



SMS for Life

Tanzania Pilot Project Report

Summary Report





"Over the last few years the United Republic of Tanzania has made steady progress in implementing its national strategic plans to achieve universal coverage with malaria control interventions and bring down malaria sickness and deaths. In Zanzibar malaria mortality has been reduced by 71 % as a result of the extensive distribution of insecticide treated nets, indoor spraying with insecticide and widespread use of Artemisinin based Combination Therapies (ACTs), the most effective malaria treatments available today. However, malaria still remains the biggest killer on the mainland of Tanzania and seriously affects the livelihoods and health of 93 % of the population who live in endemic areas. Of this population at risk 20 % are children under the age of five.

With around 11 million malaria cases annually it is vital that we have enough stocks of effective malaria treatments in all our health facilities, at all times, especially at the district level. It's simple. If there are no malaria treatments, someone will die. It is very likely to be a child. Reducing the frequency of local health facilities running out of ACT stocks (stock-outs) saves lives.

*The **SMS for Life** pilot project, designed to address this challenge, has been tried and tested in three districts of the country and, based on the results presented in this report, has showed remarkable success in keeping health facilities in those districts almost fully supplied with malaria treatments. The benefits for our health systems are potentially far reaching. Not only do we have the makings of a national stock management approach that can improve the availability of, and access to, lifesaving malaria drugs across the country, but we also have the possibility to apply this stock management approach to other essential health commodities.*

I am encouraged and excited by this type of public-private initiative which combines innovative thinking and low cost technology with a strong national programme and resourceful health personnel. It is a winning combination and a model I would like to see replicated to the benefit of all populations everywhere at risk of malaria. With these types of committed partnerships, malaria can be defeated.

I would like the next generation to wonder why we ever needed a World Malaria Day."

*David Mwakyusa
Honourable Minister of Health
World Malaria Day 2010*

Content

| | | | |
|---|----------|--|-----------|
| Executive Overview and Recommendations | 2 | Data Analysis | 7 |
| Background | 2 | Data Requests and Responses | 7 |
| Pilot Project Design | 2 | Response Rate | 8 |
| Results | 2 | Message Format Error Rate | 8 |
| Summary and Recommendations | 3 | Response Times | 8 |
| | | Data Accuracy | 8 |
| Project Design and Methodology | 4 | System Usage | 9 |
| Project Organisation | 4 | | |
| SMS for Life Pilot Location Selection | 4 | Stock Level Historical Reports | 10 |
| System Solution | 4 | Analysis of Lindi Rural Stock Levels | 10 |
| SMS Management Application and Process | 4 | Analysis of Ulanga Stock Levels | 12 |
| SMS Web-Based Reporting Tool | 5 | Analysis of Kigoma Rural Stock Levels | 13 |
| Development and Execution of Training | 6 | Quinine Injectable data analysis for all three districts | 14 |
| Pilot Support | 6 | Conclusion | 15 |
| Pilot Monitoring | 6 | | |
| Data Collection | 6 | Acronyms | 16 |

"The SMS for Life pilot project has demonstrated that it is possible to overcome the challenge of stock-outs by employing existing communication technologies. The use of mobile phones to inform the stock position for anti-malarials has prompted the supply chain to replenish those medicines on-time and thereby avoid stock-outs. The outcome has been improved malaria treatment, patient satisfaction and, I have no doubt in my mind, has saved hundreds of lives in the Districts where the pilot project was implemented."

*Dr Alex Mwita
National Malaria Control Programme (NMCP) Manager, Tanzania*

Executive Overview and Recommendations

Background

Stock-outs of malaria treatments at the health facility level in many sub-Saharan African countries have been a persistent problem for many years. A stock-out is the unavailability of medicine at the health facility. In Tanzania, 93 % of the population are at risk for malaria infection. The number of malaria cases is estimated to be 11 million resulting into 60-80 thousand deaths per year or 220 deaths per day in Tanzania alone. The goal of the **SMS for Life** pilot project was to develop a flexible and scalable solution to bring up-to-date visibility of anti-malarials within the Tanzanian Public Health Sector with a potential to reduce or eliminate stock-outs of five drugs (four dosage forms of ACTs and Quinine Injectable) in all health facilities in a pilot sample of three districts.

Initiated and led by Novartis, a public-private partnership was established with the Roll Back Malaria Partnership, IBM, Vodafone and the Ministry of Health in Tanzania. This unique partnership developed a solution using mobile phones, SMS messages, internet and mapping technology to visualize weekly stock inventory of Artemisinin Combination Therapy (ACTs) and Quinine Injectable at 129 health facilities and 226 villages. Over the course of one year, the Project Team designed the system, created a data repository, trained key staff and implemented the solution for a 21-week pilot in three districts of Tanzania: Ulanga, Kigoma Rural and Lindi Rural. These districts are located in three different regions and supplied from different Zonal Stores with a catchment population of 1.2 million people.

The **SMS for Life** pilot had three objectives:

1. Demonstrate that visibility of weekly stock levels of five key medicines at the outer edges of the Tanzanian Public Health System, i.e. the health facilities, will promote action to eliminate and/or reduce stock-outs, thereby significantly improving access to these essential medicines.
2. Demonstrate that a state-of-the-art data gathering infrastructure can be made available via simple, basic everyday tools like SMS and mobile phones, to people situated in the remotest locations in sub-Saharan Africa.
3. Demonstrate the effectiveness of a public-private partnership model.

Pilot Project Design

The **SMS for Life** pilot was designed so that health workers in Tanzania used their personal cell phone to send a weekly SMS stock-count message into a centralized database. The district management and National Malaria

Control Program management could then use any Internet browser on any PC, or alternatively a Blackberry device, to access this data. Centralized training was given to both management staff and health facility workers, with follow-up training and resources provided as needed.

Results

Objective 1. The **SMS for Life** system provided visibility of accurate anti-malarial stock levels of the health facilities, and this visibility has supported the districts in better stock management and the elimination of stock-outs.

The **SMS for Life** pilot provided, for the first time ever, reliable weekly stock information on anti-malarials at the health facility level. This information was provided via the Internet or Blackberry mobile phones and accessed by district management and project team staff. At the beginning of the pilot project, all three districts had high stock-out rates of one or more of the five medicines (Lindi Rural at 57 %, Kigoma Rural at 93 % and Ulanga at 87 %). During the pilot, malaria medicine availability improved significantly in all three districts, such that at the end of 21 weeks, stock-out rates were reduced to 0 % in Lindi Rural, 47 % in Kigoma Rural and 30 % in Ulanga.

In relation to ACT medications, at the start of the pilot, 26 % of facilities had no stock of any dosage form of ACT. By pilot end, this was reduced to 0.8 %. A rough calculation based on the pilot population would indicate that approximately 300,000 people had access to ACTs at the end of the pilot who did not have access in week 1. At pilot baseline, 17 % of all facilities had no Quinine Injectable. By pilot end, this was reduced to 3 %. The above results were achieved through a combination of emergency deliveries of new stock and ongoing stock redistribution (from facilities with too much to those that had none). These actions were initiated at the district level in direct response to the new health facility stock data visibility provided by the system.

Objective 2. The **SMS for Life** application is a viable, easy to use system leveraging common everyday technology.

The project team successfully designed and implemented a complex data repository application system, with built-in automated workflow and error message handling in addition to on-line statistical analysis, graphing and stock reporting. The system is located in an industrial data centre used by the banking industry in London, UK, with guaranteed availability, backup and all the normal fire suppression, standby generators, multiple communications and multiple electricity sources required

to ensure continuous availability. While hidden from users, the ease of access by the health care workers and NMCP and district management staff is demonstrated by system usage/data access statistics showing average access per user group of more than once per day. The pilot project collected 13,500 stock-level data points from 129 health facilities across three remote districts in Tanzania over 21 weeks utilizing the **SMS for Life** application.

