TECHNICAL BRIEF

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Electronic Community Health Information System Implementation in Ethiopia: Achievements, Challenges, and the Way Forward

Background

The World Health Organization (WHO) estimated that at least half of the world's population cannot obtain essential health services due to a global shortage of health workers. One way to help close this gap is to train community health workers (CHWs) (1).

In low-resource settings, CHWs bridge formal health systems and communities, improving the relevance, acceptability, and accessibility of health services. CHWs perform many functions, including conducting home visits, assessing and treating diseases, educating and counseling, referring people for care at higher-level health facilities, and collecting and reporting data (2).

Ethiopia launched its famous Health Extension Program (HEP) in 2003. Health extension workers (HEWs), the Ethiopian version of CHWs, are trained, government employed and salaried female frontline health workers who implement the HEP at the community level.

Close to 40,000 HEWs implement 17 packages of health promotion, disease prevention, and basic curative services at health posts and through home visits. On average, two HEWs serve 5,000 people (3). The HEP enabled Ethiopia to achieve significant improvements in maternal and child health, communicable diseases, hygiene, sanitation, and health care-seeking (4).

To track and manage the HEP, a paper-based community health information system (CHIS) was designed to help HEWs capture, track, and report data on their work at the health post and community levels. The CHIS is a component of the reformed health management information system (HMIS) designed by the ministry of health (MOH) to assist in the management functions of health programs.

The HEWs use the CHIS data to target pregnant women and children for services, and use the tickler file arrangement system to track appointments, identify defaulters, and track the health of individual family members using a family folder. They use family folders to document the family-centered HEP services and household practices that they provide. Every household is expected to have a family folder at the health post level to document services provided to individual members of the household. Through monthly reports, woreda, zonal, and regional managers access health post data and use it to plan, monitor, and make decisions to improve the health of the community (9,10).

CHIS challenges

Even though the CHIS provided data for the management of the HEP, it produced poor-quality data. Thus, national figures on key maternal health care indicators extracted from primary health care service reports were subject to considerable errors (5–8). In addition, the family folders were bulky and vulnerable to damage from rain when carried from house to house. HEWs ended up recording in registers instead and transferring the data to the family folders later, which also predisposed the system to poor-quality data (16). Health posts also generated large amounts of data, which became manually unmanageable (9). This added a significant work burden to the HEWs (17).

In addition, duplicative data collection and analysis led to reporting errors. The family folder system had redundant data elements in registers within

and across health posts and districts. Time spent collecting and harmonizing redundant and non-transferable data could have been spent serving the community, which ultimately hindered HEWs performance (16). The lack of confidence in data quality; unfiltered and overwhelming information at the community level; and lack of time and capacity limited the use of CHIS data for decision making.

Figure 1: MOH Family Folder for the Health Extension Program

The electronic community health information system (eCHIS)

In response to these health system data quality and use challenges, Ethiopia identified the Information Revolution (IR) as a major component of its first Health Sector Transformation Plan (HSTP) (2015/16–2019/20) (9). Digitization of the health information system (HIS) and promotion of data use were pillars of the IR transformation, based on a strong governance foundation.

In 2016, the electronic CHIS (eCHIS) was started. The next three years were spent on visioning, designing, gathering requirements, developing software,

