun	2	3	44.0
Sanda Tendaren	2	5	34.2
Bombali Sebora	2	14	6.1
Tambaka	**	3	76.0
	Total Wedge 1	54	24.4
	Total Wedge 2	41	31.2
	Overall total	98	28.8
** functional PHUs only, ** excluded from wedge design*			

4.2 Participant characteristics

Participants in qualitative interviews

In total 40 participants (2 health managers, 10 health workers, 12 TBAs, 16 mHealth enrolled female clients) from two out of the six chiefdoms in Wedge 1 were interviewed.

has a large catchment population. At the time, it was formally an MCHP (the lowest level of PHU) although it didn't represent the staffing situation of MCHPs in general. It has meanwhile been upgraded to CHP level.

The two health managers at district level had an average age of 56 years and average 15 years working experience in the health sector.

The 10 health workers (six MCH aides, two CHOs and two CHAs) came from two chiefdoms: Paki Masabong (selected as the TBA intervention chiefdom in Wedge 1) and Sella Limba. They had an average age of 45 (30-58) years and an average of 15 (3-34) years working experience in the health sector. Almost all of the health workers were PHU in-charges (nine out of the 10). The 12 TBAs in Paki Masabong chiefdom had an average age of 53 years. They walk on average 104 minutes to reach the health facility that supervises them.

Of the 16 female mHealth enrolled clients interviewed, eight joined the mHealth scheme when they were pregnant and attending ANC and eight joined the mHealth scheme when they attended family planning services. Seven of the clients came from Paki Masabong chiefdom, while 9 came from Sella Limba. Their average age was 28 years. They had to walk on average 70 minutes to reach the health facility.

More detailed background characteristics of the qualitative interview participants are provided in Annex 12.

Health worker survey respondents

Information was collected from 173 health worker respondents employed in 97 out of the 99 health facilities in Bombali district. Data were not collected from the non-functioning facility, Fullah Town II, as previously mentioned. Data were also not collected in a second facility in Bombali Sebora chiefdom (Rokonta) because the staff were out of their centre during the survey.

The number of health workers surveyed (173 out of 202) represents 86% of the clinical staff reported to be in place in the district and was considered sufficient to represent all the primary health care maternal health workers in the district at the time of the midline survey. Figure 8 shows the number of health worker respondents by cadre (type).

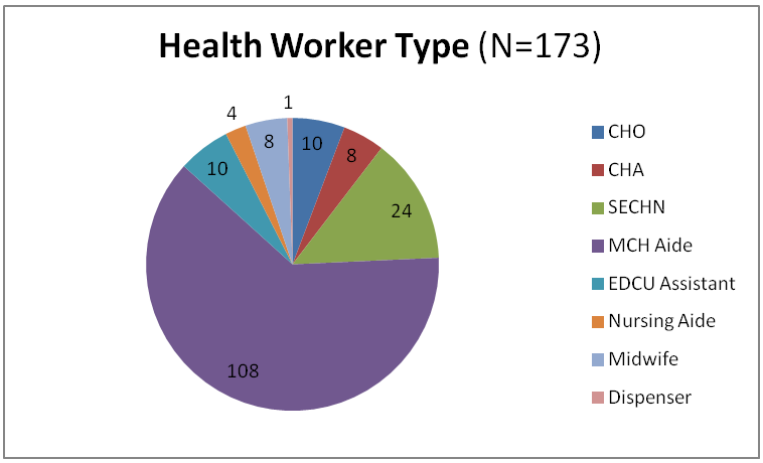


Figure 8: Type and number of respondents

The health worker respondents ranged in age from 25 to 60, with an average age of 42. Most of the health workers (82%) were female. CHOs, EDCU assistants and dispensers were all male, and MCH aides and nursing aides were all female. Midwives were all female, while there were 1:1 and 3:1 ratios women to men in the CHA group and SECHN group respectively. Only five out of the 173 (3%) health workers reported *not* having children.

Almost all of the health workers (95%) had worked at the present facility for more than three months. Only four out of the 173 respondents (2%) reported *not* being on the government payroll; half of these were nursing aides, and the

rest were one CHO and one EDCU assistant. Annex 11 provides a detailed overview of the background characteristics of the health worker survey respondents.

Figure 9 shows the distribution (percentages) of the total respondent group by type of health worker and type of health facility. The largest group of health workers, MCH aides, are found in all types of PHUs but work primarily in MCHPs. All 10 CHOs and eight midwives work only in CHCs, and the CHAs work either in a CHC (three out of eight) or a CHP (5/8). SECHNs are found in all levels of health facility. EDCU assistants work in CHPs and MCHPs. The one dispenser respondent works in a CHP. Nursing aides work generally in hospitals, but the four who participated in our survey work in CHCs (3) and a CHP (1).

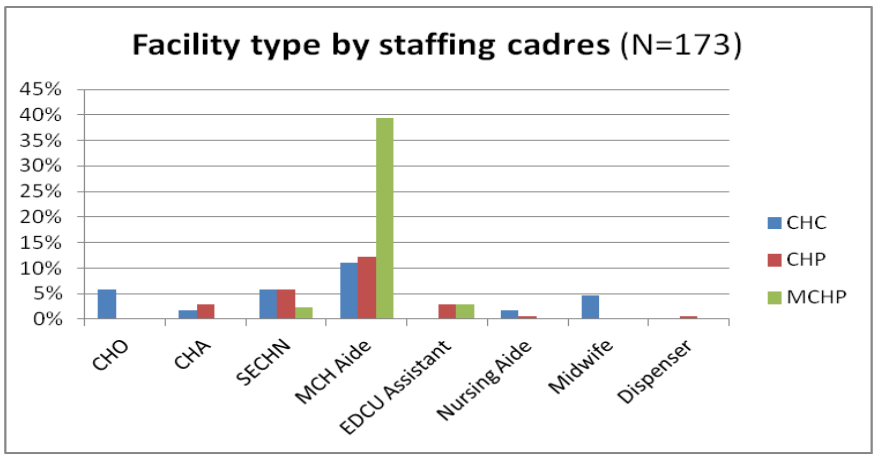


Figure 9: Total respondents by cadre and facility type

Every PHU has a designated in-charge responsible for the management of the facility. In general, the higher the PHU level, the higher the level of in-charge. In total, 94 (54%) of the respondents were recorded as facility in-charge. Figure 10 shows the distribution of the in-charge positions by cadre and facility. Almost all the in-charges of MCHPs were MCH aides. The majority of in-charges of CHPs are CHAs and SECHNs. More than 60% of the in-charge positions in CHCs are filled by CHOs. Nursing aides were never in-charge of a facility.

Comparison baseline-midline and Wedge 1-Wedge 2

Health worker and health facility characteristics were compared in five ways:

- Baseline Wedge 1 versus baseline Wedge 2
- Midline Wedge 1 versus midline Wedge 2
- Baseline versus midline, using total group of respondents (Wedge 1 + Wedge 2 + chiefdom Tambaka)
- Baseline Wedge 1 versus midline Wedge 1
- Baseline Wedge 2 versus midline Wedge 2

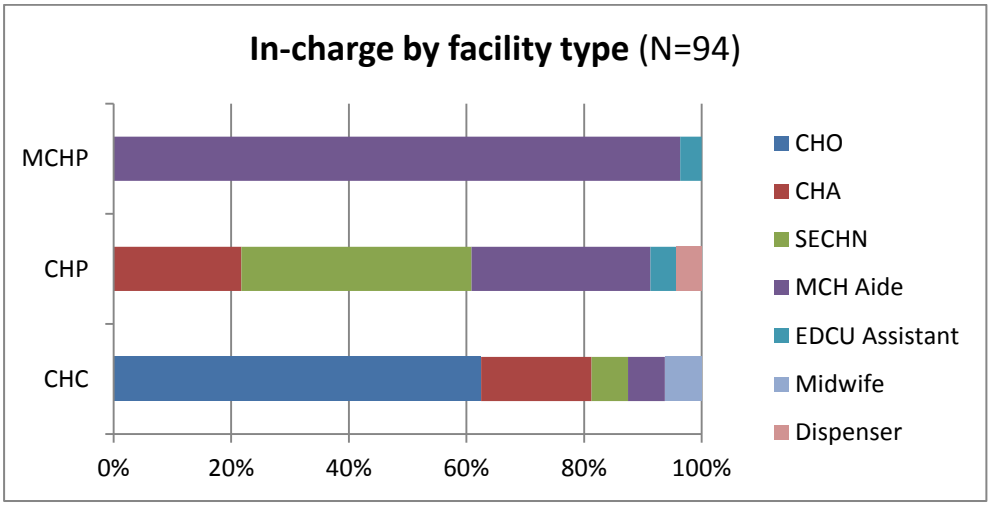


Figure 10: Cadre of in-charge by facility type

The results are displayed in Annex 17. For all indicators/variables the wedges and baseline/midline were similar, except for type of facility. At midline there are more CHC/MCHP respondents (across both wedges), this is statistically significant. When comparing Wedge 2 at baseline to midline, there were more CHC/CHP respondents at midline, which is borderline significant (p=0.05).

4.3 Descriptive information about intervention

Network coverage and network providers

The percentage of health workers that reported being able to make and receive phone calls and text messages *inside* their PHU was similar at baseline and midline (86 vs. 87% respectively), while for Wedge 2 the percentages showed a small difference between baseline (90%) and midline (84%).

For the 25 (14%) health workers who reported at midline that they were *not* able to make and receive phone calls and text messages *inside* the PHU, the time needed to walk to a place where there would be network coverage averaged 21 minutes (range 2-120 minutes, mode[13] 5 minutes).

Most health workers at midline reported good mobile telephone coverage; all the time (53%) and most of the time (35%). This indicates that there was almost never 'no coverage'. Slightly more health workers in CHCs and CHPs indicated all/most of the time coverage compared to those working in MCHPs, although this was not significant. CHCs are usually located in chiefdom headquarter towns, which are more likely to be in the vicinity of (or have) mobile network poles. CHPs are located in larger villages/smaller towns that are usually bigger than the MCHP localities.

The difference found at baseline regarding network coverage being significantly more in Wedge 2 was not found again at midline. For details see Table 4.

[13] The mode is the result found most frequently. Here, a mode of 5 minutes compared to a range of 2-120 minutes implies that there are many short distances and a few large distances.

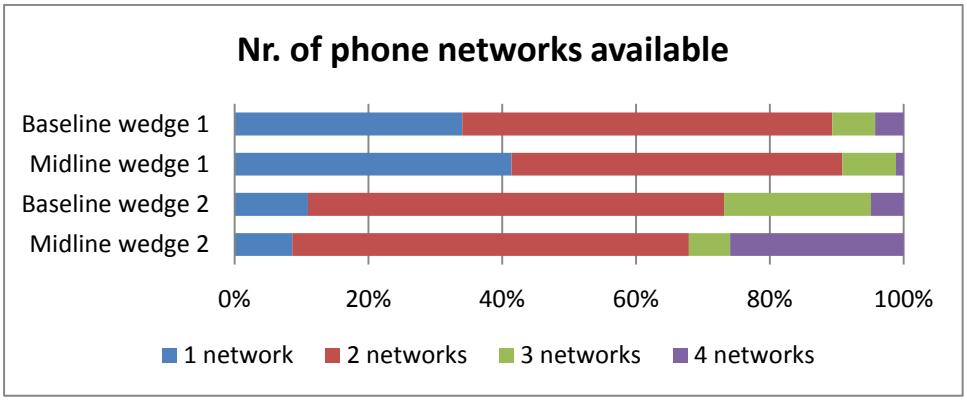
Table 4: Frequency network coverage at normal calling spot

	Baseline			Midline		
	Wedge 1 % (n=94)	Wedge 2 % (n=82)	Total* % (n=181)	Wedge 1 % (n= 87)	Wedge 2 % (n=81)	Total* % (n=173)
All the time	39	72	54	47	58	53
Most of the time	37	20	30	36	35	35
Sometimes	22	9	15	17	7	12
Almost never	1	0	1	0	0	0

*Total includes Wedge 1+ Wedge2 + chiefdom Tambaka

All respondents indicated having at least one network available in their area. At midline 13%, 7%, 54% and 26% of respondents had respectively 4, 3, 2 and 1 network(s) available. There is a statistically significant difference, as shown in Table 5, between Wedge 1 and Wedge 2 both at baseline and at midline, with Wedge 2 having on average a higher number of networks available. This might be explained by the presence in Wedge 2 of the chiefdom Bombali Sebora, which contains a big part of the district headquarter town Makeni.

Table 5: Number of phone networks available per respondent



Airtel (94%) and Africell (78%) were available to most health worker respondents at midline. Airtel is the network that is used for the interventions (VPN and health worker to client), and its high percentage at baseline and midline confirms the choice for this network.

Reported phone coverage for wedges 1 and 2 at baseline and midline show small yet significant differences (Table 6). The greatest difference is seen in Wedge 2 for Sierratel coverage. These differences could be related to the presence of Bombali Sebora chiefdom that includes the district capital city of Makeni where more providers are operating.

Meanwhile, it is important to highlight that no difference is found across the wedges and between baseline and midline for Airtel coverage, as this is the network of choice for the intervention.

Annex 18 shows the various combinations of networks available among respondents by wedge at baseline and midline.

Health worker qualitative interview respondents from only some communities reported good network coverage. In all other communities there was reported unstable coverage at times and in some frequently, this was confirmed by

various types of respondents from various chiefdoms. People have learned some ways to overcome network problems mostly by finding *hot spots* which may be on top of a hill or in a certain place in the backyard.

Table 6: Reported network availability*

Phone networks available	Baseline (N=180)				Midline (N=173)			
	Wedge 1		Wedge 2		Wedge 1		Wedge 2	
	Nr	%	Nr	%	Nr	%	Nr	%
Airtel	93	*100*	82	*100*	82	*94*	78	*96*
Africell	62	*67*	73	*89*	56	*64*	76	*94*
Comium	11	*12*	22	*27*	8	*9*	27	*33*
Sierratel	4	*4*	4	*5*	1	*1*	21	*26*

** Multiple responses allowed, percentages do not add up to 100.*

> "*The network problem is everywhere. Even in Makeni, Airtel has a problem there. We all have the network problem."* (ML P16 Health worker, TBA intervention chiefdom)
>
> "*Yes, I find it difficult to make calls. Like sometimes, when there is no network, I have to go to the top of the hill in order to find coverage*". (ML P31 Health worker, non-TBA intervention chiefdom)

Clients confirm this as well:

> *"We go finding it* [the network]*… We move around and try to find a particular location."* (ML P12 Pregnant woman, non-TBA intervention chiefdom)

Ownership of and access to phones

For health workers, the intervention of providing mobile phones within the entire district (all wedges) and establishing the VPN for health workers to health worker communication is reflected in a much higher use of a facility phone at midline compared to baseline. Only 1% of the health workers reported using a facility phone at baseline while this increased to 94% at midline. The 11 (6%) health workers who reported using a personal phone indicated that this was for making work related calls and messages and all but one (91%) indicated that they received work-related calls and messages on their personal phone. It appears that in general there was good accessibility of the facility phone.

Midline interviews with the DHMT and health workers provided insights into the use and accessibility of the facility phone provided during this study and gave a better understanding of problems relating to accessibility that could have resulted in the use of personal phones in some cases.

Of the mHealth-enrolled pregnant women, 23% used their own phone, 71% used another person's phone and 6% used a TBA phone. Among female family planning clients 32% used their own phone, 63% used another person's phone and 5% used a TBA phone. Women who did not have a phone they could be reached on were more difficult to reach. In the areas where TBAs were part of the intervention and received phones, the health workers called the TBAs to reach clients.

"*I call the TBAs because most of the pregnant women do not have phones, so I call the TBAs in other to inform the pregnant women to come for clinic*". (ML P16 Health worker, TBA intervention chiefdom)

Paying for phone calls

At midline (after the first stage intervention implementation), 39 (23%) health workers indicated they pay for work related phone calls and text messages compared to 100% at baseline. A significant difference was found at midline between Wedge 1 (14% paying) and Wedge 2 (33% paying) that can be explained by the provision of credit to call clients in wedge 1. From the 12 respondent health workers in Wedge 1 who indicated paying for work related calls/messages, nine (75%) did not fulfil an in-charge position possibly indicating a problem about phone accessibility as indicated in the section above. More than half (58%) of the paying health workers in Wedge 1 worked in three PHUs where all respondents indicated they had to pay for calls, possibly indicating a structural problem with the phone or transfer of credit.

At midline, health workers paid an average of 11,354 SLL per week for work-related calls/messages (range 4,000 to 30,000 SLL). As expected, the average in Wedge 1 was lower (7,367 SLL) than in Wedge 2 (13,126 SLL). Almost all health worker respondents indicated that they paid out of their own pockets, combined with other non-personal funds (100% Wedge 1, 96% Wedge 2). One health worker in Wedge 2 indicated receiving all funds to pay for calls from other non-personal funds. To obtain the credit staff walked on average 12 minutes (range 0-180 minutes) with longer distances in Wedge 2 (average 15 minutes) than in Wedge 1 (average 3 minutes).

"*Well, to be sincere, I think is a responsibility for me if I am to contact somebody to come to clinic the next day and the facility phone is off, then I can use my own personal phone to call the person*". (ML P26 Health worker, non-TBA intervention chiefdom)

Charging of the phone

At midline, 43 (25%) respondents indicated they charged the work phone at the PHU, 11 (6%) at home and 119 (69%) somewhere else. As expected, in Wedge 1 facilities where solar charges were provided in the first stage, health workers charged their phones significantly more often at the PHU compared to Wedge 2 health workers (30% versus 21% respectively). Wedge 2 health workers significantly charged their phones at home more often compared to Wedge 1 health workers (11% versus 2% respectively). This could be explained by Wedge 2 containing Bombali Sebora chiefdom including Makeni city that has free electricity grid supply to many homes.

Payment for phone charging has reduced from 91% of respondents at baseline to 69% of respondents at midline. No differences were found between wedges at baseline or midline. The total average amount paid for charging at midline was 1,267 SLL (range 1,000 – 5,000 SLL), which is similar to the baseline (1,337 SLL, range 1,000 – 10,000 SLL).

As previously reported, there were problems with the solar chargers provided to Wedge 1 health facilities; midline interviews with health workers provided insights to these problems and how they were perceived. One DHMT staff and other health workers described the problem for most of the chiefdoms:

"*Oh yes, yes, they are having a lot of problems with charging. You know the community do not have electricity as such and do not have generators. A lot of them are complaining about the solar panel, so I think that is a barrier because when you call and could not get the*

person, they tell you their phone was not charged and their solar panel was down." (ML P1 District level respondent)

When the solar was down, health workers and TBAs had to pay for getting the phones charged. This costs both money and time as they may have had to travel to find a charge shop that had fuel for the generator to do the job:

> "*Where do I take the phone for charging? …We sent it to* [name of bigger town]*, or if the person who charges here is around we charge here… to* [name of bigger town] *is seven miles.*" (ML P30 Health worker, non-TBA intervention chiefdom)

Besides credit most payment by staff was for charging the phones because the chargers were not working:

> "*Our own solar* [charger] *is giving us problems, when we put it on it doesn't charge, except if we pay. We pay 1,000 SLL for it to be charged"*. (ML P11 Health worker, TBA intervention chiefdom)

It de-motivates health workers to have to pay for charging phones from their own pockets:

> "*I don't feel good, because they don't give me [reimbursement] for that. But there is no other way... it is my own money that I use to charge the phone which does not belong to me. I don't use it for my own personal purpose*" (ML P16 Health worker, TBA intervention chiefdom)

Sometimes there was no problem. The effectiveness of the training was illustrated by the knowledge from a TBA who explained to the researcher that the phone needs to go in a box and not in the hot sun:

> "*From the solar, they told us that when we want to charge the phone we must not put the phone outside in the sun, we have to put it in a box when it is in the box it cannot be spoilt by the sun".* (ML P13 TBA, TBA intervention chiefdom)

Another TBA not only knew how to charge the solar charger but was also able to fix one that was initially not working:

> *"I have the solar charger. When I take the charger out in the sun, then I connect it to the phone… At first when they gave me, it was not working, but I repaired it and it is now working*". (ML P19 TBA, TBA intervention chiefdom)

One health worker shared that they can rely on the village chief for charging the phone at night.

Calling versus texting

At midline 95% of health staff indicated that they call more than they text for work communication which is very similar to baseline (97%). The remaining staff (5%) indicated to use the same amount calls and texts for work communication at midline as compared to 3% at baseline. No differences were found between wedges at baseline and midline.

The preference for calling rather than texting was confirmed by the interview data at midline. There was consensus amongst all types of respondents about the preference for using calling rather than texting. The reasons given for the preference for calling from health worker to health worker were having difficulty reading, finding calls easier to understand and not having learnt how to text:

"*Well I don't know how to text, so I prefer calling. What I don't know I will not do so that I will not get myself into problems.*" (ML P4 Health worker, TBA intervention chiefdom)

However, the preference for texting or calling may also relate to network problems. A few health workers liked texting especially when the network was not very reliable, to ensure that information is received:

> *"I text when there is problem with the network… For me the network is not stable, especially when I am in my quarters. Even in my office when a call comes, if I don't go out quickly the line will break, but if you text me I will receive it and I will read the message."* (ML P30 Health worker, non-TBA intervention chiefdom)

Health workers and clients also had a clear preference for calling rather than texting because they understand the contents of the message better because many are illiterate. Many, but not all, prefer to 'flash' (a short call to signal 'call me back') because they did not have money or did not want to spend the credit of another who owns the phone.

> *"I prefer to call because right now 90% of them are illiterate."* (ML P26 Health worker, non-TBA intervention chiefdom)

This was explained by clients as follows:

> "*I want to be called more, because that is what I understand* [more] *than texting.*" (ML P20 Female family planning client, TBA intervention chiefdom)

> "*We tell them to flash us because they don't have money. The phones that they have, they access it from another person.*" (ML P26 Health worker, non-TBA intervention chiefdom)

Recommendations

The recommendations for overcoming barriers to accessing and using facility phones relate to ways to charge phones, including recommendations to charge the phone with the solar system available in the PHU and a budget for generators and fuel.

> *"I will recommend that they should change the solar chargers, which is number one. Some of the TBAs their phone has problems. …I told you they need to replace those solar chargers as they are not good."* (ML P21 Health worker, TBA intervention chiefdom)

> *"What I want is they should find for us a good solar so we can charge the phone, because the solar is the major problem. If we have a solar charger we can charge the phone, but if there is no solar we will not be able to charge. Here when they charge today, tomorrow they will say there is no fuel to charge, and it will take two to three days before they charge. So if it falls on Monday, how will I call the clients that are a problem? So we want the solar chargers."* (ML P31 Health worker, non-TBA intervention chiefdom)

A less easy recommendation to take up relates to improving coverage:

> "*Well, if they are able to improve on the coverage, it will be good for us.* [The Ministry] *has done theirs, if the phone companies can do more fine."* (ML P26 Health worker, non-TBA intervention chiefdom)

4.4 Objective 1 – MNH/FP service utilization (Health worker to client communication)

Communication between health workers and clients

As expected, the frequency of *calls to* clients, initiated by health workers, increased substantially in Wedge 1 at midline compared to baseline, with the largest increase in calls being reported for the category 'once a week' or more often. The reported frequency of *calls received from* clients also increased between baseline and midline in Wedge 1 and showed a slight decrease in Wedge 2. For details see Figures 11 and 12 below.

