**Title**

Women health extension workers: Capacities, opportunities and challenges to use eHealth to strengthen equitable health systems in Southern Ethiopia

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**Conflict of interest**

None to declare

**ABSTRACT**

**OBJECTIVES:** This study assesses the feasibility of female Health Extension Workers (HEWs) to use eHealth within their core duties, supporting both the design and capacity building for an eHealth system project focussing initially on tuberculosis, maternal child health and gender equity.

**PARTICIPANTS:** Health Extension Workers, Health Centre Heads, District Health Officers, Zonal Health Department and Regional Health Bureau representatives in Southern Ethiopia

**SETTING:** The study was undertaken in Southern Ethiopia with three districts in Sidama Zone (population of 3.5 million) and one control zone district.

**METHODS:** Mixed method baseline data collection was undertaken, using quantitative questionnaires (n=57) and purposively sampled qualitative face-to-face semi-structured interviews (n=10) and focus group discussions (FGD) (n=3).

**RESULTS:** Themes were identified relating to HEW commitment and role, supervision and performance management. The Health Management Information System (HMIS) was seen as important by all participants, but with challenges of information quality, accuracy, reliability and timeliness. Participants’ perceptions varied by group regarding the purpose and benefits of HMIS and also the potential of an eHealth system. Mobile phones were used regularly by all participants.

**CONCLUSION:** EHealth technology presents a new opportunity for the Ethiopian health system to improve data quality and community health. Empowering, supporting and responding to the challenges faced by frontline female HEWs who are a critical bridge between communities and health systems will be important part of ensuring the sustainability and responsiveness of eHealth strategies. Findings have informed the subsequent eHealth technology design and implementation, capacity strengthening approach, supervision and performance management approach.

**KEY WORDS**: eHealth; Health Extension Workers; Health Management Information Systems; Tuberculosis; Maternal Child Health; Gender

**Background**

Ethiopia established a Health Extension Program (HEP) in 2004, which includes the training and deployment of female health extension workers (HEWs) based at local level to improve community access to primary health care services1. All HEWs are female as per the design of the Ethiopian Health Extension Package. They work within rural communities with the aim of achieving universal coverage of primary healthcare. HEWs are trained for one year and receive a government salary. They are managed by health extension supervisors, the majority of whom are male. Two HEWs are assigned in each community with an average population of 5,000 people (about 1000 households). In 2012, the Federal Ministry of Health commissioned an eHealth strategy providing a framework to support the HEP and improve the Health Management Information System (HMIS). This framework called for action and streamlined eHealth strategies to improve the effectiveness of HEWs’ primary health care service provision.

In Ethiopia, only 34% of mothers have access to antenatal care and only 10% have a skilled attendant at delivery2. Maternal and neonatal health is therefore a national priority. HEWs play a key role in the HMIS. Ethiopia’s HMIS is made up of paper-collected data originating from the health posts, centres and districts, submitted to the provincial health authorities. With minimal analysis the provincial and data are submitted to the Federal Ministry, which analyses and makes the overall healthcare decisions based on the national health data. HEWs are at the core of this system, but their success continues to be hampered by poor infrastructure especially on communication3 and human resources4. There is increasing network coverage in the country that has great potential for mHealth. In addition, there is a growing body of global evidence that m-Health can support programs like the HEP and improve access to and delivery of health services in sub-Saharan Africa. mHealth refers to the use of mobile phone technologies for delivery of health services to subscribers and users of mobile telephony5. It is part of eHealth, which broadly encompasses the electronic and digital processes in health including telephony, computing and the Internet6. The mHealth technology is used in improving awareness, responding to patient requests, sending follow up reminders and many other services depending on the focus area and the need. For example in Kenya, sending text messages on malaria case management to rural clinicians improved artemesinin-combination therapy prescription and treatment outcomes among children with malaria7. In Malawi, K4Health Project demonstrated that sharing reproductive health and HIV/AIDS information through short-message service among remote health workers increased service delivery communications among providers8. While in Tanzania, SMS and mobile phone vouchers that linked women throughout their pregnancy to health facilities increased skilled birth attendance to 60% in a mobile phone intervention versus 47% in comparison9. In Ethiopia, like in many African contexts, mHealth has great potential as an empowerment tool for HEWs that could facilitate access to accurate data thus improving service delivery10. Like in other sub-Saharan settings, Ethiopian HEWs are motivated to use mHealth platforms; however in reality infrastructural and technological barriers such as limited availability of airtime and technical skills on how to use phone features present challenges to progress11. Nevertheless, consistent reports that mHealth could overcome infrastructural barriers through electronic information and report delivery outweigh these barriers which can be addressed through network variability and training of users on phone features 3, 12.

