MyChild Card

Evaluation Report

Vision - A day when no child dies or suffers from preventable diseases
List of Abbreviations

BCG - Bacille Calmette-Guérin vaccine
DHIS2 - District Health Information Software (version 2)
DPT - diphtheria-pertussis-tetanus vaccine
ECC Report - Every Child Counts Report
EPI - Extended Programme on Immunisation
EIR - Electronic Immunisation Registry
EMTCT - elimination of mother to child transmission of HIV/AIDS
HIV - Human Immuno-deficiency Virus
HMIS - Health Management Information Systems
ICT - information and communications technology
MDGs - Millennium Development Goals
MoH - Ministry of Health
NMS - National Medical Stores
PMTCT - prevention of mother to child transmission of HIV/AIDS
RED Categorisation - Reach Every District Categorisation
SDGs - Sustainable Development Goals
Shifo - Shifo Foundation
SPT - Smart Paper Technology
UGX - Ugandan Shilling
WHO - World Health Organisation
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Executive Summary

The challenges

Of the estimated 19 million infants worldwide who did not complete the recommended three doses of DPT in 2014, more than 60% live in ten countries in Asia and Africa (1, 2). Some of the factors affecting greater uptake of vaccines include poor management of health systems, inadequate monitoring and data collection, and parental attitudes/knowledge (4).

This report seeks to inform on the work of Shifo Foundation in Uganda to address some of these challenges, and a number of contributing factors, including the lack of child registration; the substantial time spent by health workers on paper administration and reporting; and the lack of reliable and timely data for informed decision making and advocacy. The report focuses on the activities and processes leading to the field testing of MyChild Card - the latest solution within MyChild system - to reach every un- and under-vaccinated child.

Shifo's solution - MyChild Card

MyChild Card is an innovative child health card with a digital component that allows for child health data to be captured on paper by health workers and subsequently scanned and uploaded onto a secure server for digitisation. It supports child registration, individual follow-up on children's vaccination schedule and other preventive health services, which are part of preventive child health service delivery. Because it does not rely on electricity or network coverage during care delivery, MyChild Card can be implemented in rural settings, in areas without power supply, or in uncertain security environments.

With MyChild Card

- Children are registered and receive unique IDs
- Families receive information on their child’s growth and development
• Health workers can follow up on children's vaccination and other preventive health services
• Key actors get timely access to accurate and relevant data
• Sixty three key indicators are generated per age group, geographic area and sex; by outreach or static (in health centre) sessions on a monthly, quarterly and yearly basis
• The need for current registers such as Child Register Book, Tally Sheets and HMIS Reports is eliminated

MyChild Card is based on the Smart Paper Technology™, which is widely used in the banking, insurance and travel industries, to reduce/eliminate administrative and reporting burden of workers and digitise all recorded data.

Methods

Evaluation of MyChild Card was carried out in two phases - field test and proof of concept. The first phase of evaluation was conducted in 2015 in two districts of Uganda - Mukono and Dokolo to test user interface and content of MyChild Card, scanning and data warehouse. This evaluation was done together with nurses, midwives, families with children, medical records assistants, and the EPI focal persons in the districts.

MyChild Card proof of concept was conducted in three health centres in Mukono Municipal Council, Uganda - Mukono Health Centre 4, Goma Health Centre 3, and Nyanja Health Centre 2. Quantitative and qualitative methods were used to evaluate data quality, data needs and work processes before and after the use of MyChild Card. Interviews were used to determine parents' knowledge and feedback about educational materials included in MyChild Card.

Results

MyChild Card was integrated to the operational processes in Mukono HC4, Goma HC3, and Nyanja HC2 and the scanning station was deployed at Mukono HC4. All children, visiting the selected health centres to receive preventive health services including vaccination, received MyChild cards.

Efficiency of health centres in registering children and provided health services increased by 119%. Due to elimination of the need for several reporting and administration tasks at a health centre level, time spent on reporting and administration potentially reduced from
50-60% to 10% per day, which translates to the equivalent of one extra person into each health facility.

From interviews with parents it was evident that there was high appreciation and need for the guidance on the importance of child immunisation, breastfeeding and other preventive measures, crucial for child growth and development, which were integrated in every MyChild Card.

Analysis of the indicators currently generated by monthly HMIS from preventive child health services and MyChid system, showed that today decision-makers receive 11 indicators from current work processes compared to 63 indicators which are automatically generated by MyChild system.

**Conclusion**

The challenge in the global community in ensuring every child can grow healthy, lies with reaching the fifth child in the last mile, who cannot access life-saving preventive health services and is outside of the radar of the health system. To reach children in the last mile, we have to know who receives or misses vaccines and other preventive health services, and who is missed out/not registered from the target population and why. In order to answer these questions we need to have reliable data, which is accessible to stakeholders at community, regional, national and global levels.

