Original article

Asessment of health extension workers (HEWs) knowledge, attitude and performance in mHealth intervention in Guraghe Zone of Ethiopia: Cross-sectional study

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Abstract

Background: An mHealth initiative that intends to improve maternal and child health care delivery was implemented in Abeshge and Ezha woreda of Guraghe zone of SNNPR of Ethiopia by Addis Ababa University with financial support from the WB and AFDB. The adoption of such new technology for intended purpose depends on the knowledge and attitude of front line health workers towards the technology as well as expected benefits and acceptance by the end users. An assessment of the knowledge, attitude, and performance of HEWs is important to improve and scale intervention.

Objective: To assess the knowledge, attitude and performance of health extension workers' towards mHealth intervention in two woredas of Guraghe zone of Ethiopia.

Methods: A cross sectional survey was conducted among health extension workers who participated in mHealth intervention that was implemented from September 2012 – October 2014 in Abeshge and Ezha woreda of Guraghe zone of SNNPR of Ethiopia. A total of 77 participants were participated in the study. A structured and pre validated questionnaire was used to collect relevant data. Descriptive statistics was employed to summarize the data using SPSS 20. Chi-square test was used to determine an association between HEW's knowledge, attitude and performance and socio-demographic and economic characteristic.

Results: Seventy seven (85%) of the HEWs who work in 57 health posts in Abeshge and Ezha woreda of Guraghe zone of SNNPR of Ethiopia participated in the study. Finding shows that fifty seven (74%) of the respondents did not have information on the potentials role of mobile phone on improved maternal health service prior to current project. After mHealth intervention, participants acquired basic knowledge on mHealth. Accordingly, most of them scored ≥ six out of the eight knowledge items and were considered as having "Good Knowledge" on mHealth application to improve maternal health service (77.8% vs. 62.3% for Abeshge and Ezha respectively). Similarly positive and favourable attitude was demonstrated towards the use of mHealth technology. Performance level of using mHealth technology is found generally satisfactory.

Conclusion: Following mHealth intervention, HEWs demonstrated good knowledge and favorable attitude towards mHealth application for improved maternal health service as compared to relatively low level of knowledge at baseline. This study suggests the need to capacitate HEW's on use of technology to scale up mHealth initiative [*Ethiop. J. Health Dev.* 2015;29(3):160-169]

Key words: maternal health, mHealth, HEWs, application of technology

Introduction

Use of mobile device for health communication with an intention to improve health services and information is rapidly growing strategy for improved health care (1). Since mobile phones are readily available, including in remote rural areas, governments and development agencies tend to consider Information and Communication Technology (ICT) to improve the wellbeing of people in developing countries. Mobile technology is an emerging opportunity to improve access to services and avoid barriers in healthcare. The pervasive social connectivity of mobile phones has imperative implications for healthcare and public health in promoting health, disease prevention and management (2, 3).

Numerous mHealth solutions have emerged in Sub-Saharan African countries where health practitioners played the primary role in adopting and using mobile phones as a tool for health services delivery. These projects vary in diversity and scope, from monitoring measles outbreaks in Zambia to supporting diagnosis and treatment by health workers in Mozambique, and sending health education messages in Benin, Malawi, and Uganda (4, 5). Moreover, mobile phones have been used in sending reminder, in the collection, measurement, and monitoring and tracking epidemics (6).

The driving forces behind the current rapid mHealth growth in developing countries in general and in Africa in particular includes the rising number of phone users, expansion of mobile networks, the decline in phone costs, and innovation in mobile technology (4, 6).

The government of Ethiopia has developed health care strategy (HSDP) which is believed to help achieve universal health care coverage (7, 8). This strategy is facilitated among others the flagship Health Extension Program (HEP). This program has been implemented

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since 2003 as primary vehicle for prevention, health promotion, behavioral change communication, and basic curative care particularly in rural settings (8). The program mainly intends to mobilize community to produce its own health. Such intervention bridges gap between community and health facilities and improve health service delivery (8, 9).

HEWs as the tool of such intervention have reached out to the remote poor. However, their potential is rarely maximized so as to improve communication with their patients, co-workers as well as their supervisors who often are based at distant location (10).

