Republic of Rwanda
Ministry of Health

Rwanda Biomedical Centre
Healthy People, Wealthy Nation

Rwanda Malaria and Neglected Tropical Diseases

Annual Report

2020-2021

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Foreword

The Ministry of Health and Rwanda Biomedical Centre (RBC) would like to take this occasion to express their deep gratitude and sincere thanks to everyone (Partners and Stakeholders) who contributed to the compilation of this FY2020-2021 Annual Report of the Malaria and Other Parasitic Diseases Division (MOPDD) in Rwanda.

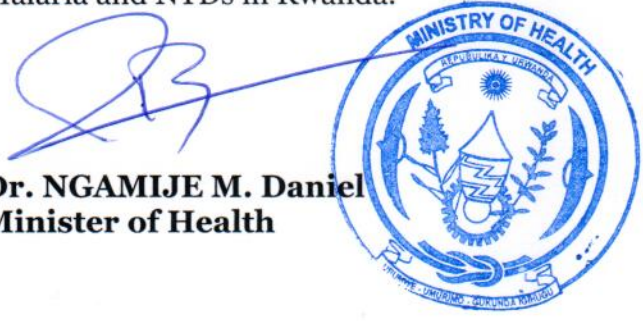
This report has been developed based on HMIS and Program data as well as program activity reports from July 2020 to June 2021. It presents a comprehensive picture of the prevention, control and management of malaria and NTDs in Rwanda and is structured based on the National Malaria and NTDs Strategic Plans.

Actions needed to control Malaria and NTDs burden in Rwanda require partnership and close collaboration between stakeholders in environmental control programs, as well the strengthening of surveillance systems across all sectors at both national and decentralized levels. These programs must be conducted using innovative and evidence-based package of interventions for prevention, treatment and support for patients, community health workers, and the communities where these strategies are implemented.

I would like to acknowledge the efforts of the dedicated staff in the various institutions of the Government of Rwanda who worked tirelessly to complete this report. We remain entirely grateful to the inputs and support provided by our partners.

Special thanks to the members of the Civil Society Organizations, Local and International Non-Governmental, Bilateral Organizations as well as the Rwandan Government institutions who fully supported the implementation of Malaria and NTDs control activities.

I would also like to thank all members of the Technical Working Group that reviewed and validated the content of this report. We thank you all for your support in the fight against Malaria and NTDs in Rwanda.



Dr. NGAMIJE M. Daniel
Minister of Health

List of Abbreviations

ACT	Artemisinin-based Combination Therapy
AL	Artemether Lumefantrine
ANC	Ante-Natal Care
SBCC	Social Behavior Change Communication
CDC	Center for Disease Control
CHW	Community Health Worker
CPDS	Coordinated Procurement and Distribution System
DQA	Data Quality Audit
EPI	Expanded Program on Immunization
EQA	External Quality Assurance
FY	Fiscal Year
GF	Global Fund
GoR	Government of Rwanda
HBM	Home Based Management
HBMA	Home Based Management in Adults
HMIS	Health Management Information System
HSSP IV	Third Health Sector Strategic Plan IV
iCCM	Integrated Community Case Management of Malaria
IRS	Indoor Residual Spraying
ITN	Insecticide Treated Net
IVM	Integrated Vector Management
LLINs	Long-Lasting Insecticide Nets
MCP	Malaria Contingency Plan
MDA	Mass Drug Administration
MIP	Malaria In Pregnancy
MoH	Ministry of Health
MOPDD	Malaria and Other Parasitic Diseases Division

MPPD	Medical Procurement and Provision Division
MSP	Malaria Strategic Plan
MTEF	Mid-Term Expenditure Framework
NRL	National Reference Laboratory
NSP	National Strategic Plan
NTD	Neglected Tropical Diseases
PCR	Polymerase Chain Reaction
PMI	President's Malaria Initiative
PSM	Procurement and Supply chain Management
QC	Quality Control
QMIA	Quality Management Improvement Approach
RBM	Roll Back Malaria
RDT	Rapid diagnostic test
SBCC	Social Behavior Change Communication
SCH	Schistosomiasis
SOP	Standard Operating Procedure
STH	Soil Transmitted Helminthiasis
TWG	Technical Working Group
UC	Universal Coverage
WHO	World Health Organization

Executive Summary

The Malaria, Neglected Tropical Diseases and Other Parasitic Diseases Division (MOPDD) is a technical division with key role in Malaria, Neglected Tropical Diseases (NTDs) and Other Parasitic Diseases (OPDs) Prevention, Diagnosis and Treatment countrywide.

Despite the continued malaria burden increase since 2012 in almost all 30 districts of Rwanda, good results were registered in the reporting period July 2020-June 2021.

With the end of this reporting Fiscal Year 2020-2021, malaria incidence in Rwanda reduced from 198 per 1,000 person per year in FY2019-2020 to 114 per 1,000 (41% reduction) while the National Slide Positivity Rate (SPR) dropped from 44% in FY2019/2020 to 27% in FY2020/2021.

Uncomplicated malaria cases dropped from 2.5M cases in FY2019/2020 to 1.5M cases in FY2020/2021 (40% reduction) with currently 54% of these cases managed at community level.

Severe malaria cases reduced from 4,358 cases in FY2019-2020 to 2,592 severe cases in FY2020/2021 representing 40% decrease in severe malaria.

The number of deaths due to malaria decreased significantly from 167 in FY2019-2020 to 96 deaths in FY2020-2021 (42% reduction).

During the same period, a total of 284,588 LLINs were distributed to pregnant women out of 362,301 who attended the first visit of antenatal care (78,5% of coverage) while 243,249 LLINs were distributed to children under one out of 340,296 children of nine month attending MR1(74,3% of coverage).

Regarding the universal coverage of households, a total of 1,329,888 rectangular LLINs were distributed to the general population through household's mass campaign in 7 districts not covered during mass distribution conducted in the last fiscal year. These include 235,684 LLINs IG2 Nets distributed in Rusizi district and 1,094,204 Standard LLINs distributed in Gisagara, Huye, Rwamagana, Kayonza, Gatsibo and Bugesera districts.

The number of Indoor Residual Spraying (IRS) districts fully sprayed in the FY 2020/2021 remained 12 compared to the FY 2019/2020 (Nyagatare, Kirehe, Bugesera, Gatsibo, Ngoma, Kayonza, and Rwamagana in Eastern Province; and Huye, Nyanza, Gisagara, Ruhango and Kamonyi in Southern Province) plus 8 high burden sectors of Rusizi District sprayed as an outbreak control strategy. In these targeted IRS Districts, a 99.5% coverage (1,308,889 out of 1,315,822 structures were sprayed) was achieved with a total population of 5,043,795 out of 5,070,129 protected (99.5%) from malaria.

About NTD, we conducted the first mass decentralized deworming campaign whose operational costs were owned by the country -Rwanda being the first country to own total operational costs of Mass Drug Administration in the Sub-Saharan Africa. This was possible through decentralization and integration within existing health and non-health platforms at village and school levels.

The coverage of Mass Deworming against Schistosomiasis and Soil Transmitted Helminthiasis-STH (including Ascaris lumbricoides, Trichuris trichiura and Ankylostoma duodenale and americanus) was >95% in the targeted population.

Furthermore, the first community-based and all age groups inclusive mapping survey for STH and Schistosomiasis was conducted showing that adults (16years and above) are most affected by STH with 48% of prevalence compared to School Aged Children -SAC (5-15years old) with 41% and Pre-SAC with 31% of prevalence respectively. These findings justify the need of adults' mass deworming. For Schistosomiasis, microscopic and immunological findings showed that 132 villages (44%) among 300 villages surveyed had the prevalence of 10% and above (range 10-56.7%). When applying the prevalence to cells adjacent to surveyed villages (surrounding water bodies), we found that 1016 cells are in need of Mass Drug Administration.

Introduction

Malaria and NTDs represent major public health problem in Rwanda and are considered among the leading causes of morbidity and mortality. Rwanda has made significant strides in controlling these disease through implementation of various control interventions including: mass and routine distribution of Long-Lasting Insecticide Nets (LLINs), Indoor Residual Spraying (IRS) in high endemic districts, adoption of mandatory laboratory confirmation prior to the treatment, use of ACTs in the treatment of uncomplicated malaria cases, national scale up of community based management and improvement in routine surveillance, monitoring and evaluation platforms, Mass Drug Administration (MDA) targeting Soil Transmitted Helminthiasis (STH) and Schistosomiasis (SCH) .
Despite combined efforts, Malaria and NTDs still represent a public health concern in Rwanda with millions of people affected every year.

The Rwanda Malaria and NTDs Strategic Plans build on national policies and strategies such as the Health Sector Strategic Plan IV (HSSP IV) which recognizes malaria and NTDs as major diseases that contribute to health and economic related burden. The vision of the Malaria and NTDs Strategic Plans is for Rwanda to become free from malaria and NTDs to contribute to the socioeconomic development. Reduction of malaria and NTDs burden will be achieved by strengthening and implementing appropriate control interventions and delivering quality health services. Achievement of Rwanda Malaria and NTDs Free will require a concerted and collaborative effort between the Government of Rwanda (GoR) and other partners.