strengthening infrastructure, and deploying it. The eCHIS digitized the HEP family folder. The eCHIS is primarily a mobile-based application that works in an offline environment. However, it needs connectivity for data synchronization and sharing of household and individual information between HEWs and other health workers (27). Generally, the eCHIS facilitates the following functions:
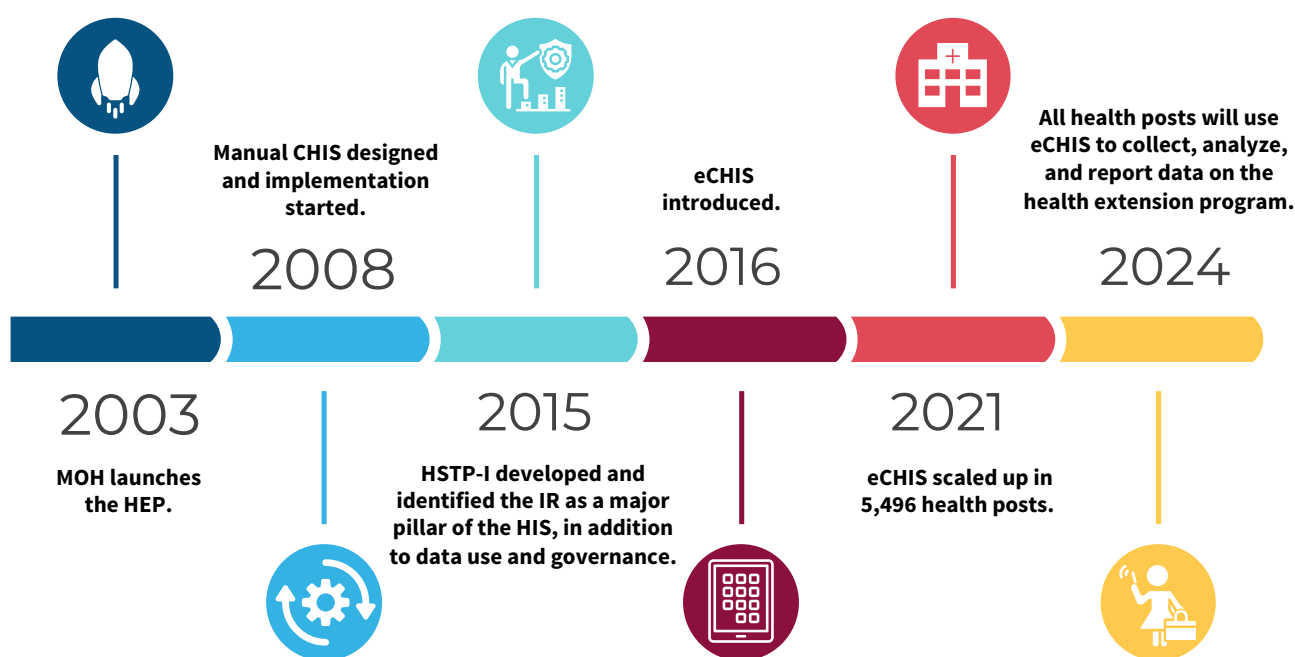
1. **Data collection, reporting, and analytics:** Automates data collection, transmission, reporting, and HEP performance analysis. Helps collect and aggregate data in a useful and meaningful format that allow HEWs, their managers, and other health workers to make informed decisions related to HEP implementation.

2. **Service delivery:** Allows HEWs and other staff to easily retrieve and review household and individual records to deliver tailored services. Has a decision support system to help HEWs make the correct client-management decisions.

3. **Identification:** Capable of uniquely identifying individual and household records, preventing errors and duplicate records. This functionality is particularly important for longitudinal follow up of individual clients and faster retrieval of their records.

4. **Referral and communication:** Enables electronic sharing of household and individual information between HEWs and other staff. This allows HEWs to receive updates and feedback about the status of clients they refer.

Major milestones in eCHIS development:

Manual CHIS designed and implementation started.

2008

eCHIS introduced.

2016

All health posts will use eCHIS to collect, analyze, and report data on the health extension program.

2024

2003

MOH launches the HEP.

2015

HSTP-I developed and identified the IR as a major pillar of the HIS, in addition to data use and governance.

2021

eCHIS scaled up in 5,496 health posts.

## eCHIS components and development approach

The development of the eCHIS application involved a wide array of stakeholders from requirement gathering to designing, development, piloting, and deployment. The requirement gathering included a series of meetings with HEWs, health service providers, health managers, universities, and implementing partners. Several iterations and user feedback helped to fine-tune the system to meet user requirements.

The eCHIS is developed on a single CommCare platform. CommCare is an easily customizable, open-source mobile platform that supports frontline workers in low-resource communities. It allows users to create, edit, and deploy mobile applications without a software developer [11]. Generally, the eCHIS is made to have the following three applications (screenshots of each are captured below).

1. **HEW application:** used by HEWs to guide and document routine services, and record data that is generated during the HEP implementation. The HEWs use the different functionalities of the HEW application at the health post level and during home visits to collect service data, make electronic referrals, get information from the system to make decisions during service delivery, and use dashboards to track performance and produce reports.

2. **Health center referral application:** supports health center workers to confirm referrals and provide referral feedback to HEWs.

3. **Focal Person Application:** The focal person, based at the health center level, is responsible for providing technical and programmatic support to the HEWs. The HEP focal person uses the eCHIS to monitor the HEWs performance and provide support to the HEW when needed.

