

Mulanje Mission Hospital

Malaria Vector Control Report

(IRS & LSM)

2022-2023

Reported by

1. Tikondwe Katumbi

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

2. Sheilla Mangwiyo

Environmental Health Officer, email: ssmangwiyo@gmail.com

3. Dr. Arie Glas

Medical Director; email: director@mmh.mw

Contents

A. Background information3

B. 2022/23 IRS implementation.....3

C. Results6

D. Conclusions13

E. Future Vector control efforts13

A. Background information

This report describes malaria vector control at Mulanje Mission Hospital (MMH) for the 2022-2023 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 100,000. 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 stopped again in 2022. In 2022-2023 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 3 months is used. When the mosquitoes land on the walls they are killed by the active ingredient of the chemical. On top of spraying 15 villages, Mulanje Prison and the hospital guardian shelter was sprayed too, as well as 77 houses on an adjoining tea-estate.

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. This year, LSM was not done.

On occupation health and safety, 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. We engage actively with the NMCP, IVVC in Liverpool, net and chemical manufacturers and funding partners.

Malawi continues to employ rapid diagnostic testing for malaria and access to first-line treatment is generally available. The government also distributed insecticide treated bednets in the area in October 2022.

B. 2022/23 IRS implementation

Since the establishment of IRS at MMH, MMH has continued with the use of well-trained villagers as spray operators. In 2022/23 spray operators formed 5 teams of 5 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.

During 2022/23, we used Actellic 300CS. Actellic 300CS will be used interchangeably with other compounds, notable clothianidin based products like Sumishield or one of the newest compounds. 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. Most other countries use two-yearly rotation.



Figure 1 Spray operators perfecting their skills during training

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. Sensitivity testing was not performed this year.



Figure 2 Spray operator adding Actellic300CS into a Hudson spray tank

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.

Monitoring

During IRS and LSM, MMH staff from the PHC department conducted malaria monitoring by 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 three 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.

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 2022/23 was 15. This was lower than before due to funding constraints.

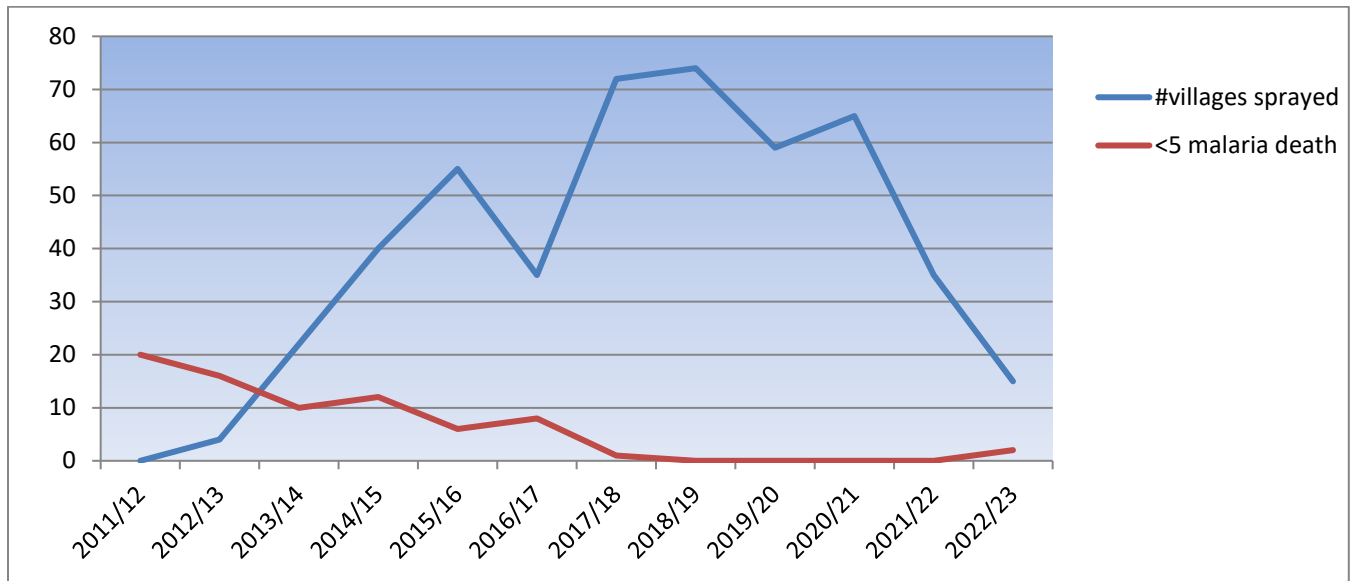
Table C.1.1 and Graph C 1.1. summarize the main outcome: under-five malaria deaths.