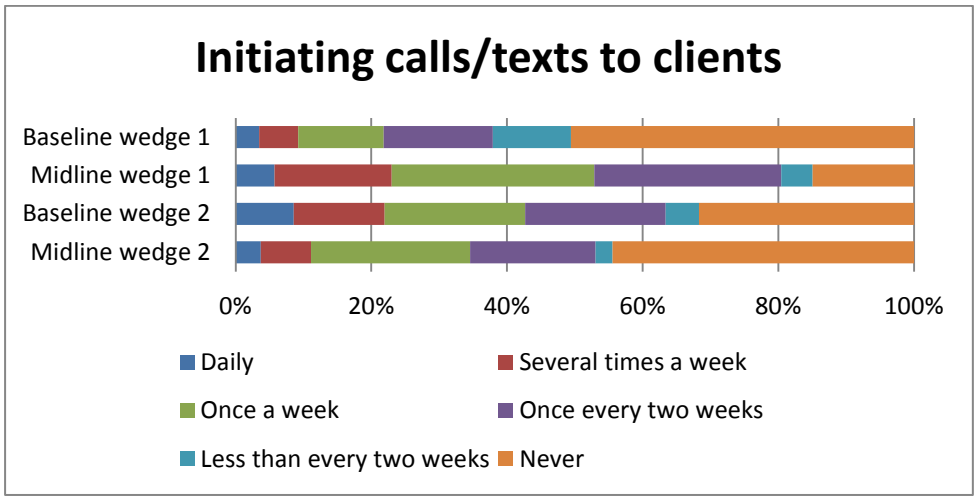


Figure 11: Frequency of health worker initiated calls and text messages to clients

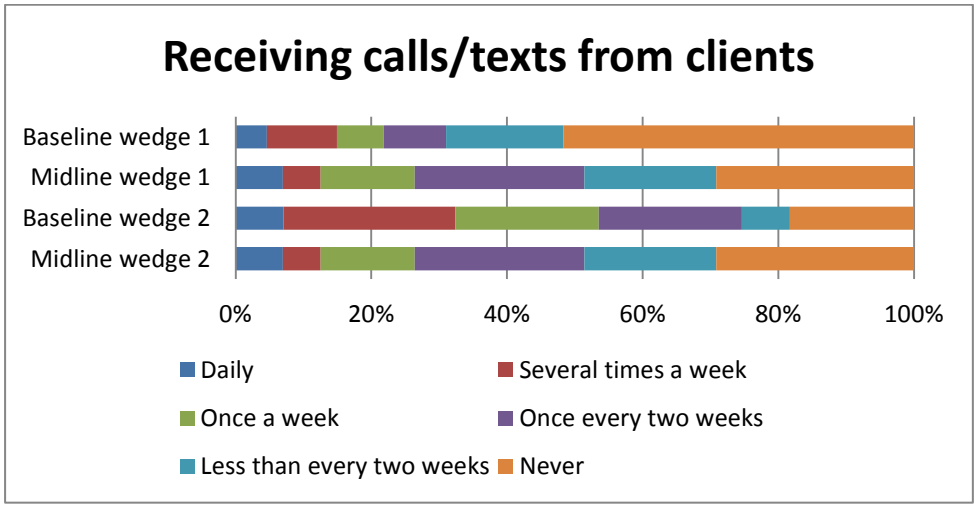


Figure 12: Frequency of health worker received calls/texts from clients

The reasons most mentioned by health workers for calling clients were to remind them about upcoming appointments, for follow-up after a clinic visit and to follow-up on missed appointments. Other reasons included informing about outreach (for example, for vaccination) or to inform clients about the availability of drugs and supplies.

Inversely, clients called health workers mostly for advice about illness and to make appointments. Other reasons mentioned were emergencies (for example, home labour, first aid, severe illness, ambulance), drug reaction and showing appreciation.

Details are in Table 7 below. (Please note that this table does not reflect the frequency of communication.)

Table 7: Reasons for communication between health workers and clients

Reasons for communication between health workers and clients	Health workers initiating calls/texts (baseline, N=106)			Health workers initiating calls/texts (midline, N=119)			Health workers receiving calls/texts (baseline, N=106)			Health workers receiving calls/texts (midline, N=95)		
	Wedge 1 %	Wedge 2 %	**Total %**	Wedge 1 %	Wedge 2 %	**Total %**	Wedge 1 %	Wedge 2 %	**Total %**	Wedge 1 %	Wedge 2 %	**Total %**
Remind client about upcoming appointments	63	41	**50**	91	78	**86**	-	-	**-**	-	-	**-**
Inform client about missed appointments	46	48	**46**	62	20	**46**	40	50	**45**	42	35	**39**
Follow-up on clinic visit by client	88	86	**87**	92	91	**92**	-	-	**-**	-	-	**-**
Client asks advice about illness	-	-	**-**	-	-	**-**	58	91	**76**	65	77	**71**
Clients to make appointment	-	-	**-**	-	-	**-**	75	64	**69**	77	93	**84**
Other	17	7	**11**	0	2	**1**	6	9	**8**	0	2	**1**

** Multiple responses allowed, percentages do not add up to 100*

Communication between health workers and TBAs

Comparing baseline to midline, in Wedge 1 there was a (contrary to expected) decrease in the frequency of calling or texting TBAs as reported by the health workers. In Wedge 2, the frequencies reported are very similar with little changes between baseline and midline. For details see Figure 13 below.

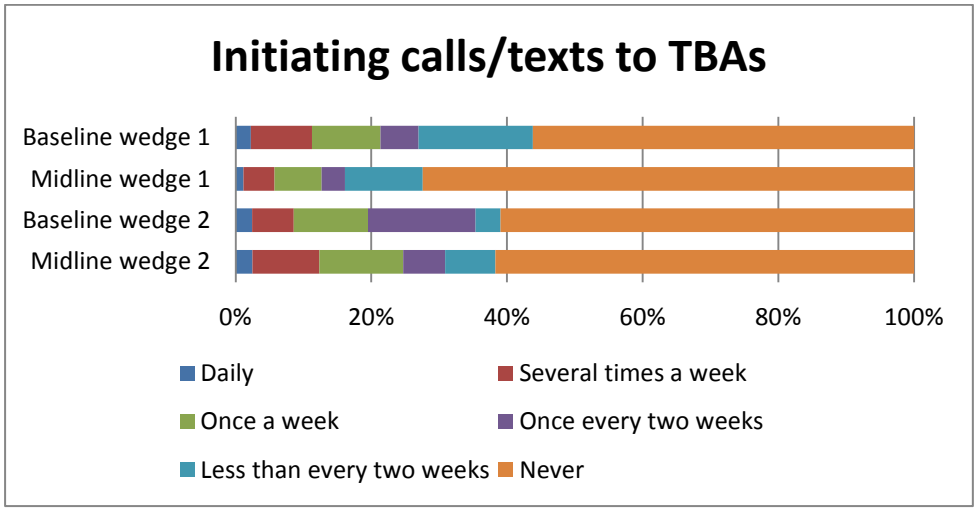


Figure 13: Frequency of health workers initiating calls/texts to TBAs

Health workers reported receiving calls/texts from TBAs less frequently (but not significantly so) at midline compared to baseline for both wedges (see Figure 14 below). This is an unexpected result that will be explored more in detail at end line with a focus on the TBA and TBA comparison chiefdoms.

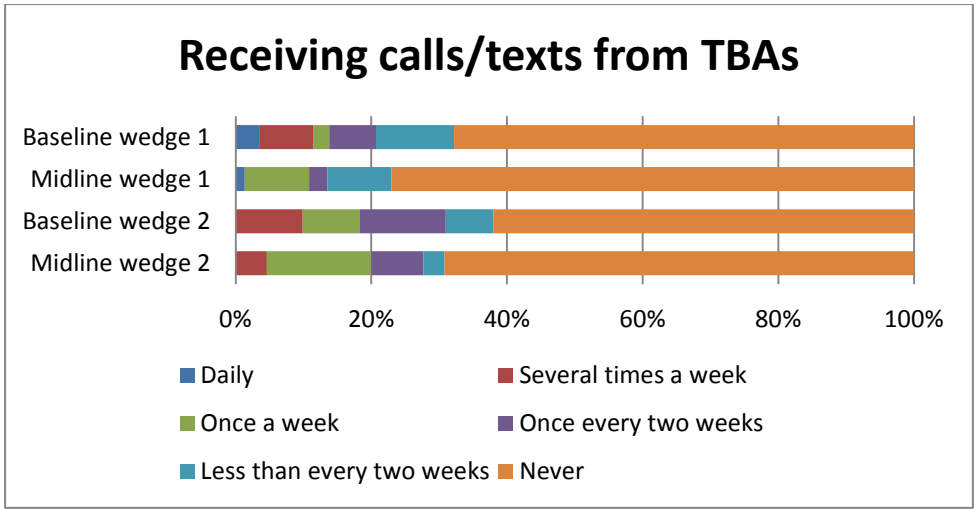


Figure 14: Frequency of receiving calls/texts from TBAs by health workers

Reasons for communication between health workers and TBAs are shown in Table 8. The reason given relating to requesting help with difficult cases is discussed in more detail in section 4.6. Other reasons mentioned for communication between health workers and TBAs related to: appointments for patients, gathering patients for clinics/sensitization/immunization, notifying about labour cases/emergencies on their way to the clinic, sometimes about outreach, supplies, supervision, or just to greet each other.

Reasons for communication

Across the various types of respondents, the two types of clients (pregnant women and family planning clients) and the two ways of initiating communication (by clients or by health workers or TBAs), roughly three reasons for communication can be identified, although with some variation, as seen in Table 8: appointments, health information and health status.

a. Health workers' reasons

When health workers (and sometimes TBAs) initiated communication with clients, they did so to discuss appointments (advance reminders, defaulter tracing, inform about 'clinic sitting' and availability of supplies), offer health information on a range of topics (nutrition, medication, child care, family planning, hygiene) and check on their health status.

Interestingly, clients much more than health workers reported receiving health information, while only health workers said they inquire about clients' health status and clients didn't mention this. There was little difference between pregnant clients and family planning clients regarding these reasons, apart from expected differences related to their specific concerns.

> *"I call them to remind them to come to the clinic. When they forget to come, I call the TBA and tell her to call a particular client to remind her to come to the clinic. Especially the pregnant women I force them to come to the clinic because I will be one to deliver them."* (ML P21 Health worker, TBA intervention chiefdom)

Table 8: Reasons for communication between health workers and TBAs

Reasons for communication between health workers and TBAs	Health workers initiating calls/texts (baseline, N=78)			Health workers initiating calls/texts (midline, N=55)			Health workers receiving calls/texts (baseline, N=78)			Health workers receiving calls/texts (midline, N=37)		
	Wedge 1 %	Wedge 2 %	**Total %**	Wedge 1 %	Wedge 2 %	**Total %**	Wedge 1 %	Wedge 2 %	**Total %**	Wedge 1 %	Wedge 2 %	**Total %**
Inform TBA about meetings and workshops	73	75	**72**	88	94	**91**	-	-	**-**	-	-	**-**
Request TBA to come help out at clinic	77	78	**78**	50	68	**60**	-	-	**-**	-	-	**-**
Request health worker to help with difficult case (including referral)	-	-	**-**	-	-	**-**	88	96	**72**	76	100	**89**
Other	16	0	**9**	46	10	**25**	21	7	**12**	24	50	**38**

** Multiple responses allowed, percentages do not add up to 100.*

> *"Well it has helped me greatly. I used to have problems with pregnant women when they never knew about clinic in this area, and I was also having defaulters since they do not know the time to come and they do not understand. But now with the use of this phone I can stand up and call a person if they are three in number, when I explain to one person she in turn can explain to the others that they are calling them to*

report at the hospital for family planning." (ML P27 Health worker, non-TBA intervention chiefdom)

Distribution of food for clients was another reason health workers called clients.

> "*At times when food supplies* [for pregnant women] *come for us they call me and tell so that I can tell the others. They come with corn flour, oil and other condiments.*" (ML P28 Pregnant woman, non-TBA intervention chiefdom)

Health workers also initiated communication with TBAs.

> "[The doctor] *asked me if everything is all right with me and if the patients are ok and I told him they are all ok."* (ML P13 TBA, TBA intervention chiefdom)

> "[PHU staff] *plead with me that since I am in the village, any pregnant woman who has problem should be advised to go to the hospital, or I accompany her to the nurses. So that is what my companions tell me, that I should not waste time with a pregnant woman. If the person has slow pain, you can walk so that is how we exchange."* (ML P14 TBA, TBA intervention chiefdom)

b. Clients' reasons

When clients called their clinic (or sometimes the TBA), they also did so to ask about agreed appointments and 'clinic sittings'. In addition, they called for health information and to discuss health problems they experienced or follow up on advice they received.

> "*Anytime when I am in doubt and I don't understand, I will call [the nurse] for direction and she will help me. …I call to ask if it is time for me to go for the injection, or it is not yet time she will tell me when to visit her. …[And] if the baby is sick I will call the nurse*." (ML P20 Female family planning client, TBA intervention chiefdom)

> "*I gave [the client] her medicine and told her to go and come any time she has problem. Since she went I have not seen her but she later flashed me and when I called her she told me that the pain has subsided after she took the medicine I gave her."* (ML P27 Health worker, non-TBA intervention chiefdom)

c. TBA reasons

TBAs called health workers to announce referral of pregnant women and children to the clinic, and to communicate they had mobilized clients for routine clinic visits.

> "[TBAs] *will call me and tell me that the baby is sick, and I will tell them to come with the baby. They also call me for pregnant women who have problems.*" (ML P21 Health worker, TBA intervention chiefdom)

> "*Pregnant women can report to me that they are not feeling well, I can call the nurse who can instruct me to treat her or to refer her."* (ML P23 TBA, TBA intervention chiefdom)

Not only TBAs from the intervention chiefdom communicated with health workers. TBAs from the other chiefdom, who did not receive a phone, contacted the PHU staff to consult:

> "*Some* [TBAs] *call me when they have difficulty with delivery. They will flash me, when I call they tell me that they have a labor case at hand.*

> *She tells me the dilation and I then tell her to move* [the client] *to my centre."* (ML P27 Health worker, non-TBA intervention chiefdom)

Communication leading to increased service utilization

DHMT members and health workers credit the initiation and availability of mobile communication with increased service utilization, in turn confirmed by observations and reports. Quotes illustrate this in response to the question whether mobile phones have made a difference in client-health worker relationships and clients' behaviour:

> "*Yes, because you will see that there is an increase in family planning because of the communication they (clients) have with the health worker… It is because of the increase in their (health workers) report which they sent to us. Those figures are increasing which we did not have before.*" (ML P2 District level respondent)

Health workers made a direct connection between increased utilization of services and mobile phones.

> "*It* [the relationship] *has changed greatly now, because patients do come to the clinic in large numbers… They come for ANC, treatments, and when pregnant women come I also treat them".* (ML P4 Health worker, TBA intervention chiefdom)

> "*They have changed now. They now take their babies to the hospital for vaccination whenever it is time for them to go the clinic.*" (ML P19 TBA, TBA intervention chiefdom)

Clients coming for family planning started to rely on health workers to remind them:

> "*Because that will make me not to forget. But if the nurse does not call me to remind me I will forget, because I have lots of work to do, but it is the job of the nurse to call us and remind us.*" (ML P37 Female family planning client, non-TBA intervention chiefdom)

Indeed, most of the respondents reported an increase in utilization of family planning services because of the client reminder scheme. In the TBA intervention chiefdom, the possibility of communication with (enrolled) clients indirectly, via TBAs, helped women to avoid a barrier, as being contacted through their husbands' phone or sometimes even their own phone was not an option.

Health workers emphasized the importance of respecting women's wish for confidentiality. As one health worker explained:

> "[The TBA] *will go and call the client that I want to talk with. I do that because they don't want their husbands to know about their family planning. Their husbands will say their wives want to be sleeping with others that is why they have joined family planning. So they don't want them to know, that is why we call them through the TBA's phone, and it has worked for them so far."* (ML P21 Health worker, TBA intervention chiefdom)

The last example also links to another issue highlighted by health workers, TBAs and clients alike: the added value of TBAs as focal points in the community, for communication to and from the health facility. Some felt this really contributed to increased service utilization.

> *"Well since they came with the phone, if a pregnant woman is here when it is time for labour, the TBA can use the phone to call out there;*

if they cannot come they will carry her to [the facility]*."* (ML P9 Female family planning client, TBA intervention chiefdom)

Service utilization data

The figures in Annex 19 show the trends of PHU attendance for antenatal visits, facility delivery, post natal visits and family planning visits, for the period April 2011 to December 2012.

Stage 1 started in August 2012 for a period of six months. For the last month (January 2013) no data are available as yet. All indicators displayed are for PHU based (fixed) services only, thus excluding services provided during community outreach. Comparisons were made for utilization indicators for the five months of phase 1 (August – December 2012) and by wedge with baseline data that is the corresponding five months of the preceding calendar year (August – December 2011). This was done to ensure that seasonal changes (for example, malaria season, Christmas period end-December) would not affect the comparison of utilization data.

The absolute number of clients for all fixed utilization indicators (ANC1-4, facility delivery, PNC1-3, family planning new and continuing clients) increased in both wedges when comparing the periods 2011 (August to December) to 2012 (August to December).

It was expected that at midline utilization would be higher in Wedge 1 compared to Wedge 2 because of the health worker to client intervention. The data show a higher increase in the number of clients for Wedge 1 as compared to Wedge 2, for five of the ten indicators (ANC 4, PNC 1-3 and family planning new clients), while the reverse is the case for two other variables (ANC3 and FP continuing clients); no difference was observed for three indicators. However, because of as yet unavailable catchment population data, needed to calculate service coverage, this analysis is indicative using absolute numbers; the end line study will include a double difference analysis between wedges. For details on current analysis see Annex 19.

Reasons for increased utilization

From the interviews it emerged that the mobile phone improved communication about the time clinics were held and enabled health workers to personally invite clients. Also, clients knew where and when an outreach clinic was held or that staff would be present, so they would not go in vain. This was especially important for clients who had to travel a considerable distance to get to the clinic. In the chiefdom where TBAs were given a mobile phone, some of the women came to the TBA to find out if and where a clinic was being held. This also enabled women without phone access to find out in advance.

"*This phone has helped a lot, because all those who used to relax on coming to clinic, I will call them and tell them; tomorrow is a clinic day… or if they don't have phone I call through the TBA's phone to remind them to come to clinic. So it helps me… makes the turnout good at the clinic. They come in large numbers.*" (ML P21 Health worker, TBA intervention chiefdom)

One of the TBAs, from the same TBA-intervention chiefdom as the health worker in the quote above, added that not only does she bring messages from health workers but women also approach her to find out where a clinic is held.

"*Why the work is easy now is that, before the clients grumbled because when they went to the clinic they would not meet the nurse. That was due to the lack of knowledge on when to go the clinic. But now if the clients want to go to the clinic they will come to me in order to call the*

nurse… So we don't have many problems again." (ML P24 TBA, TBA intervention chiefdom)

In the chiefdom where women enrolled with TBAs as their contact person, health workers often referred to contacting the TBA to inform the women which makes their task easier. TBAs also felt happy being part of the programme.

> *"…They call pregnant women to come on Thursdays. The call me and ask me to inform them to come on Thursday. I also call them to get feedback from and they will tell me they are there. That is a fine thing for us."* (ML P14 TBA, TBA intervention chiefdom)

Meanwhile, in areas where the TBA did not get a phone, an increase in utilization was also observed for similar reasons.

> *"The distance is too far. It is about one and half mile from here to (*place in catchment area*). The clients were very stubborn to go for clinic… They now go to the clinic frequently… As you can see the people, I don't need to tell you. Most times we don't even send to them. We just say we shall be holding clinic at such a place, they come there. Like one of the family planning clients, I just called her and she came… It is very wonderful; I cannot tell you a lie. It has really improved"* (ML P26 Health worker, non-TBA intervention chiefdom)

The increase in utilization was reported for the continuum of maternal health services, including family planning. Health workers also shared that being able to reach one client by phone also alerted others to come to the clinic.

> "*The kind of changes I have observed is that I get frequent family planning clients now. When I call them they come either two or three per village; they in turn will go and explain to the others and encourage them to come and join the family planning so I get more and on a frequent basis. Even the pregnant women when they come I explain to them, any time I make to any one of them she will inform the others about the clinic. So that has helped me greatly."* (ML P27 Health worker, non-TBA intervention chiefdom)

Perceived benefits: changes in outcomes

Based on the qualitative research data, various perceived benefits of the mHealth intervention programme were identified.

a. Job satisfaction of health workers and TBAs

One outcome area of the mHealth intervention programme is motivation and job satisfaction of health workers. Mobile phone communication may increase job satisfaction (feeling good about work) of health workers because the phone has increased efficiency and the utilization of their services. In answering the question whether the facility phone changed the way they feel about their work in any way, one health worker shared the following:

> "*Like I explained, the work has become lesser now on us, and we used to get just 10 patients before, but now, we have more than 20 to 25 patients every Wednesday now."* (ML P31 Health worker, non-TBA intervention chiefdom)

TBAs reported the same. The primary satisfaction TBAs seemed to get out of the programme is to be part of caring for pregnant women in the community, having the ability to call to discuss problems and be part of the solution, learning along the way. This they felt is their role and they felt proud to be part of the programme.

"*I feel good, because it is my work I am doing, I was asked if I could be involved in this mobile work and I consented, so I feel good that I am part of a process of talking to our pregnant women and family planners to visit the clinic."* (ML P8 TBA, TBA intervention chiefdom)

"*I will be happy if this continues, by regarding us as important people in our community.*" (ML P25 TBA, TBA intervention chiefdom)

"*The benefit is that whatever they tell me through the phone I will understand. So that is a benefit for me."* (ML P19 TBA, TBA intervention chiefdom)

Ownership of a telephone was for some a reason to feel proud and acknowledged.

"*I like it because it has promoted me; I have never held a phone for myself."* (ML P23 TBA, TBA intervention chiefdom)

Improved perception of health worker-client relationship

Some clients found that the increased communication has led to better attitudes of health workers and another client felt better after ANC visits since the mobile health programme was initiated:

*"As a result of this call when we come he treats us well, joke with us and attends to us." (*ML P28 Pregnant woman, non-TBA intervention chiefdom)

Health workers mirror clients' views on improved attitudes from their own perspective, by referring to improved relationship with their clients.

"*The difference is great. I am now used to them, we make jokes, although I only came here last year, I talk to them and ask them why I did not see them in the last clinic and I will say I want to see them and they will come."* (ML P21 Health worker, TBA intervention chiefdom)

"*The relationship is now cordial between us, because when they hear my call and they too call me, to interact is good. …They appreciate when we call them, they are happy*." (ML P16 Health worker, TBA intervention chiefdom)

b. Health benefits (seeking care earlier, reducing defaulting, follow-up on treatment, better emergency response and improved quality)

Health benefits can be derived from the description of how the phone is used. In addition, health workers commented on the benefits of the phone and how these come about. One benefit mentioned was that clients seek services earlier, even without being fully aware of the danger signs. They would call with a symptom and the health worker could advise them to come to the clinic or not. Another benefit was the increased continuity in contraceptive use and treatment.

"*…Now they do not wait for us to teach them about certain things, like the signs, no sooner they notice a sign they complain to us about what is happening to them. We either go to the person or they find their way to come."* (ML P26 Health worker in non-TBA intervention chiefdom)

"*The main difference which I see is that I don't have defaulters again, the phone makes it possible for them to come to clinic on time, and it now makes them use their drugs correctly. When they don't default, they will take their medication correctly.*" (ML P30 Health worker, non-TBA intervention chiefdom)

One TBA who talked about the improved communication with nurses for complicated deliveries since the introduction of the phone, remarked:

> "*Thank God for the phone given to us, or else pregnant women will die, because of lack of communication with the nurse*." (ML P25 TBA, TBA intervention chiefdom)

One district level respondent referred to better quality of services that resulted from improved communication through the use of phones, linking it to immediate benefits for clients.

> *"This mobile phone … really helps, communication is very essential in any community. …You can use* [the mobile phone] *at PHU with your health sister to conduct some difficult deliveries over the mobile phone. I have done [this] with my staff in an area that is very difficult to reach… There was a particular MCH Aide who had a case and sent here for the ambulance, the ambulance went but could not cross the river, so she called me over the on the phone and I instructed her as to what to administer and she got through successfully and she called me again in the morning and reported to me that the patient was normal and has been delivered. So I believe with mHealth we can do more."* (ML P1 District level respondent)

c. Enabling environment

One DHMT member shared other factors that may have contributed to the increase in utilization, such as drug availability.

> "*There are drugs now. Like, if I go to the clinics before there was a no drug, the patient will not go there again because she is frustrated. But now, if they go to the clinic and get drugs, and then they will continue to go to the clinic.*" (ML P2 District level respondent)

While the above mentioned drugs became available under the Free Health Care Initiative policy in advance of the mHealth intervention, others reflected on what preconditions would need to be in place to maximize benefits of improved communication, especially regarding transport, drugs and supplies.

