WORKING PAPER

Experiences and Perceptions of Health Staff on Applying Information Technology for Health Data Management in Ghana

January 2019

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MEASURE Evaluation

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ABBREVIATIONS

CHPS	community-based health planning and services
DHIMS 2	district health information management system (Ghana)
EPI	Expanded Programme on Immunization
FP	family planning
GHS	Ghana Health Service
ICT	information and communication technology
IPT	intermittent presumptive treatment
MOTECH	Mobile Technology for Community Health
OPD	outpatient department
PMTCT	prevention of mother-to-child transmission of HIV
RCH	reproductive and child health
TB	tuberculosis

EXECUTIVE SUMMARY

Background: User perspectives and experiences are pertinent to the continued use of mobile technologies for health data collection and management. What users experience affects not only what can be accomplished, but also what attracts them to the mobile technology; and what attracts them to the mobile technology affects how willing they are to understand and continue using it. Since 2011, Ghana Health Service (GHS)—in response to the expanding health information needs for the effective and efficient management of family planning (FP) and reproductive and child health (RCH) service delivery at the district level—has implemented two forms of mobile technology to facilitate health data collection and management in four districts of the Central Region of Ghana. These mobile technologies have been praised for reducing costs and the physical effort required of health staff. The main study objective was to explore and document the experiences and perspectives of health staff and managers in the four districts on use of mobile technology to collect and manage health data in district health systems.

Methods: The study design was exploratory and cross-sectional, employing a combination of quantitative and qualitative approaches to data collection. The study population consisted of 160 frontline health staff (midwives, community health nurses, health information officers, general nurses, and physician assistants) who had been trained to use mobile technologies and 14 district and regional health managers and policy makers. A structured, pretested questionnaire was administered to eligible frontline health staff. A semi-structured key informant interview guide was used to interview key health managers in the four districts and at the regional health directorate, as well as key policy makers at the national level of GHS.

Results: Almost all the study participants (95.8%) were involved in using mobile technology to collect health data. The data they collected were primarily related to child health, antenatal care, FP, postnatal care, immunization, and labor and delivery service. Although just over half (53.8%) used mobile technology to calculate coverage of healthcare services, less than half used it to conduct trend analyses (48.7%) and compile aggregate data (44.5%). Most participants (70.6%) used mobile technology to generate and transfer health reports. The main perceived benefits of using mobile technology for health data collection and management were enhancement of job and personal life. For health managers, the use of mobile technology has directly contributed to a general improvement in data quality and efficiency in data management. Almost all (97.5%) of the study participants appreciated using mobile technology to collect and manage health data; and almost all (99.2%) affirmed continued use of mobile technology for health data collection and management. Mechanisms for ensuring sustainability, from the perspective of health managers, involved setting objectives and planning for effective coordination, providing logistical support via national health programs, implementing a change management strategy to promote attitudinal change in users, and facilitating supervision and continuous training for frontline staff. Challenges cited were related, but not limited, to attitudinal change toward electronic data collection, training, and network connectivity.

Recommendations: GHS should develop a systematic on-the-job training program to empower health staff to analyze and use health data at the level where the data are collected. In addition, training institutions should include training on GHS's district health information management system 2 (DHIMS2) electronic tracker (e-Tracker) in pre-service training curriculum for health staff, especially those for FP and RCH services. Furthermore, the Policy, Planning, Monitoring and Evaluation Division, together with other stakeholders, should address the information and technology infrastructure for health data collection and management, such as inadequate supply of tablets and unreliable Internet access, to make the GHS DHIMS2 e-Tracker fully functional.

Conclusion: The findings suggest that health staff use the GHS DHIMS2 e-Tracker principally for collecting health data and transferring health reports. Many health staff did not access the full functionality of the mobile technology, such as analyzing health data. Nonetheless, health staff perceived benefits such as

enhanced social image, improved knowledge in information and communication technology, and increased work efficiency from using the GHS DHIMS2 e-Tracker to collect and manage health data. Health staff affirmed satisfaction with and continued use of the GHS DHIMS2 e-Tracker.

INTRODUCTION

Background

Previous research has found that user perspectives and experiences are pertinent to the continued use of mobile technologies for health data collection and management (Little, et al., 2013; Wu, Wang, & Lin, 2006; Lu, Yao, & Yu, 2005). Users' perspectives and experiences with mobile technology devices, access to the Internet, availability of mobile networks, and their personal lives and immediate environment all affect how and for how long mobile technology-based tools and mechanisms are used (Kuniavsky, 2003). What users experience affects not only what they can accomplish, but also what attracts them to the mobile technology; and what attracts them to the mobile technology affects how willing they are to understand and continue using it.

Accordingly, in today's technology-assisted society, a variety of mobile technology tools for collection and management of health data are increasingly being used in healthcare service delivery systems. The increasing use of mobile technology to collect and manage health data has accentuated the fact that information technology is one of the key elements for extending healthcare service delivery and improving management of health data. Introducing mobile technology into district health data collection and management has unquestionably reduced the level of effort previously required to carry out the same activities manually. This effect has improved service delivery and increased flexibility in responding to clients' health needs (Cornelius & Appiah, 2016; Oliver, Matic, & Frias-Martinez, 2015; Mwabukusi, Karimuribo, Rweyemamu, & Beda, 2014; Nygren & Isaksson, 2014; Little, et al., 2013; Meankaew, et al., 2010; Tomlinson, et al., 2009). Furthermore, this use of mobile technology has immensely increased information flow and dissemination of evidence-based knowledge among healthcare providers, and it has served to empower managers of health programs (Cornelius & Appiah, 2016; infoDev, 2006). Increases in efficiency resulting from use of mobile technology tools have affected health workers, patients and clients, and district health systems (Otto, Shekar, Herbst, & Mohammed, 2015).

Mobile Technology Use in Health Data Collection and Management in Ghana's Central Region

Since 2011, GHS—in response to the expanding health information needs for the effective and efficient management of FP and RCH service delivery at the district level—has been implementing two forms of mobile technology that facilitate health data collection and management in four districts of the Central Region of Ghana: Mobile Technology for Community Health (MOTECH) and GHS DHIMS2 e-Tracker. While MOTECH was a donor-funded project, the GHS DHIMS2 e-Tracker was part of an overall national stepladder deployment strategy to improve health data collection and management.

The MOTECH project, an initiative of GHS in partnership with the Grameen Foundation and the Mailman School of Public Health, Columbia University (Grameen Foundation, 2011), was introduced in early 2011 in Awutu-Senya District and later scaled up to Gomoa West District. The service delivery strategy allowed collection of health data on care provided to clients and reception of alerts about clients due for services. It also allowed for provision of client-focused, time-specific information alerts and reminders through a system of texts and voice messaging to clients. The system generated monthly reports that health facilities were required to submit to district and regional health directorates, which eliminated and/or reduced the burdensome processes of report compilation and transfer (Grameen Foundation, 2011).

The GHS DHIMS2 e-Tracker was first introduced in 2015 in Awutu-Senya District and scaled up to include Awutu Senya East, Gomoa East, and Gomoa West Districts by the end of 2016. The system employs

communication software that allows for the collection, collation, analyses, and management of both bio-demographic data and transactional case-based records of clients of FP and RCH services at the community level using a mobile phone or tablet. The main purpose is to improve the continuum of care by facilitating easy tracking of those who drop out of care, improve data quality for FP and RCH care services, reduce human activity especially in data collation and report generation, and make client data more visible to all service providers. The system stores information about clients, generates visit schedules, and tracks clients through text appointments and reminders. Dynamic case-based and on-the-fly statistical reports are also generated.

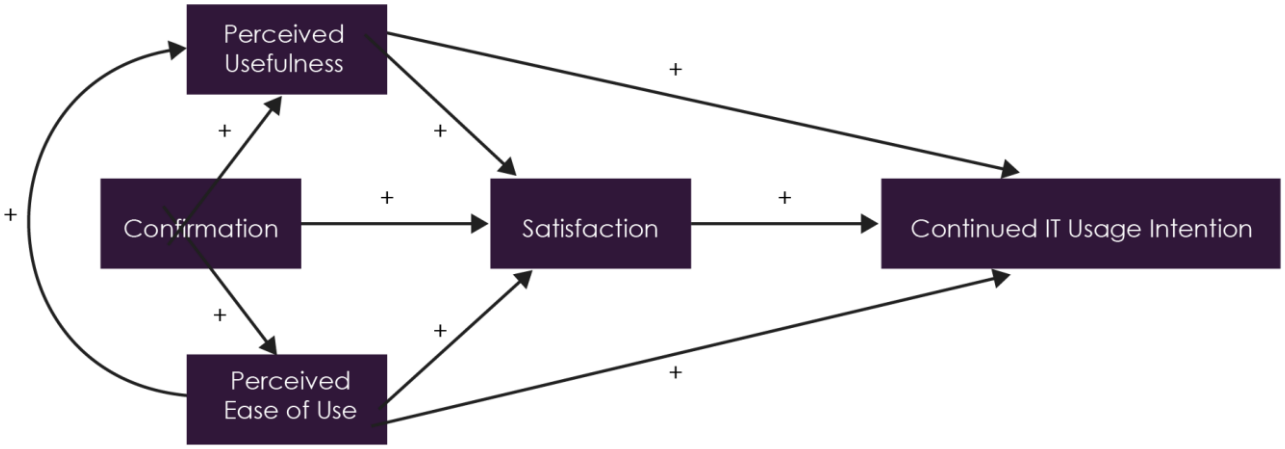
All these mobile technologies for health data collection and management at the district level have been praised for reducing costs and the physical effort required on the part of health staff. District healthcare service managers and providers now have access to FP and RCH information when and where it is needed and are better able to predict health problems facing individual clients, communities, and populations. As demonstrated by the MOTECH platform, clients have access to timely FP and RCH information tailored to their specific healthcare needs, empowering them to take control of their own health. Moreover, the network of hospitals and health centers in and between districts now experience better coordination of healthcare services and resources (e.g., improved referral system and outreach services of clinicians).