A study reveals that supporting HEWs at community level by improving use of ICT particularly mobile phones would improve health care service provision (10, 11).

Regardless of its value, ICT application has been slow particularly in rural areas. Several factors, such as infrastructural, knowledge, skills, and attitudes of users towards the technology limit potential applications (12). Health workers' interest, knowledge and computer skills and use of other technology such as the Internet influenced use of ICT for improved health services (13, 14). Furthermore, perception and willingness of community health workers to use any ICT is also influenced by their perceptions on the value of ICT and ease of use (15, 16).

During 2012 - 2014, Addis Ababa University (AAU), implemented an innovative pilot intervention on the use of mobile health (mHealth) to improve maternal health service delivery. It was implemented in three woredas of the Guraghe Zone, Ezha, Abeshge (intervention woreda) and Sodo (Control woreda) of SNNPR.

The pilot intervention aims to determine if use of mHealth technology improves flow of health related information between health extension workers (HEWs), supervisors, volunteer community health workers (vCHWs), and between HEWs and community members ultimately leading to improvements in maternal and child health service delivery. A special homegrown Frontline SMS-based application was developed to enable HEWs to register new pregnancies and new births and subsequently receive automated Short Message Service (SMS) with reminder on antenatal care (ANC) dates and delivery-related information, postnatal care (PNC) and immunization services for mothers and newborns. All HEWs in the intervention woredas were trained on purpose of use of mHealth technology. Frontline SMS software was installed on their mobile phone.

Adoption of this technology depends on the knowledge, skills and attitude towards its application and perceived benefits of the end users (14, 17, 18). Thus, as part of the general mHealth intervention, HEWs were equipped both with knowledge and skill on how to use mHealth. Thus

this survey aims to assess the knowledge, attitude and performance of health extension workers' towards mHealth intervention in the intervention woreda.

Methods
The study was carried out in Abeshge and Ezha woredas of Guraghe zone where mHealth intervention was implemented. A cross sectional survey was conducted targeting health extension workers who participated in mHealth intervention during 2012 – 2014. Of the 91 HEWs, a total of 77 participated in this study. List of all Kebeles in the districts and HEWs working in each Kebele was prepared. Totally 77 HEW were available and consented to participate in the study.

Structured and pre validated questionnaire was used to collect data. Data on knowledge, attitude and performance was collected during September and October, 2014 by two trained local research assistants. Descriptive statistics and Chi-square test was used to test association using SPSS ver 20.

Knowledge in this study was measured by adopting established tool such as respondent's understanding of mHealth technology; understanding use of Frontline SMS and its importance in facilitating information flow (18, 19, 20). Eight knowledge variables were identified to decide respondents level of knowledge with Yes or No. Marking '**Yes**' for each items have a value of 1, otherwise it will be 0. The sum of all eight items was categorized as "low knowledge" (score of 0-2), "moderate knowledge" (score of 3-5) and "good Knowledge" (score of 6-8).

Attitude was measured using 5 attitude items measured by a five-point Likert scale 'Strongly Disagree =1', 'Disagree =2', don't know =3', 'Agree =4' and 'Strongly Agree =5'. Higher scores i.e. 4 and 5 represented more positive attitude towards mHealth and willingness to use the technology.

Performance was measured by action which demonstrates their knowledge and attitude. Mobile based Frontline SMS use was assessed to determine their performance level.

Results
Socio-demographic profile: A total of 77 out of 91 female HEWs working in 57 health posts were available during data collection and interviewed. This makes a response rate of 85%. It was found that 53.2% of participants were in age group of 20 – 25 years while 35.1% were in the age group of 26 – 30 years old. Forty two (54.5%) of them were married and 97.4% of them have served for 9 years' as HEWs. While all of them holds certificate as HEWs 7.8% claimed to have additional college diploma. Thirty seven (48%) of the respondents reported to have attended on-the-job training

related at least three times while 42% got on the-job training once or twice (Table 1).