> *"I want to tell the government that this programme is good, so they should help us. I want them to help the nurse with medicines, so that the programme will go on well."* (ML P24 TBA, TBA intervention chiefdom)

> *"My area it is big, and there is poor network and I don't have transport facility. In case there is an emergency were in the patient stays far away from this clinic, and cannot walk again, then she calls, if there is transportation I go quickly for her. So they need to provide transportation, which I recommend strongly."* (ML P30 Health worker, non-TBA intervention chiefdom)

d. Empowerment of women

Some women prefer to hide the use of contraceptives from their husband and so did not want to use the phone or only via the TBA (see above). However, other women felt proud to be called by the nurse and talking with the health worker whilst their husband was near.

> "*They are happy. The other day when we were talking her husband was close to her, and she told her husband that she is talking to the nurse, they feel big when I talk to them on the phone*" (ML P21 Health worker, TBA intervention chiefdom)

4.5 Objective 2 – Enabling environment for health workers (Health worker to health worker communication)

The VPN is a means for health workers and other key health actors to communicate with each other without dependency on phone credits and it was envisioned that this would increase the frequency of communication. Figures 15 and 16 below show the health worker respondents' reported frequency of *initiated* and *received* calls and text messages, to and from various categories of health staff (district, own PHU in-charge, chiefdom in-charge, other health staff).

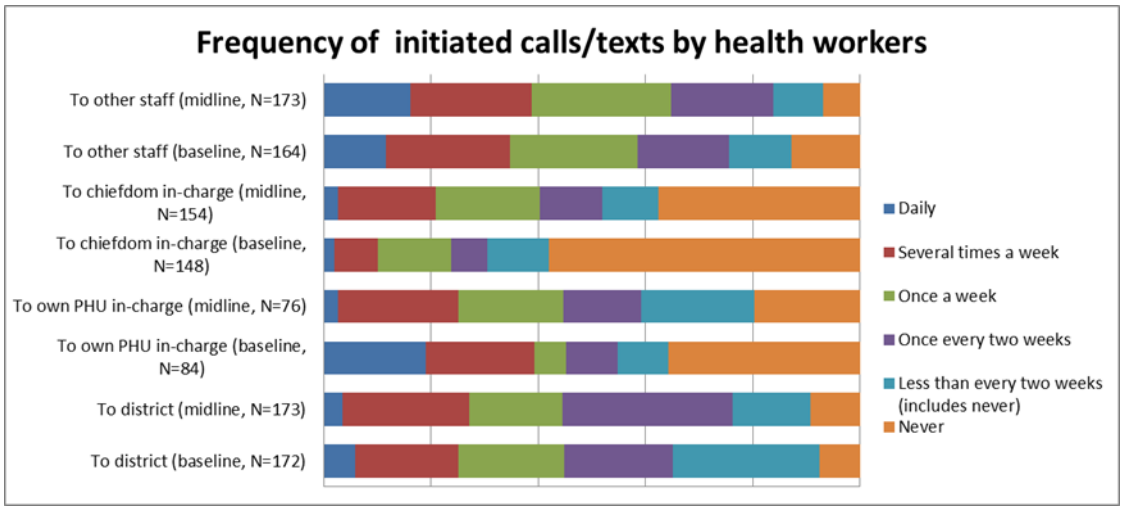


Figure 15: Frequency of initiated calls/texts by health workers

Making and receiving work-related calls and text messages to other PHU staff
As expected, health workers called or texted more frequently to other PHU staff after the intervention was implemented, at midline, compared to baseline. The difference was more pronounced in Wedge 1 with 70% of the health workers indicating that they made calls or messages to other staff (excluding in-charges) once a week or more often, which is significantly more frequent than indicated at baseline (44%). A smaller difference was seen in Wedge 2 with a slight decrease in the frequency of calls to other staff when comparing baseline to midline.

Health workers also indicated they received calls and text messages from other PHU staff more often at midline as compared to baseline. This difference was significant in Wedge 1, where 'calling once a week or more' increased from 47% at baseline to 75% at midline, compared to 63% at baseline in Wedge 2 with an increase to 72% at midline.

Making and receiving work-related calls and text messages to and from the chiefdom in-charge (at CHC)
As expected, health workers called or texted to the chiefdom in-charge at the CHC more often at midline as compared to baseline. This shift was seen in both wedges for the frequency of calling/texting once a week or more and was more pronounced in Wedge 2, with an increase from 21% to 43% (compared to a 27% to 35% increase in Wedge 1).

The same was seen for receiving calls and texts from the chiefdom in-charge at midline compared to baseline. The increase in Wedge 2 was significant from 18% to 35% for a frequency of once a week or more often, compared to Wedge 1 with an increase from 20% to 22%.

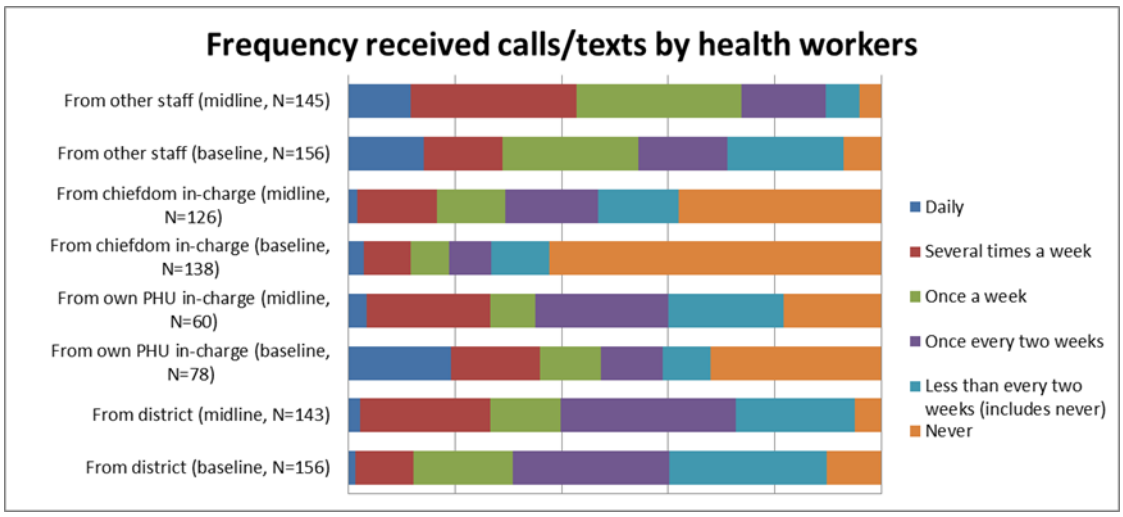


Figure 16 : Frequency of received calls/texts by health workers

Making and receiving work-related calls and text messages to and from the own PHU in-charge

The data show increases in initiated communication frequencies (except for daily calls) to the own in-charge, from baseline to midline. Across wedges there is variation regarding which frequency category increased, from baseline to midline.

The frequency of received calls and messages also increased at midline compared to baseline, as expected. This was seen in both wedges with a more significant increase in Wedge 1 for calling and texting 2-4 times a month from 16% at baseline to 32% at midline, compared to Wedge 2 from 15% to 26% respectively.

Making and receiving work-related calls and text messages to district level

The frequency of calls and text messages initiated by health workers to the district level also increased from baseline to midline, also expected as a result of the intervention. This shift was different between the wedges but not statistically significant. Wedge 1 respondents reported almost no change between baseline and midline for daily and weekly calling/texting, although there was an increase in the frequency 'several times a week' from 19% baseline to 29% midline. In contrast, Wedge 2 respondents indicated the greatest frequency shift in the category calling/texting 'once every two weeks', with an increase from 17% to 31% from baseline to midline.

As in the other categories, the frequency of calls and messages received by health workers from the district level also increased from baseline to midline. Here there were no significant differences found between the wedges.

Reasons for health worker to health worker communication

As at baseline, health workers at midline were asked about the reasons they initiated and or received calls and text messages from other health workers for each type of level of health worker interaction. These results are summarized in this section and more detailed graphic overviews can be found in Annex 20.

In general, there were small differences found for the reasons reported for initiating and/or receiving call/texts between baseline and midline. The number of health workers noting the reasons surveillance, HMIS information and data and drugs and supplies decreased from baseline to midline in all levels of interaction.

Making and receiving calls/texts for clinical advice was reported slightly more often at midline compared to baseline for all levels or interactions except for health worker to own PHU in-charge. This could be related to only one staff person having access to the VPN network phone at any given time, so that they preferred calling someone else in the VPN network for advice rather than having to use a personal phone and phone credits.

The interview data furthermore allowed identification of a number of reasons why health workers communicate with each other. Health workers in both chiefdoms mentioned they called other health staff to exchange ideas (with peers) and seek advice (from peers and seniors), in order to address problems, doubts and improve the quality of their work. The type of problems ranged from clinical advice to reporting.

> "*I call them to exchange ideas. I work here alone, so I find it difficult, and I call for advice….They also help to clear my doubts*." (ML P21 Health worker, TBA intervention chiefdom)

> "*Sometimes when I have doubts with this paper work, I call* [colleague health workers] *for direction and they will tell me what I want."* (ML P16 Health worker, TBA intervention chiefdom)

Another health worker, who indicated that the phone had been useful, said "*it is really great*". The health worker explained:

> "*If I have any problem or a difficult case, I will call my bosses to direct me, how to handle the case…..Like I had one case where there was a* [problem] *and I augmented the delivery, and I administered a drip, but about the drip, I called the sister and she told me to increase* [the drip], *and I started seeing progress."* (ML P31 Health worker, non-TBA intervention chiefdom)

Others referred to the need to stay up-to-date on planned meetings, training workshops and program activities.

> "*I ask them* [supervisors] *if there is any meeting or programme and we get it* [the information) *from them. Anyway, the phone is helping us. Initially workshops used to be held there without our knowledge*." (ML P27 Health worker, non-TBA intervention chiefdom

Health workers also indicated they use the phones for supply chain management and to exchange disease surveillance information. DHMT staffconfirm this.

> "*The Disease Surveillance Officer called us and asked about the disease outbreak, so we told him and in turn we also called the District Operations Officer to inform him if we are short of vaccines and he would tell us when to go for it*". (ML P26 Health worker, non-TBA intervention chiefdom)

> "*I believe they [health workers] have already realized different things because of the fact that they have a telephone in their possession… For example, during this cholera outbreak it was really wonderful to see them communicate to report the number of cases they have. They can even use it to communicate with their companions to report what has happened in their area and I believe with that they put things together and know the step they should take*." (ML P1 District level respondent)

TBAs also expressed reasons for having the communication-link between health workers and TBAs:

"…Now you people can see the difference when we are involved in reminding the patient, so please let it continue, it would help increase pregnant women going to the clinic." (ML P8 TBA, TBA intervention chiefdom)

"Yes, we [TBAs] *have to be there* [included in the mobile phone scheme]*. …We are all living together, you don't have to say you are the only one to enjoy the facility".* (ML P14 TBA, TBA intervention chiefdom)

Job satisfaction and communication

As described in the baseline report, information on job-related satisfaction and communication was obtained through 22 agreement statements making up 3 domains that were shown to be reliable and were part of the health worker survey at baseline and midline[14]. For each domain (communication with peers and seniors, working conditions and quality of working life) a combined score was calculated. The standardized combined scores for these domains range from 0-100, with a higher score indicating a better situation. Table 9 below shows the mean (average) score and the score range by wedge and for baseline and midline. A full overview table for each domain by wedge and health facility and health worker characteristics can be found in Annex 21.

Table 9: Combined scores for communication and job satisfaction domains

Domain	Baseline wedge 1		Baseline wedge 2		Midline wedge 1		Midline wedge 2	
	[*]mean	*[#]range*	*mean*	*range*	*mean*	*range*	*mean*	*range*
Communication with peers and seniors	77.8	40-96	75.3	44-88	82.6	56-96	76.3	48-96
Working conditions	62.2	32-88	63.5	40-84	66.0	40-92	67.4	40-92
Quality of working life	75.3	51-93	73.2	47-89	74.1	51-89	73.7	44-93

**Mean is the average score; [#]range refers to the lowest and highest scores*

In both baseline and midline results, health workers have lower average combined scores for the domain *working conditions* compared to the domains *communication with peers and seniors* and *quality of working life.*

In the domain *communication with peers and seniors*, the combined average score at midline is higher with a mean score of 76.5 at baseline compared to 79.4 at midline. The difference is due to a pronounced improvement of the scores in wedge 1.

In the domain *working conditions,* the combined average score at midline is also higher with a mean score 67.1, compared to 63.3 at baseline. Both wedges show equal improvement of scores from baseline to midline.

In the domain *quality of working life*, the combined average scores at baseline (74.5) and midline (74.2) are almost the same, indicating no perceived change in the perceptions of the health worker respondents.

[14] For more information on the methodology and reliability analysis see baseline report: Magbity E, K Herschderfer, H Jalloh-Vos, H Ormel, SAY Kamara, AM Jalloh, K de Koning, L Wolmarans (2013), Mobile Health: Connecting managers, service providers and clients in Bombali District, Sierra Leone. mHealth for maternal and newborn health in resource-poor community and health system settings, Sierra Leone. Baseline study report. Amsterdam: KIT, http://www.kit.nl/kit/Publication?item=3468

As in the baseline, two separate statements with agreement scales were used to measure how health workers perceive communication with clients. Table 10 below shows the result of the analysis of these two statements by wedge.

Table 10: Communication with clients

		Baseline						**Midline**					
		Wedge 1		*Wedge 2*		***Total***		*Wedge 1*		*Wedge 2*		***Total***	
		N	*%*	N	*%*	N	*%*	N	*%*	N	*%*	N	*%*
Contacting individual clients in the community for ANC, FP and other services is easy	Disagree	13	*13,8*	8	*9,8*	21	*11,6*	9	*10,3*	14	*17,3*	23	*13,3*
	Neutral	10	*10,6*	4	*4,9*	15	*8,3*	6	*6,9*	3	*3,7*	12	*6,9*
	Agree	71	*75,5*	70	*85,4*	145	*80,1*	72	*82,8*	64	*79*	138	*79,8*
I have the means to contact individual clients directly	Disagree	15	*16*	5	*6,1*	20	*11,1*	3	*3,5*	7	*8,6*	10	*5,8*
	Neutral	10	*10,6*	4	*4,9*	14	*7,7*	9	*10,3*	5	*6,2*	16	*9,3*
	Agree	69	*73,4*	73	*80*	147	*81,2*	75	*86,2*	69	*85,2*	147	*85*

In general, a large percentage of health workers feel that contacting clients is easy and that they have the means to do so. At both baseline and midline, about 80% of the health workers agree with the statement that 'contacting individual clients in the community for services is easy'. The percentage of Wedge 1 health worker respondents who agree with this statement increased significantly from 75.5% at baseline to 82.8% at midline. This increase is expected in Wedge 1 due to the health worker to client communication intervention.

An increase in the number of health workers respondents agreeing with the statement 'I have the means to contact individual clients directly' was seen from baseline (81.2%) compared to midline (85%), as would be expected because of the provision of the mHealth intervention. A significant increase was seen in Wedge 1 that shifted from 73% agreement at baseline to 86% at midline. Another (unexpected) shift in agreement was also seen in Wedge 2 from 80% to 85% (baseline to midline).

Benefits

Respondents identified several benefits of the improved communication options.

a. Improved perception of relationships

Alongside above reasons that relate directly to work, maintaining relationships with peers and supervisors also emerged as a motivation to keep in touch.

> *"This phone has created a lot of relationship, we discuss lengthily about our problems on the phone and we assist one another."* (P30: Health worker in non-TBA intervention chiefdom)
>
> [The facility phone] *has made the relationship between the DMHT and even the clients that we have outside so cordial. Now in every one or two days, you either talk to your clients or your bosses. Whatever happens in the office you will know."* (ML P26 Health worker, non-TBA intervention chiefdom)

b. Reduced TBA efforts (transport, cost, time)

For TBAs an explicit benefit mentioned was the reduction of effort (both physical and monetary) needed to travel back and forth to the facilities.

"There is much difference, because when they [the facility nurses] *send for me I don't have to walk to go there."* (ML P18 TBA, TBA intervention chiefdom)

"I have no other work, this work has helped me because there are problems that come up here we used to pay transport but now if it happens I don't have to pay transport, I remain sitting here and call." (ML P23 TBA, TBA intervention chiefdom)

c. Improved perception of HW-TBA relationships

The responses of some TBAs and also health workers and DHMT indicate that the improved communication is also about better relationships among health workers and TBAs.

"*We now use the mobile phone to report anything you have in mind you can say it. You can tell the nurse and they too can tell you. So we are fine*." (P14: TBA in TBA intervention chiefdom)

"[The mobile phone] *has changed my feeling because it was not easy to call the TBAs because they did not have phones, and it was not easy for us to call the phones of our client's relatives. But now we call them and they are happy to answer their call, for which I am also very happy about*." (ML P4: Health worker in TBA intervention chiefdom)

*"Giving the phone to the TBAs was a big motivation, because they now call the health staff and talk to them. This has motivated them a lot and there is that cooperation between them and the health staff. Now they bring clients to the health staff. This did not happen before, although some areas have bye-laws. When they have problems they will call the PHU staff." (*ML P2: District level respondent)

d. Potential for expansion

Health workers praised the phone intervention as a means of improving communication, and this was seen to support a move towards better health. They felt that the intervention should be expanded to other chiefdoms in other districts so that others could benefit too.

"*I want them to go with same functions they have provided, because communication is the best thing in the world, without communication everything will come to a standstill*." (ML P30: Health worker in non-TBA intervention chiefdom)

4.6 Objective 3 – MNH referral systems

Referrals take place from community and TBA to health facilities, from lower level PHUs (like an MCHP) to higher level PHUs (like a CHC), and from PHUs to the hospital. In this section we will mostly focus on ambulance referral from PHUs to the hospital.

As expected and displayed in Figure 17 and in Annex 15, the majority of phone calls and text messages about ambulance referral was made from the PHUs to the other levels, especially the district level. There were only few calls/texts received about ambulance referral.

There was a significantly higher percentage of respondents using PHU to district level calls/texts for ambulance referral purposes in Wedge 1 than in Wedge 2 both at baseline and midline. There was a higher percentage of respondents that used PHU to district level calls/texts for ambulance referral purposes in Wedge 2 at baseline (as compared to midline), but this is only borderline significant.

At baseline, significantly more calls/texts were made about ambulance referral to the own PHU in-charge and to other staff, but this difference had disappeared at midline. This difference might be explained by the increased access to and availability of the district staff through the VPN with less reason to communicate with the own facility/chiefdom in-charge.

Regular calls were also made between PHU level and chiefdom in-charge level about ambulance referral, with no significant differences in/between Wedges at baseline/midline.

At baseline, one respondent mentioned a client calling/texting for the ambulance, with no respondents mentioning this at midline.

Of the respondents who said they ever received calls/texts from TBAs, 56 out of 61 at baseline (92%) and 33 out of 37 respondents at midline (89%) indicated that TBAs requested for help with difficult cases (including referral).

While there is no difference between the Wedges at baseline for this, there is a significant difference at midline. Respondents in Wedge 2 at midline indicated that from all the TBAs (100%) they received messages requesting help with difficult cases (including referral), while only 76% did so in Wedge 1. This might reflect earlier and more regular attendance of clients to the PHU in Wedge 1.

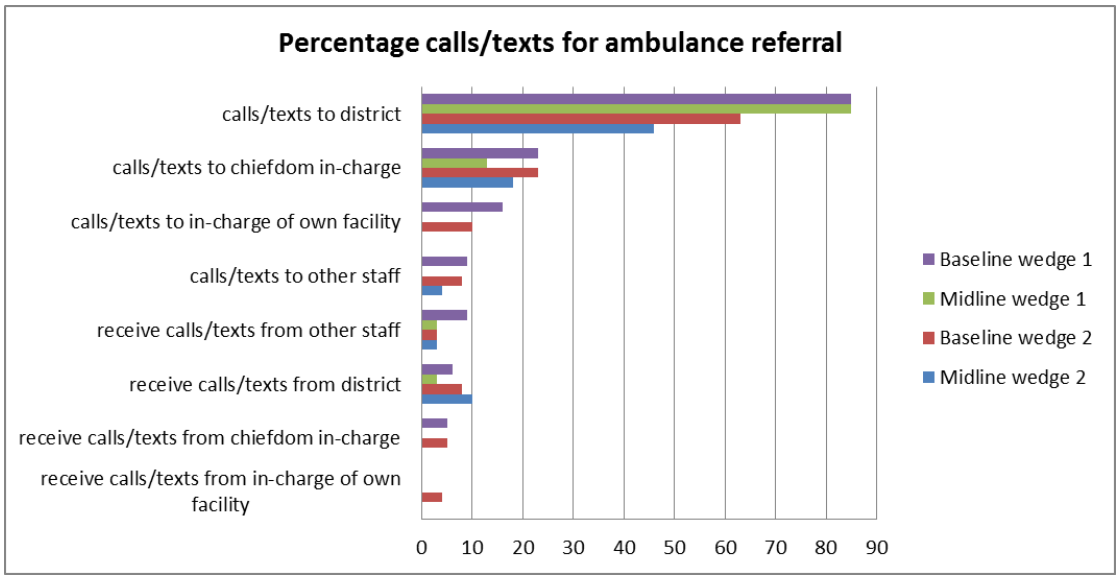


Figure 17: Percentage calls/texts for ambulance referral

Many interview respondents mentioned (ambulance) referral, with several mentioning that it is easier now to get the ambulance of the DHMT through the VPN system established as part of the intervention.

> *"Before now we found it difficult to get the ambulance if we had pregnant woman in critical condition. But now as we call the office at Makeni, they will send the ambulance immediately." (*ML P4 Health worker, TBA intervention chiefdom)

> *"It has also helped in times of emergency, for instance to call an ambulance to come and pick a pregnant woman. Now I can just look at the list, there is a transport officer and I call him up."* (ML P10 Health worker, TBA intervention chiefdom)

Several respondents mentioned that it is much easier with the facility phone to call the ambulance than before, for example, they now got used to calling the

ambulance of the Kamakwie hospital (a Mission hospital in the North of Bombali District).

> *"Yes, I called Kamakwie at one time when I had prolonged labour here, so that they should come and collect the patient… They sent the ambulance in order to collect the patient."* (ML P30 Health worker, non-TBA intervention chiefdom*)*

There were also suggestions that referral indications might have become more clear, as health workers could first get advice from district level and then decide together whether referral was really necessary. This might contribute to more efficient use of referral resources like ambulance fuel and staff time, as many of the PHUs are many kilometres removed from the district head quarter town (see Annex 14 for distance PHU to Makeni) and most are reached through un-tarred roads and usually rough terrains.

> *"For example, as I was telling you things have changed especially in referral cases. The PHU staff will call, 'sister I have a case here and we need the ambulance to convey the patient to the referral hospital'. Then the sister will call her to explain what the problem is. Then, she will explain to the nurse how to deliver that complicated case through phone until the pregnant woman deliver safely without any problem, or sending the ambulance. This has helped greatly."* (ML P2 District level respondent)

> *"One can now communicate with the PHU staff at any time when you are free. But this did not happen when they used their own phones, as their credit was finished before even telling us the message. But now if there is any critical case during labour, the nurses will call the sister and the sister will explain how to do it without any referral. The sister will communicate through the phone, by instructing the nurse what to do and how to do it, without any problems."* (ML P2 District level respondent)

Consultations about referral also took place between the TBA and the PHU and between clients and PHU, as is illustrated by the following quotes.

> *"The nurse had been cooperative with me, there are times I contact her when I have serious cases of referral, she in turn will call her authorities to come with vehicle for the patient."* (ML P25 TBA, TBA intervention chiefdom)

> *"And whatever happens here I call them to tell them. If a pregnant woman reports to me that she is feeling pain I call the nurse first before taking any action. If the nurse instructs me to do the work I will go ahead, if she asks me to go with her I go with* her." (ML P23 TBA, TBA intervention chiefdom)

> *"If the woman is about to deliver they* [TBAs] *will call me and tell me, so I will tell them to bring her to the clinic, or if someone is sick, I tell them to bring the person to the clinic."* (ML P21 TBA, TBA intervention chiefdom)

The phone system also assisted with making arrangements with family members of a patient that is being, or will be, referred.