MyChild Card is a solution to give insight into all children’s progress in receiving preventive health services. Especially the fifth child, living in rural, isolated and oftentimes insecure environments.

MyChild system adds value across the entire healthcare chain starting from families with children, frontline health workers, local and national governments to global actors working to close the immunisation gaps. Every parent is empowered with knowledge that is based on evidence; every nurse works with effective tools and work processes; and every decision maker can make decisions based on precise data which they receive in a timely manner. Within a short time frame, healthcare can be transformed in a positive way.
1. Introduction

"Strong infrastructure – quality services, availability of trained managers and health workers, good information and data systems, and supply chains... [is] the key to reaching the one in five children still missing out on the basic package of childhood vaccines..." -- GAVI Progress Report 2014

1.1 Challenges in reaching the fifth child with preventive health services

In 1974 the World Health Organisation (WHO) established the Expanded Programme on Immunisation (EPI) to ensure that all children have access to routinely recommended vaccines. Since then, four core vaccines – Bacille Calmette-Guérin vaccine (BCG) for protection against tuberculosis; diphtheria-pertussis-tetanus (DPT) vaccine; polio; and measles vaccines, have become an established part of child health care delivery worldwide (1). Three doses of DPT vaccine is considered as a key indicator of immunisation coverage, and in 2014, 86% - an estimated 115 million infants up to the age of 12 months – received DPT3 globally (2) and 129 countries had achieved at least 90% coverage of DTP3 vaccine (2).

Coverage varies widely within and across countries however and more than 95% of children are unable to access the full course of 11 vaccines recommended for infants by the WHO (3). Of the estimated 19 million infants worldwide who did not complete the recommended three doses of DPT in 2014, more than 60% live in ten countries - the Democratic Republic of the Congo, Ethiopia, India, Indonesia, Iraq, Nigeria, Pakistan, the Philippines, South Africa and Uganda (1, 2). Some of the factors affecting greater uptake of vaccines include poor management of health systems, inadequate monitoring and data collection, and parental attitudes/knowledge (4).

For millions of children today, the biggest health challenge is to survive until their fifth birthday. In 2015, 5.9 million children (5) - 16,000 per day - died before their fifth birthday; of which 4.5 million - 75% of all under-five deaths (5) - occurred within the first year of life.
Many of these deaths were from treatable or preventable causes, such as pneumonia, poor nutrition, malaria or diarrhoea.

Far too many children worldwide fall outside of the reach of health services. A 2013 UNICEF report attests that the births of nearly 230 million children (6) under five around the world have never been registered; Sub-Saharan Africa is home to 85 million of these (6). We cannot know for certain who are under or unvaccinated or where they live. Information about the extent of care received, if any, is uncertain, but it is estimated that one in five children in the African region does not have access to vaccines and other preventive health services (7).

Frontline health workers in low resource settings do not have the right tools and methods to follow up on each child's vaccination plan. This means that there is almost no way for health personnel to individually target children, who are due for immunisation or other preventive health services. A child's entire vaccination history can be lost if the paper-based child health card, which is kept by the families, is misplaced.

Paper-based data collection and recovery is a cumbersome and time-consuming process, prone to errors, and detracts from time spent delivering quality care. This in turn leads to unreliable and fragmented data along the healthcare chain. Policy and decision-makers, and key stakeholders do not have reliable and relevant information on which to base decisions, ascertain gaps in service delivery, or implement appropriate interventions (16).

The need to monitor the effects of the Millennium Development Goals (MDGs) in 2000, resulted in increased investment to improve data for monitoring and accountability (8). Today, more is known about the state of the world and, especially, the poorest people in it. But despite this significant progress, huge data and knowledge gaps remain about some of the biggest challenges we face, and many people and groups still go uncounted (8). The importance of reliable data for evidence-based decision making (9) has long been acknowledged. Poor and irregular access to information however, makes it nearly impossible for key actors working to close the gaps in low-income settings to achieve the targets in Sustainable Development Goals by 2030 (8).

1.2 Electronic immunisation registries

Electronic immunisation registries (EIRs) are seen as an alternative means to counter the issues plaguing effective delivery of preventive child health services. Defined as computerised, confidential, population-based information systems that contain data on vaccine doses administered (9), they enable real-time public health surveillance and monitoring of immunisation coverage by provider, vaccine, dose, age or other indicators;
as well as feedback of information to families, decision-makers, healthcare providers, and the public for transparent accountability. They provide a single data collection point for health workers to follow patients along the care delivery chain and across levels of care providers; and facilitate individual follow-up (10, 11). By providing data at the individual, and population levels, EIRs can also help support decision-making, and provide a better understanding of coverage gaps, which enables more targeted vaccination delivery, social communication, and advocacy strategies (11).

