MAMaZ Against Malaria

Developing innovative approaches to increase rural access to commodities for the case management of severe malaria in Zambia

Final Project Report

August 2018

transaid DAI DEVELOPMENT DATA disacare wheelchair centre MMV Medicines for Malaria Venture

Acknowledgments

This report was produced to document results from MAMaZ Against Malaria (MAM) pilot project on 'Developing innovative approaches to increase rural access to commodities for the case management of severe malaria in Zambia.' MAM is a partnership of Transaid, DAI Global Health (now incorporating Health Partners Zambia), Development Data, and Disacare; and works closely and in partnership with the National Malaria Elimination Centre (NMEC) and District Health Management Teams (DHMTs) of the Ministry of Health, Government of the Republic of Zambia. We are grateful to the NMEC, Serenje DMHT and health facility personnel who participated in the pilot project. Our sincere gratitude to all community health volunteers in project areas in Serenje District who implemented key activities of the project.

MAM and NMEC wish to thank Medicines for Malaria Venture (MMV) for funding and providing technical assistance for this project which has enabled the introduction and uptake of rectal artesunate in Zambia.

Authors and contributors

National Malaria Elimination Centre (NMEC)	MMV	MaMAZ Against Malaria
Dr Elizabeth Chizema Dr Busiku Hamainza Donald Mukumbuta	Kim van der Weijde Pierre Hugo	Ernest Chanda Dennis Simuyuni Victor Simfukwe Bernard Mpande Auxilia Piringondo Garikai Zinumwe Paula Quigley Caroline Barber Cathy Green Tammy McCann Tendayi Kureya

Cover picture: Emergency Transport Scheme Rider, Serenje District, ©Transaid/Toby Madden

Contents

Acronyms

CHAs	Community Health Assistants
CHVs	Community Health Volunteers
CMS	Community Monitoring System
DHMT	District Health Management Team
ETS	Emergency Transport System
RAS	Rectal Artesunate
HF	Health Facility
HMIS	Health Management Information System
Inj AS	Injectable Artesunate
MAM	MAMaZ Against Malaria
MMV	Medicines for Malaria Venture
MOH	Ministry of Health
NMEC	National Malaria Elimination Centre
PMI	President's Malaria Initiative
QA RAS	Quality Assured Rectal Artesunate Suppository
RAS	Rectal Artesunate Suppository
RHC	Rural Health Centre
RHP	Rural Health Post
SMAGs	Safe Motherhood Action Groups
WHO	World Health Organisation

Executive Summary

In July 2017, the National Malaria Elimination Centre (NMEC) and MAMaZ Against Malaria (MAM) initiated a 12-month pilot project on 'Developing innovative approaches to increase rural access to commodities for the case management of severe malaria in Zambia'[1]. The initiative was implemented in close partnership with the Ministry of Health (MOH) and Serenje District Health Management Team (DHMT) and was funded by Medicines for Malaria Venture (MMV), who also provided ongoing technical support. The aim was to introduce and increase access to community-based management for severe malaria using pre-referral rectal artesunate (RAS) for children aged six months to six years old; and to reduce referral delays from the community to HFs equipped to treat severe malaria, ideally with injectable artesunate (Inj. AS). The pilot project was implemented in 45 communities in the catchment area of eight health facilities (HFs) and reached 54,000 people (40% of the district population).

Zambia's entire population of 16.6 million people is categorised as at high risk of contracting malaria, leading to an estimated 3.3 million cases in 2016.[2] Despite concerted efforts by NMEC, Zambia reported an increase in malaria cases between 2015-2016 and is unfortunately among the countries that are not on track to achieve a 40% reduction in malaria incidence by 2020, the target set out in the World Health Organisation's Global Technical Strategy (GTS) for Malaria. In Zambia, as in other countries with a similar malaria burden, reducing malaria-related mortality requires a stronger focus on areas where mortality is highest. An estimated 5-7% of malaria cases progress to severe malaria.[3] Epidemiologically, children under five years old are the age group most susceptible to severe malaria due to a lack of immunity. Left untreated, severe malaria can quickly become fatal.

This project came at exactly the right moment as NMEC already intended to roll RAS out across the country but were yet to develop a roadmap. This pilot was designed in collaboration with NMEC and had two main objectives:

1) Increase access to 100mg quality assured RAS and to Inj. AS
2) Use RAS to improve case management of severe malaria in children at community level

The MAM pilot built on two earlier maternal health focused projects, Mobilising Access to Maternal Health Services in Zambia (MAMaZ) (2010-2013) and MORE MAMaZ (2014-2016). At community level, 225 Community Health Volunteers (CHVs) (including Safe Motherhood Action Group volunteers who had earlier been trained by MAMaZ and MORE MAMaZ, plus i-CCM and other malaria volunteers) were trained to administer RAS and mobilise communities on severe malaria and child health. A further 252 CHVs were trained in the severe malaria community mobilisation component only, helping

[1] MAM is a partnership of Transaid, Health Partners Zambia, Development Data, and Disacare; and works closely and in partnership with the National Malaria Elimination Centre (NMEC) and District Health Management Teams (DHMTs) of the Ministry of Health, Government of the Republic of Zambia.
[2] WHO, UNICEF, 2015, **Achieving the Malaria MDG Target: reversing the incidence of malaria 2000-2015**, Geneva, WHO.
[3] WHO, 2014, 'Severe Malaria', **Tropical Medicine and International Health**, Vol 19 (suppl 1)..

to raise awareness of severe malaria and of the actions that needed to be taken when danger signs were recognised. The 477 CHVs helped to establish community systems to reduce access and affordability barriers to uptake of health services. These included food banks and emergency savings schemes. Community-based emergency transport systems (ETS) were introduced or enhanced in order to strengthen the weakest part of the referral system - the link between communities and rural HFs. Community members were trained to operate these vehicles, or, in cases where ETS was already operational, provided with refresher training which added a child health focus onto their previous maternal health training. Community monitoring systems (CMS) managed by CHVs were also established to measured progress. At HF level, health providers were trained in effective severe malaria case management, including use of Inj. AS. Linkages between HFs and communities were strengthened via provision of mentoring and supportive supervision and data review. At the district level emphasis was placed on building sustainable capacity for RAS programming. At provincial and national levels, the emphasis was on sharing experience and results to inform national policy on scale-up.

The results of the pilot were derived from project monitoring records as well as baseline and endline surveys that were conducted in August 2017 and May 2018 respectively.

The results from the pilot have been encouraging. The project identified a total of 1,215 cases of children with severe malaria danger signs, and 100% of these cases were administered with RAS and referred to HFs. Quality assured RAS was introduced into existing community systems and the referral process was functional in all project areas. All identified CHVs were trained; 100% of children were provided with referral forms by CHVs, and 72% obtained counter-referral forms from the facility; 100% of trained CHVs provided RAS; health workers were trained and provided required treatment for all referred children; and the ETS carried a larger proportion of identified children than had been planned (71% of cases where ETS was available).

The results show that knowledge on severe malaria danger signs improved significantly, with more than 85% of CHVs knowing three or more danger signs at endline compared to less than 50% at baseline.

The pilot's main impact was a reduction in the reported case fatality rate from severe malaria, from 8% at baseline to <0.5% at endline. An increase in cases of severe malaria identified, from 224 at baseline to 1,215 at endline indicates a significant increase in ability to identify severe malaria danger signs at community level and refer children to a HF without delay. The results suggest that before the intervention many cases were not identified, and thus a significant number of deaths were occurring in communities without being reported.

1. Introduction

1.1 Background

In 2017, the Government of the Republic of Zambia adopted the National Malaria Elimination Strategic Plan 2017-2021[4] which aims to 'move from accelerated burden reduction to malaria elimination in Zambia.' This strategy has a vision of a malaria-free Zambia. It seeks to achieve this by eliminating local malaria infection and disease in Zambia by 2021, maintaining malaria-free status, and preventing reintroduction and importation of malaria into areas where the disease has been eliminated. An important element in the country's approach to eliminating malaria includes effective case management strategies that focus on treating detected cases. Timely diagnosis and effective treatment are regarded as a first step in reducing the country's malaria burden.

In July 2017, the National Malaria Elimination Centre (NMEC) and MAMaZ Against Malaria (MAM) conducted a 12-month pilot project on 'Developing innovative approaches to increase rural access to commodities for the case management of severe malaria in Zambia'[5]. The project was implemented in close partnership with the Ministry of Health (MOH) and Serenje District Health Management Team (DHMT). The project was funded by Medicines for Malaria Venture (MMV), who also provided ongoing technical support. Project activities were embedded in national structures and systems to ensure sustainability. MAM's pilot project worked with eight HFs in Serenje district: Kabamba Rural Health Centre (RHC), Kabundi RHC, Kalela Rural Health Post (RHP), Kashishi RHP, Malcom Moffat RHC, Mulilima RHC, Muzamani RHP, and Serenje Urban Clinic. The pilot project was implemented in 45 communities in the catchment area of these HFs and reached 54,000 people (40% of the district population).

The project aimed to introduce and increase access to community-based pre-referral management for severe malaria using pre-referral rectal artesunate (RAS) for children aged six months to six years old; and to reduce referral delays from the community to HFs equipped to treat severe malaria, ideally with injectable artesunate (Inj. AS). WHO recommends pre-referral treatment of children (six months to six years old) who present with severe malaria danger signs using quality assured RAS. Severe malaria is a medical emergency which results in high mortality - up to 90% of cases.[6] The pilot project set out to provide proof of concept and evidence of impact by testing:

- The feasibility of training community health volunteers (CHVs) to provide quality assured rectal artesunate (RAS)
- Effective ways to mobilise communities to access appropriate pre-treatment for severe malaria and reduce life-threatening delays
- How to build sustainable capacity at district level to support effective severe malaria case management (i.e. RAS at community level; Inj. AS at rural HFs

[4] https://www.nmec.org.zm/malaria-elimination-strategic-plan

[5] MAM is a partnership of Transaid, Health Partners Zambia, Development Data, and Disacare; and works closely and in partnership with the National Malaria Elimination Centre (NMEC) and District Health Management Teams (DHMTs) of the Ministry of Health, Government of the Republic of Zambia.

[6] Thwing J., Eisele T.P. and Steketee, R.W., 2011, 'Protective efficacy of malaria case management and intermittent preventive treatment for preventing malaria mortality in children: a systematic review for the Lives Saved Tool', BMC Public Health, 11, (Suppl 3), S14.

- How to prepare the ground for scale-up beyond the pilot intervention sites, working in partnership with DHMT and NMEC

The timing of the pilot project was opportune: RAS had been included as part of Zambia's strategy to eliminate malaria; and Inj. AS, recommended by WHO as a treatment for severe malaria at referral facilities, had just been made available at district level. Pre-qualified RAS (100 mg) had been developed as a complementary intervention to support children with severe malaria while they sought life-saving treatment at referral HFs. This was important in a context where many hard-to-reach communities struggled to reach their nearest HF quickly when health emergencies occurred.

The purpose of this report is to present the pilot project's performance, using the project's logframe as a point of reference. The logframe was designed to carefully track performance based on the project's two objectives and 10 output areas. This report documents how the pilot project was implemented, discusses the key findings from the pilot, and offers lessons and recommendations for the scale-up of quality assured rectal artesunate in Zambia. The results presented in this report are derived from project monitoring data as well as baseline and endline surveys that were conducted in August 2017 and May 2018 respectively. The pilot project ended in early July 2018.

1.2 The malaria context in Zambia

Zambia's entire population of 16.6 million people is categorised as at high risk of contracting malaria, leading to an estimated 3.3 million cases in 2016.[7] Despite concerted efforts by NMEC, Zambia reported an increase in malaria cases between 2015-2016 and is unfortunately among the countries that are not on track to achieve a 40% reduction in malaria incidence by 2020, the target set out in the World Health Organisation's Global Technical Strategy (GTS) for Malaria. The World Malaria Report 2017 estimates that 7,000 Zambians lost their lives to malaria in 2016.[8] In contrast the national Health Management Information System (HMIS) reported 1,851 malaria deaths in 2016. The higher WHO figure includes an estimate of malaria deaths occurring at community level out of sight of the formal health sector. *P. falciparum*, the species of plasmodium parasite that causes the most lethal form of malaria, accounts for an estimated 98% of malaria cases in Zambia[9]. Central Province has a malaria parasite prevalence rate of 21.8%.[10]

In Zambia, as in other countries with a similar malaria burden, reducing malaria-related mortality requires a stronger focus on areas where mortality is highest. This includes severe malaria. An estimated 5-7% of malaria cases progress to severe malaria.11 Epidemiologically, children under five years old are the age group most susceptible to severe malaria due to a lack of immunity. Severe

---

[7] WHO, UNICEF, 2015, **Achieving the Malaria MDG Target: reversing the incidence of malaria 2000-2015**, Geneva, WHO.
[8] WHO, 2017, World Malaria Report 2017, Geneva: WHO.
[9] National Malaria Elimination Centre, National Malaria Elimination Strategic Plan, available at http://www.afro.who.int/en/zambia/press-materials/item/9548-zambia-launches-the-national-malaria-elimination-strategic-plan-to-guide-the-efforts-targeted-at-the-realisation-of-the-vision-of-a-malariafree-zambia-by-2021.html
[10] Zambia Malaria Incidence Survey, 2015.
[11] WHO, 2014, 'Severe Malaria', **Tropical Medicine and International Health**, Vol 19 (suppl 1)..

malaria is defined by clinical or laboratory evidence of vital organ dysfunction. In a community setting, severe malaria can be recognised via observation of danger signs (fever plus one or more of the following: inability to eat or drink, repeated vomiting, convulsions, or lethagy or unconsciousness). In practice, many cases are missed. Left untreated, severe malaria quickly becomes fatal.

1.3 About MAMaZ Against Malaria (MAM) Pilot Project

Objective 1: increasing access to WHO approved Inj. AS and RAS

When the project started, Inj. AS had already been WHO prequalified as a first line treatment for severe malaria. However, it had not been widely distributed to HFs below district level and health providers in lower level HFs had not been trained in its use. At the start of the project in July 2017, RAS had only recently been quality assured by WHO, and was still to be included in WHO's list of essential medicines. Since then, the government of Zambia has put in place plans to procure RAS for use from 2018/19 onwards in high burden areas with support from the Global Fund and the President's Malaria Initiative (PMI).