The **SMS for Life** pilot also demonstrated that accurate stock level information (accuracy rate of 94 %) can be collected from rural health facilities in Tanzania on a weekly basis using simple SMS technology. To verify the accuracy of the data collected, surveillance visits to 116 (90 %), of all facilities in the pilot were performed. During these visits, stock ledgers were checked along with a complete physical inventory of all five products located in the store room, the dispensary and the injection room and validated with the most recent SMS stock messages sent from the facility. The result of these surveillance visits determined an overall data accuracy rate of 94 %.

The average weekly response rate over the 21 weeks across all three pilot districts was 95 %, never dropping below 93 %. Message formatting errors averaged 7.5 % per week with almost all error messages fixed and re-sent within the specified time limits. The high response rate with a data accuracy of 94 % was achieved by a simple half-day centralized training session for all health workers in each district. The application can be easily expanded to collect data on any medicines or health events. In addition, it was designed and built as a service which is totally scalable to be expanded to any number of countries, along with a commercial model to support future sustainability.

Objective 3. The **SMS for Life** public-private partnership model is an effective organizational structure to identify, build and implement a solution to help resolve longstanding societal problems.

The **SMS for Life** pilot created a unique public-private partnership model that enabled the problem to be precisely identified, a technical solution to be designed, built, and implemented in three rural districts in Tanzania in less than one year. No formal budget, legal contracts, or MOUs were developed between any of the partners. The concept of creating a partnership from multiple public and private organisations, and assembling a very lean team combining all the expertise, skills and influence necessary to tackle a complex problem, has worked very well. Each partner committed their unique resources and covered their associated project costs, eliminating the need to source and manage budgets on a project level. This model also made it easier, faster and

more efficient to obtain results, by passing the often lengthy and difficult approval processes for project funding allocation and transfer.

We found that organizations are much more likely to commit their resources for piloting new initiatives when the following conditions apply:

- The project is well documented including clear deliverables
- Participation is for a short pre-determined timeframe and exit date (one year or less)
- All partners display a strong affinity or emotional connection with the goal
- Each partner has control over its particular area of expertise and deliverable(s)
- Funds do not need to be approved and transferred to a third party

The result highlights a new and creative way in which the private sector can direct its resources, for a finite period, to address and try to solve complex and longstanding societal problems.

Summary and Recommendations

The **SMS for Life** solution has achieved its three objectives and has the potential to alleviate one of the major problems in the treatment of acute malaria attacks: the lack of drug availability because of stock-outs at the point of care.

We recommend the following actions:

- Implement the **SMS for Life** solution in all districts of Tanzania
- Implement **SMS for Life** in other African or non-African countries that have a need to bring visibility to medicine stocks at the health facility and district levels, and eliminate/reduce stock-outs
- Encourage countries to use the **SMS for Life** solution to track other medicines of priority in their national environments
- Apply the **SMS for Life** solution to disease surveillance
- International bodies and governments should utilize the public-private partnership model that has been piloted, which harnesses the diverse skills and expertise across the public and private sectors, to tackle other societal problems

For further information, questions, comments or data requests, please contact Jim Barrington at jim.barrington@novartis.com.

Project Design and Methodology

Project Organisation

The **SMS for Life** pilot involved a collaborative partnership of public and private institutions, selected for the specific skill sets they possess. This model was chosen to insure that all aspects of the project, from building the technical solution to engaging health staff on the ground, were carried out as expertly as possible. The **SMS for Life** pilot partnership consisted of the following institutions:

Ministry of Health and Social Welfare, Tanzania

The National Malaria Control Program (NMCP) is the custodian of all malaria prevention and control activities in Tanzania. The NMCP is the owner and main user of the **SMS for Life** solution, and coordinates all project activities in the country.

The Roll Back Malaria (RBM) Partnership

RBM facilitated the project oversight including the work of the steering committee, and led advocacy activities.

Novartis

This organization initiated and led the overall program to define the solution, source the partners, establish a steering committee, partner with the Ministry of Health of Tanzania and the RBM Partnership secretariat, and provide resources and funding to complete the pilot in Tanzania.

Vodafone

This organization and its partner Matssoft supported the design, funding and development of the application and the implementation of the technical solution. They also fully funded all technical operations of the pilot.

IBM

This organization supplied management resource support to the project and provided an on-line collaboration tool, "Lotus Live" which allowed all the project partners, public and private, to coordinate their inputs across company networks.

In support of the project team was a steering committee consisting of:

- Prof Awa Marie Coll-Seck, Exec. Dir. Roll Back Malaria Partnership (Chair)
- Dr Alex Mwita, Tanzania Nat. Malaria Control Program Manager
- Dr Desmond Chavasse, PSI VP and Global Malaria Control Director
- Prof Marcel Tanner, Director of the Swiss Tropical Institute
- Prof Klaus Leisinger, CEO Novartis Foundation for Sustainable Development
- Silvio Gabriel, Exec. VP Novartis Malaria Initiatives
- Jim Barrington, **SMS for Life** Program Director, Novartis

SMS for Life Pilot Location Selection

The pilot project was conducted in three rural districts in Tanzania: Lindi Rural, Ulanga and Kigoma Rural. These three districts cover 226 villages, a population of over 1.2 million people and 129 health facilities. The pilot districts were selected by the NMCP in Tanzania to satisfy the following criteria:

- The pilot districts should be representative of the overall country. Lindi Rural represents the "average" of the 131 districts in Tanzania. Ulanga represents one of the top 10 of the most difficult districts to work in, in terms of shortages of staff, skill levels and remoteness. Kigoma Rural was chosen because of the difficulties associated with its very large geographical size, e.g. the Zonal Store is a one-day drive away and the furthest health facility is a 12-hour boat trip from Kigoma.
- Districts should be supplied from different Zonal Stores and be in different regions
- Districts where Malaria is the most common cause of death
- Districts which are not currently involved in other pilot projects

System Solution

The **SMS for Life** system consists of two components: an SMS management tool and a web-based reporting tool, based in the UK. Built upon a commercial model, it supports flexibility and scalability.

SMS Management Application and Process

The SMS application stores the health facilities registered phone numbers and locations and sends every week a weekly stock request message to each health facility.

The system is mobile network-agnostic and leverages a free short code number, which enables health facility workers to send their stock message at zero cost and does not require phones to be in credit. The SMS system utilizes a standard message format for capturing the ACT and Quinine Injectable stock quantities, and handles formatting errors through follow-up SMS messages to the facility.

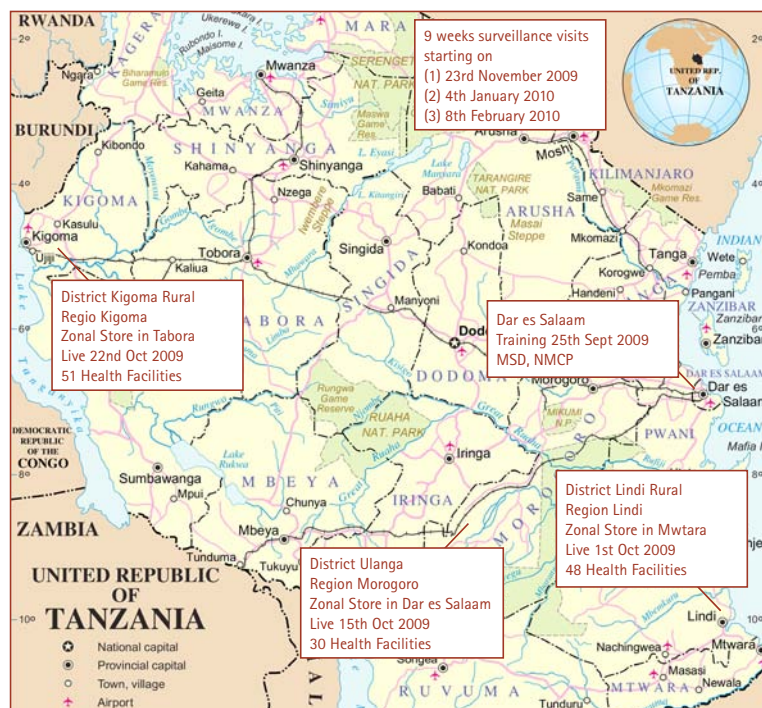


Figure 1. Map of Tanzania showing the three pilot districts

Following training and mobile phone registration, the overall weekly SMS process is as follows:

Step 1: Thursday at 2 pm, weekly stock level request SMS sent to all health facility workers.