 mHealth has the potential to address gendered norms that lead to health inequities such as sex, age, and other socio-economic characteristics that impede service access by vulnerable groups such as adolescents 13. As many service points are personalized and access is arranged on convenience, mHealth tools could potentially increase services in Ethiopian communities and overcome scenarios where gendered norms mean that women have to seek permission from others to access services or seek care14, although the ways in which gender norms shape the impact of eHealth is poorly understood and the need to ensure confidentiality is key.

This paper reports on empirical research conducted with HEWs and other key players in the Ethiopian Health Extension Programme on the capacities, opportunities and challenges and to use eHealth to strengthen equitable health systems in Southern Ethiopia with an initial focus on tuberculosis, maternal health and gender. The research took place as part of the baseline situation analysis of an intervention research process to develop an eHealth system that is consistent with Ethiopia’s eHealth Strategy.

**Methods**

**Setting**

This study is conducted in Sidama and Gedeo zones in southern Ethiopia. Sidama zone (intervention zone) has a population of about 3.5 million living in 19 rural districts and two town administrations. There are more than 100 health facilities providing health services. Gedeo zone (control zone) shares a border with the Sidama zone and has similar health service coverage and population density. The study sites were selected in order to capture diversity in geography (distance from zonal headquarters, topography, health service coverage and utilization, population density and general socio-economic condition). Three districts from the intervention and one district from the control zone were selected.

**Data collection**

Data collection was undertaken utilising a mixed methods approach. The application of both quantitative and qualitative methods is useful in understanding complex research issues. The main methodological focus however was qualitative in order to capture the perceptions and experiences of different purposively sampled participants and how they are shaped by context15.

Data were collected from policy makers and health service providers in the health facilities; HEWs from HPs in the community, Health Centre Heads (HCH) for TB, MCH and HMIS , District Health Officer (DHO) TB, MCH and HMIS leads, Zonal Health department (ZHD) representatives and Regional Health Bureau (RHB) HMIS Officers.

Quantitative data were collected through a face-to-face questionnaire; one generic questionnaire was developed for all participants (n=57) with three supplementary questionnaires for HC leads in ANC, TB and HMIS. Quantitative research involved collecting demographic data, knowledge of eHealth, technological skills, use and capacity (mobile phones and computers), skills of reporting and HMIS.

Qualitative methods included face to face semi-structured interviews (n=10) and focus group discussions (FGD) (n=3). Two qualitative interview topic guides were developed by SZHD in collaboration with LSTM. One topic guide was for individual interviews and focus groups with HEWs. The second topic guide was for individual interviews with HC, DHO, ZHD and RHB representatives. Questions concerned background and role of the HEWs, length of service, communication (advantages and challenges), HMIS (components, application, reporting, structure, and challenges), performance management and eHealth (knowledge and feasibility) were included in the topic guides. Experienced qualitative researchers were trained in using the topic guides and conducted the interviews. Interviews were recorded using digital Dictaphone devices.

**Data Analysis**

Quantitative data were inputted from completed questionnaires into SPSS Version 21 for processing and analysed using SPSS Version 21.

Qualitative data were transcribed by SZHD team. An experienced external translator who was not part of the research converted these to English. These translations were verified by bi-lingual members of the research team for the accuracy. Transcripts were read and re-read by SZHD and LSTM researchers, informing the development of codes for analysis, identifying emerging themes and areas for further exploration. Transcripts were uploaded to transcription software NVivo version 10 and a coding framework developed in a face-to-face meeting of researchers. Initial coding was undertaken as a group activity for two days. The transcripts were divided and the SZHD and LSTM teams continued to code separately, then analysed thematically through face-to-face and virtual meetings. The qualitative and quantitative results are combined below and presented against key themes that emerged from the qualitative analysis.

Ethical approval for the baseline was given from the Federal Ministry of Science and Technology (MoST), National Research Ethics Review Committee in April 2014. A support letter was obtained from Regional Health Bureau to conduct the interviews. Written informed consent was obtained from the participants of the study.