The MAM pilot project sought to increase (from zero) the proportion of children with severe febrile illness who received quality assured RAS by CHVs in project areas. Children aged six months to six years old were the key target group for the proposed intervention due to the proven efficacy of quality assured RAS in this age group. [12] This was done by:

- Procuring and distributing RAS to project areas, and making the drug available at community level
- Developing a severe malaria and RAS training module, as well as tools for community monitoring to accommodate a new focus on severe malaria
- Increasing the number of referral HFs in project areas with capacity to provide Inj. AS or alternative recommended severe malaria treatment as per WHO guidelines
- Increasing the percentage of children with severe malaria who were pre-treated with RAS by CHVs in the community and then followed up and investigated for adverse events in the 30 days post-exposure

Objective 2: Using RAS to improve case management of severe malaria in children at community level

MAM also aimed to increase (from zero), the number of children with suspected severe malaria who were appropriately managed with RAS at community level and effectively referred to a HF where they would be treated, ideally with Inj. AS as first line treatment for severe malaria. To meet this objective, the project proposed to train CHVs to administer RAS to children showing danger signs of severe

[12] HMIS collects data for subgroups of 0-1 years and 1-5 years of age. As such, data for 1-5 years of age from HMIS was used to approximate for the project age group of six months to six years.

malaria and promptly refer these children to a designated HF (i.e. one of the eight project intervention HFs) where they could receive treatment.[13]

In addition, the project proposed to improve severe malaria case management by ensuring that all children who received RAS in the project areas completed referral to a designated referral HF able to provide appropriate treatment for severe malaria and received a counter referral form with evidence of diagnosis and treatment. CHVs were tasked to keep registers of severe malaria cases and follow-up RAS clients at pre-agreed intervals.[14] This objective depended on the availability of RAS, trained CHVs and a functional Emergency Transport System (ETS) which was either set up or enhanced if already in place. Once severe malaria danger signs had been recognised by a CHV, malaria was confirmed (or otherwise) with a Rapid Diagnostic Test (RDT). If the test was positive, the child was then administered RAS and immediately referred to an appropriate HF where severe malaria treatment was provided using Inj. AS (the preferred firstline treatment) or other WHO approved severe malaria drugs (such as Quinine), and completed using Artemisinin-based Combination Therapy (ACTs). Each step was documented in a referral/counter-referral form which originated with the CHV, was sent with the patient to a HF, and sent back to the CHV via the patient.

1.3.1 Implementation approach

MAM built on two earlier maternal health focused projects, Mobilising Access to Maternal Health Services in Zambia (MAMaZ) (2010-2013) and MORE MAMaZ (2014-2016). At community level, 225 CHVs (including Safe Motherhood Action Group volunteers who had earlier been trained by MAMaZ and MORE MAMaZ, plus i-CCM and other malaria volunteers) were trained to administer RAS and mobilise communities on severe malaria and child health. A further 252 CHVs were trained in the severe malaria community mobilisation component only, helping to raise awareness of severe malaria and of the actions that needed to be taken when danger signs were recognised. The 477 CHVs helped to establish community systems to reduce access and affordability barriers to uptake of health services. These included food banks and emergency savings schemes. Community-based emergency transport systems were introduced or enhanced in order to strengthen the weakest part of the referral system - the link between communities and rural HFs. Community members were trained to operate these vehicles, or, in cases where ETS was already operational, provided refresher training which added a child health focus onto their previous maternal health training. Community monitoring systems (CMS) managed by CHVs were also established to measured progress.

At HF level, health providers were trained in effective severe malaria case management, including use of Inj. AS. Linkages between HFs and communities were strengthened via provision of mentoring and supportive supervision and data review. At the district level emphasis was placed on building sustainable capacity for RAS programming. At provincial and national levels the emphasis was on sharing experience and results to inform national policy on scale-up.

[13] In line with the national Integrated Community Case Management of Malaria (i-CCM) strategy, CHVs were also trained to identify, treat (where appropriate) and refer children suffering from other common childhood illnesses.

[14] CHVs were trained to follow-up a child once they had returned from the health facility and once a week for a month to check on the child's condition.

1.4 Project innovations

The pilot project used a comprehensive and innovative 'end-to-end' approach which mobilised communities around a severe malaria agenda, and connected communities to HFs ensuring that severe malaria case management was completed, adequate follow-up was provided, and that the health system was fully responsive to beneficiary needs.

1.4.1 Community engagement approach

An evidence-based community engagement approach, Whole Community Engagement[15], reached out to and empowered entire communities to address barriers and delays to severe malaria treatment. The approach was implemented in hard-to-reach areas and facilitated by trained CHVs. Training methods were developed for a low literacy context. CHVs were taught to memorise severe malaria and other childhood illness danger signs and to train their communities to recognise these using communication body tools. Key messages were represented by a gesture or "pose" which helped participants remember the verbal message associated with the action. Community members learnt to do the action and to say the message. This approach helped intervention communities to acquire knowledge quickly, retain it, and apply it effectively.[16]

A focus on social inclusion in the CHV training helped to ensure that all members of the community were reached by the CHVs, including individuals who did not normally use health services or participate in community activities. CHVs and ordinary members of the community were trained to identify the least-supported women in the community (i.e. women who lacked social and other forms of support from their husbands, immediate or extended families) and encouraged to offer practical support and encouragement so that they could participate in project activities.

The project also utilised a number of gender-smart strategies to promote women's and girls' empowerment. These included integrating a strong emphasis on male involvement; and creating a large network of male and female role models (CHVs) who could positively influence the community change process.

1.4.2 Emergency transport systems (ETS)

A community-managed ETS strengthened the lowest and weakest part of the referral system - the physical link between communities and rural health centres. Lack of transport is commonly cited as a reason why poor rural populations delay or fail to utilise health services, even in health emergencies.[17] The MAM ETS utilised a non-motorised mode of transport, a bicycle that pulls a trailer behind it, and

[15] Reaching out to the whole community

[16] Green, C., *et al*, 2013, 'A training approach for community maternal health volunteers that builds sustainable capacity', Development in Practice, Vol 24 (8): pp 948: 959. See also: http://www.heart-resources.org/blog/meeting-the-needs-of-adult-learners-in-the-design-of-community-health-volunteer-training/

[17] Starkey, P. and Hine, J., 2014, Poverty and Sustainable Transport. How transport affects poor people with policy implications for poverty reduction: A literature review**.** UN Habitat, the Overseas Development Institute and SLoCaT.

built on an established bicycle culture in the intervention district. Selected community members were trained as riders, and fully equipped to operate the bicycle ambulances. The project supported implementation of a culturally appropriate transport system based on vehicles that were easily maintained using locally available spare parts. The vehicles (designed by consortium partner Disacare) were specifically designed for the terrain in Serenje and allowed comfort and privacy for a sick child and their carer. An emphasis on community management of the vehicles helped to ensure that the system was responsive to community needs.

2. Project Monitoring and Evaluation Methodology

2.1 Evaluation framework

The pilot project's logframe (Annex 2) provided the framework for evaluation. Performance was measured by tracking progress on each of the project's set objectives during implementation (monitoring) and by comparing the baseline situation with the endline (evaluation).

The goal of the project was assessed by evaluating changes in the goal level indicators. The main indicator focused on reducing malaria mortality in children in target areas. The project proposed to reduce the proportion of children with severe febrile illness (between the ages of six months to six years) in project areas that resulted in death. The evaluation at endline assessed the overall contribution that the project made to reducing the malaria case fatality rate. To do this objectively the actual number of deaths registered in the project areas was reviewed and compared to what was observed during the baseline period (i.e. the previous year). The malaria context within which these deaths occurred was analysed. Changes in malaria incidence in Serenje District resulted in adjustment of the impact of the reduction in mortality.

To assess the impact of the project on child fatality from severe malaria it was important to analyse data for the period when RAS was available at community level and compare it to the respective baseline period. RAS became available in intervention HFs from October 2017 onwards, and HF and community monitoring data became available for all eight HFs from November 2017 onwards. The impact of the project on child fatality due to severe malaria was therefore assessed using data from November 2017 onwards. The numerator for the indicator was the number of children (six months to less than six years) with severe febrile illness (who presented to CHVs) in project areas who died; while the denominator was the total number of children (six months to less than six years) with severe febrile illness in project areas seen by CHVs. To update the project logframe, data from CMS was used.

To measure the two project objectives (i.e. (i) to increase access to injectable and rectal artesunate and (ii) increase the number of children with suspected severe malaria who were appropriately managed with RAS at the community level and effectively referred to a HF where they would be treated) the project tracked two indicators: the proportion of children who received RAS and were referred to a designated HF; and the proportion of children who received RAS in the project areas and completed referral to a designated referral HF, and received a counter referral form with evidence of diagnosis or treatment.

2.2 Data Sources

To adequately measure performance, three data sources were used. These include HF data; data collected from the project's CMS; and baseline and endline surveys. The baseline and endline surveys complemented and triangulated the results from the facility data and CMS. This section provides a detailed overview of the three data sources.

2.2.1 Community monitoring system (CMS)

The project collected data at community level through trained CHVs who recorded their activities. CHVs who were trained to administer RAS were also provided training on how to record the numbers of children seen, tested for malaria, referred to HFs, used ETS, and other indicators outlined in the project logframe. In total, 18 indicators were tracked monthly through the CMS. These were:

M1: No. children with severe malaria danger signs seen by CHVs
M2: No. children with suspected severe malaria given RAS
M3: No. children with suspected severe malaria tested with an RDT
M4: No. children with suspected severe malaria given referral form/letter to take to health facility (HF)
M5: No. children with suspected severe malaria given counter-referral form by HF
M6: No. children with suspected severe malaria who died
M7: No. cases of childhood pneumonia seen and referred by CHVs
M8: No. cases of childhood severe diarrhoea seen and referred by CHVs
M9: No. childhood illness discussion group sessions held
M10: No. door-to-door visits for general awareness-raising on severe malaria and other childhood illnesses
M11: No. door-to-door visits to follow up children with severe malaria
M12: No. sick children (suspected severe malaria cases) transported to HF by ETS
M13: Total no. sick children (all other illnesses) transported to HF by ETS
M14: No. emergency savings schemes beneficiaries (cases of childhood illness)
M15: No. food bank beneficiaries (cases of childhood illness)
M16: No. RAS-trained CHVs
M17: No. RAS-trained CHVs administering RAS this month
M18: % RAS trained CHVs administering RAS this month

Lead CHVs compiled the numbers for each indicator and submitted their reports to the Project Coordinator. The coordinator compiled the report for all eight facilities. This data is presented in Annex 1 a.

2.2.2 Health facility (HF) data

As part of ongoing project monitoring, the project also collected and reported on eight indicators based on facility level data, including on severe and uncomplicated malaria cases seen each month, number of patients treated with Inj. AS, and number of staff involved in treatment of severe malaria cases. This data is presented in Annex 1b. This information was used to track progress towards project targets, and also provided valuable insights on necessary modifications and areas requiring increased attention during the project. The eight indicators that were tracked monthly were:

H1: No. cases of uncomplicated malaria this month (children 5 years or under)
H2: No. cases of severe malaria this month (children 5 years or under)
H3: No. children with severe malaria given Inj. AS
H4: No. children with suspected severe malaria given RAS in the community this month
H5: No. counter referral forms issued for children with severe malaria this month

H6: No. staff in HF trained in Inj. AS
H7: No. staff in HF who administered Inj. AS to children this month
H8: % trained staff who administered Inj. AS this month

The first two indicators were already being recorded by the HFs as a part of their monitoring and evaluation activities. The first is part of the routine Health Management Information System (HMIS), while the number of cases of severe malaria is compiled on request by the DHMT. The MAM team used the data compiled by the facility staff when reporting on these indicators.

Data on children with severe malaria given Inj. AS is recorded in facility registers. Data on children with suspected severe malaria given RAS in the community was a new indicator that was introduced by the pilot project. HF staff recorded the number of patients presenting with suspected severe malaria symptoms who had been given RAS at community level. The MAM team extracted this data and recorded the results in a spreadsheet.

CHVs originated referral forms that carers of patients took to HFs. For Indicator H5, HF staff provided a counter-referral by recording on referral forms the type of treatment given. These counter-referral forms were kept in and available at community level. MAM-trained CHVs collected data on this indicator at both facility and community levels.

The last three indicators related to the training of HF staff, and included those who were trained by MAM and the DHMT and those who received cascade training from their trained colleagues within the HF. MAM recorded the total number of staff at the HF who had been trained to administer Inj. AS, and the number of HF staff who administered Inj. AS each month. A corresponding percentage was then calculated.

2.2.3 Baseline and endline surveys

Two surveys were conducted at the start (baseline) and end (endline) of the project. Similar approaches were used in both surveys. The baseline survey was conducted in August 2017 after a protocol for the pilot project was cleared by an independent ethical review board (Eres Converge) and the National Health Research Authority.

Two tools were developed at baseline and updated for the endline survey. These were i) a HF audit tool which was used to capture information on personnel, available commodities, and severe malaria case management practices; and ii) a structured interview tool used with CHVs and ETS riders (see annex for data collection tools). Fieldwork for the endline survey was conducted in May 2018 by a team of enumerators who had not directly participated in project activities. Data was collected using Android tablets and Computer Aided Personal Interview software. All interviews took place at each of the eight HFs. Interview respondents were mobilised in advance for data collection and were interviewed at their respective HFs. No remuneration was given to those taking part in the baseline or endline surveys.

At both baseline and endline, CHVs were interviewed using a structured questionnaire. A total of 300 CHVs were reached at baseline, including 239 CHVs (SMAGs and iCCM-trained volunteers) and 61 ETS drivers. At endline, the respective figures were 244 CHVs and 33 ETS drivers. For the purposes of analysis, the CHVs were categorized into two subgroups: MAM CHVs (doing SMAG and other volunteer work, including i-CCM volunteers); and ETS riders (most of whom were also SMAG members, but treated as a separate type of CHV because their main role focused on providing ETS). Results from baseline and endline surveys are presented in Annex 1c.

2.3 Limitations with evaluation data

This report draws from a multiplicity of data sources, all of which are centred on responses from HF staff and CHVs. None were paid to collect data or provide responses to project teams and survey enumerators. As a result, data quality was influenced by their willingness to provide accurate information without any expectation of financial benefit. It was possible to get different figures for the same indicator or from the same respondent, HF or volunteer, depending on when the information was collected, how it was collected, and the source of the information from within the HF registers. The project team used all three data sources to ensure that results were representative of the correct picture.

At the endline survey, the project aimed to reach the same sample size reached during the baseline survey. However, in one HF (Serenje Urban Clinic), a smaller number of CHVs were reached at endline compared to baseline because the project worked with fewer CHVs in this facility. Although the endline survey included additional respondents who were aspiring volunteers, their data was not used in the analysis.

3. Findings

The findings presented in this section are organised according to the project logframe and use data from all three sources discussed in the methodology section. The detailed data is available in Annex 1. Each result indicates the source(s) of data used.

