



Improving Child Healthcare in Low-Resource Settings: A Pilot Study of MyChild System in Afghanistan

Timothy Anderson (Tallinn University, Shifo), Shahnoza Eshonkhojaeva (Shifo), Dr. Humayon Safi (SCA), Dr. Samargul Hamidi (SCA), Malaika Mikaelsson (Shifo)

Table of contents

| | |
|-----------------------------------------------------|----|
| Abstract | 3 |
| 1. Background | 4 |
| Objectives | 4 |
| Afghanistan: Current preventive child health system | 4 |
| MyChild Card & MyChild System | 5 |
| 2. Methods | 6 |
| Fieldwork Sites & Project Partners | 6 |
| Evaluation Tools | 6 |
| Observation Tools | 7 |
| 3. Results | 8 |
| Summary of Observation Results | 8 |
| Summary of Interview Results | 10 |
| 4. Discussion | 11 |
| 5. References | 12 |

Abstract

Background: This text details the methods and results of a child healthcare intervention study at two clinics in rural Afghanistan. A mixed-methods study was used to determine whether the introduction of MyChild System (MCS) could improve healthcare delivery times for children and reduce the burden of paperwork for clinic staff.

Methods: Observational fieldwork was conducted at Mehterlam Provincial Hospital (PH) and Mehterlam Comprehensive Health Centre (CHC) within Laghman Province in Afghanistan. A comparative intervention mixed-methods study was used to measure efficiency gains in work processes of health workers providing preventive child health services. Administration tasks by health workers were observed and timed to determine results. Interviews with select staff were also conducted to evaluate staff satisfaction with MyChild System.

Results: Results from this pilot study indicate that moving from the old system to MyChild System allowed children (both for new appointments and follow-up appointments) to be served 68%-74% faster. Time spent by staff on daily and monthly administration tasks was also shown to be reduced, and some tasks (the creation of immunisation follow-up lists) were eliminated for staff entirely. In total, administration within MyChild System was shown to be reduced by 73%. Interviews with staff at each clinic indicated that MyChild System had been received favourably and was preferable to the previous administration system. By incorporating salary information, we can also broadly estimate the financial cost of fully immunising a child in each system. As the MCS might save 8 Afghanis (USD 0.12) per child fully immunised, over the course of a year 8 million Afghanis (approximately USD 118,000) could be saved if MCS was fully integrated nationally.

Conclusion: We see this study as a promising start for MyChild System in Afghanistan, and we hope that more positive results for children and healthcare workers can come from expanding this new programme to other regions of the country.

1. Background

The effective and efficient delivery of child health services remains a pressing issue in low income countries. Both preventive care measures (such as vaccines) and routine check-ups need significant improvements in coverage and consistency. One of the largest challenges for low-income nations in Africa, the Middle East, and Southeast Asia is the use of antiquated paper-based systems for health data collection [1]; [2]. Paper-based data collection and recovery systems are needlessly time-consuming, tedious for health workers, and prone to errors in recording and copying [3]. The inefficiencies intrinsic to paper-based systems can create further delays and fragmentation as healthcare data is passed to the regional, state, and international levels.

As an alternative to paper-based systems, electronic medical records systems, or eHealth systems are commonly recommended [2]; [4]. However, while fully digitised systems may be appropriate for wealthy nations with high-quality infrastructure, there have been significant problems in applying eHealth systems in low-resource settings. Low-income countries can struggle with the considerable technical, financial, and administrative resources required for eHealth implementation. Perhaps most critically of all, frequent power outages and network failures can render electronic health systems unusable in rural regions [5]. Partly for these reasons, only 4% of low-income countries utilise electronic systems for patient data [1].

In response to the pressing needs and concerns surrounding child healthcare delivery in low-income countries, Shifo has developed MyChild System (MCS). MCS utilises an innovative child health card with a digital component based on Smart Paper Technology™, which allows for child health data to be captured on paper by health workers. These cards can be subsequently scanned and digitised. This has the potential to improve work processes by simplifying or eliminating administration and reporting for health workers, allowing them to focus on quality of care and effective healthcare delivery for children. The development of MyChild System was prompted 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 the infrastructure to support eHealth technology is weak or does not exist in many areas. Thus, while electronic systems provide a more efficient alternative to paper-based systems, given the costs of implementation and maintenance, they are not feasible options for many low-resource settings today.

