



WORKING PAPER

A mobile health application to manage acute malnutrition

Lessons from developing and piloting
the app in five countries

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Executive Summary

Malnutrition is the world’s most serious health problem and the single biggest contributor to child mortality and the global burden of disease. Severe acute malnutrition (SAM) is responsible for between 1–2 million preventable deaths every year and affects around 17 million children under five. Community based Management of Acute Malnutrition (CMAM) is a proven high-impact and cost-effective approach in the treatment of acute malnutrition in developing countries. It enables community health workers and volunteers to identify and initiate treatment for children with acute malnutrition before they become seriously ill, using ready-to-use therapeutic foods (RUTF) – a high-energy, micronutrient enhanced paste and routine medications which mothers can give their children at home. However, the success of CMAM is limited if treatment protocols are not followed, record keeping and data management is poor and reliable data is not available in time for decision makers. There is strong evidence that mobile device based (mHealth) applications can improve frontline health workers’ ability to apply CMAM treatment protocols more effectively and to improve the provision of supply chain management.

World Vision, together with implementing partners International Medical Corps and Save the Children and technical partner Dimagi, have developed a CMAM mHealth application (app) that guides health workers through CMAM protocols and provides accurate and timely data for district health managers to respond to changes in caseloads and treatment outcomes, manage supplies, and inform national statistics. The application was piloted in Chad, Kenya, Mali, Niger and Afghanistan between 2014 and 2016 through established World Vision, IMC and Save the Children CMAM programmes. In September 2016, Save the Children through Transform Nutrition, commissioned a consultant to interview headquarter and programme country staff across the five countries to capture their experiences adapting and piloting the mobile app in remote health facilities and inform future mobile health projects.

Despite facing a number of external factors, including security issues across all countries and the Ebola outbreak in West Africa, that caused significant delays throughout the project timeline, the pilot has shown that the app has great potential in strengthening health workers’ ability to provide improved quality of care for lifesaving CMAM services and more accurate and timely data for decision making.

Key lessons from the pilot project include that early and in-depth buy in from local ministries of health is essential to successful deployment, and plays a key role in scaling up and sustaining an mHealth initiative. Thorough technical landscape analysis, prior to deployment, of electricity provision and network coverage can greatly minimise delays and increase uptake. Finally, in order to continuously motivate and engage health workers to use the app, it is essential to secure regular onsite technical and software support, while also building local capacity for ongoing troubleshooting.

Whilst these points were not all successfully achieved across project countries, all participating ministries of health, as well as the majority of health workers and caregivers, have accepted the CMAM mHealth app as a tool, and see its potential to improve CMAM quality of care and supply management.

▼ A health worker screening a child for malnutrition, using the Community based Management of Acute Malnutrition mobile application.



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► A malnourished child is provided with RUTF at Dambas dispensary, Wajir County, Kenya.



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Introduction

Context

Malnutrition is the world’s most serious health problem and the single biggest contributor to child mortality and the global burden of disease. There are at least 50 million children suffering from acute malnutrition worldwide, with approximately 17 million children suffering from severe acute malnutrition (SAM)¹. When compared to well-nourished children, those suffering from SAM are nine times more likely to die² and face an increased risk of morbidity through a weakened immune system.

Community based Management of Acute Malnutrition (CMAM) is a proven high-impact and cost-effective approach in the treatment of acute malnutrition in developing countries, in which the majority of cases are treated as outpatients at community level. It enables community health workers and volunteers to identify and initiate treatment for children with acute malnutrition before they become seriously ill, using ready-to-use therapeutic foods (RUTF) – a high-energy, micronutrient enhanced paste and routine medications which mothers can give their children at

home. However, the success of CMAM programmes can be limited by a number of factors, including lack of adherence to treatment protocols by health workers, and inaccurate record keeping, due to a lack of training, sufficient supervision and the absence of up to date information. Moreover, limitations in the paper based system to support referrals make it difficult to track individual children through the different levels of treatment to recovery and discharge.

Data management presents another significant challenge as information is frequently missing or of poor quality and not accessible to decision makers within a reasonable timeframe, making its use in development contexts and for humanitarian response, surveillance and logistics management limited. Lack of timely information has made programmes unresponsive to stock-outs and undermines their ability to respond effectively when there is an upsurge in acutely malnourished children. ‘Easy to use’ job aids and effective performance monitoring systems are needed to improve the quality of CMAM programmes globally.

¹ <http://apps.who.int/gho/data/node.wrapper.nutrition-2016?lang=en>

² <http://www.nowastedlives.org/>

The CMAM mHealth project

Developing a mobile health app to manage acute malnutrition

Rationale

Currently, the majority of frontline health workers supporting CMAM programmes are trained in standardised protocols but do not have frequent onsite supportive supervision, or job aids, to support protocol adherence and accurate treatment. All tracking and site monitoring systems are paper-based and subject to error and misreporting.

There is strong evidence that mobile device based (mHealth) apps can improve frontline health workers' ability to apply treatment protocols more effectively and improve the provision of supply chain management³. An innovation that secures a dynamic link between frontline patient treatment data with programme performance, reporting and stock management has the potential to dramatically improve monitoring, evaluation and real time decision making for CMAM. An app that provides health workers with an easy to use case management information resource, through simple and powerful decision making and patient tracking tools, could enable a full continuum of care from the home to the health centre. This type of mHealth solution could also lead to a faster, more responsive and accurate aggregation of programme data for easy analysis and support to supervisors and other decision-makers. Service provision could be

How the mHealth app works

The mHealth app provides health workers with simple, step-by-step guidance to help them assess, treat or refer children visiting the CMAM programme. The app is built on the CommCare platform, which uses a touch swiping function to take health workers through the steps, remind them of the treatment protocol and counselling messages and calculate z-scores and numbers of ready-to-use therapeutic foods (RUTF) sachets and routine medications. It also records the child's information, making child follow up easier and uploads the data to the 'cloud' providing live and accurate data for district and national level decision making and management.