**Results**

**Descriptive profile of participants**

A total of 90 participants were enrolled for the study. Of these 49 participants were from the implementation zone (9 from district, 24 from HC and 16 from HPs), 57% being women. We enrolled eight (5 men and 3 women) participants from control zones for qualitative study. Ten participants (3 from control and 7 from intervention zone) were interviewed using semi-structured questionnaire. Three FGDs were conducted comprising of 23 participants from implementation and 12 from control zones.

**Setting the context: HEW’s commitment**

All HEWs interviewed reported and emphasised that their main role is to effectively deliver, monitor and evaluate their performance in delivering the sixteen health packages:

“Besides teaching sixteen health packages, we monitor or follow up the practice or application of what the society has learnt” **(**HEW Focus Group Implementation Zone)

The inspiration of the HEWs comes from perceiving health outcomes they observe within the community consequently impacted the HEWs commitment to deliver the services expected from them by the rural communities.

“I have served… I have noticed changes up on the society and by myself. This inspires me to serve them more” (HEW FGD Implementation Zone)

**Current modes of communication within the health system**

Communication strongly emerged as a theme from the quantitative and qualitative data across the range of professionals. Key sub themes related to mode of communication, with a large focus on mobile phones - factors for utilisation, advantages and challenges (Table 1).

All HEWs (n=18) undertaking the quantitative questionnaire had access to a mobile phone. Mobile phone communication was valued and utilised by HEWs for enabling clients to access health facilities, co-ordinating care, sharing information with colleagues and offices and obtaining resources.

Most HEWs (n=16) reported sending two or more SMS per week for general communication. However, two HEW reported not knowing how to send a text. The majority of HEWs (94% n=17) were unable to use internet via mobile phone.

Mobile phone communication was perceived by one HEW as contributing to preventing maternal child mortality.

“Labouring mothers call us in the midnight and we soon call ambulance. Hence, it is very useful to save lives of mothers in problem”. (FGD HEW Implementation zone)

It was also perceived by many professionals as a method of sharing information between colleagues and officers urgently, effectively and efficiently.

“We use (Mobile) to exchange information… to share it quickly and timely. When immediate information is required in certain level, for example Zone or District level, we use either fixed or mobile phones to convey the required message”.(HCH Implementation Zone Interview)

Significant challenges were reported by the majority of participants concerning mobile network

“..in our village, may be because of topography of our village, there is extreme shortage of network”(HEW Focus Group Implementation Zone)

“Unavailability of network coverage is a common challenge. If there is a little coverage, it becomes very busy. As a result, sharing information in a timely way is a bit impeded. Moreover, lack of electric power to recharge the battery when it gets lower is another problem in rural area” (HCH Implementation Zone)

The DHO and ZHD Officers in the implementation zone triangulate the experience and challenges related to network.

“In our area, honestly speaking, there is no network coverage**” (**DHO Implementation Zone)

These issues are recurrent and persistent challenges which have an impact on communication flow and service delivery. Several HEWs in the implementation zone reported that in urgent situations they would travel to find network coverage or travel to the client to relay a message.

There was reported personal economic cost of paying for pre-pay airtime when using a mobile phone for work purposes and sometimes unavailability of local suppliers for new airtime card.

“..re-charging the balance is challenging us. Thus, as we use it for office work too, I think the office should have budget for its service”(Health Professional FGD Implementation Zone)

The majority of quantitative participants charged their mobile phones at home, however there was a personal economic cost for 11% of HEWs (n=2) who paid to charge their phone at a local shop.

#### **Perceptions, limitation and opportunities of the current Health information management system**

HEWs described a HMIS for capturing family data, through registration, logging HEW service provision and assisting in follow-up. The benefit of HMIS perceived by most HEWs relate to the ability to organise and access information.

 “HMIS is important specially to get TB clients who stopped prescribed medication. HMIS provides full address..... so that they can get him or her with a little effort. So, HMIS is very helpful for our work” (HEW FGD Implementation Zone)

In contrast, the Health Professionals, DHOs, HCHs and ZHD representative described the benefits of a HMIS based on indicators, with a systematic reporting process for monitoring and evaluation to assess outcomes and the performance of health extension programme.