Table 1: ***Socio-Demographic Characteristics of Respondents (HEWs)***

Variables	Categories	Count	Table N %
Woreda	Abeshge	45	58.4%
	Ezha	32	41.6%
Sex	Female	77	100.0%
	Male	0	0.0%
Age Category	Less than 20	5	6.5%
	20 – 25	41	53.2%
	26 – 30	27	35.1%
	30 – 35	4	5.2%
	36 – 40	0	0.0%
	40+	0	0.0%
Marital Status	Single	34	44.2%
	Married	42	54.5%
	Divorced	1	1.3%
	Widowed	0	0.0%
Years of Service	Less than 5 Years	32	41.6%
	5 - 9	43	55.8%
	10 - 14	2	2.6%
	15 and Above	0	0.0%
Qualification	Diploma	6	7.8%
	Certificate	70	90.9%
	Other	1	1.3%
On the Job Training related to MNCH, reproductive health, hygiene & sanitation …	Once	28	36.4%
	Twice	12	15.6%
	Three Times	1	1.3%
	More than Three	36	46.8%

Knowledge of HEWs on mHealth technology, Frontline SMS based application and its importance on facilitating information flow: For a question assessing their prior understanding of mHealth technology, fifty seven (75%) of the respondents, reported to have no prior knowledge of mHealth technology. On the other hand, among those who claimed to have prior knowledge, participation in on the job training and radio/TV were reported as source of information on mHealth (Table 2). All of the respondents reported to have attended training on Frontline SMS based application and use of protocols developed for mHealth intervention. Of the respondents, 93% reported to be satisfied where the two days training helped them to comfortably use mHealth technology to improve maternal health service delivery (Table 2).

Table 2: **HEWs understanding/knowledge of mHealth Technology and Source of Information**

Variables	Categories	Count	Table N %
Have Prior Knowledge of mHealth Technology	Yes	19	25.0%
	No	57	75.0%
Source of Information on mHealth Technology	Newspaper	0	0.0%
	Radio/TV	8	10.5%
	Training/Workshop	8	10.5%
	mHealth Project	57	75.0%
	Colleagues	3	3.9%
	Other	0	0.0%
Attended the 2 days Training on mHealth intervention & comfortable to use the current Frontline SMS based mHealth system	Yes	69	93.2%
	No	8	10.4%

Measurement of HEW's knowledge on mHealth shows that respondents correctly responded to such questions as "what mHealth technology means", "the potential of mHealth to reduce health care cost", "understanding of Frontline SMS based mHealth system", "Usefulness of Frontline SMS in reminding mothers ANC, PNC and immunization" and "the systems capability in facilitating information flow between HEWs, patients and Health Centers" (Table 3). There was no statistically significant differences between respondents from the two woreda for most of the variables (p-value >0.05) except for three of the knowledge variables. Knowledge level variables in which significant differences observed are on "understanding of mHealth as an application of mobile phones for health care", "usefulness of Frontline SMS system in reminding mothers on ANC, PNC and immunization" and on "the Frontline SMS to facilitate information flow".

Table 3: **Status of Knowledge of HEWs on Selected mHealth Related Knowledge Variables by Woreda**

Knowledge Variables		Woreda				Chi-Sq.	Sign.
		Abeshge		Ezha			
		Count	Column N %	Count	Column N %		
mHealth is application of mobile phones for health care	Yes	45	100.0%	27	84.4%	7.520	.006
	No	0	0.0%	5	15.6%		
I know well Using Frontline SMS based mHealth system	Yes	42	93.3%	26	81.2%	2.645	.104
	No	3	6.7%	6	18.8%		
Frontline SMS system is useful in Reminding Mothers ANC, PNC, immunization	Yes	45	100.0%	29	90.6%	4.390	.036
	No	0	0.0%	3	9.4%		
mHealth has a potential to reduce health care cost	Yes	45	100.0%	30	93.8%	2.888	.089
	No	0	0.0%	2	6.2%		
Frontline SMS system has application for Requesting Contraceptives& vaccination	Yes	42	93.3%	27	84.4%	1.612	.204
	No	3	6.7%	5	15.6%		
mHealth is useful for better health information flow	Yes	30	66.7%	19	59.4%	.430	.512
	No	15	33.3%	13	40.6%		
I am effectively using the SMS Reminders for follow-up	Yes	43	95.6%	28	87.5%	1.689	.194
	No	2	4.4%	4	12.5%		
mHealth system would facilitate communication b/n HEWs & HC	Yes	43	95.6%	25	78.1%	5.505	.019
	No	2	4.4%	7	21.9%		