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substantially improved to significantly reduce avoidable deaths in children suffering from acute malnutrition.

The CMAM mHealth project design

In 2013, World Vision (WV) initiated the development of a mobile phone based application for CMAM. Funded by the Office of US Foreign Disaster Assistance (OFDA), the app was piloted in Chad, Kenya, Mali, Niger and Afghanistan. Collaborating implementation partners International Medical Corps (IMC) and Save the Children (SC) led the contextualisation and deployment of the app in their respective project countries, working closely with the technical partner, Dimagi, WV, and local ministries. In Mali, Niger, Chad and Afghanistan, WV implemented the CMAM mHealth project, partnering with IMC in Chad, whereas SC led the process in Kenya.

The specifications for the CMAM mHealth app were originally developed in Chad in 2013 based on Chad national protocols. Approximately four months were spent further refining the specifications prior to engaging Dimagi to build the first prototype. Based on these detailed specifications, an initial prototype was built and tested with nutrition technical specialists within WV. Alongside the refinement to the specifications, WV launched a global call for partners to collaborate on the development and testing of the app. Several coordination calls were arranged among interested NGOs, resulting in signed agreements to collaborate with Save the Children and IMC. Five months were spent testing and refining the prototype app prior to any

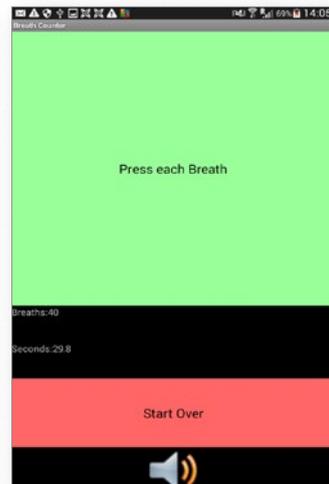
▲ The CMAM app helps health workers assess children with acute malnutrition, as well as caregivers and post-treatment follow up.

³ <https://www.ncbi.nlm.nih.gov/pubmed/15772326>

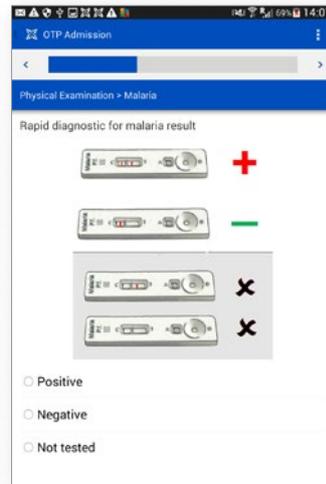
https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/12077/ER200_MixedMethodImpactEvaluationofaMobilePhoneApplicationforNutritionMonitoringinIndonesia.pdf;jsessionid=A2D575B44550CF91FC11C1D73143C8DF?sequence=1



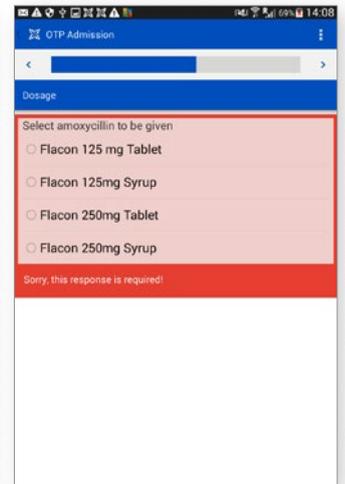
▲ The app prompts the health worker to conduct the appetite test and provides a reminder for the criteria to 'pass or fail'.



▲ The app has an integrated respiratory rate timer, which automatically calculates if the child has a high respiratory rate for their age, and prompts the health worker if they need referral for pneumonia.



▲ The app prompts the healthworker to test the child for malaria using a rapid diagnostic test.



▲ The app doesn't allow the healthworker to proceed to the next stage of treatment without providing a response, ensuring that a consistent treatment approach is used.

country-level contextualisation and deployment to ensure basic calculations and workflows were aligned to CMAM best practices. The prototype app was then contextualised and piloted during 2014 and 2016 to assess impact on CMAM programme performance. The project was intended to use already established CMAM programmes to pilot technology to support frontline health workers, and the project countries were chosen partly due to their existing CMAM projects, country office interest among the implementing agencies, current mHealth environment, as well as their chronically high rates of Global Acute Malnutrition (GAM). By nature, the sites where the need for increased interventions and programming to treat acute malnutrition is the greatest, tend to be located in remote, hard to reach areas and/or emergency settings.

The overall objective of the project was to improve CMAM treatment, reporting, monitoring, and supply management for improved quality of care for children suffering from acute malnutrition, ensuring more prompt treatment; adherence to recommended treatment protocols; and improved healthcare behaviours to prevent malnutrition.

Technology partner

Over the last nine years, WV has been collaborating with the Bill and Melinda Gates Foundation, Grameen Foundation, and Dimagi in a public-private partnership arrangement in the development of a common set of apps built within the MoTECH Suite. Dimagi is a US based software social enterprise that develops technologies to improve service delivery in underserved communities. Dimagi's technology platform, CommCare, one of the key mHealth components of the MoTECH suite, is utilised by WV, the WHO and 50

other leading organisations in 30 developing nations across four continents. Functionally, CommCare can manage and monitor health records of children and pregnant mothers; support diagnosis and treatment; collect real-time data; disseminate audio and pictorial behaviour change communication messages; and refer complicated cases. Prior to the start of this project, the CMAM prototype app was already developed under the WV-Dimagi partnership, and the CMAM mHealth project would use this as a starting point for developing and contextualising the versions for the pilot countries. As such, Dimagi was the natural choice of technical partner for this project.