Today, Malaria and NTDs Control efforts are being implemented at all levels through evidence-based interventions to reduce the burden of both diseases in the population. This consists of effective implementation of high impact interventions, including countrywide MDA for NTDs Chemoprophylaxis, LLINs Mass and Routine Distribution, IRS using an effective insecticide in targeted high malaria endemic districts, early diagnosis and treatment at health facility and community level, environmental management, Surveillance/Monitoring and Evaluation and Social Behavior Change Communication (SBCC).

The following report details malaria and NTDs control activities implemented from July 2020 to June 2021. These activities have been coordinated by the Malaria and Other Parasitic Diseases Division (MOPDD) of the Rwanda Biomedical Centre (RBC) with support from other GoR institutions, Health Facilities and Community Health Workers (CHWs) and implementing partners under the leadership of Rwanda Biomedical Centre and the Ministry of Health (MoH)

Malaria Program Results per Strategic Plan Framework

Goal: By 2024, reduce malaria morbidity and mortality by at least 50% of the 2019 levels

The following objectives will lead to achievement of the goal:

Objective 1: By 2024, at least 85% of population at risk will be effectively protected with preventive interventions;
Objective 2: All suspected malaria cases are promptly tested and treated in line with the national guidelines;
Objective 3: By 2024, strengthen surveillance and reporting in order to provide complete, timely and accurate information for appropriate decision making at all levels;
Objective 4: Strengthen coordination, collaboration, procurement & supply management and effective program management at all levels;
Objective 5: By 2024, 85% of the population at risk will have correct and consistent practices and behaviors towards malaria control interventions.

PART I: MALARIA PREVENTION

Objective 1: BY 2024, AT LEAST 85% OF POPULATION WILL BE EFFECTIVELY PROTECTED WITH MALARIA PREVENTIVE INTERVENTIONS

Strategy 1.1. Sustain and Expand IRS in High Malaria Incidence Districts

A- Introduction

Vector control interventions are primary component of malaria control and prevention. The two -core important vector-control interventions used in Rwanda are of Indoor Residual Spraying (IRS) and Long-Lasting Insecticidal Nets (LLINs). The IRS intervention consists of the spraying of interior surfaces of dwellings with a residual insecticide to kill and repel endophilic mosquitoes[1]. In order to be effective, IRS needs to be implemented at a high level of coverage before the peak of malaria transmission seasons. In 2007, IRS was introduced in Rwanda targeting districts with high risk of malaria transmission in urban district of Kigali and then extended in the rural districts in 2011.

Since 2008, the above core vector-control interventions have been progressively supplemented with other measures including larval source management using bio-larvicides and environmental management, mosquito repellents, fish farming in fish ponds and water dams. To ensure a successful and sustainable approach, Rwanda introduced the approach of Integrated Vector Management approach (IVM) by implementing its five pillars (i) Advocacy and social mobilization, ii) collaboration, iii) capacity building, iv) integrated approach and v) evidence-based decision-making. In order to successfully implement and optimize IVM strategies, the bionomics, behavior and transmission of local malaria vectors species are annually assessed. This information includes (1) the monitoring of the species composition and density, (2) the biting and resting behavior of mosquitoes, (3) susceptibility to insecticides and the infection rate of mosquitoes with *Plasmodium* parasite and (4) the entomological inoculation rate calculated per species, per study site and per year. The coverage, usage, quality, and

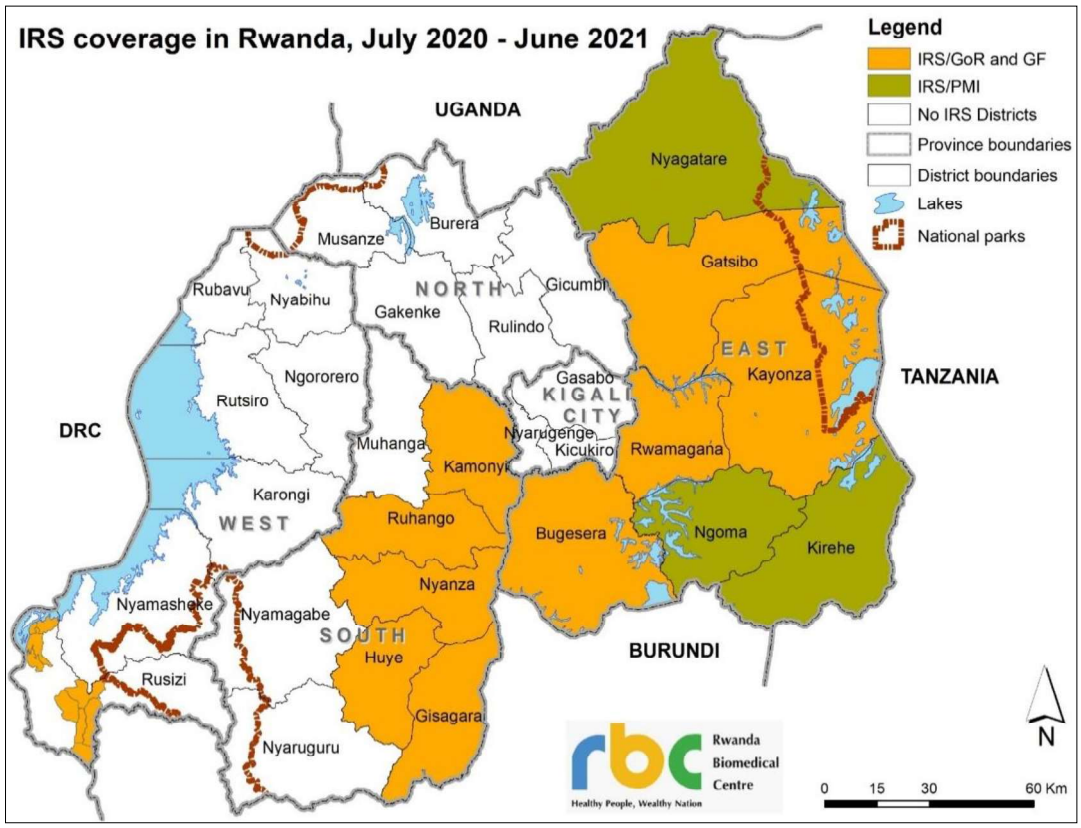
[1] WHO 2018, Malaria terminology, Global Malaria Programme, **Geneva-Switzerland. 38 pp**

durability of vector-control products and interventions are also annually monitored following their setting deployment.

B- Indoor Residual Spraying

During FY 2020-2021, 13 districts were sprayed out of 15 targeted districts for Indoor Residual Spraying (IRS). Three out of the above districts (Nyagatare, Kirehe, and Ngoma) were supported by PMI/VectorLink project implemented by Abt Associates. The remaining 10 districts received the support from The Global Funds and Rwanda Government (GF/GoR): Bugesera, Gatsibo, Kayonza, Rwamagana in Eastern Province; Gisagara, Huye, Nyanza, Ruhango, Kamonyi in Southern Province and eight sectors (Gikundamvura, Gitambi, Bugarama, Nyakabuye, Muganza, Kamembe, Nkanka and Gihundwe of Rusizi district in Western Province (Figure 1).

Figure 1: Indoor Residual Spraying Districts, FY2020/2021

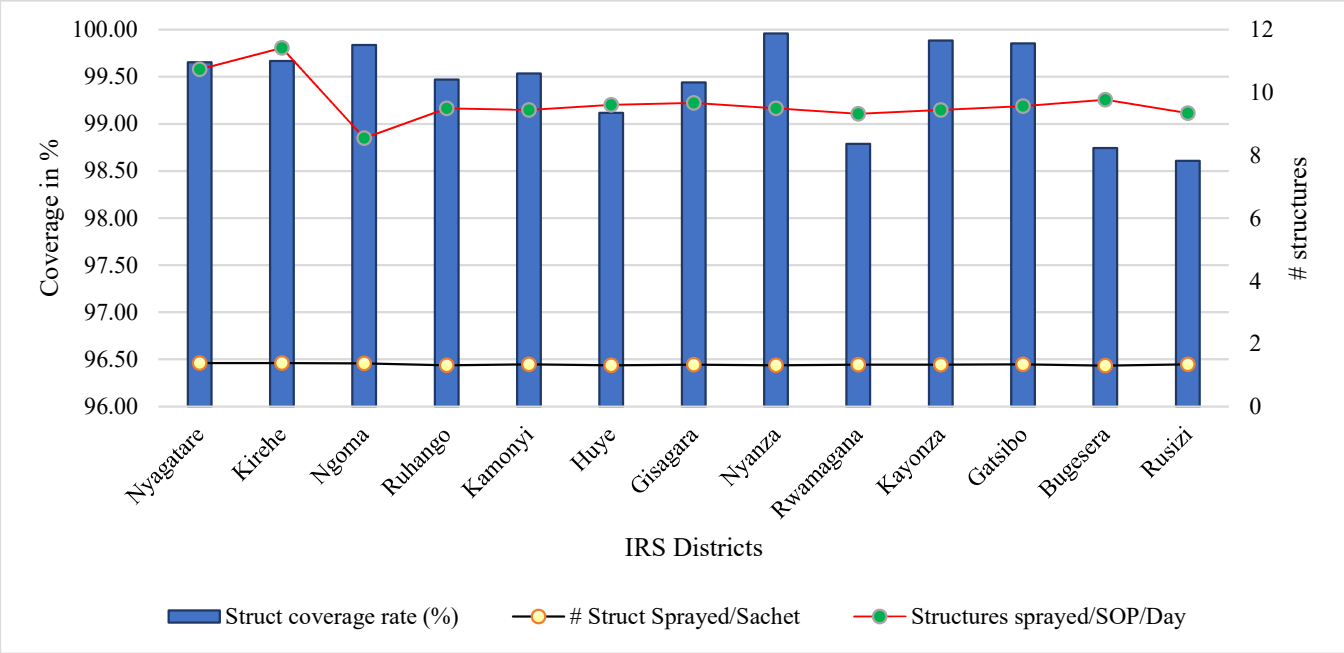


Over the FY 2020-2021, a total number of 1,315,822 out of 1,308,889 structures were sprayed making a coverage rate of 99.5%. The PMI/VectorLink project sprayed 334,802