Health administrators access data, generate reports and view dashboards to inform their decision making. Users include staff at the MoH, regional health bureaus, zonal health departments, woreda health offices and kebele officials.
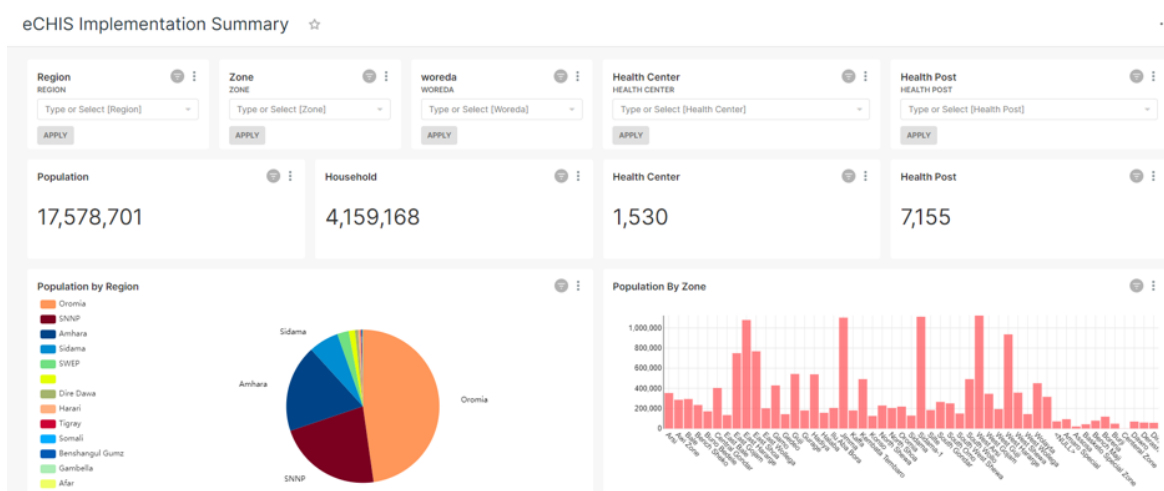

Figure 2: Sample eCHIS Dashboard

A phase-based approach was used to develop the eCHIS modules, which include reproductive, maternal, newborn, and Child health (RMNCH); communicable diseases (CDs) (tuberculosis, HIV, malaria, and leprosy); non-communicable diseases (NCDs); neglected tropical diseases (NTDs); and nutrition and supply chain modules. Similarly, the pastoralist and urban eCHIS modules are being developed in a phased-manner.

The eCHIS application has different components and functionalities, as follows:

1. **Family folder:** used to enter data about household characteristics and family member health status.
2. **Services:** captures HEW-provided services, which include RMNCH, CDs, NCDs, and NTDs.
3. **Setting:** enable users to navigate between different functionalities of the eCHIS application.

4. **Reports:** produces reports (e.g., demographic, service coverage, disease, HMIS, CHIS) on HEW services.
5. **Data synchronization:** helps synchronize data collected on the tablet to a central server.
6. **Dashboard:** visualizes performance summaries in the form of charts, graphs, maps, and tables.
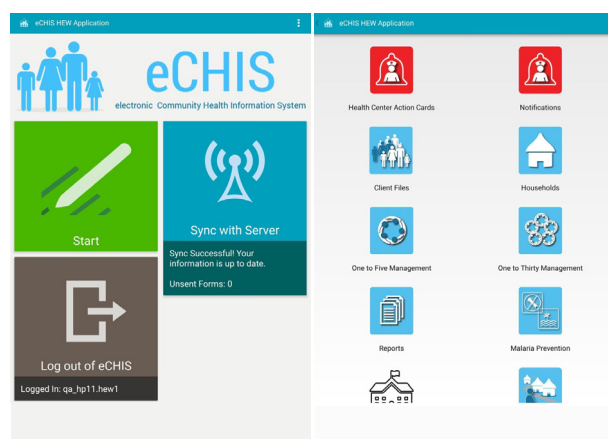
Figure 3: eCHIS HEW Application Screenshot

Partnership and collaboration

The eCHIS development and implementation has been led by the MOH, with technical and financial support from JSI projects in Ethiopia, particularly DHA, Data Use Partnership (DUP), L10K and HMIS projects with funding from donors that include USAID, Bill and Melinda Gates Foundation and the Children's Investment Fund Foundation (CIFF). Other partners include Ethiopian universities and other local and international partners.