Project inception

Prior to the inception of this project, WV had invested in the development of a set of core mHealth project monitoring and evaluation tools. These tools included rapid assessment, training competency assessments, among others. Baseline surveys were conducted in the four African implementation countries, starting in December 2014. Wasting and mortality rates were collected through existing sources, as well as specific CMAM programme performance indicators. A qualitative study using the rapid assessment tool collected important primary data on the coverage and usage levels of mobile networks and technology in the implementation areas, as well as benchmark data on current practices and processes of data management within CMAM programmes. This data was collected to inform the design of the CMAM mHealth project, as well as to serve as the basis for the end of project evaluation and for reflection and learning.

For practical and logistical reasons, the project was designed to have staggered start-ups in the four African countries, so

that roll out in one country was complete before starting up the next country. In addition, the CMAM mHealth app was also contextualised for and implemented in Afghanistan, as part of the WV, Global Affairs Canada-funded Maternal and Under 5 Nutrition and Child Health (MUNCH) project.

Assumptions

At project design stage, a number of assumptions were made relating to the development of the app and in-country technical support, including:

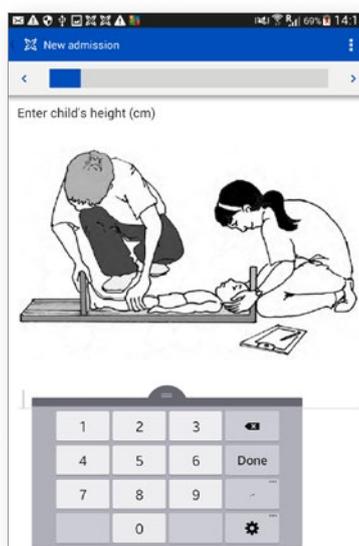
- Fully developing the app for Niger, first, then adapting the app for the other four project countries
- Once the app was deployed and in use, design and add the reporting function
- A minimum of two in-country, on-site support visits by Dimagi technical team to develop and test the app, and return for training of trainers and end users
- The presence of a WV West Africa Regional Nutritionist for regular support and supervision

However, a number of external factors, including security issues in Afghanistan, Chad, Kenya and Niger, and the Ebola outbreak in West Africa, resulted in travel restrictions for Dimagi staff and their inability to carry out all of the planned site visits. Instead, a joint workshop in Senegal for the West African teams replaced the majority of the planned individual visits, with technical support in contextualising and adapting the app largely conducted remotely via Skype and email communication.

Additionally, the assumption that the Niger app would be relatively quick and easy to translate and adapt to the other countries, turned out to be incorrect, as adapting the app to individual national protocols took significantly longer than anticipated, with more changes required than anticipated, and a larger impact on the software programming to adjust the app. This was further complicated by the fact that the majority of the technical support was conducted remotely as opposed to on-site, and that the position of WV West Africa regional Nutritionist was eliminated due to organisational restructuring.

These factors caused significant delays from the beginning of the project, meaning that planned tasks could not be carried out according to the original timeline to which Dimagi had allocated staff and time, and were therefore not sufficiently available once the project teams had caught up.

Due to the delays and underestimations relating to contextualising the app, all available resources, for the majority of the projects, were focused on developing and fixing the app itself. Unfortunately, this meant that a significant deliverable, the reporting functionality – automated reporting of admission, discharges, and



▲ The app asks the health worker to enter the child's height. If the height entered is not plausible (based on the child's age) the app will ask for the height to be re-entered, reducing data entry errors.



▲ The app prompts the health worker to check the child for bilateral pitting oedema. It also provides a picture to help in the case identification.

performance outcomes, from data collected by the app – was not completed for the West African countries.

The Kenya reporting function was developed towards the end of the project, and is to serve as a template for designing the reporting functions for the West African countries. The lack of reporting functionality severely limited the ability to assess the impact of the app on CMAM performance indicator outcomes, as data collected in the app, was not readily available in a user friendly format for decision making. WV staff had to download the data collected via the app from the 'cloud' into excel, and manually manipulate the data to generate the performance indicators.

The objective of this learning paper is to draw lessons from the CMAM mHealth project planning, implementation and evaluation phases for anyone considering future app development and adaptation, and for scale up by ministries of health and other partners.

Information for this learning paper was collected from quarterly and other project reports, and from in-depth phone and Skype interviews with key informants, including project country and head office staff, and technical partner, Dimagi. Where available, early findings from final evaluation reports were included, based on data collected using observation checklists, focus group discussions, and key informant interviews with users, caregivers, and health officials. The paper contains lessons and recommendations both relating to the development and contextualisation of the app, followed by key successes and challenges in the individual project countries, as well as considerations for scale up by MoH.

Key lessons and recommendations

Summary across the five countries

Feasibility and acceptance

The pilot project has shown that with sufficient training and support, health workers are able to use the app, which strengthens their ability to provide improved quality of care for lifesaving CMAM services. Health workers, MoH staff and caregivers of malnourished children have all expressed their acceptance of the tool across the different pilot countries. The app also improved communication between health workers and their managers by providing a platform for sharing problems and solutions. It also helped follow-up of hard to reach nomadic children between health facilities.

Technical landscape

Procurement of suitable, quality devices as well as reliable network operators and data packages within budget was a challenge. Battery life issues, screen size, phone inauthenticity, network speed and coverage were all issues that had a negative impact on participating health workers' motivation and uptake of the app. It is recommended that information gathered through the use of the rapid assessment tool (such as network coverage and electricity sources) be used more strategically to plan and document contingency plans with regards to lack of network coverage and electricity, and replacement phones and chargers in case of repairs, faults etc. These contingency plans should be jointly developed and agreed to with MoH partners, as well as mobile network operators.

Local government engagement

Though it can require considerable time and effort to achieve, early buy-in and in-depth engagement by local ministries of health is essential to successful implementation, in particular where the objective is handover and scale up by the governments themselves. This might not be immediately possible, often not until a refined app is ready, but should still be set as a deliverable in the early design and scoping stages.