3.1 Project contribution to reducing malaria mortality in children

3.1.1 Malaria mortality

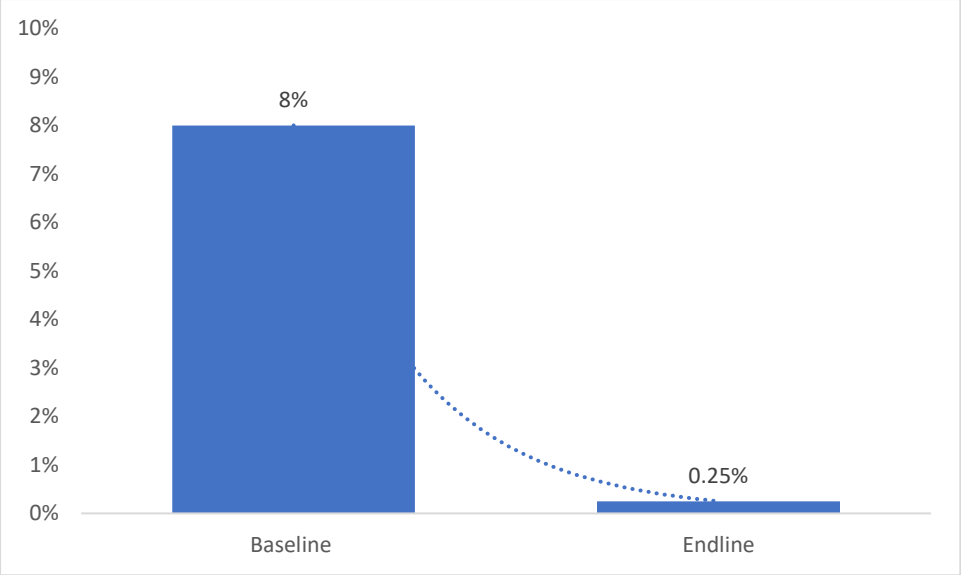
The goal of the project was measured using the indicator '*Proportion of children with severe febrile illness (six months to six years) seen at community level (by CHV) in project areas that resulted in death'*. At baseline in August 2017, the project calculated that between August 2016 and July 2017 as many as 18 deaths occurred from 224 cases of severe malaria that had presented at the eight intervention HFs. This represented a case fatality rate of 8%. The project aimed to reduce the percentage of deaths to 3.3% or lower.

Community monitoring data from the project is presented in Annex 1a. This shows that the project identified a total of 1,215 cases of children with severe malaria danger signs, and these were all administered with RAS and referred to HFs. The project recorded three deaths during the period that RAS was being administered by trained CHVs in project areas. The case fatality rate was, therefore, 0.25% (i.e. 3/1,215) and this is equivalent to >95% reduction in fatality rate. This impact of the project on mortality is presented in the table below:

Table 1: Performance against set project goal

Results	SMART indicators	Target	Baseline	Endline	Sig.
Goal (Impact): Contribute to reducing malaria mortality in children in target areas					
Indicator G1:	Proportion of children with severe febrile illness (6 mon. to 6 years) seen at community level (by CHV) in project areas that resulted in death	3.3% (50/1500)	8% (18/224)	0.25% (3/1,215)	P<0.05

Figure 1: Severe Malaria case fatality rates at baseline and endline



Deaths were recorded at three sites: at Kashishi RHP in January 2018 (child 1- 5 years); at Kabamba RHC in January 2018 (child 1-5 years); and at Kabundi RHC in March 2018 (child 1-5 years). Audits of these deaths showed that none was directly linked with use of RAS, although the drug had been administered during case management in one of the cases.

In the first case, the child had a history of convulsions, and was referred to the HF by his parents, without passing through a CHV. This child was not given RAS, and died at the facility. In the second, a male child of two years old with a history of convulsions presented at the HF and was treated with intramuscular artesunate injection. The child received all the three required doses and showed signs of recovery, and was discharged after 24 hours on oral Coartem. Three days post discharge the facility received news that child became severely ill at night and developed difficulties breathing (stridal breathing). The primary care giver failed to take the child back to the HF and he died the same night. In the third case, the child was administered RAS and referred to the HF where Inj. AS was used as per protocol. The child recovered and was discharged on ACTs (Coartem) as per guidelines. However, HF staff failed to diagnose a severe anaemia complication with the child, and he died at home.

3.1.2 Incidence of malaria

Data on various malaria incidence-related statistics was collected from all HFs that participated in the pilot project. Both the endline survey and HF project monitoring data collected information on malaria incidence in adults and in children, severe malaria incidence in children, and numbers of child deaths. The endline survey also collected data on adverse events reported by HF staff.

Data on malaria incidence provides insights on whether there was an overall decline or increase in cases of malaria, and therefore the total number of potential severe malaria cases. It was important to check how overall malaria incidence during the project period changed to see if any other factors contributed to the decline in the case fatality rate. Malaria incidence data is presented in Table 1

below. A comparison of malaria incidence during the peak malaria season (November to March) for 2016/2017 and 2017/2018 is provided at the bottom of the table.

Table 2: Malaria incidence statistics recorded in project sites.

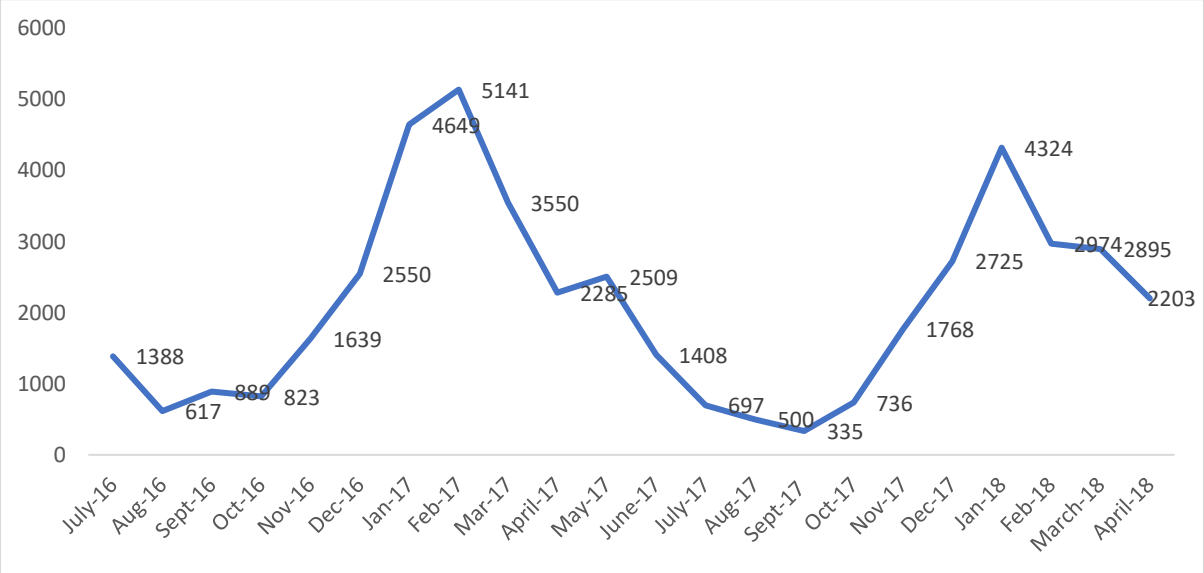
		Total malaria cases in adults and children	Total malaria cases in children who are <1 year	Total malaria cases in children who are <5 years	Severe malaria cases in children who are <1 year	Severe malaria cases in children who are <5 years	Number of deaths attributed to malaria which were of children who are <1 year	Number of deaths attributed to malaria which were of children who are <5 years	Number of observed adverse effects from malaria treatment affecting children who are <1 year	Number of observed adverse effects from malaria treatment affecting children who are <5 years
2016	July	1388	81	185	0	1	0	0	0	0
	August	617	34	76	2	0	0	1	0	0
	September	889	59	83	0	4	0	0	1	0
	October	823	112	150	0	4	0	0	0	0
	November	1639	126	369	0	4	0	0	0	0
	December	2550	354	1127	3	51	3	0	0	0
2017	January	4649	236	1346	10	45	2	1	0	0
	February	5141	383	1991	6	23	4	0	0	1
	March	3550	335	1333	15	33	2	2	0	0
	April	2285	117	855	2	10	1	2	0	0
	May	2509	174	813	0	5	0	0	0	0
	June	1408	85	420	4	2	0	0	0	0
	July	697	62	183	3	7	0	0	0	0
	August	500	42	144	0	16	0	0	0	0
	September	335	29	115	4	21	0	0	0	0
	October	736	60	314	13	31	0	1	0	0
	November	1768	150	683	13	52	0	0	0	0
	December	2725	249	929	30	97	0	0	0	0
2018	January	4324	590	1427	60	107	0	2	0	0
	February	2974	319	966	37	93	0	0	0	0
	March	2895	343	906	49	81	0	1	0	0
Nov 16-March 17		17529	1434	6166	34	156	11	3	0	1
Novt 17-March 18		14686	1651	4911	189	430	0	3	0	0
Net changes		-2843	217	-1255	155	274	-11	0	0	-1

Source: HMIS and health facility records

The results show that during the peak period, total recorded malaria cases dropped from 17,529 in 2016/2017 to 14,686 in 2017/2018 (a drop of 16%). However, total reported cases in children below the age of one significantly increased (from 1,434 to 1,651), possibly showing higher levels of identification and referral of cases for this age group. Reported cases of severe malaria also increased from 34 to 189 for children under the age of 1 ($p<0.05$), and from 156 to 430 in those between the ages of 1 and 5 ($p<0.05$). During the project timeframe, reported deaths from malaria in children under one reduced from 11 to 0; while they stayed at three for the age groups one-five. The data shows that there were very significant increases in reported severe malaria cases in both age groups, suggesting an improvement in communities' recognition of severe malaria danger signs and a willingness by communities to act. Additionally, the results seem to show an increase in the total number of cases of malaria in children below the age of one, but with no deaths reported at all. These results show that

pre-treatment, referrals and facility level treatment were working as planned. The trends discussed above are presented in the graph below.

Figure 2: Incidence of malaria in project sites



3.2 Project contribution to access to WHO approved Inj. AS and RAS

The project's first objective is to 'increase access to WHO approved RAS among children with suspected severe malaria.' Performance on this objective is presented in the table below and discussed in the following section:

Table 3: Performance against Objective 1 targets

Results	SMART indicators	Target	Baseline	Endline	Sig.
Outcome 1: Increased access to WHO approved RAS among children with suspected severe malaria					
Indicator P1	Proportion of children (6 months to less than 6 years) with severe febrile illness who received QA RAS by CHVs in project areas	50% (750/1500)	0	100% (1,215/1,215)	P<0.05
Output1: QA RAS is made available for safe and appropriate malaria pre-referral management					
Indicator O1.1	Quantity of QA RAS (in units) procured for project areas and available for project.	3000	0	3000 procured, 1,215 used.	Adequately met
Indicator O1.2	Development of severe malaria/RAS training module, CMS forms adapted to accommodate new SM focus and job aids/posters developed	1	0	1	Adequately met
Indicator O1.3	Number of referral health facilities in project areas able to provide Inj. AS or alternative recommended severe malaria treatment as per WHO guidelines	10	8	8	Output met[18].

[18] At project planning, it was assumed that two additional sites would be commissioned within the project's catchment. This did not happen.

Indicator O1.4	Percentage of children treated with QA RAS by CHV who have been followed and investigated for adverse events in the 30 days post-exposure in the project areas	50% 750/1500	0	100% (1215/1215)	P<0.05

As already discussed, all the 1,215 children identified with severe malaria danger signs were administered RAS and referred to a HF. This was made possible because the project managed to procure adequate RAS (3,000 doses) for use in the project. Training materials for CHVs were developed in advance and used for training.[19] Training materials included guides prepared by MMV and additional materials from the Severe Malaria Observatory (https://www.severemalaria.org/) At facility level, trained health personnel were in place, and referred children were treated with Inj. AS. CHVs were also able to conduct follow-up visits to check on adverse events. The work undertaken by CHVs is discussed in Section 3.3. In the following sub-sections, we present some of the reasons why the project managed to produce such promising results.

3.2.1 Staffing levels at project health facilities

Treatment of severe malaria requires suitably qualified health cadres who are trained on appropriate use of existing medicines, especially Inj. AS which is the first line treatment option for severe malaria. In Zambia, each HF, including RHPs, should have a qualified nurse at least. RHCs are referral facilities for RHPs and have clinical officers in addition to qualified nurses. The table below shows the staffing levels at HFs in April 2017 (just before the commencement of the project) and a year later, when the endline survey was conducted. The data shows that required staff were in place, and of note, two clinical officers were added to Kabundi RHC and Malcom Moffat RHC. This shows a slight increase in staffing levels among cadres that are of critical importance from a severe malaria perspective.

Table 4:Staffing levels at project health facilities

Health Facility	Doctors	Clinical officers	Nurses	EHTs	Trainees	CHAs	CDEs	Other	Total
Staffing levels at start of project									
Kabamba RHC	0	1	3	1	0	0	1	5	11
Kabundi RHC	0	0	1	1	0	2	2	0	6
Kalela RHP	0	0	1	0	0	2	0	0	3
Kashishi RHP	0	0	1	0	0	0	0	0	1
Malcom Moffat RHC	0	0	1	1	0	0	1	0	3
Mulilima RHC	0	1	2	1	0	0	2	0	6
Muzamani RHP	0	0	1	1	0	2	1	0	5
Serenje urban clinic	0	4	6	0	0	0	0	2	12
Total Staff in Apr 17	**0**	**6**	**16**	**5**	**0**	**6**	**7**	**7**	**47**
Staffing levels towards end of project									
Kabamba RHC	0	1	1	1	0	0	2	1	6
Kabundi RHC	0	1	1	1	0	0	2	1	6
Kalela RHP	0	0	1	0	0	2	0	0	3
Kashishi RHP	0	0	1	0	0	0	1	0	2
Malcom Moffat RHC	0	1	2	0	0	0	0	2	5
Mulilima RHC	0	1	3	1	0	0	1	0	6
Muzamani RHP	0	0	2	1	0	2	1	0	6

[19] MAM training resources can be found on the Severe Malaria Observatory website at: https://www.severemalaria.org/in-the-field/projects/mamaz-against-malaria.

Serenje urban clinic	0	4	5	1	0	0	6	1	17
Total Staff in Apr 18	**0**	**8**	**16**	**5**	**0**	**4**	**13**	**5**	**51**
Net change in staffing levels	*0*	*2*	*0*	*0*	*0*	*-2*	*6*	*-2*	*4*

Source: Endline and Baseline surveys

Availability of qualified health personnel was not a barrier for the project, although in one facility, health personnel indicated a preference to administer intra-muscular (IM) as opposed to intravenous (IV) artesunate. Staff allocation varied with the size of the population served by the HF (and subsequently, total number of malaria cases). Nevertheless, there was at least one nurse at every facility ensuring that Inj. AS could be administered in all sites. Serenje Urban Clinic had the highest number of nurses: six and five at baseline and endline respectively. The three RHPs Kalela, Kashishi and Muzamani operated without clinical officers, but had qualified and trained nurses at all times.

3.2.2 Training on Inj. AS

Training on Inj. AS was an important activity because it ensured that referred children would be treated with Inj. AS as per protocol. Data on staff training was collected through the project monitoring system, and also during endline and baseline surveys. When the project started, Serenje District already had a master trainer in inj. AS based at Serenje Urban Health Clinic. NMEC had earlier trained one-two personnel per district. However, Inj. AS was not available at this time and the DHMT lacked funds to roll out the training to the rest of the district. MAM's Health Systems Adviser worked with the DHMT's Clinical Care Officer to train four other master trainers in severe malaria case management. The training was then rolled out to one member of staff from each intervention HF. These health providers then trained other providers in their respective HFs in a cascade training approach. Ongoing support and supervision was provided by the master trainers. The two trainings (of master trainers and of health providers at intervention HFs) took place in August 2017, in advance of the RAS rollout in October 2017. The in-facility cascade happened immediately afterwards. During the timeframe of MAM, Serenje DHMT independently rolled out training in severe malaria case management to health providers across the entire district using the five master trainers.