The MOH, in collaboration with partners, established a national eCHIS Steering Committee and a Technical Working Group to provide a coordination mechanism, leadership, monitoring and evaluation in the following major areas:

1. **Module development:** conducting scoping, requirement analysis and the development of l eCHIS modules. The module development process was made in a phased approach.

2. **Module enhancement and troubleshooting:** Following the development of the modules, ongoing support is provided to eCHIS users to ensure the functionality and use of eCHIS. In the process, gaps have been identified and system enhancements and updates were made through continuous learning and feedback from users. A helpdesk was also established for users to report issues and get readily available support ensuring uninterrupted system functionality.

3. **Capacity building:** To enable utilization of the eCHIS, training was provided to more than 10,000 health workers in 370 woredas. To build their skill and capacity, eCHIS users receive ongoing post training follow-up support and supervision.

4. **Infrastructure and maintenance:** The eCHIS implementation needs ongoing maintenance and infrastructure support. The MOH mobilized resources and deployed the necessary infrastructure (tablets, SIM cards, power banks, server and the eCHIS application) and provided continuous demand-driven gap filling infrastructure support wherever it is needed. This includes making sure that the eCHIS server is up and running all the time.
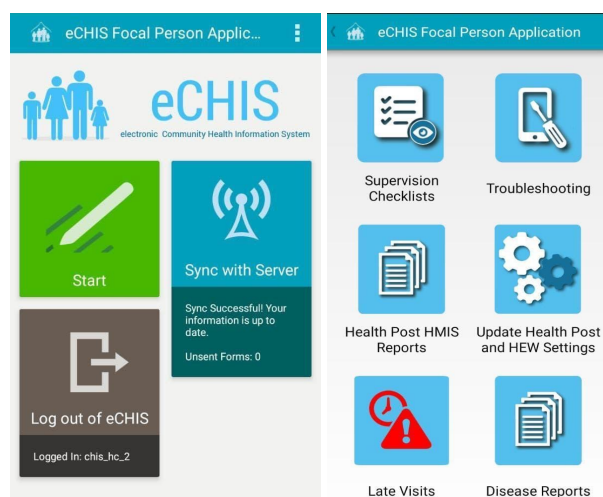

Figure 4: eCHIS Focal Person Application

Major Achievements

The following result is summarized based on data from routine monitoring of eCHIS implementation.

1. eCHIS scale up: eCHIS has been scaled up to over 7,000 health posts covering 370 woredas in Tigray, Amhara, Oromia, Sidama, Benishangul Gumuz , Sidama, South West Ethiopia, SNNPR, Harari and Somali regions and Dire Dawa City Administrations of Ethiopia. Scale up involves provision of training and distribution of tablets, SIM cards, power banks and installation of the eCHIS application. In addition, the MOH is currently customizing the family folder for pastoralist settings with a plan to pilot it in about 100 pastoralist health posts.
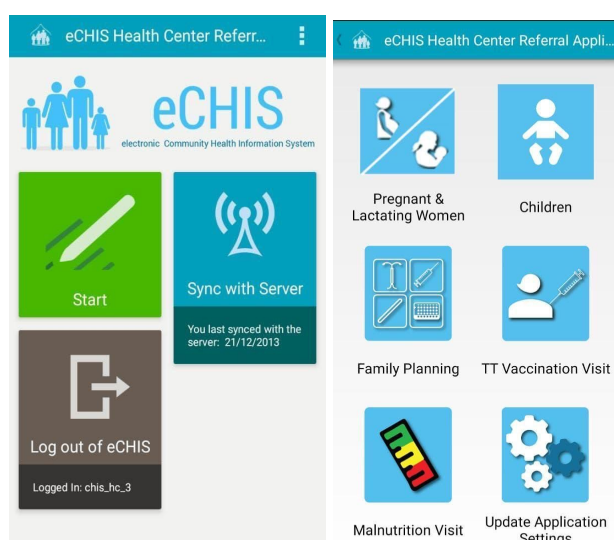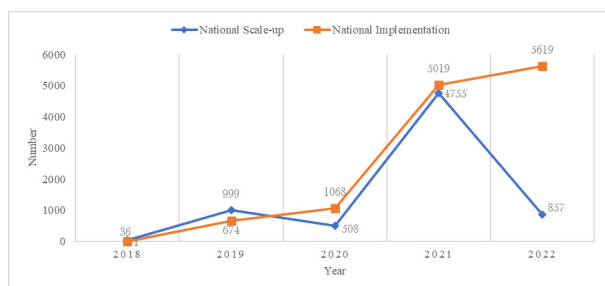

Figure 5: eCHIS Health Center Referral Application

The figure below indicates that the cumulative number of health posts implementing eCHIS (health posts that have registered at least 20% of the households in their catchment area) reached 5,619 in 2022. (Figure 6).

