Mulanje Mission Hospital

Malaria Vector Control Report
(IRS & LSM)

2023-2024

Reported by

Tikondwe Katumbi
Head of Primary Health Care, email: tikondwekatumbi@gmail.com

Sheilla Mangwiyo
Environmental Health Officer, email: ssmangwiyo@gmail.com

Dr. Arie Glas
Medical Director; email: director@mmh.mw

Contents

A. Background information

This report describes malaria vector control at Mulanje Mission Hospital (MMH) for the 2023-2024 malaria season. MMH is a mission hospital under CHAM (Christian Health Association of Malawi) with 72 villages in its catchment area. The population in this catchment area is estimated at 100,201. From the year 2012 MMH started to implement malaria vector control using Indoor Residual Spraying (IRS). In the year 2017, Larval source management (LSM) was added and discontinued in 2022. In 2023-2024 the project was funded by the Good Little Company (GLC) and Eastern Produce Malawi.

Indoor Residual Spraying involves spraying insecticide onto interior walls of houses so as to kill Anopheles mosquitoes which cause malaria. A long-acting formulation proven to work for at least 6 months is used. When the mosquitoes land on the walls they are killed by the active ingredient of the chemical. Larval Source Management involves modifying breeding sites of mosquitoes so that either mosquitoes are unable to breed or larval are killed before they become adults. A chemical proven to be only killing mosquito larvae is used.

MMH practices occupation health and safety guidelines when conducting IRS. All IRS workers at MMH use standard Personal Protective Equipment (PPE). This includes a helmet with a face shield, mask, overall, heavy duty gloves, and gumboots. A standard store room and wash area with showers is also available. MMH also checks that all used and un-used bottles/sachets of insecticides are returned to stores and incinerated before ashes are landfilled in a deep concrete lined pit.

MMH has a long track record in IRS. From 2012 to 2015, alpha-cypermethrin (Fendona) which is in the group of Pyrethroids was being used. In 2015 MMH also sprayed one part with Terminator (Fenitrothion) which is in the group of organophosphates. From 2016 to 2018, MMH was using Actellic 300CS which is in the group of organophosphate as well. From 2019 onward Actellic 300CS is used interchangeably with Sumishield, a clothianidin based compound. Malawi's Ministry of Health Insecticide resistant management plan stipulates that insecticides should be changed yearly. This strategy was introduced from 2019 in our area. Other countries use two-yearly rotation.

MMH engages actively with the NMCP, IVVC in Liverpool, net and chemical manufacturers

and funding partners.

Malawi continues to employ rapid diagnostic testing for malaria. Bed net distribution through antenatal care, clinical care including critical care and management of complications and continuous availability of anti-malarials also contribute to reducing morbidity and mortality due to malaria.

Climatic conditions during the 2023 and 2024 were difficult. Cyclone Freddy in March 2023 caused extensive flooding and may have contributed to higher mosquito densities at the start of the season. An initial dry period during November and December 2023 was followed by protracted rains up to April 2024. This was favourable to mosquito breeding.

B. 2023/24 IRS Implementation

Since the establishment of IRS at MMH, MMH has continued with the use of well-trained villagers as spray operators. In 2023/24 spray operators formed 5 teams of 6 people who are supervised by team leaders (Health Surveillance Assistants). In turn these team leaders are supervised by Environmental Health Officers.
During the spraying period, spray operators completed daily record forms which were submitted to their team leaders for daily summaries.

Figure 1: spray operators during training.

During 2023/24, the campaign used Actellic 300CS 833mL bottles (735 bottles) and a clothianidin formulation: Klypson (2500 sachets). Sensitivity testing was not performed this year due to lack of capacity in the country. One entomologist was found willing to do the job, but at a cost of 40,000

US$ this was not pursued.

Figure 2 Spray operator adding water into IK spray tank.

In the spraying period of 2023/24, MMH's had a transition of pump usage of Hudson pumps to IK pumps. Hudson pumps have been used since 2012 to 2022 in IRS program.