out of 335,774 structures found with a coverage of 99.7% while the support from GF/GoR covered 974,087 out of 980,048 found structures with a coverage of 99.3%. The support from the GF/GoR represented 74.4% and 25.6% from PMI/VectorLink Project. In the targeted districts, the IRS intervention was performed with blanket coverage in 12 districts (153/153 administrative sectors) and focal coverage in Rusizi districts where 8 sectors (44%) were sprayed out of the 18 sectors (table 1). In terms of rooms covered, 4,761,954 were sprayed from 4,803,458 rooms found with a coverage of 99.1%. The total population protected was 5,043,795 out of 5,070,129 targeted populations with an estimated population covered of 99.5% in IRS districts. Among the population protected, 69,845 were pregnant women (1.38%) and 679,979 were children below five years (13.48%). The total insecticide used is 977,818 mix of Fludora Fusion® 56.25 WP and Actellic 300CS, 746,531sachets of Fludora Fusion® 56.25 WP were used in nine Districts plus 8 sectors of Bugesera District while the 231287 bottles of Actellic 300CS were used in three Districts plus seven sectors in Bugesera District. The quantity of 242,849 sachets of Fludora Fusion® 56.25 WP were procured by PMI, The quantity of 503,682 sachets of Fludora Fusion® 56.25 WP as well as 231,287 bottles of Actellic were procured by GOR/GF (Table 2).

In terms of performance, one sprayer operator (SOP) performed an average of 8.3 structures per day, with 8.9 and 8.2% structures/SOP/Day in districts supported by PMI and GF/GoR respectively. The highest performance was observed in Kirehe District with 10 structures sprayed per SOP per day. The average rooms per sprayed structure were 3.6 and ranging from 3.2 in Ruhango and 4 in Rusizi. In average, 1.34 structures were sprayed by one sachet/bottle of insecticide with 1.38 structures in districts supported by PMI and 1.33 structures in districts supported by GF/GoR and ranging from 1.39 in Kirehe district to 1.30 structures in Bugesera district (Figure 2).

Figure 2 : Performance of IRS (Coverage, Structures per SOP per Day and per Sachet)



Regarding the sources of funds for IRS operational cost, in total, 2,872,431,282 RFW were disbursed from GF/GOR and transferred to the district hospitals, with 2,582,192,054 RFW (89.9%) from GF, 290,239,228RFW (10.1%) from GoR.

The GoR also contributed 2,407,390,986Frw (21.8%) to procure insecticides and other IRS supplies, whereas the GF contributed 8,638,665,654 (78.2%).

Table 1: IRS Coverage per Partner and per District, FY 2020/2021

No	District	IRS Start	IRS End	# Structures Targeted	# Structures Found	# Structures Sprayed	Structures Coverage Rate (%)	Structures Sprayed/ SOP/Day
1	Nyagatare	24/08/2020	18/09/2020	127 440	137 673	137 196	99,7	9,4
2	Kirehe	24/08/2020	18/09/2020	98 729	102 266	101 925	99,7	10,0
3	Ngoma	24/08/2020	18/09/2020	93 601	95 835	95 681	99,8	7,2
Total Covered by PMI				**319 770**	**335 774**	**334 802**	**99,7**	**8,9**
4	Ruhango	05/11/2020	27/11/2020	97 059	99 952	99 424	99,5	8,2
5	Kamonyi	07/10/2020	29/10/2020	104 164	106 067	105 576	99,5	8,1
6	Huye	25/01/2021	16/02/2021	87 930	92 101	91 289	99,12	8,30
7	Gisagara	20/02/2021	13/03/2021	91 256	95 576	95 040	99,44	8,34
8	Nyanza	07/02/2021	01/03/2021	85 988	87 920	87 884	99,96	8,18
9	Rwamagana	11/03/2021	02/04/2021	98 033	99 076	97 875	98,79	7,98
10	Kayonza	10/03/2021	01/04/2021	106 473	108 098	107 975	99,89	8,12
11	Gatsibo	10/03/2021	01/04/2021	130 959	134 693	134 499	99,86	8,22
12	Bugesera	19/04/2021	11/05/2021	90 970	102 505	101 218	98,74	8,46
13	Rusizi	19/04/2021	11/05/2021	53 232	54 060	53 307	98,61	8,00
Total Covered by GF/GoR				**946 064**	**980 048**	**974 087**	**99,34**	**8,19**
Total FY 2020-21				**1 265 834**	**1 315 822**	**1 308 889**	**99,53**	**8,52**

Table 2: Population Protected, Room Coverage and Insecticide Used per IRS District

No	District	Population targeted	Total Pop protected	Pregnant Women	Children < years protected	Rooms sprayed	Coverage Sprayed Rooms	Average room per structure	Total Insecticide used	Type of Insecticide	# Structures Sprayed per Unit
1	Nyagatare	542 018	540 188	8 055	77 615	461 942	98,6	3,4	99 570	FF	1,38
2	Kirehe	436 219	435 309	6 367	61 573	388 061	98,9	3,8	73 546	FF	1,39
3	Ngoma	380 747	380 159	5 046	48 623	376 034	99,6	3,9	69 733	FF	1,37
Total PMI		**1 358 984**	**1 355 656**	**19 468**	**187 811**	**1 226 037**	**99,0**	**3,7**	**242 849**	**FF**	**1,38**
4	Ruhango	347 544	345 710	3 963	42 435	320 786	99,0	3,2	75 994	FF	1,31
5	Kamonyi	389 148	387 090	4 090	47 675	360 979	98,7	3,4	78 893	FF	1,34
6	Huye	345 680	342 448	4 614	43 780	354 681	102,0	3,9	69 817	FF	1,31
7	Gisagara	373 447	371 395	5 373	50 930	366 719	101,1	3,9	71 120	FF	1,34
8	Nyanza	322 267	322 141	4 194	40 553	299 144	99,6	3,4	67 060	FF	1,31
9	Rwamagana	367 620	362 905	4 862	47 444	374 582	97,9	3,8	73 257	Actellic	1,34
10	Kayonza	416 575	416 071	6 472	55 774	389 236	99,5	3,6	81 140	Actellic	1,33
11	Gatsibo	504 712	504 093	6 880	68 592	481 880	98,8	3,6	100 303	FF	1,34
12	Bugesera	403 190	398 098	5 918	60 135	374 320	97,3	3,7	77 567	Actellic+FF	1,30
13	Rusizi	240 962	238 188	4 011	34 850	213 590	97,8	4,0	39 818	Actellic	1,34
Total GF/GoR		**3 711 145**	**3 688 139**	**50 377**	**492 168**	**3 535 917**	**99,2**	**3,7**	**734 969**	**FF&Actellic**	**1,33**
Total FY 20/21		**5 070 129**	**5 043 795**	**69 845**	**679 979**	**4 761 954**	**99,1**	**3,7**	**977 818**	**FF&Actellic**	**1,35**

Strategy 1.3: Introduction of Innovative Integrated Vector Control Tools

A. Insecticide Resistance Monitoring and Quality Control of IRS

- **Insecticide Resistance Monitoring**

a. Biological Resistance

From July 2020 to June 2021, the biological resistance tests were carried out in 30 different sites. The tests followed the WHO mosquito susceptibility guidelines using the cylindrical tube method[2] for the eight insecticides belonging to the four classes: Carbamates (Bendiocarb 0.1%); Organophosphates (Fenitrothion 1%, and Pirimiphos methyl 0.25%); Organochlorines (DDT 4%); Pyrethroids (Deltamethrin 0.05%, Permethrin 0.75%, and Alpha cypermethrin 0.05%); and the new class of the pyrrole (Chlorfenapyr 200µg) .

Thus, larvae collections of *Anopheles* genus were conducted using the dipping method as described by the WHO[3]. Mosquito larvae were subsequently reared in the locally established insectary in different sites following the standard conditions of temperature (26-28°C) and relative humidity (70-80%). The susceptibility test was conducted on *Anopheles gambiae* s.l aged 3 to 5 days, and fed on glucose. For testing, a minimum of 100 mosquitoes were used in 4 replicates with 20-25 females per tube for each insecticide, each test had two control replicates of 50 mosquitoes.