Given infrastructural limitations and the lack of necessary structures such as continuous technical support and capacity building, countries have been less than successful at national roll-out of EIRs. The first product developed by Shifo in 2013 - MyChild App - was an EIR which was implemented in two districts in Uganda. During the implementation and operations phases following lessons were learned:

1. Electronic systems may not be used in the outreach and mobile clinic settings, due to security and other infrastructural issues (electricity, connectivity, etc.), which will still require complementary paper-based records.
2. Majority of health centres have black-out days or completely lack electricity/connectivity and hence cannot use electronic systems every day.
3. Based on the work processes in different health centres, more than one mobile device (e.g. laptop) should be used, which requires establishing reliable network connectivity to synchronise information, and it requires continuous on-site technical support.
4. Majority of health workers are computer illiterate, and workload during service delivery is increased until health workers get computer proficient, which takes between 3 months-1 year.
5. In rural areas the internet connectivity is unreliable (12) and the costs are high (sub-Saharan Africa is more expensive than the rest of the world).
6. Mobile devices e.g. laptops should be replaced every 2-3 years, and it can be costly for countries to sustain these interventions in the long-term.
7. Structures including continuous technical support to end-users especially when technical group needs to travel to remote clinics, and provide on-the-job learning to ensure current and new end-users are trained on the tools, shall be created and sustained to ensure sustainability of the EIRs. The implementation and maintenance costs of the structures are hard to maintain in low resource settings.
8. EIRs can mostly be implemented in health centres located in urban areas with good security, electricity, connectivity. However, the fifth child oftentimes lives in rural,
isolated and insecure environments. Therefore, the benefits of EIRs may not reach the fifth child.

Based on these limitations, the full potential for the use of EIRs in low-income countries cannot be realised today and for some years to come.

1.3 Ugandan context

Developed in 1985 with the latest revision in 2014, the Ugandan Health Management Information System (HMIS) was based on a number of paper tools, the majority of which are used by the health workers during health service delivery. Data would then be recorded and compiled at the district level before being forwarded to the central level health authority (13).

The core functions of HMIS tools include: a) data collection and compilation of health events; b) timeliness, completeness and accuracy of reported data; c) analysis, interpretation and utilisation for evidence-based decision making and action; d) regular dissemination and feedback to all stakeholders; and e) enhancement of knowledge and skills of health workers in all aspects of data management, analysis and utilisation at all levels of service delivery (13). Further revisions in 2000-2001 allowed for the integration of the various aspects of data into one reporting system. The intention was to reduce the workload of medical records assistants on the compilation of reports, and to minimise error (13).

Despite these intentions, there is reportedly little evidence of data utilisation at the point of collection, and no clear statistics on the availability and accuracy of routine reports at the district health level (14). Shifo’s observations in high patient flow health centres (100-150 children per day) show that up to 50% of child data including registration and health, may not be entered into Child Registers. Assessments conducted in 2013 reveal a high level of inaccuracy in the data with immunisation estimates inaccurate in as much as one third of the 112 districts; poor immunisation coverage estimates; and DPT3 coverage reported under HMIS over-reported by 20% (15,16). Reliability of data is a crucial factor for stakeholders to make targeted actions. Data reliability with current HMIS reporting standards is poor (14, 22, 23).

Shifo’s observations on work processes in high patient flow health centres show that nurses in some parts of Uganda can spend as many as four hours per day on administration including patient registers, tally sheets and attendance summaries. The work burden on frontline health workers may be further worsened by the nurse shortage.
affecting the Ugandan health sector, where the nurse patient ratio can be one nurse to a population of more than 3000, and nurses have continuously complained about the work overload (17).

Additionally, EIRs require a stable power supply. Since 2005 however, Uganda has experienced power outages of up to 24 hours every 48 hours (14). In the Tororo district, this was found to have led to increased work load, because data could not be captured in real time, and the resulting backlog meant it was not entered into the system in a timely manner (14).

Also troubling is the evidence that in the period 2007-2009, an estimated 590,000 children were unimmunised against DPT3, and 652,711 children were unimmunised against measles (18). In 2009, the total number of unimmunised children (DPT3) was 223,218 nationally, increasing from 210,361 reported in 2008. This, together with other vaccine preventable diseases that are still occurring, has resulted in Uganda being ranked among the top five countries with the largest number of un-immunised children in Eastern and Southern Africa (18). The proportion of children who are fully immunised has been dropping from 47% in 1995, to 37% in 2001; rising to 44% in 2006 and finally to 52% in 2011 which is far below the national target of 80% coverage for all vaccines (18).

The Ugandan Ministry of Health, in its Strategic Action Plan for 2010/11-2014/15, revealed that although 72% of the households in Uganda live within 5km of a health facility, utilisation is limited due to poor infrastructure, lack of medicines and other health supplies, a human resource shortage in the public sector, low salaries, lack of accommodation at health facilities and other factors that further constrain access to quality service delivery. The Ministry further acknowledged that 75% of the disease burden in Uganda is preventable through improved hygiene and sanitation, vaccination against child diseases, good nutrition, and other preventive measures such as use of condoms and insecticide treated nets to prevent malaria (24).

