



FOHSEN | Digital Health Project

Assessment Updates and Proposal¹

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2 EXECUTIVE SUMMARY

Foundation for a Healthier Senegal (FOHSEN) seeks to improve health outcomes in rural Senegal. Although considerable progress has been made in reducing maternal mortality over the past 25 years, the national maternal mortality ratio (MMR) sits at 315 per 100,000 live births. While progress has been made in regard to improving access to quality care, there is ample room for improvement.

FOHSEN's current care delivery workflow involves clinical intake forms in paper format. This creates administrative challenges and delays in the care delivery process, which can affect timely access to care. A key priority of FOHSEN is to develop an Information Communications Structure (ICS) that replaces the current workflow with a more effective and efficient system. This infrastructure would also be the first step towards the implementation of telemedicine solutions for rural communities in Senegal's Kaffrine region.

In this proposal, we lay out the motivation for such infrastructure, propose a design, and recommend options for development and implementation.

3 COUNTRY CONTEXT

In Senegal, maternal deaths dropped 43% between 2000 and 2017 (from 553 to 315 deaths per 100,000 births). While this represents significant progress, compared to 19 deaths per 100,000 births in the United States, the 315 deaths (as of 2017) suggest there is wide room for improvement. When the data are disaggregated by both region and cause of death, an even more challenging picture emerges. Government statistics from 2013 showed that while the MMR was 389 in urban areas, it was 459 in rural areas overall, and as high as 700 in the most remote, underserved areas of the country. Direct obstetrical causes (hypertensive disorders of pregnancy, haemorrhage, infection, unsafe abortion and obstructed labour) account for the majority of these deaths.

National strategies (UHC policies) and international efforts (such as Millennium Development Goals [MDG]) have led to notable improvements in maternal health in Senegal, largely driven by a significant increase in access to and utilization of care over the last three decades. The high maternal mortality rate despite this progress suggests more work is needed to not only continue to improve access and utilization but also ensure high levels of maternal care quality. Research suggests women in Senegal and the broader sub-Saharan African region receive remarkably low-quality care according to best practices globally. In the words of Professor Margaret Kruk, a prominent quality of care scholar at Harvard: "For an antenatal care visit, a family planning visit, or a parent who brings in a sick child, people might not be asked their symptoms. They might not be examined. They might not be told when to return. They're basically getting half the care that they should be getting, according to best practices globally. Even for diseases that are well known in these countries, such as diarrhea or TB, people get the correct treatment only about 50 percent of the time."

With the UHC policies launched by the Senegalese government in 2013, healthcare services have been made more affordable through the use of community-based health insurance. However, due to lack of information and awareness, uptake of insurance is still low in rural areas. Even among populations with insurance, effective utilization of care might be hampered by access barriers. Without stable healthcare

infrastructure that supports maternal and reproductive services, disease prevention, and health literacy, access to quality health services will remain a dire challenge.

4 ABOUT FOHSEN

FOHSEN aims to improve maternal and child health outcomes throughout rural Senegalese communities. In partnership with local and national leaders, the organization delivers effective community-based primary healthcare for mothers and children under five in the villages of Nganda, Ndankou, Mina, Kelimane and Medina bordering Gambia, which is home to 190,000 residents.

FOHSEN employs trained community health workers (CHWs) who serve the daily health needs of populations by delivering an integrated package of healthcare services, including reproductive, maternal, neonatal, and child health care.

5 DIGITAL HEALTH VISION

The long-term vision of FOHSEN's Digital platform is to enhance access to healthcare services in rural Senegal. The platform will be designed with the following objectives in mind:

- Improving access to and quality of health services and information through the effective use of technology health worker training and support
- Increasing uptake of health services through the effective use of targeted interventions through SMS messaging and outreach

The development of the platform will proceed in stages. **Stage 1** of this process, the focus of the current report, begins with solving the administrative problem related to the use of paper-based intake forms and setting up a basic healthcare delivery management system.

In delivering the services mentioned earlier, CHWs routinely collect health and administrative information on individuals using intake forms currently in paper format. In this process, certain patients (for example, those with high blood pressure or blood glucose levels) are referred to the community health post in Nganda. The intake forms are of three types (maternal health, child health, and adult health). In the current workflow, completed forms are periodically (every one to two weeks) brought to the health post for scanning. The data are then manually extracted from scanned documents and processed for analysis. The last step in the pipeline consists of sharing key insights with clinical staff at the community health post and FOHSEN administrators.