Within Afghanistan, one of the countries that was selected for a trial of MCS, there is significant potential for the system to improve healthcare delivery efficiency, vaccination compliance, and consistency in data collection. Child health outcomes in Afghanistan are among the worst in the world, owing largely to poor infrastructure, regional instability, fragmented governance, and geographical barriers [6]. Moreover, there is a significant shortage of health workers - particularly nurses, midwives, and vaccinators [7]. The current data collection systems are paper-based, and child health data is split between four different forms/books, all of which must be written and managed by hand. We hypothesise that MCS could contribute to more consistent and effective childcare in the country, easing the burden on healthcare workers and improving outcomes for local children in the process.

Objectives

To assess if MyChild System can improve efficiency in work processes and reduce time spent on administration by health workers, compared to currently used alternatives, such as paper-based systems. Fieldwork in Afghanistan will be used to measure time and satisfaction related to the implementation and use of MyChild System.

Afghanistan: Current preventive child health system

At Mehterlam CHC and PH, work processes are split between three vaccinators. Outreaches involve only one health worker providing preventive services at specific outreach sites. New visitors/newborns arriving to each clinic/outreach are vaccinated and below listed forms are filled out:

- Register of Child Immunisation (new visitors are registered here and the page number where they registered is recorded on the child's vaccination card)
- Child Registration Book (newborns are registered here)
- Child Registration Card (newborns are issued this card)
- Daily Vaccine Administration & Utilisation Sheet (any vaccines given are tallied here)

- Child's Vaccination Card (newborns are issued this card; any vaccinations given are recorded here)

Depending on the time of the visit, newborns may also be served in the clinic's Maternity Ward.

Follow-up visits are more common than new visits, as children require six appointments to be fully vaccinated. For these visits, the process is the same as described above, with the exception of the initial registration process (this is only done for new visits). It is essential for parents to bring their children's vaccination cards – this allows vaccinators to find the child within the 'Register of Child Immunisation'. However, if the vaccination card has been lost, this makes delivering the appropriate vaccines extremely difficult. Given the size of the Register of Child Immunisation (one register can be more than 200 pages and include information on over 3000 children), number of registers in the health facility, and the often chaotic nature of registration, it is sometimes impossible to locate child information without knowing the respective page number.

At the end of the day, 15-20 minutes are spent compiling statistics within the Vaccine Administration & Utilisation Sheet, which is kept on-site and filed within a dedicated binder or book. A Stock & Delivery Report is also completed each day, as health workers count and record the vaccine supplies that have been used, including any wastage.

At the end of each month, all tallies from the daily Vaccine Administration & Utilisation Sheet are manually counted, added together, and summarized in a Monthly Vaccination Activity Report. This report also includes information regarding the vaccine consumption and wastage. Both of these documents are then sent to a higher authority.

Current work processes in Afghanistan, as described above, involve large amounts of paperwork and the manual recording/copying of information in different registries. Many hours are spent on the various monthly administration forms, which are hand-written and manually calculated based on daily reports. There is high potential for human error within this system. Moreover, the current process of registering newborns leaves no alternative for parents who lose their child's vaccination card. A significant amount of time can be wasted on searching the Child Immunisation Register for a child's vaccination schedule. In some cases, the information is simply lost, and health workers cannot serve the family properly.

In addition to the issues outlined above, the statistics that come out of the monthly high-level reports are limited. They are relatively basic summaries and calculations that do not reflect the amount of work and data collection that health workers have to manage each day. High-level regional authorities are detached from the process of data collection at clinics, as they are currently only expected to handle monthly reports. For these regional authorities, making sense of daily records that are made at each facility would be time-consuming.