Step 2: Health facility workers count ACT and Quinine Injectable stock levels.

Step 3: Health facility workers count and send stock level SMS to the free short code 15009. Health facility workers identify the different dosages of ACTs and Quinine Injectable in the stock SMS by letters as follows:

- Y – Yellow For babies 5 kg to less than 15 kg
- B – Blue For children 15 kg to less than 25 kg
- R – Red For children 25 kg to less than 35 kg
- G – Green For children over 12 years old,
weighing 35 kg or more and adults
- Q – Quinine Injectable

A stock count message could therefore look like the following: B4G3YOR2Q99.

Step 4: Friday at 2 pm, the SMS system sends an automatic reminder message to all health facilities who have not yet responded.

Step 5: Friday at 5 pm, system sends credit to health facility mobile phones which submitted a stock level SMS message. Messages received after 5 pm on Friday are

considered late and no credit is awarded. However, late messages are accepted until Thursday 1 pm the following week. The project provided mobile phone credit to motivate health workers to send the message on time, and recognize the additional tasks the health facility worker was performing for the pilot above their normal workload. Because personal mobile phones are used, the incentive credit is guaranteed to reach the correct health worker.

Step 6: Monday at 12 am the system sends an automatic message to the DMO indicating the health facilities who did not send a stock count SMS and also details of all health facilities with a stock-out.

SMS Web-Based Reporting Tool

The data captured through the SMS stock count messages is available through a secure reporting website. The website can be accessed via the internet on a computer or a Blackberry mobile application. Access to the website is granted through a unique User ID and password allocated at the group level and has been granted to the following groups:

- The District Medical Officer and his staff in each district
- The Regional Medical Officer and his staff in each region affiliated with the chosen districts
- The project team
- The NMCP in the Ministry of Health
- The Medical Stores Department (including the Zonal Stores affiliated with each district)

The web-based reporting tool enables users to view the following data elements:

- Current and historical ACT and Quinine Injectable stock levels at the health facility and district levels
- Google mapping of district health facilities with stock level overlays
- SMS message sending statistics (errors, health facilities sent in etc)
- Web-reporting usage statistics tool

Overall, the SMS for Life system was built to be a generic and scalable solution that can be leveraged to support any medicine or product, and can be implemented in any country with minimal tailoring. Additionally the system could also be utilized for disease surveillance.

Development and Execution of Training

| | | | |
|--------------|--|--|--|
| User Group | Central management | District management | Health facility workers |
| Location | NMCP (Dar es Salaam) | District | District |
| Participants | NMCP MSD | DMO MFP DP Zonal Store representative | 1 health facility worker from each of the 129 health facilities |
| Language | English | English | Swahili |
| Duration | 1/2 day | 1/2 day | 1/2 day |
| Objective | Understand and support the objective of the project Understand how to use the reporting system | Understand how to use the reporting system Understand how to react to system alerts | Understand how to count stock levels and compose the SMS message Register health facility phones Understand stock management best practices |

The *SMS for Life* project provided centralized training to support the roll-out and the execution of the pilot project. All training for the pilot was conducted through live in person training sessions within the three districts. The training was tailored to three different user groups: central management, district management and health facility. 129 health facility workers were trained in four centralized training sessions.

The health facility training included a live simulation activity to provide a hands-on experience for all health facility workers and ensure comprehension of the system.

Pilot Support

Each DMO appointed one person to take the lead in driving corrective actions resulting from the stock level visibility. This included: registering new users, educating new users, assisting workers experiencing difficulties, and redistributing medicines in response to stock-outs. An additional allowance was paid to the district lead for the duration of the project in recognition of the extra tasks they were asked to perform.

Pilot Monitoring

The SMS pilot was monitored by the project team using a combination of remote and in-country monitoring.

1. **Remote monitoring:** Daily review of the on-line information available in the *SMS for Life* web application.
2. **Surveillance visits:** The project team visited 116 (90 %) of the pilot health facilities and conducted full physical stock counts to be matched against the most recent data entered in the *SMS for Life* application.

Data Collection

The pilot collected stock data from all 129 participating health facilities for a period of 21 weeks. The data collected was the stock level of each of the five products at each facility every week (approximately 13,500 data points). The period of 21 weeks was chosen because it covered at least two quarterly order and delivery cycles.

Week 1 data collection from each facility served as the baseline. The date of week 1 differed across the three districts, with the starting date for each week 1 chosen independent of any delivery cycle or distribution event. This methodology promotes week 1 as representative of any "normal" weekly stock position and a valid baseline from which to measure results. The week 1 start dates for the three participating districts were:

- Lindi Rural (48 health facilities) 1st October 2009
- Ulanga (30 health facilities) 15th October 2009
- Kigoma Rural (51 health facilities) 22nd October 2009

Data Analysis

The Data Analysis part is broken into three main sections: Data Requests and Responses, System Usage and Stock Level Historical Reports. The charts and graphs analysed are all produced from the data held in the **SMS for Life** application database. The data was collected from

1st October 2009 at 2 pm until 25th February 2010 at 1 pm. Analysis of the graphs was made using information collected from the district management interviews, the health worker interviews and the records of district stock movements that were collected during the pilot period.

Data Requests and Responses

Key Findings

The system was simple and easy to use.

The response rate of health workers across all three districts remained consistently high throughout the pilot with an average response rate of 95 %, and a low error rate of 7.5 %.

The data is accurate.

The project team calculated an overall data accuracy rate of 94 %. This was supported by surveillance visits to 116 (90 %) of the 129 health facilities to carry out full physical stock counts.

Health workers sent their stock count messages consistently every week.

95 % of health facilities responded with stock counts every week with 93 % responding within the time limit to receive mobile phone airtime credit.

The following graph illustrates the collective response rate, response time, and error rates over the 21-week pilot running period.