Shifo’s solutions have been designed to address these challenges and help strengthen health systems while bringing direct value to families, health workers, decision makers and key stakeholders who are working in these areas globally.
Episodes of Shifo's journey in health centres of Uganda

Observing the work processes in child health clinics and HMIS Reporting tools

Nurses are scarce and work with competing tasks in child health, maternal health units. Here a nurse showing HMIS tools for different units/wards which she needs to work with by herself

District Health Team draws the trend graphs for Vaccination Coverage manually

Archive room where Child Health Registers and other reports end up.
Shifo team working with EPI focal person analysing the current data availability and gaps

It is very hard to follow the hand writing in the register books, which are used as basis to know who missed the vaccination visit
2. Background

2.1 What is MyChild Card

MyChild Card is the latest solution developed by Shifo. It is specifically designed to address issues related to high child mortality from preventable diseases. It supports child registration, individual follow-up on children’s vaccination schedule and other preventive health services, which are part of preventive child health service delivery. Because it does not rely on electricity or network coverage during health service delivery, MyChild Card can be implemented in rural settings, in areas without power supply, or in uncertain security environments. MyChild Card was developed to bring four key values:

1. Ensure every child can be registered and followed up to receive all preventive health services they are entitled to
2. Address knowledge gaps of parents/guardians, so that families know how to take care of their children during early stages of child growth and development
3. Improve work processes, simplify and eliminate administration and reporting from social and health workers, so they can focus on quality of care for children during health service delivery
4. Generate reliable and relevant information to decision-makers, so they know the progress and gaps regarding preventive child health service delivery to make actions to close the gaps.

MyChild Card is an innovative child health card with a digital component that allows for child health data to be captured on paper by health workers then subsequently scanned and uploaded onto a secure server for digitisation. It is based on Smart Paper Technology™, which combines the practicality of paper with the strength of technology when digitising data. Smart Paper Technology™ (SPT) allows health workers to fill in paper forms as they are used to, and digitise information through automatic scanning afterwards.
SPT is heavily used in the banking, finance and travel industries to optimise and automate routine work processes, connected with data management and digitisation of records. Shifo has managed to innovate and apply this technology to healthcare, by keeping strong checks and balances to get reliable and trustworthy data, and simplifying digitisation of individual patient’s health records. SPT delivers all the benefits of electronic health record systems, and enables smooth implementation in health centres and areas without electricity, connectivity and security, i.e. the last miles of health service delivery. With this technology, all existing paper forms and existing administration and reporting routines can be eliminated. Additionally, it is more affordable and faster in implementation and maintenance compared to any other technologies that exists.

2.2 Development of MyChild Card

The development of MyChild Card was led by the fact that while there is great advocacy for the use of information technology to address issues with health service delivery in low-resource settings, the reality is that in many areas, particularly rural settings, the infrastructure to support electronic technology (eHealth) is weak or does not exist. The biggest challenge is that many countries lack the capacity to sustain electricity-dependent solutions: for instance, in Sub-Saharan Africa, the capacity to generate power is lower than in any other world region; and the supply of electrical power is unreliable throughout the continent (19).

Development of MyChild Card was also informed by evidence from studies done in Pakistan between 2003-2006 which showed that providing a redesigned immunisation card; educating mothers at the health centre; or a combination of the two were all effective in increasing vaccination rates (20). A 2013 Ugandan study further supports how a well-designed immunisation card can contribute to increased immunisation: study findings revealed that children with an immunisation card had a greater probability of being fully immunised when compared to children who had no card (21).

Keeping in line with WHO guidelines, MyChild Card includes a growth chart and information about general child health management. Conforming with the focus of the Sustainable Development Goals (SDGs) on maternal and child health, MyChild Card provides information relating to pre- and antenatal care, along with guidance to the parents or guardians on the importance of breastfeeding and immunisation. Content of the card was based on WHO recommendations on core content of home-based vaccination records (25).
The design of the card was governed by the needs of parents and health workers. With feedback from our ground work with parents, nurses and local governments, MyChild Card was designed to provide education and guidance to parents to help them look after the child properly, as well as empower nurses to offer quality care to infants and children.