MyChild Card & MyChild System

MyChild Card (MCC) is a uniquely designed child health card and the centerpiece of MyChild System. The design of MCC allows health workers to quickly record and retrieve a child's registration information (including name, birth date, and address) along with all vaccinations that have been administered. The card also contains general information for parents on vaccination schedules, importance of vaccination and date of the next visit. MyChild System incorporates the wider processes of digitisation, automatic registration, stock ordering, and data collection that come with the implementation of MCC. MCS is comprehensive and meant to constitute a new preventive healthcare system for children in Afghanistan.

MyChild System is also designed to make work processes in Afghanistan more efficient and much less prone to human error. The standardised (i.e., designed to a template) MyChild Card is scanned and digitally backed-up, and each child is given a unique serial number, making it possible to quickly retrieve a child's information in any circumstance. SMS reminders are automatically sent to parents based on their child's vaccination schedule. Daily and monthly reports are also automatically generated from existing data instead of being written up by hand. Many indicators and improvements can be generated from the MyChild System – monthly reports accurately indicate how many children have been vaccinated, what vaccines have been used, where medical errors have been made, and what region(s) are experiencing problems/shortages. This makes it possible to design targeted child health interventions within the country.

2. Methods

Fieldwork Sites & Project Partners

Observational fieldwork was conducted at Mehterlam Provincial Hospital (PH) and Mehterlam Comprehensive Health Centre (CHC) in Afghanistan (Laghman Province). Fieldwork was conducted by Shifo and the Swedish Committee for Afghanistan (SCA), in close collaboration with provincial leadership and the Ministry of Public Health (MoPH). Shifo is a non-profit organisation based in Sweden, which focuses on strengthening health systems and child health services in low-resource settings. SCA in turn is a non-profit organisation with more than thirty years of experience working for an Afghanistan free from poverty, violence and discrimination, with projects in healthcare, education, rural livelihoods and community governance. Via one of SCA's healthcare programmes, the organisation is responsible for providing Basic Packages of Health Services (BPHS) in two provinces, one of which is Laghman. This project has received financing from the IKEA Foundation. Fieldwork at the Mehterlam Provincial Hospital (PH) and Mehterlam Comprehensive Health Centre (CHC) was conducted by an SCA employee, who is also currently working within the MyChild project.

These two health facilities were selected for several reasons. Foremost, these facilities cover a large population (28,000), experience large flows of patients, and are considered understaffed, meaning that there is large potential for record-keeping and service delivery to be improved from implementing MyChild System. Mehterlam itself is the urban centre of Laghman Province.

Observations (vaccinations for new visits and vaccinations for follow-ups) were conducted once per day over a total of three days for both pre- and post-intervention fieldwork. The baseline (pre-intervention) fieldwork was conducted from August – October 2016. November and December 2016 were used for the analysis of baseline data. The post-implementation fieldwork took place from January – February 2017, and a further analysis of this post-implementation fieldwork data was conducted through March and April 2017. We estimated that the 3 – 4 month gap between pre- and post-intervention fieldwork would be enough time for MyChild System to be fully incorporated into healthcare delivery routines at the selected health facilities.

Evaluation Tools

A comparative intervention mixed-methods study was used to measure efficiency gains in work processes of health workers providing preventive child health services (such as vaccines). By 'mixed-methods', we refer to a combination of quantitative (timing activities) and qualitative (interviews) to compare health delivery in pre- and post-intervention fieldwork (for more on mixed-methods design, see Sandelowski [8]). Direct observation of time spent by health workers on administrative tasks before and after MyChild System was conducted. Administrative tasks were observed during and after care delivery to capture the time spent per vaccination/care delivery session in total. Each child arriving at the clinic was followed through their session of care delivery, with each activity (e.g., vaccination, counselling, administration) being timed and recorded individually. General administration tasks at the end of the day were timed and recorded. All times were measured using a stopwatch.

Time-and-motion studies are a valuable way of quantifying how individuals sequence tasks and distribute their time [9]. The methodology consists of breaking down a process into its constituent tasks and observing and recording time for each task repeatedly. It employs direct on-site observation using manual timing techniques [10]. In Mehterlam, observational fieldwork was conducted until a 'saturation point' was reached. In other words, observation and recording continued over multiple days (with a minimum of 3) until results were consistent and repetitive. Our Observation Guides are based on the work of Taylor-Powell & Steele [11], who recommend direct observation-based methods for researchers looking to compare the relative efficacy of different programs or interventions.