The mosquitoes were exposed to the standard dose of insecticide for one hour (knock down test) and observed for 24 hours' post-exposure for mortality assessment. The exposure mortality was calculated as number of dead mosquitoes over the total number exposed. A mortality rate between 98% and 100% is considered to indicate fully susceptibility; 90-97% mortality suggests the possible resistance that needs to be confirmed. Mortality that is < 90% indicates confirmed resistance. It was found that resistance status to at least one insecticide was more prevailing in endemic districts of low land areas than in high land (Figure 3, 4).

[2] WHO (2013). Test procedures for insecticide resistance monitoring in malaria vector mosquitoes

[3] WHO (2013) Malaria entomology and vector control – Learner's Guide

Figure 3: Distribution of Insecticide Resistance to Pyrethrinoid Insecticides

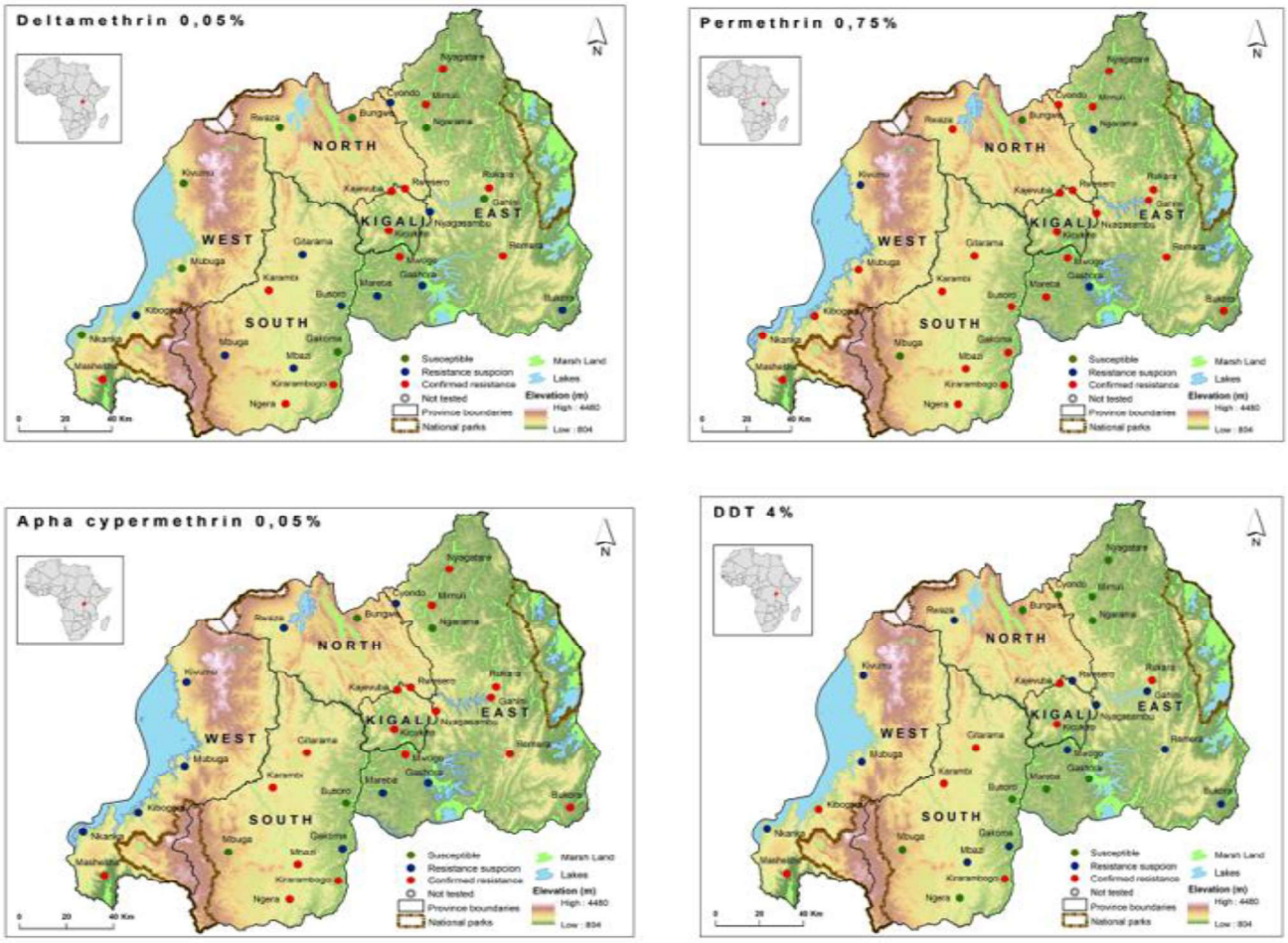
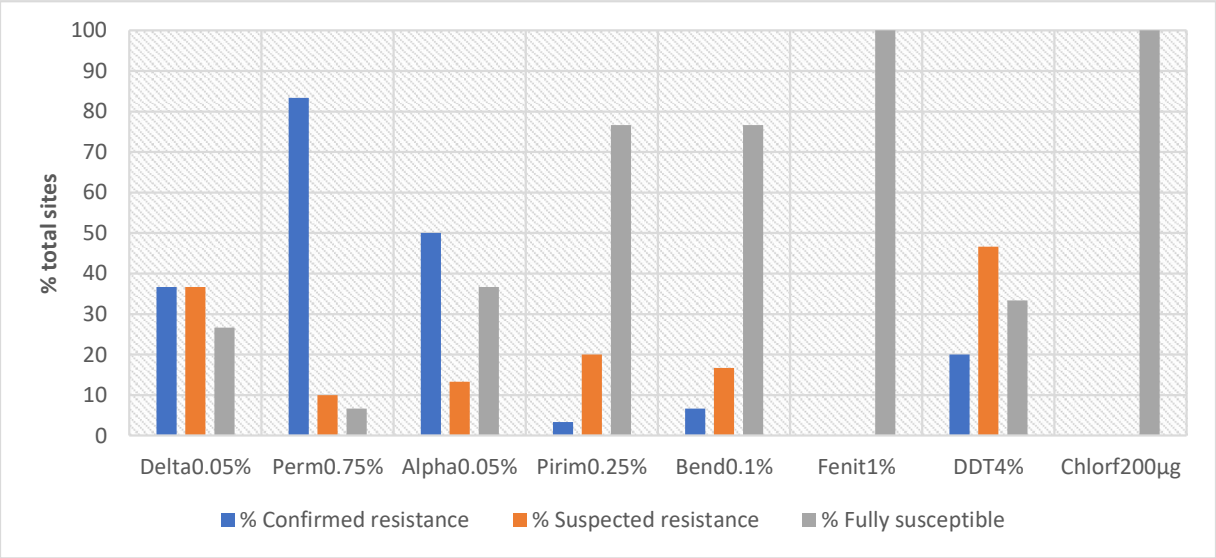


Figure 4: Levels of Insecticide Resistance per Insecticide Product, 2020-2021



b. Resistance Mechanism

In the 20 sites with confirmed resistance to at least one of the pyrethroids class insecticides; deltamethrin, permethrin and Alphacypermethrin, the addition of synergist (Piperonyl Butoxide: PBO) restored the susceptibility in 50 to 67% of the sites depending on the insecticide product (Figure 5). The results suggest a role of metabolic mechanisms in mediating pyrethroid resistance in malaria vectors which is increasing over years and also the potential involvement other resistance mechanisms that needs to be investigated. In FY 2020-2021, all three insecticides tested, the susceptibility was restored at 100% after the addition of PBO.

Table 3: Results of Resistance Tests for Insecticides (with PBO) Performed, 2020-2021

Susceptibility Status	Product Name					
	Delta. 0.05%+PBO		***Perm. 0.75%+PBO***		***α-cyper 0.05%+PBO***	
	# Sites (n=10)	**%**	**# Sites (n=20)**	**%**	**# Sites (n=12)**	**%**
Resistance with PBO confirmed	2	20	3	15	1	8
Resistance with PBO suspected	3	30	6	30	3	25
Susceptibility restored with PBO	5	50	11	55	8	67

c. Resistance Intensity using WHO Susceptibility Test Kits

The intensity of the resistance was also tested in 25 sites where the resistance at diagnostic doses was confirmed to deltamethrin, permethrin, and Alpha cypermethrin. The intensity assays were performed at five (5x) and ten (10 x) times the diagnostic dose described for biological resistance tests except for deltamethrin where only 10x was used. The resistance was found to be low and moderate levels. The intensity to Deltamethrin was found high in three sites of Gakoma, Rukara and Mimuli and moderate in remaining sites 4 sites. For Permethrin, the resistance intensity was low (14 sites) to moderate (11 sites) for Permethrin in all 25 sites. Regarding Alpha-cypermethrin, the resistance intensity was high in Mwogo site, and low (11 sites) to moderate (3 sites) out of the 15 sites surveyed. (table 6).