Adapting to national systems

If app development and reporting is streamlined with the project country's health information systems, national protocols and training of government health workers, it greatly increases the likelihood of uptake by health workers, and scale up by the governments.

Internal planning

For a multi-country pilot study, whether for a staggered or simultaneous roll out, a pre-development joint workshop for all key actors, including head office and country staff and technical partner, would be of great value. This would provide a platform for early identification of differences in national protocols, and facilitate better and earlier harmonisation of the app.

Flexible timeline

The project timeline needs to allow for external (security issues/travel restrictions) and internal (staff turnover, incorrect assumptions of time required) factors that can cause inevitable delays to project implementation, further supported by flexibility in budgets. For the CMAM mHealth project, significantly more time than anticipated was required to allow sufficient time between scoping and planning; developing, testing and updating; and training and deployment. Due to initial delays in the project, these phases were conducted almost simultaneously, resulting in deployment of an app that hadn't been sufficiently tested, causing frustration amongst both users and project teams. It is highly recommended that the app is thoroughly tested – by programmers, project staff and users – prior to deploying, and that sufficient time is allocated to this key element of the process.

Software development, testing and technical support

For the CMAM mHealth project, delays in ironing out software and programming issues had a largely negative impact on users and project staff alike. It is imperative that the technology partner provides ongoing support for troubleshooting, bug fixing and capacity building. The ideal technology partner would need to provide considerable in-country presence and support, either through country representatives or frequent site visits to build national capacity. In addition, and particularly for a pilot study where early assumptions do not always match the reality on the ground, significant flexibility to timeline, budgets, and tasks need to be available on the part of the technology and implementing partners, as well as the donor.

Project site selection

The contexts in which this type of mHealth innovation is most needed, tend to be more complex and challenging

environments. Therefore, there is a definite need to understand the feasibility of deploying projects in these contexts, and to resource and adapt the deployment accordingly. However, it has been noted that there could be significant value in choosing pilot project countries and sites in lower risk, more stable and accessible areas with more reliable infrastructure. This would minimise delays, frustrations and limited uptake caused by lack of network, electricity and access for sufficient support supervision. Once app development and testing is at a satisfactory level, and training and support requirements have been identified, a more stable version of the app could be deployed to high risk/poor infrastructure areas.

Staffing

Overall, the project country teams were understaffed, not least due to the long distances to project sites, and the lack of on-site technical support from Dimagi. It is highly recommended that budgets allow for each team, from the onset and for the duration of the project, to have at least one nutrition specialist in a project coordinator and monitoring role, as well as a dedicated IT person to deal with software and programming issues.

Health worker protocol adherence

The use of the app seems to have improved adherence to the treatment protocol and the quality of care, compared

to the paper based job aids and reporting tools. However, as the general treatment protocols for CMAM are complex and time consuming, and with the app based on standard national protocols, the app itself was relatively complex and data-heavy. The app guides the health worker through the treatment protocol step by step and the process does not allow steps to be missed or skipped. By contrast, when using paper forms and manuals, the majority of health workers working under great pressure with limited resources, tend to skip steps in protocols. As the app requires all steps to be completed, it was at times seen to be too time consuming, particularly in the case of this pilot, where health workers were using dual systems – electronic and standard government paper forms – due to the reporting function not being completed on time. The introduction of the app has therefore highlighted the need to review and better understand what is feasible in terms of capacity and time for health workers in low resource settings, with high patient caseloads (and resulting long waiting times for children and caregivers). This is a larger issue for discussion with the relevant stakeholders who work on global guidelines for management of acute malnutrition, but the use of an app may help accuracy in case management, and if reporting functionality is resolved, could eventually save the health worker reporting time.



◀ Ibrahim, a nutrition clinical officer, attends to mothers during a nutrition clinic at Dambas Dispensary, Wajir County, Kenya.

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The collaboration between the implementing partners across the different project countries has been highly successful and important to the project, with mutual sharing and learning having a positive effect

on all implementation sites. The above lessons and recommendations represent all of the project countries, whereas additional, individual country experiences are documented in the following country case studies.

Niger case study



Location: Maradi Region, Dakoro District
Project timeline: May 2014-May 2016
GAM rate: 13.3%
Health workers using mHealth app: 20
Number of health facilities using the app: 8
Number of children registered using the app: 7,396
Technology: MoTECH Suite
Device: SAMSUNG Galaxy Duos S7562i
Network providers: Airtel & Orange

Timeline					
May 2014	Dec 2014	Jan 2015	Jan-March 2015	April-June 2015	October 2016
Initial visit from Dimagi for user testing on CMAM app	Grant project launch	Agreement signed with network providers	Competency assessment of users	User acceptability assessment	Final evaluation

Project overview

As the first implementation country, the CMAM mHealth project was implemented within a government led CMAM Programme receiving long term support from WV. In April 2014, WV initiated contextualisation of the Chad prototype to the Niger context, along with translation of the application into French. Some remote application review was

also completed. Using private funding, WV and Dimagi conducted a joint visit for user testing and application iteration. District health staff were invited to participate in the process. Unfortunately, the discovery that the phones were fake (only detected due to inability to do some complex calculation functions), which resulted in shortening of the four week support visit.

The Niger project team staff were trained during two Dimagi site visits, and the project coordinator participated in the joint workshop in Senegal.

Developing the app

The app contextualisation process was based on the MoH national protocol for the management of acute malnutrition. Remote contextualisation and translation was complete prior to Dimagi’s visit. A user testing and initial training, followed by further application refinement were started during Dimagi’s visit in May 2014. Between June – October 2014, significant remote application refinement was completed, which

“Some caregivers see the project as revolutionary and, in some areas, mothers prefer the app over traditional consultations, and are willing to travel further to access it. They perceive it as less prone to mistakes, and are curious about the technology and the innovative aspect. The registration process on the phone is seen as quicker and safer than paper forms, and there is more confidence in the data collected via the phones ending up where needed.”