Brief semi-structured interviews with staff and a selection of visitors, using a combination of closed-ended and open-ended questions, were conducted in order to ascertain their experiences and perceptions of work processes. These interviews were used to assess staff satisfaction following the implementation of MyChild System. All evaluation tools were pre-tested to identify questions that may cause confusion or be misinterpreted by participants; these were revised as/if needed based on the results of those tests.

Our analysis of interview material was informed by Gale et al's 'framework method', which provides a qualitative way to code and assess interview material according to themes and key words [12]. Although we did not work

with a large volume of interview material, we assessed and coded post-intervention participant responses based on where health workers express their feelings and critiques regarding administration/paperwork.

To reduce potential translation errors and to provide comparable data, we centred our post-intervention interviews around an initial closed-ended question: "Would you [the health worker], given the choice, want to go back to the old [pre-MCS] system?" From here, we followed up with several open-ended questions (e.g., "why or why not"?) that allowed health workers to provide explanation and detail. Our aim was to gain an overview of how health workers experience and evaluate MyChild System in their daily work, especially as compared to their experience of prior systems.

Observation Tools

For our pre- and post-intervention studies, our time-and-motion data took the form of eleven designated Observation activities, listed below. These were used to measure how long service delivery and administration took under each system. Each Observation was conducted three times (one per day of fieldwork). Due to factors that arose during preparation and preliminary fieldwork, the numbering for each Observation is not consistent across pre- and post-intervention data. Some initially proposed Observations had to be omitted when the scope of our study was narrowed to only include vaccination-related activities (instead of incorporating nutrition/de-worming activities). We also excluded Observations of some monthly tasks at the regional level, since we could not draw any meaningful comparisons from what we had collected.

Pre-intervention (using the present national health system):

Observation 1: Vaccinations for newborns/first visits: Time spent on services (vaccinations) for new visitors (including newborns and children being newly registered)

Observation 2: Follow-up vaccinations: Time spent on services (vaccinations) for follow-up visitors

Observation 5: Administration at the end of the day: Daily administration time spent on summarising/tallying vaccine reports and taking stock

Observation 6: Creating follow-up list from Register of Child Immunisation: Monthly administration time spent on creating a follow-up (defaulter) list from existing registers

Observation 7: Reporting at the end of the month: Monthly administration time spent on summing up tally sheets, providing monthly vaccination activity report, integrated monthly activity report and vaccination and other supply report and request form

Post-intervention (using the MyChild system):

Observation 1: Vaccinations for newborns/first visits: Time spent on services (vaccinations) for new visitors (including newborns and children being newly registered)

Observation 2: Follow-up vaccinations: Time spent on services (vaccinations) for follow-up visitors

Observation 3: Administration at the end of the day: Daily administration time spent on scanning session vouchers. This replaces the previously manual process of writing daily reports.

Observation 4: Reporting at the end of the month: Monthly administration time spent on preparing vaccine/syringe utilisation report

3. Results

With the introduction of the MyChild System (MCS) to Mehterlam Comprehensive Health Centre (CHC), vaccination and recording systems have changed, minimising the number of steps needed to serve both new visits/newborns and follow-ups. Moreover, daily and monthly administration tasks have been streamlined and automated to a large extent, reducing the time health workers will need to spend on manual paperwork. There are fewer forms to fill in and a greater degree of standardisation in how child information is collected. This report provides a brief summary of the results from the pilot study in Mehterlam, including estimations for how much time and money could be saved per child by switching to the MyChild System. A more detailed breakdown of the results, including times recorded for every activity and observation in the fieldwork, can be found in the relevant Excel spreadsheets.