Table 4: Insecticide Resistance Intensity in 26 Sites with Confirmation of Resistance

No	Sites	Deltamethrin 0.05%	Permethrin 0.75%		Alpha cypermethrin 0.05%	
		Deltamethrin 0.5% (10x)	Permethrin 3.75% (5x)	Permethrin 7.5% (10x)	Alpha cypermethrin 0.25% (5x)	Alpha cypermethrin 0.5% (10x)
1	Bukora		97	100	92	98
2	Cyondo		100	100		
3	Gahini		96	100	100	100
4	Gakoma	95	100	100		
5	Gitarama		100	100		
6	Kajevuba	100	88	100	90	98
7	Karambi	100	100	100	100	100
8	Rukara	97	97	100	97	100
9	Kibogora		94	99		
10	Kicukiro		100	100		
11	Kirarambogo	100	94	100	90	100
12	Mareba		95	100		
13	Mashesha		91	100	87	100
14	Mbazi	100	93	98	95	99
15	Mimuli	95	97	100	93	98
16	Mubuga		100	100		
17	Mwogo	100	98	100	82	93
18	Remera	100	95	99	74	99
19	Nkanka		100	100		
20	Nyagasambu		100	100		
21	Nyagatare	100	97	100	96	99
22	Busoro		100	100		
23	Ngera		100		100	
24	Rwaza		100	100		
25	Rwesero	100	95	100	97	100

Remark: (5x ≥ 98% mortality = low intensity, < 98% mortality = moderate intensity; 10x ≥ 98% mortality = moderate intensity, < 98% mortality = high intensity)[4]

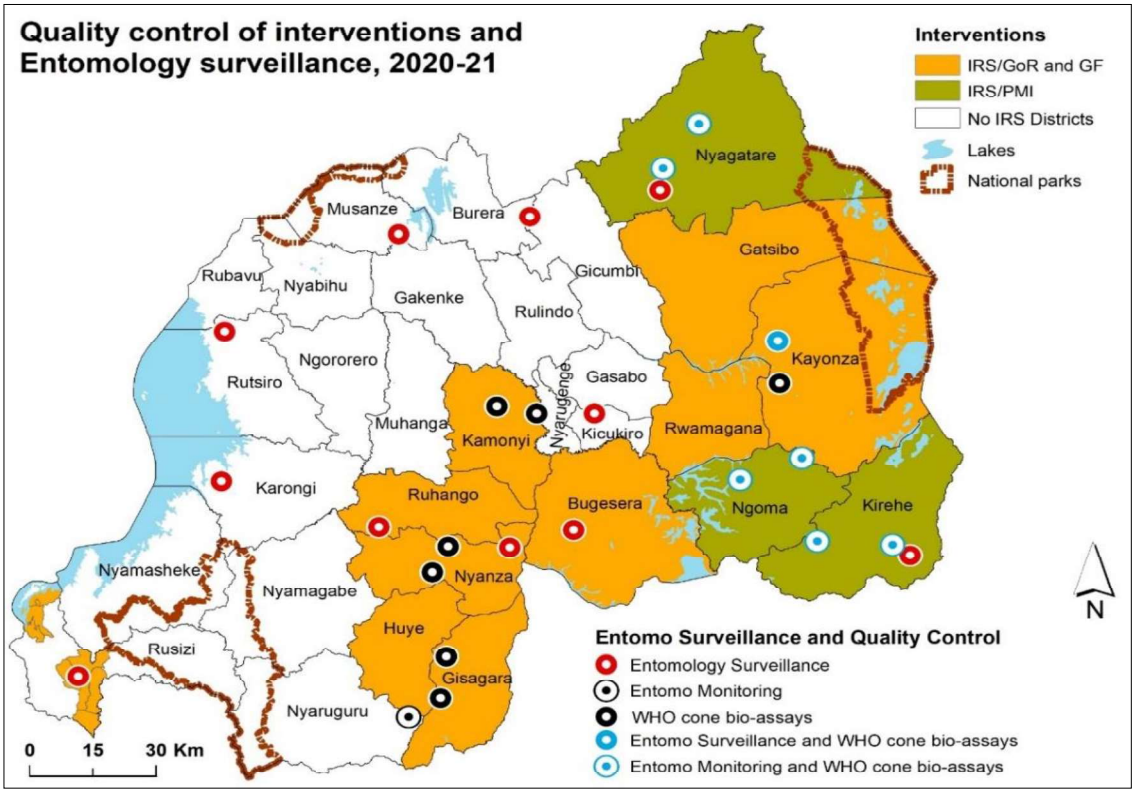
[4] WHO (2013). Test procedures for insecticide resistance monitoring in malaria vector mosquitoes

- **Quality Control of Interventions and Entomology Surveillance**

a. Quality Control of IRS using Wall Bioassays

IRS quality control (wall bioassays) was performed one-week post IRS as well as on a monthly basis to determine the residual efficacy of the insecticide on sprayed house walls. The IRS campaigns were performed in different periods as indicated earlier. The districts were sampled for IRS Quality Control as following: Gisagara, Kamonyi, Kayonza, Kirehe, Ngoma, Nyagatare and Nyanza.

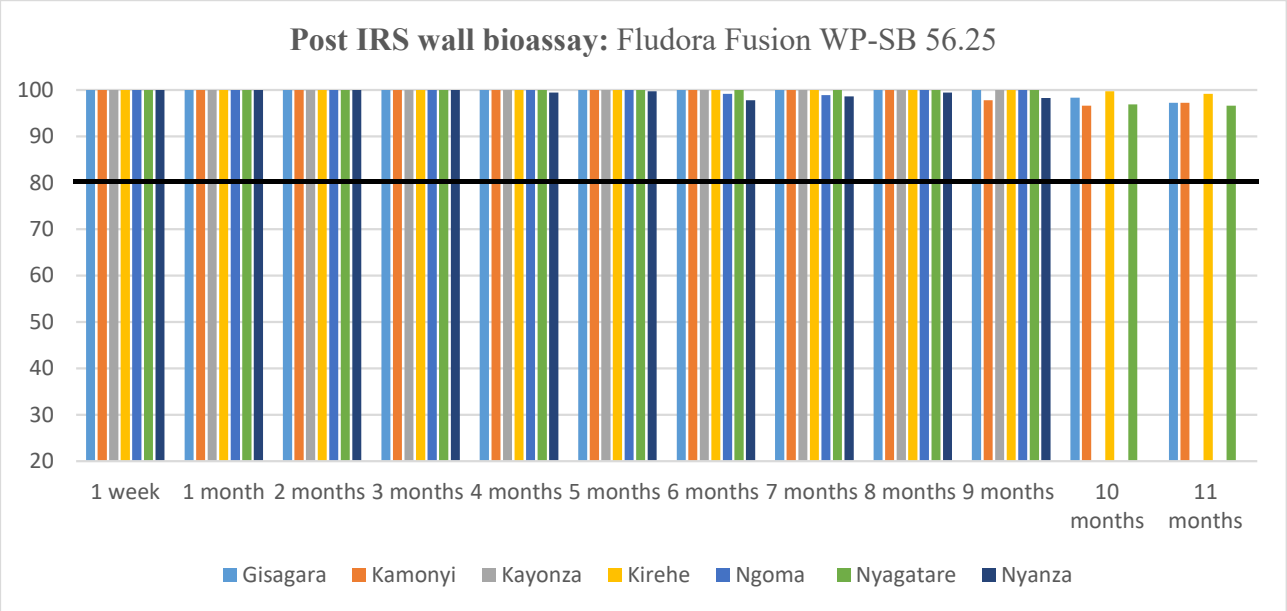
Figure 5: Quality Control of Interventions and Entomology Surveillance 2020-2021



The IRS quality control was performed in 2 sectors from each of the seven out of the 13 IRS districts. At each sector, 6 houses (2 plastered non-painted, 2 plastered painted, and 2 mud) were selected for bioassay tests. The susceptible Kisumu strains of *Anopheles gambiae* s.s. reared at the MOPDD/RBC insectary based at national entomology laboratory were used to run appropriate tests. Mosquitoes 2-5 days old were exposed in each wall house at the top, middle and bottom level of the walls. Two replicates for each type of house were applied. Mortality were red after 96 hours of exposure to the

insecticide, the **Fludora Fusion 56.25WP**. The mortality was calculated for both exposed and control samples.

Figure 6: Post IRS Wall Bioassays Performed in FY 2020-2021



The results and sites of the post IRS wall bioassays are shown in figure 5 and 6. The results of the wall bioassay were available up to eleven months in Gisagara, Kamonyi, Kirehe and Nyagatare, ten months in Kayonza, Ngoma and Nyanza. In all districts, the insecticide was still effective at the end of the year with mortality of exposed mosquitoes above the cut off mortality of 80% as recommended by WHO. Results confirm a residual efficacy of Fludora Fusion 56.25 WP of more than ten months in the context of Rwanda as shown the above results from all Districts (Figure 6).

b. Quality Control of IRS using Entomology Monitoring

The entomological monitoring was carried out, from July 2020 to June 2021 in two sites located in each IRS district respectively Nyagatare (Nyagatare & Rukomo), Kirehe (Gatore & Nyamugali), Ngoma (Zaza & Remera). The control district was Nyaruguru (Ngera) from September 2020 to June 2021. Between July 2020 and June 2021, mosquitoes were collected from indoor and outdoor on a monthly basis for assessment of the following

parameters: vector bionomics using human landing catching method and indoor resting behavior of mosquitoes using Pyrethrum Spraying catching method.