The majority of HC participants (n=8) stated HMIS reports take between 1-7 days to reach districts and All HEW (n=18) participants stated that HMIS reports take 1-3 days to reach health centre. However, majority of HEWs (n=16) reported discrepancy between HP tally sheets and HMIS reports.

Most HEWs report workload, shortage of resources for documenting HMIS activity, multiple HMIS formats and management of patient folders as challenges of HMIS.

“HMIS report is not sent in time… because of campaign of certain activities, when the format or report is delayed (shortage of resources), and when we are overloaded with business in which case we forget tallying customers received health service, and in turn this affect our performance negatively.” **(**HEW FGD Control Zone**)**

HMIS format being in English language was a significant area for improvement expressed by many HEWs as this impeded their ability to report accurately.

“We get recurrent feedback which shows some errors. But, as to me, these errors are recurring just because the HMIS documents are written in English. As we have gaps in understanding ideas written in this medium, we repeatedly mistake...we face language barriers which affect our performance” (HEW FGD Implementation Zone)

There was mixed perceptions regarding data quality and completeness ranging from DHOHCHEW boredom and lack of commitment to data collection while a DHO and HEW stated that it is not significant. Other HEWs raised various reasons including human error, work overload and demands, lack of training and language. One HEW reported that over reporting resulting in data inaccuracy.

Solutions proposed to improve data quality included systems for requesting resources, supervision and performance management.

**Knowledge, awareness and benefits of using eHealth**

In the majority of individual interviews and FGDs with HEWs in the implementation zone there was a significant lack of awareness and knowledge about eHealth. 67% of 12 DHOs, 81% of 27 HCHs and all (18) HEWs did not know what eHealth is about. However, the potential benefit, current use and issues related to eHealth are described below.

Several HEW participants in the intervention zone proposed thoughts about what eHealth might entail ranging from “education health”, “consolidating health through education” “improving health of society via education”.

Within the control zone the HEW focus group were aware of eHealth as an immediate system to receive and share health information but had not used eHealth.

 “if we use our mobile cell phone, it will facilitate our work. It also used to keep the quality of information and to keep information or documents safely”(HEW FGD Participant – Control Zone)

HEWs reported current use of mobile phone text messaging and this increased speed of preparing and delivering of the communication message. The use of mobile phones for prompting appointments was triangulated with similar responses from health professionals. HCHs perceived that use of mobile phone texting could reduce the number of non-attendees at clinical appointments.

**Discussion**

**HMIS – current challenges**

HMIS was seen as an important component of health system with benefit of providing the ability to organise and access information to effectively provide health services. The key findings of this study revealed a number of challenges with HMIS in its current form related to information quality, accuracy, reliability and timeliness16. Keeping multiple records – often in different formats – in paper form is challenging for HEWs, and some supervisors felt that some HEWs needed to be more committed to data collection. The multiple formats in a paper system was seen as tedious and time consuming and creates a large work burden and can lead to mistakes and inconsistences as observed in the record review process3. An eHealth system if properly embedded and used could enhance the rigour, quality and timeliness of reporting and the responsiveness of the health system 3, 17, 18.

**Knowledge and experience of mobile phones, technology and eHealth**

With the advances in technology, access to mobile phones and improved connectivity, countries have revolutionized the data capturing mechanism, shifted from paper based to electronic system, improved patient care and follow up and contributed to better access to care and improved outcomes 19. However, the utilization of mobile phones for health varies across settings depending on the availability of the technology, capacity of the health system to use and infrastructure. This depends on the capacity of the health workers to use mobile phones which directly relates to their knowledge. In our study, HEWs used mobiles for both personal and professional purposes for calls, although the majority had not used the internet on their mobile phones. There is limited experience of using mobile phones to facilitate HMIS. There is great potential as the health workers from HC and higher health system used mobile phones for emails and communication for health. With the rapid expansion of mobile phone services, electronic HMIS system and available strategy extending the services to improve HMIS and patient care is a great potential to improve health service delivery and data capturing for decision-making without delay20, 21. However, most of the respondent’s surveyed have limited experience of internet use, technology and eHealth in general although they expressed considerable enthusiasm to learn and improve health services. Compared to HEWs, health professionals had relatively more awareness and knowledge of eHealth and its benefits as has been shown in other settings22.

This has implications for training of HEW and their supervisors in terms of pedagogic approach deployed, time dedicated to training and opportunities for ongoing support. These issues will be taken into consideration when training is provided by the project to HEWs and their managers in the districts chosen.