Development of MyChild Card including the interface, paper mechanics and interoperability, was led by the following general requirements:

1. Children can be registered with unique ID
2. Data collection does not depend on electricity, mobile network coverage or security in the health facility
3. Technical support is not required for every health facility
4. Simplify documentation and eliminate data reporting from health workers
5. Available at all times and is 100% reliable
6. Data should be reliable and we should know if the child has actually visited the health centre
7. Child's medical history should be available electronically and can be retrieved when needed
8. Supports existing governmental structures, and does not require big changes to work processes
9. Can easily be localised for different countries (language, clinical standards and country based mortality/morbidity causes)
10. Lead time for development/improvements should be short
11. Bring direct value to families with children, frontline health workers, decision makers
12. Enable proactive and reactive follow up of children to complete vaccination schedule on time
13. Automatic generation of HMIS reports
14. Data can be automatically integrated to national health information systems, such as DHIS2
15. Automatic generation of reports with micro gaps (stock-outs, cold chain problems, etc.) from every health facility
16. Easy to add more indicators when necessary
17. Effective utilisation of scarce human resources
18. Cost-effective compared to existing work processes
19. I would use the solution myself
2.2.1 MyChild system requirements gathering framework

It was determined by the Shifo technical group, that requirements of the system would be received from three main sources - (1) users, (2) work process, and (3) industry domain. It has been acknowledged that involvement of end-users in the field test is one of the most dynamic and sensitive processes of product development. Thus, at Shifo we consider a user-centred design (26) approach as one of the main frameworks to evaluate the product. By applying user-centred design approach, Shifo's technical group has focused on optimising the product around how users can and need to use the tool, rather than forcing them to accommodate to the product. The diagram below presents general framework of requirements gathering.

![Diagram of requirements gathering process](image)

Figure 1. Adopted from Requirements Engineering framework of Kotonya and Sommerville (26)

2.3 How MyChild Card works

MyChild Card is provided to children under 5 years of age who receive preventive health services including vaccination, nutrition, growth, development among others. Parents or guardians are the holders of MyChild Card. Each time a child comes to receive preventive health services, information about provided services is recorded in the relevant card slips. MyChild Card is designed in a way that during care delivery, nurse uses specially-designed visit slips. Completed slips are detached from the card, stored in a Data Box specially
designed for the appropriate storage of the slips, and transferred to a scanning station and scanned. This way hand written information is saved digitally in the database, which creates an electronic health record for every child registered and followed up.

Scanning stations are placed in district hospitals and district health office. Lower level health centres bring the visit slips to district hospitals or to the district health office, or alternatively the slips can be fetched by logisticians who bring medicines and supplies to lower level health centres on a weekly/monthly basis. At a district hospital, visit slips are scanned every day, hence electronic health records are updated on a daily basis. Decision-makers can receive daily, weekly, monthly, quarterly and annual reports as PDF by email, on the web, or through existing health management information systems (e.g. DHIS2). Additionally, follow-ups and sms reminders can be generated based on digitised data and sent to parents/guardians who have access to mobile phones.

2.4 Benefits of MyChild Card

With MyChild Card:

• Every child is registered and accounted to receive health services.

• Every family receives educational information related to their child's development and what they should do to provide needed care during child's most vulnerable time - early childhood.

• Nurses can follow-up on children's vaccination, growth, nutrition, HIV prevention and other health services provided in the routine child visits. Reliable, child-based information which is automatically generated by MyChild system eliminates administration from nurses and midwifes, thus they can focus more on every child's development and give right and timely information to the families.

• Key actors have access to reliable and relevant data that is automatically integrated with national health information systems.

Refer to Annex 1 to learn more about what values MyChild Card brings to key actors including children and their families, nurses/frontline health workers, local and national governments, NGOs, key actors globally.

Learn about MyChild Card from this short video - youtu.be/YsVoEXlin-c

Annex 1: Values of MyChild System compared to current work processes
https://shifo.org/static/doc/MyChildCardValues.pdf

Annex 6: Video about MyChild Card
youtu.be/YsVoEXlin-c
3. Methods

Evaluation of MyChild Card was carried out in two phases - field test and proof of concept. MyChild Card processes were used alongside existing HMIS reporting processes because MyChild system is not yet fully integrated into national health structures in Uganda.

3.1 Field test

In 2015, field testing was conducted on the first MyChild Card prototype in two districts of Uganda - Mukono and Dokolo. Components of MyChild Card including user interface, scanning and data warehouse were tested. The usability test was conducted in order to make the product fit for use and purpose from families, health workers and local decision makers perspectives. Observations and interviews were carried out with nurses, midwives, families, medical records assistants, and the EPI focal persons in 2 districts.

3.2 Proof of concept

MyChild Card evaluation was led by the following objectives:

1. To evaluate efficiency gains from improved processes
2. To determine the extent of parents’ knowledge about the educational material contained in MyChild card and their feedback about it
3. To evaluate data quality and data needs for informed decision making

MyChild Card proof of concept was conducted in three health centres in Mukono Municipal Council, Uganda - Mukono Health Centre 4, Goma Health Centre 3, and Nyanja Health Centre 2. Implementation sites were selected to include health centres within levels 2, 3 and 4 that provide preventive child health services including vaccination, both in rural and urban areas. Mukono HC4 provides vaccination on a daily basis. Goma HC3 provides vaccination service on a weekly basis, Nyanja HC2 provides vaccination service on a monthly basis.
1. Observation and interview sessions were used to evaluate and map the work processes before and after MyChild Card implementation. All health workers in child health department including medical records assistants in the 3 health centres were included in the evaluation. The technical working group of Shifo, together with the health workers, identified gaps in the current work processes and designed new work processes based on the identified gaps. Work process design included two scenarios - children who visit the health centre for the first time, and those who come for follow-up visit. Efficiency gains with new work processes were evaluated and documented.