Figure 6: eCHIS scaleup and implementation, September 2018 to August 2022

2. Household registration: As of the end of August 2022, a total of 4,186,779 households with a population of 18,051,113 have been registered using eCHIS. This represents a significant number of households and population in the country (Figure 7).
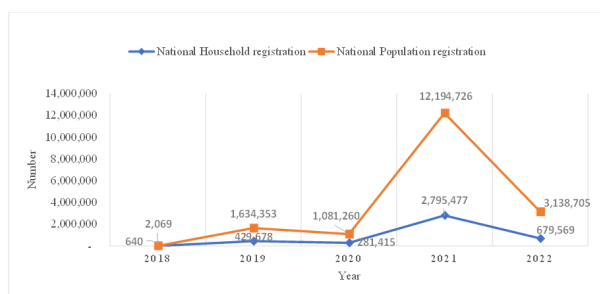
Figure 7: Households and population registered annually in eCHIS, September 2018 to August 2022

3. Service delivery

3.1. Maternal Services: Maternal services, including pregnant mother registration and antenatal, delivery and postnatal care have been registered using eCHIS. A total of 203,456 maternal services were provided using the application. This included 157,318 pregnancy registrations, 24,365 ANC visits (ANC1 62.3%, ANC2 23.2%, ANC3 10.9%, ANC4 3.6%), 19,374 deliveries and 2,399 PNC visits (PNC1 35.3%, PNC2 22.6%, PNC3 14.0%, PNC4 28.1%) (Figure 8).
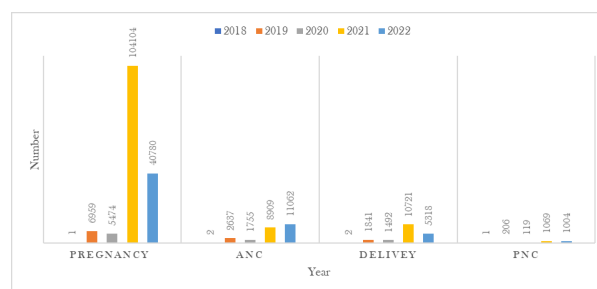

Figure 8: Maternal health services provided using eCHIS, September 2018 to August 2022

In addition, 48,648 family planning services were provided through eCHIS from 2018 to 2022 of which 64.1% and 35.9% were new and repeat clients, respectively (Figure 9). This constitutes 19% of the total maternal services provided using eCHIS nationally (Figure 9).
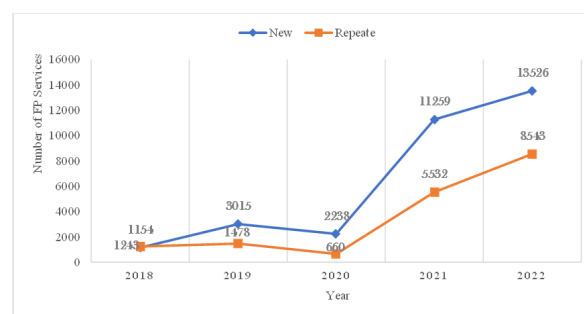
Figure 9: Family planning services provided using eCHIS, September 2018 to August 2022

3.2. Child health services: From September 2018 to August 2022, 1,836,831 children under five were registered using eCHIS nationally, constituting one-tenth of the total population registered using the application. Children under two years old account for 37.8% of the total children registered (Figure 10).
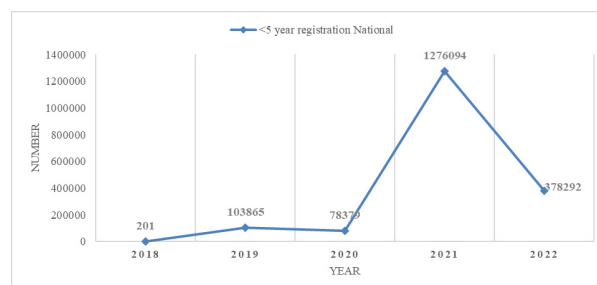
Figure 10: Under-five year children registered using eCHIS, September 2018 to August 2022.