Indicator	*IK pumps*	*Hudson pumps*
Durability	More durable as it is made of more plastic hence can not corrode.	Less durable as compared to IK pumps its metal sometimes corrode.
Comfortability during handling	More comfortability, it has two strips and is put at the back when spraying.	Less comfortable than IK pumps. It is put on one shoulder when spraying because it has one strip.
Maintenance	Easy to maintain.	Maintenance is complex sometimes.
Pressure sensing	It senses pressure and stops spraying when pressure is low.	It senses pressure but requires the spray operator to stops the spraying when pressure is low.
Nozzle protector	It has nozzle protector	It does not have nozzle protector.

Comparison of IK versus Hudson pumps.

Community awareness

Radio talks were organized to ensure community awareness of vector control activities. Village meetings were also done to help people prepare for the actual spraying - as a result a lot of people took part.

IRS Monitoring

IRS monitoring is carried out by MMH staff from the PHC department, Environmental Health section. IRS monitoring involves testing individuals for the presence of malaria parasites in their blood. The project also compares previous years and current malaria cases by checking registers at the hospital and neighbouring hospitals.

This year's monitoring programme used data from intervention (IRS) and non- intervention areas. The intervention area is the MMH catchment area, and the non-intervention area four villages in the neighbouring Chambe area. The project also compared hospital registry data from MMH and Holy Family Mission Hospital in Phalombe district, which has no vector control programme.

Spray results

51 villages in the catchment area were sprayed, benefitting 71000 people.The hospital's admission rooms, guardian shelter and staff houses were also sprayed. In addition staff houses at EPM estates were also sprayed.

The main indicators tracked are the following:

1. Number of under-five malaria deaths, with comparisons with non-intervention areas (table C1.1)
2. Parasitaemia levels (table C2.1)
3. Mosquito population density in intervention and non-intervention villages (table C3.1)
4. Numbers and rates of malaria and non-malaria in-patient admissions at MMH for different age groups (table C4.1.-C4.3)

C. Results

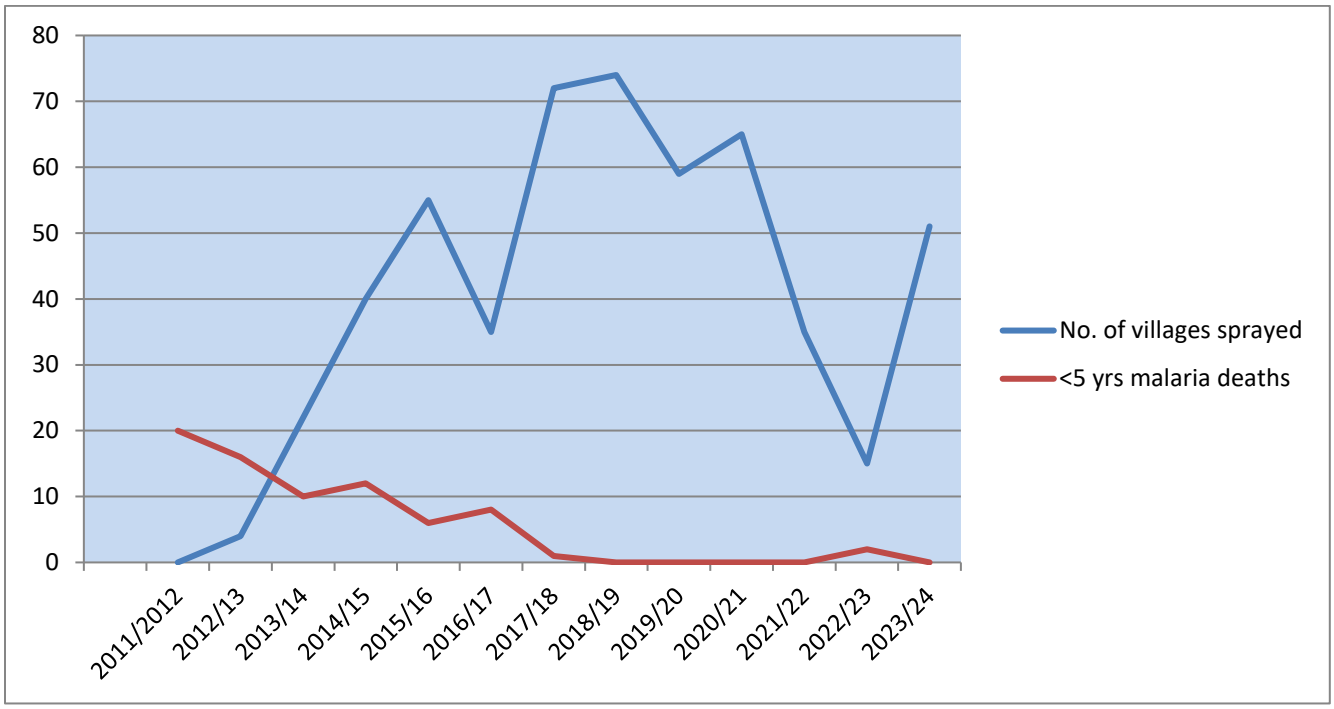
The number of villages covered in 2023/24 was 51. This is more than double than what was sprayed in 2022/23 year.