Conceptual Framework of the Study

Otto, Shekar, Herbst, and Mohammed (2015) enumerated seven areas that must be considered and addressed to assure effective establishment and sustained use of mobile technology for collecting and managing health data in district health systems: data infrastructure, standards for data and systems interoperability, local capacity, policy and regulatory environments, suitability of the business model, alignment of partnerships and priorities, and monitoring and evaluation. However, user perspectives and experiences have been emphasized as being highly influential on the continued use of mobile technology for collecting and managing health data in district healthcare systems (Cornelius & Appiah, 2016; Kuniavsky, 2003). Thus, the significance of our study is the focus on user's experiences with and perspectives on the ease of using mobile technology and the associated cost implications (Haberer, Kiwanuka, Nansera, Wilson, & Bangsberg, 2010).

Accordingly, a conceptual framework—the Extended Expectation-Confirmation Model in the Information Technology Domain—proposed by Hong, Thong, and Tam (2006) was adopted to guide the study (Figure 1). The framework stipulates that a number of constructs of user perspectives and experiences predict intention to continue use of mobile technology for collecting and managing health data in healthcare systems. They include perceived ease of use, perceived usefulness, confirmation and satisfaction with the mobile technology, and the purpose for which it is being applied. Perceived ease of use influences perceived usefulness of the mobile technology for health data collection and management. However, both perceived ease of use and perceived usefulness can independently and directly influence intention to continue using mobile technology for health data collection and management, and can indirectly influence satisfaction with the use of the technology. Expected benefits that users derive from experiences using the mobile technology for health data collection and management (confirmation) determine satisfaction with use, which in turn predict intention to continue using the technology (Hong, Thong, & Tam, 2006).

Figure 1. Extended expectation-confirmation model in the information technology domain



Study Objective and Research Questions

The main study objective was to explore and document the experiences and perspectives of health staff and managers in the four districts using mobile technology to collect and manage health data in district health systems. The study's specific research questions follow:

- What is health staff's engagement with and experience in using mobile technology to collect, collate, analyze, and transmit health data?
- What is health staff's perception about the usefulness of collecting, collating, analyzing, and transmitting health data by means of the mobile technology?
- What benefits do health staff derive from using mobile technology to collect, collate, analyze, and transmit health data?
- To what extent are health staff satisfied with using mobile technology to collect, collate, analyze, and transmit health data?
- How do health staff sustain the use of mobile technology for collection and management of health data?

The study also explored how health managers perceive the usefulness of mobile technology to manage health data.

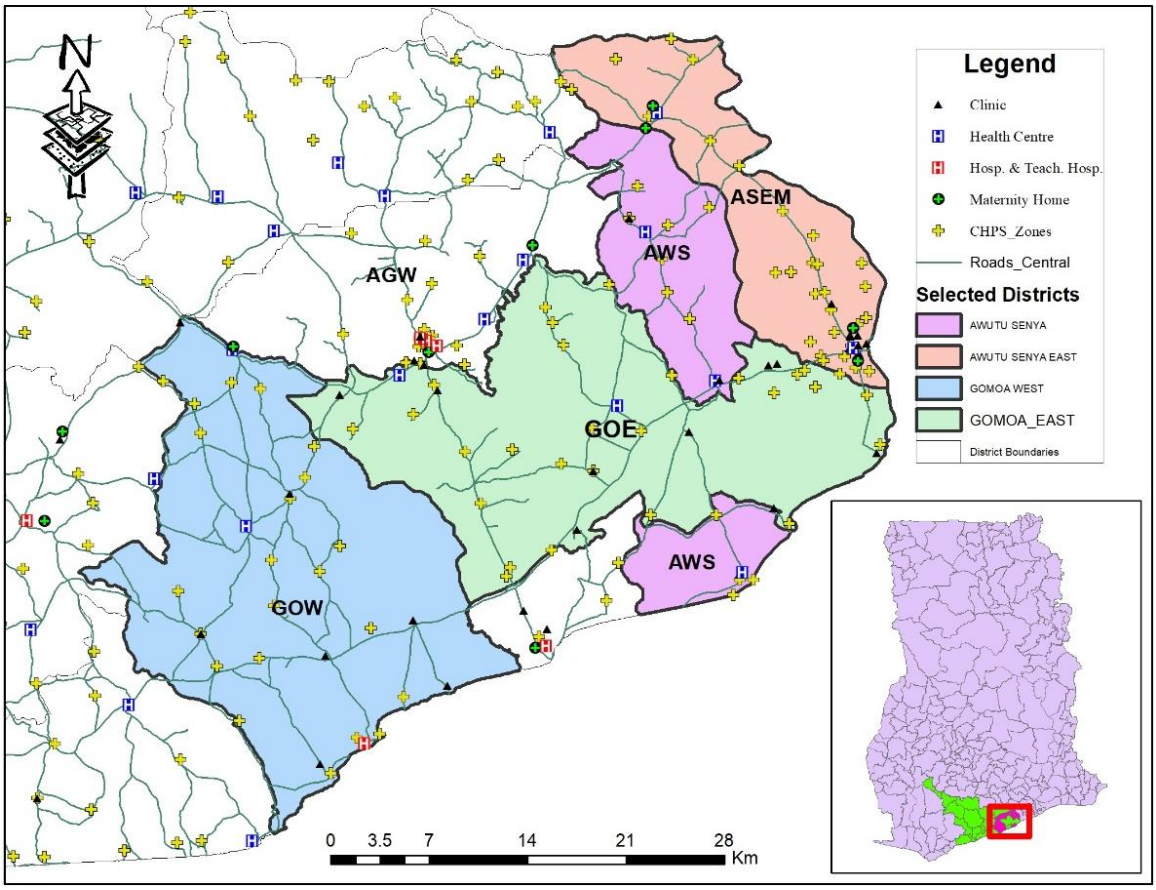
METHODS

Study Setting

The study was conducted in Ghana's Central Region, on the southern coast of the country. Four of the region's twenty administrative districts were selected where both MOTECH and GHS DHIMS2 e-Tracker were implemented; namely, Awutu Senya, Awutu Senya East, Gomoa East, and Gomoa West Districts. All four districts are located at the eastern corner of the region (Figure 2). Together, the four districts control an extensive system of publicly and privately managed health facilities encompassing six hospitals, one polyclinic, 15 health centers, 13 maternity homes, 20 clinics, and 92 community-based health planning and services (CHPS) compounds.

In these districts there are 1,213 total frontline health staff involved with health data collection and management comprising twenty public health nurses, 236 midwives, 462 community health nurses, 445 "enrolled" (auxiliary) nurses, 16 health information officers, and 34 field technicians. Each district has a district health directorate, which is responsible for coordinating all healthcare delivery services in the district.

Figure 2. Study area in local and national context with location of health facilities



Source: Regional Health Information Unit, GHS Central Regional Health Directorate (2018)

Study Design

The study design was exploratory and cross-sectional, employing a combination of quantitative and qualitative approaches to data collection. The study population consisted of 160 frontline health staff (midwives, community health nurses, health information officers, general nurses, and physician assistants) at both the district and subdistrict levels—in the four districts with providers who had been trained to use mobile technology (MOTECH or GHS DHIMS2 e-Tracker) to collect, collate, analyze, and transmit health data—and 14 district and regional health managers and policy makers. All eligible health staff available at the time of data collection were included in the study, and their experiences and perspectives regarding the use of the mobile technology (MOTECH or GHS DHIMS2 e-Tracker) were explored. The district and regional health managers and policy makers were purposively selected based on their level of involvement in health data management and use; monitoring and evaluation; and information, communication, and technology (ICT).