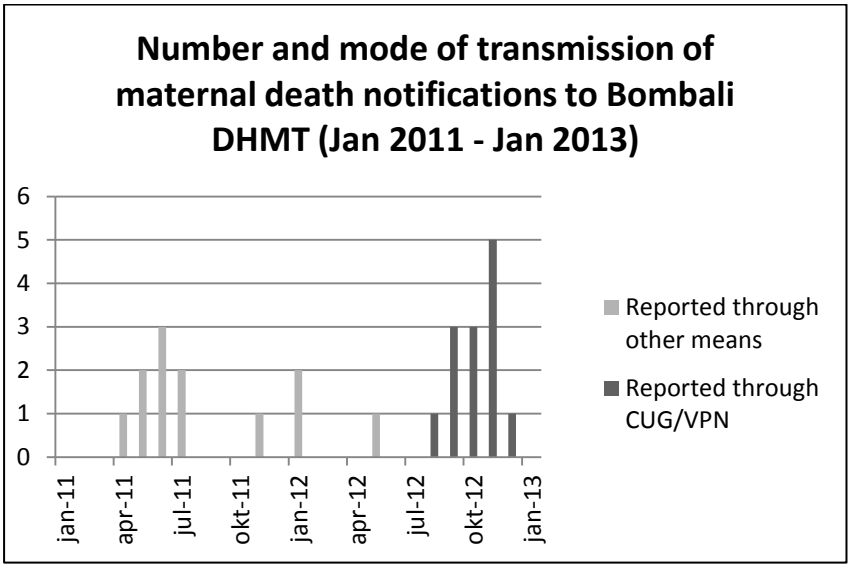
> *"The phone has enabled me to tell relatives that the case she brought is going to be referred and I will encourage him or her to find some money to come and meet me, or if it is so urgent I can call the ambulance to come and collect the person and I will later call the*

relative of the person. That is how the phone has been helping me handle complications." (ML P27 Health worker, non-TBA intervention chiefdom)

4.7 Objective 4 – Maternal death notification reports

Maternal death notifications in Bombali District are received by the DHMT. Before the start of the mHealth project these notifications were communicated on paper or through personal phones of health workers. For the period January 2011 to July 2012 (19 months) a total of 12 maternal death notifications were received by the DHMT. For the period August 2012 to January 2013 (the six months of stage 1), a total of 13 maternal deaths were received, see Figure 18.

Figure 18: Number and mode of transmission of maternal death notification to Bombali DHMT



**source: DHMT Bombali*

This is a more than tripling of the notifications, although several respondents in SSIs mentioned that there actually were less maternal deaths since the start of the program. Over the six months period a total of 82 maternal deaths would be expected for Bombali district, which indicates underreporting even after tripling of the notifications[15].

> *"…If we have a patient in a difficult situation, we call the ambulance and they come immediately and take the patient. It has helped greatly, because there were many deaths before. Now thank God for this* [mobile phone] *programme." (*ML P4 Health worker, TBA intervention chiefdom)

In the baseline survey there were 13 out of 181 health workers who mentioned calling or texting the district level (11), their CHC in-charge (2) or other PHU staff (2) for maternal death reporting, while only one health worker received calls or text from other PHU staff on maternal death reporting.

At midline three out of 173 health workers mentioned maternal death reporting for which they called or texted the district level (2) or called or texted their own in-charge (1) in the previous three months to report a maternal death.

[15] Expected maternal deaths for Bombali district six months period based on: population 2012 (469,065 as extrapolated from Census 2004), 4.1% pregnant women, maternal mortality rate 857/100,000 (DHS 2008) and six months period (0.5) = 469,065*4.1/100 *857/100,000*0.5 = 82 expected maternal deaths.

None of the health worker respondents indicated receiving calls or text in the previous three months on maternal death reporting.[16]

As there was no time period indicated in the questions in the baseline survey, this is difficult to compare to the midline survey, where a period of the previous three months was part of the question.

When asked about maternal death reporting in the SSIs, none of the respondents had encountered a maternal death.

> *"No, I don't have maternal death. Even last week I had a crucial case where I administered a dose, and maintenance dose, nothing happened, I called for an ambulance to come and take the client."* (ML P34 Health worker, non-TBA intervention chiefdom)

[16] Questions in the health worker survey who relate to this had no time period indicated at baseline, but this was changed at midline – where to each question about calling to various levels the addition "in the past three months" was added, thus making comparison between baseline and midline for these questions difficult.

5 Discussion and implications

This chapter discusses the findings in light of trends emerging, implications for stage two of the interventions (starting with health worker to client communication component in six additional chiefdoms (Wedge 2) and TBA involvement in the VPN in one more TBA chiefdom) and issues raised in relation to the end line research, including adaptation of some of the data collection tools.

5.1 Phone access and use

Mobile network coverage
Most (88%) of the health workers indicated that they had network coverage all or most of the time. Those who indicated they could not make or receive calls explained this was due to the distance they need to walk to get into an area with network coverage.

The qualitative data, that covered two of the 13 chiefdoms in the district, confirmed this finding. Network coverage was mentioned as a problem that occurred some of the time in some of the areas. Respondents suggested that network problems be discussed with mobile network providers. Although this is not within the scope of the current project to change, the MoHS may take this up with providers.

Access to the phone
Access to the facility phone was reported as good by many, but irregular by some, survey respondents. The latter already surfaced in supervision data that pointed to some in-charges taking the phone with them when leaving the facility. Although the qualitative data seem to indicate that the phone was available to all, we need to take into account a potential bias as interviewees were designed to be mostly in-charges. The guideline issued by the DHMT that facility phones should be accessible to all facility staff, all of the time, seems a good step that needs to be followed up.

Calling versus texting
Health workers, TBAs and clients had a clear preference for calling rather than texting. As well as the illiteracy of many of the female clients, health workers state not knowing how to text and being unable to read the small print. Also, text messages were seen as having the disadvantage of possibly reaching late (due to network coverage) and not getting an immediate response. This has implications for the design of future mHealth interventions.

Phone charging
Lack of electricity remains a barrier. The solar chargers were included in the intervention (for Wedge 1 chiefdoms) to address this problem, but often this did not work out due to technical problems with many of the chargers.

At baseline, 91% of health workers used to go elsewhere (and also pay) to charge their personal phones. The provision of a solar charger created expectations among Wedge 1 facility staff that were not met, which led to some level of dissatisfaction. A mere 30% of the Wedge 1 health workers (of which many from facilities that received a solar charger) said they charged the facility phone at the PHU. For Wedge 2 health staff (who in any case did not receive chargers), charging at home was easier for those located in Makeni town, because of the available electricity grid.

Health workers and TBAs who were faced with a non-functional charger were creative in finding alternative solutions, including paying for charging but also

using the Chief's generator and actually fixing the chargers (as one TBA did). The solar charger component needs revision, for example, by identifying higher-quality (but yet affordable) alternative chargers, making a generator available or including a budget line for charging elsewhere. The last two solutions are outside the scope of the project to implement in stage 2, while the search for better yet affordable solar chargers has not yet yielded results.

Personal expenses associated with work-related phone use
Apart from paying for charging (see above), there is a statistically significant difference in payment for phone credit for work-related purposes at midline between Wedge 1 and 2. More health workers paid in Wedge 2 (33%) compared to Wedge 1 (14%), which can partly be explained by the provision of phone credit to Wedge 1 staff to call clients. It appears that in three PHUs, all respondent staff were paying from their own pocket, implying they use their personal phones. Interviews indicate that this is mostly related to problems with charging the facility phone or the phone being dysfunctional.

Involvement of TBAs
The qualitative data indicate that the involvement of TBAs may overcome the lack of phone ownership among female health service clients and, at the same time, client concerns about confidentiality issues related to family planning.

One constraint identified was the problems some TBAs had to fully operate the phone. Follow-up through supportive supervision by PHU staff and emphasizing this aspect even more during the training of TBAs may overcome this.

Despite barriers mentioned, there was an overall increase in phone use, although with differences across wedges.

5.2 Health worker to client communication (research objective 1)

Communication with clients
The survey data show that the average frequency of calls to clients initiated by health workers increased, with 43% (midline) rather than 31% (baseline) now initiating such calls on a weekly basis or more often. The proportion of health workers reporting to 'never initiate calls' decreased by about a quarter.

Communication patterns between health workers and TBAs
The baseline to midline changes in frequency of calls between health workers and TBAs are puzzling. Data show that health workers both initiated less calls to TBAs and received less calls from TBAs in the midline, as compared to the baseline. Some increase had been expected after the provision of facility phones in general (both wedges) and to TBAs in one chiefdom (Wedge 1). The end line research may offer more clarity.

Reasons for calling
Across the various types of interview respondents, the two types of clients (pregnant women and family planning clients) and the two ways of initiating communication (by clients or by health workers/TBAs), roughly three reasons for communication were identified, although with some variation: (i) appointment reminders and follow-up, (ii) provision of health information on a range of topics and (iii) checking on clients' health status. Clients more than health workers reported receiving health information, while only health workers said they inquire about clients' health status. This finding may refer to an expectation from clients that health workers in any case tend to ask about how they are doing and ask about their health (without interpreting this as a specific reason for the call) but find the health information much more special. Health workers see it as their duty to inquire how clients are doing health-wise.

Increased utilization
HMIS/DHIS data tentatively show a higher increase in service utilization for Wedge 1 facilities than for Wedge 2 facilities, for five of ten indicators; two other indicators show the reverse while three show no difference. However as this is based on absolute client numbers and not service coverage data, additional data available for the end line study will need to establish whether there is a real difference in utilization between wedges.

Qualitative results point in that direction. During interviews health workers, DHMT members, clients and TBAs all indicated they observed an upward trend in utilization of services across the continuum of care for maternal health, and for some neonatal and child health services. Reasons provided for this increase are that clients are better informed about time and place of clinics, thus avoiding clients walking a considerable distance only to find staff are not available; and that alerting one person with a phone leads to others being informed (multiplier effect).

Quality of care
The progress achieved by introducing mobile phones contributes to improved perceptions of quality services, however for this also other aspects of service delivery may need to be enhanced, especially supplies availability, which is often seen as also important for perceived quality.

5.3 Health worker to health worker communication (research objective 2)

There are indications from the qualitative data that the improved communication opportunities, brought about by the interventions, allow health workers to consult more timely and fully with their supervisors and colleagues, without time or phone credit constraints. Consultations, among others, focus on getting clinical advice, which might improve quality of care (including timely and correct referral) and contribute to reducing maternal deaths.

Communication patterns among health workers
Health worker survey responses indicate changes in the baseline vs. midline proportions of staff initiating and receiving calls and text messages with the various staff levels: district management, chiefdom in-charge, own PHU in-charge and peers. However, trends are inconsistent overall and across wedges. Communication with DHMT staff improved in Wedge 1 but overall remained the same; communication with the chiefdom in-charges shows a very different pattern, with increases for both Wedge 2 and overall, but not Wedge 1. Improvements in communication with colleagues (peers) are only observed for Wedge 1, not Wedge 2 or overall. Again, the end line data may offer more insights.

The interview data allow identification of a number of reasons why health workers communicate with each other. Health workers in both chiefdoms mentioned they called other health staff to exchange ideas (with peers) and seek advice (from peers and seniors), in order to address problems, doubts and improve the quality of their work. The type of problems ranged from clinical advice to reporting. Other reasons included: staying updated on planned meetings, training workshops and program activities; supply chain management; and exchanging disease surveillance information.

Benefits of communication improvements
The expanded mobile phone communication options offer a number of benefits to health workers and TBAs, including reduced travel time and increased service utilization. These provide incentives for both groups and result in perceptions, as expressed by interviewees, of improvements: increased job

satisfaction, improved relationship and trust among health workers and between these and TBAs, improved attitudes of health workers towards clients, improved continuity of family planning services and treatment follow-up, and improved and more timely emergency care consultations and referral.

These qualitative data illustrate some of the results of the health workers survey (specific section on job-related satisfaction and control at work). The communication (with peers and seniors) domain results indicate significantly higher overall scores for the midline as compared to the baseline, with Wedge 1 having significant higher scores at midline as compared to Wedge 2 (midline) and Wedge 1 (baseline). Since both wedges experienced the same VPN intervention, the difference could be due to the client-communication intervention in Wedge 1, which may have caused staff to give more attention to the potential benefits of the VPN. However, this explanation is not sustained by the results of the working conditions domain, which in turn shows significantly higher scores at midline for Wedge 2 (as compared to the baseline); Wedge 1 does not show a midline-baseline difference.

Meanwhile, the quality of working life domain scores do not show a significant difference within or between wedges at baseline vs. midline or between baseline and midline overall.

The 'contacting clients is easy' statement shows significantly higher Wedge 1 midline scores as compared to Wedge 2 (midline) and Wedge 1(baseline). This can be explained by the introduction of the health worker to client communication scheme in Wedge 1, including the provision of monthly credit to facilities to contact clients.

The 'means to contact clients' statement shows a similar trend: while Wedge 2 had significantly higher scores at baseline, this difference disappeared at midline, with significantly higher scores for Wedge 1 at midline but also at midline overall.

5.4 Referral and maternal death reporting (research objectives 3 and 4)

The VPN system shows to be useful in a number of ways: it has strengthened ambulance referral, encouraged pre-referral discussions between service levels and thus better indications for referral, and led to better access to next-level staff.

Experience in the district suggests that, in the past and in absence of a facility phone, communication relied heavily on personal phones that were not always operational. The facility phone is thus leading to more timely access to the relevant person to discuss possible referral and, where needed, alert an ambulance. The discussion of the signs and symptoms via the phone potentially improves accurate indications for referral.

The number of maternal death reports did go up in the first half year of the intervention. As maternal deaths are known to be grossly underreported in Bombali, the increased reporting most likely means exactly that (improved reporting of deaths) and not that there was an actual increase in maternal deaths. This is confirmed by observations emerging from the qualitative data, where respondents report a perceived decrease in maternal deaths.

5.5 Implication for the health system (research objective 5)

The midline research findings and related discussion hints to a number of considerations that relate to the health system. These will be tabled once the

full set of data, including the end line results, are available and implications become clearer.

5.6 Implications for intervention and research

The stage 1 experiences and midline research findings have implications for stage 2 interventions and the end line research design.

Stage 2 interventions
Based on the referral communication findings, the stage 2 intervention regarding VPN will include a mobile phone for the Kamakwie ambulance.

In view of the disappointing experiences with the solar chargers by Wedge 1 PHUs, adequate solutions are needed before introducing this intervention component among Wedge 2 PHUs.

The training design for Wedge 2 PHU staff and TBAs, dealing with all district-level interventions (VPN, VPN for TBAs and health worker to client communication) will be adapted, as compared to the Wedge 1 training. This will aim to strengthen TBA phone use, and client enrolment and follow-up registration by facility staff. Also, supervision and monitoring will be intensified, combining supportive supervision and monitoring through field visits (where possible by a combined team of DHMT and project staff) with remote monitoring and mentoring by phone contact.

Coordination with the DHMT team will be done to follow-up on the instruction that facility phones should be accessible to all facility staff all of the time.

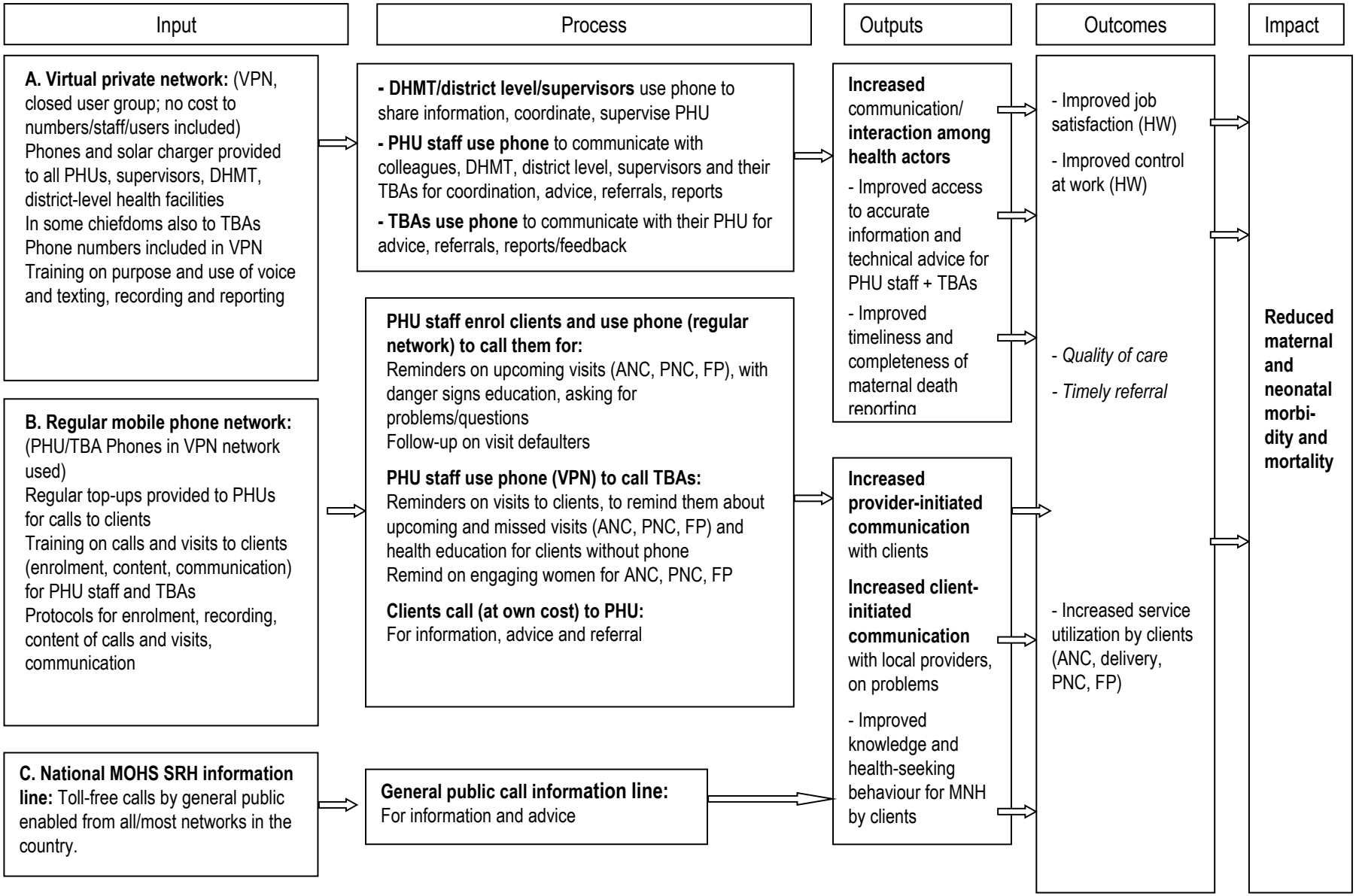
End line research
Implications for end line research mainly relate to changes in the use of tools. Although, in principle, the end line health worker questionnaire survey will be the same as the midline tool, the midline analysis showed that some changes would be necessary i.e. adding specific questions to ensure end line evaluation of interventions.

Regarding qualitative tools, midline research experiences and quality assurance mechanisms identified the need to emphasize more adequate probing during interviews. This will be addressed during end line data collectors' training.

The separate interviews with non-enrolled eligible clients will no longer be pursued during the end line, based on the midline difficulties to identify respondents. We will aim to obtain the information expected from these respondents through the focus group discussions with community members, planned for the end line.

During interviews with DHMT staff and health workers, more emphasis will be placed on maternal death reporting and MNH referral systems. This implies expanding the topic guide with specific issues related to changes as compared to the pre-VPN situation.

Annex 1 – Intervention logic diagram



Annex 2 – Phase 2 intervention study research table

Objectives	Indicators, variables, issues	Research methods	Data collection tools	Research participants
1. To assess changes in MNH/FP service utilization by clients, associated with expanded options for client-initiated and provider-initiated mobile communication: a. for entire district (engaging all PHUs and through the national information line) b. in the selected chiefdoms that implement the intervention involving TBAs	Average gestation stage of pregnant woman at first ANC visit	PHU records analysis and calculations	DAT-1 Data collection tool for PHU/DHMT records	All PHUs in one TBA intervention chiefdom and one TBA comparison (non-intervention) chiefdom. Purposive sampling of TBA intervention chiefdom, pairing with comparable comparison chiefdom.
	Percentage of pregnant women having 1, 2, 3 or 4 ANC visits	HMIS data analysis and calculations	District-level HMIS data records	All PHUs in Bombali district
	Percentage of pregnant women with delivery at health facility	HMIS data analysis and calculations	District-level HMIS data records	All PHUs in Bombali district
	Percentage of pregnant women having 1,2 or 3 PNC visits	HMIS data analysis and calculations	District-level HMIS data records	All PHUs in Bombali district
	Number of new FP clients enrolled and existing clients who continue	HMIS data analysis	District-level HMIS data records	All PHUs in Bombali district
	Number of clients enrolling in mobile phone reminders (with registry of being contacted and their response)	PHU records analysis and calculations	DAT-3 Data collection tool for PHU/DHMT records	All intervention PHUs (step-Wedge sequence)
	Client views on client-initiated and provider-initiated communication; and related improvements in access to information, advice and referral and perceived changes in health-seeking behaviour (including national information line, client calls to PHUs and interaction/communication)	Semi-structured interview	SSI-1 Interview guide clients enrolled mobile phone reminders	Total 25–30 clients enrolled in mobile phone reminders, divided over responders (clients who could be reached) and non-responders (clients who could not be reached by phone or who were reached but declined to talk to the HW); from 8 different PHU catchment areas (2 urban, 2 semi-urban, 2 remote, 2 near the feeder road)

Objective 1 (see above)	Community views on client-initiated and provider-initiated communication; and related improvements in access to information, advice and referral an perceived changes in health-seeking behaviour (including national information line, client calls to PHUs and interaction/communication)	Focus group discussion	FGD-1 Topic guide community	4 PHUs catchment areas selected (1 urban, 1 semi-urban, 1 remote, 1 near the feeder road). Each area 1 male and 1 female FGD, total 4 F + 4 M = 8 FGDs; each with about 8–10 participants
	Non-enrolled women's views on improved communication options, whether they have made use of them, whether have been reached by HW/TBAs, and why this has not led to them using relevant services	Semi-structured interview	SSI-6 Topic guide non-enrolled clients	20–25 pregnant women who were eligible (=having (access to) a phone) but declined, from same 8 different PHU catchment areas as SSI-1.
	TBA views on usefulness of phones to strengthen their work and improve clients' earlier use of services and self-reported changes (including national information line, client calls to PHUs and interaction/communication)	Semi-structured interview	SSI-2 Interview guide TBAs	15 TBAs with intervention phone in TBA intervention area (from 4–6 different PHUs)
	HW views on client-initiated and provider-initiated communication; and related options to improve clients' use of services and self- reported changes	Semi-structured interview	SSI-3 Interview guide HW	Total 15–20 health staff (working at PHUs, various levels of staff; from same chiefdoms of SSI-1, SSI-6 and FGD-1) until no new information emerges for both intervention and non-intervention areas
		Survey	SUR-1 Questionnaire HW	All PHU clinical health workers in Bombali District (includes MCH Aides, SECHNs, CHOs, CHAs), total around 150

Objective 1 (see above)	Health manager (HM) views on client-initiated and provider-initiated communication; and related options to improve clients' use of services and self-reported changes	Semi-structured interview	SSI-4 Interview guide HM	Total 5 district health managers (various types, e.g. DMO, DHS, M&E officer, Hospital manager etc.)
	Male partners' perspectives on benefits and issues regarding their wives' more intense involvement in communication with health staff	Semi-structured interview	SSI-5 Interview guide male partners	Total 20–25 male partners of female clients enrolled in mobile phone reminders (but not partners of female clients interviewed)
2. To assess changes in health workers' job satisfaction and control at work, and self-reported changes due to expanded options for provider–provider communication	HW use of mobile communication options; perceptions on benefits and challenges of the new options available; on improvements in their job satisfaction and control at work; and ultimate benefits to clients	Survey	SUR-1 Questionnaire HW	All PHU clinical health workers in Bombali district (includes MCH Aides, SECHNs, CHOs, CHAs)
	Same – more in-depth	Semi-structured interview	SSI-3 Interview guide HW	Total 15–20 health staff (working at PHUs, various levels of staff; from same chiefdoms of SSI-1, SSI-6 and FGD-1) until no new information emerges for both intervention and non-interventions areas
		Semi-structured interview	SSI-4 Interview guide HM	Total 5 district health managers (various types, e.g. DMO, DHS, M&E officer, Hospital manager etc.)
3. To assess changes in MNH referral systems due to expanded mobile communication options	Perceptions of clients, HW and health managers	Semi-structured interview	SSI-1 Interview guide clients	Total 25–30 clients enrolled in mobile phone reminders, divided between responders (clients who could be reached) and non-responders (clients who could not be reached by phone or who were reached but declined to talk to the HW); from 8 different PHU catchment areas (2 urban, 2 semi-urban, 2 remote, 2 near the feeder road)