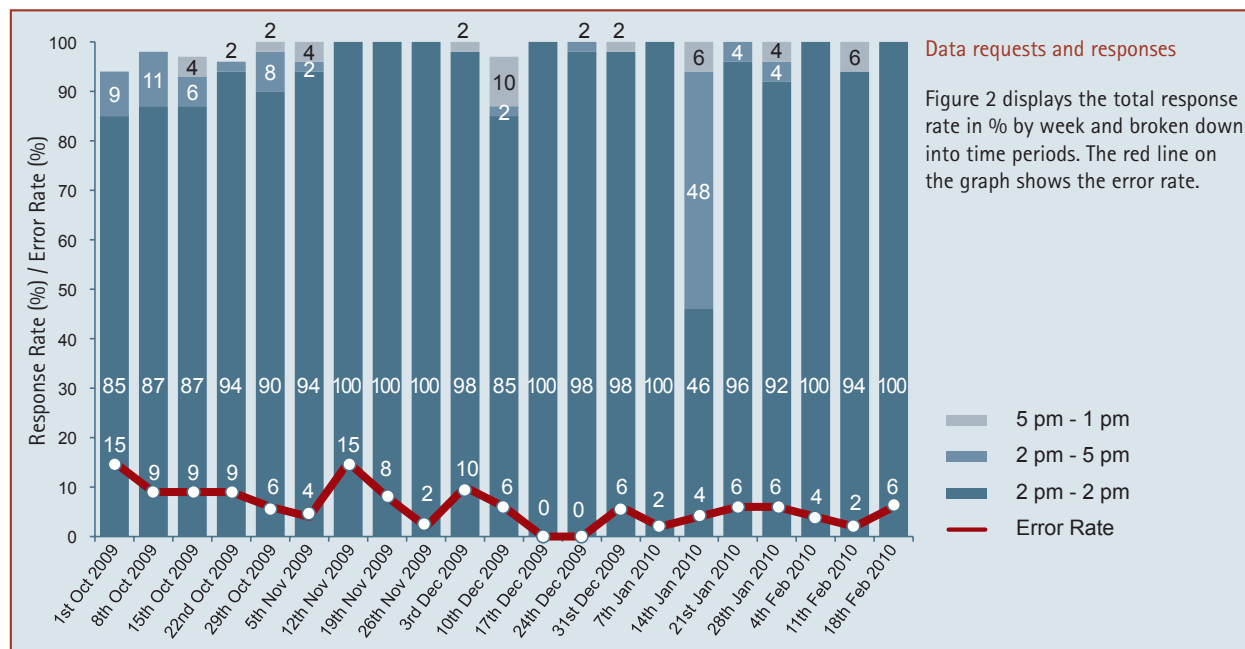


Figure 2. Collective Performance across the three districts

Response Rate

| | Overall | Lindi Rural | Ulanga | Kigoma Rural |
|---------------|---------|-------------|--------|--------------|
| Response Rate | 95 % | 99 % | 93 % | 94 % |

The average response rate was 95 % per week, significantly higher than the pilot target of 80 %. The pilot demonstrated that health workers are able to repeatedly send in stock counts correctly and on-time. The high response rate can be attributed to the incentive, the

simplicity of the system and the hands-on scenario training methods used. Additionally, the qualitative data gathered during the surveillance visits indicates that health facility workers are motivated to perform their duties and avoid being non-compliant.

Message Format Error Rate

The overall message error rate was low, averaging 7.5 %, and reduced from the start of pilot to the end of the pilot from 15 % to 7 % respectively.

Response Times

It is useful to compare the response times across all three districts.

| | Overall | Lindi Rural | Ulanga | Kigoma Rural |
|-----------------|---------|-------------|--------|--------------|
| Total Responses | 96 % | 99 % | 93 % | 94 % |
| Responded Late | 3 % | 2 % | 6 % | 3 % |

93 % of health facilities responded on-time, and received air time credit, of these, 85 % responded early, before the Friday reminder message. These results indicate health facility workers are motivated to respond on-time to

receive the airtime credit. The project team recommends the use of airtime credit incentives at least for the first year of implementation.

Data Accuracy

| | Overall | Lindi Rural | Ulanga | Kigoma Rural |
|----------|---------|-------------|--------|--------------|
| Accuracy | 94 % | 98 % | 93 % | 92 % |

The *SMS for Life* team visited 116 of the health facilities in the three pilot districts over the pilot running period and found 94 % data accuracy between the data submitted and the physical stock counts. This high level of accuracy supports the effectiveness of the training and the ease of use of the *SMS for Life* system. Qualitative feedback

highlighted that the pharmacy management training helped health facility workers better manage, and therefore count, their stock. Of 116 facilities interviewed, 45 had changed their stock-keeping practices after attending the *SMS for Life* training.

System Usage

Key Findings

Stock-outs were the lowest where system usage was the highest:

Lindi Rural accessed the system the most and eliminated stock-outs by week 8 of the pilot.

Provision of mobile phone system access increased system usage at the district level:

Providing blackberries at the district level eliminates the computer literacy and internet connectivity challenges within the districts and enables system benefits to be realized more quickly.

Identification of role of Zonal Store:

Adding the nine Zonal Stores to the system would provide an accurate total countrywide picture of the stock situation on a weekly basis. Such comprehensive visibility would be extremely valuable.

Central NMCP access provides guidance to districts:

The Central NMCP accessed the system on a daily basis and was able to provide guidance to the district offices on actions that could be taken to reduce stock-out incidences.

MSD did not use the system. This is probably because facility level stock data is not of value to the Zonal Stores. The Mtwara Zonal Store representative suggested it would be valuable for the Zonal Stores to provide weekly stock level information; this would allow a complete picture of the drug distribution throughout the country and add real value for them.

During the pilot, districts accessed the system as follows:

- Lindi Rural 137 times of which 22 were in the last six weeks.
- Ulanga 105 times of which 70 were in the last six weeks.
- Kigoma Rural 61 times of which 28 were in the last six weeks.

It is clear that a high frequency of system accesses drives a speedy reduction in stock-outs. Lindi Rural accessed the system the most throughout the entire pilot period, with the largest number of log-ons at the

commencement of the project. Lindi Rural eliminated stock-outs by week 8 of the pilot. After stock-outs were eliminated, Lindi Rural log-ons declined. This would indicate that once users are proficient at using the system and stock-outs are low the system needs to be accessed less frequently.

Ulanga district encountered issues of computer literacy and bad internet connectivity both of which were reflected in the low initial usage of the system. Six weeks before the end of the pilot we provided the Malaria Focal Person with a Blackberry. Following this the system was accessed twice per day with immediate and visible improvements in stock-out levels.

Kigoma Rural accessed the system much less than the other districts. The increase in system usage in the last six weeks is attributable to the provision of a Blackberry at that time. From discussions with the Kigoma district management, the overall lower system access is in part due to their decision to make more use of the weekly e-mail stock level updates and printing reports in preference to system access.

Stock Level Historical Reports

The following section analyses the percentage of health facilities with stock-outs, the stock levels of ACTs in the

district and the percentage and amount of quinine at health facilities over the course of the pilot.

Key Findings

Stock-outs were reduced in all three districts:

At the beginning of the pilot 78 % of participating facilities had a stock-out of one or more of the five anti-malarials. By the pilot close this figure had fallen to 26 %. Lindi Rural eliminated stock-outs by week 8 of the pilot and maintained an almost zero stock-out level until the pilot close. Ulanga and Kigoma Rural reduced the percentage of health facilities with stock-outs from week 1 to the pilot close with a decrease of 87 % to 30 % in Ulanga and 93 % to 47 % in Kigoma Rural.

A minimum stock level of anti-malarials must be maintained at every health facility within a district to enable normal delivery cycles to prevent stock-outs.

This observation is based on the fact that no minimum stock level has been calculated for any of the anti-malarials at the health facility level, and that stock levels across all districts were too low at the pilot start to prevent health facilities from having stock-outs.

Redistribution of anti-malarials within a district is necessary in order to eradicate stock-outs.