- As shown in tables below, during the period of activities, 21 406 mosquitoes (*Culicidae*) were collected using human landing catching method and out of them, 92.5% (n=19796) were *Culicinae* and 7.5% (n=1610) Anopheles mosquitoes. The *Anopheles gambiae* s.l. were the major malaria vectors and representing 71.7% (n=1155) of the total catches of anopheles mosquitoes. Other Anopheles mosquitoes collected were respectively *An. coustani 0.7%, An. funestus 2.8%, An. maculipalpis 2.9%, An. pharoensis 2.3%, An. ziemanni 18.2%* and *An. squamosis 1.4%*. Of the *An. gambiae* s.l. collected, 56.7% (n=655) caught outside the houses while the 43.3% (n=500) of other Anophelines mosquitoes were also collected outside the dwellings.
- The biting rate by *Anopheles gambiae s.l.* varied from 0.2 to 3.7 bites per person per night within sites, the biting rate by *Anopheles* varied from 0.4 to 3.7 bites per person per night within sites with an average of 1.6 bites per person per night. The average biting rate of mosquitoes in general *(Culicidae)* was 21.2 bites per person per night and ranging from 11 to 38.3 bites per person per night.
- The total collected mosquitoes through PSC method were 2,099 mosquitoes including *243 Anopheles gambiae s.l.*, 49 total *Anophelines* and *1807 Culicinae* from seven sites. Among *Anophelines*, 174 (59.4%) were unfed and 119 (40.6%) were found fed. In total 67 were fresh fed, 24 half-gravid and 28 gravid. The proportion of gravid was 44% in all sites.
- The determination of parity on a sample of 703 ***Anopheles gambiae s.l.*** dissected and collected from inside and outside in IRS sites and 125 ***Anopheles gambiae s.l.*** dissected and collected from inside and outside in none IRS site (control) showed respectively that the parous rates were 26.1% (n=578) in IRS sites and 53.6% (n=45) in none IRS sites. The results showed that the IRS intervention affects by reducing the longevity of malaria vectors.
- The entomological inoculation rate (EIR) which is the number of infectious bites per person per unit time was measured and expressed per year. The EIR was 0 infected bite per person and per year for 1655 Anophelines tested with a sporozoite infection rate of 0 in seven sites.

- Out pf 60 anopheles mosquito tested for blood meal, 26.7% were fed on human, 46.7% were fed on bovine, 13.3% were fed on multiple hosts (human, bovine and goat), while 13.3% was unspecified blood source.
- The speciation of *Anopheles gambiae* s.l. was performed in the entomology lab to identify the siblings of *Anopheles gambiae* complex. Out of 1016 samples analyzed using PCR-identification, 3.6% samples were found to be *Anopheles gambiae s.s.* and 96.4% were *Anopheles arabiensis*. The dominant malaria vector recently became *Anopheles arabiensis* in the most entomological monitoring sites within IRS districts.

Table 5: Distribution of Malaria Vectors/HLC and PSC –July 2020-June 2021

No	Site name	Anopheles gambiae s.l. / HLC			Other Anopheles / HLC			Cn/HLC	PSC			Tot. An	Tot. Cn	Cd	Biting behavior %				Biting rate person/night				Inf rate (%) An	EIR An
		In	Out	Total	In	Out	Total		An.g	Ao	Cn				Ag. Endo	Ag. Exo	Ao. Endo	Ao. Exo	An .g	An	Culc	Culd		
1	Gatore	53	160	213	8	59	67	5224	107	9	364	396	5588	5 984	24,9	75,1	11,9	88,1	1,5	1,9	36,3	38,2	0,0	0,0
2	Nyamugali	12	52	64	11	42	53	1460	6	8	207	131	1667	1 798	18,8	81,3	20,8	79,2	0,4	0,8	10,1	11,0	0,0	0,0
3	Nyagatare	7	18	25	11	22	33	3969	3	0	44	61	4013	4 074	28,0	72,0	33,3	66,7	0,2	0,4	27,6	28,0	0,0	0,0
4	Rukomo	281	251	532	2	4	6	3944	29	0	765	567	4709	5 276	52,8	47,2	33,3	66,7	3,7	3,7	27,4	31,1	0,0	0,0
5	Remera	35	33	68	13	26	39	1877	12	0	164	119	2041	2 160	51,5	48,5	33,3	66,7	0,5	0,7	13,0	13,8	0,0	0,0
6	Zaza	40	33	73	10	24	34	2128	6	1	47	114	2175	2 289	54,8	45,2	29,4	70,6	0,5	0,7	14,8	15,5	0,0	0,0
7	Ngera	72	108	180	82	141	223	1194	80	31	216	514	1410	1 924	40,0	60,0	36,8	63,2	1,3	2,8	8,3	11,1	0,0	0,0
Total		**500**	**655**	**1 155**	**137**	**318**	**455**	**19796**	**243**	**49**	**1 807**	**1 902**	**21603**	**23 505**	**43,3**	**56,7**	**30,1**	**69,9**	**1,1**	**1,6**	**19,6**	**21,2**	**0,0**	**0,0**

Table 6: Results of Pyrethrum Spraying Catches: Anophelines –July 2020 to June 2021

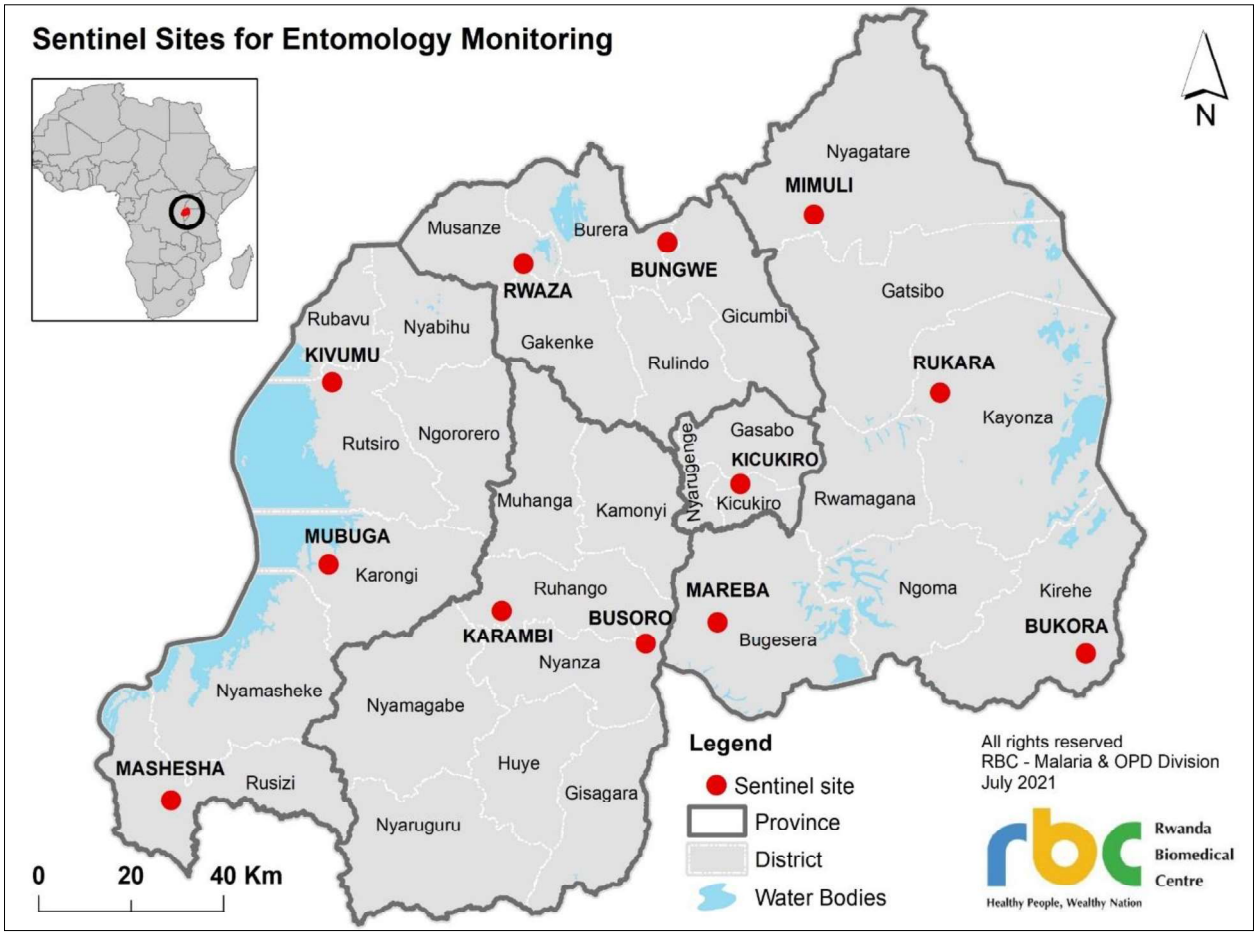
Period	Site	# of houses	# of Occupants	*An. gambiae* s.l	*Other Anopheles*	Abdominal/Blood Digestion stages				Proportion of gravid	*An. gambiae* s.l. *per house*	Fed per house	Fed/human host	Culicinae
						UF^	F^	HG^	G^					
July 2020 - June 2021	Gatore	180	723	107	9	76	15	13	12	63%	0,6	0,2	0,1	364
	Nyamugali	180	861	6	8	9	3	1	1	40%	0,1	0,0	0,0	207
	Nyagatare	180	1101	3	0	0	1	1	1	67%	0,0	0,0	0,0	44
	Rukomo	180	871	29	0	16	11	1	1	15%	0,2	0,1	0,0	765
	Remera	180	670	12	0	4	6	1	1	25%	0,1	0,0	0,0	164
	Zaza	180	715	6	1	6	0	0	1	100%	0,0	0,0	0,0	47
	Ngera	180	950	80	31	63	31	7	11	37%	0,6	0,3	0,1	216
Total		**1260**	**5891**	**243**	**49**	**174**	**67**	**24**	**28**	**44%**	**0,2**	**0,1**	**0,0**	**1807**