As of end of August 2022, a total of 572,084 Expanded Program on Immunization (EPI) services have been given to children under-five using the eCHIS application (OPV 132,778, PCV 135,160, PENTA 136,001, ROTA 101,715, IPV 43,691 and Measles 22, 739) (Figure 11).
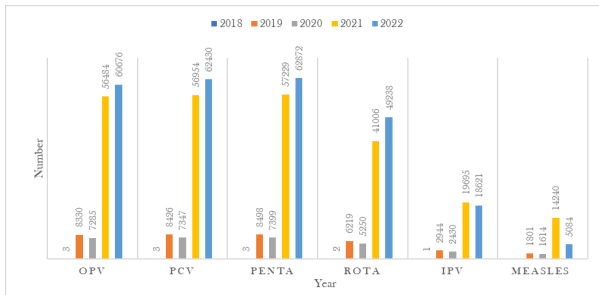

Figure 11: EPI services delivered using eCHIS, Ethiopia, 2018 to August 2022

4. Ensuring Quality and Sustainability of eCHIS: Jimma university has been identified and supported to become a center of excellence in eCHIS implementation. MOH and DHA, provided technical and financial support to Jimma University to enable it provide high quality and advanced eCHIS in-service and pre-service training, support the digitization and optimization of eCHIS, and establish eCHIS learning woredas.

5. Improving eCHIS governance: MOH, with support from its partners, drafted eCHIS Standard Operating Procedures (SOP) to help standardize the use of eCHIS. In addition, a national steering committee and technical working are established to provide high level technical and policy level guidance to the implementation of eCHIS.

In 2022, DHA in collaboration with Jimma, Gondar, Haromaya and Hawassa universities conducted a study to understand the acceptability, usability, motivation, barriers, and facilitators of eCHIS in six regions across Ethiopia (Oromia, Amhara, SNNP, Harari, Sidama and South West Ethiopia). The result showed that the acceptance of eCHIS by HEWs is very high, ranging from 94.4% to 97.4%. Despite high acceptance**,** only half of the HEWs managed to use eCHIS either frequently or always in their routine work (Figure 12). This shows that there is a huge discrepancy between acceptability and actual usage behavior of eCHIS by HEWs.
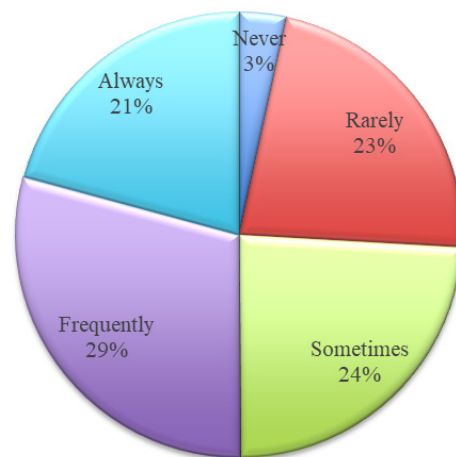
Figure 12: Frequency of eCHIS use among HEWs in Ethiopia, June 2022

Perceived usefulness and ease of eCHIS use were significantly associated with its acceptability, which in turn affected usability. The study identified barriers against the use of eCHIS operating at different levels, including the following which explain the acceptance-utilization gap:

• **Infrastructure related barriers:** The utilization of eCHIS has been hindered by infrastructural and resource related barriers such as lack of or improper functioning of tablets, SIM cards and connectivity problems, intermittent server up-time, interruption of electricity including shortage of power banks, no readily available tablet maintenance service, and lack of eCHIS integration with DHIS2.

• **Training related barriers:** HEWs use of eCHIS has been challenged by the poor quality of training and support they received from supervisors at woreda and health center level. Inadequate training including content skipping, lack of sufficient demonstration and practical sessions, lack of regular post-training follow up, and lack of technical support from staff at woreda and health center level were mentioned as major challenges in the study.

• **Resources related challenges:** HEWs raised challenges in connection with the quality, quantity and type of resources needed to implement eCHIS. In some health posts, the staffing of HEWs is below the national standard. It was mentioned that there is inadequacy of human resources in

light of the burden of competing priorities, such as frequent campaigns (immunization, deworming, etc.) and involvement of HEWs in additional duties that are outside the regular scope of work. It was also reported that there is a shortage of budget at woreda levels to undertake supportive supervision and review meetings.