Summary of Observation Results

Daily Observations gathered data on a varying number of children - this depended both on the number of children visiting the clinic on that day and on the time it took to reach a data saturation point (e.g., when there is clear repetition in the times recorded). For each daily Observation, the saturation point was at fifteen children; beyond this number there were no notable variations from the trends already established. Full charts for each day can be found in the relevant Excel spreadsheets included with this report, but there was an average of seven new visits recorded and fifteen follow-up visits recorded per day. These numbers were similar for both Mehterlam CHC and Mehterlam PH. In total, across three days of pre-intervention observation, 69 children were observed in Mehterlam CHC, and 64 were observed in Mehterlam PH. Across three days of post-intervention, 70 children were observed at Mehterlam CHC. Post-intervention results for Mehterlam PH are not yet available. Daily administration tasks were also observed once per day over a period of three days at each clinic. We were not able to record monthly tasks as consistently, given the time frame of the study. Observation 6 (pre-intervention, follow-up list creation) was conducted only twice, and only at Mehterlam CHC. General reporting at the end of the month was observed three times at Mehterlam CHC and three times at Mehterlam PH during the pre-intervention period. Post-intervention monthly reporting was only recorded once, and only at Mehterlam CHC.

Since the observation strategies were adjusted during fieldwork, the observation sheets for the pre- and post-intervention studies are numbered differently. To avoid confusion, the comparable observation results are listed below with corresponding descriptions. All times are written as HH:MM:SS.

Table 1: Descriptions and results of the fieldwork observations

| Pre-intervention Observation Activity | | Post-intervention Observation Activity | | Potential time saved | Potential time saved % |
|-------------------------------------------------------------|-----------------------------|----------------------------------------|-----------------------------|----------------------|-------------------------|
| Name | Result (average time spent) | Name | Result (average time spent) | | |
| Vaccinations for newborns/first visits | 00:08:11 | Vaccinations for newborns/first visits | 00:01:50 | 00:06:21 per child | 77.6% reduction in time |
| Follow-up vaccinations | 00:00:56 | Follow-up vaccinations | 00:00:20 | 00:00:36 per child | 64.3% reduction in time |
| Administration at the end of the day | 00:12:49 | Administration at the end of the day | 00:00:52 | 00:11:57 per day | 93.2% reduction in time |
| Creating follow-up list from Register of Child Immunisation | 01:08:04 | N/A (Automated)* | 0 | 01:08:04 per month | 100% reduction in time |
| Reporting at the end of the month | 08:16:23 | Reporting at the end of the month | 00:21:13 | 07:55:10 per month | 95.7% reduction in time |

* Although this process had to be done manually in the pre-intervention system, MyChild System handles this automatically.

Potential time saved for health workers using MCS

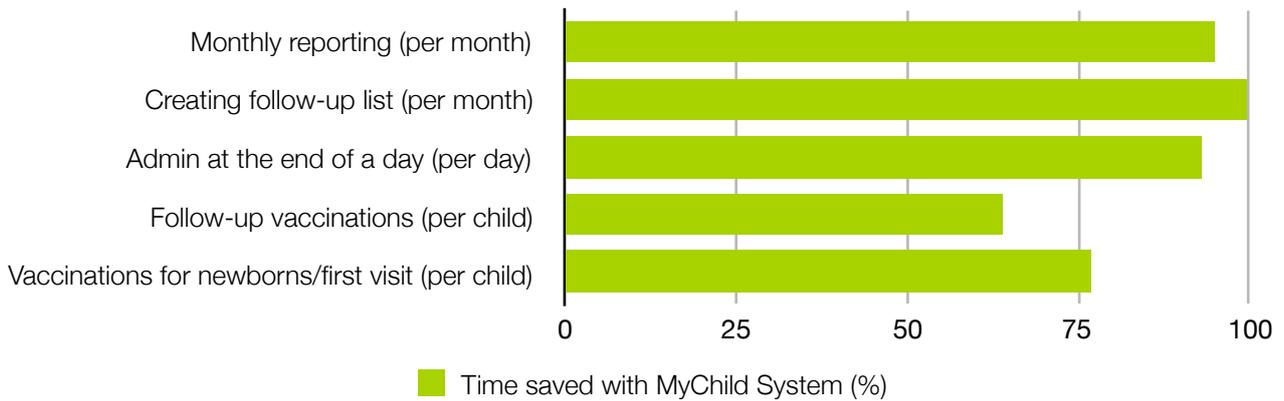


Chart 1: A graphical representation of time saved for each task when switching to MyChild System from the current system

Regarding daily tasks, the most significant reduction in time spent occurred in Observation 1. This suggests that MyChild System has been particularly effective at streamlining care delivery for newborns and initial registrations, dramatically decreasing the amount of time needed to register child information and record administered vaccines.