DR NAROUA OUSMANE, NATIONAL HEALTH AND NUTRITION ADVISOR, WORLD VISION NIGER

included adding local multimedia (visual and audio), discussions with the mobile network operators, and refinement and translation of project monitoring and evaluation tools. Following the award of the grant at the end of October, a second visit from Dimagi was completed in December. This visit completed a Training of Trainers and user training, followed by user observations in the field.

Challenges and lessons

- Despite procuring phones according to the given specs, the phones turned out not to be authentic, and new phones had to be procured, causing delays to deployment.
- Once the app was successfully installed on the phones, it was discovered, despite initial assurance by the network provider, that some project sites had connection issues, meaning that pre-testing in the field was not possible prior to training of users.

App use, monitoring and support

After deployment, acceptability tests took place on the third and sixth month during which the users were observed. In addition, project staff would access servers to monitor the work of individual users, and respond and supervise accordingly, i.e. prompting updates of app versions, uploading data etc. When users experienced technical issues, project staff would go to the field, resolve if possible, otherwise liaise with Dimagi to fix them.

The acceptability tool was used in each site approximately six weeks after training was completed, and was conducted a total of three times during the project. The post training assessment was conducted after the original training and then again during the evaluation.

Challenges and lessons

- There was initial resistance amongst users, requiring more thorough explanations of purpose and use of data collection to encourage uptake. Health workers also noted that using both paper and phone, as the reporting function wasn't completed, adds time to the consultation process.

User perceptions

Overall, feedback from users was positive, with the app seen as more thorough, gathering better quality information, and storing data more securely. In addition, the app facilitates communication with supervisors, where great distances usually make this a challenge.

- Poor network coverage and issues with the solar chargers provided meant that nearly half of the health workers needed to travel to network/electricity areas in order to upload data, for which they were provided allowances to cover transport costs and extra time spent.
- With no vehicles allocated in the budget, only fuel allowances, project staff had to organise field travels according to WV vehicle availability. This could delay urgent visits to project sites for technical troubleshooting and support by several days, which affected uptake in the early stages. It is highly recommended that budget allows for independent travel, particularly where project sites are remotely located.
- In Niger, the phones were blocked for personal use to minimise wasting of data, battery and memory card. Set up from the beginning, the block of personal use did not cause any complaints or issues with users.

Considerations for scale up

For scaling up by MoH, early involvement and leadership by national and regional MoH officials is essential, particularly as Niger does not currently have a national mHealth or digital health strategy. For Niger, it is recommended that supervision and monitoring involves middle management at both levels, and that MoH integrates activities into its action plans. Additionally, scale up related costs (device procurement, network operators, training and supervision) need to be identified and discussed at the beginning of the project, allowing the MoH time to secure the necessary funding.

Following a final evaluation of the Niger project, findings were shared at the district level, with further plans to convene MoH and partners to present results and discuss recommendations for scale up of the mHealth intervention.

Afghanistan case study



Location: Herat, Ghor, and Badghis provinces
Project timeline: March 2013–September 2016
GAM rate: 9.5%
Health workers using mHealth app: 52
Number of health facilities using the app: 50
Number of children registered using the app: 6,047
Technology: MoTECH Suite
Device: Samsung Duos (GT-S7582)/CommCare software platform
Network providers: Roshan in Herat; MTN in Badghis and Ghor

Timeline		
Nov 2014	Jan 2015	Feb 2015
Training of trainers by Dimagi in Dubai	Health facility selection, testing and updating the app	Training of users, deployment, feedback collection, app adjustments

Project overview

World Vision Afghanistan (WVA) began using mHealth through an operational research project between 2008–2013, piloting the use of mobile technology by community health workers to improve maternal health practices. Building on the successes of this project, WVA expanded it to include the CMAM mHealth application to support nutrition programming as part of the MUNCH project, working with 50 health facilities in three provinces in the Western region of Afghanistan.

Following training of the project team by Dimagi in Dubai in November 2014, team members trained the users – nurses and midwives from selected health

facilities – as well as Provincial Nutrition Officers, and deployed the phones and apps.

Developing the app

Based on the Niger version, two mHealth apps – CMAM and Growth Monitoring and Promotion (GMP) – were contextualised to help health workers detect and treat malnutrition, and to collect project monitoring data and feedback. Both apps were translated and adapted to Afghanistan MoH protocols and technical recommendations from Dimagi.

MoH perceptions

Regional and national MoH officials were greatly involved, from the beginning when the app was contextualised, through to implementation, and have showed interest in scaling up mHealth interventions. To officials involved, the app is seen as cost effective, compared to paper form, where supervisors have to visit the health facilities to collect data, facilitating easy collection of data that can be accessed at every level.

“After the project gave me this mobile phone, I am able to track children growth without filling paper, and it helps me to remember the [steps for] treatment of malnutrition.”

REPORTED BY A HEALTH WORKER

Challenges and lessons

- The political environment in Afghanistan caused significant delays in the project implementation. Due to weather conditions and security concerns in the area, Dimagi was not able to provide onsite support. This resulted in more than a one-year delay in mHealth activities starting.

App use, monitoring and support

Two weeks after deployment, project staff collected feedback from health workers – in person or via telephone – using a standardised questionnaire, and minor adjustments were made to the app.

Bugs and technical issues were fixed by project staff where possible, or handled by Dimagi technical staff when required. As the CMAM app was bigger, it had more technical issues than the GMP app, though the issues were generally minor and relatively easy to fix.

Ongoing evaluations were conducted as part of the supervision plan via questionnaires embedded in the app with technical support from Dimagi. Where possible, these were done monthly and in person.