- **Human-system interactions challenges:** HEWs reported that navigating through the different pages of the eCHIS has been a challenge for HEWs during service delivery. Challenges reported include being stuck on a page and the application spontaneously restarting without saving the data. It was reported that lack of experience on how to manage screen brightness resulted in visual and ocular discomfort among HEWs. HEWs also stated that fear of theft and robbery during home visits for registration and service delivery is hindering them from using eCHIS.

- **Policy gaps:** Policy gaps like parallel recording of CHIS and eCHIS, a phase-based release of eCHIS modules and lack of tablet use protocol at a national level were reported as barriers to the use of eCHIS.

Facilitators and motivators of eCHIS

Despite the challenges, there are some eCHIS utilization facilitators and motivators. Among the facilitators identified were the fact that eCHIS improves data quality including data retrievability, transparency and traceability and tablet portability. Furthermore, encouragement by supervisors, support from colleagues, and the positive image that results from the use of technology at the community level motivated HEWs to use eCHIS in their routine work. The HEWs also mentioned that effective implementation of eCHIS saves resources such as reducing printing cost of charts and manuals, saving time, reducing workload, and allowing accurate estimation of the catchment population.

Key lessons learned

The Ethiopian government and other major donors in the field of digital health have made considerable investments in the eCHIS. The tool has enabled the capturing of health data of a significant number of the population and households in the country. While it is very important to improve the eCHIS user experience by addressing the barriers, important work lies ahead which includes scaling the eCHIS to additional health posts in agrarian and pastoralist areas.

Despite the huge investments, there are insufficient resources to scale eCHIS in all agrarian, pastoralist, and urban health posts. At this point in time, it is important to rethink the whole eCHIS development and implementation approach to maximize its benefits and achieve its programmatic goals. Generally, lessons relate to one of the following categories:

- **Development:** Include all system users right from the start to ensure user perspectives are included in system design and implementation. Another benefit is that this creates user ownership, which facilitates system sustainability.

- **Implementation related:** Phased scale up helps synthesize and apply lessons to subsequent efforts. Training eCHIS users consumes a huge amount of money and time; it takes 42–45 days to complete all training modules of eCHIS. It is also important to support health posts to start eCHIS implementation immediately after training, before knowledge and skills imparted through training are forgotten. Equally important is provision of continuous onsite tailored and context-sensitive support to ensure initiation and continuity of implementation following training. Rollout should be carefully planned.

- **Data Quality and Data Use:** The phased scale-up of eCHIS provides opportunities to compare improvements in data quality and use across HPs.

- **Worth of the investment:** The eCHIS has huge upfront investment. Currently, the average unit cost of eCHIS initiation per woreda is estimated at USD17,500. However, better efficiency and return on investment (ROI) is expected in the long term. The ROI includes the contribution of going digital to the environment as a result of going paperless.

Way forward

The eCHIS implementation design needs to aim at maximizing the intended benefits. This necessitates meticulous planning, monitoring, and evaluation of the process and the outcomes with its users always at the center.

It is very critical to continuously build the capacity of HEWs to make effective and sustained use of the eCHIS. Before going into further scale up, consolidating gains and lessons helps avert similar challenges faced by users so far. To this effect, planning and conducting learning activities is important to continuously refine the eCHIS. In line with this, DHA, DUP and Jimma university have conducted various studies which can be used as inputs to course-correct the eCHIS implementation.

The role of the private sector in eCHIS implementation and support needs to be explored and engagement strategies should be developed and implemented. For instance, DHA has established youth enterprises to make them become viable businesses. The youth enterprises provide close technical support to health institutions including HPs. Early results demonstrate that such arrangements help improve the private sector engagement and contribute to a potentially sustainable outcome.

Self-hosting and full ownership of data has been a high priority of the MOH since the start of the eCHIS. It is critical to address the performance bottlenecks while eCHIS is being scaled up in terms of users and actual content of the application. In addition, a disaster recovery plan must be in place. Disasters vary in scale from simple power outages to data center fires and natural and human-caused hazards. Innovations such as the Wellness Pass solution helps to ensure resilience.

Creating community demand for use of technologies by health institutions, such as the eCHIS, for better handling of health data and improved and continued health system-patient/client digital interaction is important. To this end, improving the digital literacy of the community and promoting a favorable digital behavior including community and health workers faster adoption of digital tools requires targeted digital behavior change communication interventions.

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