Table 2: Estimations of how many children could be served per hour under each system

| Observation | Number of children served per hour (pre-intervention) | Number of children served per hour (post-intervention) | Percentage increase in children served per hour |
|----------------|-------------------------------------------------------|--------------------------------------------------------|-------------------------------------------------|
| 1 (new visits) | 7 | 32 | 78 % |
| 2 (follow-ups) | 64 | 180 | 64 % |

Number of children served per hour under each system

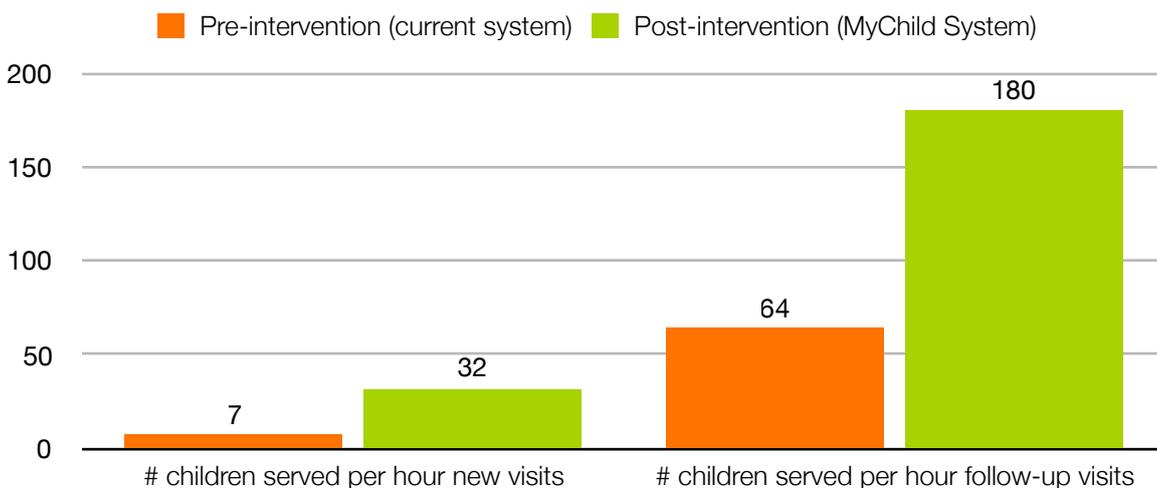


Chart 2: A graphical representation of the number of children that can be served per hour in both MyChild System and the current system

Another way of conceptualising the results is to consider how much time it takes for a child to become fully immunised in each system. Although this is a rough estimation, since it takes six visits for a child to be fully immunised (an initial visit and five follow-up visits), it would take approximately 00:13:14 of administration time to immunise a child in the old system and 00:03:32 in the new system. Put in different terms, administration in the new MyChild System is reduced by 73%. This calculation includes a broad estimate of daily and monthly administration time spent per child.

By incorporating salary information, we can also broadly estimate the financial cost of fully immunising a child in each system. Assuming a salary of approximately 50 Afghanis (approximately USD 0.74) per hour for a health worker, it would cost approximately 11 Afghanis (USD 0.16) to fully immunise a child in the old system and 3 Afghanis (USD 0.04) using the MyChild System.

We could also calculate how much money could be saved each year if we broadly consider the number of newborns needing registration in Afghanistan each year. According to the World Health Organisation, Afghanistan sees approximately one million births per year [13]. As the MCS might save 8 Afghanis (USD 0.12) per child fully immunised, over the course of a year 8 million Afghanis (approximately USD 118,000) could be saved if MCS was fully integrated nationally.