Challenges and lessons

- Being forced to complete the protocol, some health workers would examine a few patients using the app, and then revert to paper form to shorten consultation time. To address this issue, project staff visited clinics to encourage health workers and supervisors, though long distances to some of the health facilities presented a further challenge.
- The different provinces experienced varying degrees of network connectivity, and where there was poor or no network, project staff had to collect data via SD cards and transfer data when connected to a wireless network. With long distances to travel, this added considerable time to the project staff's schedule.
- As the apps contain a lot of information, they require considerable data to upload the forms, and in Herat province in particular, the data bundles ran out, requiring project staff to travel to sites to collect data via SD cards. Health workers also

User perceptions

The majority of users showed great interest in the app, as it was seen as new to Afghanistan. Feedback showed it eased the process of passing information to the client, especially using the pictorials, which were well received by caretakers. Time spent on diagnosing was shortened, as referring to paper manuals was not necessary, and health workers noted that they were less likely to forget steps or details when using the app, and felt they learnt more about nutrition by passing on information and recommendations to caregivers provided by the app.

tended to use the phones for personal purposes, using up data. Blocking certain sites and social apps was considered to prevent this but was not put into action because of concerns that it would demotivate the health workers, and add to the service provider costs.

Considerations for scale up

Before scaling up the project in Afghanistan, it is recommended that the reporting dashboard is finalised to ease extraction of relevant data.

Involving community health workers should be explored, as they might be more accepting to an mHealth intervention, as opposed to health facility staff, who tend to be understaffed and with high caseloads.

With a deeper involvement by the MoH, ideally integrating mHealth interventions in national policies and strategies, health workers will be more likely to incorporate the app into their daily routines. In addition, MoH issues that can impact project uptake, such as stock outs of nutrition supplies, should be discussed in relation to the app functions.

Following project close out, plans are being finalised for a joint workshop with the MoH, World Vision and Dimagi to discuss possibilities for scaling up, including ownership of data and future hosting responsibilities.

Mali case study



Location: Tominian district
Project timeline: January 2015–May 2016
GAM rate: 8.6%
Health workers using mHealth app: 27
Number of health facilities using the app: 10
Number of children registered using the app: 4,956
Technology: MoTECH Suite
Device: Samsung GT-S7582
Network providers: Malitel, Orange

Timeline				
Feb 2016	April 2015	May 2015	July 2015	Sept 2016
Joint training workshop for West African project teams	Training of staff, MoH officials and users	Official launch and ongoing testing	Updated app deployed to 10 health centres	Final evaluation

Project overview

A baseline feasibility study and risk assessment was conducted by the project staff at the 10 health centres included in the project, collecting information on communication infrastructure, and timing and costing of the paper method.

In April 2015, training of the trainers (project staff and district officials) was conducted in partnership with Dimagi, followed by training of the 22 users over two sessions. During this training, the app underwent testing by users to refine the application to be more in line with the national context and health centre workflows. In addition the app was systematically run through various test cases to check for consistency with national CMAM protocols, and post training competency assessments was conducted of the users.

Developing the app

Based on the Niger app, the Mali version was translated and adapted to national protocol and guidelines,

working remotely with Dimagi, and with national and district level officials. The first version was tested in three health centres and updated according to findings, such as inconsistencies between sections of the app and the national protocol, and errors to automatic z-score calculations. Testing was conducted by project staff and involved selected users to boost interest in the project, incorporating their comments and feedback early on. The feedback was collected and sent to Dimagi, and incorporated into revisions of the app.

Challenges and lessons

- The Mali project benefited from the MoH (ANTIM/ Agence Nationale de Télé-santé et d’Informatique Médicale) expertise and its support. The ministry was involved in all the stages of the process of mHealth (planning, implementation and evaluation), meaning buy-in and commitment in the regulation and acceptance of the app as a tool in the patient and reporting. To strengthen this further, it is recommended that a workshop or

presentation to all stakeholders, including users, take place at the beginning of the project to ensure everyone is properly informed about objectives and potential.

- The relatively high turnover of health facility staff required continuous training to ensure uptake amongst new staff.

App use, monitoring and support

World Vision worked with Dimagi to correct some small but important programming issues with the app. Where possible, the project team attempted to correct issues themselves, or communicated with the Dimagi team to deal with issues remotely.

Project staff continued to monitor the use of the app through field visits observing users during the patient care. Users' comments were documented and shared with the project staff on a weekly basis, and forwarded to Dimagi and/or to the IT person depending on the issue. Additional follow ups were done on the phone or site visits.

Challenges and lessons

- The project encountered some resistance from the users related to the perceived workload associated with the double data entry, as they were still required to complete the paper registration forms in addition to the app.

User perceptions

The Mali project staff observed a positive impact on health worker motivation because of the app. MoH officials noted a reduction in the number of errors made by the health workers as a direct result of using the app, indicating improved quality of care. They also appreciated the remote monitoring through the server.

Considerations for scale up

Ensuring continuity in the Mali CMAM mHealth project was a challenge, largely because the MoH prioritises resources to its own projects. In order to scale up, the project needs to demonstrate a strong correlation to MoH work, which could have been achieved by improved efforts to communicate and cooperate with the MoH from the beginning of the project.

For scaling up in Mali, it is recommended that more efforts should be made to link the app and reporting function to the national health information system, as well as hosting the server with the MoH as the government has in place the necessary structures, capacity and technical staff to manage it.

Chad case study



Location: Guera Region (WV), Ouaddai Region (IMC)

Project timeline: January 2015–May 2016

GAM rate: 11.5%

Health workers using mHealth app: 24

Number of health facilities using the app: 16

Number of children registered using the app: 6,756

Technology: MoTECH Suite

Device: Samsung GT-S7582

Network providers: Airtel

Timeline							
Feb 2015	April 2015	May 2015	July 2015	Nov 2015	Jan 2016	July 2016	Aug 2016
Selection of 8 health centres, Joint training workshop for West African project teams	Training of staff, MoH officials and users	Official launch and ongoing testing	Refresher training of users and updated app deployed to 8 health centres	Data collection started in WV sites	Data collection started in IMC sites	Project close	Final evaluation

Project overview

The Chad CMAM mHealth project was implemented by World Vision and International Medical Corps (IMC), with each organisation implementing in eight health centres in two separate districts. Due to security issues related to Boko Haram movements near the Chad-Nigeria border, IMC had to change the project implementation area from the Lac Region to Ouaddai region, causing significant delays to their project timeline. Difficulties in recruiting qualified local project staff also caused delays and IMC made the decision to engage an expat project manager.