Abbreviations: HLC: Human Landing Catching; PSC: Pyrethrum Spray Catch; In: Inside; Out: Outside; An: Anophelines; An.g: *Anopheles gambiae* s.l.; Cn: *Culicinae*; Cd: *Culicidae*; Inf: Infectivity; endo: Endophagic; exo: Exophagic, UF^: Unfed, FF^: Fresh fed, HG^: Half gravid, G^; Gravid, EIR: Entomological inoculation rate

c. Entomology Surveillance in 12 Sentinel Sites

Entomological surveillance was carried out over twelve sentinel sites located in different districts according to malaria eco-epidemiological strata (Bungwe and Rwaza in Nothern Province, Rukara, Bukora, Mareba and Mimuli in Eastern Province; Busoro, Karambi in Southern Province; Mashesha, Kivumu, Mubuga in Western Province and Kicukiro in Kigali City (Figure 7). Between July 2020 and June 2021, mosquitoes were collected using human landing catching method from indoor and outdoor on a monthly basis for assessment of the different entomological parameters.

Figure 7: Sentinel sites for entomology surveillance



As shown in table 9, during the entomology activities 136,739 mosquitoes (Culicidae) were collected out of them 24.7% were *An. gambiae* s.l., 26.7% total anopheles and 73.3% culicines. Out of 36,545 total anopheles mosquitoes, 92.2% were *An. gambiae* s.l., 1.6% *An. funestus* and 6.2% other anopheles species. Over that period, 55.0% *Anopheles gambiae s.l.* were collected outside and ranging from 45% in Mubuga to 82.8% in Bukora.

The average of outdoor biting was 51% in non IRS sites while it was 68.8% in IRS sites. Overall, 601 *Anopheles funestus* were caught with more than 95% total collections in only three sites of Bungwe (44.1%), Kivumu (22.5%) and Mubuga (28.1%). An intervention of focal IRS should be deployed and eliminate the above indoor malaria vector where it is appearing as the dominant species in malaria transmission.

Regarding the biting rate by *Anopheles gambiae s.l.*, it varies from 0 (Bungwe) to 55.6 (Mashesha) bites per person per night (b/p/n), with an average of 6.5 b/p/n. The average biting rate of *An. gambiae s.l.* was found respectively 2.5 and 12.1 b/p/n in IRS and non IRS sites while it was 26.4 b/p/n in *Culicidae* and ranging from 4.3 (Rukara) to 80.4 (Mashesha) bi/p/n with 14.9 and 42.5 b/p/n in IRS and non IRS sites. There was a decrease of mosquito density of 14% in *An. gambiae* s.l. and an increase of 11% in total *Culicidae* in comparison with mosquito catches of 2019/2020. Except for Busoro in Nyanza District, where both *An. gambiae* s.l. and *Culicidae* were observed, other sites experienced an isolated increase of *Culicidae,* the increase of mosquito density to *Culicidae* was the most important in the following five sites of Kivumu, Rwaza, Busoro, Mubuga and Bukora (Figure 4 and 5). The above increase in mosquito density should be linked to the abnormal rainfall reported in the above sites and developmental activities such as the road construction in Busoro of Nyanza District.

The entomological inoculation rate (EIR) which is the number of infectious bites per person per unit of time was measured and expressed per year (ib/p/y). The average of EIR was 20.6 ib/p/y for *An. gambiae* s.l. and 0.5 ib/p/y for *An. funestus*. **All infected mosquitoes were reported in non IRS sites**. The *An. gambiae* s.l. carrying *Plasmodium* infections were found in four sites of Mashesha, Kicukiro, kivumu and Mubuga while the *An. funestus* carrying malaria infections were found in one site of Mubuga (table 5). This information, particularly the prevailing of malaria infection at site level should be used to inform the control methods and to set the priorities in specific district.

Figure 8: Comparison of *An. gambiae* s.l. and Total *Culicidae* FYs 2019/2020 and 2020/2021

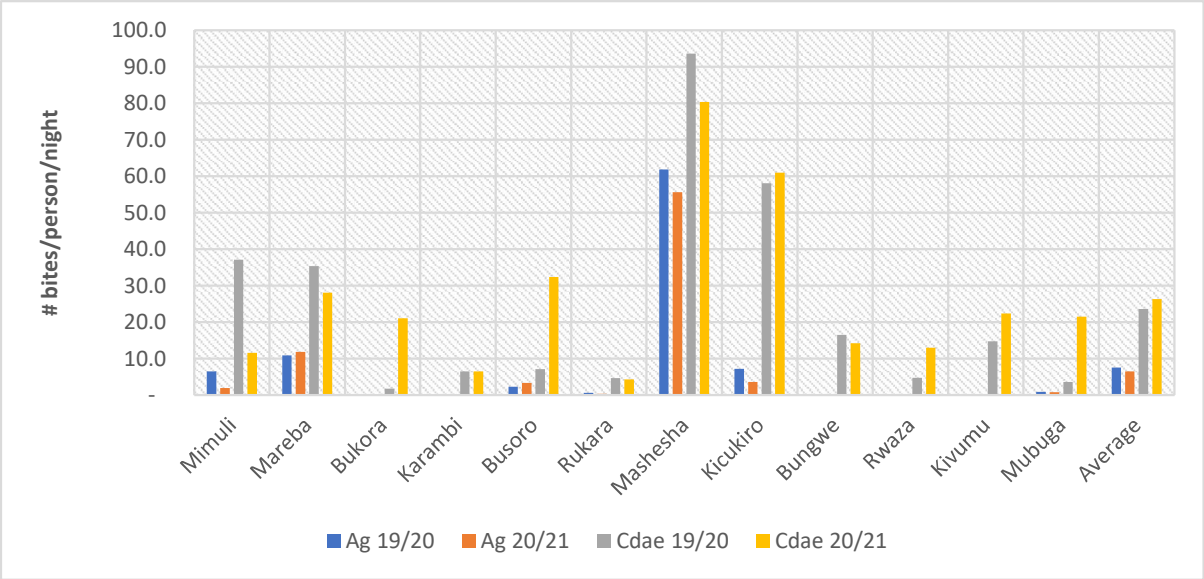


Figure 9: Trends of *An. gambiae* s.l. and Total *Culicidae* 2019/2020 and 2020/2021