Results from Observations 1 and 2 indicate that a similar amount of time is spent on counselling in pre- and post-intervention measurements (00:01:26 vs 00:01:13), despite spending less time on administration. However, these times only include individual counselling – more time is spent on group counselling, which is not recorded in the Observation sheets. Each day at Mehterlam CHC, there are three group counselling sessions of approximately 10-15 minutes each (totalling about 40 minutes a day). These group counselling sessions are meant to provide general guidance for families visiting the clinic, informing them of what to expect from vaccinations, how to prepare for their next visit, etc. As a result of the time savings from MCS, the time spent on group counselling sessions has increased. Although we do not have precise figures for the increase in counselling time, it was frequently emphasised in interviews with both staff and patients.

Summary of Interview Results

So far, feedback from health workers and patients (from the Observation sheets and several filmed interviews) has been positive. Interviews with three vaccinators at Mehterlam CHC indicate that staff prefer the current implementation of MCS to the old administration system. None of the participants said that they would rather go back to the previous system. All three vaccinators stressed that MCS was significantly easier to use and greatly reduced the time they spend on paperwork and administrative tasks. One also noted that outreach sessions were easier to coordinate and receive data from using the new electronic system. Another vaccinator gave a similar appraisal of the new system, adding that the ability to receive child health information from an ID code allowed staff to serve children even if their child health card had been lost as data for any child could be found electronically.

Several visiting mothers were also interviewed alongside the vaccinators. The mothers focused on the benefits of the SMS reminders automatically sent within MCS. One noted that, in the old system, it was often difficult for her to remember the exact date(s) for child appointments and follow-ups, and was grateful that she was always updated via SMS. She was also pleased with the increased time staff spent on group counselling, which was made possible by the reduction of daily administration tasks. These responses indicate that the use of MyChild System might allow health workers to be more flexible and attentive to patients.

Overall, results from this pilot study show that MyChild System has been favorably received by health workers and patients. In Mehterlam, the MyChild System has reduced the burden of administrative work in clinics. The time that has been freed by the MyChild System could potentially be used for more counselling and/or to serve more children within clinic opening hours. These changes could also lead to greater vaccine compliance and fewer missed appointments.

4. Discussion

New types of child healthcare data collection systems are needed in low-income countries. Because full eHealth services are not feasible or reliable in many of these countries, we contend that MyChild System presents a viable solution.

MyChild System, based on a child health card that is paper-based but designed for digitisation, was implemented and tested within two health centres in the Mehterlam district of Afghanistan. Our mixed-methods approach incorporated a time-and-motion observation study, supported by semi-structured interviews to gauge staff satisfaction. This occurred in two phases: a pre-intervention study in late 2016 and a post-intervention study in early 2017. A comparative cost analysis will also be carried out later in 2017. The purpose of this study is to assess if MyChild System can improve efficiency in work processes and reduce time spent on administration by health workers, compared to currently used alternatives, such as paper-based systems.

Based on our own post-intervention study, expert knowledge, and previous experience in the field (see our Ugandan study [14]), we anticipate that MyChild System will lead to a more efficient, productive, and effective healthcare administration system for children in Afghanistan.

In addition to what was recorded in our observations and on-site interviews, there are several features of MCS in Mehterlam we would like to outline in this conclusion. Within MCS, medical errors can be detected automatically (e.g., giving children of a certain age inappropriate vaccines). This is because all data on vaccine use is collected and reported automatically, which can allow vaccinators to see where errors are being made and correct them. This detailed data collected by MCS also means that child health in Afghanistan can potentially be understood more precisely. All electronic reports from each clinic are automatically sent to a higher authority, which could give officials a clearer picture of the health outcomes in each province. These reports will also show which clinics are experiencing the most pressing staff shortages, allowing workers to be moved and reassigned based on local need. Similarly, because clinics experiencing challenges can be identified, we also expect that MCS will reduce the cost of monitoring and evaluation across Afghanistan. Currently, Monitoring & Evaluation teams visit every clinic in Afghanistan once a month, which is expensive and often unnecessary. Based on MCS indicators, resources can be concentrated where they are most needed, and evaluations can be carried out only when they are shown to be necessary.