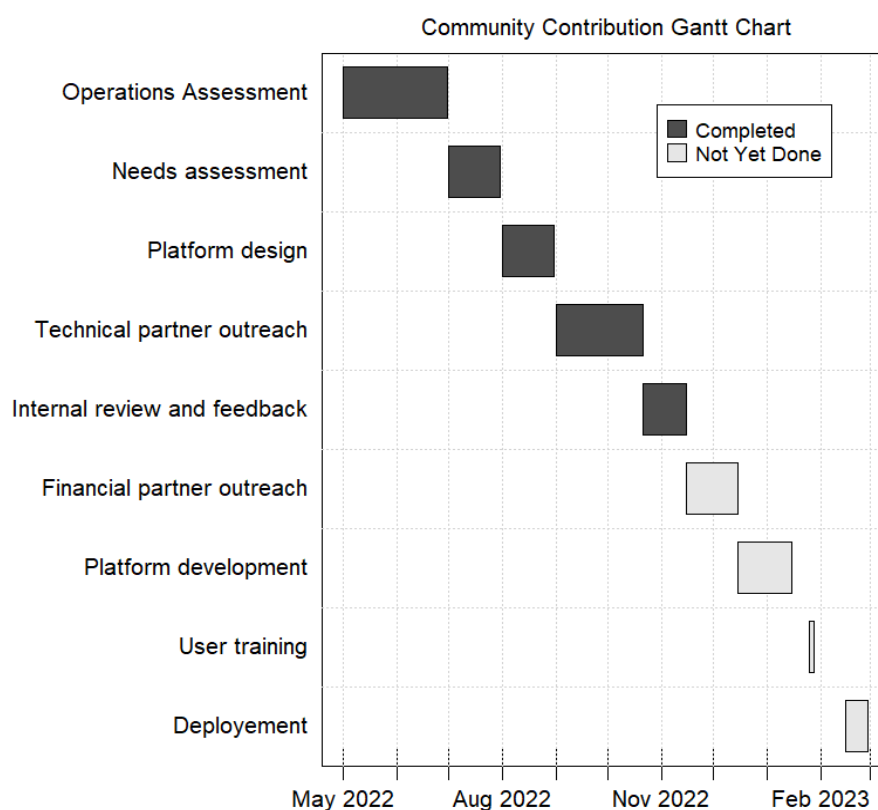
This workflow is not only administratively burdensome, but it also creates time lags between important steps in the care process and creates hazards into the handling of confidential patient information. Stage 1 of the digital health initiatives aims to digitize this pipeline. The outcome of this stage is a digital management system that can be accessed by the different agents involved in caring for the populations in the served areas. In the next section, we outline the approach taken, and the outcomes resulting from it. We end the report with recommendations and notes regarding timeline and next steps.

6 STAGE 1

6.1 OVERALL APPROACH AND TIMELINE

The approach adopted by the Innovations Team in **Stage 1** consisted of four main steps. The first step was an operations assessment. This consisted of in-depth interviews of stakeholders involved in caring for patients. Following these interviews, the second step involved defining the needs voiced by each key stakeholder. The third step involved outlining the design features of the ideal digital platform that addresses these needs. The fourth and final stage consisted of evaluating options for technical development. The detailed overall project timeline is depicted in **Figure 1** below.

Figure 1: Overall project timeline



6.2 OPERATIONS ASSESSMENT

In FOHSEN's prior experience with digital health, CHWs collected information using Google Forms via iPads. However, this initiative did not work optimally and was eventually discontinued. The goal of the needs assessment was to understand the role of key agents involved in FOHSEN's current pipeline of care delivery, their current digital needs, and their experiences with FOHSEN's prior digital health platform.

Between May and June 2022, we interviewed FOHSEN's most experienced CHW, the head nurse of the Nganda health post, and members of the FOHSEN administrative team. We also interviewed a Nganda

community leader and board member (Mathe Mbaye) to receive additional context regarding FOHSEN's work.