Table C.1.1 and Graph C 1.1. Summarize the main outcome: under-five malaria deaths.

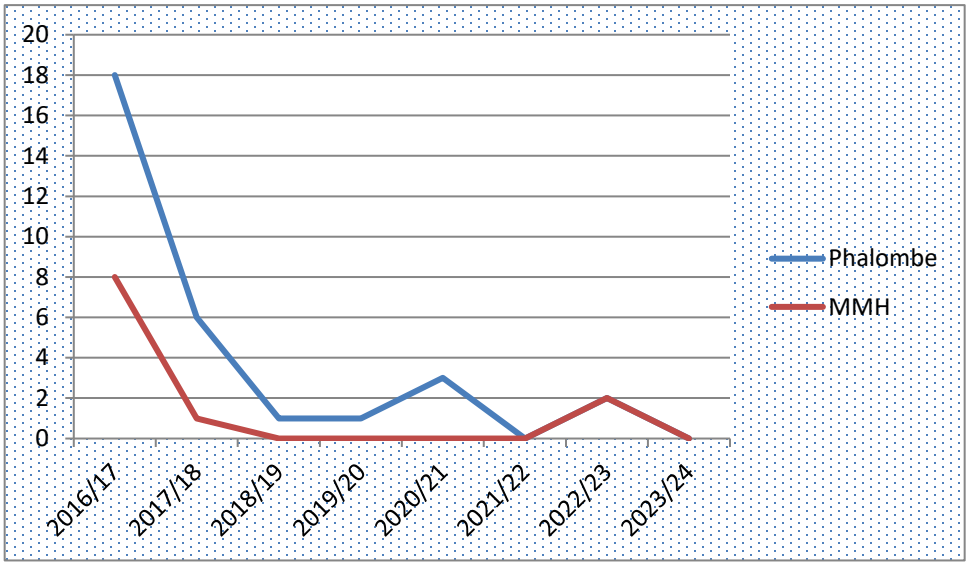
Year	No of villages IRS only	No. of villages LSM only	No. of villages LSM&IRS	Total no. of villages with vector control	% of villages with vector control	Total population protected (est).	Total no of <5 yrs deaths
2011/12	0	0	0	0	0	0	20
2012/13	4	0	0	4	5.4	5246	16
2013/14	22	0	0	22	30	16,136	10
2014/15	40	0	0	40	56	37,985	12
2015/16	55	0	0	55	76	47,121	6
2017/18	46	20	6	72	97	82,702	**1**
2018/19	32	32	10	74	100	85,000	**0**
2019/20	46	3	7	59	80	72,500	**0**
2020/21	48	13	4	65	90	79,872	**0**
2021/22	23	6	6	35	49	56,840	**0**
2022/23	15	0	0	15	21	12,767	**2**
2023/24	51	0	0	51	70	27991	**0**

The number of malaria deaths has been reduced to 0 in the reporting period.

Graph C 1.1. Number of villages sprayed versus under-5 malaria deaths at MMH



Graph. C.1.2 Under-5 deaths in intervention area (MM Hospital) versus non-intervention area (Phalombe Hospitals) based on hospital registries



In 2023-24, a new hospital was opened in Phalombe (Phalombe District Hospital, PDH). Data for 2023-24 are for admission in both Phalombe hospitals and prior to that for Holy Family Hospital (HFH) only. Since 2016, cumulatively there have been 31 under five malaria deaths in the non-

intervention area of HFH and later also PDH catchment area, compared to 11 deaths in the MMH catchment area. The catchment area of HFH is 46,964 and 91,056 for MMH (NSO 2024), which includes the area around Chisitu Health centre. Some patients around Chisitu may have gone to another health facility. The population for PDH is yet to be confirmed.