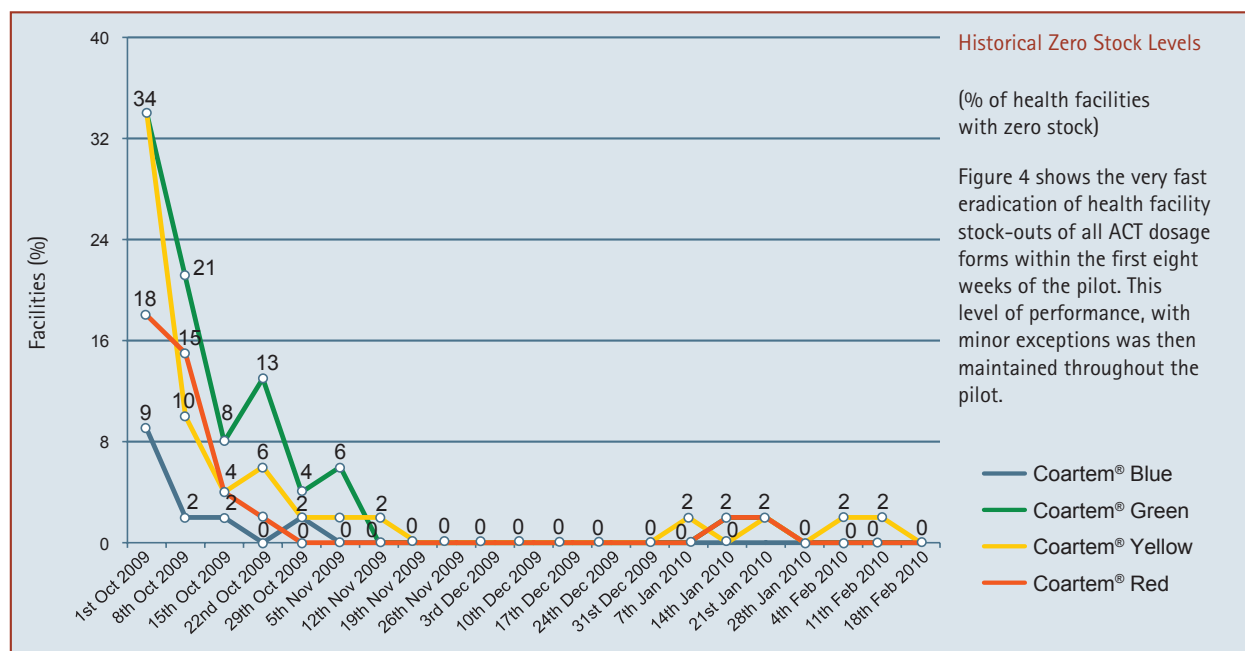
A combination of different consumption rates across health facilities, unequal packing of health facility "kits" and erratic MSD deliveries indicates that medicines will need to be redistributed within a district to ensure every facility has every medicine type at all times.

Analysis of Lindi Rural Stock Levels

| Date | Drugs in Stock | | Drugs out of Stock | | | |
|-----------------------|----------------|-------------|--------------------|---------------|--------------|--------------|
| | All in stock | One or more | Two or more | Three or more | Four or more | Five or more |
| Thu, 1st October 09 | 43.18 % | 56.82 % | 36.36 % | 4.55 % | 2.27 % | 2.27 % |
| Thu, 18th February 10 | 100.00 % | 0.00 % | 0.00 % | 0.00 % | 0.00 % | 0.00 % |
| | + 56.82 % | - 56.82 % | - 36.36 % | - 4.55 % | - 2.27 % | - 2.27 % |

Figure 3. Lindi Stock-outs at start and end of pilot

Figure 3 shows that Lindi eliminated stock-outs and ended the pilot with all five medicines available in all 48 health facilities. Their starting stock-out rate was 57 %.

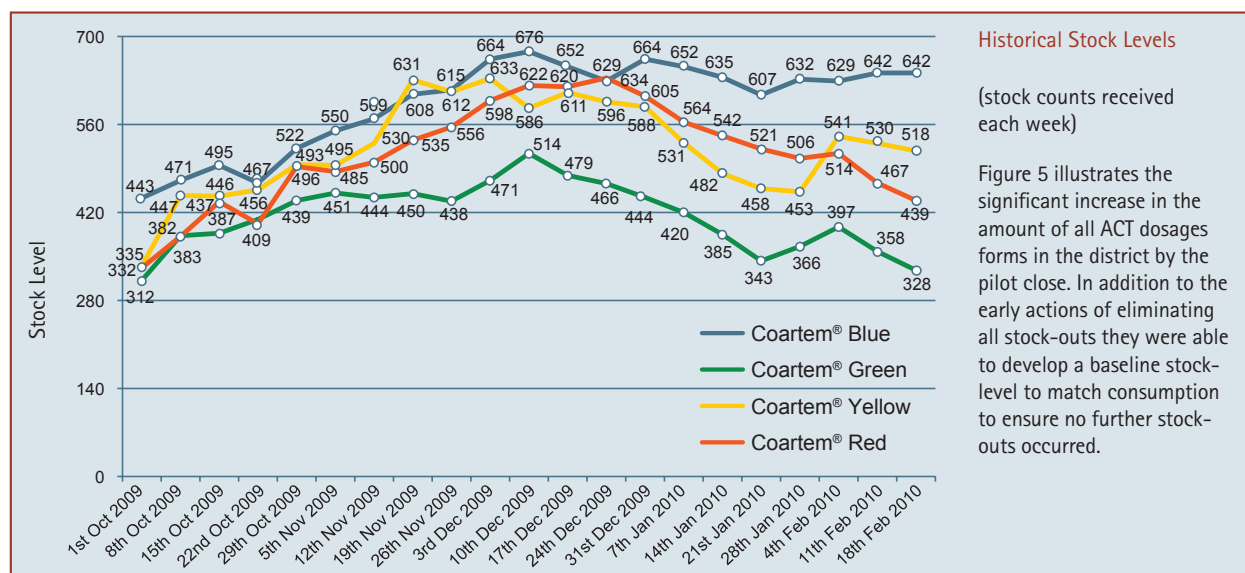


| Date | Coartem® Blue | Coartem® Green | Coartem® Yellow | Coartem® Red |
|-----------------------|---------------|----------------|-----------------|--------------|
| Thu, 1st October 09 | 9.09 % | 34.09 % | 34.09 % | 18.18 % |
| Thu, 18th February 10 | 0.00 % | 0.00 % | 0.00 % | 0.00 % |
| | - 9.09 % | -34.09 % | -34.09 % | - 18.18 % |

Figure 4. Lindi facility stock-out percentages by product

Having seen their health facility stock levels for the first time, Lindi district management made an emergency order to the Mwtara Zonal Store on 4th October 2009. This consignment was picked up from MSD on the week beginning 15th October. However, before this delivery was ready, district management took a proactive

approach by initiating immediate redistribution of stock between health facilities. Using the system information they decided to target first those facilities with the greatest number of products out of stock first (five drugs: 2.27 %) and then to work down to the health facilities with one dosage of ACTs out of stock.



| Date | Coartem® Blue | Coartem® Green | Coartem® Yellow | Coartem® Red |
|-----------------------|----------------|----------------|-----------------|---------------|
| Thu, 1st October 09 | 443 | 312 | 335 | 332 |
| Thu, 18th February 10 | 652 | 328 | 518 | 439 |
| | + 199 (+ 45 %) | + 16 (+ 5 %) | + 183 (+ 55 %) | +107 (+ 32 %) |

Figure 5. Lindi stock levels by product

Analysis of Ulanga Stock Levels

Prior to analyzing Ulanga's performance, it is important to note that Ulanga is in transition from the "push" delivery system to the ILS request "pull" system. This is important for two reasons:

Firstly, delivery schedules were disrupted and late and there were discrepancies between what the district management ordered and what was delivered to the district. Secondly, no Coartem® Blue had been delivered since March 2009.

| Date | Drugs in Stock | | Drugs out of Stock | | | |
|-----------------------|----------------|-------------|--------------------|---------------|--------------|--------------|
| | All in stock | One or more | Two or more | Three or more | Four or more | Five or more |
| Thu, 15th October 09 | 13.33 % | 86.67 % | 76.67 % | 16.67 % | 10.00 % | 3.33 % |
| Thu, 18th February 10 | 70.37 % | 29.63 % | 14.81 % | 7.41 % | 3.70 % | 0.00 % |
| | + 57.04 % | - 57.04 % | - 61.86 % | - 9.26 % | - 6.30 % | - 3.33 % |

Figure 6. Ulanga facility stock-out percentages.