From the HF project monitoring data, results show that from November 2017 until the end of the project, each facility had staff trained on how to constitute and administer Inj. AS (Artesun, 60mg three vial pack, manufactured by Fosun Pharmaceuticals) (see table below).

Table 5: Staff trained to administer Inj. AS

Health Facility	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18	Apr 18	May 18
Kabamba	2	2	2	2	2	2	2	2
Kabundi		4	4	4	4	4	4	4
Kalela	3	3	3	3	3	3	3	3
Kashishi	1	1	1	1	1	1	1	1
Malcom Moffat	3	3	3	3	3	3	3	3
Mulilima	4	4	4	4	4	4	4	4
Muzamani	4	4	4	4	4	4	5	5
Serenje Urban	10	10	10	10	10	10	10	10
Total	27	31	31	31	31	31	32	32

Source: Health Facility project monitoring data

During the life of the project, all trained health care workers managed at least one case of severe malaria. The proportion of trained health workers who managed severe malaria cases was tracked and varied from month to month (see table below). All cases of severe malaria were attended to by trained staff, and facilities such as Serenje Urban Clinic, which had 10 trained staff, used only some staff to treat each month.

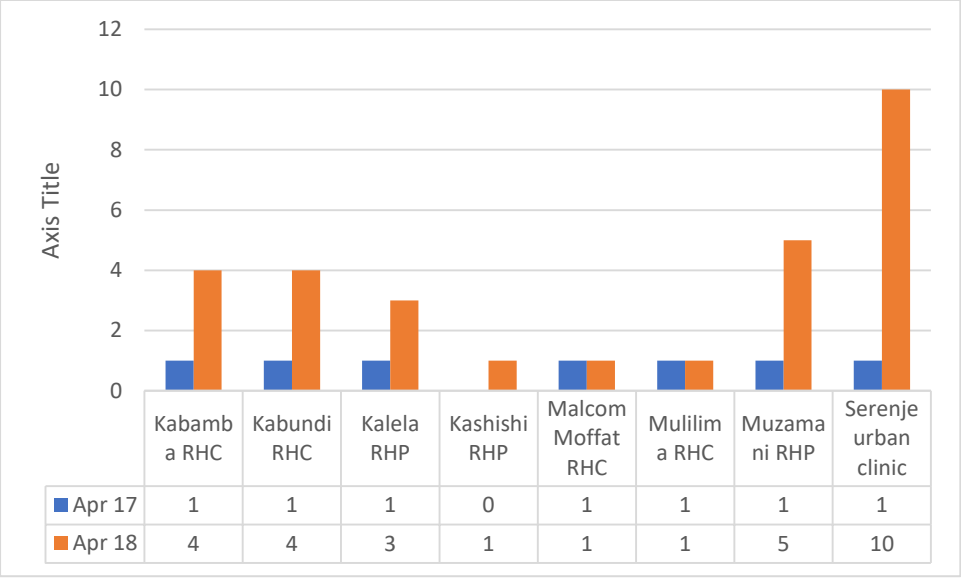
Table 6:Propotion of health staff who managed cases of severe malaria

Total: All Intervention Health Facilities	2017			2018				
Indicator	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**
H6: No. staff in this facility trained in Inj. AS	27	31	31	31	31	31	32	32
H7: No. staff in this facility who administered Inj. AS to children this month	4	13	14	21	16	14	21	20
H8: % trained staff who administered inj AS to children this month	15	42	45	68	52	45	66	63

Source: Health Facility Data

Data collected during the baseline and endline surveys shows the increase in numbers of staff trained in administering Inj. AS. This is presented below. It corroborates the findings from project monitoring data, and additionally shows that seven of the eight HFs had a cadre trained by the time the pilot project started. It means that where Inj. AS was available, there was some capacity to utilise it. However, prior to the training that was rolled out in October, Inj. AS was mainly being administered via the less effective IM route.

Figure 3: Number of staff trained in Inj. AS



3.2.3 Severe malaria drug availability at health facilities

The pilot project was able to register success because drug availability to manage severe malaria improved significantly. The project influenced the DHMT to make Inj. AS available at RHCs and RHPs. Availability of drugs to manage severe malaria was assessed at project baseline and endline. At the time of the baseline survey in August 2017, both Inj. AS and RAS (for distribution to communities) had

not yet been delivered to HFs. The table below compares the baseline and endline situation with regards to drug availability for managing severe malaria.

Table 7: Facilities with adequate drugs to last the next 30days

	Health Facility	Quinine	COARTEM	Inj AS	RAS
Baseline	Kabamba RHC				
August	Kabundi RHC	✓	✓		
2017	Kalela RHP				
	Kashishi RHP	✓	✓		
	Malcolm Moffat RHC				
	Mulilima RHC	✓	✓		
	Muzamani RHP	✓	✓		
	Serenje Urban Clinic	✓	✓		
Endline	Kabamba RHC	✓	✓	✓	✓
May	Kabundi RHC	✓	✓	✓	✓
2018	Kalela RHP	✓	✓	✓	✓
	Kashishi RHP	✓	✓	✓	✓
	Malcom Moffat RHC	✓	✓	✓	✓
	Mulilima RHC	✓	✓	✓	✓
	Muzamani RHP	✓	✓		✓
	Serenje urban clinic	✓	✓	✓	✓

At baseline, five out of the eight HFs (Mulilima RHC, Kabundi RHC, Serenje Urban Clinic, Muzamani RHP and Kashishi RHP) reported having stock levels that could last 30 days or more. The other three facilities (Kabamba RHC, Malcom Moffat RHC and Kalela RHP) reported having stocks that would last only a few days, and experienced stockouts at some points. At project endline, malaria drug availability had greatly improved. There were no reported stockouts during the entire time that the project was active. All facilities but one had adequate supplies of all drugs to last at least 30 days. Muzamani RHP was the only facility that had a week's supply of Inj.AS, although it had more than 30 days' supply of the other drugs. The drug availability situation at endline was thus much improved compared to baseline.

3.2.4 Access to quality assured RAS 100mg

MAM introduced RAS in Zambia for the first time. Based on calculations made at baseline[20], 3,000 doses were procured to cover the project's need (1,500 doses) and to have some stocks for use when the pilot ended while a plan for scale-up was being developed. The RAS procured had a shelf life of 2 years, which will allow CHVs to continue giving the pre-treatment for at least a year beyond the project's timeframe. The project made sure that all target communities had a trained CHV able to

[20] At baseline, the total number of severe malaria cases that were expected in project areas were calculated using HMIS data on incidence of malaria in project areas; and an incidence rate of severe malaria of 6% (based on discussions with health facility personnel in project sites, and literature review which showed the rate to be between 5-7%). The number of severe malaria cases estimated at baseline was therefore approximately 1,500.

administer RAS, and placed some stock at HFs that was used to replenish CHVs' supply. During the life of the pilot none of the CHVs registered any stockouts.

3.3 Project results in case management of severe malaria in children at community level

Work at the community level was spearheaded by trained CHVs and ETS drivers. The project recruited 477 CHVs (225 of whom were trained to administer RAS, while the balance performed community mobilization activities) as well as 66 ETS drivers. Details on these CHVs, including their demographic information and knowledge levels are discussed in subsequent sub-sections. The project indicators for Objective 2 are presented in the table below.

Table 8: Performance against Objective 2 targets

Results	SMART indicators	Target	Baseline	Endline	Sig.
Outcome 2: Increased number of children with suspected severe malaria, appropriately managed with RAS at the community level and effectively referred					
Indicator P2	Number and percentage of children who received QA RAS by CHVs in the project areas and referred to a designated referral health facility providing severe malaria treatment	40% (600/1500)	0	100%[21] (1215/1,215)	P<0.05
Indicator P3	Number and percentage of children who received QA RAS by CHVs in the project areas, completed referral to a designated referral health facility providing severe malaria treatment, and received a counter referral form with evidence of diagnosis/treatment	40% 600/1500	0	72% (871/1215)[22]	P<0.05
Output 2: QA RAS is introduced into existing community and the referral process is functional in project areas					
Indicator O2.1	Number and percentage of CHVs (who manage sick children) trained in project areas	47% 225/477	0	100% 477/477[23]	
Indicator O2.2	Number and percentage of trained and functional CHV in project areas who provided QA RAS	100% 225/225	0	100% (225/225)	
Indicator O2.3	Number of HWs from referral facilities trained on the appropriate management of referred severe malaria cases, including Inj AS	27	11	32[24]	
Indicator O2.4	Number and percentage of trained HWs at referral facilities in project areas who managed referred cases	83% 25/30	0	100% 32/32	
Indicator O2.5	Number of ETS drivers recruited and trained	66	0	66	
Indicator O2.6	Number and percentage of children with suspected severe malaria cases transported to health facility using ETS	31% 470/1500	0	59% of all cases (714/1215), 71% where ETS was available	P<0.05 for both figures

The outcome level indicators were attained and far exceeded the targets: 100% of identified cases of severe malaria were referred to a HF. The main output for this objective was on ensuring that QA RAS was introduced into existing community systems and the referral process was functional in all

[21] Based on project monitoring data. The endline survey shows a slightly smaller value (94%).
[22] Based on community monitoring data. Although 1,212/1,215 (99%) of children received referral forms from CHVs at community level, only 72% received a counter referral form from the health facility. This is also confirmed at endline, where 65% of respondents mentioned that they always received a counter-referral form, while 24% sometimes did.
[23] Based on both the endline survey and project monitoring data.
[24] Based on project monitoring data.

project areas. This was largely achieved: all identified CHVs were trained; 100% of children were provided with referral forms by CHVs, and 72% obtained counter-referral forms from the HF; 100% of trained CHVs provided RAS; health workers were trained and provided required treatment for all referred children; and the ETS carried a larger proportion of identified children than had been planned (59% actual vs 31% planned; and 71% of cases where ETS was available).

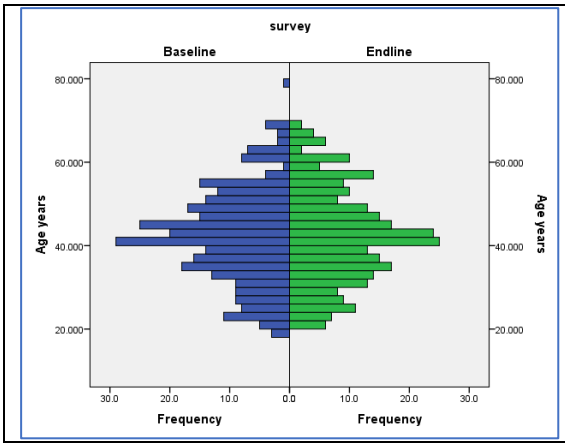
3.3.1 Type and quality of volunteers used

This section outlines the type and quality of CHVs used in the MAM project. This data is presented to demonstrate why the pilot produced the results that it did.

Age and Sex of CHVs and ETS Drivers

The age distribution of volunteers is presented in the figure below. Additional data is presented in the table that follows the figure. The average age of MAM-trained CHVs was 42.8 years for males at baseline, and 43.0 at endline; and 40.7 for females at baseline, compared to 41.1 years at endline. Thus, the typical male volunteer was about 43 years old, while the typical female volunteer was two years younger.

Figure 4: Age-sex structure of CHVs



Age years				
Gender	survey	Mean	N	Std. Deviation
Male	Baseline	42.75776	161	12.323137
	Endline	43.04032	124	12.573297
	Total	42.88070	285	12.411368
Female	Baseline	40.66923	130	9.984786
	Endline	41.12418	153	10.544592
	Total	40.91519	283	10.275628
Total	Baseline	41.82474	291	11.367234
	Endline	41.98195	277	11.515099
	Total	41.90141	568	11.429755

Education levels of CHVs

With regards to education, between 45-55% of CHVs had completed primary education, while 45-55% had secondary education. A small percentage of volunteers had not completed any education or completed tertiary education. There were no statistically significant differences between CHVs doing RAS work and ETS drivers, nor between baseline and endline (considering only those with primary or secondary education). The results show that the typical MAM CHV or ETS driver had attained a primary or secondary level of education.

Table 9: Education level of CHVs

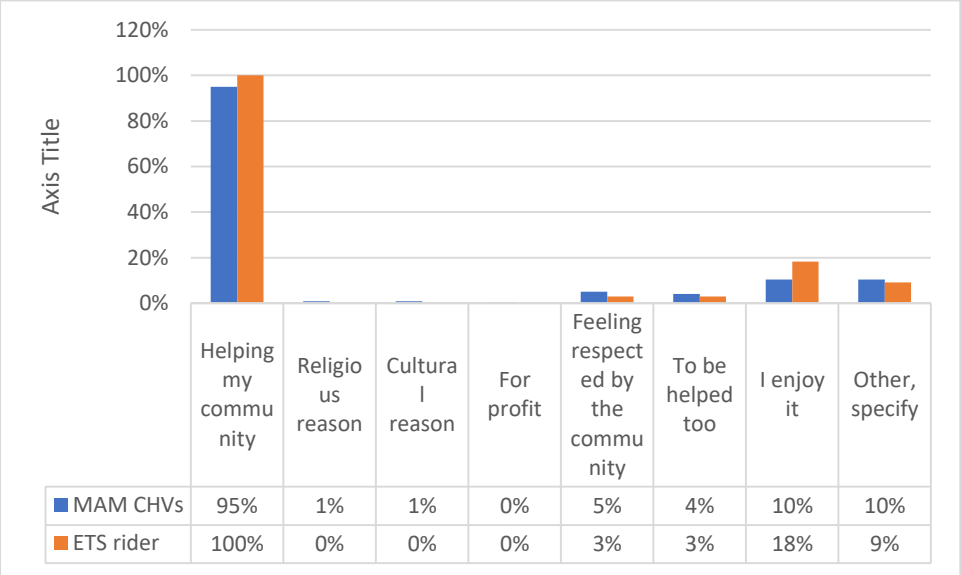
	Survey			
	Baseline		Endline	
	MAM CHVs	ETS rider	MAM CHVs	ETS rider
	Column N %	Column N %	Column N %	Column N %

What is your highest level of education?	None	0.0%	1.6%	1.2%	0.0%
	Primary	45.6%	55.7%	51.2%	57.6%
	Secondary	54.0%	42.6%	47.5%	36.4%
	Tertiary	0.4%	0.0%	0.0%	3.0%
	Other	0.0%	0.0%	0.0%	3.0%

CHVs source of motivation

At endline, all 277 CHVs interviewed were asked to indicate the reasons why they were volunteering. The most predominant reason was the need to help their communities (mentioned by 95% of CHVs and all 33 ETS drivers). About one-fifth of ETS drivers and a tenth of CHVs also mentioned that they volunteered because they enjoyed it.

Figure 5: Reasons for volunteering



When asked if they intended to continue volunteering, 97% mentioned that they did. 70% of CHVs and 81% of ETS drivers mentioned that they intended to volunteer 'forever'; while 27% of CHVs and 15% of ETS drivers intended to volunteer for a few years more. These results were consistent with observations made at both baseline and endline, where more than 85% of all volunteers had volunteered for two or more years.