There is also a decrease in deaths in the non-intervention area since 2016, likely attributed to net distribution campaigns and improved access to testing and treatment.

Table C 1.2. Number of under-5 malaria deaths and mortality rates in intervention and non-intervention area (November to March).

Year	MMH (intervention)		Phalombe hospitals (non-intervention)	
	No of deaths	Mortality rate*	No of deaths	Mortality rate
2016/17	8	0.61**	18	2.66
2017/18	1	0.07	6	0.87
2018/19	0	0.00	1	0.14
2019/20	0	0.00	1	0.14
2020/21	0	0.00	3	0.40
2021/22	0	0.00	0	0.00
2022/23	2	0.13	2	0.26
2023/24	0	0.000	0***	0.00
*deaths per 1000 under-fives.				
denominator is # under-fives, data taken from NSO, 2023 projection * data unverified and definite conclusions should not be drawn. (Zero deaths for an entire district is highly unlikely, to be verfied).				

The table above shows that the mortality has been higher in the non-intervention area compared to the intervention area since 2016, but that last year both areas recorded zero deaths. No quality control has been applied in the data from the other facility.

C2. Malaria parasitaemia

Parasitemia is the presence of parasites in the blood. This data was collected in targeted

communities by conveniently sampling participants and test their blood using malaria rapid diagnostic test (MRDT) kits. Participants found to be malaria positive were given malaria drugs by a clinician at the same time.

During 2023/24 monitoring period, 400 people were tested from 8 villages of which 4 villages were samples from intervention villages(MMH area) and other 4 from non-intervention villages (Chambe area) respectively.

Table C2.1: Parasitaemia – intervention versus no intervention villages

Village (with vector control)	**Intervention**	**% mRDT positive**	**Village (with no vector control)**	**% mRDT positive**
Kangoma	IRS	3	Chilela	11
Demula	IRS	0	Mussa	16
Bwanali/Mabuka	IRS	8	Kazembe	3
Mwamadi	IRS	0	Livetele	5
Overall average		**5.5%**		**17.5%**

Malaria parasitaemia remains lower in the intervention area compared to the non-intervention area. In 2023-24, positivity rate was 5.5% in the intervention and 17.5% in the non-intervention area (the same villages were sampled). This is compared to 1.5% and 5.75% respectively in 2022-23, indicating a higher malaria pressure this year.

Table C.2.2 Parasitaemia in Mwamadi village from 2013 to 2024.

Year	**malaria positive%**
2013	**53**
2014	**38.8**
2015	**20**
2018	**16**
2019	**9.5**

2020	**8**
2021	**5**
2022	**2**
2023	**0**
2024	**0**

Parasitemia results for Mwamadi village are now at zero, following a continued decrease since the introduction of IRS in the village. This data is sourced from blood tests using MRDT at Mwamadi village over the years. The sample siz this year was 45 and has been around 50 each year.

C3. Mosquito population density testing

Mosquito population density involves counting the number of mosquitoes present in dwelling houses using the pyrethroid knock-down test. This was done in 4 villages in the MMH intervention area and 4 villages at the neighboring Chambe non-intervention area.

Table C.3.1 Mosquito population density in intervention and non-intervention area.

Village (with vector control)	**Intervention**	**No of mosquitoes**	**Village (no vector control)**	**No of mosquitoes**
Kangoma	IRS	143	Chilela	357
Demula	IRS	16	Mussa	401
Bwanali/ Mabuka	IRS	472	Kazembe	23
Mwamadi	IRS	17	Livetele	23
Total		**648**		**824**

In comparison, in 2022-23 only 186 (intervention) and 281 (non-intervention area) mosquitoes were counted. This reflects a much higher mosquito density this year.

This year's mosquito population density has shown a great increase in number of mosquito

population in both areas of intervention and non-intervention areas. This perhaps must also be contributed to weather patterns of the two areas.

C4. Malaria cases admitted to MMH between November & March from 2016 to 2024

This section presents the number of admissions of under-five children and in those five and older years from sampled villages since 2016, before and after vector control measures.

Table C4.1: number of under-five admissions due to malaria from sampled villages 2016- 2024.