(Pearson Chi-Square Tests, The Chi-Square Statistic is Significant at 0.05 level)

As detailed in table 4 below, majority of respondents had 'Good knowledge' on mHealth technology (77.8% -vs- 62.3% for Abeshge and Ezha respectively). There was no strong association between good knowledge and respondents' age, qualification, service year and attendance of on the job training (Table 5).

Table 4: **Summary of Knowledge Score for the Selected Knowledge Variable**

Knowledge Score of Respondent (Result)	Woreda			
	Abeshge		Ezha	
	Frequency	%	Frequency	%
Low knowledge	-	-	2	6.26
Moderate knowledge	10	22.1	10	31.23
Good knowledge	35	77.8	20	62.3

Table 5: **Pearson Chi-Square Test on Significance of Factors Modifying Status of mHealth Knowledge**

Knowledge variables		Age Category	Years of Service	Qualification	On the Job Training Attended
mHealth is application of mobile phone for health care	Chi-square	.883	.982	1.019	.458
	Sig.	.830	.612	.601	.928
Frontline SMS is useful in Reminding Mothers ANC, PNC and immunization	Chi-square	3.860	12.716	2.856	3.555
	Sig.	.277	.002	.240	.314
I know well using Frontline SMS based mHealth System	Chi-square	1.803	.101	.205	2.339
	Sig.	.614	.951	.902	.505
Frontline SMS has application for Requesting Contraceptives and vaccine	Chi-square	3.050	1.407	.893	3.348
	Sig.	.384	.495	.640	.341
mHealth has a potential to reduce health care cost	Chi-square	1.993	1.296	.535	1.123
	Sig.	.574	.523	.765	.772
I am Using the Reminders Very Effectively for follow-up	Chi-square	8.498	1.435	.614	2.164
	Sig.	.037	.488	.736	.539
mHealth is useful for better health information flow	Chi-square	.986	1.747	.783	2.992
	Sig.	.805	.418	.676	.393
mHealth System would facilitate communication between HEWs & HC	Chi-square	2.173	2.735	.281	.458
	Sig.	.537	.255	.869	.928

Attitude of HEWs towards mHealth Technology: Assessment of attitude of participating HEWs shows positive attitude. Finding on attitude towards mHealth technology shows 75 to 95% of participants hold favourable attitude on the use of mHealth (Table 6).

Table 6: **Attitude of HEWs towards mHealth Technology**

Variables	Categories	Woreda			
		Abeshge		Ezha	
		Count	Column N %	Count	Column N %
Interested to know mHealth Technology	Strongly Disagree	0	0.0%	2	6.2%
	Disagree	0	0.0%	0	0.0%
	Don't Know	0	0.0%	0	0.0%
	Agree	14	31.8%	3	9.4%
	Strongly Agree	30	68.2%	27	84.4%
Happy to use mHealth Technology in the Future even if it entails Cost	Strongly Disagree	1	2.3%	1	3.1%
	Disagree	1	2.3%	2	6.2%
	Don't Know	3	6.8%	0	0.0%
	Agree	15	34.1%	3	9.4%
	Strongly Agree	24	54.5%	26	81.2%
I am willing to use my personal phone for mHealth Purpose	Strongly Disagree	0	0.0%	1	3.1%
	Disagree	8	17.2%	0	0.0%
	Don't Know	3	6.8%	0	0.0%
	Agree	9	20.5%	4	12.5%
	Strongly Agree	25	55.5%	27	84.4%
Willing to use mHealth for Maternal and child health care delivery	Strongly Disagree	1	2.3%	1	3.1%
	Disagree	5	11.4%	0	0.0%
	Don't Know	0	0.0%	0	0.0%
	Agree	10	22.7%	5	15.6%
	Strongly Agree	28	63.6%	26	81.2%
mHealth Technology would help me to improve performance of my daily work	Strongly Disagree	1	2.3%	0	0.0%
	Disagree	0	0.0%	1	3.1%
	Don't Know	1	2.3%	0	0.0%
	Agree	16	36.4%	8	25.0%
	Strongly Agree	26	59.1%	23	71.9%