Stock-outs reduced from 86.67 % on week 1 (15th Oct) to 29.63 % at the conclusion of the pilot on Feb 18th. Now, 70.37 % of health facilities have stock of all products, compared with only 13.33 % at the start of the pilot.

The high percentage of health facilities with at least one stock-out (86.67 %) can be attributed in part to the fact that no Blue ACT dosage had been delivered to the district since March 2009. Stock-outs were reduced over the course of the pilot, with the majority of stock-outs eliminated by week 9, (Dec 10th). Stock-out of Blue ACT took the longest to reduce.

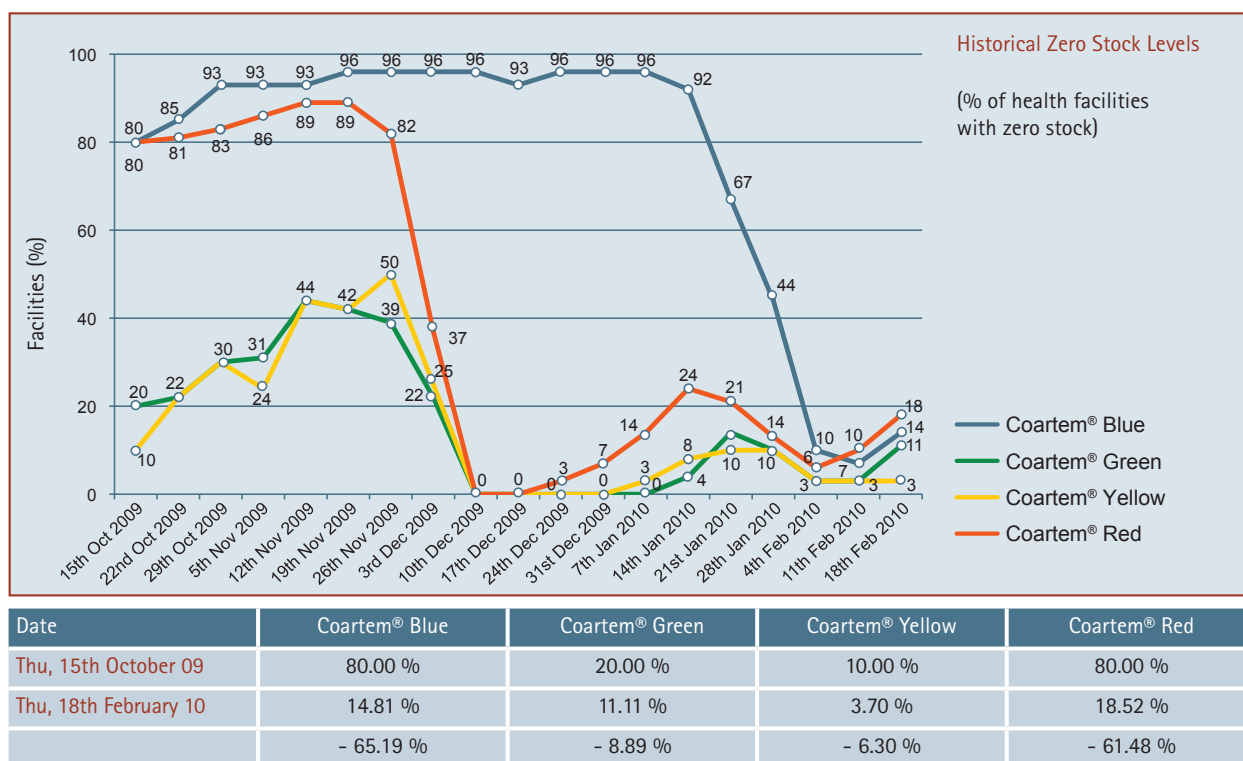
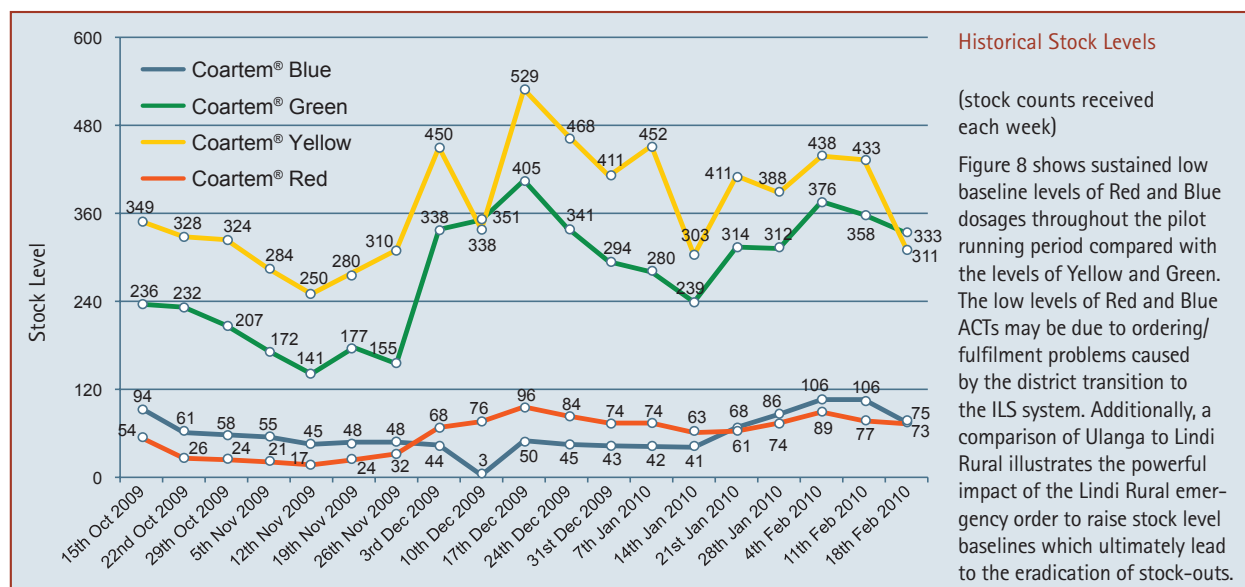


Figure 7. Ulanga facility stock-out percentages by product.

The November MSD delivery did not include any Blue dosage forms, and the Blue stock-outs did not begin to decline until the second "push" delivery was received in early January, which was the first delivery in almost one year to include Blue.

The district management placed an emergency order in late October, specifically requesting Blue ACTs; however, this order was never received by the district.