6.3 NEEDS ASSESSMENT

With insights from the interviews, we outlined key features that need to be included in the digital health infrastructure for each key stakeholder (**Table 1**). We also summarize lessons learned from our prior digital health experience. We shall keep these lessons in mind as we start developing the new infrastructure.

Table 1: summary of agent roles, current needs, and prior experience

	Role	Features desired	Experience with prior digital infrastructure
CHW	<ul style="list-style-type: none"> • Consultations • Data collection • Community outreach 	<ul style="list-style-type: none"> • User-friendly data collection tool that can work with or without internet • Coverage progress tracking 	<ul style="list-style-type: none"> • Issues with internet access • Poor quality tablets • Lack of support when devices malfunctioned
Head nurse	<ul style="list-style-type: none"> • Head of community health post 	<ul style="list-style-type: none"> • Timely identification of individuals with medical needs • Disease surveillance 	<ul style="list-style-type: none"> • Delayed access to data • No functional referral system
FOHSEN admins	<ul style="list-style-type: none"> • General management 	<ul style="list-style-type: none"> • Coverage and impact tracking • CHW performance monitoring 	<ul style="list-style-type: none"> • Lack of custom built-in features for monitoring, progress tracking, and data analysis

With these needs defined, the team conducted research and outlined the general components of the infrastructure that will include these desired features.

6.4 KEY PLATFORM DESIGN FEATURES

Considering the needs specified above, the team identified the following components as necessary to build into the new infrastructure:

- **Data collection:** ability to enter information collected during consultations using applications hosted on tablets with online and offline capabilities
- **Records management:** ability to store patient information and access records safely and securely
- **Referral platform:** ability for head nurse and CHWs to view and manage referrals to the health post, so that appropriate steps can be taken to ensure referred individuals receive care in a timely manner

- **Progress tracking:** ability to keep track of coverage progress made overall and stratified by village/CHW
- **Disease monitoring:** ability to monitor in real time the evolutions of different symptoms and conditions (diabetes, hypertension, etc.) among the served communities

6.5 OPTIONS FOR TECHNICAL DEVELOPMENT

The next step was to conduct research to identify options for developing this infrastructure. Throughout this step, we received inputs from internal colleagues, external digital health experts, and organizations doing similar work ([Muso Health](#) in particular). This step allowed us to identify the following potential frameworks: [DHIS2](#), [ODK](#), [THINKMD](#), [CommCare](#), and [CHT](#). After further exploration, we ruled out DHIS2 and ODK as these would only support a subset of the features outlined above. THINKMD would address all our needs, but it was designed for larger health organizations (100+ users) that focus on broader health conditions than FOHSEN and involved substantial funds (\$50,000+ for development). Therefore, this option may be premature for FOHSEN at the current stage.

CommCare and CHT were targeted as two viable options. While both platforms are widely used, they involve advantages and disadvantages that are summarized in **Table 2** below.

Table 2: Comparison of two viable options

	CommCare *	CHT
Development organization	Dimagi	Beehyv with support from Medic
Description	Drag and drop solution from available features for general use	Full custom technical development
Development time horizon	5 – 6 weeks	3.5 – 4 months
Cost in year 1	\$6,000	\$26,000
Cost in subsequent years	\$6,000	\$8,000 (maintenance + cloud hosting fees)
Flexibility for additional custom features	Limited	High
Intellectual property (IP) owner	Dimagi	FOHSEN
Data security**	Enhanced security features	Standard security protocols
Reactivity of user support	1-day guaranteed response	Unspecified

Notes:

* The data presented here reflect the “Pro” version of CommCare, which suffices for our current needs. Dimagi offers more advanced options at higher costs.

** Both platforms would satisfy the minimum required standards of data privacy and security. CommCare offers enhanced security features such as two-factor authentication and has been touted as the safest service in this space.