2. Semi-structured interviews were carried out with 25 caregivers, who came for immunisation sessions to the health centres. The aim of the study was to determine:
   - parents' extent of knowledge about importance of immunisation, infant and young child feeding, danger signs, child development and other preventive care during early childhood development
   - how parents comprehend the information, and if there are any aspects in need of clarification or improvement

3. Observations were carried out to evaluate data reliability/completeness before and after MyChild Card proof of concept in the three selected health centres. Observations were carried out during immunisation sessions to document number of children who were missed to be registered in Child Registers from total number of children who received vaccination. The same evaluation was conducted after implementation of MyChild Card.

Using unstructured interviews and literature review, availability of current data/indicators from preventive child health services was evaluated. Comparison was made between data availability from current HMIS reporting standards and indicators generated with MyChild Card.

Additionally, a questionnaire with close ended questions was distributed to the Local Governments in Central Region of Uganda, including 50 decision makers, to assess the relevance of indicators which are generated by MyChild system. District Health Management Teams and health centre managers from two districts were included in the study.
4. Results

Field test

Based on several feedback iterations during the field test, the design and content of MyChild Card was revised and adapted to the needs of frontline health workers and their work processes. Feedback from families about the usability and content of MyChild card was gathered in order to refine the educational materials in MyChild card. The prototype of MyChild Card passed several laboratory tests including evaluation of paper mechanics and data digitalisation in Sweden and Uganda. The tests of MyChild Card in the laboratory and in the real environments were approved for proof of concept phase in Uganda.

Proof of concept

During proof of concept, Mukono Municipality Local Government together with Shifo technical working group raised awareness to the social and health workers in Mukono about MyChild Card. Training sessions were followed with nurses and medical records assistants, who provide child health services in the selected 3 health centres. The medical records assistants were additionally trained to perform the scanning of the slips in Mukono HC4, where the scanning unit was set up. The following pictures give a brief insight into this process.
4.1 Observation of daily work processes and design of improvements into work processes

Observation of daily work processes and designed improvements, based on the identified gaps, were done together with the frontline health workers in selected health centres in Mukono District.

Before implementing MyChild Card, the following limitations in the work process were observed:

1. 50-60% of the children were not registered in the Child Registers since the registration process was done after the vaccination was administered, and families would leave the health centre without waiting for their turn in the queue. This mostly occurred during the days when patient flow was high or in the health centres which have high patient flow on a regular basis.
2. Families with children spent majority of their time in the queue waiting to receive vaccination and to be registered in the Child Registers.

3. Due to shortage of time health talks to families were not prioritised during care delivery and the waiting time of families was not utilised to provide the families with relevant information about the preventive health services and their importance, among others.

4. Tally sheets and reporting requirements during direct care delivery process took nurses' focus from families and children.

5. Health unit daily EPI attendance summary and deworming register were not available in the health centres, thus not filled in.

6. Health centre 4s with a high patient flow need to work with many issues (books) of Child Registers. During a 6-12 months period, the number of registers goes up to more than 12 issues, therefore it becomes cumbersome to carry them during every EPI session. Searching for children and registering follow up visits is a time-consuming and laborious process.

7. Child Register is the only back up mechanism if the child health card is lost and taking into account that children may not be registered in the Child Registers, the entire medical history of a child regarding preventive health service delivery may be lost.

The use case diagrams, presented below, show comparisons of the key activities and work process of health workers while they are using HMIS tools and MyChild card. Comparison of activities is presented in Use Case diagrams A, B, and C. Each diagram depicts use cases including HMIS tools and MyChild card. For example, diagram A consists of two use cases (A1, A2), and every use case includes a number of activities. In order to depict the main difference between use cases, circle of activities are presented using colour coding. The grey circles highlight activities that can be eliminated by using MyChild card. Full description of diagrams is available in Annex 2.

- Diagram A "Child's first visit" presents the key activities during vaccine and data administration of newborn children during the first visit.
- Diagram B "Child's follow up visit" presents the key activities during vaccine and data administration of children during follow up visit.
- Diagram C "Administration after service delivery" presents the key activities of data administration and reporting after completion of service delivery.