Year	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24
Village*	IRS only							
Kang'oma	3	2	1	1	0	1	0	1
Zipangani	1	2	0	3	0	0	1	2
Ngolowera	5	9	1	5	0	0	3	1
Mwamadi	0	0	1	0	0	0	0	1
Demula	0	0	0	3	4	0	0	0
Total	9	13	3	12	4	1	4	5
Total cases per 1000 under 5s	**8.8**	**12.7**	**2.9**	**11.6**	**3.8**	**0.9**	**3.8**	**1.5**
	IRS only	IRS &LSM					No intervention	
Bwanali/ Mabuka	2	3	2	1	0	0	1	1
Nankhumwa	4	0	0	2	0	1	5	1
Liwaya	0	3	1	0	0	0	1	0
Bokosi	0	0	0	0	0	0	2	1
Nkhonya	0	0	0	3	2	0	2	2
Total	6	6	3	6	2	1	11	5
Total cases per 1000 under 5s	**3.1**	**3.4**	**1.5**	**3.1**	**1.0**	**0.5**	**5.7**	**1.6**
	IRS only	LSM only					No intervention	
Sikoya	2	1	1	3	0	0	1	1
Tambala/Chikumbu	6	7	5	18	0	0	3	2
Bwanali/Chikumbu	11	1	2	3	0	0	2	2

Gilbert	0	0	0	0	0	0	0	1
Chitambi	0	0	0	4	3	0	1	3
Total	19	9	8	28	3	0	7	9
Total cases per 1000 under 5s	**13.3**	**6.2**	**5.5**	**19.5**	**2**	**0**	**4.8**	**2**
*Population size from annual headcounts by health surveillance assistants.								

Table C4.2: number of over-five admissions due to malaria from sampled villages 2016-2024

Year	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24
Village	IRS only							
Kang'oma	1	0	1	1	1	0	0	0
Zipangani	1	0	0	1	0	0	0	0
Ngolowera	6	2					0	0
Mwamadi			0	2	2	0	0	1
Demula			0	1	1			0
Total	8	2	1	5	4	0	0	1
Total cases per 1000 over 5s	**1.6**	**0.4**	**0.1**	**0.9**	**0.7**	**0**	**0**	**0.3**
	IRS only	IRS &LSM					No intervention	
Bwanali/ Mabuka	2	0	0	0	1	0	0	0
Nankhumwa	1	0	0	3	2	0	0	0
Liwaya	2	0	0	0	0	0	0	0
Bokosi	0	0	0	1	2	0	0	0
Nkhonya	0	0	0	0	0	0	0	1
Total	5	0	0	4	5	0	0	1
Total cases per 1000 over 5s	**0.5**	**0**	**0**	**0.4**	**0.5**	**0**	**0**	**0.2**
	IRS only	LSM only					No intervention	
Sikoya	2	2	1	3	4	0	0	1
Tambala/Chikumbu	1	0	1	6	4	0	0	1

Bwanali/Chikumbu	0	0	0	2	1	0	0	0
Gilbert	0	0	0	4	0	0	0	0
Chitambi	1	1	0	2	2	0	0	0
Total	4	3	2	13	11	0	0	2
Total cases per 1000 over 5s	**0.5**	**0.4**	**0.2**	**1.8**	**1.5**	**0**	**0**	**0.4**