Data Collection

A structured pretested questionnaire was designed in English and administered to eligible frontline health staff in the four districts who used the mobile technology (MOTECH and GHS DHIMS2 e-Tracker) to collect and manage health data, including FP and RCH services data. The questionnaire was used to probe information including (1) background characteristics of the health staff, (2) health staff's experience using mobile technology to collect and manage health data, (3) health staff's perception of usefulness of mobile technology to collect and manage health data, (4) perceived benefits health staff derived from using mobile technology to collect and manage health data, (5) health staff's level of satisfaction with using mobile technology to collect and manage health data, and (6) health staff's sustained use of the mobile technology to collect and manage health data.

A semi-structured key informant interview guide was designed in English and used to interview key health managers in the four districts and at the regional health directorate, and it was used to interview key policy makers at the national level of GHS.

Quality Assurance

Two research teams were formed for the data collection. The first team, comprising three research assistants and a field supervisor, was responsible for administering the questionnaire. The second team, consisting of an interviewer and a recorder, collected the qualitative data. Both research teams were trained on data collection procedures and techniques, ethics (including confidentiality), and data quality. The field supervisor conducted daily data quality checks and quality control procedures, to minimize study errors. The quantitative data were entered twice, once each by two individuals, and these two records were later compared by the principal investigator to ensure internal consistency before analysis. The investigators also verified transcripts of interviews by checking the recorder's notes against audio records.

Data Analysis

Data were checked for accuracy, consistency, and completeness. The quantitative data were analyzed using the EPIInfo software version 7.2. Frequency distribution of health staff's experiences, perceptions, and sustained use of the mobile technology for health data collection and management was determined. Measures of central tendency and dispersion were used to describe perceived usefulness, perceived benefits, and level of satisfaction with the use of mobile technology to collect and manage health data. The tape-recorded in-depth interviews were transcribed verbatim, supplemented with field notes, and reviewed to remove any

identifying information, thus ensuring participants' anonymity. The study investigators read the transcripts, identified key themes, and developed a coding scheme. Content analysis with description of themes was employed to analyze the qualitative data.

Ethical Considerations

The study was approved by the GHS Ethics Review Committee. Study participants were made aware that participation in the study was entirely voluntary. After the researchers thoroughly explained the purpose and procedures of the research, study participants were asked to sign written informed consent forms before beginning any study activities.

RESULTS

Background Characteristics of Study Participants

A total of 119 frontline health staff were involved in the study. Many (43.7%) of them were from the Gomoa West District, with the fewest (14.3%) from Awutu-Senya East District. Most were female (80.7%) and nurses (89.9%), and 10.1 percent belonged to other staff cadres, such as field technicians and health information officers. Among the nurses (n=107), 75.7 percent were community health nurses, 10.3 percent were midwives, 8.4 percent were enrolled nurses, and 5.6 percent were staff nurses. Altogether, about half (51.3%) worked at a CHPS compound, and 37.8 percent worked at a health center. The health staff were between the ages of 21 and 41 years, with an average age of 30.4 (SD 3.5) years.

With respect to health data collection and management, 58.0 percent of the study participants were accountable to the district health information officer, 12.6 percent to the community health officer, 6.7 percent to the district director of health services, another 6.7 percent to the district public health nurse, and 5.9 percent to the facility in-charge.

All study participants received initial training before commencing use of the mobile technology. The average interval from when the study participants received initial training to the time of data collection was 32.7 (SD=20.0) months. Although 42.0 percent of participants received the initial training 12 to 24 months before the time of data collection, 29.4 percent had received the initial training 36 to 48 prior, and 18.5 percent had received the initial training over 60 months before data collection. Only 10.1 percent received the initial training less than 12 months before data collection. Many of the study participants (62.2%) had received refresher training since commencing use of the mobile technology. Among those who had received refresher training, more than half (52.7%; 74) received the training once in a year; 21.6 percent received it twice in a year, and 13.6 percent received it four times in a year.

Experiences with Mobile Technology for Health Data Collection and Management

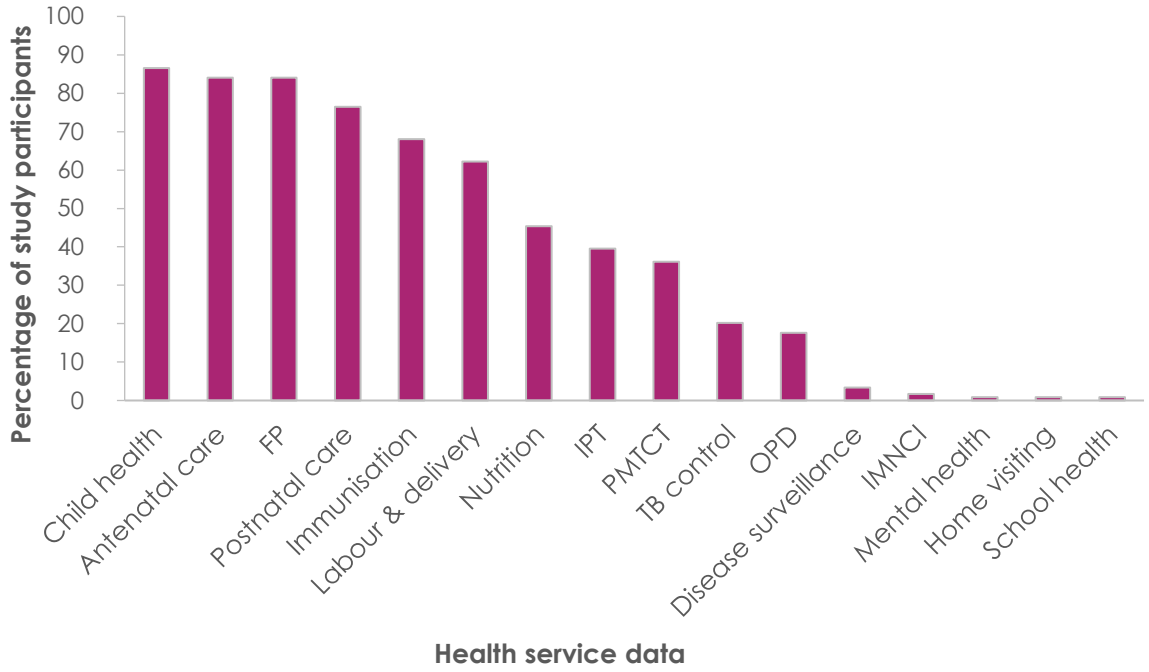
Two forms of health staff experiences with mobile technology tools and mechanisms for collecting and managing health data were assessed: the use of mobile devices (mobile phone/tablet and software) and the use of mobile networks to facilitate health data collection and management.

Use of Mobile Technology

On average, the study participants had been using mobile technology to collect and manage health data for 21.3 (SD=23.6) months. 38.7 percent of participants had been using mobile technology for 24 to 35 months; 23.5 percent had used it for 12 to 23 months; 16.8 percent had used it for 48 months or more; 14.3 percent had used it for 11 months or less; and 6.7 percent had used it for 36 to 47 months. The mobile technology was used for three main purposes: collecting health data, analyzing health data, and generating and transferring health reports.

Almost all the study participants (95.8%) were involved in using mobile technology to collect health data. The health data they used mobile technology to collect were primarily healthcare service data, as shown in Figure 3, related to child health, antenatal care, FP, postnatal care, immunization, and labor and delivery services. Other important healthcare service data being collected using mobile technology involved nutrition, intermittent presumptive treatment for malaria in pregnancy (IPT), prevention of mother-to-child transmission of HIV (PMTCT), tuberculosis (TB) control, and outpatient department (OPD) services.