Application of Frontline SMS: All respondents reported to have mobile phone which was provided by mHealth project. Forty (52.6%) of the respondents indicated to spend 30 minute to 1 hour on phone call and phone response while twenty-six (34.2%) spend less than 30 minutes and twenty nine (38.2%) of them spend an average of less than 15 minutes for the project related data communication daily. It was found that 6.6% of them use their phone to download various mobile applications for personal requirements (Table 7).

Almost all HEW reported that all electronic protocols that were loaded into personal mobile phone were important to facilitate maternal health interventions. It was found that 52% of them frequently used mother and child related protocol while 36.8% of them frequently used mothers' registration protocol. On the other hand, the majority of participants (97.7%) reported less utilization of contraceptive and vaccine requesting and reporting protocols (Table 7).

Table 7: **Mobile phone and Electronic protocol use**

Variables	Categories	Count	Table N %
Average Time Spent for Phone Call Per day for project related as well as routine phone usage	Less than 30 Minute	26	34.2%
	30 Minute - 1 Hour	40	52.6%
	1 - 2 Hours	4	5.3%
	2 - 3 Hours	4	5.3%
	More than 3 Hours	2	2.6%
Average Time Spent for project related SMS communication Per Day	Less than 15 Minute	29	38.2%
	15 - 30 Minute	28	36.8%
	30 - 45 Minute	3	3.9%
	45 Minute - 1 Hour	3	3.9%
	More than 1 Hours	13	17.1%
Average Monthly Cost for Mobile Card	50 Birr	30	39.5%
	100 Birr	32	42.1%
	150 Birr	11	14.5%
	Not at All	3	3.9%
	Other	0	0.0%
Phone Use other than Phone Call	SMS	71	93.4%
	E-Mail	0	0.0%
	Download Application	5	6.6%
	Other	0	0.0%
Very Important Protocol Forms	Mother Registration	3	3.9%
	Child Registration	1	1.3%
	Contraceptives Request	0	0.0%
	Vaccination Request	0	0.0%
	Reporting Forms	0	0.0%
	All	72	94.7%
Most Frequently Used Protocol Forms	Mothers Registration	28	36.8%
	Child Registration	6	7.9%
	Contraceptives Request	0	0.0%
	Vaccination Request	0	0.0%
	Reporting Forms	2	2.6%
	Mother and Child Form	40	52.6%
Less Frequently Used Protocol Forms	Mothers Registration	0	0.0%
	Child Registration	1	1.3%
	Contraceptives Request	16	21.1%
	Vaccination Request	20	26.3%
	Reporting forms	20	26.3%
	Contraceptive, Vaccine and Reporting forms	19	25.0%

Barriers Affecting Practice: HEWs identified barriers to mHealth. These includes network failure (84.2%), irregularity of electric power to charge phones (76.3%), cost of mobile card (56.6%) and resistance to new technology and phone sharing culture with family members (31.6%). Phone quality and ease of use were also considered as barriers to use of mobile health for the intended purpose for 14.3% and 13% of the participants respectively. Monthly provision of free air-time and encouragement by their bosses were on the other hand reported to facilitate use of mobile phone for health service delivery (Table 8).