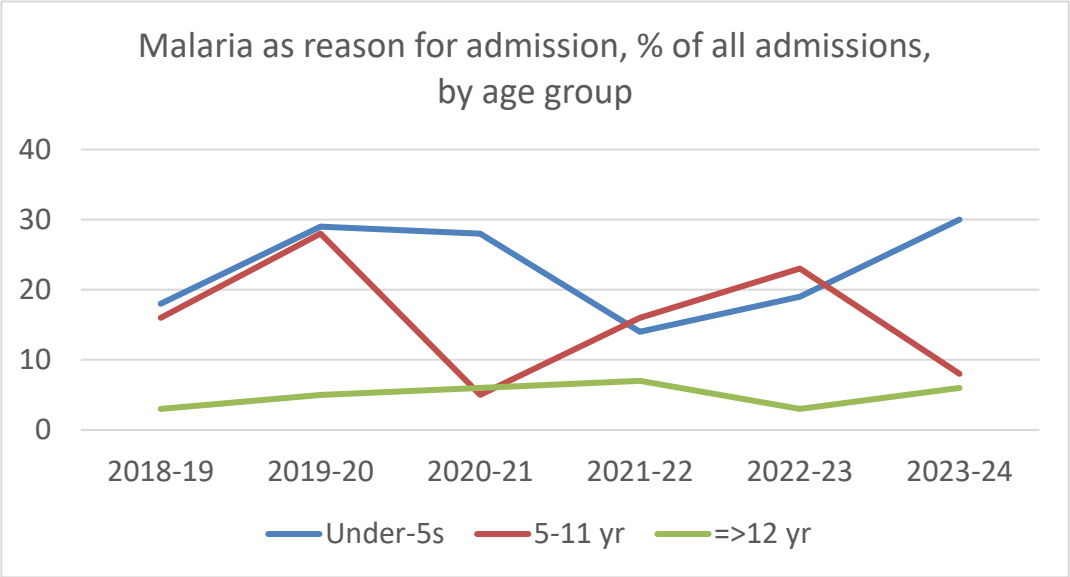
IRS has reduced malaria in under-5s and over-5 significantly in the community over the years. There number of cases in under-5s per 1000s in 2024 was lower in the IRS villages compared to villages with no intervention.

Below is a summary of the proportion of admissions due to malaria at MMH, relative to all admission in three different age groups.

Table C4.3: Total number of admissions at MMH, in all age groups, relative to the number of admissions due to malaria 2018-2024

Year	Month	Total <5 years	Malaria	%	Total 5-11 years	Malaria	%	Total =>12 years	Malaria	%
2018-19	**Total**	**917**	**166**	**18%**	**139**	**22**	**16%**	**2431**	**83**	**3%**
2019-20	**Total**	**1215**	**352**	**29%**	**148**	**41**	**28%**	**2064**	**95**	**5%**
2020-21	**Total**	**850**	**240**	**28%**	**544**	**26**	**5%**	**1700**	**108**	**6%**
2021-22	**Total**	**498**	**68**	**14%**	**76**	**12**	**16%**	**921**	**60**	**7%**
2022/23	**Total**	**712**	**132**	**19%**	**60**	**14**	**23%**	**2044**	**58**	**3%**
2023/24	November	114	20	18	61	2	3	223	7	3
	December	130	30	23	72	3	4	261	14	5
	January	114	61	7	72	6	8	260	25	10
	February	152	49	32	70	10	13	254	13	5
	March	205	53	26	80	8	10	290	21	1.5
	Total	**715**	**213**	**30%**	**355**	**29**	**8%**	**1288**	**80**	**6%**
NB for monthly figures in previous years, see earlier reports.										

Graph C 4.1 Malaria as reason for admission at MMH 2018-24, % of total, by age group



This table and graph show that the proportion of malaria to all admissions dropped in 5-11 age group but increased in other age groups. This is another sign that environmental factors contributed to a high malaria burden this year.

D. Conclusions

This project shows that is it is possible to significantly reduce the burden of malaria through vector control even in a relatively small programme. At the same time, reductions are seen in non-intervention areas This could be the effect of the government nets distribution, which effect is expected to wean off during the 24-25 season.

The community around MMH, poor rural families, strongly urge the hospital and its' partners to continue doing vector control. They cite less disease, but also the killing of other insects of medical importance like fleas, bedbugs and cockroaches, leading to peaceful nights.

E. Future vector control efforts

MMH is committed to optimal use of every available dollar. We therefore critically look at the vector control programme on a yearly basis. The government is planning to distribute bed nets in all districts with Mulanje receiving piperonyl-butoxide nets at the end of 2024.

Using the MINT-programme from Imperial College, London, some estimates of efficiency and cost-effectiveness of the various intervention areas can be made.

In July and August ‘23, a comprehensive review of available nets and IRS compounds was undertaken.

See https://mint.dide.ic.ac.uk/. Model outcomes suggest that IRS, although more expensive, has a higher potential of maintaining low malaria mortality in under-fives compared to nets.

USAID through the Malawi NMCP have donated over 1,598 sachets of Sumishield (clothianidin) and 728 sachets of FludoraFusion (clothianidin-deltamethrin) were donated in April 2024, with possible more donations coming too. This is a significant recognition of MMH’s efforts in Malawi’s malaria landscape.

MMH, April 2024