Figure 3. Health service data collected using mobile technology

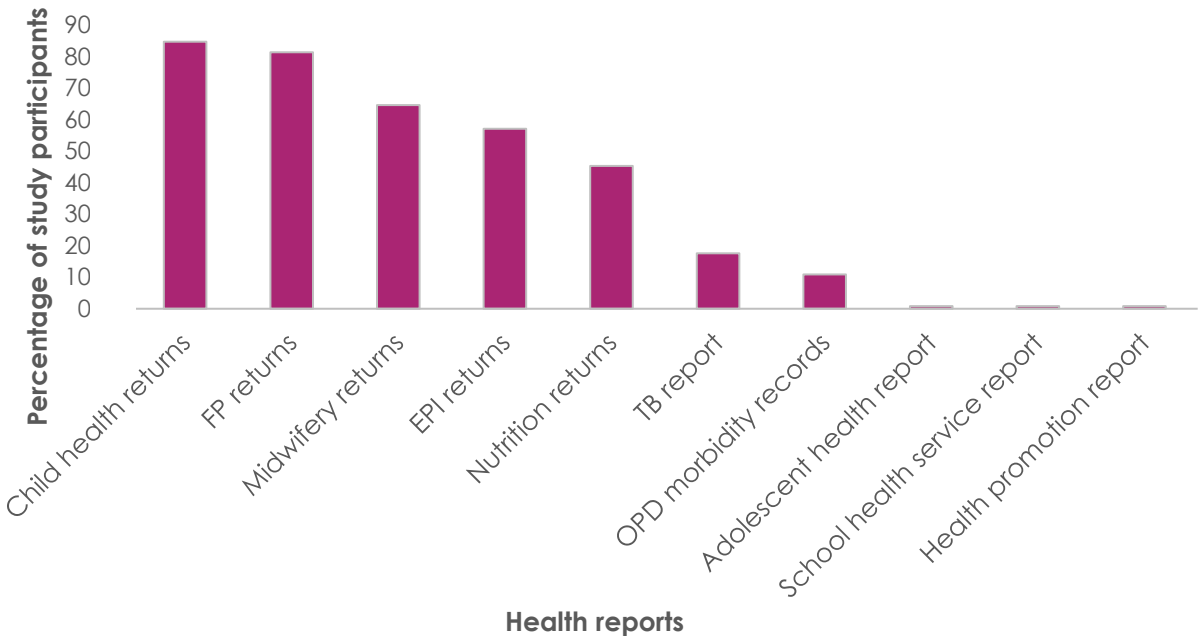


IMNCI: Integrated management of neonatal and childhood illnesses

More than half (59.7%) of the study participants were involved in collating health data, and 55.5 percent were involved in health data analyses. Study participants used mobile technology to carry out three key data analyses: calculating coverage, analyzing trends, and compiling aggregate data. 53.8 percent of participants used mobile technology to calculate coverage of healthcare services, 48.7 percent used it to conduct trend analyses, and 44.5 percent used it to compile aggregate data. Most participants (70.6%) were involved in using mobile technology to generate and transfer health reports. These were primarily child health returns, FP returns, midwifery returns, and EPI (Expanded Program on Immunization) returns (Figure 4). Others were nutrition returns, TB report, and OPD morbidity records.

In addition to using mobile technology for collecting and analyzing health data and generating and transferring health reports, 50.4 percent of the study participants used mobile technology for other work-related purposes, such as tracking and calling clients and defaulters, taking photographs of health events, searching the Internet for information, writing narrative reports, compiling National Health Insurance Scheme claims, and planning activities. Other ancillary usage involved using mobile technology (tablet) as an audio-visual aid during presentations at meetings and when providing health talks.

Figure 4. Health reports that study participants generate and transfer using mobile technology



Study participants used the mobile technology for collecting and managing health data an average of five (SD=1.8) days per week. The number of days ranged from one to seven. Most of the study participants (85.7%) used mobile technology to collect and manage health data only at the workplace (health facility). However, 5.9 percent used mobile technology to collect and manage health data at home, wherever it was convenient for them (5.0%), and at outreach sites (3.4%). Whereas 68.0 percent used mobile technology to collect and manage health data only during working hours, 16.0 percent used it only during off-working hours, and 16.0 percent used it all day long.

The following were the most common reasons for using mobile technology to collect and manage health data at various times during the day: it was an appropriate time for health data collection and management (45.4%); client data must be collected when the client comes (15.1%); and the workload during working hours was heavy (11.8%). More than half (55.5%) of the study participants reported that they were comfortable using mobile technology to collect and manage health data, and 29.4 percent reported being very comfortable. However, a significant percentage of the study participants (15.1%) were not comfortable using the mobile technology to collect and manage health data.

The most common challenges that study participants associated with use of mobile technology to collect and manage health data were unstable, slow, bad, or poor network connections (69.8%); it is time-consuming (23.5%); and it increases their workload (15.1%).

In addition to using mobile technology for collecting and transferring health data, almost all (96.6%) of the study participants concurrently used paper-based data collection and reporting tools for the same purposes. The most common paper-based data collection and reporting tools used were registers (95.8%), tally sheets (53.8%), immunization returns (51.3%), and FP returns (50.4%). Others were child welfare clinic reports (45.4%) and midwifery returns (39.5%).

Major reasons that study participants offered for using the paper-based data collection and reporting tools alongside the mobile technology involved assurance of data accuracy (34.5%), functioning as data backup (27.7%), unavailability or poor mobile network (22.7%), and functioning as data filing material (18.5%). Other reasons involved the use of paper-based data collection and reporting tools to complete the e-Tracker

(14.3%), policies requiring both mobile technology and paper-based data collection and reporting tools (14.3%), and perceptions that using both makes work easier (11.8%).

Use of Mobile Networks

The principal mobile networks study participants used to facilitate health data collection and management were MTN (68.9%) and Vodafone (29.4%). Only 1.7 percent of the study participants used other mobile networks such as Tigo and Glo. Study participants reported varying perspectives on the time it took to connect to the Internet using the mobile network they were on.

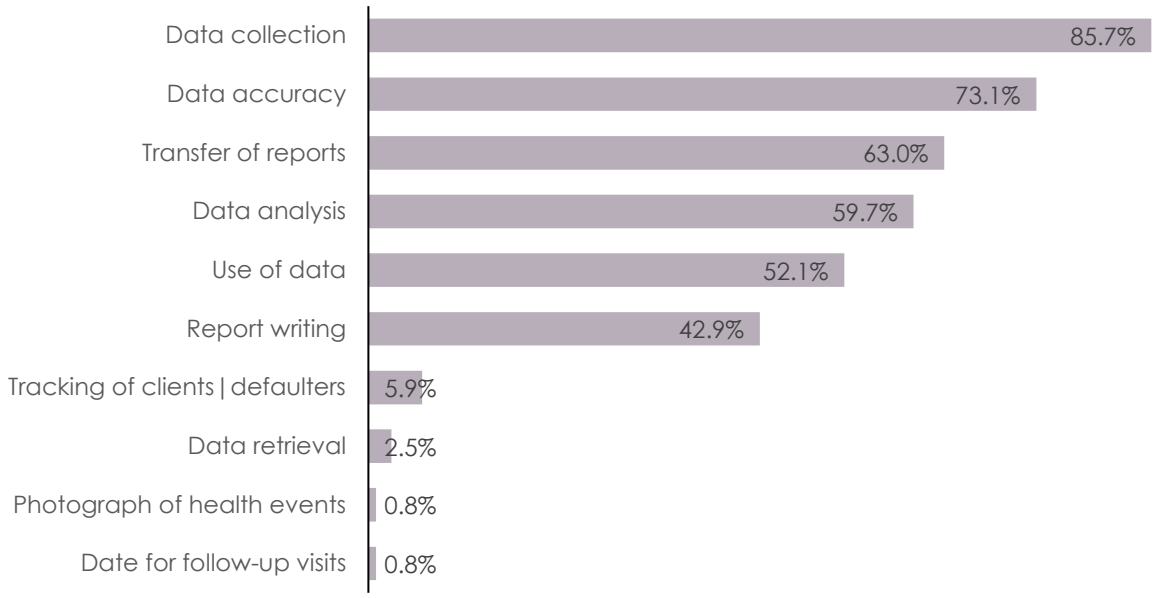
While 39.5 percent of respondents reported that the time to connect was normal, 31.1 percent indicated it was fast, and 10.9 percent found the time to be very fast. About one-tenth (10.9%) found the time to be slow and 6.7 percent found it very slow. However, once connected, about half (49.6%) of the study participants found stable Internet connectivity with the mobile network they were on, with 12.6 percent finding the connectivity to be very stable. Others (37.8%) found the Internet connectivity unstable.

The average monthly cost of credit (for wireless data and phone service) that study participants used to facilitate health data collection and management was 24.7 (SD=17.7) Ghana cedis. For more than half (58.0%) of the study participants, credit for data collection and management was paid for from the health facility's internally generated funds. For 26.9 percent, the cost of credit was reimbursed by the district director of health services, district public health nurse, sub district in-charge, or head of the health facility. For 11.8 percent, credit was paid for by their employer (GHS). However, 3.4 percent of the study participants self-financed the credit used for health data collection and management. Nearly half (48.7%) of the study participants found the cost of credit to be reasonable. 31.9 percent found the cost of credit to be costly, and 10.9 percent found it to be too costly. A few (4.2%), however, found the cost of credit cheap.

Perceived Usefulness of Mobile Technology for Collecting and Managing Health Data

Perceived usefulness was assessed by asking to what extent perceived health data collection and management needs were addressed by mobile technology. The leading perceived health data collection and management needs of the study participants were data collection, data accuracy, transfer of reports, data analysis, and utilization of data (Figure 5).

Figure 5. Perceived health data collection and management needs of study participants



Study participants' perception of the extent to which mobile technology addresses health data collection and management needs was assessed on a scale of one to 10 (Table 1). The mean perceived extent to which mobile technology addresses health data collection needs was 6.6 (SD=3.2), and the mean perceived extent to which mobile technology addresses data accuracy needs was 5.4 (SD=3.6).