		Semi-structured interview	SSI-2 Interview guide TBAs	15 TBAs with intervention phone in TBA intervention area (from 4–6 PHUs)
		Semi-structured interview	SSI-3 Interview guide HW	Total 15–20 health staff (working at PHUs, various levels of staff; from same chiefdoms of SSI-1, SSI-6 and FGD-1) until no new information emerges for both intervention and non-interventions areas
4. To assess changes in maternal death reporting	Number of maternal deaths reported	PHU/DHMT records analysis and calculations	DAT-2 Data collection tool for PHU/DHMT records	All PHUs and DHMT M&E office
	TBA views and self-reported changes in reporting of maternal deaths	Semi-structured interview	SSI-2 Interview guide TBAs	15 TBAs with intervention phone in TBA intervention area (from 4–6 PHUs)
	HW views and self-reported changes in reporting of maternal deaths (including timeliness)	Semi-structured interview	SSI-3 Interview guide HW	Total 15–20 health staff (working at PHUs, various levels of staff; from same chiefdoms of SSI-1, SSI-6 and FGD-1) until no new information emerges for both intervention and non-interventions areas
	HM views and self-reported changes in reporting of maternal death (including timeliness)	Semi-structured interview	SSI-4 Interview guide HM	Total 5 district health managers (various types, e.g. DMO, DHS, M&E officer, Hospital manager etc.)
5. To identify implications for the health system of mobile communication initiatives	Facilitating and constraining factors in implementation of the various mHealth applications	Semi-structured interview	SSI-3 Interview guide HW	Total 15–20 health staff (working at PHUs, various levels of staff; from same chiefdoms of SSI-1, SSI-6 and FGD-1) until no new information emerges for both intervention and non-interventions areas
		Semi-structured interview	SSI-4 Interview guide HM	Total 4–5 district health managers (various types, e.g. DMO, DHS, M&E officer, Hospital manager etc.)
		Semi-structured interview	SSI-4 Interview guide HM	Total 2–3 mHealth system managers (from RH/FP programme and Department of Planning and Information)

Annex 3 – Overview data collection plan and variation

Data collection – plan and variation (+ = implemented as planned; [+] = planned but changed)

Plan and variation						Comments
Tool	Code	Participants	Baseline	Midline	End line	
Qualitative semi-structured interviews	SSI 1	Clients enrolled		+	+	Completed as planned
	SSI 2	TBAs (TBA intervention area)		+	+	Completed as planned
	SSI 3	Health workers		+	+	Completed as planned
	SSI 4	Health managers		+ District level	+ Distr+nat level	Completed as planned
	SSI 5	Male partners of enrolled clients			+	Completed as planned
	SSI 6	Eligible non-enrolled clients		[+]	[+]	Adapted: planned but unable to collect at midline; thus discontinued at end line; information aimed for collected via end line community FGDs
Qualitative FGD	FGD 1	Community (male and female)			+	Completed as planned; expanded as indicated above
Quantitative survey	SUR-1	Health workers	+	+	+	Completed as planned
Other quantitative data collection	DAT-1	PHUs (gestation age at ANC1) in TBA interv./comp. areas	+	[+]	[+]	Discontinued after baseline, as data collected proved unreliable
	DAT-2	PHUs (Maternal death reports)	+	+	+	Completed as planned
	DAT-3	PHUs (nr. Clients enrolling)		+	+	Completed as planned
	DAT-4	Facility information questionnaire	+			Completed as planned
	DAT-5	Data collection re. national information line		[+]	+	Only end line, as phone line implementation suffered delays (outside influence of project)
Other		HMIS / DHIS PHU service utilization (ANC1-4,facility delivery, PNC1-3, FP (new/continuing))	+ Apr11-Jul12 (pre-interv.)	[+/-] Aug-Dec12 and [Jan13] (6 months)	[+] [Feb-Jul13] (6 months)	Baseline completed. Midline completed 84% (1 month pending). End line incomplete (6 months pending).
		Intervention supervision records	Continuous			Completed
		PHU monthly mHealth summary reports	Continuous			Received from many but not all PHUs
		PHU mHealth client enrolment and follow-up registers			+	Received from many but not all PHUs and quality irregular

Annex 4 – Midline health workers questionnaire

Interview Code:			Interviewer's initials:
Health Workers Questionnaire for Midline ***SUR 1-mHealth phase 2***			
Date:	*Write DD/MM/YYYY*	|___|___| / |___|___| / |___|___|___|___|	
Chiefdom:	1=Bombali Sebora 2=Makari Gbanti 3=Libiesaygahun 5=Safroko Limba 4=Paki Masabong 6=Biriwa 7=Gbendembu Ngowahun	8=Magbaimba Ndowahun 9=Sanda Tendaren 10=Sanda Loko 11=Sella Limba 12=Tambaka 13=Gbanti Kamaranka	|___|___|
Name of facility:	*(please write carefully, spell correctly)*	*……*	
Type of health facility:	☐ ☐ ☐ ☐	*1=CHC* *2=CHP* *3=MCHP* *9=Other, specify* *……*	|___|
Section I: Information Health Worker			
1.1	Type of (clinical)health worker *This category includes health workers who provide antenatal, delivery, postnatal and Family Planning services and does <u>not</u> include Community Health Workers, porter, vaccinators etc.*	☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=CHO* *2=CHA* *3=SECHN* *4=MCH aide* *5=EDCU assistant* *6=Nursing aide* *9=Other, specify* *……* |___|
1.2	Are you the in-charge of the facility?	☐ ☐	*1=YES* *2=NO* |___|
1.3	Are you on the government payroll?	☐ ☐	*1=YES* *2=NO* |___|
1.4	Sex of respondent	☐ ☐	*1=Female* *2=Male* |___|
1.5	Age of respondent	*In whole years at last birthday*	|___||___|
1.6	Do you have children?	☐ ☐	*1=YES → Go to 1.6.1* *2=NO → Go to 1.6.4* |___|
1.6.1	How many children do you have?	*Fill in number …….*	|___||___|
1.6.2	How many children are below the age of 18?	*Fill in number …….*	|___|
1.6.3	How many children below the age of 18 are <u>NOT</u> living with you?	*Fill in number …….*	|___|

1.6.4	How many months have you worked in this facility?	☐ ☐ ☐	*1=Less than one month* *2=Between 1-3 months* *3=3 months or more*	|___| |___| |___|
Section II: Mobile Phone Use				
2.1	What mobile phone network is available in your PHU area? *(multiple answers allowed)*	☐ ☐ ☐ ☐	*1=Airtel* *2=Africell* *3=Comium* *4=Sierratel*	|___| |___| |___| |___| *Fill in code if ticked*
2.2	Are you able to make/send and receive phone calls and text messages <u>inside the PHU</u>?	☐ ☐	*1=YES →Go to 2.3* *2=NO→ Go to 2.2.1*	|___|
2.2.1	How many minutes do you need to walk to reach a place with network coverage?	*Number of minutes*		|___|___|
2.3	Indicate how often you have network coverage at your normal calling spot.	☐ ☐ ☐ ☐	*1=All the time* *2=Most of the time* *3=Sometimes* *4=Almost never*	|___|
2.4	Indicate which statement reflects your work related use of the telephone	☐ ☐ ☐	*1=I call more often than I send text messages* *2=I call and send text messages about the same amount of times* *3=I send text messages more often than I call*	|___|
2.5	Do you make use of a phone that is provided to the facility (this is not a personally owned phone) for work related calls and text messages?	☐ ☐	*1=YES → Go to 3.1* *2=NO → Go to 2.5.1*	|___|
2.5.1	If you are <u>not</u> using a facility phone, how do you **make** work-related phone calls and text messages? *(multiple answers allowed)*	☐ ☐ ☐ ☐ ☐	***1=Do not make them*** *2=<u>Personal phone</u>* *3=<u>Phone from other health worker/volunteer in clinic</u>* *4=<u>Phone from someone else</u>* *9=<u>Other, specify</u>* ……..	|___| |___| |___| |___| |___| *Fill in code if ticked*
2.5.2	If you are <u>not</u> using a facility phone, how do you **receive** work related phone calls and text messages? *(multiple answers allowed)*	☐ ☐ ☐ ☐ ☐	***1=Do not receive them*** *2=<u>Personal phone</u>* *3=<u>Phone from other health worker/volunteer in clinic</u>* *4=<u>Phone from someone else</u>* *9=<u>Other, specify</u>* ……..	|___| |___| |___| |___| |___| *Fill in code if ticked*

NOTE: If 2.5.1 AND 2.5.2 are **BOLD ANSWERS** → Go to 5.1 If 2.5.1 is **BOLD ANSWER** and 2.5.2 is <u>underlined answer</u> → Go to 4.1a Otherwise continue to next section → 3.1a				
Section III: Making calls and text messages				
3.1a	How often do you **make** work related phone calls *in the past 3 months?*	☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks (<u>includes never</u>)* *6=Do not know/not sure*	 |___|
3.1b	How often do you **send** work related text messages *in the past 3 months*?	☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks (<u>includes never</u>)* *6=Do not know/not sure*	 |___|
District Level				
3.2	How often do you **make** work-related calls/text messages to someone at the district level *in the past 3 months*?	☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks* *6=Never → Go to 3.3* *7=Do not know/not sure*	 |___|
3.2.1	Who do you call/text at the district level *in the past 3 months*? *(multiple answers allowed)*	☐ ☐ ☐ ☐ ☐ ☐	*1=DMO* *2=DHS* *3=M&E Officer* *4=Coordinator MCH Aide training* *5=Other DHMT member, specify* …… *9=Other person(s), specify* ……	|___| |___| |___| |___| |___| |___| *Fill in code if ticked*
3.2.2	For what reasons do you **make** work-related calls/text messages to someone at the district level *in the past 3 months*? *(multiple answers allowed)*	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Ambulance referral* *2=Clinical advice* *3=Surveillance (notifiable diseases)* *4=HMIS information/data* *5=Drugs and supplies* *6=Informing about staff human resources issues (sickness, absence, leave)* *7=Reporting maternal death* *9=Other, specify* ……	|___| |___| |___| |___| |___| |___| |___| |___| *Fill in code if ticked*

PHU Level				
If the respondent in an in-charge → Go to 3.4				
3.3	How often do you **make** work-related calls/text messages to your in-charge of your own PHU *in the past 3 months*?	☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks* *6=Never → Go to 3.4* *7=Do not know/not sure*	|___|
3.3.1	For what reasons do you **make** work-related calls/text messages to the in-charge at your own PHU *in the past 3 months*? *(multiple answers allowed)*	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Ambulance referral* *2=Clinical advice* *3=Surveillance (notifiable diseases)* *4=HMIS information/data* *5=Drugs and supplies* *6=Informing about staff human resources issues (sickness, absence, leave)* *7=Reporting maternal death* *9=Other, specify* ……	|___| |___| |___| |___| |___| *Fill in code if ticked*
If the respondent is an in-charge at a CHC → Go to 3.5				
3.4	How often do you **make** work-related calls/text messages to your in-charge of the CHC in your chiefdom *in the past 3 months*?	☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks* *6=Never → Go to 3.5* *7=Do not know/not sure*	|___
3.4.1	For what reasons do you **make** work-related calls/text messages to the in-charge of the CHC in your chiefdom *in the past 3 months*? *(multiple answers allowed)*	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Ambulance referral* *2=Clinical advice* *3=Surveillance (notifiable diseases)* *4=HMIS information/data* *5=Drugs and supplies* *6=Informing about staff human resources issues (sickness, absence, leave)* *7=Reporting maternal death* *9=Other, specify* …… ……	|___| |___| |___| |___| |___| |___| |___| |___| *Fill in code if ticked*
3.5	How often do you **make** work-related calls/text messages to other PHU staff *in the past 3 months?* (others than mentioned above)	☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks* *6=Not at all → Go to 3.6* *7=Do not know/not sure*	|___|

3.5.1	For what reasons do you **make** work-related calls/text messages to other PHU staff (others than mentioned above) *in the past 3 months*? *(multiple answers allowed)*	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Ambulance referral* *2=Clinical advice* *3=Surveillance (notifiable diseases)* *4=HMIS information/data* *5=Drugs and supplies* *6=Informing about staff human resources issues (sickness, absence, leave)* *7=Reporting maternal death* *9=Other, specify* …… ……	|___| |___| |___| |___| |___| |___| |___| |___| *Fill in code if ticked*
Community Level				
3.6	How often do you **make** work-related phone calls/text messages to clients *in the past 3 months*?	☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks* *6=Not at all → Go to 3.7* *7=Do not know/not sure*	|___|
3.6.1	For what reasons do you **make** work-related calls/text messages to clients *in the past 3 months*? *(multiple answers allowed)*	☐ ☐ ☐ ☐	*1=Remind about upcoming appointments* *2=Inform about missed appointments* *3=Follow-up* *9=Other, specify* …….. ……	|___| |___| |___| |___| *Fill in code if ticked*
3.7	How often do you **make** work-related phone calls/text messages to TBAs *in the past 3 months*?	☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks* *6=Not at all → Go to 3.8* *7=Do not know/not sure*	|___|
3.7.1	For what reasons do you **make** work-related calls/text messages to TBAs *in the past 3 months*? *(multiple answers allowed)*	☐ ☐ ☐	*1=Inform about meetings and workshops* *2=Request for come help out at clinic* *9=Other, specify* …… ……	|___| |___| |___| *Fill in code if ticked*
3.8	Do you receive work related phone calls /text messages?	☐ ☐	*1=YES → Continue* *2=NO → Go to 5.1*	|___|

Section IV: Receiving calls and text messages				
4.1a	How often do you **receive** work related phone calls *in the past 3 months*?	☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks (includes never)* *6=Do not know/not sure*	|___|
4.1b	How often do you **receive** work related text messages *in the past 3 months*?	☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks (includes never)* *6=Do not know/not sure*	|___|
District Level				
4.2	How often do you **receive** work-related calls/text messages from someone at the district level *in the past 3 months*?	☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks* *6=Not at all → Go to 4.3* *7=Do not know/not sure*	|___|
4.2.1	Who do you **receive** the work-related calls/text messages from at the district level *in the past 3 months*?	☐ ☐ ☐ ☐ ☐ ☐	*1=DMO* *2=DHS* *3=M&E Officer* *4=Coordinator MCN Aide training* *5=Other DHMT member, specify* …… *9=Other person(s), specify* ……	|___| |___| |___| |___| |___| |___| *Fill in code if ticked*
4.2.2	For what reasons do you **receive** work-related calls/text messages from someone at the district level *in the past 3 months*? *(multiple answers allowed)*	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Ambulance referral* *2=Clinical advice* *3=Surveillance (notifiable diseases)* *4=HMIS information/data* *5=Drugs and supplies* *6=Informing about staff human resources issues (sickness, absence, leave)* *7=Reporting maternal death* *9=Other, specify* ……	|___| |___| |___| |___| |___| |___| |___| |___| *fill in code if ticked*

PHU Level				
If the respondent in an in-charge → Go to 4.4				
4.3	How often do you **receive** work-related calls/text messages from your in-charge of your own PHU *in the past 3 months*?	☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks* *6=Not at all → Go to 4.4* *7=Do not know/not sure*	|___|
4.3.1	For what reasons do you **receive** work-related calls/text messages from the in-charge at your own PHU *in the past 3 months*? *(multiple answers allowed)*	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Ambulance referral* *2=Clinical advice* *3=Surveillance (notifiable diseases)* *4=HMIS information/data* *5=Drugs and supplies* *6=Informing about staff human resources issues (sickness, absence, leave)* *7=Reporting maternal death* *9=Other, specify* ……	|___| |___| |___| |___| |___| |___| |___| |___| *Fill in code if ticked*
If the respondent is an in-charge at a CHC → Go to 3.5				
4.4	How often do you **receive** work-related calls/text messages from your in-charge of the CHC in your chiefdom *in the past 3 months?*	☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks* *6=Not at all → Go to 4.5* *7=Do not know/not sure*	|___|
4.4.1	For what reasons do you **receive** work-related calls/text messages from the in-charge of the CHC in your chiefdom *in the past 3 months*? *(multiple answers allowed)*	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Ambulance referral* *2=Clinical advice* *3=Surveillance (notifiable diseases)* *4=HMIS information/data* *5=Drugs and supplies* *6=Informing about staff human resources issues (sickness, absence, leave)* *7=Reporting maternal death* *9=Other, specify* ……	|___| |___| |___| |___| |___| |___| |___| |___| *Fill in code if ticked*
4.5	How often to you **receive** calls/text messages from other PHU staff (others than mentioned above) *in the past 3 months?*	☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks* *6=Not at all → Go to 4.6* *7=Do not know/not sure*	|___|

4.5.1	For what reasons do you **receive** calls/text messages from other PHU staff (others than mentioned above) *in the past 3 months?* *(multiple answers allowed)*	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Ambulance referral* *2=Clinical advice* *3=Surveillance (notifiable diseases)* *4=HMIS information/data* *5=Drugs and supplies* *6=Informing about staff human resources issues (sickness, absence, leave)* *7=Reporting maternal death* *9=Other, specify* …… ……	|___| |___| |___| |___| |___| |___| |___| |___| *Fill in code if ticked*
Community Level				
4.6	How often do you **receive** work-related phone calls/text messages from clients *in the past 3 months*?	☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=less than every two weeks* *6=Not at all → Go to 4.7* *7=Do not know/not sure*	|___|
4.6.1	For what reasons do you **receive** work-related calls/text messages from clients *in the past 3 months*? *(multiple answers allowed)*	☐ ☐ ☐ ☐	*1=Advice about illness* *2=Inform about missed appointment* *3=Make appointment* *9=Other, specify* …… ……	|___| |___| |___| |___| *Fill in code if ticked*
4.7	How often do you **receive** work-related phone calls/text messages from TBAs *in the past 3 months*?	☐ ☐ ☐ ☐ ☐ ☐ ☐	*1=Daily* *2=Several times a week* *3=Once a week* *4=Once every two weeks* *5=Less than every two weeks* *6=Not at all → Go to 5.1* *7=Do not know/not sure*	|___|
4.7.1	For what reasons do you **receive** work-related calls/text messages from TBAs *in the past 3 months*? *(multiple answers allowed)*	☐ ☐	*1=Request to help with difficult case (including referral)* *9=Other, specify* ……	|___| |___| *Fill in code if ticked*

Section V: Mobile Phone Barriers				
5.1	Do you have to pay for work-related phone calls/text messages?	☐ ☐	*1=YES → Go to 5.1.1* *2=NO → Go to 5.2*	|___|
5.1.1	How much do you pay per week for work related phone calls/text messages	*Le……*		
5.1.2	Who pays the costs of work-related phone calls/text messages? *(multiple answers allowed)*	☐ ☐ ☐ ☐	*1=Myself* *2=PBF fund* *3=Other non-personal funds* *9=Other, specify* *……*	|___| |___| |___| |___| *Fill in code if ticked*
5.1.3	How do you buy credits (top-up) for the phone?	☐ ☐ ☐ ☐	*1=Buying phone voucher* *2=Buying top-up card* *3=Both answers above* *4=Other, specify* *……..*	 |___|
5.1.4	How far do you have to walk to buy top up credits for the phone?	Number of minutes ……..		|___||___|
5.2	How can you charge the phone that you use for work related calls/text messages?	☐ ☐ ☐	*1=Charge at PHU* *2=Charge at home* *3=Charge somewhere else*	 |___|
5.3	Do you pay to have the phoned charged?	☐ ☐	*1=YES → 5.3.1* *2=NO → 6.1*	 |___|
5.3.1	How much do you pay to have the phone charged?	*Fill in SLL* ……		
Section VI: Satisfaction and Communication				
6.1	My employer provides me with me with what I need to do my job effectively	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	 |___|
6.2	It is easy for me to get information to the DHMT on time	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	 |___|
6.3	I am more productive than other people who do a similar job to me	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	 |___|
6.4	I am able to discuss difficult cases with other colleagues	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	 |___|

6.5	The working conditions are satisfactory	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.6	Contacting DHMT members in no problem for me	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.7	The people who are important to me outside of my work support my work commitments	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.8	Patients show appreciation for what I do for them	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.9	I enjoy my work	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.10	The facility I work in offers enough space to do the work	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.11	I feel motivated to do my best in my current job	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.12	Communicating with other colleagues helps me in my work	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.13	Overall, taking everything into consideration, I am satisfied with my job as a whole	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.14	The DHMT contacts me to get my input on certain issues	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.15	I work in a safe environment	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|

6.16	Contacting individual clients in the community for ANC, FP and other services is easy	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.18	I am satisfied with the overall quality of my working life	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.19	Essential drugs are available	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.20	My colleagues contact me to get my opinion on certain issues	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.21	I have the means to contact individual clients directly	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|
6.22	I am able to achieve a healthy balance between my work and home life	☐ ☐ ☐ ☐ ☐	*1=Strongly disagree* *2=Disagree* *3=Neutral* *4=Agree* *5=Strongly agree*	|___|

Annex 5 – Topic guide Enrolled Client

Topic guide for semi-structured interviews with enrolled Clients (SSI-1)

Go through informed consent procedure and ask for the form to be signed or thumb printed, then start the interview.

Code	
Date / Time	
Name moderator / signature	
Name recorder / signature	
Name transcriber / signature	
Chiefdom / community	
Duration	
Language of interview	
General comments	

PERSONAL DATA RESPONDENT (circle answer)

A1) Name facility / A2) Type of facility	
B) Age: (*in whole years*)	
C) Education:	
D) Mother tongue:	
E) Walking distance from home to facility *(minutes)*	
F) Were you asked by the health worker if you wanted to be called using a mobile phone	Yes / No **(If no, end interview)**
G) Reason for visit to PHU when asked by health worker if you could be called	ANC / FP / other:……
H) Did you agree to be phoned by the health workers?	Yes / No **(If no, end interview)**
I) If yes, whose phone did you agree to in order to receive calls/text messages from health workers?	- Own phone - TBA phone *(only in TBA chiefdom)* - Someone else's phone and relationship to person with phone: ……
J) **If recruited during ANC:** How many ANC visits did you attend?	1, 2, 3, 4, 4+
K) **If recruited during ANC and still pregnant:** How many months/weeks pregnant?	……. months
L) **If recruited during ANC and delivered:** Where did you deliver?	home / facility / other: ……
M) **If recruited during ANC and delivered**: How long ago did you give birth?	…….. weeks
N) **If recruited during ANC or after delivery:** How many times did you visit the health centre for check-up after delivery	1, 2, 3, >3
O) **If recruited during FP:** Was this your first visit?	Yes / No
P) **If recruited during FP:** Do you still use family planning (a contraceptive)?	Yes / No
Q) How often were you **called** by the health worker?	…… **(If not one time, end interview)**

(NOTE TO INTERVIEWERS: Some questions are for all respondents and some are different depending on how the client receives calls from the health worker (question I on cover page). Follow the question numbers and use the question in the appropriate column where there is a choice of questions.

Mobile phone coverage and use (general)

1. How would you describe the mobile health network coverage in your area?
2. Which service provider/network is available in your area?

Own mobile phone	**Someone else's phone**	**TBA phone**
3. How is the phone you use being charged? Where can this be done? *(Probe how far away this is, and how much it costs and how they feel about this)*		
	4b. When you receive a phone call or text message from the health worker, whose phone is being used*?* Why this person's phone? *(Probe: for reasons why this phone number was used)*	4c. Why did you choose to receive calls on the TBA's phone? *(Probe why is this different than using a phone from someone in the family)*
	5b. What is good about being reached through someone else's phone?	5c. What is good about being reached through someone else's phone?
	6b. What is difficult about being reached through someone else's phone?	6c. What is difficult about being reached through someone else's phone?

Receiving calls from health workers

7. Before this programme, were you ever called by a health worker?

If yes, why did a health worker contact you? *(probe reasons: to give health information, to inform about appointment, to ask about missed appointment, to ask about heath-follow up to visit)*

How did you respond to this? Did this influence your decision to sign up for this programme?