Table C.1.1: Vector control interventions and under five malaria deaths at MMH since 2011

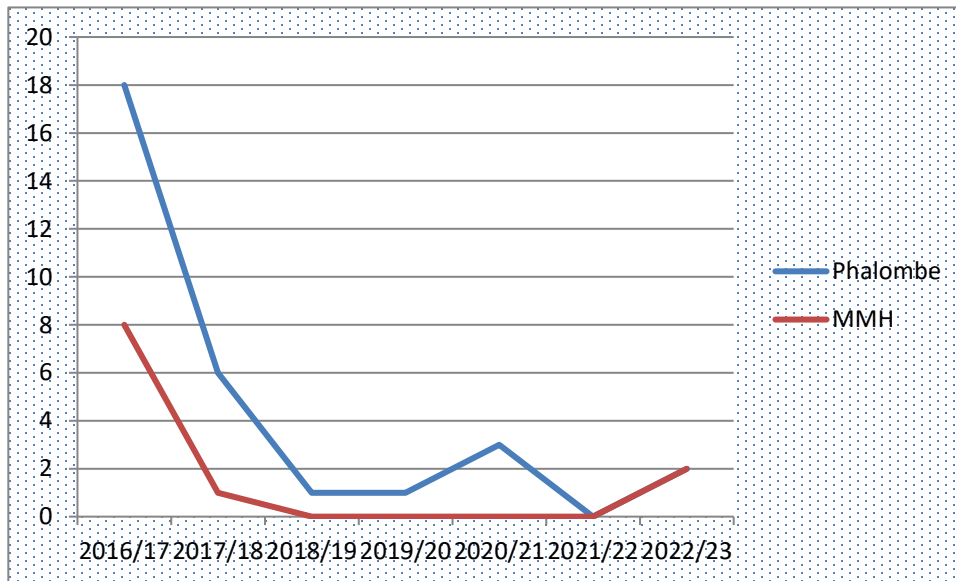
Year	No. villages IRS only	No. of villages LSM only	No. of villages LSM&IRS	Total no. of villages with vector control	% of villages with vector control	Total population protected (est).	Total no of <5 yrs deaths
2011/12	0	0	0	0	0	0	20
2012/13	4	0	0	4	5.4	5246	16
2013/14	22	0	0	22	30	16,136	10
2014/15	40	0	0	40	56	37,985	12
2015/16	55	0	0	55	76	47,121	6
2016/17	35	0	0	35	49	29,986	8
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

After 4 consecutive years of 0 under five malaria deaths, this season there were two deaths from Chitambi and Ekhamhuno villages. These villages were both outside the IRS area. Malaria vector control coverage except nets has reduced from 100% in the 2018/19 season to 21% in 2022/23 season, but nets are used in all areas.

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 (HF Hospital) based on hospital registries



Since 2016, cumulatively there have been 31 under five malaria deaths in the non-intervention area of Phalombe Holy Family Hospital catchment area compared to 11 deaths in the MMH catchment area. The catchment area of HFH is 45,798 and 89,138 for MMH (NSO 2023), which includes the area around

Chisitu Healthcentre. Some patients around Chisitu may have gone to another health facility. 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).

	MMH (intervention)		HFH (non-intervention)	
	No of deaths	Mortality rate*	No of deaths	Mortality rate
2016/17	8	0.061**	18	0.266
2017/18	1	0.007	6	0.087
2018/19	0	0.000	1	0.014
2019/20	0	0.000	1	0.014
2020/21	0	0.000	3	0.040
2021/22	0	0.000	0	0.000
2022/23	2	0.013	2	0.026
*deaths per 100 under-fives. NB revised for earlier years, published before.				
**denominator is # under-fives, data taken from NSO, 2023 projection and adjusted for earlier years based on 2.3% population growth annually and 17% of population in under-five age group.				

The table above shows that the mortality rate is consistently higher in the non-intervention area compared to the intervention area since 2016.

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 2022/23 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. 4 villages.