Despite encouraging results and positive feedback from this study, there have been several limitations. At present, our full cost-benefit analysis is missing. This has been due to difficulties encountered in acquiring information regarding current costs. We expect this analysis to be covered at a later time this year. There has also been a delay in receiving post-implementation results from Mehterlam PH, so they have not yet been included in our analysis. Our original plan to include a third health clinic in our study had to be changed because of security concerns and regional instability. However, we hope to use these results to expand in Afghanistan nationally. When integrated at the national level, we hope to be able to evaluate child health data within each province, allowing for more accurate international comparisons and targeted care interventions. These longer-term process improvements in data collection could not be fully covered within this study.

We will use the experience and results from this fieldwork to improve MCS, including additional pilot studies in The Gambia, Rwanda, Lao PDR, Vietnam and India over the coming years.

5. References

1. World Health Organisation (2012). Management of patient information: trends and challenges in Member States: based on the findings of the second global survey on eHealth. Global Observatory for eHealth Series - Vol. 6. http://apps.who.int/iris/bitstream/10665/76794/1/9789241504645_eng.pdf
2. Frøen JF et al. (2016). eRegistries: electronic registries for maternal and child health. BMC Pregnancy and Childbirth 16:11 Jan 2016 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4721069/>
3. O'Connor Y et al. (2016). Stakeholders perspectives on paper-based and electronic clinical decision support systems in Malawi Africa. June <http://www.tandfonline.com/doi/pdf/10.1080/12460125.2016.1187400>
4. Cline GB & Luiz JM (2013). Information technology systems in public sector health facilities in developing countries: the case of South Africa. Jan <http://bmcmmedinformdecismak.biomedcentral.com/articles/10.1186/1472-6947-13-13>
5. World Health Organisation (2013). The world health report 2013: research for universal health coverage http://apps.who.int/iris/bitstream/10665/85761/2/9789240690837_eng.pdf?ua=1
6. World Health Organisation (2017). Immunisation: Afghanistan. Available at: <http://www.emro.who.int/afg/programmes/epi.html>
7. Acerra JR, Iskyan K, Qureshi ZA, & Sharma RK (2009). Rebuilding the health care system in Afghanistan: an overview of primary care and emergency services. International Journal of Emergency Medicine, 2(2), 77-82. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2700223/>
8. Sandelowski M (2000). Combining qualitative and quantitative sampling, data collection, and analysis techniques in mixed-methods studies. Research in Nursing & Health, 23, 246-255. [http://onlinelibrary.wiley.com/doi/10.1002/1098-240X\(200006\)23:3%3C246::AID-NUR9%3E3.0.CO;2-H/abstract](http://onlinelibrary.wiley.com/doi/10.1002/1098-240X(200006)23:3%3C246::AID-NUR9%3E3.0.CO;2-H/abstract)
9. Baysari MT et al. (2015). A workshop on how to use the Work Observation by Activity Timing (WOMBAT) tool – an easy and precise way to quantify patterns of work and communication. Proceedings 19th Triennial Congress of the IEA, Melbourne 9-14 August http://ergonomics.uq.edu.au/iea/proceedings/Index_files/papers/367.pdf
10. Lopetegui M et al. (2013). Time motion studies in healthcare: what are we talking about? Journal of Biomedical Informatics vol 49 June <http://www.sciencedirect.com/science/article/pii/S1532046414000562>
11. Taylor-Powell E & Steele S (1996). Programme Development and Evaluation – Collecting evaluation data: Direct observation. University of Wisconsin. <http://learningstore.uwex.edu/assets/pdfs/g3658-5.pdf>
12. Gale NK et al. (2013). Using the framework method for the analysis of qualitative data in multi-disciplinary health research. BMC Medical Research Methodology 13:117 Sept 2013 <http://bmcmmedresmethodol.biomedcentral.com/articles/10.1186/1471-2288-13-117>
13. World Health Organisation (2014). Maternal and parental health profile: Afghanistan. Available at: http://www.who.int/maternal_child_adolescent/epidemiology/profiles/maternal/afg.pdf
14. Mikaelsson M et al. (2016). 'Too many books to write' - An evaluation of administration for health workers before and after MyChild Card in Uganda. Shifo. <https://shifo.org/doc/toomanybookstowrite.pdf/>