The time spent on volunteer activities was 14 hrs for CHVs and 8 hrs for ETS drivers at baseline (significantly different between these two types of volunteers, $p=0.026$). At endline, both CHVs and ETS drivers were volunteering for approximately 14 hrs per week. Comparing the baseline to the endline situation, there was a significant difference in times spent by CHVs and ETS drivers volunteering ($p<0.05$).

CHV knowledge levels on uncomplicated malaria

At baseline and endline, both CHVs and ETS drivers were tested on their knowledge levels of uncomplicated malaria (fever, refusing to eat, chills, vomiting etc). Regarding what they believed were the causes of malaria knowledge levels were high at both baseline and endline,: 96% indicated

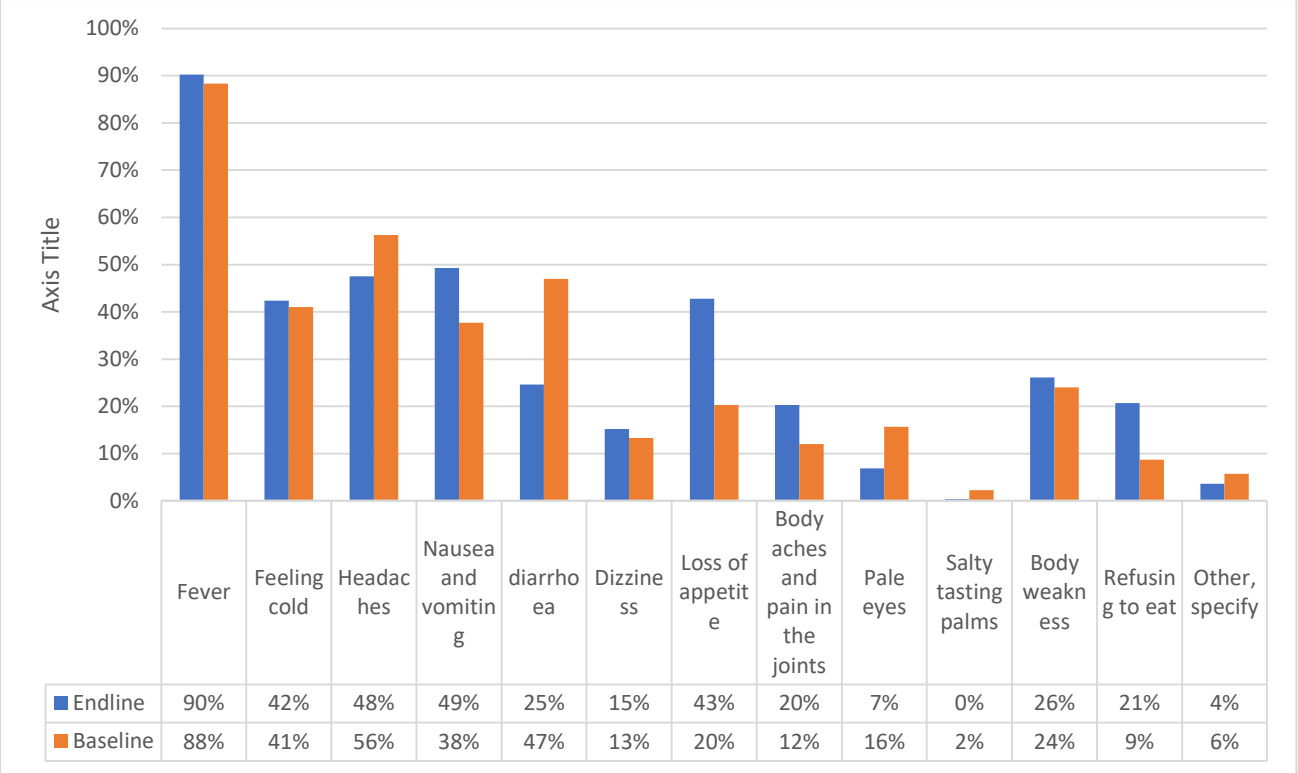
mosquito bites at baseline, while 98% indicated so at endline. Also, the percentages of CHVs who mentioned inaccurate causes such as drinking dirty water dropped from 16% at baseline to 7% at endline (see Table 5 below).

Table 10: Opinions on causes of malaria, and the people most affected

	Baseline		Endline	
	MAM CHVs	ETS rider	MAM CHVs	ETS rider
Malaria causes				
Mosquito bites	98%	90%	99%	94%
Eating immature sugarcane	2%	10%	3%	0%
Eating cold nshima	1%	3%	3%	3%
Eating other dirty food	3%	2%	3%	6%
Drinking dirty water	16%	7%	7%	6%
Getting soaked with rain	7%	0%	1%	0%
Cold or changing weather	5%	3%	1%	3%
Witchcraft	0%	0%	0%	0%
Don't know	1%	3%	0%	6%
Other, specify	5%	2%	5%	9%
People most affected				
Children	95%	97%	80%	79%
Adults	18%	44%	3%	0%
Pregnant women	19%	12%	7%	6%
Elderly	6%	0%	1%	6%
Everyone	6%	5%	19%	21%
Don't know	2%	0%	0%	0%
Other, specify	2%	0%	1%	0%

CHVs and ETS drivers were asked to mention the signs and symptoms of **uncomplicated** malaria that they knew. Most mentioned fever; nausea and vomiting; headaches; diarrhoea; and feeling cold. Of note, statistically significantly fewer CHVs and ETS drivers mentioned diarrhoea at endline, compared to baseline; and significantly more mentioned loss of appetite at endline (43%) than baseline (20%); ($p<0.05$ in both cases), signifying increasing knowledge levels.

Figure 6 Main signs and symptoms of malaria reported by CHVs and ETS drivers



	Fever	Feeling cold	Headaches	Nausea and vomiting	diarrhoea	Dizziness	Loss of appetite	Body aches and pain in the joints	Pale eyes	Salty tasting palms	Body weakness	Refusing to eat	Other, specify
Endline	90%	42%	48%	49%	25%	15%	43%	20%	7%	0%	26%	21%	4%
Baseline	88%	41%	56%	38%	47%	13%	20%	12%	16%	2%	24%	9%	6%

The percentage of CHVs and ETS drivers who indicated that they knew signs and symptoms of uncomplicated malaria in children was 86% at baseline, and 98% at endline ($p<0.05$, significant). Related to this, the percentage who said they knew the signs of uncomplicated malaria in children was 71% at baseline, and 98% at endline ($p<0.05$). The results show that almost all CHVs and ETS drivers indicated that they knew about the signs and symptoms as well as danger signs of uncomplicated malaria at endline compared to baseline. Both CHVs and ETS drivers were asked to mention all the danger signs that they knew. On average, CHVs and ETS drivers knew 3.7 signs and symptoms of uncomplicated malaria at baseline, and 3.9 at endline ($p=0.153$, not significant). The percentage who knew three or more danger signs was significantly higher at endline, 88% at endline, compared to 83% at baseline ($p=0.04$). Considering both the average number of danger signs known and number of CHVs who knew three or more danger signs, the results show that there was less variability in the number of danger signs known at endline, (which indicated that most knew the same type of signs), presumably the four from a list that included fever, feeling cold, headaches, nausea and diarrhoea.

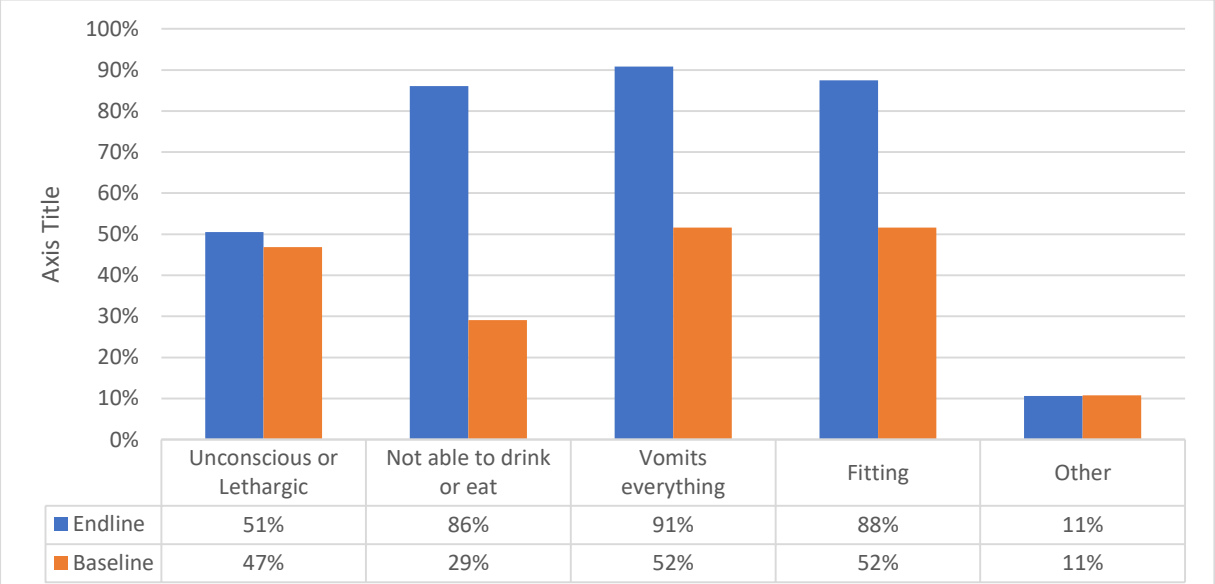
CHV knowledge levels on severe malaria

When asked at endline if they felt confident to recognise **severe** malaria danger signs (the danger signs being fever, fitting, refusing to eat, vomiting everything or being lethargic or unconscious), 95% of CHVs and 100% of ETS drivers responded affirmatively. Additionally, 98% of CHVs and 100% of ETS drivers also indicated that they were confident that they could administer RAS without any challenges.

CHVs were then asked to mention the danger signs of severe malaria. The figure below shows the reported danger signs. At endline almost all (91%) mentioned vomiting everything (baseline 52%, p,0.05); followed by fitting (88%, baseline 52%, $p<0.05$); followed by inability to eat or drink (86%,

baseline 29%, p<0.05); and unconscious or lethargic (51%; baseline 47%, p=0.06). Other signs mentioned by less than 10% of respondents were pale eyes, crying a lot, and diarrhoea. The results show that knowledge on severe malaria danger signs improved significantly, with more than 85% knowing three or more danger signs at endline compared to less than 50% at baseline.

Figure 7: Knowledge of severe malaria danger signs in children mentioned by CHVs and ETS drivers



The results show that at endline, the number of CHVs who knew about severe malaria danger signs had increased much more than that for uncomplicated malaria. It shows that the project had effectively filled a gap in CHVs' knowledge on severe malaria.

3.3.2 Case management of severe malaria

This section shows how CHVs managed cases of severe malaria in their communities. The data presented is largely drawn from the baseline and endline surveys. Community monitoring data already showed that all 1,215 cases of severe malaria that were identified were referred to HFs. This section further shows how CHVs and ETS riders managed cases at community level. CHVs were trained to provide one dose to cover a 12-hour period, and a second would be provided if it took longer than 12 hours before medical treatment was provided. CHVs provided RAS to children aged between six months and six years old.

During baseline and endline surveys, CHVs and ETS riders were asked when they had last managed a case of severe malaria in a child. At baseline, 24% of CHVs and 49% of ETS drivers had not managed any cases. At endline, all types of volunteers had managed a case, with 93% of all CHVs having managed a case during 2018.

Table 11: When was the last time you managed a severe malaria case in a child?

	Endline		Baseline	
	MAM CHVs	ETS rider	MAM CHVs	ETS rider

This year	98%	90%	70%	51%
Last year	2%	11%	5%	0%
More than two years ago	0%	0%	1%	0%
Not applicable	0%	0%	24%	49%
Total	100%	100%	100%	100%

At baseline, CHVs who had manged cases of severe malaria had either referred to a HF or to an i-CCM trained community health worker (RAS was not yet available).

The endline survey provided additional insights. None of the CHVs and ETS drivers reported doing nothing or using traditional medicines when presented with a case of severe malaria. Instead, most CHVs (71%) administered RAS themselves and referred the child to HF, while 29% referred cases to a CHV who could administer RAS (only 47% of CHVs trained by MAM were trained to administer RAS - the remainder were trained in severe malaria/child health community mobilisation only). In addition, 37% of ETS drivers could administer RAS themselves and refer straight to the HF.

At baseline, on average, each volunteer had identified 4.85 children with uncomplicated or severe malaria in the preceding 12 months (equivalent to about 0.4 cases per month). At endline, each one had identified an average of 3.5 children per month since RAS was made available, almost eight times the number before the project. Project monitoring data confirms this assertion: the total number of complicated and uncomplicated malaria cases identified by CHVs and ETS drivers was 11,638 (i.e 22 cases per CHV over seven months, or 3.14 cases per CHV over the period).

3.3.3 Referral of cases of severe malaria

At endline, CHVs provided insights into the referral of cases of severe malaria, including on the types of document used. 92%[25] of CHVs and 100% of ETS drivers interviewed mentioned having referred a case of a child to a HF. Of these, 87% used referral forms, while 11% used notebooks, the remaining used other materials (e.g. other paper).[26] According to this survey, 65% of CHVs and ETS drivers always received counter-referral forms or notebooks, while 24% sometimes did, and 11% never did. This result corroborates monitoring data which shows that counter-referral forms were given in 72% of cases. HFs indicated that they always provided counter-referral forms in 65% of cases, and sometimes provided these in 24% of cases. 94% of volunteers interviewed reported that they followed up to check on the health of severe malaria patients after they returned from the health facility[27] (see table below).

[25] The survey included some CHVs who were trained on mobilisation only, and referred cases to other CHVs who could administer RAS.

[26] CHVs were trained to use either an official referral form provided by the district, or to copy an official form into their notebooks and issue a form from their notebook. Both approaches were approved by the DHMT.

[27] This shows that CHVs who referred cases to RAS-trained CHVs did not necessarily participate in follow-up activities.

Table 12: Use of referral forms and follow up of clients by CHVs and ETS drivers

Question	Response	MAM CHVs	ETS rider	Total
Have you ever referred any children with suspected severe malaria to a health facility	Yes	92%	100%	92%
	No	8%	0%	8%
If yes, what type of written material or form do you use to refer clients to health facility.	Referral form	87%	100%	87%
	Notebook	12%	0%	11%
	Nothing	1%	0%	1%
	Other, specify	1%	0%	1%
If yes, what type of written material or form do you get from the health facility	Counter-referral form	83%	67%	82%
	Notebook	15%	17%	15%
	Nothing	2%	17%	3%
	Other, specify	1%	0%	1%
Frequency of provision of counter referral form by health facility	Always	66%	50%	65%
	Sometimes	24%	17%	24%
	Never	10%	33%	11%
Do you follow up to check on the health of clients after they have returned from	Yes	94%	100%	94%
	No	6%	0%	6%

Follow-up of severe malaria cases

Community monitoring data shows that CHVs followed up more than 1,215 cases where RAS was administered, which implies that some CHVs recorded multiple follow up visits in their reports. During follow-up visits, CHVs checked on the health status of the child, whether all medications had been taken as prescribed, and if there were and new danger signs. One case of adverse events was recorded. This was a case where a child who had been discharged from the HF continued to feel dizzy and showed some signs of allergic reaction to either artesunate or Coartem used in the treatment. This case was taken back to the HF. Apart from these, one of the three deaths occurred in the community even though a CHV had visited the child post discharge from the facility.