Table C2.1: Parasitaemia results

Village (with vector control)	Intervention	% mRDT positive	Village (no vector control)	% mRDT positive
Kangoma	IRS	0	Chilela	9
Demula	IRS	2	Mussa	4
Bwanali/Mabuka	IRS	4	Kazembe	5
Mwamadi	IRS	0	Livetele	5
Overall average		1.5%		5,75%

Malaria parasitaemia remains lower in the intervention area compared to the non-intervention area. In 2021-22, positivity rate was 3% in the intervention and 7,25% in the non-intervention area (the same villages were sampled).

Table C.2.2 Parasitaemia in Mwamadi village from 2013 to 2023.

Year	malaria positive%
2013	53
2014	38.8
2015	20
2018	16
2019	9.5
2020	8
2021	5
2022	2
2023	0

Data sourced from blood tests using MRDT at Mwamadi village, has been showing a continuous decrease in malaria parasitaemia over the years. It was 53% in 2013 and in 2023 it is at 0% only. The sample size 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	16	Chilela	13
Demula	IRS	21	Mussa	195
Bwanali/ Mabuka	IRS	148	Kazembe	27
Mwamadi	IRS	1	Livetele	46
<i>Mean</i>		<i>46.5</i>		<i>70.3</i>

There is less number of mosquitoes on average in intervention than non-intervention areas, although the number of mosquitoes sharply increased compared to last season. In the intervention area last year, a mean of 4.8 mosquitoes were seen versus 8.5 in the non-intervention area. This could possibly be because of more stagnant water following cyclone Freddy.

C4. Malaria cases admitted to MMH between November & March from 2016 to 2023

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 2016-2022.

Year	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Village*	IRS only						
Kang'oma	3	2	1	1	0	1	0
Zipangani	1	2	0	3	0	0	1
Ngolowera	5	9	1	5	0	0	3
Mwamadi	0	0	1	0	0	0	0
Demula	0	0	0	3	4	0	0
Total	9	13	3	12	4	1	4
Total cases per 1000 under 5s	8.8	12.7	2.9	11.6	3.8	0.9	3.8
	IRS only	IRS & LSM					No intervention
Bwanali/ Mabuka	2	3	2	1	0	0	1
Nankhumwa	4	0	0	2	0	1	5
Liwaya	0	3	1	0	0	0	1
Bokosi	0	0	0	0	0	0	2
Nkhonya	0	0	0	3	2	0	2
Total	6	6	3	6	2	1	11
Total cases per 1000 under 5s	3.1	3.4	1.5	3.1	1.0	0.5	5.7
	IRS only	LSM only					No intervention
Sikoya	2	1	1	3	0	0	1
Tambala/Chikumbu	6	7	5	18	0	0	3
Bwanali/Chikumbu	11	1	2	3	0	0	2
Gilbert	0	0	0	0	0	0	0
Chitambi	0	0	0	4	3	0	1
Total	19	9	8	28	3	0	7
Total cases per 1000 under 5s	13.3	6.2	5.5	19.5	2	0	4.8

*Population size from annual headcounts by health surveillance assistants. Data published for previous years was revised.

Table C4.2: number of over-five admissions due to malaria from sampled villages 2016-2023

Year	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Village	IRS only						
Kang'oma	1	0	1	1	1	0	0
Zipangani	1	0	0	1	0	0	0
Ngolowera	6	2					0
Mwamadi			0	2	2	0	0
Demula			0	1	1		
Total	8	2	1	5	4	0	0
Total cases per 1000 over 5s	1.6	0.4	0.1	0.9	0.7	0	0
	IRS only	IRS & LSM					No intervention
Bwanali/ Mabuka	2	0	0	0	1	0	0
Nankhumwa	1	0	0	3	2	0	0
Liwaya	2	0	0	0	0	0	0
Bokosi	0	0	0	1	2	0	0
Nkhonya	0	0	0	0	0	0	0
Total	5	0	0	4	5	0	0
Total cases per 1000 over 5s	0.5	0	0	0.4	0.5	0	0
	IRS only	LSM only					No intervention
Sikoya	2	2	1	3	4	0	0
Tambala/Chikumbu	1	0	1	6	4	0	0
Bwanali/Chikumbu	0	0	0	2	1	0	0
Gilbert	0	0	0	4	0	0	0
Chitambi	1	1	0	2	2	0	0
Total	4	3	2	13	11	0	0
Total cases per 1000 over 5s	0.5	0.4	0.2	1.8	1.5	0	0