Table 1. Study participants' perception of the extent to which health data collection and management needs are addressed by mobile technology

Health data collection and management need	Perceived extent to which need has been addressed by mobile technology, on a scale of 1–10	
	Mean perceived extent	Standard deviation
Data collection	6.6	3.2
Data accuracy	5.4	3.6
Transfer of reports	4.9	4.0
Data analysis	4.6	4.1
Utilization of data	4.1	4.2
Report writing	3.1	3.7

Perceived Benefits from Using Mobile Technology to Collect and Manage Health Data

The main perceived benefit from using mobile technology for health data collection and management was enhancement of job and personal life. With respect to improving their job, more than half (51.3%) of the study participants believed that using mobile technology for health data collection and management increased work efficiency, one-third (33.6%) perceived that it improved data accuracy, and nearly one-third (31.9%) thought that it eased completion of health reports. Likewise, 28.6 percent reported that use of mobile technology increased completeness of data, with 27.7 percent believing that it eased retrieval of reports.

Regarding improving personal life, 73.1 percent of the study participants noted that using mobile technology for health data collection and management improved their social image and broadened their knowledge and skills in ICT. Likewise, 30.3 percent thought that it improved their knowledge in health data collection and management. Some (12.6%) similarly believed that using mobile technology had increased free time for personal affairs. However, a few (3.4%) saw no benefit.

Level of Satisfaction with Using Mobile Technology to Collect and Manage Health Data

Almost all (97.5%) of the study participants appreciated using the mobile technology to collect and manage health data. Among those who enjoyed using the mobile technology (n=116), 34.5 percent indicated that they well-enjoyed using the mobile technology, with 31.9 percent expressing that they very well-enjoyed using the technology. About one-third (33.6%) deemed it just okay to use mobile technology to collect and manage health data.

Study participants found all aspects of using mobile technology to collect and manage health data fascinating. Almost all (99.2%) found collection of health data using mobile technology captivating; 89.1 percent found collation of health data interesting; 83.2 percent found analysis of health data enthralling; and 84.0 percent found generation and transfer of health reports fascinating.

Similarly, study participants found all aspects of using mobile technology to collect and manage health data to be satisfying. Almost all (97.5%) found collection of health data using mobile technology fulfilling; 86.6 percent found collation of health data pleasing; 81.5 percent found analysis of health data rewarding; and 83.2 percent found generation and transfer of health reports gratifying.

Furthermore, the study participants found all aspects of using mobile technology to collect and manage health data necessary. All (100.0%) found collection of health data using mobile technology essential; 96.6 percent found collation of health data necessary; 95.0 percent found analysis of health data indispensable; and 96.6 percent found generation and transfer of health reports vital.

Likewise, more than half (52.9%) of the study participants believed that mobile technology for health data collection and management was complete with nothing lacking. However, nearly 12 percent felt that RCH service data (such as school health and adolescent sexual and reproductive health) was incomplete.

Sustained Use of Mobile Technology for Collecting and Managing Health Data

Almost all (99.2%) of the study participants affirmed they will continue using mobile technology for health data collection and management. The principal reason given for continued use was that use of mobile technology made work efficient and easier (52.1%). Other reasons were that it eased health data transmission and reporting (16.8%), assured data accuracy (11.8%), eased data collation (10.1%), made data analysis less petrifying (10.1%), and eased data retrieval (9.2%).

Health Managers' Perceived Usefulness of Mobile Technology to Manage Health Data

Health managers are managers and administrators at the national, regional, and district levels of GHS. In exploring the health managers' perceptions of the usefulness of the mobile technology to collect and manage health data, three key issues were discussed: benefits and challenges of using the mobile technology and strategies to facilitate continued use.

Benefits of Using Mobile Technology

Generally, health managers thought the use of mobile technology directly contributed to general improvement in data quality for both clinical and nonclinical purposes. Respondents reported that data quality improved, because increased visibility of the data highlighted data quality issues for redress. In addition, they thought that using mobile technology contributed to efficiency in data management with a marked improvement in data completeness and timeliness.

> *We have the* [mobile technology] *running. . . . Well, I think what it has done is that it has brought some efficiency in the way data is being managed. Because, at least for the aggregate data, you get it on time and you can really find out who has not reported and get the report done. I mean, data completeness has gone up tremendously; data completeness and timeliness have improved a lot.*
>
> – National-level manager

> [Mobile technology] *is one of the best things that has happened to the Ghana Health Service with respect to data management; because with* [the mobile technology], *wherever I am in the world, I can have an idea of what is happening in my district and I can send messages. . . . And if you use it well, you identify the mistakes, you do the corrections, and then you have excellent data. But if you leave it for people to enter anything, then it would be rubbish in rubbish out. It is one of the best things that has happened to Ghana Health Service.*
>
> – District-level manager

Moreover, the availability and use of mobile technology to collect and manage health data offered health managers the opportunity to identify and resolve discrepancies in data collated and presented at review meetings.

> *We do annual reviews at all the subdistrict levels. . . . As we present, the health information officer and others look at the* [mobile technology] *data, but . . . if it's not the same, we point it out to you that it is not in the* [mobile technology] *for you to clarify. For example, during the presentation of the hospital, we did that to them and told them that we did not know the source of the data they were presenting. So, we asked them to go back and look at that so that at least it becomes clear to all. So actually, we use the mobile technology for discussion, decision making, and all that.*
>
> – District-level manager

The use of the mobile technology facilitated supervision and monitoring of health facilities in general, particularly health facilities located in hard-to-reach areas of the district, based on travel cost and time. A district level health manager had this to say:

> *I can now sit in my office and monitor activities at the peripheries and even at hard-to-reach areas like* [name of town withheld], *which activity would otherwise have cost transport, fuel, and much time. Now, I can go on* [the mobile technology] *and check . . . everywhere a health facility is located or a health staff may work with ease using technology.*

Similarly, the use of mobile technology to collect and manage health data improved management decision making and resource allocation. Management decisions were now based on evidence from data generated and analyzed with the mobile technology. As shown in the quote below, essential logistics for child healthcare were now distributed based on data from the mobile technology:

> *We use* [the mobile technology] *for everyday decision making. For example, distribution of logistics is now based on the data. Just this morning, we received items—child welfare cards and registers—which we had to distribute. We got into the* [mobile technology]*; we looked for the number of children seen by each facility over a six month period; and we estimated the average. Then, based on the average*

> *number of children seen by each facility, we did the allocations for the various facilities. . . . In the past, it would have been difficult to get that data ready. It would have been in different registers with different people.*
>
> – District-level manager

> *So, for everyday basic work, another example, we want to see which facility is performing better; we go into the* [mobile technology]*; we look at the various selected health indicators and use them to assess performance of each facility and then give the facilities feedback*
>
> – District-level manager

Indirect benefits from using mobile technology to collect and manage health data were improvements in service delivery and financial management. The key effect on service delivery that was highlighted involved reduced client waiting time because of increased efficiency in data management with mobile technology. As one respondent observed:

> *I think also, the* [mobile technology]*, those who have deployed the technology, it really makes their work efficient. They are able to submit their* [reports] *on time, and like patient waiting time can be much reduced, especially for those who have matured in the system use.*
>
> – National-level manager

With respect to financial management, mobile technology facilitated processing health insurance claims. The laborious process of collating information on claims for onward submission to the national health insurance authority has been markedly reduced.

> *So, gone are the days when we put the* [health insurance] *claims at the back of the* [intercity] *coach and then send. Now if you have* [the mobile technology]*, at the click of a button you can submit your* [health insurance] *claims. Financial management has also improved because of the use of technology. Once you send your* [health insurance] *claims electronically and it's adjudicated at the claims processing center, you get advanced payment in real time, as against where you take the manual, and then someone has to manually vet the claims to make sure it complies with processes.*
>
> – National-level manager

Challenges with Using Mobile Technology

Challenges cited were related but not limited to attitudinal changes, training, and network connectivity. The respondents observed that providing mobile devices and technology does not replace the human aspects required to effectively use health data. Of concern was how to get health staff to use the mobile technology to analyze and use the data for decision making. Introducing or deploying any technology was considered the easiest part of the intervention. A bigger challenge was "how to manage the people as you roll out these electronics because it does disturb their environment; it's an intrusion in a way and it's always something that we grapple with" (national-level manager). As a health manager explained:

> *You need to change the healthcare professional who has that mindset first before you let him use* [the technology] *because you are changing the way he's going to do his work forever with the use of technology.*
>
> – District-level manager

One national-level manager mentioned two levels of training: end-user training (for health workers) and technical training (for ICT staff). At each level, three categories of end-user training programs were noted. The first category was training novice health staff on how to use the mobile devices and understand

computer systems. The second category involved training health staff to use the software application. The third category entailed regular refresher or update trainings. Challenges were observed with all the trainings. One challenge observed pertaining to ICT novices was the "fear of the use of technology and the fear one might lose power and control." This was suggested in the quote below:

> *Initially, people will not even touch the computer. But when you know that is what* [mobile technology] *you have to use. . . . I have a colleague who used to write the hard copies, and I'll say to her, 'you have to enter the data by yourself.' So, eventually she had to learn on the job. Otherwise, your report would not be transmitted and then you will be found wanting.*
>
> – District-level manager

Another challenge was adequacy of training on the use of specific aspects of the software, which was often overlooked. Consequently, when there is a difficulty in the field, the user may not get the needed support and may discontinue using the product. This was illustrated in an incident narrated by one district-level manager:

> *Like I said, some of them* [health staff members] *are still struggling to grasp the full concept. So, that's how we found the continuous training important. But let me give an example, and I think that will help. The last issue, for example, one of the community health nurses said that the day for data entry had passed. We usually list all those facilities that have missed the deadline* [for data entry]. *So, you have up to this period to make up. We do that monthly and we put it up on the WhatsApp platform for only the community health nurses. The last time that we did that, one of the nurses replied that* [the mobile technology] *was not working. So, the information officer replied, 'it's not true because I'm actually logged in.' Apparently, she had not even connected her modem. We asked that she sends us a picture of what the* [computer] *screen looked like and then we realized that the Internet access. . . . She had not even connected the modem to the laptop. For a lot of the modems we have, you have to open the software and connect* [to the Internet]. *So, we were able to help her resolve that situation just by looking at the picture she sent. Later on, when we met her . . . she goes like, 'director, when you gather us in the conference room and you take us through these things, we don't understand anything.' So, she got the concept and the understanding when she received further coaching and tried to do it herself, then she overcame her challenges.*
>
> – District-level manager

Refresher and/or update training was haphazard, unplanned, and on an as-needed basis. As noted by some of the health managers:

> *Every opportunity we have as a region . . . we use it as a form of retraining for the staff that we get into contact with. There is no structure that we say every quarter we will have a* [mobile technology] *refresher training or half yearly or periodic training set up. This is because of availability of resources to carry out such training activities.*
>
> – Regional-level manager

> *There have been challenges . . . with issues of transfers and re-location of staff, new staff coming into the system, some going on retirement, and some dying as well. There is the need, at every point in time, to retrain the staff that are available.*
>
> – District-level manager

> *As and when it is needed. For instance, I have trained all the CHPS facilities as at December 22nd, and when I go for monitoring and I realize you have a gap, I will try to fill that gap right there. My laptop and phone is there; I connect it and then start.*
>
> – District-level manager

Internet connectivity was challenged by unstable connections, slow uploads, and unavailable networks, which can delay or prolong the data management process. Unstable Internet connectivity makes using mobile technology for data transmission frustrating, and sometimes health staff abandon the task, thus further prolonging the time for data management.

> *When they face challenges in entering or trying to access the network, that's when you see them . . . they move data aside and they don't go back to it again. And . . . at times, the network problems—Apart from that, there are no major challenges as such.*
>
> – District-level manager

> *The challenge is that sometimes, when you want to make entries during the day, it (the platform) will not open; it's very frustrating. And sometimes, when you enter the data and you want to upload, it takes a long time for the server to upload. . . . And you have to repeat the process. The network is not stable, . . . so I think something should be done about the network.*
>
> – District-level manager

> *Few facilities had the tablets while the rest had desktops. But whenever there is no network and they have to move, with the desktop, it becomes impossible. So, they send their phones or their personal laptops where they may get the network.*
>
> – District-level manager

Connectivity in Ghana is improving, but it is better in some areas than in others. To solve the problem, managers introduced "reliable routers," but the challenge persists, owing to lack of funds.

> *The challenge has to do with the Internet connectivity, but it's improving over the last few months. But, we've put in some interventions, bought routers that are more reliable. But the challenge has to do with the funds for the data.*
>
> – District-level manager

Strategies to Facilitate Continued Use of Mobile Technology

Mechanisms for ensuring sustainability, from the perspective of health managers, focused on the following: setting objectives and planning for effective coordination; incorporating logistical support from national health programs; implementing a change management strategy to promote attitudinal change in users; conducting facilitative supervision; and administering continuous training for frontline staff.

One respondent thought that the use of mobile technology for health data collection and management in any organization must be well planned with specific objectives. Setting objectives for the use of the mobile technology requires involving all relevant stakeholders. This respondent also expressed that ensuring stakeholder input engenders ownership and commitment. Lack of planning might result in underutilization of the system. This idea was summed up in the following quote:

> *There are hospitals that have implemented solutions that are not being used to its fullest capacity because they have not planned for it; it just happened suddenly. But for those that have planned for it, and have done investment, they are using it. They are increasing in the model because it's making an impact on their service delivery and also office work.*
>
> – National-level manager

Participants suggested that stakeholder involvement could be achieved through effective ICT governance involving all relevant stakeholders. Since there are broad logistical concerns that must also be looked at, the structure might require different competencies and skill sets and therefore must be multidisciplinary, as explained by one manager:

> [*It should include*] *everybody involved in the delivery of healthcare. So, they . . . have a pediatrician; they have a pharmacist; they have an accountant; they have an IT security specialist; they have the business analyst; they have the systems analyst; they have everybody there. So, when they are discussing policy issues, everybody is looking at it from his or her own perspective because they recognize and respect everybody's expertise as against somebody sitting in his corner and deciding, go and buy a hundred computers.*
>
> – National-level manager

Given the limited resources available to district health directorates and health facilities to support crosscutting activities such as data management, logistical support from relatively well-funded national health programs becomes very useful. Examples of logistical support for data management are routers and Internet bundles. The availability of these logistics has reduced the challenges related to data collection, collation, and transmission.

> *I'm seeing that . . . that is already the way we are going, if you ask me. You take e-Tracker for example. As much as possible in its implementation, the national AIDS control program is on board, the national TB control, the family health division of the Ghana Health Service, and PPME working together as a unit. Recently we had malaria control giving us routers to help with. . . . What has malaria control got to do with Internet routers? So, when there is that integration, everybody realizes that I need information to be able to make scientific decisions that will help; so, everybody comes on board. Like I mentioned, a lot of the computers that we are using are from the various programs in the health service, so the integration is going on. It's not like this is ICT activity, but this is across board. The router that were brought they didn't say that use it for only malaria data. It's a router for the unit. So, when a computer is brought, the computer is for the unit, for the service, for the activities.*
>
> – District-level manager

Likewise, change management was considered essential to mentally prepare health staff for an effective transition from the existing mode of doing things to another. The change management should involve a systematic process of awareness creation prior to the introduction of the mobile technology, with further periodic refresher trainings following the initial training. This perception is exemplified by the following response:

> *So, once you don't do change management and awareness creation, you miss it; and that is what we don't spend time to do. . . . We think when we provide computers and laptops, we have solved the problem and the software solution. But we don't solve the problem. Because what those end users eventually do is to find a problem with either the computer or the software. So, they get to tell you that the computer is not working, 'when we power it, it doesn't work' or 'the software cannot do this' or 'it doesn't do that.' That is not the issue.*
>
> – National-level manager

Facilitative supervision and continuous training for frontline staff were perceived as being equally useful in terms of providing the needed support for frontline staff in the various aspects of data management. For example, some managers have established district-wide 'WhatsApp' platforms for staff who work directly with data. Health information officers from all management levels provide facilitative supervision and continuous demand-driven technical support as a way of strengthening the capacity of frontline staff in health data management. As explained in the quotes below, these strategies have helped to share information, as well as resolve health data management-related challenges.

We have a WhatsApp platform and for the beginning of the month, like this, all the communications are on data entry and those kind of things, 'I have this challenge,' 'Okay. Do it like this.' That kind of thing. So that's how we have our training.

– District-level manager

The health information officer is tasked with that responsibility, and it's part of integrated monitoring. Anytime we go on monitoring, we do some education based on the checklist we use whenever a problem comes up. Because one training has been done already and everybody knows [the mobile technology], *so the refresher is just on continuous basis. It's the private facilities that we are focusing on lecturing because, as for the public ones, the training is always going on when we visit. So, . . . we've not planned a full-scale training for staff. But for the private facilities, we have a platform for them so whenever anybody is ready the district officer will go and do the training for them.*

– District-level manager

As a district, we have training in our program of work. . . . For example, we have a training on e-Tracker coming. . . . As a district, we have a target that every facility enters its report directly at the facility level, and they don't have to send the hard copy to somebody else to help them enter. So that's what guides the training and that it is routine and ongoing and it's at the facility level.