Chad MoH officials from both implementation areas participated in the selection of project sites and users, assisted in translating messages for the app, and were in charge of distributing the phones.

Although the IMC team was not able to attend, the WV team attended the Senegal workshop in February 2015 and the WV project manager also participated in the training held by Dimagi with the team in Mali, enabling him to lead both the WV Chad team and the IMC team in the training of users.

Users were given refresher sessions when app versions were updated. In addition, a district health facility staff member was also trained on the CommCare website for monitoring the use of the app and the relevant data. Following the training of users, 4–5 beneficiaries were sampled to test the app.

App development

Because significant changes had been made from the original prototype, the Niger application was used

as the base for contextualisation in Chad. The Chad project teams worked remotely with Dimagi and WV technical experts to contextualise and align the app to the Chadian national CMAM protocol and the workflow of project site health centres. There were significant delays in the country contextualisation of the Chad app, for example with regards to the chosen terminologies not easily understood by users, and the need to translate to local languages, as the majority of health workers did not have a sufficient level of French.

Challenges and lessons

- The process of securing agreements with telecom companies in some implementation areas was slower than anticipated.
- The project did not have sufficient budget to fund MoH officials to join field visits and trainings, which could have strengthened early buy-in from the MoH. Though all levels of MoH staff were trained as mHealth facilitators, they were not able to provide supervision and support to the project site users.

App use, monitoring and support

Corrections to the app have been required throughout the implementation phase, which has caused significant delays and frustration among users. Refresher training and support visits were conducted on an ongoing basis to help improve the perception of the app and increase user buy in. Users, who had lower competency scores in post training assessments were monitored and supported.

Challenges and lessons

- The evaluation found that with sufficient training, even community health workers with low education levels are able to upload data and sync apps at their work site. A high level of education is not required to use the app.
- Main challenges reported by health workers were inadequate battery life and non-functioning solar chargers, and the time required to register a child using the app, which was almost double of that usually spent (though, this is largely due to the

User and caregiver perceptions

The app was reported to be a useful tool to support health workers, particularly the pictorials and recorded messages, to better assess clients and make improved treatment decisions. Most caregivers see the app as a more convincing tool for diagnosing malnutrition, and the app helps avoid conflicts with regards to treatment selection, approach and dosages.

fact that busy health workers do not necessarily complete all steps required when using the paper system).

- Independently to the mHealth project development process, the lack of a consistent supply of nutritional commodities has negatively impacted CMAM treatment. CMAM mHealth project sites were frequently running out of stock of RUTF and essential drugs, leading to a high default rate.

Considerations for scale up

The lack of close involvement by the district health officials in the project implementation process has hindered the level of leadership by MoH to move the MHealth project forward and link it to their health information system.

A better understanding of the language needs of the local health facility structures will be part of any scale up and the next version of the app will be translated into local languages (this is outside the scope of the current project funding).

To reduce the volume of communication during the testing phase, it is recommended to organise a workshop attended by all stakeholders and users, during which the app can be tested, and errors and inconsistencies can be identified prior to field testing.

The project would need to reinforce CMAM food and non-food items management to avoid stock-outs and improve outcomes by pre-positioning buffer stock to fill temporary gaps in national supply.

Strengthen the capacity of local project IT staff to enable immediate and in-house modification of the app quickly when needed, and in particular for complete updates when changes are made to protocol.

Kenya case study



Location: Wajir County

Project timeline: April 2015–October 2016

GAM rate: 6% (estimated 11.4% in Wajir county)

Health workers using mHealth app: 31

Number of health facilities using the app: 20

Number of children registered using the app: 2,212

Technology: MoTECH Suite

Device: Samsung Galaxy 2 (tablet)

Network providers: Safaricom

Timeline				
Dec 2014	Jan–Feb 2015	Mar 2015	Apr 2015	October 2016
Selection of 20 health centres and technology procurement	Baseline survey, remote application review and contextualisation	ToT and pilot test launch	Training of users and start of app deployment	Final evaluation

Project overview

As the final implementer, the Kenya CMAM (referred to as IMAM/Integrated Management of Acute Malnutrition in Kenya) mHealth project was implemented by Save the Children, in collaboration with World Vision, incorporating lessons learnt from the West African countries. In the planning phase of the project, sensitisation meetings were held with the Ministry of Health to secure ongoing engagement in the pilot project and in the development of the contextualised app. There were two scoping visits by the Dimagi team to the project site.

A training of trainers workshop was conducted by Dimagi in Nairobi for Save the Children project staff and Wajir Department of Health representatives in June 2015. The ensuing training of users was done in collaboration with county and sub county managers to strengthen their supervisory role, and to outline the expectations of the users.

While outside the scope and funding of the CMAM pilot, additional funding has been secured through Transform Nutrition to conduct a rigorous Cluster Randomised Trial to evaluate the impact of the app and devices on quality of care and reporting. The results of this study will be available in August 2017.

“I prefer this method of data collection and submission to the paper registers. The app is easy to use and secure, whereas the paper reports are cumbersome to record and retrieve, and sometimes get lost. I wish all the facility reports and registers could be incorporated into this model.”

ISININA MOHAMED ROBLE, HEALTH WORKER, SABULI HEALTH CENTRE

App development

The Kenya app was developed based on the Niger version, and Save the Children Kenya worked with Dimagi to translate, customise and contextualise the app. This process took four months, largely because the Kenya protocol and case management guideline differs considerably from that of Niger.