Annex 2: MyChild Card use case diagram annotation  
https://shifo.org/static/doc/MyChildCardUseCaseDiagram.pdf
Figure 2: Diagram A “Child's first visit”
Use case B1.
HMIS tools during follow up visit

Use case B2.
MyChild card during follow up visit

Figure 3: Diagram B “Child's follow up visit”
4.2 Efficiency gains of MyChild Card during care delivery process

MyChild Card was integrated to the operational processes in Mukono HC4, Goma HC3, and Nyanja HC2. All children, visiting the selected health centres to receive preventive health services including vaccination, received MyChild cards. The scanning station was deployed at Mukono HC4, which is a health sub-district in Mukono and has electricity, internet connectivity and security. Data officer of Mukono HC4 was trained as a master trainer for further development and retention of capacity within Mukono, and assigned to facilitate technical questions and maintenance of scanning station. Furthermore, a training programme and manuals were developed to facilitate end-users in the learning...
process. The health centres which fall under Mukono HC4 submit their monthly reports and hence MyChild Card slips for scanning and further digitisation purpose.

Prior to the proof of concept of MyChild Card, health workers registered children after care delivery. This entailed for parents a wait of several hours in addition to the time they had spent waiting to receive vaccinations. Many parents chose to leave instead of waiting to have the details entered into the Child Register, which meant that the children were not in the system and are missed for potential follow up.

During the proof of concept phase, efficiency of health centres in registering children and their health services increased by 119% - from an average of 51 children being registered in the Child Registers during immunisation session to an average of 112 children registered with MyChild Card.

Before MyChild Card, it was observed that health personnel spent 50-60% of their time per day on administration and reporting, using existing HMIS tools. With MyChild Card and small changes in the work processes, time spent on reporting can be potentially reduced to less than 10%, mainly due to elimination of the need for the following registers and reports:

1. Child Register - HMIS Form 073
2. Child tally sheet - HMIS Form 073a
3. Health unit daily attendance summary (static/community based) - Table 3a
4. Health unit outpatient monthly report (Child health services) - HMIS 105
5. Health unit annual report (child health services) - HMIS 107
6. Deworming register - HMIS form 075.

Reduction in administration/reporting time translates to the equivalent of one extra person into each health facility, which is an important gain in the settings with extreme scarcity of human resources.

These are some of the pictures during care delivery process using MyChild Card in Mukono District.
Nurses using MyChild Cards during health service delivery

Nurse counselling a mother on importance of vaccination follow up

MyChild Card in the hands of parents

Nurse Annet vaccinates up to 100 children by herself during high patient flow days in Mukono HC4
4.3 Extent of parent knowledge and efficiency gains with MyChild Card

During the proof of concept, every child was registered with unique ID, providing the means for every child to be followed up to adhere to their immunisation schedule.

Fact-finding interviews were conducted with parents to ascertain if they valued and understood the parental guidance information, provided in MyChild Card. Twenty-five parents were interviewed. From the interviews with parents it was evident that there was a high appreciation and need for the guidance on the importance of child immunisation, breastfeeding and other preventive measures, crucial for child growth and development.

The danger signs brought in the MyChild card were unknown among the interviewed mothers. None had previous knowledge about preparing Oral Rehydration Solution (ORS) at home, but almost every parent highlighted the importance of this knowledge in cases they do not have access to health centres or possibility to buy ORS packages from pharmacy.

Half of the parents did not know the child development indicators, or realise the importance of completing the vaccination schedule in time. We discovered that parents did not know what diseases are prevented by vaccines, and many are misled by incorrect information. Many thought that if the vaccination was missed at a given time (e.g. 6 weeks) they would not need to visit the health centre since the schedule was missed. Some miscomprehension was also revealed about other aspects of the information, for instance with regard to the use of insecticide-treated nets for malaria prevention.
Mothers knew about exclusive breastfeeding for the first 6 months but did not know how it impacted their child's early development and its value to themselves and their own health.

4.4 Data quality and data needs for efficient decision making

Reporting and statistics generation are also done in the district health office, where the reports collected from health centres are manually entered into DHIS2. The district health offices also manually generate Reaching Every District (RED) categorisation using Microsoft Excel. Inputting of the RED data however, is at times compromised by lack of electricity and/or computers.

MyChild system integrates the aggregated data/HMIS reports directly into DHIS2 and automatically generates RED Categorisation of Health Centres. This simplifies the work processes in the district health office. To learn about MyChild System Enterprise Architecture including interoperability/integration aspects refer to Annex 3.

Data needs

In 2014-2015, we conducted an assessment with decision makers about their access to data and what data/indicators would empower them to know the gaps in health services and close them. A total of 50 people answered the questionnaire. Overall, majority of respondents considered most of the indicators provided by MyChild system as necessary for informed decision making.

From the feedback obtained from respondents, additional indicators were added to Every Child Counts Report (ECC). The updated ECC is automatically generated by MyChild system and is periodically sent to decision makers and partner institutions based on their data needs.

Data availability

The Shifo technical group analysed the indicators currently generated by HMIS and compared them with those generated by MyChild system. This analysis shows that today decision-makers receive 11 indicators from preventive child health services, whereas MyChild system generates 63 indicators.