Additionally, the percentage of Red ACT stock-outs began to rise shortly after the November delivery, from Dec 24th through Jan 14th. This is directly related to the unusually small quantities of Red ACTs included in the November "push" delivery to Ulanga.



| Date | Coartem® Blue | Coartem® Green | Coartem® Yellow | Coartem® Red |
|-----------------------|---------------|----------------|-----------------|---------------|
| Thu, 15th October 09 | 94 | 236 | 349 | 54 |
| Thu, 18th February 10 | 75 | 333 | 311 | 73 |
| | - 19 (- 20 %) | + 97 (+ 41 %) | - 38 (- 11 %) | + 19 (+ 35 %) |

Figure 8. Ulanga stock levels by product

Analysis of Kigoma Rural Stock Levels

Stock-outs reduced from 92.86 % on week 1 to 45.94 % across all four dosage forms at the close of the pilot. Complete stock-outs

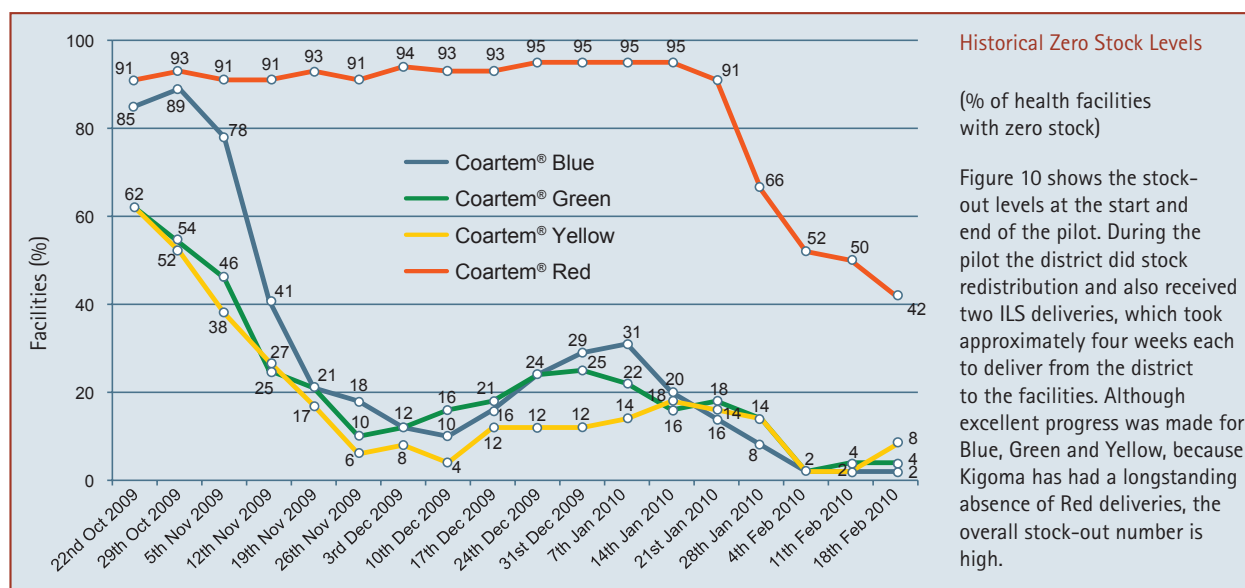
of Quinine Injectable and ACTs were reduced from 30.36 % to 0 % from the start of the pilot to the close of the pilot, ensuring that all health facilities have some form of ACT available.

| Date | Drugs in Stock | | Drugs out of Stock | | | |
|-----------------------|----------------|-------------|--------------------|---------------|--------------|--------------|
| | All in stock | One or more | Two or more | Three or more | Four or more | Five or more |
| Thu, 22nd October 09 | 7.14 % | 92.86 % | 87.50 % | 69.64 % | 57.14 % | 30.36 % |
| Thu, 18th February 10 | 53.06 % | 46.94 % | 14.29 % | 0.00 % | 0.00 % | 0.00 % |
| | + 45.92 % | - 45.92 % | - 73.21 % | - 69.64 % | - 57.14 % | - 30.36 % |

Figure 9. Kigoma facility stock-out percentages

Figure 9 shows the reduction of stock-outs from 92.86 % on week 1 of the pilot to 45.94 % stock-outs by the end of the pilot period. 30 % of health facilities had no ACTs or Quinine Injectable

and 55 % had no ACT of any dosage form. By the end of the pilot all health facilities had at least three or more anti-malarials in stock.



| Date | Coartem® Blue | Coartem® Green | Coartem® Yellow | Coartem® Red |
|-----------------------|---------------|----------------|-----------------|--------------|
| Thu, 22nd October 09 | 85.71 % | 62.50 % | 62.50 % | 91.07 % |
| Thu, 18th February 10 | 2.04 % | 4.08 % | 8.16 % | 42.86 % |
| | - 83.67 % | - 58.42 % | - 54.34 % | - 48.21 % |

Figure 10. Kigoma facility stock-out percentages by product.

The last delivery of Red was in June 2009, this was a small delivery, and the October delivery did not include any Red ACT.

The December delivery included very small quantities of Red but this was far short of what would be required to eliminate stock-outs.

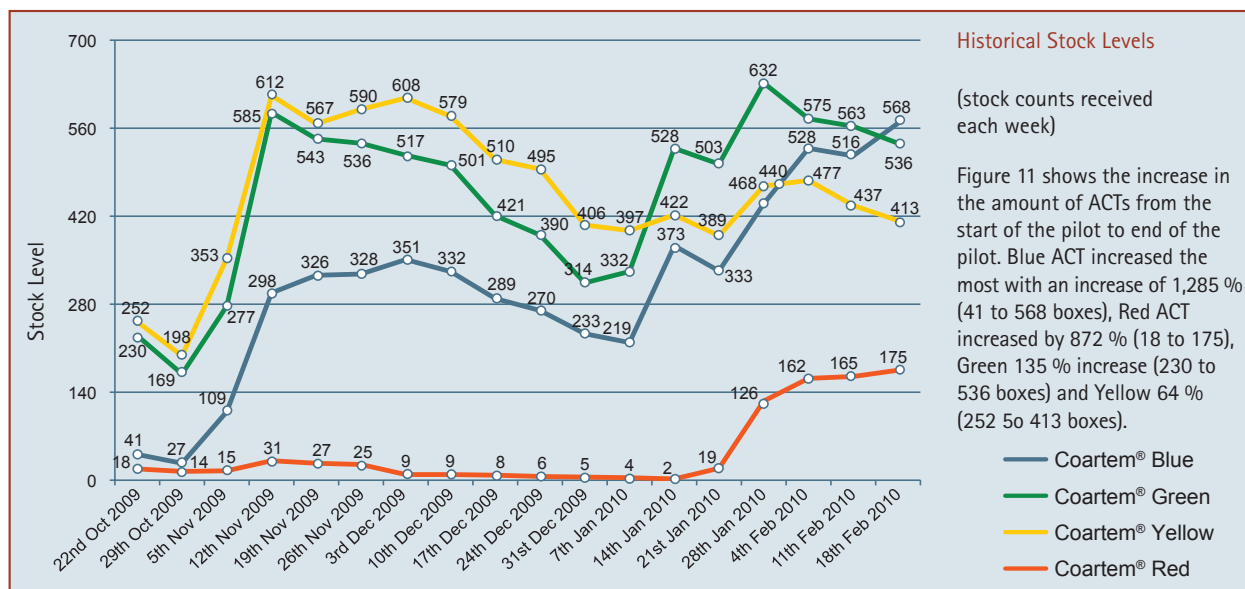


Figure 11. Kigoma stock levels by product

A comparison of the ACT stock-levels to the percent of health facilities with stock-outs highlights that despite the substantial increases in stocks there are still 47 % of health facilities with stock-outs. The high percentage of stock-outs indicates that the level of stock in the district

is still too low to eliminate stock-outs and that they have not been as successful with redistribution as the other districts. This may be in part due to the very large geographic size of the district. However, the non-availability of Red is still the largest contributing factor.