3.3.4 Use of emergency transport system

At endline, ETS drivers were asked about the distances they travelled to reach their nearest HF, the time it took them, and the numbers of children they had taken to HFs. The results are presented in the table below. On average, HFs were reported to be 14km away and took more than two hours to reach by bicycle ambulance. Each ETS driver had transported an average of 10 clients since the time they were trained in November 2017.

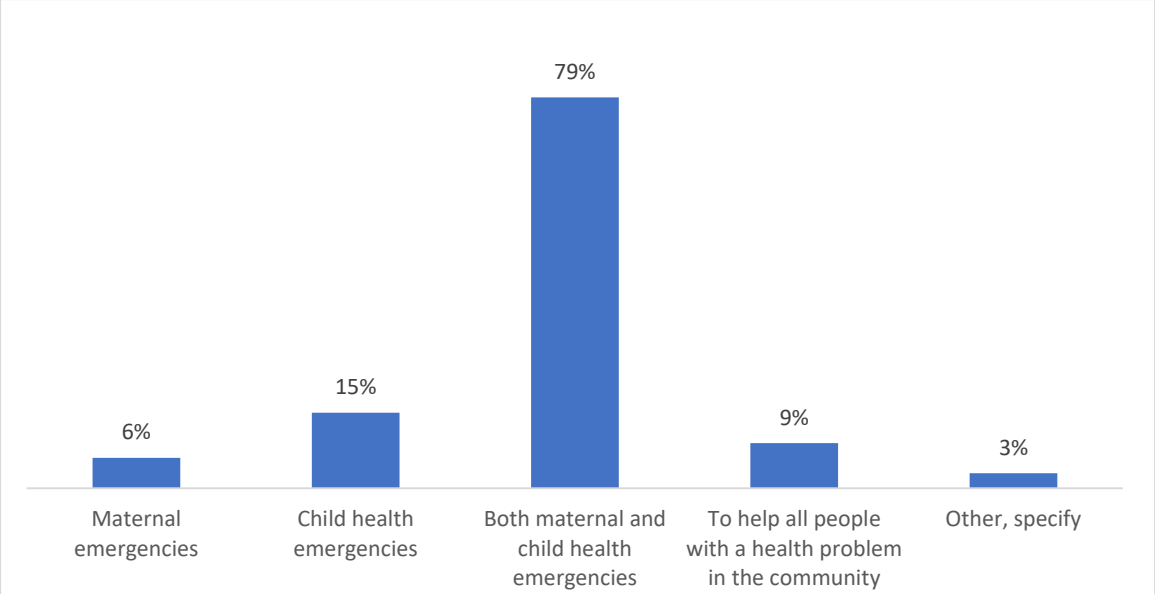
Table 13: Distance to health facility, time taken, and number of clients transported by ETS drivers.

	Mean	N	Std. Deviation
What is the distance in KM from your community to the HF?	13.8	31	7.9
How long (in minutes) does it take you to reach the health facility with a patient	113.9	33	75.7

How long does it take you to reach the health facility on foot?	179.2	33	116.3
How many children suspected of having severe malaria have you transferred to the health facility since the time they were trained.	10.3	33	10.7

ETS riders provided insights into what community members thought were the intended uses of the bicycle ambulances. 79% of ETS riders reported that community members thought that the bicycle ambulances were meant for both maternal and child emergencies, 15% believed they were for child health emergencies only, 9% thought they were for all health issues and 6% thought they were maternal emergencies only (see figure below). ETS was initially put in place to cater for maternal emergencies but is now used for severe malaria cases as well. This is in line with policy around integration of services and promotes wider coverage of maternal and child health response systems at community level.

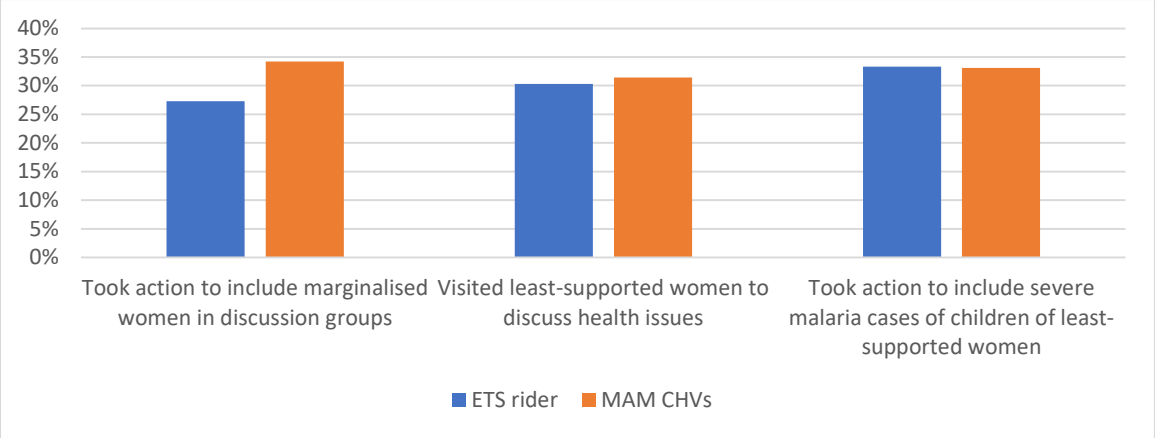
Figure 8:What community members thought were the purposes of the bicycle ambulances



3.3.5 Social inclusion

Social inclusion is an important consideration for health access and health equity. The earlier MORE MAMaZ project (2014-2016) had identified that women who lacked social and other forms of support from their husbands and families were less likely to utilise health services and more likely to self-exclude from community activities and events. Drawing on this learning, MAM integrated a focus on social inclusion in the training of CHVs and ETS riders. All volunteers were encouraged to identify and support women and children who lacked support. Some social inclusion questions were included in the endline survey. Specifically, CHVs and ETS drivers were asked to indicate if they had taken any actions to include poorly supported women in community discussion groups, if they had visited least-supported women to discuss health issues and if they had deliberately supported the children of any of these women. A third of the volunteers (33%, 31% and 33% respectively) indicated that they had taken these three actions. The results are presented in the figure below.

Figure 9:Actions taken to include least-supported women.



Case Study: Social Inclusion

Barbra Bwale and her family live in the catchment area of Kalela Rural Health Post in Serenje. Both she and her husband suffer from mental health issues. They currently have 7 children, but several of their children have died in the past. Until a year ago, Barbra had never visited a health facility or been supported by a CHV. Her extended family found it difficult to support her because they live a long way away. CHVs were informed of Barbra's predicament and she was put on a list of community members needing frequent support. Following a first visit by a CHV, Barbra attended an ante-natal care session at the health facility. She was invited to severe malaria discussion sessions when they started in her community. Sometime later Barbra gave birth to a baby girl.

Barbra said:

"The CHVs have taught me a lot. They visited me when I was pregnant. I have received good education from them, financial support from the community savings scheme, food from the community and my family now comes to help me…. When I was due to deliver volunteers organised a bicycle ambulance to take me to the clinic…..The CHVs are still visiting me regularly and I have learnt severe malaria signs like fever, vomiting all, failure to feed….I now go to the under-fives clinic, and community meetings. We have even joined the agricultural co-operative programme to benefit from farming inputs. The CHVs are good people. You can see that my child is in good health."

3.3.6 Problems reported with administering RAS

The endline survey provided an opportunity to ask CHVs what challenges they faced with administering RAS. Twenty CHVs reported any challenges. These were:

- When RAS must be administered at night and there was no reliable light (five cases). This included an additional challenge to take the child to the HF in the dark.
- When there is no additional helper to calm the child down, or hold them still when inserting RAS (seven cases).
- When the child was lethargic or unconscious (five cases).
- Children with severe diarrhoea had difficulties keeping the RAS in place (13 cases).
- One CHV felt that community members thought she was too young to administer RAS (she was in her 20s).

- Lack of protective clothing (gloves - one case). HFs provided disposable gloves to CHVs in most cases.
- Parental acceptance at the beginning of the project, and if the CHV was male and the sick child was female (1 case).

When asked what general challenges each volunteer faced, the three main ones were transport (to visit clients and travel to HFs), long distances to HFs, and absence of material that would identify them as CHVs. Supportive monitoring visits to CHVs identified another challenge: some caregivers want their children over the ages of 6 to also receive RAS.

4. Discussion

This section provides a discussion of the results achieved by the MAM pilot project and offers suggestions on how the pilot can be scaled up.

4.1 RAS contribution to reducing mortality

The results from MAM show the main impact from implementing the pilot: the reported case fatality rate from severe malaria reduced from 8% at baseline, down to <0.5% at the end of May 2018. At the same time, severe malaria danger signs were identified in 1,215 children - up from 224 at baseline. This indicates a significant increase in ability to identify severe malaria danger signs at community level and refer children to HFs without delay. The results suggest that before the intervention many cases were not identified, and thus a significant number of deaths were occurring in communities without being reported.

The drop in number of deaths can be attributed to project activities and other activities taking place in the target areas. The data shows that deaths from severe malaria in children below the age of 1 completely disappeared, from 10 before the project started to 0. Maintaining the assumptions made at baseline and adjusting for the 16% reduction in overall incidence of malaria, the total number of severe malaria cases that would have been recorded without the project would have been 188, resulting in 15 deaths. We estimate, therefore, that in the project areas deaths reduced from 18 to 3, with 12 deaths avoided due to the activities of the project, and three due to a decline in malaria incidence.

The overall picture of malaria incidence showed decreasing numbers of cases between July 2016 and April 2018 (cases reached a peak of 5,141 in February 2017 and a lower peak for the following high season of 4,324 in February 2018). Discussions with government officials in Serenje District indicated that various malaria prevention measures were being implemented regularly, with distribution of insecticide-treated nets (ITNs) undertaken in November 2017 and indoor residual spraying conducted in January and February 2018, which could have contributed to a decreased number of cases. Regardless, the number of severe malaria cases identified was quite high at 619, compared to 187 the year before; showing that the project was able to identify an additional 432 cases that would probably have gone unreported. This would have resulted in at least 59 deaths occurring at home, assuming the same case fatality rate observed at baseline. Based on this, the number of severe malaria related deaths at baseline was at least 77; but only a few, less than 25%, were reported through the HMIS.

4.2 Treatment of severe malaria

There is a difference between numbers of severe malaria cases identified by CHVs (1,215) and those treated with Inj. AS at HFs (970). CMS data shows that all cases of suspected severe malaria identified by CHVs were referred to a HF. Project personnel believe that there are many different reasons for the difference between reported RAS cases and reported cases treated with Inj AS: some RAS beneficiaries may have been referred to another HF, or some may have chosen to use another

HF (for example the District Hospital, which was not an intervention HF); it is also possible that some RAS beneficiaries may have been misdiagnosed at community level or their symptoms may have improved due to the RAS pre-treatment before reaching the HF. These factors may also help to explain the differences noted in the project monitoring data and the final HMIS entries; however, this issue warrants further investigation.

Extrapolating the calculations made at baseline, and after adjusting for the decline in incidence of malaria, it is observed that the project would have expected to see 1,260 severe malaria cases in the project sites between July 2017 and June 2018. This is close to the numbers identified by CHVs (1,215 excluding June-September which are low malaria season months). A follow up of 30 cases through a diagnosis verification exercise undertaken in June 2018 found that in 70% of cases, the health workers agreed with the CHV's suspicion of severe malaria. There are two possible reasons why the remaining 30% of cases were not categorised as severe malaria by health providers: some cases were misdiagnosed by CHVs and some were misdiagnosed by health providers who may have recognised an improvement in symptoms following administration of the RAS pre-treatment. A larger scale and more detailed verification exercise would be able to determine the reasons for the different categorisation of cases and whether over-prescribing of RAS or under-prescribing of Inj. AS is the issue.

4.3 Collaborations between HFs, CHVs and ETS drivers

This project showed that it was possible to bridge the transportation gap between HFs and communities. 100% of severe malaria cases were provided with a referral form from the community and 72% of these cases received a counter-referral form from the HF. The drop in counter referral forms issued was because some health personnel did not issue them, and also, some cases identified by CHVs as having severe malaria danger signs were not diagnosed as such by HF staff. In the project areas, each CHV was catering for about 250 population, which was about half the number stipulated in government policy (1:500). Even then, distances between households and from HFs required that numbers of trained CHVs be varied accordingly. Communities around Serenje Urban Clinic, although having many households, had fewer CHVs (10), compared to Muzamani (38) which is less densely populated but more dispersed.

Time spent volunteering was close to 16 hrs per week- equivalent to two full 8-hour shifts. Each volunteer spent an equivalent of about two hours per day on volunteer activities. Practically, however, CHVs were able to set aside days and time periods when they focused on volunteer work, while ETS drivers were required to respond to emergencies, rendering their services demand-driven. If the current national CHV strategy is rolled out with a ratio of 1 CHV to 500 population, CHVs will be expected to spend up to 4 8-hr shifts per week on volunteer activities. This workload is likely to impact negatively on CHV motivation and retention and could reduce the CHVs' capacity to reach and include the entire community, including the most vulnerable members.

4.4 Training approach

The training approach used by MAM is appropriate in low literacy settings that have a strong oral tradition. The approach relies on song, dance, mime and use of communication body tools (where key

health messages are spoken and then demonstrated using different parts of the body) as opposed to printed IEC materials. This largely paperless approach[28] is affordable for government and logistically easier to implement (i.e. much of the cost associated with printing and distributing training manuals, flip charts, picture cards and other IEC materials is avoided).[29] Lower costs increase the replicability of this approach.

The MAM training approach lends itself to adaptation to suit specific social-cultural contexts. Local languages and idioms, and reference to specific beliefs and practices that are familiar to particular ethnic groups or localities, are easily incorporated into the approach. In Zambia, the training approach has been used in 14 districts and has been adapted to suit a variety of ethnic groups, languages and socio-cultural contexts.

The CHV training approach used by MAM is an adaptation of the evidence-based training approach developed by the UK Aid-funded MAMaZ Programme (2010-2013) and which was further refined by the Comic Relief-funded MORE MAMaZ Project (2014-2016). Under these projects, the training approach was implemented in 14 districts, covering a population of 669,000. Both projects exceeded their core targets using this approach. MAMaZ increased the skilled birth attendance rate by 27% over a two year period, and MORE MAMaZ increased this rate by 32% over a shorter timeframe while working on a significantly larger scale.

Prior to MAMaZ, a similar training approach was used in Northern Nigeria by the UK Aid and Norwegian Government funded PRRINN-MNCH programme (2008-2014), implemented by Health Partners International. The MAM training approach is therefore tried and tested, having proved effective on both a small- and large-scale, and over a timeframe of a decade in many districts and provinces of Zambia and in a variety of states and local government areas in Nigeria.