Own mobile phone	**Someone else's phone**	**TBA phone**
8a. Were you ever called by the health worker and you were not able to take the call? If yes, why did this happen, what did you do afterwards and why?	8b. Did it ever happen that you were called by the health worker and you did not get the message or got it much later? If yes, why did this happen, what did you do afterwards and why? How did you feel about this?	8c. Did it ever happen that you were called by the health worker and you did not get the message or got it much later? If yes, why did this happen, what did you do afterwards and why? How did you feel about this?

9. Did the phone call from the health worker influence your actions regarding your health in any way? If yes, in what way? (*Probe: decide to go to clinic, follow advice)*
10. Can you think of anything else that happened because of the phone calls? What ? How? Can you give an example?
11. Can you think of anything you learned from the phone contact with the health workers *(Probe: what did they learn , give examples, why was this important, how did they feel about this)*

Calling health workers

9. Did you receive a telephone number to call the health worker?
10. If yes, did you ever use this phone number to call/text or flash the health worker?
11. Did you use yours/or someone else's phone to call/text the health worker?
    - If no, how did you know (in the past) who to call/text and at which number?

- If yes, why did you call and tell me what happened. *Probe about the reason(s) (information, delivery, emergency) what was said by the health worker and what the client did with the information.*
- Did you get what you needed from the health worker *(advice, help, instructions)*
- How did it feel to have a phone number of the health worker to call?

National free telephone line

12. Have you ever heard about the national free telephone line for complaints about Free Health Care and information about *Belle woman/pikin well-bodi* business? If yes, did you ever use it?
    - If yes, what question did you ask? How did you feel about the response? In what way has the answer influenced what you did afterwards? *Explore why.*
13. Do you know anybody who has used the national information line? If yes, Do you know why they used it? Do you know if they were happy with it?

General

14. Do you prefer to be **called** or **texted** by the health worker? *Probe why or why not for each answer*
15. Do you prefer **to call** or **to text** or **to flash** the health worker? *Probe why or why not for each answer*
16. Is there anything else you would like to say about health workers having a mobile phone to call clients or be called by clients?

Thank you very much for your willingness to take part in the interview.

Annex 6 – Topic guide TBA

Topic guide for semi-structured interviews with TBAs (SSI-2)

Go through informed consent procedure; fill in the personal data sheet, then start the interview.

Code	
Date / Time	
Name moderator / signature	
Name recorder / signature	
Name transcriber / signature	
Chiefdom / community	
Duration	
Language of interview	
General comments	

PERSONAL DATA RESPONDENT (*circle answer)*

Age *(in whole years)*	
Years of experience *(in whole years)*:	
Name / type of facility you are attached to	/ CHC, CHP, MCHP
How much time does it take to walk from your community to the PHU? *(minutes)*	
Mother tongue:	
Did you receive a work mobile phone to be in contact with the PHU?	Yes / No **(If no, end interview)**
When did you get the phone?	Month: Year:
Did you receive a solar charger?	Yes / No
Did you get an orientation training or receive an explanation on how to use the phone/charger?	Yes / No

Mobile phone coverage and use

1. How would you describe the mobile phone network coverage in your area? Which service provider/network is available in your area?
2. Do you have a personal phone? Do you ever use this phone for work related issues? Do you use someone else's phone for work related issues? If yes, what kind of work issues do you use these phones for? *(Probe: why they are not using the work phone)*

The rest of the interview is only about using the work phone received for the mHealth programme

3. You have said that you received a work mobile phone to communicate with the PHU you are attached to. How do you keep this work phone charged? Where can this be done? *(Probe about solar charger, where else they charge and how far away this is and how much this costs. Probe how they feel about each answer)*

Making calls to health workers with the work phone

4. Who have **you called** with the work phone in the past three months? *For each answer ask who they called and why and if they got the response they wanted, needed or expected. (remember to probe about other reasons besides reaching clients)*
5. Have you encountered any problems barriers to calling health workers using the work mobile phone? Give examples of what and why
6. Since you have a work phone to call with health workers, has work been different? What is different and give example(s) of what has changed. *Probe for each change mentioned: give an example; what things caused the change? How did this work? Why? (some examples: more information, better relationship, not arriving at empty facility…)*
7. Since you have a work phone, have you used it to refer clients? *If yes, probe for details: ask to tell the story of how this happened and follow the timeline asking what happened and what did you do then. Ask what they would have done if they did not have the phone (or in the past).*
8. Do you think that the use of the work phone to call health workers has made the care you give better? If yes in what way? Explain how the phone has caused this? Are there any other things that happened that influenced this?
9. Do clients ever ask you to call the facility for them/or ask to use your phone to call themselves? Do you know why clients call the PHU? Give examples. *(probe how they feel about that)*

Receiving calls from health workers with the work phone

10. Do you receive calls from health workers on your phone? If no, why not? If yes, who has **called you** on the work phone in the past three months? *For each answer ask who called them and why. Did they always understand what the health workers called for?*
11. How often do you receive calls from health workers who want to reach a client in the community? How do feel about this? How do you respond to this *(Probe: possible answers as, go immediately to client or later when there is time)*
12. Since you receive calls on the work phone from health workers, do you work differently than before? *(Probe: how and what has changed and ask for examples and especially how the change is linked to the phone. Ask for more examples and if no new information emerges probe with the following possibilities: more work to find clients and give messages, more work talking with clients and convincing them to go to clinic)*

Changes in community because of health workers calling with clients

13. Have you noticed that health providers are calling people in the community (outside of calling through you)? How do you know this?
14. Have you seen changes in the community that are caused by health workers calling with people in the community (directly or through you): Ask for each of the following and probe to link answers to the phone:
    - *Changes in utilization of ANC: how did you observe this; why do you think it happened because of clients being called by health workers ?*
    - *Change in place of delivery: how did you observe this; why do you think it happened because of the mobile phone use?*
    - *Change in utilization of PNC: how did you observe this; why do you think it happened because clients being called by health workers ?*
    - *More uptake of Family planning services: how did you observe this; why do you think it happened because of clients being called by health workers?*
    - *Other changes?*
15. Being part of this programme, has that benefitted you or disadvantaged you in any way? *(Ask that they explain why or why not and give examples)*.
16. Do you think that TBAs in the future should be included in mHealth schemes to help with communication between health workers and clients?

Thank you for your willingness to take part in this interview.

Annex 7 – Topic guide Health Worker

Topic guide for semi-structured interviews with health workers (SSI-3)

Go through informed consent procedure, fill in the personal data sheet, then start the interview.

Code	
Date / Time	
Name moderator / signature	
Name recorder / signature	
Name transcriber / signature	
Chiefdom / community	
Duration	
General comments	

PERSONAL DATA RESPONDENT: *(circle answer)*

Facility name /and type:	……/ CHC, CHP, MCHP
Designation:	CHO, CHA, SECHN, MCH aide, Other.....
Are you in charge of the PHU?	Yes / No
Age *(in whole years)*	
Years of experience in health sector *(in whole years)*:	
Did your facility receive a **work** mobile phone as part of the mHealth programme?	Yes / No
Did you get an orientation training to follow clients up by phone?	Yes / No
If yes, who provided the training?	
Have you received instructions about the use of the facility phone?	Yes / No
If yes, how?	training, other explanation, during supervision, other way ……
Have TBAs been supplied with mobile phones in your chiefdom?	Yes / No

Mobile phone use

1. Can you access your facility's work-related mobile phone?
    a. If no, inform why not. *(Ask for an example and probe: where was the phone, what did you do, how did it turn out?)* GO TO QUESTION 2
    b. If yes, ask how the health worker accesses this phone to use. *Probe: have it all the time, need to ask someone else to use it…)*
    c. Have there been problems in accessing the work phone If yes, ask to give an example of when and why and what they did to get hold of the phone.
2. How is the facility mobile phone kept charged? Have you been able to keep the work mobile phone charged? *Probe: where this is done, are the solar panels for charging at the clinic, if no, how is the problem solved, what does this involve (time and money).*
3. Do you use this phone for work related issues? If yes, what kind of work issues do you use the personal mobile phone for? Why do you use your own phone? *(Probe examples of this; How do you feel about having to use a personal phone for work related when there is facility phone available?*

End of interview for those who do NOT access facility phone

The rest of the interview is only for HWs who have access to a phone

Making calls with facility phone to managers, in-charges and colleagues

4. Who have **you called** with the facility phone in the past three months? (*other health workers and managers/in charges) For each answer ask who they called, what the call was about and what response they received? (examples from baseline data are: clinical advice, call for ambulance, surveillance data, reporting (HMIS data), drugs and supplies, maternal death reporting, staff issues (illness, absence, leave)*
5. Have you encountered any problems when calling these persons with the facility phone? *Give examples of when and why.*
6. How has the use of the mobile phone helped your work? Have you noticed any changes since you use the work mobile phone to call with these persons? If yes, what changes have you observed? *Probe for each change mentioned: give an example; what things caused the change? How did this work? Why?*

Once no new issues emerge, probe for other changes not mentioned, some examples:
- *Contact with members of DHMT=easier to send reports and information, easier to get information , easier to make orders and requests, get ambulance service*
- *Contact with in-charge (especially when you and in-charge in not in the same area)=easier to discuss cases, easier to send information*
- *Contact with colleague health workers= easier to get information, easier to discuss cases, easier to find replacement, just to chat*

7. Has the use of the phone to call providers changed the way you deal with complications during pregnancy, delivery and post-delivery? If yes, in what way? Give an example for what you do different. *Probe for details: follow a timeline from what happened? What did you do then? What happened then? What would you have done if you could not consult by phone?*
8. Do you use the work phone more often to **make calls** or to **make text messages** to health workers, in-charges, managers?
9. Do you prefer **calling** or **texting** with health workers, in-charges, managers? Ask why for each group separately.

Receiving calls with facility phone from other health workers in-charges and managers

10. Who has **called you** on the facility phone in the past three months? (other health workers and managers/in charges) *For each answer ask who they called, what the call was about and what response they received? (Examples from baseline: clinical advice, referrals, surveillance data, reporting (HMIS data), drugs and supplies, maternal death reporting, staff issues (illness, absence, leave)*
11. How has receiving calls from colleagues and managers helped your work? Have you noticed any changes since you receive calls and text messages on the work phone from these persons? If yes, what changes have you observed? *(Probe: some issues could be more work because they are accessible, more information about meetings etc.)*
12. Do you prefer receiving calls or texts from health workers, in-charges, managers? Ask separately for each group and why.

Initiating calls to clients (using own phone or someone else's phone) with facility phone

13. Have you used your facility phone to call clients in the community? If yes, ask if this was directly to clients
14. Have you encountered any problems in calling clients with your facility phone? *Give examples of what happened and how you dealt with this. (Ask specifically about the difference between calling clients with own phone and with someone else's phone)*
15. How many clients do you call on average per week? What were the calls about? What were the responses you received? *(Examples from baseline data are: appointments reminders, informing about missed appointments, follow-up to visit, health information)*

16. Has having the facility phone made a difference in your direct contact with clients? (*If yes, probe direct contact; what that means to them) and how this has changed since they received the facility phone.*
17. Does using the mobile phone make a difference on how clients act, respond, think? Have you noticed any changes in clients' actions since you use the work mobile phone to call clients? If yes, what changes have you observed? *Probe for each change answer given mentioned: give an example; what things caused the change? How did this work? Why?*

Once no new issues emerge, probe for other changes issues not mentioned, some examples:

- *More utilization of services: Ask separately for ANC, delivery, PNC, FP (how did you observe this; why do you think it happened because of the mobile phone use? Were any other new interventions or practices in the area implemented that may have caused the change?)*
- *On time and day for appointments(how did you observe this; why do you think it happened because of the mobile phone use? Were any other new interventions or practices implemented that may have caused the change?)*
- *More compliance with treatment: (how did you observe this; why do you think it happened because of the mobile phone use? Were any other new interventions or practices implemented that may have caused the change?)*

Receiving calls/texts from clients

18. Have you received calls/texts/flashes from clients on your facility phone? What are the reasons that the clients want to speak with you? *(Probe for each reason what they did and how they felt about this)* ***If no, skip question 21***
19. If question 20 is yes, is does this happen more often than in the past? Why do you think that is? What does this mean for your work?

For chiefdom Sella Limba, go to question 231

This section is only for health workers in TBA intervention chiefdom (Midline: only Paki Masabong)

Initiating calls to TBAs with facility mobile phone

20. Have you used the facility phone to call TBAs in the community? If no, why not? and go to question 24.
21. Have you encountered any problems in calling with TBAs? Give examples of what happened and how you dealt with this. *(Probe if there are still problems)*
22. How often do you call with TBAs on average per week? What do you call them for? *Probe: For what reasons and how this worked (separately for reaching clients but also for other reasons as inform about meeting, request help at clinic)*
23. Have you noticed any changes in your work and/or in your relationship with TBAs since you use the facility phone to call TBAs? If yes, what changes have you observed? *Probe for each change mentioned: give an example; what things caused the change? How did this work? Why?*
24. *Once no new issues emerge, probe for other changes not mentioned, some examples:*

25. *More utilization of services by clients: ask separately for ANC, delivery, PNC, FP (how did you observe this; why do you think it happened because of the mobile phone use? Were any other new interventions or practices implemented that may have caused the change?)*
26. *Better relationship with TBAs (how did you observe this; why do you think it happened because of the mobile phone use? Were any other new interventions or practices implemented that may have caused the change?)*
27. *Timely referral in cases of danger signs: (how did you observe this; why do you think it happened because of the mobile phone use? Were any other new interventions or practices implemented that may have caused the change?)*

Receiving calls from TBAs

28. Have you received calls on your facility phone from TBAs? If yes, what for? *Probe: for what reasons and how this worked* (*separately for reaching clients and any other reasons*) and list all reasons. Is this any different from the past? If yes, why do you think this happened?

Job satisfaction and quality of care

29. Does the work facility telephone change the way you feel about your work? If yes, in what way? Give examples.
30. Do you think that the use of the facility to call providers has helped make the care you give women better? If yes in what way? If no, why not.

Recommendations

31. What would you recommend to other PHU and districts who want to implement mobile phones to communicate with clients? Any other use you would recommend?

Thank you for your willingness to take part in this interview.

Annex 8 – Topic guide DHMT

Topic guide for semi-structured interviews with health managers (SSI-4)

Go through informed consent procedure. Fill in the personal data sheet, then start the interview.

Code	
Date / Time	
Name moderator / signature	
Name recorder / signature	
Name transcriber / signature	
Duration	
General comments	

PERSONAL DATA PARTICIPANTS *(circle answer)*

Designation:	District health sister / M&E officer / Other: ……
Age *(in whole years)*	…… years
Years of experience in the health sector: *(in whole years)*	…… years

1. Can you tell us what you do in the mobile health project? *(Probe: what they personally have done over time and maybe different things like training, supervision, helping with equipment problems)*
2. Before the mHealth project started, were you ever called by health workers? If yes, what were the calls about? *(Probe for reasons and keep asking until no new reasons emerge) How did the manager respond to the calls, was he/she able to answer to the needs, expectations of the caller?*
3. What do you think about the mobile phone intervention? Have you observed changes related to the use of the VPN network? (*Probe for each observation mentioned=probe types of changes; between DHMT members and health workers, between health workers, between health workers and TBAs, between health workers and clients: give an example; what things caused this? How did this work? Why? Keep asking if they observed anything else. If no new issue emerges than probe by asking specifically about the following:*
    a. Do you think that the use of the facility phone to call between providers has influenced the quality of care that is provided? Ask separately for calls between PHU and managers, in-charges, colleague health workers). If yes in what way? how did you observe this; why do you think it happened because of the mobile phone use? Were any other new interventions or practices implemented in the area that may have caused the change?
    b. Do you think the use of the facility phones between providers has changed the way health workers deal with medical complications? If yes, in what way? How did you observe this? Why do you think this changed? What other new intervention or practice could have caused this change?
    c. Do you think the use of mobile phones has changed the job satisfaction and the way health workers feel about their work? If yes, in what way? How did you observe this? Why do you think this changed? What other new intervention or practice could have caused this change?
4. Have you observed any changes resulting from the use of the work phone to call clients?
5. *Probe for each answer: how do you know this, why do you think this was caused by health workers calling clients, are there other interventions or programmes that may have influenced this?*
6. Ask separately for the following
    a. Changes in utilization of ANC: how did you observe this; why do you think it happened because of the mobile phone use? Were any other interventions implemented that may have caused the change?
    b. Delivery: how did you observe this; why do you think it happened because of the mobile phone use? Were any other interventions implemented that may have caused the change?
    c. PNC, how did you observe this; why do you think it happened because of the mobile phone use? Were any other interventions implemented that may have caused the change?

    d. Family planning services: how did you observe this; why do you think it happened because of the mobile phone use? Were any other interventions implemented that may have caused the change?
7. Have you observed any barriers in the use of the facility mobile phones? What kind of barriers? *(ask specifically for VPN and for health workers calling clients)* Can you give an example? *(probe further; why are there barriers, have anything been done to deal with them); probe specifically about charging and top-ups if not mentioned spontaneously.*
8. What would you recommend to other PHU and districts who want to implement mobile phones to phone clients? Any other use you would recommend?

Thank you for your willingness to take part in this interview.

Annex 9 – Topic guide Non-Enrolled Eligible Clients

Topic guide for semi-structured interviews with <u>non-enrolled</u> Clients (SSI-6)

Go through informed consent procedure and ask for the form to be signed or thumb printed, then start the interview.

Code	
Date / Time	
Name moderator / signature	
Name recorder / signature	
Name transcriber / signature	
Chiefdom / Community	
Duration	
Language interview	
General comments	

PERSONAL DATA RESPONDENT *(circle answer)*

A1 Name facility / A2 Type of facility	
B) Age: (*in whole year*s)	
C) Education:	
D) Mother tongue:	
E) Walking distance from home to facility (in minutes)	
F) Were you asked by the health worker if you wanted to be called using a mobile phone	Yes / No **(If no, end interview)**
G) Reason for visit to PHU when asked by health worker if you could be called:	ANC / FP / other:……
H) Did you agree to be phoned by the health workers?	Yes / No **(If yes, use enrolled client topic guide)**

<u>Mobile phone coverage and use (general)</u>

1. How would you describe the network in your area?
2. Which service provider/network is available in your area?
3. How do you/people charge mobile phones? *(Probe how far away this is, and how much it costs and how they feel about this)*
4. Who are the people that own mobile phones in this community? (*Probe for younger and older women and men)*
5. And the people in this community who do not own a phone what kind of people are that?
6. For how long have people used mobile phone in your community?
7. What function of the phone do people like you use? (call, text, flash) *(probe: why)*

<u>Recruitment procedure</u>

8. Were you asked by a health worker to be part of this mHealth scheme? **If no, end of the interview**
9. When you were asked did the health worker explain the scheme to you, what it involved and did you understand it; were you able to ask questions about it? *(Probe: why if they did not understand)*
10. I understand that you declined to take part? (let the respondent confirm) **If no, go to enrolled client topic guide**

11. Do you remember why at that time you did not want to join the scheme? *(Keep asking for reasons until no new ones come up)*

Impact of mHealth scheme in community

12. Do you know other women who are part of the scheme? If yes, have you talked with them about it; what did they say? Do they like it? Why/why not? *(Probe reasons for liking; learning more, follow up care, do not miss appointment and reasons for not liking; privacy, being told what to do)*
13. Have you noticed changes in the community because of the mHealth scheme? What are they and how are they related to the phone. *(Probe: knowledge about MNH, use of facility)*
14. If given the opportunity again, would you reconsider taking part in a mobile health scheme? Why and why not?
15. Have you ever heard about the national information line? Did you ever use it? Do you know anybody who uses it?

Thank you very much for your willingness to take part in the interview.

Annex 10 – Sampling framework midline qualitative interviews

Midline								
Chiefdom in Wedge 1	**Type Facility**	**TBA SSI**	**HW SSI**	**Client enrolled SSI**		**Client non-enrolled SSI**		**Health Manager SSI**
				PW	*FP*	*PW*	*FP*	*DHMT members*
TBA intervention chiefdom: Paki Masabong	CHC	2 - 3	2	1	1	1	1	2
	CHP	2 - 3	2	1	1	1	1	
	MCHP	2 - 3	1	1	1	1	1	
Non TBA intervention chiefdom: Sella Limba	CHC	0	2	1	1	1	1	
	CHP	0	2	1	1	1	1	
	MCHP	0	1	1	1	1	1	
Sub-total		*6 - 9*	*10*	*6*	*6*	*6*	*6*	*2*
TOTAL WEDGE 1 SSIs = 42 - 45								

Criteria for selection (maximum variation)

	Midline
Chiefdom	**Paki Masabong** (TBA intervention chiefdom) **Sella Limba** (highest contrast with Paki Masabong in PHU density)
Type of facility	Use all types of facilities (CHC, CHP, MCHP) because of differences between them.
Geographical distribution of facility	Criteria: - CHC- there is usually one CHC per chiefdom but if there are two, the one with the most senior level in charge will be selected - CHP and MCHP will be selected according to chiefdom geographical distribution in order to cover the entire chiefdom - If the chiefdom does not have a (functioning) CHP, an MCHP will be selected (meaning two MCHPs in that chiefdom) - If (based on supervision reports) a chosen facility does not have sufficient numbers of participating clients, an alternative facility will be selected in close geographical proximity if the target number of clients cannot be found and recruited for the interviews.
Facility selection	Paki Masabong: no CHP in chiefdom - CHC: Mapaki - MCHP: Kathanta Bana (replacing CHP)=100 PW/89 FP, 2 of the 5 TBAs not in contact due to no charger - MCHP: Makolor= reports showing poor enrolment (11PW, 2FP) and poor network coverage, TBAs not active because of having no charger. 2nd Option for recruitment clients/TBAs is MCHP Masabong Pil (PW 29, FP 36) no other problems reported
Health workers	Per chiefdom 5 health workers: - CHC : 1) most senior (highest level in-charge*) 2) MCH Aide# - CHP: 1) most senior (highest level in-charge) 2) MCH Aide - MCHP: 1) most senior MCH Aide or other MCH Aide (if not available other staff) *senior in-charge ensures the getting information with diversity in level of health workers #More MCH Aides to represent the distribution of work force

Clients	Equal number of client interviews in the following groups: - Enrolled pregnant woman (PW) *PW is the term used in the registers to indicate enrolment during pregnancy, delivery or PNC* - Enrolled Family Planning clients (FP) - Non-enrolled PW - Non-enrolled FP
TBA	2-3 per PHU: As there are 6 TBAs recruited per PHU and they are all living outside of the immediate vicinity of the PHU, it may be difficult to find and recruit. Recruiting 2-3 TBAs ensures the minimum target of 6 TBAs interviews per facility. Choice for individual interviews because it is unlikely to get them together at one place as they are spread geographically
DHMT	DMO is too involved with process so best select: - District Health Sister - M & E Officer

Annex 11 – Background characteristics of health worker respondents – midline questionnaire

		CHO N=10		CHA N=8		*SECHN* N=24		MCH aide N=108		EDCU assistant N=10		Nursing aide N=8		Midwife N=8		Dispenser N=1		Total N=173	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Sex of respondent	Female	0	0	4	50.0	18	75.0	108	100	0	0	4	100	7	87.5	0	0	141	81.5
	Male	10	100	4	50.0	6	25.0	0	0	10	100	0	0	1	12.5	1	100	32	18.5
Children	Yes	8	80	8	100	23	95.8	106	98.1	10	100	4	100	8	100	1	100	168	97.1
	No	2	20	0	0	1	4.2	2	1.9	0	0	0	0	0	0	0	0	5	2.9
Number of months worked at facility	< one month	0	0	0	0	0	0	0	0	0	0	0	0	1	12.5	0	0	1	0.6
	Between 1-3 months	0	0	1	12.5	6	25.0	1	0.9	0	0	0	0	0	0	0	0	8	4.6
	3 months or more	10	100	7	87.5	18	75	107	99.1	10	100	4	100	7	87.5	1	100	164	94.8
On government payroll	Yes	9	90	8	100	24	100	108	100	9	90.0	2	50	8	100	1	100	169	97.7
	No	1	10	0	0	0	0	0	0	1	10	2	50	0	0	0	0	4	2.3
Facility in-charge	Yes	10	100	8	100	10	41.7	61	56.5	3	30	0	0	1	12.5	1	100	94	54.3
	No	0	0	0	0	14	58.3	47	43.5	7	70	4	100	7	87.5	0	0	79	45.7
Type of facility	CHC	10	100	3	37.5	10	41.7	19	17.6	0	0	3	75	8	100	0	0	53	30.6
	CHP	0	0	5	62.5	10	41.7	21	19.4	5	50	1	25	0	0	1	100	43	24.9
	MCHP	0	0	0	0	4	16.7	68	63	5	50	0	0	0	0	0	0	77	44.5

Annex 12 – Background characteristics of respondents – midline qualitative interviews

Summary characteristics district level respondents

Nr. interviews	Average age in years	Average number of years working experience
2	56	15

Summary characteristics of health worker respondents

Chiefdom	Nr. interviews	Age in years Average (range)	Years of experience in health sector Average (range)	Nr of PHU in-charges interviewed
Paki Masabong	5	47 (30 – 58)	20 (4 – 34)	4
Sella Limba	5	42 (35 – 51)	11 (3 – 28)	5
Total	**10**	**45 (30 -58)**	**15 (3 – 34)**	**9**

Summary characteristics of TBA respondents

Chiefdom	Nr. interviews	Age in years Average (range)	Distance to health facility in walking minutes Average (range)	Mother tongue
Paki Masabong	12	53 (36-70)	104 (15-240)	Temne (8), Limba (3), Krio (1)

Summary characteristics of client respondents

Chiefdom	Nr. of interviews with clients who joined mHealth during antenatal visit	Nr. of interviews with clients who joined mHealth during family planning visit	Age in years Average (range)	Distance to health facility in walking minutes Average (range)	Mother tongue	Education	Nr. of ANC visits attended by pregnant clients (Range)	Phone used to communicate with clinic	Nr. of calls received from health worker Average (range)
Paki Masabong	4	3	26 (16-45)	69 (35-130)	Temne(4), Limba (3)	None (4), primary (1), secondary (2)	2 – 4+	TBA phone (6), someone else's phone (1)	2 (1-3)
Sella Limba	4	5	28 (16-49)	71 (30-240)	Limba(7), Temne(2)	None (7), primary (1), unknown (1)	1 – 4+	Own phone (3), husband (4), brother in law (1), uncle (1)	3 (1-7)
Total	**8**	**8**	**28 (16-49)**	**70 (30-240)**	**Limba (10), Temne (6)**	**None (11), primary (2), secondary (2), unknown (1)**	**1 – 4+**	**TBA phone (6), someone else's phone (7), own phone (3)**	**3 (1-7)**

.