Indicators within the following categories are generated automatically by MyChild system:

1. Child registration
2. Vaccination
3. Growth and nutrition
4. Child development
5. Counselling and education for families
6. Vitamin A and deworming
7. Distribution of long lasting insecticidal nets
8. Children who need special care
9. Family planning, sexual and reproductive health rights
10. Maternal Healthcare
11. HIV/PMTCT
12. Health centre performance
13. Outreach session performance
14. Strengthening referral and follow-up
15. Micro gaps
16. Other indicators

Please refer to Annex 4 to learn about the indicators generated by MyChild Card compared to existing work processes. Annex 5 illustrates the example Every Child Counts Report, which is automatically generated by MyChild system. All indicators in Every Child Counts Report can be generated per age group, geographic area, sex (female/male), outreach or static (in health centre) sessions. All indicators can be generated in absolute numbers and in percentage. Indicators generated by MyChild system are compared to the denominator (compared to the total number of children registered and target population) to compare the progress per total target number of children living in the region and therefore know if the indicator is good/poor.

Gaps in child health services are automatically identified so that decision makers can prioritise and allocate resources to close these gaps. With MyChild Card it becomes possible to systematically receive the micro gaps from health centres. Based on this, decision-makers know which health centres have stock-outs of vaccines and supplies, issues with cold chain, lack of human resources, shortages of tools and supplies. Equipped with this information, decision-makers can work on closing the real gaps, to bring direct benefit to frontline health workers and provide communities with access to better quality health services.

Annex 4: Indicators from MyChild Card  
https://shifo.org/static/doc/MyChildCardIndicatorList.pdf

Annex 5: Every Child Counts Report  
Data quality

Based on the observations, 50-60% of the families were not registered in the Child Registers since the registration process was done after the vaccination was administered, and families would leave the health centre without waiting for their turn in the queue. This mostly occurred during the days when patient flow was high or in the health centres which have high patient flow on a regular basis.

With MyChild card all the children who came to receive immunisation were registered and no child was missed from being registered. This is achieved because every family receives MyChild Cards with unique ID and the health services provided to children are captured in the visit slips, which will be scanned, digitised and individual patient and medical record for every child created.

In addition reliability and checks and balances of data are improved once the data has been entered into MyChild system as it is connected to an individual child. Because parents/guardians retain the MyChild Card in between immunisation visits, decision-makers know if the child has actually visited the health centre. Since digital health record of every child is created and updated, decision-makers know exactly how many children are fully immunised (immunisation coverage) and are receiving other preventive health services within the target population. Error associated with manual data entry and data fabrication is eliminated.
5. Conclusion

"One child's death is one death too many. We can and must do more to reach every child with life-saving vaccines." --Dr Asha Mohammed, Deputy Secretary General, Kenya Red Cross (26).

Challenging the status quo and reaching the fifth child

We know that the challenge in the global community in ensuring every child can grow healthy, lies with reaching the fifth child in the last mile, who cannot access life-saving preventive health services and is outside of the radar of the health system. To reach children in the last mile, we have to know who receives or misses vaccines and other preventive health services, and who is missed out/not registered from the target population and why. In order to answer these questions we need to have reliable data, which is accessible to stakeholders at community, regional, national and global levels.

The key to strengthening health systems lies in the supporting infrastructure. Given the limitations of the Ugandan health care system and the challenges in increasing immunisation coverage, we set out to improve the work and data management processes in the health centres selected to evaluate MyChild Card.

MyChild Card is a solution to give insight into all children's progress in receiving preventive health services. Especially the fifth child, living in rural, isolated and oftentimes insecure environments.

MyChild system adds value across the entire healthcare chain starting from families with children, frontline health workers, local and national governments to global actors working to close the immunisation gaps. Every parent is empowered with knowledge that is based on evidence; every nurse works with effective tools and work processes; and every decision maker can make decisions based on precise data which they receive in a timely manner. Within a short time healthcare can be transformed in a positive way.
The reduced time spent by health workers on administration and reporting indicates that MyChild Card can substantially streamline care delivery and modernise data collection and recovery. With increased efficiency and improved capacity in every health centre we have a high probability to reach more children and provide quality health services.

When families are equipped with information which tells them exactly what, when and how they should take care of their children to prevent some of the deadly diseases, their children have a greater chance to reach their fifth birthday. When families are empowered with knowledge about full immunisation, nutrition and other domains, and know how they can contribute towards their child's development, they will prioritise it.

With MyChild system we are closing the gaps in data for decision making with 52 additional indicators than decision-makers currently receive today, which they can trust. With this additional information they can act on and follow the progress, learn lessons and scale interventions that bring the highest value. Data availability will also accelerate research to inform which interventions deliver the highest impact and are cost-effective.

We have a long way ahead of us, a continuous learning process that will enable us to innovate based on the current and new challenges in countries which have their own context, strengths, opportunities and priorities. We believe in the potential of MyChild system to transform and strengthen the health systems.
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