4.5 Community monitoring system

The CMS in Serenje has several purposes: to generate health-related data that are useful for the district; to highlight gaps in existing data collection systems that focus on HF level; to build district understanding of and capacity in community health systems strengthening; and to influence national level thinking about how to extend the HMIS down to community level. Questions about the sustainability of CMS therefore need to look at the impact the project has had in all four areas. Sustainability can be taken to mean:

- The extent to which CHVs continue to collect and report health- and community engagement-related data beyond the end of the project
- The extent to which HF staff are able to effectively supervise CHV data collection efforts
- The extent to which districts have a deeper understanding of the role and potential of CHVs and the data they collect

[28] Job aids are, however, used at facility level within MAM.
[29] MAM does, however, use one job aid which was produced by MMV. The latter is given to the CHVs that are trained to administer RAS. The job aid acts as an aide memoire on issues such as correct positioning of a child to receive RAS; the quantity of drug to use and so on.

- The extent to which the MOH incorporates some of the learning from MAM / the MAMaZ projects into its thinking about the new community component of the HMIS

In both MAMaZ and MORE MAMaZ a considerable amount of support was given to CHVs to instil a culture of activity monitoring and data collection. Strong linkages between communities and the HF are required to sustain these activities - if data are not requested or used outside the community, then communities are less likely to collect it systematically. By the end of MORE MAMaZ gaps in the provision of supervisory support to communities and CHVs were evident in some facility catchment areas in Serenje, less so around other facilities. Demand for community-generated data also needs to come from the DHMT. The fact that so many additional cases of severe malaria were detected by CHVs highlights the limitations of the current HMIS and the unmet need for treatment of severe malaria at community level.

4.6 Emergency Transport System

The link between communities and their local HF is the lowest level of the referral system. The lack of affordable transport options available to rural communities in Serenje contributes substantially to health-related barriers and delays. Community-owned and managed ETS can play an important role in extending the referral system down to the lowest level. In Serenje, the ETS comprises bicycle ambulances (a bicycle and a covered trailer). This intermediate mode of transport is appropriate to the terrain and fits well with the existing bicycle culture.

The ETS can be adapted based on the realities on the ground, including factors such as what type of transport is already available, the topography and terrain. For example, in other more sandy districts, MAMaZ and MORE MAMaZ developed an ETS system based on use of oxen and carts. Different localities may require different technological solutions, for example in Madagascar cycle-rickshaw ambulances, canoe ambulances and stretchers have been used.

ETS is, however, about more than the hardware. For ETS to function effectively, it needs to be managed by trained and highly motivated riders, supported by traditional leaders, accepted by local communities, linked to the HF, and integrated with other activities within the community health system. Questions about the replicability of ETS therefore necessarily need to extend beyond the technology *per se* and include a focus on the underlying community engagement approach that helps to ensure that ETS functions effectively. The specific aspects of MAM's ETS component that are replicable to other areas and countries are its emphasis on:

- Introducing an ETS that is appropriate to the context and which can be sustained using local resources. This could be motorised or non-motorised.
- Building community capacity to own, manage and maintain their ETS system
- Using an ETS rider training approach which is socio-culturally appropriate and relevant
- Training ETS riders to operate as part of the community health system by emphasizing their linkages to other CHVs and to the local HF

4.7 Considerations for scaling up RAS

As a health system strengthening intervention, MAM built capacity on a number of levels: within intervention communities and intervention HFs; within the DHMT and among the wider district health team. The project also engaged with and shared its experience and learning with provincial and national level government stakeholders to inform thinking on national scale-up.

Key questions relating to replicability and scale-up that are relevant to MAM include whether the MAM approach can be replicated outside the intervention sites in Serenje; which specific aspects of the approach are replicable; to what extent the MAM approach is scalable; and what the potential scale-up opportunities in and beyond Zambia are.

4.7.1 Scalability of MAM in Zambia

MAM uses an adapted version of an approach that has already been piloted and implemented on a larger scale in Zambia. MAMaZ was implemented in six districts of Zambia and covered approximately 25 percent of the respective district populations. MORE MAMaZ was implemented in five districts and covered an average 74 percent of the district populations. The geographical areas that were not covered by MORE MAMaZ were urban, peri urban or military areas that were considered low priority by the DHMTs. MORE MAMaZ's national scale-up component also supported the roll-out of the project approach in an additional 15 districts. Other districts also benefited from the project approach when core components of the project's community engagement approach were integrated into the 2016 National Safe Motherhood Action Group Training Manual, the manual that is used to train maternal and newborn health CHVs nationwide. The approach used by MAM was originally developed for implementation in Nigeria by Health Partners International. Under the PRRINN-MNCH programme, the approach was used to train 34,000 CHVs who, in turn, reached a population of over seven million. This was one of the largest community engagement initiatives ever to be implemented in Nigeria and resulted in significant improvements in health indicators. Hence, the approach used by MAM has proved scalable both within and outside Zambia.

4.7.2 Scaling Up Opportunities in Zambia

There are many scaling up opportunities for MAM in Zambia. The MOH plans to roll out RAS at community level in 2019. MAM is well-placed to support this process.

Priorities for MAM in Zambia are to:

- Take the learning from the pilot project in Serenje and apply it on a larger scale in Zambia.
- Scale up in districts where the MAM consortium has worked before (where there are well trained and motivated CHVs), and build on pre-existing relationships and capacity.
- Adopt a cluster approach to scale-up where implementation focuses on a cluster of districts in a province. Provincial Health Authorities may favour this approach since it encourages regional experience sharing and the sharing of resources across district borders.
- Adopt and implement a national scale-up component which focuses on supporting NMEC to role out the project approach on an even larger scale.

- Ensure integration of the community RAS training in national i-CCM and other CHV training manuals.

There are 14 districts located in Southern, Muchinga, Central and Western Provinces where the MAM consortium has worked previously and where there are longstanding partnerships with communities, HFs, district health teams and DHMTs. Working in a selection of these districts would allow MAM to demonstrate how to effectively implement the project activities on a larger scale. The addition of a national scale up component will enable the project to support implementation in areas beyond the main implementation districts. This could be done by:

- Working in partnership with NMEC, supporting their national scale-up priorities in a flexible way
- Supporting the training of a pool of CHV master trainers who can roll out the RAS and community mobilisation training in additional districts - and on a large scale
- Encouraging experience sharing between implementing and non-implementing districts by arranging exchange visits

4.7.3 Scaling Up Opportunities in Other Countries

Implementing the MAM approach in other countries in the region is very feasible. However, scaling up would be quicker and potentially easier to achieve in Zambia. Working in a new country will entail beginning with a pilot intervention to provide proof of concept before progressing to working on a larger scale. Any pilot would benefit from the application of the learning from MAM in Zambia. Nevertheless, key approaches and activities used in Zambia would need to be adapted to suit the new implementation context and hence would need to be tested on a small scale to see if they work.

It is worth noting that MAM was built on the foundations laid by, and achievements of, two predecessor projects. Other countries may lack this foundation, and this could mean that implementation is slower in comparison. However, there are likely to be other existing community health programmes that could be built on.

4.8 Programme costing data

Various components of the pilot project have been costed and are presented below. These represent the costs to a DHMT of rolling out MAM interventions within the district following a small pilot or demonstration intervention. The figures assume the following:

- DHMT can capitalise on design and other investment costs made by MAM
- DHMT can use its own RAS master trainers to train CHVs in new sites within the district
- Costs assume interventions are targeted to an average of six communities around each HF
- Costs assume 14 CHVs per intervention community (five Lead CHVs and nine ordinary CHVs) and two ETS riders per community

Table 14:Scaling up into new sites in a district following a small 'demonstration' input

Intervention	Explanation	Cost Assumptions	Cost Per Facility	Cost Per Community	Cost Per Trainee/Unit

Training in RAS administration and SM community mobilisation training	Training is provided direct to Lead CHVs by master trainers	Training of 5 CHVs per community. 4 day training. Held in central location.	GBP 1,746	GBP 291	GBP 58
SM community mobilisation training	Training is cascaded down by Lead CHVs to ordinary CHVs	Training of additional 9 CHVs per community. 3 day training provided at community level	GBP 1,220	GBP 203	GBP 23
Community discussion groups and other mobilisation activities	CHVs mobilise communities using community discussion group methodology, door to door visits, and establish safety nets	HF staff supervisory visits required during the early part of the cascade. Should come out of general supervisory budget	-	-	-
Community Monitoring System	CMS tools have already been developed. The costs would relate to provision of supportive supervision by HF staff	Supervisory inputs can be combined with outreach visits, and hence should be no additional cost to government.	-		-
ETS training	Cost of training new ETS riders in new sites	Training is 2 days. Held at community level. Delivered by DHMT ETS focal person.	GBP 495	GBP 83	GBP 41
ETS vehicles	Cost of providing new ETS vehicles in new sites	One ETS vehicle per intervention community. Assume 6 communities per HF.	GBP 3,510	GBP 585	GBP 585
ETS accompanying bicycle	With each ETS vehicle, bicycle provided for use by accompanying riders	One accompanying bicycle per ETS vehicle. Assume 6 ETS vehicles per HF.	GBP 600	GBP 100	GBP 100
CHV 'tools of the trade'	Identification t-shirt, notebooks, pens	Kit per CHV. Assume 14 trained CHVs per community. 6 communities per HF.	GBP 672	GBP 112	GBP 8
ETS riders 'tools of the trade'	High visibility vests, gum boots, torch	Gum boots (GBP 12); reflector vests (GBP 9); solar torch (GBP 5). Total kit = GBP 26	GBP 312	GBP 52	GBP 26
RAS and Inj art and commodities procurement	Procurement of additional SM drugs and RDTs etc	Covered by MOH	-	-	-
CHV/ ETS rider sitting allowances	Quarterly meetings at HF	Estimated at K50 per meeting per CHV per quarter (96 vols in total)	GBP 1,107 pa	GBP 185 pa	GBP 11.50 pa

Summary

Estimated total unit costs per RAS CHV (training, kit and sitting allowances for ongoing supervision) = GBP 77.50

Estimated total unit costs per ordinary CHV (training, kit and sitting allowances for ongoing supervision) = GBP 42.50

Estimated total unit costs per ETS rider (training, kit and supervision) = GBP 78.50

Estimated total cost for one community to have ETS (2 x trained, equipped and supervised riders, 1 bicycle ambulance and accompanying bicycle) = GBP 843

Estimated total cost for one community to have trained severe malaria volunteers, and ETS system = GBP 1,611

ETS and CHV training comprise 52% and 48% respectively of the total cost of the community intervention

All figures in this document are based on a reworking of the design costings (spreadsheet available separately)

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

MAM increased the availability of RAS and Inj. AS for treatment of children with suspected severe malaria in Serenje District, Central Province, Zambia. A large number of children with suspected severe malaria were appropriately managed with RAS at community level and effectively referred to HFs. The severe malaria case fatality rate among children aged < 1 to 5 years reduced significantly – from 8% to 0.48%, showing that it is possible to eliminate malaria. Intervention communities readily embraced the need for early identification and referral of severe malaria cases. MAM's emphasis on social inclusion helped ensure that no-one was left behind. This is crucial – the least-supported often have the poorest access to services and carry the highest burden of ill-health.

An effective partnership between MAM, Serenje's DHMT and NMEC was central to the results achieved. The Serenje pilot demonstrated proof of concept – that RAS can be effectively administered at community level by trained CHVs – and generated robust evidence of impact. The pilot therefore paves the way for and provides a strong rationale for wider national scale-up. MAM was implemented where there were large numbers of highly motivated and well-trained SMAGS. SMAGs were trained alongside i-CCM volunteers and proved just as effective as CHVs with previous malaria training at identifying and managing severe malaria cases.

MAM trained up to 14 CHVs per intervention site. The large number of CHVs helped increase coverage and created a network of volunteers to support each other. This was positive for CHV motivation and for sustainability. 'Whole community' approaches are needed to change social norms in favour of improved child health care seeking. A whole community response cannot be achieved in situations where only one or two CHVs are trained per community.

The average distance to the HF in the project's hard-to-reach intervention sites was 13.8 kms. Community-based ETS can significantly reduce travel times to the HF and be a positive factor in encouraging prompt referral of very sick children.

Increasing demand for SM services is only fully effective when a comparable improvement in the supply-side occurs. A reliable supply of drugs and consumables, and well-trained health providers were significant factors in encouraging use of severe malaria services. HFs also need to be accessible at all times. As community RAS is rolled out in Zambia, it will be important to ensure that CHVs receive adequate training on community mobilisation, drawing on proven practices from MAMaZ Against Malaria.

5.2 Recommendations

Based on outcomes and experiences of the MAM project and team, the following recommendations are made:

- MAM provided proof of concept that QA RAS administered at community level in rural Zambia is a highly effective intervention for severe malaria among young children (6 months to 6 years old). The severe malaria case fatality rate in this age group fell by >95%. It is recommended that community RAS is scaled up across the country as part of Zambia's strategy for reducing severe malaria mortality.

- RAS is not yet available in Zambia. It is recommended that development partners work with the MOH to expedite procurement of RAS through the national system so that the community RAS intervention can be scaled up to other rural districts in 2019. Once procured, it will be important to ensure timely quantification and procurement of stock to ensure future supply and prevent stock-outs.

- Effective case management of severe malaria in young children requires access to RAS, inj. AS, and commodities such as RDTs and disposable gloves. An uninterrupted supply of these essential drugs and commodities will be essential as community RAS is scaled up in Zambia.

- MAM demonstrated that different cadres of CHV can be successfully trained to administer RAS and mobilise communities around a child health agenda. Training a variety of CHVs (SMAGs, i-CCM, CHWs) builds on existing structures, increases coverage, promotes equity of access to severe malaria services, helps sustain the CHVs' work, and is cost-effective. It is recommended that the MOH follows this approach and incorporates good practice from MAM's RAS training approach into i-CCM and other CHV training manuals.

- The average distance to the HF in the project's hard-to-reach intervention sites was 13.4 kms. Community-based ETS can significantly reduce travel times to the HF and be a positive factor in encouraging prompt referral of very sick children.

- Increasing demand for severe malaria services is only fully effective when a comparable improvement in the supply-side occurs. A reliable supply of drugs and consumables, and well-trained health providers were significant factors in encouraging use of severe malaria services. HFs also need to be accessible at all times.