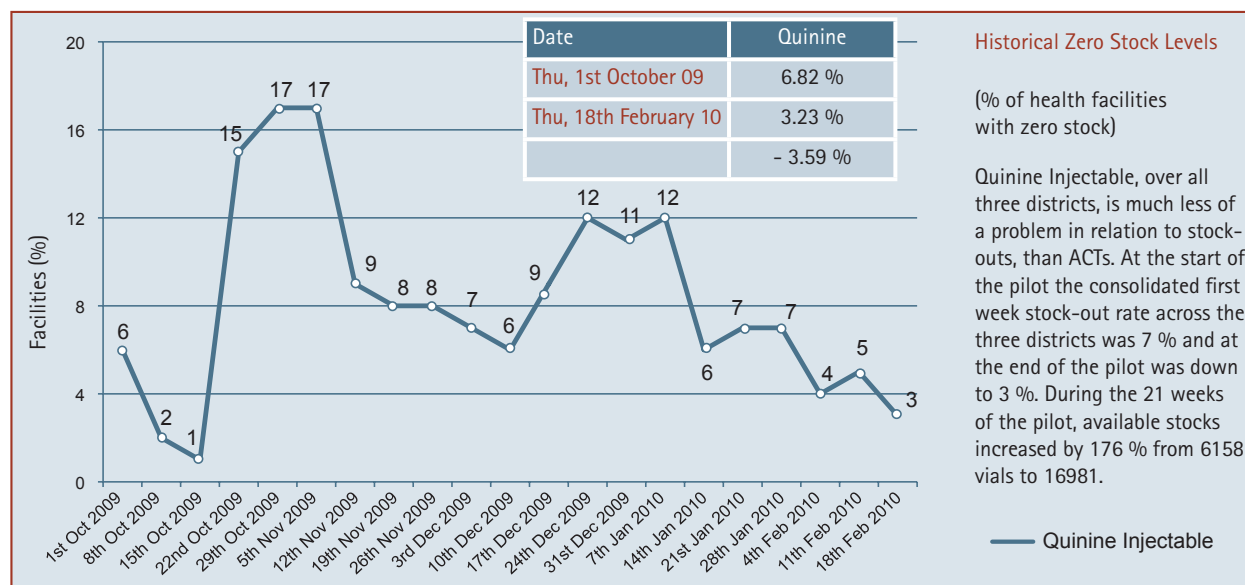


Figure 12. Percent of health facilities in all three districts with stock-outs of Quinine

Despite the large quantities of Quinine Injectable available in all three districts, the stock-out rate in Ulanga did reach a high of 19 % during the pilot. At that time they had over 5500 vials in the district which should be adequate to cover 30 health facilities. This highlights the need for ongoing and proactive management and

redistribution of medicine stock within districts. Many of the faith based facilities in our pilot had constant stock-outs of Quinine Injectable. This is a funding issue as they are not supplied from MSD but must purchase Quinine Injectable themselves.

Conclusion

1. Visibility of anti-malarial stock levels at the health facility level supports the elimination of stock-outs and more efficient stock management.

The *SMS for Life* project produced for the first time up-to-date stock level information on the quantities of anti-malarials at the health facility level in the three pilot districts. Specifically, the Lindi Rural district used this new information to eliminate stock-outs by week 8, (from 57 % in week 1), and maintain an almost zero stock-out rate for the rest of the pilot. Ulanga reduced stock-outs from 87 % to below 30 % and Kigoma reduced stock-outs from 93 % to 47 %. These results demonstrate that visibility of stock levels can be used by district management to make corrective redistributions to replenish facilities between delivery cycles and improve quantification for normal quarterly orders.

The visibility produced by the system shows that existing stock levels within the three districts were too low at the pilot start to enable the elimination of stock-outs through the normal drug delivery schedule. Lindi Rural district management used this information to create an emergency order to uniformly raise the level of anti-malarials within the district across all health facilities and across all medicine types. Minimum stock levels need to be established.

The data also supports the fact that frequency of access to the system allows faster reduction in stock-outs. Lindi accessed the system every day at the start of the pilot and had more than halved their stock-out rate before any new delivery to the district. Ulanga who had bad internet connectivity to the system at the start of the pilot made little progress until they were supplied with Blackberries, which enable mobile access to the information. With access to the information, they reduced their stock-out levels by 57 percentage points.

2. The *SMS for Life* project has shown that innovative everyday technologies can be used in the remotest parts of Tanzania to collect accurate stock level information from rural health facilities.

Across all three pilot districts, the average response rate was 95 %, with the response rate remaining consistently above 93 % each week for the pilot duration. This high response rate (with an accuracy of 94 %) shows that with a half day of training and by using personal mobile phones, health workers are able and willing to send in accurate data.

The pilot also demonstrated that this technical solution works in the remotest areas of Tanzania. By providing system access and information using a variety of

technologies (pushed weekly emails, on-line via internet and mobile via Blackberry), system users have choices and can easily access their stock information. There is nothing concerning the technology used or anything particular about the pilot districts chosen to suggest that the new system will not produce equal or better results in any other district in Tanzania, or in any other country.

3. The public-private partnership model used in *SMS for Life* pilot has proved to be a major contributor to the success of the project.

The *SMS for Life* partnership model has enabled a technical solution to be designed, built and implemented in three rural districts in Tanzania in less than one year, with no formal budget and with no legal contracts between any of the bodies involved. The use of multiple multinational companies to tackle the problem of stock-outs has allowed each aspect of the solution to be built by experts in that relevant field.

The importance of the above conclusion demonstrates a new way in which the private sector all over the world – independent of charitable contributions, NGOs and corporate social responsibility commitments – can direct their resources for a finite period to address societal problems.

None of the partners involved could have produced such a solution on their own. Being one of the largest producers of anti-malarials in the world and therefore aware of inefficiencies in the anti-malarial supply chain, Novartis was able to bring the problem of stock-outs to other interested companies. Vodafone was best placed to design the technical solution in view of its experience in mobile phone health-related initiatives across Africa and their capacity as the world's largest telecommunications company. IBM provided project management support and sophisticated tools allowing for cross-sector online collaboration. The umbrella of the Roll Back Malaria Partnership served as the best place to promote the project within Tanzania and internationally. Most crucially, the Government of Tanzania ensured the public health sector was fully engaged in the project implementation. Ministry officials were trained and participated fully in the running of the pilot project.

Key to the partnership was the decision to build the solution on a commercial model. The benefit of this model as opposed to a donation model is that the solution is more sustainable. The system technology is developed on a business model so that it could be tailored for use by the commercial sector to track commercial products. Finally, it was built by one of the most reputable companies in the world, and is completely flexible and scalable to meet most demands or changes.

Acronyms

| | |
|-------------------|---|
| ACT | Artemisinin Combination Therapy |
| Anti-malarials | The four dosage forms of ACT plus Quinine Injectable |
| BCC | Behavioural Change and Communication |
| DHMT | District Health Management Team |
| DMO | District Medical Officer |
| DP | District Pharmacist |
| RMO | Regional Medical Office |
| ILS | Integrated Logistics System |
| MFP | Malaria Focal Person |
| MOU | Memorandum of Understanding |
| MSD | Medical Stores Department |
| NMCP | National Malaria Control Programme |
| Q | Quinine Injectable |
| Y | Yellow ACT dosage for babies weighing 5 kg to less than 15 kg |
| B | Blue ACT dosage for children weighing 15 kg to less than 25 kg |
| R | Red ACT dosage for children weighing 25 kg to less than 35 kg |
| G | Green ACT dosage for adults and children over 12 years or weighing > 35 kg |
| WHO | World Health Organisation |
| Push System | The original medical product delivery system in which the district receives medical stock based prior usage statistics and receives product once every three months. |
| ILS "Pull" System | The Integrated Logistics System (ILS) is the new system the Medical Stores Department is implementing where health facilities request products from the MSD on a quarterly basis. The district health facility shipments are split into three group deliveries, A, B and C and one group delivery takes place each month per quarter. |



SMS for Life

Tanzania Pilot Project Report

April 2010

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