Table 8: **Barriers to use mHealth in the intervention woreda**

Variables	Categories	Count	Table N %
Low Quality of phone	Yes	11	14.3%
	No	66	85.7%
Difficulty to use mHealth	Yes	10	12.98%
	No	67	87.01%
Irregularity of electric power	Yes	58	76.3%
	No	18	23.7%
Problem of network	Yes	64	84.2%
	No	12	15.8%
Resistance to new technology & community culture	Yes	24	31.6%
	No	52	68.4%
Cost of service use	Yes	38	50.0%
	No	38	50.0%
Intention to use If you have to pay	Yes	33	43.4%
	No	43	56.6%
Role of immediate Boss to use mobile phone	Encourage	73	96.1%
	Discourage	0	0.0%
	Indifferent	3	3.9%
	No Opinion	0	0.0%

Discussion

It is generally agreed that communication technologies are essential to improve access and quality of health services. Provision of health information is believed to improve overall health outcomes (2, 3). With the recent advent of multifunctional mobile phone technologies and rapid incursion of the phone network, mHealth applications are considered as potential solutions to address health needs and challenges in developing countries (2, 21). Adoption of this technology ultimately depends on knowledge, attitude and use of technologies by health practitioners.

As depicted from other studies age as well as education status of health care providers offer favorable ground to promote and facilitate adoption of innovative health technology such as mHealth (5, 9). Nonetheless, such demographic profile is associated with aspiration for better life and it is likely that they may leave their job. This in turn challenges continuity of intervention. This could be explained by our findings where 41.6% of HEWs in the two woredas have under five years' experience as HEWs despite over twelve years of health extension program implementation (8, 9).

Launch of this innovative initiative has improved what was previously found to be limited knowledge (25% of them have prior knowledge) on the use of mobile technology for health intervention. Currently mHealth application by HEWs is expanding. The role of training to HEWs is evident to improve the application of mHealth technology.

Frontline SMS based phone applications is simple and open source that can be easily learned and adopted by any low level health staff.   Application of similar technology (mSakhi) in two districts of the state of Uttar Pradesh, India shows that community health care workers got confident in providing services to pregnant women and their families (22). On the other hand, the extent to which community health workers use of simple and ultra-short screening programmed into mobile phones has improved community case detection was documented (23). They found out that CHW knowledge and capability to use simple mobile based application to detect antenatal depression is comparable to the well trained workers who use standard tool. This current study utilized Frontline SMS based technology where participants could easily understand the application of technology with short training.

There is a wide spread belief that age, religion and other socio-demographic variables affect acceptance of technology (12, 13). Yet, in this study there was no

significant association between knowledge variables and respondents' age, qualification, service year or on-job training attended. Such discrepancy can be explained by the absence of difference in demographic and socio cultural characteristics among HEWs who were involved in the study. Recent unpublished report by Getachew et al has similarly documented that age does not significantly influence use of telemedicine technology among doctors at black lion hospital (Getachew Mengesha, PhD Dissertation Paper, 2015).

While in this study mHealth technology users reported to be happy with the use of inbuilt protocols and realize its importance, extremely poor utilization of the request and report forms is evident. Even though, the acceptability of existing manual system contribute to this low utilization, other factors like changing system of practice after the initiation of the intervention strongly contributed for low utilization, as stated in the other companion papers.

There are multiple barriers for a widespread mHealth adoption. Study has documented that misalignment of incentives to adopt mHealth technologies, lack of awareness about how to implement mobile solutions and keeping pace with mobile innovation are key barriers (24). Besides, clinician's resistance to new technology, cost and infrastructure implications, network capacity, non-availability of mHealth policy and guideline on usage and security challenges as significant barriers to implementation of mHealth systems (25). In line with the same finding, the major hindrance reported by HEWs in the current study was network failure, irregularities of electric power, resistance to new technology and phone sharing culture among family members.

Positive attitude towards any new technology is important for smooth adoption of technology for improved health delivery. Findings in other studies showed that study participants adore the experience and reported no discomfort in the use of technology (9, 11, 13, 25). In conformity to these reports, finding from this study unveiled the fact that majority of respondents from both woreda have favorable attitude towards mHealth technology.

Conclusion:
The current study revealed a relatively low level of baseline awareness of HEW on mHealth. This suggests the need for adequate orientation to community level health workers on the use of available technologies to improve and scale health service delivery. Once use of technology starts, it is evident that health care workers enjoyed improved health service delivery and satisfaction with their service. Thus, scaling lessons drawn from community health service delivery could be achieved with use of technology.

Acknowledgment

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