Annex 13 – Overview significant differences and similarities

Overview of significant differences and similarities (wedge-wedge, baseline-midline)															
	Baseline			Midline			Baseline versus Midline			Wedge 1 versus Wedge 1			Wedge 2 versus Wedge 2		
Indicator/Variable	Wedge 1		Wedge 2	Wedge 1		Wedge 2	Baseline		Midline	Baseline		Midline	Baseline		Midline
Health worker and health facility characteristics															
Type of facility		↔		Wedge 1 more CHC/MCHP respondents				↔			↔		More CHC/CHP respondents at midline (borderline significant)		
Type of health worker		↔			↔			↔			↔			↔	
Facility in-charge		↔			↔			↔			↔			↔	
On government payroll		↔			↔			↔			↔			↔	
Sex		↔			↔			↔			↔			↔	
Staff size		↔			↔			↔			↔			↔	
Months at facility		↔			↔			↔			↔			↔	
Age		↔			↔			↔			↔			↔	
Having children		↔			↔			↔			↔			↔	
Mileage to Makeni		↔			↔			↔			↔			↔	
Mobile phone coverage and use															
Make and receive calls inside PHU		↔			↔			↔			↔			↔	
Coverage at normal calling spot			↑		↔			↔			↔			↔	
Frequency making calls			↑	↑				↔			↔			↔	
Frequency sending messages			↑			↑		↔				↑	↑		
Pay for calls		↔				↑	↑			↑			↑		
Pay for charging		↔			↔		↑			↑			↑		
calls/texts to district			↑		↔			↔			↔			↔	
calls/texts to in-charge of own facility		↔			↔			↔			↔			↔	
calls/texts to chiefdom in-charge		↔			↔				↑		↔				↑
calls/texts to other staff		↔			↔			↔				↑		↔	
calls/texts to clients		↔		↑					↑			↑		↔	
calls/texts to TBAs		↔				↑		↔			↔			↔	
receive calls/texts from district			↑		↔			↔				↑		↔	
receive calls/texts from in-charge of own facility		↔			↔			↔			↔			↔	
receive calls/texts from chiefdom in-charge		↔			↔				↑		↔				↑
receive calls/texts from other staff			↑		↔				↑			↑		↔	
receive calls/texts from clients			↑		↔			↔			↔			↔	
receive calls/texts from TBAs		↔			↔			↔			↔			↔	
Job satisfaction and communication combined average scores															
Communication with peers and seni	↔			↑					↑			↑		↔	
Working conditions		↔			↔				↑		↔				↑
Quality of working life		↔			↔			↔			↔			↔	
Contacting clients is easy		↔		↑				↔				↑		↔	
Have means to contact clients directly			↑		↔				↑			↑		↔	
↔= no difference in frequency; ↑= more frequent															

Annex 14 – Distance PHU to Bombali district headquarter town

PHU	Chiefdom	Distance in km to DHMT office in Makeni -2012
1 Fullah Town II*	Bombali Sebora	3
2 Loreto	Bombali Sebora	2
3 Mabolleh	Bombali Sebora	5
4 Maforay	Bombali Sebora	11
5 Makama	Bombali Sebora	2
6 Makump Bana	Bombali Sebora	7
7 Masory	Bombali Sebora	15
8 Masuba	Bombali Sebora	2
9 Patebana	Bombali Sebora	6
10 Police Barracks	Bombali Sebora	2
11 Robat	Bombali Sebora	8
12 Rokonta	Bombali Sebora	15
13 SLRC	Bombali Sebora	2
14 Teko	Bombali Sebora	7
15 Tonko	Bombali Sebora	2
16 Fullah Town	Makari Gbanti	14
17 Karafay Loko	Makari Gbanti	9
18 Kolisokoh	Makari Gbanti	16
19 Kunsho	Makari Gbanti	7
20 Maboyo	Makari Gbanti	8
21 Magbaikoli	Makari Gbanti	22
22 Makarie	Makari Gbanti	7
23 Mangay Loko	Makari Gbanti	5
24 Masongbo	Makari Gbanti	6
25 Panlap	Makari Gbanti	2
26 Punthun	Makari Gbanti	9
27 Stocco	Makari Gbanti	2
28 Thonkomba	Makari Gbanti	19
29 Yainkassa	Makari Gbanti	19
30 Batkanu	Libiesaygahun	42
31 Gbonkonka	Libiesaygahun	50
32 Kiamuinday	Libiesaygahun	60
33 Magbaingba	Libiesaygahun	25
34 Matoto	Libiesaygahun	35
35 Kathanta Bana	Paki Masabong	30
36 Makeni Lol	Paki Masabong	16
37 Makolor	Paki Masabong	13
38 Mapaki	Paki Masabong	23
39 Masabong Pil	Paki Masabong	18

40	**Masingbi Lol**	Paki Masabong	15
41	**Binkolo**	Safroko Limba	7
42	**Kabonka**	Safroko Limba	14
43	**Kagbo**	Safroko Limba	13
44	**Kagbombeh**	Safroko Limba	6
45	**Kapethe**	Safroko Limba	12
46	**Kayassie**	Safroko Limba	21
47	**Mabonkani**	Safroko Limba	10
48	**Maselleh**	Safroko Limba	15
49	**Masongbo Limba**	Safroko Limba	15
50	**Bumban**	Biriwa	22
51	**Bumbandain**	Biriwa	19
52	**Kagbaneh**	Biriwa	15
53	**Kagbankona**	Biriwa	45
54	**Kamabai**	Biriwa	22
55	**Kamasikie**	Biriwa	36
56	**Kanikay**	Biriwa	40
57	**Karina**	Biriwa	32
58	**Kayonkoro**	Biriwa	30
59	**Manjoro**	Biriwa	32
60	**Gbendembu**	Gbendembu Ngowahun	22
61	**Kalangba**	Gbendembu Ngowahun	15
62	**Kortuhun**	Gbendembu Ngowahun	29
63	**Madina Loko**	Gbendembu Ngowahun	24
64	**Maharie**	Gbendembu Ngowahun	24
65	**Mamaka**	Gbendembu Ngowahun	32
66	**Tambiama**	Gbendembu Ngowahun	11
67	**Hunduwa**	Magbaimba Ndowahun	46
68	**Kagbere**	Magbaimba Ndowahun	37
69	**Mabiama**	Magbaimba Ndowahun	49
70	**Mabunduka**	Sanda Tendaren	25
71	**Manack**	Sanda Tendaren	46
72	**Mateboi**	Sanda Tendaren	36
73	**Rogbin**	Sanda Tendaren	34
74	**Rokulan**	Sanda Tendaren	30
75	**Kamalo**	Sanda Loko	47
76	**Laiya**	Sanda Loko	65
77	**Laminaya**	Sanda Loko	66
78	**Madina Fullah**	Sanda Loko	61
79	**Maharibo**	Sanda Loko	55
80	**Rothata**	Sanda Loko	54
81	**Kabba Ferry**	Sella Limba	63
82	**Kagboray**	Sella Limba	63

83 Kamabaio	Sella Limba	60
84 Kamakwie	Sella Limba	56
85 Kamawonie	Sella Limba	66
86 Kaponkie	Sella Limba	60
87 Kathanta Yimbor	Sella Limba	63
88 Masankorie	Sella Limba	61
89 Fintonia	Tambaka	70
90 Samaya	Tambaka	70
91 Sanya	Tambaka	88
92 Borongoh / Makarankay	Gbanti Kamaranka	50
93 Gbainkfay	Gbanti Kamaranka	42
94 Gbanti	Gbanti Kamaranka	38
95 Gbonkobana	Gbanti Kamaranka	42
96 Kamaranka	Gbanti Kamaranka	38
97 Kambia	Gbanti Kamaranka	45
98 Makaiba	Gbanti Kamaranka	35
99 Royeama	Gbanti Kamaranka	39
** Not functional*		

Annex 15 – Analysis ambulance referral calls

Calls/Texts for Ambulance Referral	Baseline				Midline				Significant differences and similarities			
	w1		w2		w1		w2		baseline w1-w2	midline w1-w2	w1-w1	w2-w2
	N	%	N	%	N	%	N	%				
calls/texts to district	77	85	45	63	69	85	33	46	more Wedge 1	more Wedge 1	↔	more baseline*
calls/texts to in-charge of own facility	4	16	3	10	0	0	0	0	↔	↔	more baseline	↔
calls/texts to chiefdom in-charge	11	23	6	23	7	13	7	18	↔	↔	↔	↔
calls/texts to other staff	7	9	6	8	0	0	3	4	↔	↔	more baseline	↔
receive calls/texts from district	5	6	5	8	2	3	6	10	↔	↔	↔	↔
receive calls/texts from in-charge of own facility	0	0	1	4	0	0	0	0	↔	↔	↔	↔
receive calls/texts from chiefdom in-charge	2	5	1	5	0	0	0	0	↔	↔	↔	↔
receive calls/texts from other staff	8	9	2	3	2	3	2	3	↔	↔	↔	↔
Legend: ** borderline significant (p(chi2)=0.054), ↔ (similar) no difference in frequency* *w1= Wedge 1, w2= Wedge 2*												

Annex 16 – Calculation sample size health worker survey

As presented in the research protocol, the district has about 120 health facilities. Standard sample size calculations (see below) showed that we need to use the 'take all' approach: for a one-sample problem, to detect a difference in outcome from 80% to 88% (10% diff), sample size is 225.

The one-sample Problem

	two-sided alpha
90% Confidence	1,645
95% Confidence	1,96
99% Confidence	2,576

	Beta
80 % Confidence	1,28

	Fill in
Po	0,80
Pa	0,88
alpha level	1,96
beta level	1,28
Sample Size	**225**

$$n = \left[\frac{Z_{\alpha}\sqrt{\pi_0(1-\pi_0)} + Z_{\beta}\sqrt{\pi_1(1-\pi_1)}}{\pi_0 - \pi_1} \right]^2$$

Null hypothesis	
Start P_0	**0,1**
Increment P	**0,05**
Alternative hypothesis	
P1	**0,2**	
Increment P	**0,05**

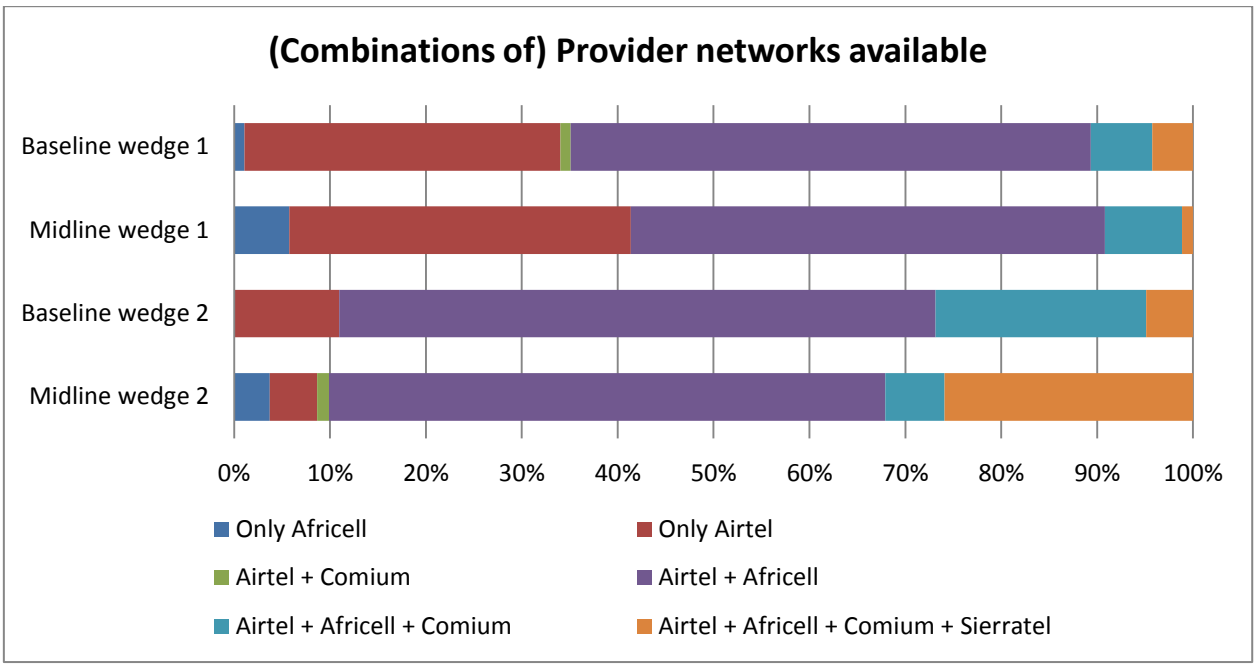
	P- alternative												
P_0	**0,20**	**0,25**	**0,30**	**0,35**	**0,40**	**0,45**	**0,50**	**0,55**	**0,60**	**0,65**	**0,70**	**0,75**	**0,80**
0,10	121	58	35	23	16	12	9	7	6	5	4	3	2
0,15	588	157	74	43	28	20	15	11	9	7	5	4	3
0,20		717	188	87	50	32	23	17	12	10	8	6	5
0,25	741		825	213	97	55	36	25	18	13	10	8	6
0,30	199	845		912	233	105	59	38	26	19	14	10	8
0,35	93	222	927		977	247	110	62	39	27	19	14	10
0,40	54	102	240	988		1021	256	113	63	40	27	19	14
0,45	35	59	109	252	1028		1045	260	114	63	39	26	18
0,50	25	38	61	113	259	1047		1047	259	113	61	38	25
0,55	18	26	39	63	114	260	1045		1028	252	109	59	35
0,60	14	19	27	40	63	113	256	1021		988	240	102	54
0,65	10	14	19	27	39	62	110	247	977		927	222	93
0,70	8	10	14	19	26	38	59	105	233	912		845	199
0,75	6	8	10	13	18	25	36	55	97	213	825		741
0,80	5	6	8	10	12	17	23	32	50	87	188	717	
0,85	3	4	5	7	9	11	15	20	28	43	74	157	588
0,90	2	3	4	5	6	7	9	12	16	23	35	58	121
0,95	2	2	2	3	4	5	6	7	9	12	16	24	39

Annex 17 – Overview of similarities and significant differences health worker and health facility characteristics

	Baseline		Midline		Baseline versus midline		Wedge 1 versus Wedge 1		Wedge 2 versus Wedge 2	
Indicator/ variable	Wedge 1	Wedge 2	Wedge 1	Wedge 2	Baseline	Midline	Baseline	Midline	Baseline	Midline
Type of facility	↔		↑ Wedge 1 more CHC/MCHP respondents		↔		↔		↑ Midline more CHC/CHP respondents (borderline significant)	
Type of health worker	↔		↔		↔		↔		↔	
Facility in-charge	↔		↔		↔		↔		↔	
On government payroll	↔		↔		↔		↔		↔	
Sex	↔		↔		↔		↔		↔	
Staff size	↔		↔		↔		↔		↔	
Months at facility	↔		↔		↔		↔		↔	
Age	↔		↔		↔		↔		↔	
Having children	↔		↔		↔		↔		↔	
Distance to Makeni	↔		↔		↔		↔		↔	

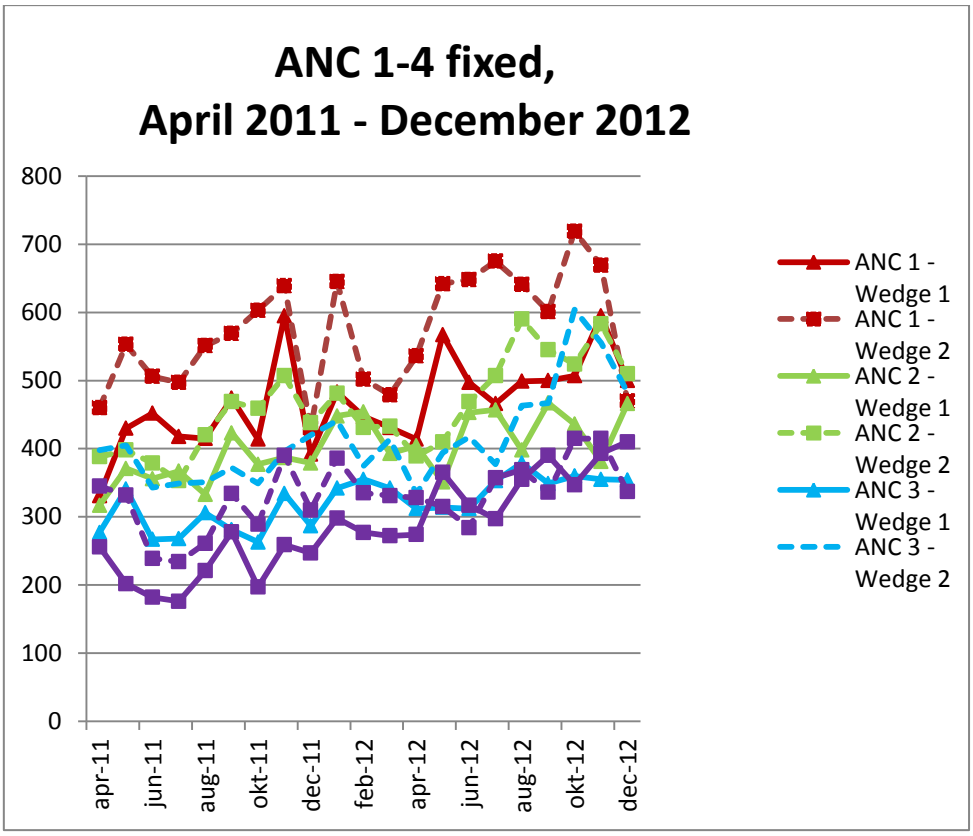
Legend: ↔ = similar (no difference in frequency), ↑ = significant difference (more frequent)

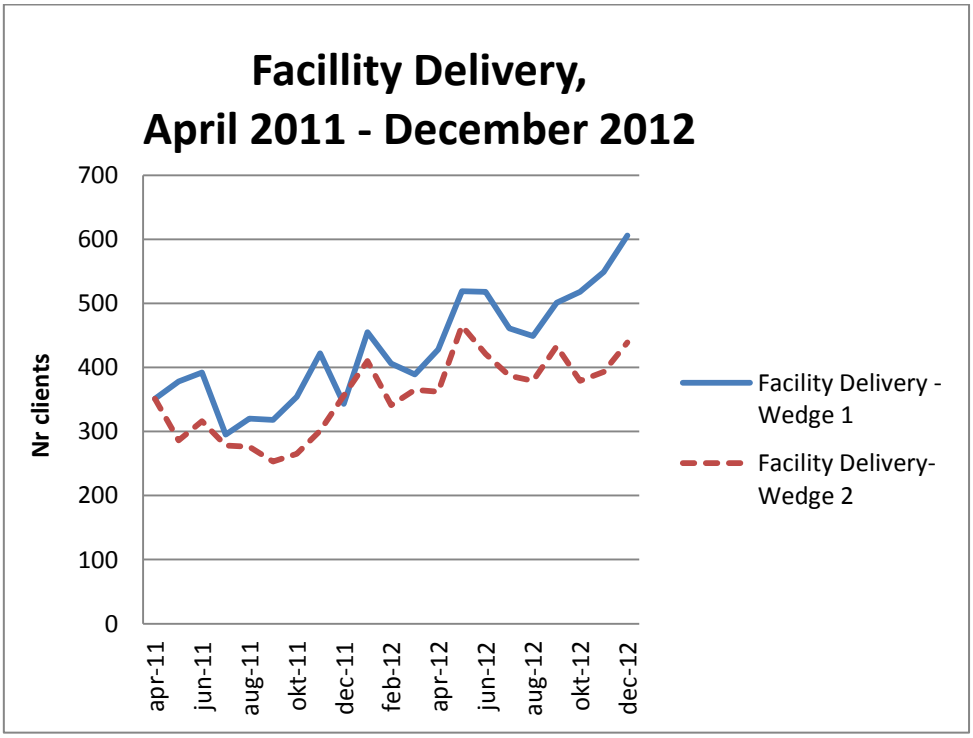
Annex 18 – Combinations of provider networks available