The costs in the table above include only software development costs. Other components of cost include hardware costs and operations launch costs. These are described below and summarized in **Table 3**:

Table 3: Estimated additional costs

	Hardware	Deployment	Data	Travel and accommodation costs
Description	Smart tablets for data collection and monitoring, and referrals management for 10 CHWs, 1 head nurse, 2 FOHSEN admin, and 2 back-up	Technical support during software installations, user training	Monthly data plans for 10 CHWs	Travel from USA to Dakar for a member of the Innovations team, and from Dakar to Nganda for the implementation and training
Units	15		10	
Unit cost estimate (including shipping) in USD	\$150		\$25 per month per CHW	
Total cost estimate	\$2,250	\$3,000	\$3,000 (annual)	\$2,000
Overall additional cost estimates	~\$12,000			

6.6 FINAL RECOMMENDATIONS

The choice of solution among the available options involves trade-offs that can be summarized as follows:

- **CommCare:**
 - Pro: provides access to a secure and mature infrastructure at an affordable cost and with quick implementation
 - Con: IP is owned by Dimagi. As a result, FOHSEN cannot take ownership of its digital infrastructure, and there may exist constraints with regards to future expansion of custom features
- **CHT:**
 - Pro: provides access to custom-developed infrastructure owned by FOHSEN
 - Con: more costly, and implementation takes a longer time horizon

We recommend starting with CommCare for one year as a proof of concept. This helps us avoid the high costs of building, operating, and maintaining our own infrastructure. Upon the completion of the initial experiment with CommCare, we can then assess whether additional capabilities beyond what CommCare currently offers are needed. Based on the above cost breakdown, we estimate an upper bound of 20,000 USD to develop and operate the platform for a year.

6.7 IMPLEMENTATION

The development of the platform will be spearheaded by the Innovations team working alongside mentors and advisors who have technical expertise in the digital health space and implementation experience. Biographies of the advisors and the members of the Innovations team are included in the appendix.

6.8 NEXT STEPS AND TIMELINE

The next step is to decide which of the two options above optimizes the trade-offs and discuss other possible options. After this decision is finalized, financial resources will need to be gathered for the technical development. The timeline of the development process depends on the option that is adopted. We think FOHSEN could aim to deploy an initial version of the infrastructure as part of the Nganda health fair that usually takes place every February. This would give us an opportunity to enroll a large number of individuals who can then be tracked over time.

7 APPENDIX: MEMBERS OF THE INNOVATIONS TEAM AND ADVISORS

7.1 ADVISORS

Abdoulaye Kante

Abdoulaye is a senior specialist in digitalization in developing country contexts. He holds an engineering degree in ICT with a concentration in design and implementation of digital public policies from the University of Paris Nanterre in France. Abdoulaye has more than fifteen years of experience in the digital transformation of public administration and social and economic services to populations in the context of developing countries. He is an expert in the digitization of care protocols, management of health data for the monitoring and evaluation of service delivery, and impact evaluation.

Eva Achero

Eva is a Programs and Operations Manager at the Digital Impact Alliance (DIAL), which she joined in January 2018. Eva's professional background spans higher education, social security administration, mobile telephone industry and print media. Prior to joining DIAL, she was a Senior Administrative Assistant at the College of Engineering, University of Florida. She has also worked for the University of St. Augustine in Florida, National Social Security Fund (Nairobi), Safaricom Limited (Nairobi), and Nation Media Group (Nairobi). Eva holds a Bachelor of Science in business with a concentration in global management from University of Phoenix, a Diploma in business studies from Eldoret National Polytechnic, Kenya.

7.2 INNOVATIONS TEAM

Ibrahima Dieye

Ibrahima serves as FOHSEN's Vice-President of Innovations. He is a doctoral student in Health Economics at Harvard University. His research interests include community-based approaches to health care delivery and health insurance, universal health coverage, behavioral health economics, and the

applications of Artificial Intelligence in healthcare. Prior to Harvard, Ibrahima received a bachelor's degree from Macalester College in 2017 with majors in Applied Mathematics and Economics and a minor in Computer Science. Following graduation, he spent four years at Analysis Group (AG), where he worked in Health Economics and Outcome Research (HEOR) as an Analyst, a Senior Analyst, and a Data Scientist. Some of his work has been published in journals such as PLOS One and The Journal of Comparative Effectiveness Research.

Cheickna Sacko

Cheickna is an IT-project coordinator for FOHSEN's Innovations Team. He is a University of Delaware graduate with a degree in Information Systems. Currently, he is working as a Business Analyst in Finance. His interests include tech-education, health equity and systems improvement.

Mintou Kone

Mintou serves as a member of FOHSEN's Innovations Team. He is currently pursuing a degree in electrical engineering at Polytechnique Montreal. His interests include technological advancement in Africa, political reforms and African storytelling.