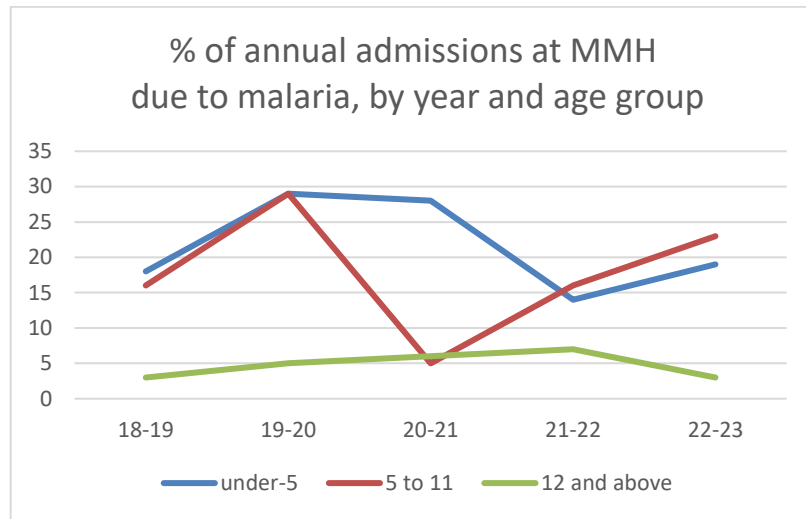
IRS have reduced malaria in under-5s and over-5 significantly in the community. There was no malaria admission of individuals above 5 years from the villages with vector control interventions they came from other villages which do not have malaria vector control.

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 2018-2023

Year	Month	Total <5 years	Malaria	%	Total 5-11 years	Malaria	%	Total =>12 years	Malaria	%
2018-19	November	185	35	19%	20	3	15%	458	8	2%
	December	157	40	25%	28	3	11%	444	15	3%
	January	179	34	19%	35	4	11%	488	31	6%
	February	185	27	15%	23	3	13%	543	11	2%
	March	211	30	14%	33	9	27%	498	18	4%
	Total	917	166	18%	139	22	16%	2431	83	3%
2019-20	November	175	34	19%	26	3	12%	361	4	1%
	December	261	67	26%	33	12	36%	441	25	6%
	January	253	80	32%	29	10	34%	415	20	5%
	February	283	82	29%	30	8	27%	434	17	4%
	March	243	89	37%	30	8	27%	413	29	7%
	Total	1215	352	29%	148	41	28%	2064	95	5%
2020-21	November	182	39	21%	128	1	1%	354	12	3%
	December	180	36	20%	111	5	5%	364	17	5%
	January	208	89	43%	149	11	7%	387	41	11%
	February	141	42	30%	83	5	6%	258	18	7%
	March	139	34	24%	73	4	5%	337	20	6%
	Total	850	240	28%	544	26	5%	1700	108	6%
2021-22	November	80	8	10%	9	3	33%	175	11	6%
	December	78	15	19%	17	2	12%	169	25	15%
	January	117	10	9%	30	5	17%	203	6	3%
	February	84	21	25%	15	1	7%	183	5	3%
	March	139	14	10%	5	1	20%	191	13	7%
	Total	498	68	14%	76	12	16%	921	60	7%
2022/23	November	117	13	11%	13	1	8%	321	6	2%
	December	140	19	14%	8	1	13%	403	12	3%
	January	168	40	24%	12	5	42%	450	23	5%
	February	113	19	17%	20	6	30%	448	6	1%
	March	174	41	24%	7	1	14%	422	11	3%
	Total	712	132	19%	60	14	23%	2044	58	3%

Graph C 4.1 Malaria as reason for admission at MMH 2018-23



This table and graph show that the proportion of malaria to all admissions was raised in the under-five and 5-12 age group compared to previous years.

D. Conclusions

The above data demonstrates that the vector control project implemented at MMH has successfully reduced mortality and morbidity from malaria in all age groups. This project shows that 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 and despite a much smaller vector control programme this year, under-five deaths and morbidity figures have not greatly increased. This could be the effect of the government nets distribution, which effect is expected to wean off during the 23-24 and more so 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 has rolled out third-generation bednets in selected districts, with Mulanje receiving piperonyl-butoxide nets at the end of 2021. WHO guidance suggests that in the presence of PBO nets it may not always be needed to continue performing IRS at the same intensity, but underlying clinical trials have conflicting evidence.

2022/2023 MMH Vector Control

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.

MMH, August 2023