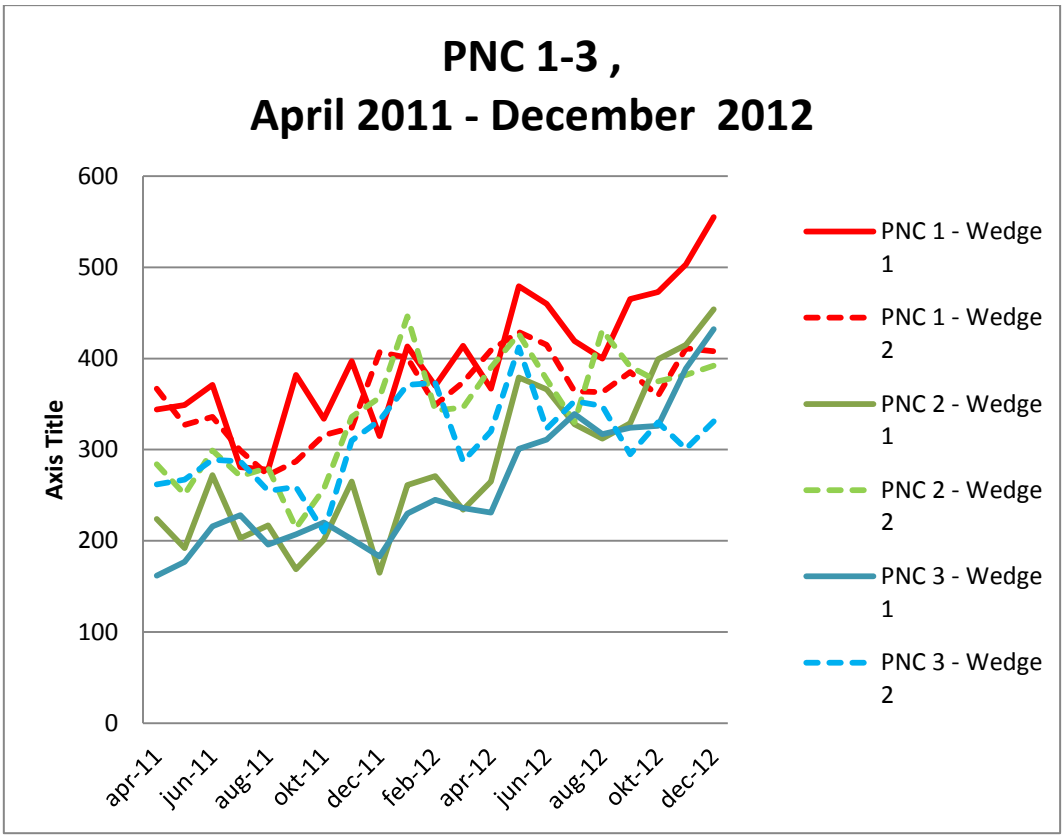


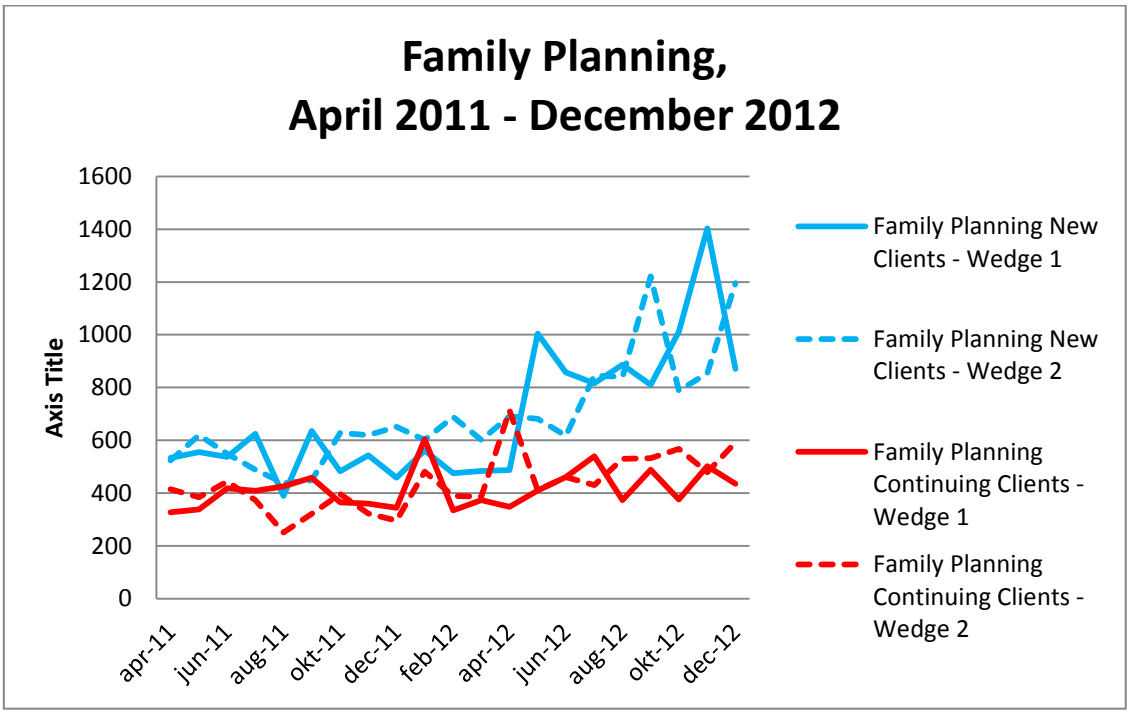
Annex 19 – PHU utilization data from DHIS – trends and comparison

Indicator, per wedge *Note*: data relate to static (facility-based) services and do not include outreach service data	Period		Change (Aug-Dec11 = 100)
	Aug-Dec 11	Aug-Dec 12	
ANC 1 - Wedge 1	2290	2601	114
ANC 1 - Wedge 2	2792	3100	111
ANC 2 - Wedge 1	1899	2148	113
ANC 2 - Wedge 2	2293	2752	120
ANC 3 - Wedge 1	1471	1797	122
ANC 3 - Wedge 2	1888	2572	136
ANC 4 - Wedge 1	1202	1895	158
ANC 4 - Wedge 2	1584	1872	118
Facility Delivery - Wedge 1	1757	2623	149
Facility Delivery - Wedge 2	1451	2023	139
PNC 1 - Wedge 1	1706	2396	140
PNC 1 - Wedge 2	1606	1926	120
PNC 2 - Wedge 1	1017	1909	188
PNC 2 - Wedge 2	1444	1971	136
PNC 3 - Wedge 1	1008	1788	177
PNC 3 - Wedge 2	1366	1605	117
Family Planning New Clients - Wedge 1	2510	4981	198
Family Planning New Clients - Wedge 2	2786	4899	176
Family Planning Continuing Clients - Wedge 1	1954	2177	111
Family Planning Continuing Clients - Wedge 2	1587	2701	170

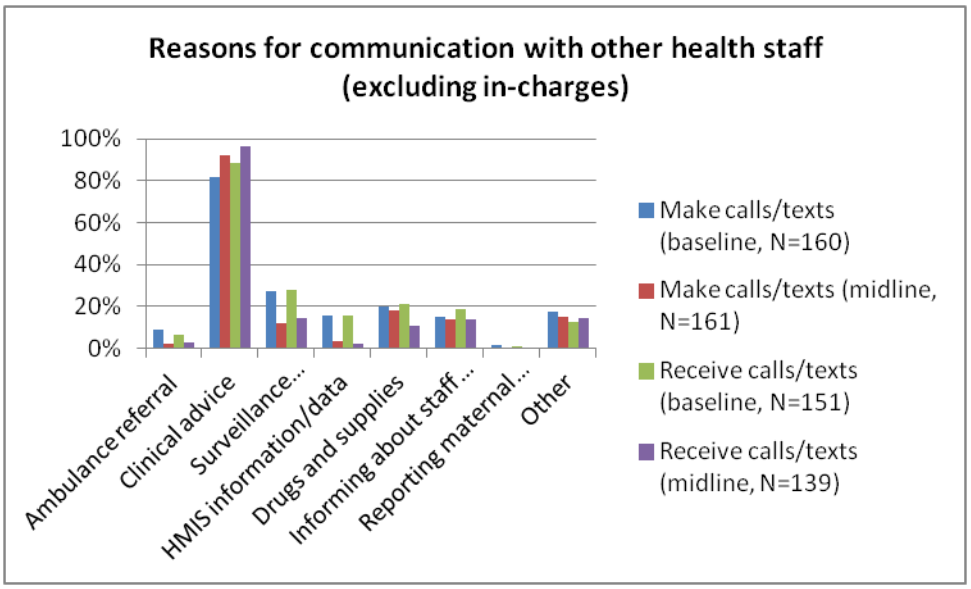

ANC 1-4 fixed,
April 2011 - December 2012
800
700
600
500
400
300
200
100
0
apr-11
jun-11
aug-11
okt-11
dec-11
feb-12
apr-12
jun-12
aug-12
okt-12
dec-12
ANC 1 - Wedge 1
ANC 1 - Wedge 2
ANC 2 - Wedge 1
ANC 2 - Wedge 2
ANC 3 - Wedge 1
ANC 3 - Wedge 2

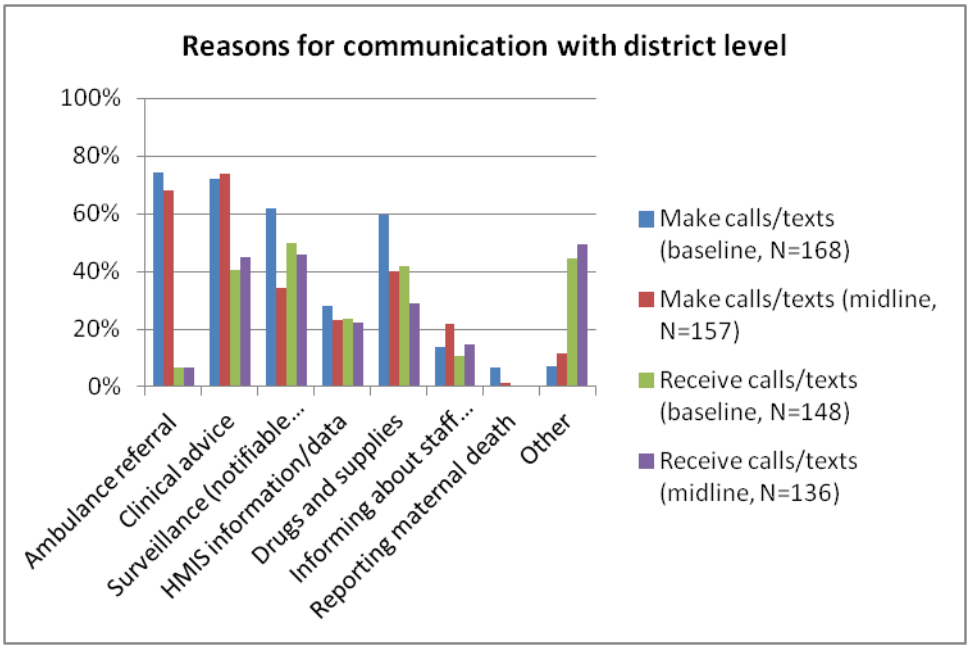

Facillity Delivery,
April 2011 - December 2012
Nr clients
700
600
500
400
300
200
100
0
apr-11
jun-11
aug-11
okt-11
dec-11
feb-12
apr-12
jun-12
aug-12
okt-12
dec-12
Facility Delivery - Wedge 1
Facility Delivery- Wedge 2

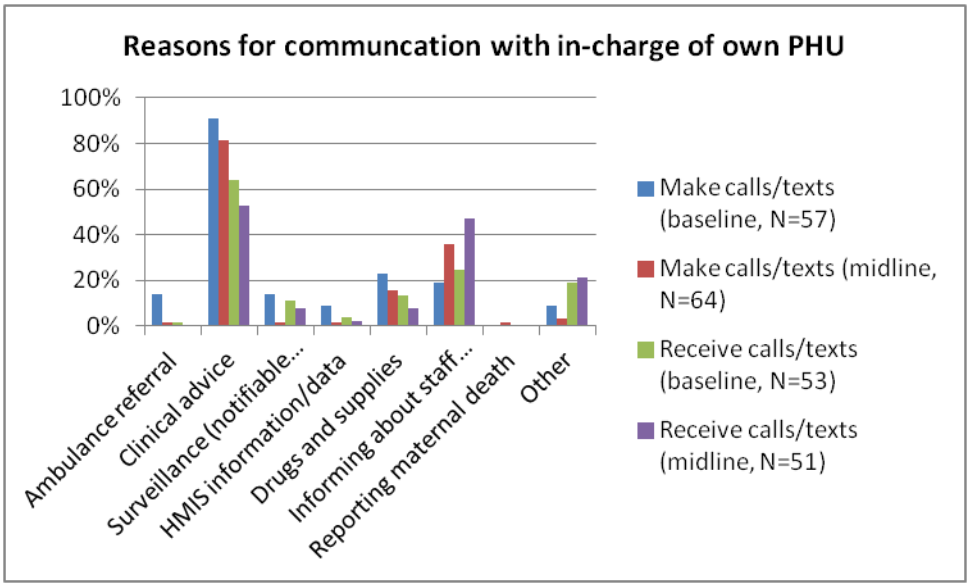

PNC 1-3 ,
April 2011 - December 2012
Axis Title
600
500
400
300
200
100
0
apr-11
jun-11
aug-11
okt-11
dec-11
feb-12
apr-12
jun-12
aug-12
okt-12
dec-12
PNC 1 - Wedge 1
PNC 1 - Wedge 2
PNC 2 - Wedge 1
PNC 2 - Wedge 2
PNC 3 - Wedge 1
PNC 3 - Wedge 2

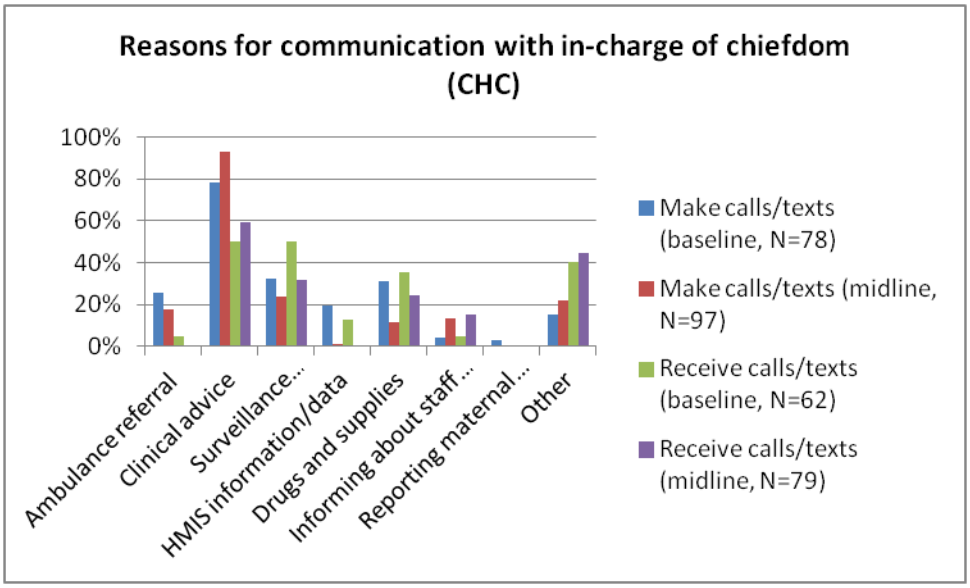

Family Planning,
April 2011 - December 2012
Axis Title
1600
1400
1200
1000
800
600
400
200
0
apr-11
jun-11
aug-11
okt-11
dec-11
feb-12
apr-12
jun-12
aug-12
okt-12
dec-12
Family Planning New Clients - Wedge 1
Family Planning New Clients - Wedge 2
Family Planning Continuing Clients - Wedge 1
Family Planning Continuing Clients - Wedge 2

Annex 20 – Reasons for communication between health workers






Reasons for communcation with in-charge of own PHU
100%
80%
60%
40%
20%
0%
Ambulance referral
Clinical advice
Surveillance (notifiable...
HMIS information/data
Drugs and supplies
Informing about staff...
Reporting maternal death
Other
Make calls/texts (baseline, N=57)
Make calls/texts (midline, N=64)
Receive calls/texts (baseline, N=53)
Receive calls/texts (midline, N=51)


Reasons for communication with in-charge of chiefdom (CHC)
100%
80%
60%
40%
20%
0%
Ambulance referral
Clinical advice
Surveillance...
HMIS information/data
Drugs and supplies
Informing about staff...
Reporting maternal...
Other
Make calls/texts (baseline, N=78)
Make calls/texts (midline, N=97)
Receive calls/texts (baseline, N=62)
Receive calls/texts (midline, N=79)

Annex 21 – Overview tables for job satisfaction and communication domains

Average combined scores for domain "Quality of Working Life" by wedge, health facility and health worker characteristics						
significant difference highlighted	Mean scores (Nr. of items)					
	Baseline			*Midline*		
	Wedge 1	Wedge 2	Total*	Wedge 1	Wedge 2	Total*
Type of facility						
CHC	75.5 (n=22)	76.9 (n=20)	76.5 (n=44)	72.4 (n=28)	74.8 (n=23)	73.9 (n=53)
CHP	79.7 (n=15)	73.8 (n=16)	77.1 (n=34)	76.1 (n=13)	71.2 (n=27)	73.5 (n=43)
MCHP	74.1 (n=57)	71.2 (n=46)	72.8 (n=103)	74.5 (n=46)	75.1 (n=31)	74.7 (n=77)
		significant difference due to difference CHC versus MCHP	significant difference due to difference CHP MCHP, difference CHC MCHP just not significant (0.055/0.06)			
Type of healthworker						
CHO	74.7 (n=5)	77.3 (N=5)	76.0 (n=10)	71.1 (n=5)	78.9 (n=4)	75.6 (n=10)
CHA	82.8 (n=4)	70.2 (n=5)	75.8 (n=9)	80 (n=3)	72.9 (n=5)	75.6 (n=8)
SECHN	75.9 (n=7)	71.3 (n=11)	73.1 (n=18)	75.6 (n=8)	73.5 (n=16)	74.2 (n=24)
MCH Aide	74.7 (n=71)	73.7 (n=52)	74.5 (n=126)	74.1 (n=60)	75.5 (n=45)	74.9 (n=108)
EDCU assistant	74.4 (n=6)	70.2 (n=7)	73.6 (n=15)	72.6 (n=3)	60.7 (n=6)	66.9 (n=10)
Nursing Aid	93.3 (n=1)	72.2 (n=2)	79.3 (n=3)	70 (n=2)	70 (n=2)	70 (n=4)
Midwife				72 (n=5)	71.1 (n=3)	71.7 (n=8)
Dispenser				82.2 (n=1)		82.2 (n=1)
					significicant due to significant differences between EDCUvCHO,EDCUvSECHN, EDCUvMCHA	
In charge						
Yes	75.7 (n=52)	74.5 (n=39)	75.3 (n=92)	75.5 (n=52)	74.8 (n=40)	75.4 (n=94)
No	74.8 (n=42)	71.7 (n=43)	73.7 (n=89)	71.9 (n=35)	72.6 (n=41)	72.7 (n=79)
Sex						
Female	74.9 (n=80)	72.6 (n=66)	74.1 (n=149)	74.0 (n=75)	74.7 (n=63)	74.5 (n=141)
Male	77.3 (n=14)	74.9 (n=16)	76.5 (n=32)	74.4 (n=12)	70 (n=18)	72.6 (n=32)
Facility staff size						
Single staff	76.8 (n=18)	76.2 (n=14)	76.5 (n=32)	78.8 (n=25)	75.9 (n=14)	77.8 (n=39)
2 or more staff	74.9 (n=76)	72.4 (n=68)	74.0 (n=149)	72.1 (n=62)	73.2 (n=67)	73.1 (n=134)
TOTAL	**75.3 (n=94)**	**73.1 (n=82)**	**74.5 (n=181)**	**74.1 (n=87)**	**73.7 (n=81)**	**74.2 (n=173)**
** total= wedge 1 + wedge 2 + chiefdom Tambaka*						

Average combined scores for domain "Communication with peers and seniors" by wedge, health facility and health worker characteristics						
significant difference highlighted	Mean scores (Nr. of items)					
	Baseline			*Midline*		
	Wedge 1	Wedge 2	Total*	Wedge 1	Wedge 2	Total*
Type of facility						
CHC	80.2 (n=22)	77.4 (n=20)	78.7 (n=44)	78.6 (n=28)	75.0 (n=23)	77.6 (n=53)
CHP	78.7 (n=15)	72.3 (n=16)	74.8 (n=34)	82.8 (n=13)	74.8 (n=27)	78.3 (n=43)
MCHP	76.7 (n=57)	75.4 (n=46)	76.1 (n=103)	83.2 (n=46)	78.6 (n=31)	81.4 (n=77)
Type of healthworker						
CHO	83.2 (n=5)	81.6 (n=5)	82.4 (n=10)	82.4 (n=5)	80 (n=4)	82.4 (n=10)
CHA	76 (n=4)	77.6 (n=5)	76.9 (n=9)	86.7 (n=3)	76 (n=5)	80 (n=8)
SECHN	80.6 (n=7)	75.3 (n=11)	77.3 (n=18)	80.5 (n=8)	77.8 (n=16)	78.7 (n=24)
MCH Aide	78.1 (n=71)	76.3 (n=52)	77.3 (n=126)	82.4 (n=60)	76.9 (n=45)	80.4 (n=108)
EDCU assistant	68 (n=6)	62.9 (n=7)	65.9 (n=15)	81.3 (n=3)	72.7 (n=6)	76.8 (n=10)
Nursing Aid	80 (n=1)	70 (n=2)	73.3 (n=3)	58 (n=2)	72 (n=2)	65 (n=4)
Midwife				80 (n=5)	65.3 (n=3)	74.5 (n=8)
Dispenser				84 (n=1)		84 (n=1)
		significant due to EDCUvCHO, EDCUvMCHA (EDCUvCHA 0.07, EDCUv.SECHN 0.06)	significant due to significant difference between EDCUvCHO, EDCUvSECHN, EDCUvMCHA (EDCUvCHA 0.06)	significant due to significant diffference NurseAvCHO, NurseAvCHA, NurseAvSECHN,NurseAvMCHA		
In charge						
Yes	78.2 (n=52)	77.2 (n=39)	77.7 (n=92)	83.8 (n=52)	77 (n=40)	81.1 (n=94)
No	77.4 (n=42)	73.5 (n=43)	75.3 (n=89)	78.4 (n=35)	75.6 (n=41)	77.5 (n=79)
Sex						
Female	77.7 (n=80)	75.9 (n=66)	76.8 (n=149)	81.3 (n=75)	76.9 (n=63)	79.6 (n=141)
Male	78.9 (n=14)	72.8 (n=16)	75.3 (n=32)	83.7 (n=12)	74.2 (n=18)	78.8 (n=32)
Facility staff size						
Single staff	77.6 (n=18)	76 (n=14)	76.9 (n=32)	85.4 (n=25)	73.4 (n=14)	81.1 (n=39)
2 or more staff	77.9 (n=76)	75.1 (n=68)	76.4 (n=149)	80.1 (n=62)	76.9 (n=67)	79.0 (n=134)
TOTAL	**77.8 (n=94)**	**75.3 (n=82)**	**76.5 (n=181)**	**81.6 (n=87)**	**76.3 (n=81)**	**79.4 (n=173)**
** total= wedge 1 + wedge 2 + chiefdom Tambaka*						

Average combined scores for domain "Working conditions" by wedge, health facility and health worker characteristics						
significant differences highlighted	Mean scores (Nr. of items)					
	Baseline			*Midline*		
	Wedge 1	Wedge 2	Total*	Wedge 1	Wedge 2	Total*
Type of facility						
CHC	66.4 (n=22)	63.8 (n=20)	65.9 (n=44)	62.6 (n=28)	67.0 (n=23)	65.1 (n=53)
CHP	65.3 (n=15)	60 (n=16)	64.1 (n=34)	72 (n=13)	65.5 (n=27)	68.5 (n=43)
MCHP	59.8 (n=57)	64.5 (n=46)	61.9 (n=103)	66.4 (n=46)	69.4 (n=31)	67.6 (n=77)
Type of healthworker						
CHO	63.2 (n=5)	58.4 (n=5)	60.8 (n=10)	68 (n=5)	63 (n=4)	67.2 (n=10)
CHA	62 (n=4)	57.6 (n=5)	59.6 (n=9)	73.3 (n=3)	56.8 (n=5)	63 (n=8)
SECHN	75.4 (n=7)	61.8 (n=11)	67.1 (n=18)	63.5 (n=8)	66.8 (n=16)	65.7 (n=24)
MCH Aide	61.2 (n=71)	63.8 (n=52)	62.7 (n=126)	66 (n=60)	69.9 (n=45)	68 (n=108)
EDCU assistant	62 (n=6)	70.9 (n=7)	68.8 (n=15)	65.3 (n=3)	64.7 (n=6)	66.4 (n=10)
Nursing Aid	40 (n=1)	66 (n=2)	57.3 (n=3)	76 (n=2)	62 (n=2)	69 (n=4)
Midwife				57.6 (n=5)	66.7 (n=3)	61 (n=8)
Dispenser				80 (n=1)		80 (n=1)
In charge						
Yes	61.5 (n=52)	63.5 (n=39)	62.6 (n=92)	68.4 (n=52)	66.8 (n=4)	68.0 (n=94)
No	63.1 (n=42)	63.4 (n=43)	64.0 (n=89)	62.5 (n=35)	68 (n=41)	66.0 (n=79)
Sex						
Female	62.5 (n=80)	63.6 (n=66)	63.3 (n=149)	65.7 (n=75)	67.6 (n=63)	66.8 (n=141)
Male	60.9 (n=14)	62.8 (n=16)	63.1 (n=32)	68.3 (n=12)	66.9 (n=18)	68.3 (n=32)
Facility staff size						
Single staff	60 (n=18)	66 (n=14)	62.6 (n=32)	70.4 (n=25)	70 (n=14)	70.3 (n=39)
2 or more staff	62.7 (n=76)	62.9 (n=68)	63.4 (n=149)	64.3 (n=62)	66.9 (n=67)	66.1 (n=134)
TOTAL	**62.2 (n=94)**	**63.5 (n=82)**	**63.3 (n=181)**	**66 (n=87)**	**67.4 (n=81)**	**67.1 (n=173)**
** total= wedge 1 + wedge 2 + chiefdom Tambaka*						