Annex 1: Project evaluation data

Annex 1 a: Community monitoring system data used in this report

Indicator	Kashishi	Kabamba	M. Moffat	Mulima	Urban	Kabundi	Kalela	Muzamani	Total
No. children with severe malaria danger signs seen by CHVs	32	191	73	308	131	230	34	216	1215
No. children with suspected severe malaria given RAS	32	191	73	308	131	230	34	216	1215
No. children with suspected severe malaria tested with an RDT	32	191	73	307	130	230	34	216	1213
No. children with suspected severe malaria given referral form/letter to take to HF	32	191	73	308	128	230	34	216	1212
No. children with suspected severe malaria given counter-referral form by HF	26	126	73	235	18	144	34	215	871
No. children with suspected severe malaria who died	1	1	0	0	0	1	0	0	3
No. door-to-door visits for *general awareness-raising* on severe malaria and other childhood illnesses	64	597	56	592	560	786	178	371	3204
No. door-to-door visits to *follow up children* with severe malaria	32	255	50	276	166	191	38	218	1226
No. sick children (suspected severe malaria cases) transported to HF by ETS	18	90	1	248	0	92	32	233	714
Total no. sick children (all other illnesses) transported to HF by ETS	21	89	0	219	0	136	68	305	838
Percentage of children with SM transported by ETS in sites with ETS									71%
No. RAS-trained CHVs	18	40	10	39	41	48	10	21	227
Average number of RAS trained CHVs administering RAS per month	4	13	4	20	12	20	4	11	
Average number of RAS trained CHVs administering RAS as % of total RAS CHVs	21	33	37	51	30	42	37	51	

Source: CHV records kept in the Project Community Monitoring System

Annex 1b: Selected indicators from the health facility data

Table 15: Project indicators on access to RAS

Indicator	Total
H1: No. cases of uncomplicated malaria per month (children 5 years or under)	10,423
H2: No. cases of severe malaria per month (children 5 years or under)	1,215
H3: No. children with severe malaria given Inj. AS	970
H4: No. children with suspected severe malaria treated with RAS in the community	1,215
H5: No. counter referral forms issued for children with severe malaria this month	871
H6: No. staff in this facility trained in Inj. AS	32
H7: No. staff in this facility who administered Inj. AS to children	32

H8: Highest monthly % of trained staff who administered inj AS to children tat month	63

Source: Health Facility Data

Annex 1c: Summary results from the endline and baseline surveys

Table 16:CHV Motivation and Retention

Indicator	Baseline	Endline
Intention to continue volunteering forever (CHVs and ETS riders)	-	71.2%
Intention to continue volunteering forever (ETS riders)	-	81.8%
Intention to continue volunteering forever (CHVs)	-	69.7%
Volunteers motivated by wish "to help my community" (CHVs and ETS riders)	-	95.6%
Volunteers motivated by making a profit (CHVs and ETS riders)	-	0.4%
Volunteers motivated by religion (CHVs and ETS riders)	-	0.7%
Volunteers motivated by feeling respected by the community (CHVs and ETS riders)	-	4.7%
Volunteers motivated by a wish to be helped too (CHVs and ETS riders)	-	4%

Table 17:Years and Time CHVs Spend on Volunteering

Indicator	Baseline	Endline
Average years spent volunteering (male CHVs)	6.38	3.4
Average years spent volunteering (female CHVs)	4.27	4.34
Average years spent volunteering (male ETS riders)	2.9	4.2
Average years spent volunteering (female ETS riders)	2.78	5
Average hours per week on voluntary activities (male CHVs)	13.6	20.3
Average hours per week on voluntary activities (female CHVs)	13.6	12.2
Average hours per week on voluntary activities (male ETS riders)	8.7	11.7
Average hours per week on voluntary activities (female ETS riders)	4.6	38.6

Table 18:Households Served by CHVs

Indicator	Baseline	Endline
Average number of households served (CHVs and ETS riders)	232.9	213.1
Average number of households served (CHVs)	257.2	192.7
Average number of households served (ETS riders)	137.3	366.5

Table 19:Community Perceptions on the Purpose of the ETS

Indicator	Baseline	Endline
What do community members think is the main purpose of the bicycle ambulances (maternal and child health emergencies)	-	78.8%
What do community members think is the main purpose of the bicycle ambulances (maternal health emergencies only)	-	6.1%
What do community members think is the main purpose of the bicycle ambulances (child health emergencies only)	-	15.2%

What do community members think is the main purpose of the bicycle ambulances (to help everyone with a health problem in the community)		9.1%

Table 20:ETs Rider Motivation and Support

Indicator	Baseline	Endline
What motivates you as an ETS rider? Helping my community		100%
What motivates you as an ETS rider? Religious reasons		3.1%
What motivates you as an ETS rider? For profit/personal gain		0%
What motivates you as an ETS rider? Feeling respected by the community		0%
What motivates you as an ETS rider? Possibility of being helped too		9.4%
What kinds of support do ETS riders get from the community? recognition	-	36.4%
What kinds of support do ETS riders get from the community? praise	-	3%
What kinds of support do ETS riders get from the community? material support	-	24.2%
What kinds of support do ETS riders get from the community? financial support	-	3%
What kinds of support do ETS riders get from the community? nothing	-	48.5%
What kinds of support do ETS riders get from the community? other	-	3%

Table 21:Distance and Time to the Health Facility and When ETS is Used

Indicator	Baseline	Endline
What is the distance (in kms) from the community to the health facility?	13.43 kms	13.84
How long does it take you to reach the health facility with a patient (using ETS)?		114 mins (just under 2 hours)
How long does it take you to reach the health facility by foot?		179 mins (just under 3 hours)
What time of the day do you get the most ETS transfers? (all the time)		51.5%
What time of the day do you get the most ETS transfers? (morning - 6am-midday)		12.1%
What time of the day do you get the most ETS transfers? (daytime - midday - 6pm)		6.1%
What time of the day do you get the most ETS transfers? (evening - 6pm-10pm)		0%
What time of the day do you get the most ETS transfers? (night - 10pm - 6am)		30.3%
How many children with suspected severe malaria have you transported to the health facility?	3.64	10.3

Table 22:Knowledge of Malaria

Indicator	Baseline	Endline
Malaria is caused by mosquito bites (CHVs and ETS riders)	96.7%	98.6%
Malaria is caused by eating immature sugar cane (CHVs and ETS riders)	3.3%	2.2%
Malaria is caused by witchcraft (CHVs and ETS riders)	0.3%	0%
Malaria is caused by getting soaked by rain (CHVs and ETS riders)	5.3%	0.7%

Malaria is caused by eating cold nshima (CHVs and ETS riders)	1.3%	2.9%
Malaria is caused by eating other dirty food (CHVs and ETS riders)	2.3%	2.9%
Don't know what causes malaria (CHVs and ETS riders)	1.7%	1.1%
Knowledge of fever as malaria danger sign (CHVs and ETS riders)	88.3%	90.2%
Knowledge of headache as a malaria DS (CHVs and ETS riders)	56.3%	47.5%
Knowledge of diarrhoea as a malaria DS (CHVs and ETS riders)	47%	23.4%
Knowledge of loss of appetite as malaria DS (CHVs and ETS riders)	20.3%	42.1%
Knowledge of nausea/vomiting as malaria DS (CHVs and ETS riders)	37.7%	49.3%
Respondents who say they know the main signs/symptoms of malaria in children (CHVs and ETS riders)	86.3%	97.8%
Respondents who say they know the main signs/symptoms of malaria in children (CHVs)	87%	98%
Respondents who say they know the main signs/symptoms of malaria in children (ETS riders)	83.6%	97%

Table 23:Knowledge of Severe Malaria

Indicator	Baseline			Endline		
	All	CHVs	Riders	All	CHVs	Riders
Respondents who say they know about the severe malaria danger signs in children	**70.3%**	69.5%	73.8%	**98.6%**	98.8%	97%
Knows "unconscious or lethargic" as severe malaria danger sign	**46.9%**	46.1%	50%	**50.5%**	51.9%	40.6%
Knows "not able to eat or drink" as severe malaria danger sign	**29.1%**	26.9%	37%	**86.1%**	89.2%	62.5%
Knows "vomits everything" as severe malaria danger sign	**51.6%**	50.9%	54.3%	**90.8%**	92.9%	75%
Knows "fitting" as severe malaria danger sign	**51.6%**	56.3%	34.8%	**87.5%**	88.8%	78.1%
Respondents who say they are confident to recognise the severe malaria danger signs	-	-	-	**95.8%**	100%	96%

Table 24:Management of Malaria Cases (respondents are CHVs and ETS riders)

Indicator	Baseline	Endline
Ever managed case of malaria or SM	70.7%	71.9%
Last managed a case of malaria / SM this year	66.3%	97%
Children with suspected malaria who were referred by CHV to government HF (hospital, RHC, RHP) for advice or treatment	65.6%	98.9%
Children with suspected malaria who were referred by CHV to pharmacist for advice or treatment	0%	0%
Children with suspected malaria who were referred by CHV to traditional healer for advice or treatment	0%	0%
Usual practice in this community when a child has malaria is to take them immediately to the HF	-	41.2%
Usual practice in this community when a child has malaria is to take them to the CHV	-	53.1%

Table 25:Management of Severe Malaria Cases (respondents are CHVs trained to administer RAS)

Indicator	Baseline	Endline
CHVs who said they were confident to administer RAS	-	98.3%

CHVs who had referred a suspected severe malaria case to a HF		92.5%
CHVs who use an official referral form or a page from their notebook to refer a child with suspected SM to the HF		98.7%
CHVs who say that children they refer to a HF always receive a counter-referral form		65.3%
CHVs who say that children they refer to a HF sometimes receive a counter-referral form		23.7%
CHVs who say that children they refer to a HF never receive a counter-referral form		11%
CHVs who say that they follow up suspected SM cases when they return from the HF		94.2%

Table 26:Reaching and Supporting the Least-Supported Women and Children

Indicator	Baseline			Endline		
	All	**CHVs**	**Riders**	**All**	**CHVs**	**Riders**
Respondents who have taken steps to ensure that least-supported women are involved in community discussion groups	46.8 %	-	-	33.3 %	34.2%	27.3%
Respondents who have visited least supported women in the community to discuss child health issues	84.7 %	-	-	31.3 %	31.4%	30.3%
Respondents who have taken action to ensure that the children of least-supported women are assisted when they are sick	41.1 %	-	-	33.1 %	33.1%	33.3%

Table 27:Number of Least-Supported Women and Children that CHVs Have Personally Helped

Indicator	Baseline	Endline
Number of least-supported women that you have personally tried to involve in project activities (CHVs and ETS riders)	-	10.6
Number of least-supported women that you have personally tried to involve in project activities (CHVs)	-	11.13
Number of least-supported women that you have personally tried to involve in project activities (ETS riders)	-	6.6

Table 28:Perceptions of Malaria Delays and Mortality Among Children (respondents are CHVs and ETS riders)

Indicator	Baseline	Endline
Respondents who think that child deaths from severe malaria have reduced since the start of MAM	-	98.9%
Respondents who think that child deaths from severe malaria have reduced by a large amount since the start of MAM	-	85%
Respondents who think that fewer children are being delayed in being taken to a HF when suspected of having malaria	-	77.3%
Respondents who think that fewer families are relying on traditional medicines to treat suspected malaria	-	92.1%

Table 29:CHV Knowledge of Danger Signs of Pneumonia and Severe Diarrhoea

Indicator	Baseline			Endline		
	All	**CHVs**	**Riders**	**All**	**CHVs**	**Riders**
Knowledge of rapid breathing as a pneumonia danger sign	**45.5%**			**76.2%**	**80.3%**	45.5%
Knowledge of noisy breathing as a pneumonia danger sign	**44.7%**			**73.6%**	**78.3%**	39.4%

Knowledge of chest in drawing as a pneumonia danger sign	**26%**			**67.5%**	**68%**	63.6%
Knowledge of child refusing to eat or drink as a pneumonia danger sign	**8.9%**			**18.4%**	**18%**	21.2%
Knowledge of child vomiting as a pneumonia danger sign	**14.6%**			**22%**	23.8%	9.1%
Knowledge of passing three or more stools in a day as a severe diarrhoea danger sign	**54%**			**72.5%**	77.5%	34.3%
Knowledge of watery stool as a severe diarrhoea danger sign	**72.6%**			**79.7%**	82.8%	56.3%
Knowledge of bloody stool as a severe diarrhoea danger sign	**21%**			**77.2%**	79.5%	59.4%

Annex 2: Summary of performance against logframe indicators

Results	SMART indicators	Target	Baseline	Endline	Sig.
Goal (Impact): Contribute to reducing malaria mortality in children in target areas					
Indicator G1:	Proportion of children with severe febrile illness (6 mon. to 6 years) seen at community level that resulted in death	3.3% (50/1500)	8% (18/224)	0.24% (3/1215)	P<0.05
Outcome 1: Increased access to WHO approved RAS among children with suspected severe malaria					
Indicator P1	Proportion of children (6 months to less than 6 years) with severe febrile illness who received QA RAS by CHVs	50% (750/1500)	0	100% (1215/1215)	P<0.05
Output1: QA RAS is made available for safe and appropriate malaria pre-referral management					
Indicator O1.1	Quantity of QA RAS (in units) procured for project areas and available for project.	3000	0	3000 procured, 1215 used.	Adequately met
Indicator O1.2	Development of severe malaria/RAS training module, CMS forms adapted to accommodate new SM focus and job aids/posters developed	1	0	1	Adequately met
Indicator O1.3	Number of referral health facilities in project areas able to provide Inj AS or alternative recommended severe malaria treatment as per WHO guidelines	10	8	8	Output met[30].
Indicator O1.4	Percentage of children treated with QA RAS by CHV who have been followed and investigated for adverse events in the 30 days post-exposure in the project areas	50% 750/1500	0	100% (1215/1215)	P<0.05
Outcome 2: Increased number of children with suspected severe malaria, appropriately managed with RAS at the community level and effectively referred					
Indicator P2	Number and percentage of children who received QA RAS by CHVs in the project areas and referred to a designated referral health facility providing severe malaria treatment	40% (600/1500)	0	100%[31] (1215/1215)	P<0.05
Indicator P3	Number and percentage of children who received QA RAS by CHVs in the project areas, completed referral to a designated referral health facility, and received a counter referral form	40% 600/1500	0	72% (871/1215)[32]	P<0.05
Output 2: QA RAS is introduced into existing community and the referral process is functional in project areas					
Indicator O2.1	Number and percentage of CHVs (who manage sick children) trained in project areas	49% 233/477	0	100% 477/477[33]	
Indicator O2.2	Number and percentage of trained and functional CHV in project areas who provided QA RAS	100% 233/233	0	100% (277/277)	
Indicator O2.3	Number of HWs trained on the appropriate management of severe malaria cases, including Inj AS	27	11	32[34]	
Indicator O2.4	Number and percentage of trained HWs at referral facilities in project areas who managed referred cases	83% 25/30	0	100% 32/332	
Indicator O2.5	Number of ETS drivers recruited and trained	66	0	66	
Indicator O2.6	Number and percentage of children with suspected severe malaria cases transported to health facility using ETS	31% 470/1500	0	59% of all cases (714/1215), 71% where	P<0.05 for both figures

[30] At project planning, it was assumed that two additional sites would be commissioned within the project's catchment. This did not happen.

[31] Based on project monitoring data. The endline survey shows a slightly smaller value (94%).

[32] Based on community monitoring data. Although 1,212/1,215 (99%) of children received referral forms from the community, only 72% received a counter referral form from the health facility. This is also confirmed at endline, where 65% of respondents mentioned that they always received a counter-referral form, while 24% sometimes did.

[33] Based on both the endline survey and project monitoring data.

[34] Based on project monitoring data.

				ETS was available	