– District-level manager

DISCUSSION

This study explored the experiences and perspectives of health staffs and managers about using mobile technology (MOTECH and GHS DHIMS2 e-Tracker) to collect and manage health data in district health systems. The results show experiences and perceptions of health staff regarding using the GHS DHIMS2 e-Tracker to collect and manage health data.

Health staff use the GHS DHIMS2 e-Tracker for three principal purposes: to collect, analyze, and transfer health data. Among these purposes, collection and transfer of health data predominate, with almost all health staff using mobile technology to collect health data and the majority (70.6%) generating and transferring health reports. More than half (55.5%) of health staff use mobile technology to analyze health data. This confirms Bernabe-Ortiz, et al., (2008) who noted that, compared to using paper-based data collection tools, health staff are effective in collecting complete, high-quality, and timely data from clients when equipped with mobile technologies.

However, as observed in this study, use of mobile technology among health staff to analyze and use health data at the local level is low. The culture of health data analysis and utilization has been observed to be weak among community-based healthcare workers. Community-based health staff do not appear to appreciate the logic of analyzing and utilizing the health data they generate.

The GHS DHIMS2 e-Tracker was introduced, in part, to allow healthcare service providers, especially those providing maternal and child health services, to collect and analyze transactional, case-based data records at the community level; however, a dearth of health data analysis and utilization at the point where data are generated persists. Analyses of health data at the level they are collected allow healthcare service providers not only to assess achievement of service indicators, but also to gauge success in reaching community members with essential healthcare services and identifying appropriate strategies to overcome challenges.

Although the use of mobile technology eliminates and/or reduces the arduous physical and time-intensive effort required to manually collect and manage district health data, the study team found that almost all (96.6%) of the study participants concurrently used the mobile technology and paper-based data collection and reporting tools for collecting and transferring health data. These paper-based tools were used to assure data accuracy, as data backup, and/or in areas where access to the Internet was erratic. This observation corroborates the findings of Junglas, Abraham, & Ives (2009) and Standing & Standing (2008) who found that, owing to the slow pace of the district healthcare system embracing innovations, users of the technology did not find it a fully acceptable match for the tasks at hand. Even with the acknowledgment of mobile ICT's many benefits, because of individual habits and characteristics of the technology users, full adoption of mobile technology in this healthcare context is problematic. Health workers are more likely to continue with what is already known while embracing the novel tools.

Perceived usefulness of the GHS DHIMS2 e-Tracker among health staff members is high for health data collection and low for health data analysis and utilization. Health staff generally believe the GHS DHIMS2 e-Tracker addresses the needs of health data collection and data accuracy, but not health data analysis and data utilization. User perception of the usefulness of mobile technology for health data collection and management has proved to be a potent determinant of user intention over time (Hong, Thong & Tam, 2006; Karahanna, Straub, & Chervany, 1999). With the majority of health staff (84.9%) finding it comfortable to use mobile technology to collect health data, it is expected that their skills and confidence to analyze and use the health data can be reinforced to empower them—especially those at CHPS zones, in their role as a bridge between communities and district health systems.

The perceived benefits from using mobile technology are significant in the process of adopting and continuing use of the technology (Karahanna, Straub, & Chervany, 1999). Mobile technology users may regard use of the technology as symbolic of prestige and adopt the technology to enhance their sense of self-importance (Sarker & Wells, 2003). As observed in the present study, the majority of health staff perceived using the GHS DHIMS2 e-Tracker to collect and manage health data as an improvement in social image and enhancement of their knowledge and skills in ICT. Some reported that using mobile technology to collect and manage health data increases work efficiency. These perceived benefits might have influenced almost all (97.5%) of the health staff to cherish using the GHS DHIMS2 e-Tracker to collect and manage health data.

Previous studies have reported that user satisfaction has a positive influence on intention to continue usage of a mobile technology (Sarker & Wells, 2003; Szymanski & Henard, 2001). As observed in this study, health staff found all aspects of using the GHS DHIMS2 e-Tracker to collect and manage health data satisfying. Almost all (97.5%) of the health staffs found using the GHS DHIMS2 e-Tracker to collect health data fulfilling, with a high percentage of study participants describing their use of mobile technology to collate and analyze health data pleasing and rewarding. The majority also found using the GHS DHIMS2 e-Tracker to generate and transfer health reports gratifying. However, further studies are required to assess the relationship between perceived benefits from using the GHS DHIMS2 e-Tracker and level of satisfaction with using mobile technology.

The primary measure of success of any mobile technology for health data collection and management is the sustained use of the technology (Hong, Thong, & Tam, 2006; Bhattacherjee, 2001). In this study, almost all (99.2%) health staff affirmed continued use of the GHS DHIMS2 e-Tracker to collect and manage health data. The principal reasons for such affirmation were job efficiency and reducing the level of effort required at work. The fact that health staff affirmed continued use of the GHS DHIMS2 e-Tracker to collect and manage health data provides compelling evidence to call for its adoption as the principal mobile technology for collecting and managing health data, especially at the peripheries of district health systems. The findings of this study suggest that the e-Tracker component of the GHS DHIMS2 can easily be scaled-up and implemented in the rest of the districts in the Central Region because all health staff expressed their willingness to continue using the mobile technology.

Health managers, however, suggested three important strategies to assure sustained use of mobile technology for health data collection and management. They were facilitative supervision and on-site training for users, implementation of change management to promote change among users, and logistical support from national health programs. Braun, et al., (2013) and Svoronos, et al., (2010) suggest that providing supervision to health workers who use mobile technology to collect and manage health data facilitates better practices, especially in leadership and management, and assures sustained use of the technology. However, further studies are required to measure the impact of the three strategies on sustained use of mobile technology for health data collection and management.

LIMITATIONS

This study was conducted in one region: the Central Region of Ghana. Some of the findings may therefore be restricted to that region. However, findings from in-depth interviews conducted with senior managers at the national level could be applicable nationally, because these interviews covered general topics such as training, Internet connectivity, and sustainability—issues that cut across all regions. Therefore, these results reflect the situation across the country, not the Central Region alone.

RECOMMENDATIONS

Based on the study findings, we recommend the following:

1. For GHS, develop a systematic on-the-job training program to empower health staff to analyze and use health data at the level where the data are collected.

2. For training institutions, include training on GHS DHIMS2 e-Tracker in pre-service training curricula for health staff, especially those for FP and RCH services.

3. The Policy, Planning, Monitoring and Evaluation Division, together with other stakeholders, should address the information and technology infrastructure for health data collection and management, such as inadequate supply of tablets and unreliable Internet access, to make the GHS DHIMS2 e-Tracker fully functional.

CONCLUSION

The aim of this study was to explore the experiences and perspectives of health staff and managers using mobile technology (MOTECH and GHS DHIMS2 e-Tracker) to collect and manage health data in district health systems.

The findings suggest that health staffs used the GHS DHIMS2 e-Tracker principally for collecting health data and transferring health reports. Many health staffs did not access the full functionality of the mobile technology, such as analysis of health data. Nonetheless, health staffs perceived benefits such as enhancement of social image and knowledge in ICT and increases in work efficiency from using the GHS DHIMS2 e-Tracker to collect and manage health data. Health staff affirmed satisfaction with and continued use of the GHS DHIMS2 e-Tracker.

As the GHS DHIMS2 e-Tracker is being scaled up to other parts of Ghana, lessons from this study could be applied to help sustain the use of the technology for data management. In addition, findings of this study could serve as baseline for future assessments.

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APPENDIX. INTERVIEW SCHEDULE FOR HEALTH STAFF'S EXPERIENCES AND PERCEPTIONS ABOUT USING MOBILE TECHNOLOGY TO COLLECT AND MANAGE HEALTH DATA

Name of interviewer:…… Date of Interview: ……/……/……

Questionnaire No.: ……..

Basic instructions for Interviewers

1. Begin by introducing yourself;
2. Explain the purpose of the interview and the amount of time it is expected to take;
3. Assure the respondent of anonymity and confidentiality;
4. For each item, write the response in the space provided, or tick (√) the appropriate box corresponding to the response the respondent gives.

District: [ ] Awutu Senya [ ] Awutu Senya East [ ] Gomoa East [ ] Gomoa West

Facility Name: ……

Section A: Background of Respondent:

1. Staff Category: [ ] Midwife [ ] CHN [ ] HIO

   [ ] Other (specify): ……
2. Sex: [ ] Male [ ] Female
3. Age (*At last birthday*): ……
4. At what **level of service delivery** do you work?

   [ ] DHD [ ] Health Centre [ ] CHPS [ ] Electoral Area [ ] Community

   [ ] Other (specify): ……
5. To whom are you **accountable** in respect to health data collection and management?