During both training layers, and in field testing supported by Dimagi, issues and inconsistencies in the app were identified, requiring further updates. In addition, systematic positive and negative test cases were put into the application to check for consistency with IMAM protocols. Tablets were provided to the users at the end of the training, though use of the app was not authorised by the county until the summary data report was aligned to the country health information system, which caused further delays.

Challenges and lessons

- The decentralised health system in Kenya requires strong local engagement, both to implement a project, but also to ensure buy-in for future scale up. As the Kenyan MoH has high workloads and competing demands, securing this buy-in took a lot longer than anticipated. But the project eventually succeeded in securing their full support, and the MoH has been a particularly strong partner in the project.
- The original assumption was that tablets would be more user friendly, with the bigger screens making navigating and data entry easier. This proved to be correct. However, when considering using tablets or cell phones, factors such as shelf life, battery life and cost should also be considered.
- Many health workers were initially resistant to using the apps because of bug or connectivity issues, but also because it meant changing habitual treatment practice e.g. they were no longer able to take short cuts when assessing and treating a child, or because they did not trust data being uploaded to the 'cloud'. It is recommended that significant time and resources are allocated to thoroughly explain the potential benefits and the concept of automated reporting, and to be upfront about the nature of technological programmes, where bugs and troubleshooting are inevitable.
- Kenya has a very high turnover of health worker staff, staff rotation, and experience difficulties in filling positions in remote locations. For the project, this meant a constant wave of trainings, for which there was not sufficient resources.

App use, monitoring and support

Project monitoring was integrated with routine monitoring and support activities, and included monthly follow up visits, on the job trainings, spot checks and daily support calls aimed at strengthening health worker capacity to use the tool. Project support used

Top tip

A WhatsApp group was created for all users to interact with each other, their managers and the project team. They used it to share experiences, receive guidance, reminders, support and encouragement. It was also used to report bugs and fixes. This initiative had a marked effect on compliance, usage and user motivation because health workers were getting immediate and direct support from their peers.

contextualised quality benchmark questionnaires and checklists to ensure quality assurance and compliance with project procedures. The project also integrated routine data quality audits to ensure proper case management recording and documentation.

There were several technical issues with the tablets, for example reverting to previous versions when updated, requiring project staff to visit sites to sync tablets and monitor the work remotely. There were consistent bugs in the app up until May 2016, which made collection of data challenging.

Challenges and lessons

- User feedback suggests that the app can improve case management, because it forces the health worker to complete all steps in the protocol, and as such ensures more correct diagnosis and treatment, and minimises defaults due to the app alert function. In addition, the health workers' nutrition related knowledge appeared to improve significantly with positive effects on nutrition counselling. Though, some health workers also saw the additional time spent per patient as a challenge.
- The tablet had a number of additional unintended benefits. Via the WhatsApp group, it provided a platform for health workers to share information, problems, ideas, support each other and receive guidance and reminders from their health managers and Save the Children MHealth team. This improved compliance as non users were encouraged directly by their peers and it eased the communication bottle neck between the frontline implementers and their managers. It also allowed nomadic children to be tracked and linked to other health facilities to ensure they continue to receive services while on the move. Health workers, share the details of nomadic children with other facilities and guide parents and caregivers to visit the nearest facilities for continued care. Despite assessing networks during the site selection process, once the implementation phase started, weak signal strength made it difficult to update

applications in most of the health facilities. Just over half of health workers were not submitting data for several months after tablets and app were deployed. Towards the end of the project, network coverage improved, and this had an immediate positive impact on usage.

- The Kenya app, due to programming issues, experienced consistent bugs throughout the project, which negatively affected user confidence. Better programming and testing would have reduced this. However, it should be understood that considerable time is required to assist health workers using an mHealth app effectively with or without bugs.
- The CMAM treatment algorithm built into the app helped the health worker make the right clinical decisions (calculate z-scores, number of RUTF sachets, etc) which ultimately improved the overall quality of care.
- In country technical support team and contractual skill transfer beyond software development to technical

support and roll out would have increased earlier and better uptake of the app.

Considerations for scale up

Before scaling up the CMAM mHealth project in Kenya, an initial training for the national level MoH team to secure their buy in at an earlier stage is recommended. It will also ensure that MoH focal points fully appreciate the functionality of the system between the app and the national health information system.

Where stock-outs of nutrition supplies are common, there is a higher risk of children defaulting on treatment. Funding for logistical support, ensuring supplies reach facilities, will increase the mHealth apps' ability to improve treatment outcomes.

Linking the app to a wider continuum of care and an integrated model of maternal and child health services should also be considered to improve uptake and scalability.

Going forward

The CMAM mHealth app has huge potential to improve CMAM quality of care, reporting and treatment outcomes. However, to take the app to scale in the five pilot countries, the following priorities are recommended:

- Strengthen linkages between the app and the reporting functions / dashboards and HMIS system, health worker and supervisor training and treatment protocols.
- Develop more specific and sensitive monitoring and reporting standards based on use of individual child data, rather than aggregated health facility/ feeding site data which paper based systems generate.
- Build the capacity of national MoH staff and a technical partner to lead the app improvement and scale up process, support uptake and use of application by health workers and community volunteers, and further improve the app.
- Link the app to other approaches such as the CMAM Surge model which adjusts resources and implementation approaches based on caseloads.
- Integrate the CMAM mHealth app with other child health focused apps on one platform (e.g. GMP, iCCM), so that all essential health workers are managed through the same device and platform.
- Simplify the CMAM treatment protocol and reflect it in the app to reduce CMAM treatment time and avoid health worker short cuts and frustrations. This is particularly important in remote areas, with staff shortage and high caseloads.
- Conduct more research to evaluate cost effectiveness and added value of using the app over a paper-based system.



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