**Challenges with using mobile phones**

The main challenges identified include limited network coverage and power sources are an ongoing challenge especially in rural areas11. Therefore intervention that improve the capacity of the eHealth system to use mobile phones, alleviate problems related to connectivity and improve interoperability with the existing HMIS will surely contribute to better health in the community by providing accurate and timely data for decision making. We have designed the eHealth system to ensure that it is possible to save data on the phone which can then be submitted once network coverage is available, whilst also retaining records already submitted.

Another challenge relates to concerns about having to pay to recharge airtime balance. This challenge is particularly faced by HEWs and has the potential to adversely affect their ability to use their mobiles in a responsive manner. Therefore, there is potential ensuring the access to prepaid airtime for use in rural communities.

**The gender lens: performance management supervision**

HEWs are all female, and juggling multiple roles at home and at work. Support of husbands, family members and communities was appreciated. There is a clear sense of excitement about the potential of eHealth and given HEWs are already balancing and delivering multiple roles and packages this will need to be carefully supported so that it enhances rather than undermines their work and experience. Engaging HEWs in using eHealth has a great potential in terms of empowering women living in remote and rural communities to improve service delivery, capture quality data and use for timely reporting and the data for local decision making and action. The importance of ensuring ongoing supportive supervision structures to address emerging problems, and empower HEWs to use technologies to support their work will be considered as we move forward. Gender discrepancies exist in general health between men and women not only in Ethiopia but also in the neighbouring countries in the region23. Evidence from other studies has demonstrated that eHealth could address these gender discrepancies in health service access, providing equitable access24. In Ethiopia, women face particular challenges with respect to maternal and reproductive health and TB outcomes25. Based on the evidence above, targeting these two health areas and working directly with women HEWs in ways that are supportive and empowering and enabling them to enhance confidential services to women, poor and marginalised groups could contribute to equitable access to services.

**Strengths and limitations**

The strength of this study is that it included health workers from policy makers to the community to understand the context and obtain necessary information to design a pragmatic solution. The limitations of the study were its inability to assess the distance and frequency of travel of HEWs to access network and lack of quantitative data to verify the data inconsistencies. The study is set in the proposed intervention and control zones selected for the intervention being designed. Reference to the “intervention” and “control” terminology in the paper does not refer to any comparison aspects of the zones and the data should not be interpreted as such.

**Conclusion**

Despite limited knowledge and experience, eHealth technology presents a new opportunity for the Ethiopian health system to improve data quality and community health by providing real time data for decision-making. Empowering, supporting and responding to the challenges faced by frontline female HEWs who are a critical bridge between communities and health systems will be important part of ensuring the sustainability and responsiveness of eHealth strategies. The lessons for this study indicate that there is great potential and pragmatic design and implementation of eHealth technology should be built on the existing HMIS and based on the available knowledge and skill, challenges and potential of the technology. Therefore appropriate training, supportive supervision and performance management should be in place to ensure its successful implementation. The intervention should address all the challenges identified in the paper, including network coverage, performance issues, eHealth training and mobile telephony infrastructure.

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| ***Table: 1*****Description of communication as a theme for mobile phone usage among the participants**  |
| **Professional Group** | ***Regional Health Bureau (RHB) representative***  | ***Zonal Health Department (ZHD)******representative***  | ***District Health Officer******(DHO)*** | ***Health Centre******Lead******(HCL)*** | ***Health Post -******Health Extension Worker (HEW)*** |
| **Mode** | Post, internet, fax, fixed line phones, person to person and mobile phones. (fax, internet, post and fixed lines were mainly for regional level; fixed lines for zones, districts and health centres, and mobile phones for HPs and across all the professional groups)  |
| **Mobile Phone Use** | Personal and professional purposes - calls, texts, social media and emails. | Mainly personal and sometimes professional purposes - calls, texts. |
| **Mobile Phone****Advantages** | Co-ordinating care, sharing information with colleagues and offices | Access health care facilities, co-ordinating care, sharing information with colleagues and offices and obtaining resources. |
| **Mobile Phone****Challenges** |  |  | Mobile network – Coverage, geography and electricity supply.Airtime cost. | Mobile network – Coverage, connectivity, geography and electricity supply.Airtime and cost to charge phone.  |