   [ ] DDHS [ ] DHIO[ ] DPHN [ ] PA [ ] CHO

   [ ] Other (specify): ……
6. What are your **job responsibilities** regarding health data collection and management? (*multiple choices allowed*)

   [ ] Collect health data [ ] Collate health data [ ] Analyse health data

   [ ] Report health data [ ] Data entry into DHIMS2

   [ ] Other (specify) ……

7. From whom do you seek **advice** when making choices regarding health data collection and management?

   [ ] DDHS [ ] DHIO[ ] DPHN [ ] PA [ ] CHO

   [ ] Other (specify): ……

Section B: Engagement with and experiencing of mobile technologies

8. When did you receive your **initial training** on the use of mobile technologies for health data collection and management?

   [ ] < one year ago [ ] 1-2 years ago [ ] 3-4 years ago [ ] ≥5 years ago

9. Have you ever received any **refresher/update training** since you commenced using the mobile technologies? [ ] Yes [ ] No

   (*If Yes, continue from Qu. 10; If No, continue from Qu. 11*)

10. How **often** have you received refresher/update training since you commenced using the mobile technologies?

    [ ] Once every 3 months [ ] Once every 6 months [ ] Once every year

    [ ] Other (specify) ……

11. Which **health data** do you use mobile technologies to collect? (*prompt; multiple choices allowed*)

    [ ] Antenatal care services data [ ] Labour and delivery services data

    [ ] Postnatal care services data [ ] Family planning services data

    [ ] Child health services data [ ] Nutrition services data

    [ ] Immunization services data [ ] PMTCT data

    [ ] IPT data

    [ ] Other (specify): ……

12. What **health data analyses** do you use mobile technologies to carry out? (*prompt; multiple choices allowed*)

    [ ] Compile aggregate data [ ] Conduct trend analysis

    [ ] Calculate coverages [ ] Compute scorecards

    [ ] Other (specify) ……

13. Which **health reports** do you use mobile technologies to generate and transmit? (*prompt; multiple choices allowed*)

    [ ] Midwifery Form "A" Returns [ ] Family Planning Returns

    [ ] Child Health Returns [ ] Nutrition Returns

    [ ] EPI Returns

    [ ] Other (specify) ……

14. Who **supplied** the mobile technology you use for health data collection and management?

    [ ] DDHS [ ] Project [ ] DPHN [ ] DHIO[ ] Self

    [ ] Other (specify) ……

15. Who **pays** for the maintenance/repair of the mobile technology you use for health data collection and management?

    [ ] DDHS [ ] Project [ ] DPHN [ ] DHIO[ ] Self

    [ ] Other (specify) ……

16. **For how long** have you been using mobile technology for health data collection and management?

    [ ] ≤11 mths [ ] 12 – 23 mths [ ] 24 – 35 mths [ ] 36 – 47 mths [ ] ≥48 mths

17. Apart from collecting, collating, analysing and transmitting health data, what **other kinds of things** do you use the mobile technology for?

    ……

18. How many **days in a week** do you use the mobile technology for health data collection and management?

    [ ] 7 days/week [ ] 6 days/week [ ] 5 days/week [ ] 4 days/week

    [ ] 3 days/week [ ] 2 days/week [ ] 1 day/week

    [ ] Other (specify): ……

19. How **comfortable** are you with using mobile technology in general?

    [ ] Very comfortable [ ] Comfortable [ ] Not comfortable

20. Where do you **often** use the mobile technology for health data collection and management?

    [ ] Home [ ] Workplace [ ] Outreach site

    [ ] Other (specify): ……

21. Which **times** during the day do you usually use the mobile technology for health data collection and management?

    [ ] During working hours [ ] During off-working hours [ ] All day long

22. Give reasons for your response in Qu. 21:

    ……

23. What **additional tools** for data collection and management do you use alongside the mobile technology? (*prompt*; *multiple responses allowed*)

    [ ] Registers [ ] Midwifery return [ ] Immunization returns

    [ ] CWC Report [ ] Tally Sheets [ ] None [ ] Family Planning Returns

    [ ] Other (specify) ……

    (*If response to Qu. 23 is "None", continue from Qu. 25*)

24. Give three **major reasons** why you still use the tools alongside the mobile technology.

	Reason 1	Reason 2	Reason 3
Registers			
Midwifery returns			
Immunization returns			
CWC report			
Tally Sheets			
Family Planning Returns			
Other (specify)			

25. Which mobile network do you **often** use to transmit health data?

[ ] MTN [ ] Vodafone [ ] Tigo [ ] Airtel [ ] Glo

26. What is your view about the time it takes to connect to the internet using the mobile network?

[ ] Very Fast [ ] Fast [ ] Normal [ ] Slow [ ] Very slow

[ ] Other (specify) ……

27. How **stable** is the internet connectivity on the mobile network you use?

[ ] Very stable [ ] Stable [ ] Not stable

[ ] Other (specify) ……

28. **On the average**, how much credit do you use for health data collection and management every month?

……..……

29. Who **pays** for the credit used?

[ ] DDHS [ ] Project [ ] DPHN [ ] DHIO[ ] Self

[ ] Other (specify) ……

30. What is your view about the **cost** of the credit required to use the mobile technology for health data collection and management?

[ ] Too costly [ ] Costly [ ] Reasonable [ ] Less costly [ ] Cannot tell

31. What **challenges** do you face when using the mobile technology for health data collection and management?

[ ] Unstable/slow/bad/poor network [ ] Time consuming [ ] No prior notice of updates

[ ] Freezing of the machine [ ] Increase in workload

[ ] Other (specify): ……

Section C: Perception of usefulness of mobile technologies

32. Which health data collection and management **needs** does the use of the mobile technology address?

[ ] Data accuracy [ ] Report writing [ ] Report transmission

[ ] Data collection [ ] Data analysis [ ] Data utilization

[ ] Other (specify): ……

33. On a **scale of 1 – 10,** how are the health data collection and management needs being addressed with the use of the mobile technology?

[ ] Data accuracy	1	2	3	4	5	6	7	8	9	10
[ ] Report writing	1	2	3	4	5	6	7	8	9	10
[ ] Report transmission	1	2	3	4	5	6	7	8	9	10
[ ] Data collection	1	2	3	4	5	6	7	8	9	10
[ ] Data analysis	1	2	3	4	5	6	7	8	9	10
[ ] Data utilization	1	2	3	4	5	6	7	8	9	10
[ ] Other (1):……	1	2	3	4	5	6	7	8	9	10
[ ] Other (2):……	1	2	3	4	5	6	7	8	9	10
[ ] Other (3):……	1	2	3	4	5	6	7	8	9	10
[ ] Other (4):……	1	2	3	4	5	6	7	8	9	10

Section D: Benefits health staffs derive from using mobile technologies

34. How has the use of the mobile technology **enhanced** your job?

[ ] Increase work efficiency [ ] Increase completeness of data for submission

[ ] Ease completion of reports [ ] Improve data accuracy

[ ] Ease retrieval of reports [ ] Reduce loss of data

[ ] Other (specify): ……

35. How has the use of the mobile technology been **beneficial** to your personal life and development?

[ ] Broaden knowledge and skills in ICT

[ ] Improve knowledge in data collection and management

[ ] Increase free time for personal things

[ ] Other (specify): ……

Section E: Health staffs satisfaction with using mobile technologies

(The following rating scale questions use a simple rating scale from Very well to Very Poor, Please read out options to respondents after each question)

36. Please indicate to what extent you **enjoy** using the mobile technology for health data collection and management? (***Please tick only one box)***

Very Well ☐ *Well* ☐ *Okay* ☐ *Poor* ☐ *Very poor* ☐ *N/A* ☐

37. Please indicate how **fascinating you find** each aspect of using the mobile technology for health data collection and management.

Please tick one box in each row to rate the following aspects of using the mobile technology

	Very Fascinating	*Fascinating*	*Okay*	*Poor*	*Very poor*	*N/A*
Collection	☐	☐	☐	☐	☐	☐
Collation	☐	☐	☐	☐	☐	☐

38. Please indicate how **satisfying you find** each aspect of using the mobile technology for health data collection and management?

Please tick one box in each row to rate the following aspects of using the mobile technology

	Very Satisfying	*Satisfying*	*Okay*	*Poor*	*Very poor*	*N/A*
Collection	☐	☐	☐	☐	☐	☐
Collation	☐	☐	☐	☐	☐	☐

39. Please indicate how **necessary you find** each aspect of using the mobile technology for health data collection and management?

Please tick one box in each row to rate the following aspects of using the mobile technology

	Very necessary	*Necessary*	*Okay*	*Unnecessary*	*Very unnecessary*	*N/A*
Collection	☐	☐	☐	☐	☐	☐
Collation	☐	☐	☐	☐	☐	☐

40. Which aspects of the mobile technology for health data collection and management do you feel are **lacking**?

……

Section F: Health staff's sustained usage of the mobile technologies

41. Will you continue to use the mobile technology for health data collection and management?

[ ] Yes [ ] No [ ] Undecided

42. Give reasons for your response to Qu. 41.

……

Thank you

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