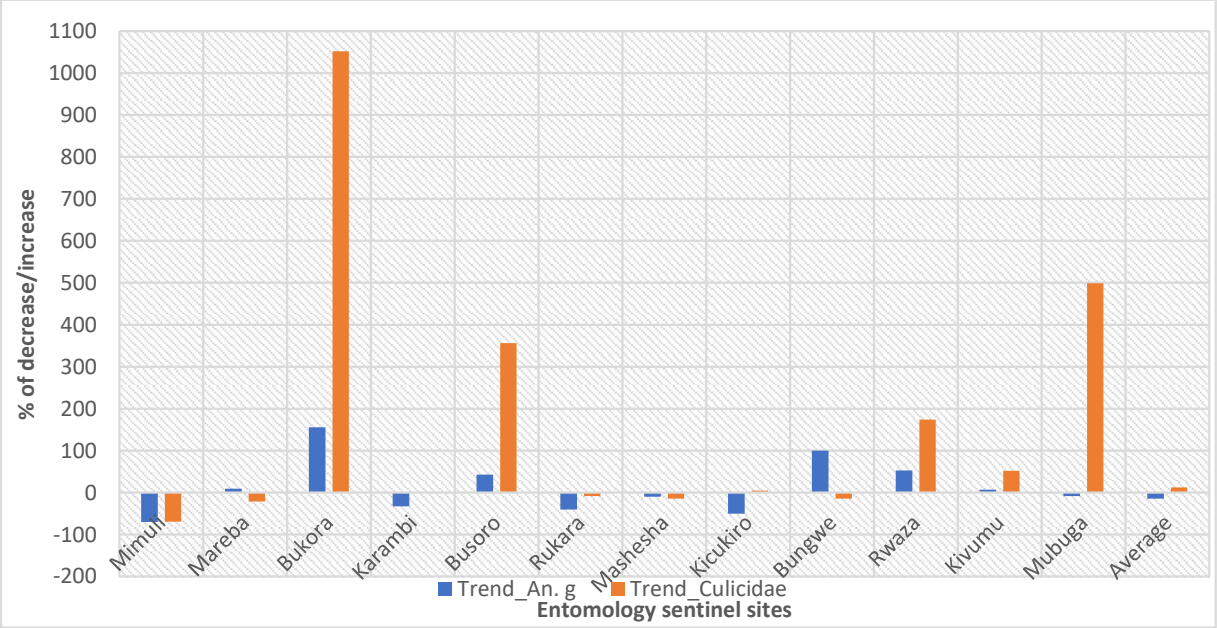


Table 7: Distribution of Malaria Vectors in 12 Sentinel Sites in Number

No	Site name	*Anopheles gambiae* s.l.			*Anopheles funestus*			Total *Anopheles*	Total *Culicinae*	Total *Culicidae*	% Anoph vs Total	% Culic./ Total	% Anoph vs Culic.
		Inside	Outside	Total	Inside	Outside	Total						
1	Mimuli	386	459	845	0	0	0	850	4 152	5 002	2	4	17,0
2	Mareba	1 332	3 797	5 129	2	4	6	5 245	6 892	12 137	14	7	43,2
3	Bukora	11	53	64	0	0	0	156	8 959	9 115	0	9	1,7
4	Karambi	18	30	48	0	0	0	87	2 721	2 808	0	3	3,1
5	Busoro	572	876	1 448	0	3	3	2 144	11 846	13 990	6	12	15,3
6	Rukara	76	73	149	8	1	9	322	1 543	1 865	1	2	17,3
IRS Districts		**2 395**	**5 288**	**7 683**	**10**	**8**	**18**	**8 804**	**36 113**	**44 917**	**24**	**36**	**19,6**
7	Mashesha	11 871	12 153	24 024	0	0	0	24 076	10 641	34 717	66	11	69,3
8	Kicukiro	674	899	1 573	0	0	0	1 743	24 599	26 342	5	25	6,6
9	Bungwe	5	12	17	70	195	265	754	5 408	6 162	2	5	12,2
10	Rwaza	7	19	26	6	8	14	46	5 574	5 620	0	6	0,8
11	Kivumu	24	25	49	76	59	135	384	9 296	9 680	1	9	4,0
12	Mubuga	184	155	339	86	83	169	738	8 563	9 301	2	9	7,9
Non IRS Districts		**12 765**	**13 263**	**26 028**	**238**	**345**	**583**	**27 741**	**64 081**	**91 822**	**76**	**64**	**30,2**
Total		**15 160**	**18 551**	**33 711**	**248**	**353**	**601**	**36 545**	**100 194**	**136 739**	**100**	**100**	**26,7**

Table 8: Distribution of Malaria Vectors in 12 Sentinel Sites

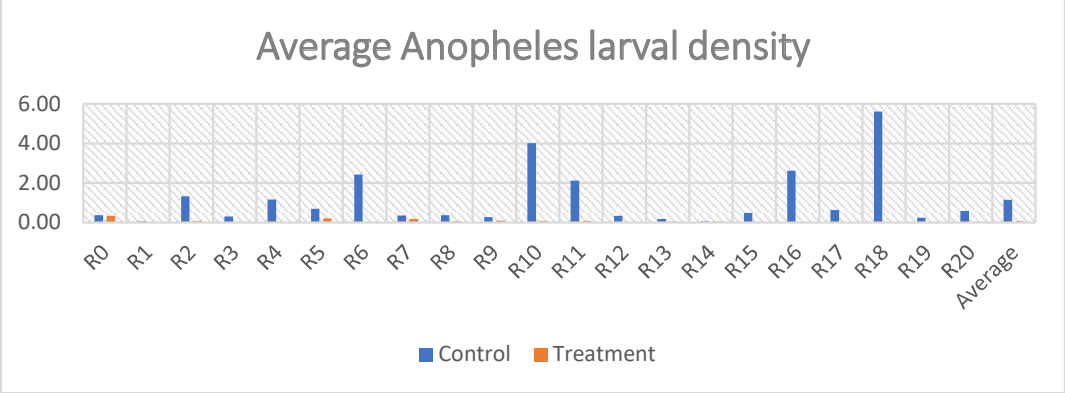
No	Site name	Biting behavior, %				Biting rate person/night			Infectivity rate (%) Ag	EIR Ag	Infectivity rate (%) Af	EIR Af
		Ag. Endo	Ag. Exo	Af. Endo	Af. Exo	Ag	Af	Culicidae				
1	Mimuli	45,7	54,3	0	0	2,0	0	11,6	0	0	0	0
2	Mareba	26,0	74,0	33,3	66,7	11,9	0,0	28,1	0	0	0	0
3	Bukora	17,2	82,8	0	0	0,1	0	21,1	0	0	0	0
4	Karambi	37,5	62,5	0	0	0,1	0	6,5	0	0	0	0
5	Busoro	39,5	60,5	0	100,0	3,4	0,0	32,4	0	0	0	0
6	Rukara	51,0	49,0	88,9	11,1	0,3	0,0	4,3	0	0	0	0
IRS Districts		**31,2**	**68,8**	**55,6**	**44,4**	**2,5**	**0,0**	**14,9**	**0**	**0**	**0**	**0**
7	Mashesha	49,4	50,6	0	0	55,6	0	80,4	0,3	14,5	0	0
8	Kicukiro	42,8	57,2	0	0	3,6	0	61,0	0,1	0,4	0	0
9	Bungwe	29,4	70,6	26,4	73,6	0,0	0,6	14,3	0	0	0	0
10	Rwaza	26,9	73,1	42,9	57,1	0,1	0,0	13,0	0	0	0	0
11	Kivumu	49,0	51,0	56,3	43,7	0,1	0,3	22,4	1,7	0,2	0	0
12	Mubuga	54,3	45,7	50,9	49,1	0,8	0,4	21,5	1,2	0,9	2,0	0,8
Non IRS Districts		**49,0**	**51,0**	**40,8**	**59,2**	**12,1**	**0,3**	**42,5**	**2,2**	**26,1**	**3,0**	**0,8**
Total		**45,0**	**55,0**	**41,3**	**58,7**	**6,5**	**0,1**	**26,4**	**3,2**	**20,6**	**4,0**	**0,5**

Abbreviations: In: Inside; Out: Outside; An.: *Anophelines*; An.g: *Anopheles gambiae* s.l.; EIR/Y: Entomological inoculation rate per year, ibp/y: infected bites per person and per years

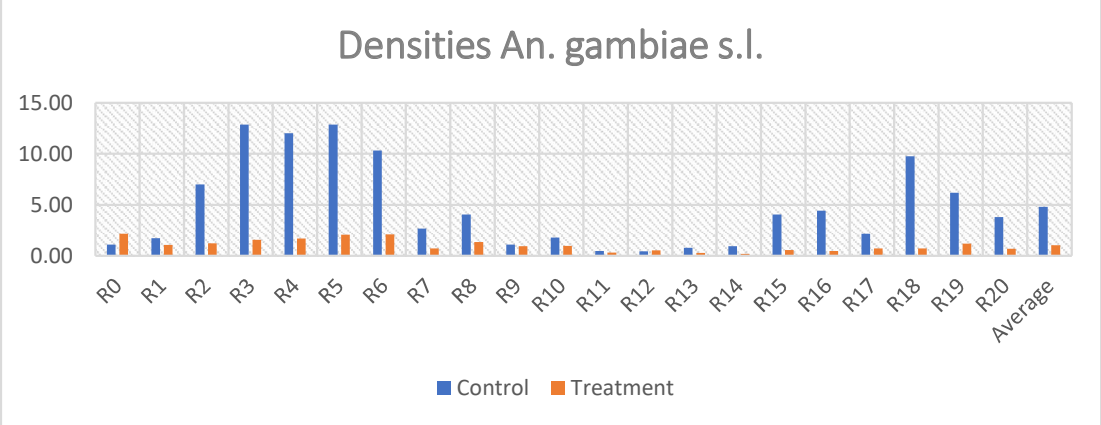
d. Implementation of Innovative Vector Control Interventions

RBC in collaboration with CHARIS UAS and SFH Rwanda implemented for a period of ten months, from July 2020 to April 2021 a pilot project of malaria control using LSM with the drone's based application of larvicides; *Bacillus thuringiensis* Israeliensis (Bti) in the marshlands of irrigated rice fields in Kabuye, Jabana sector of Gasabo District. The marshlands are located between the sectors of Jabana, Gisozi, Gatsata and Kinyinya with an area of 336 ha. Drone technology provided by CHARIS UAS brought a new approach to accurately map and apply larvicides in mosquito larval habitats inaccessible by hand sprayers.

Results show a positive impact on entomological data, the intervention dropped down to more than 90% and 60% respectively of Anopheles mosquito larval and adult stages.



The average *anopheles* larval density (# An. larvae/dip) reduced by 94% in treatment area while increased by 61% in control area



The average adult *anopheles* mosquito reduction was 67% in treatment area while increased by 339% in control area.

e. Climate Surveillance

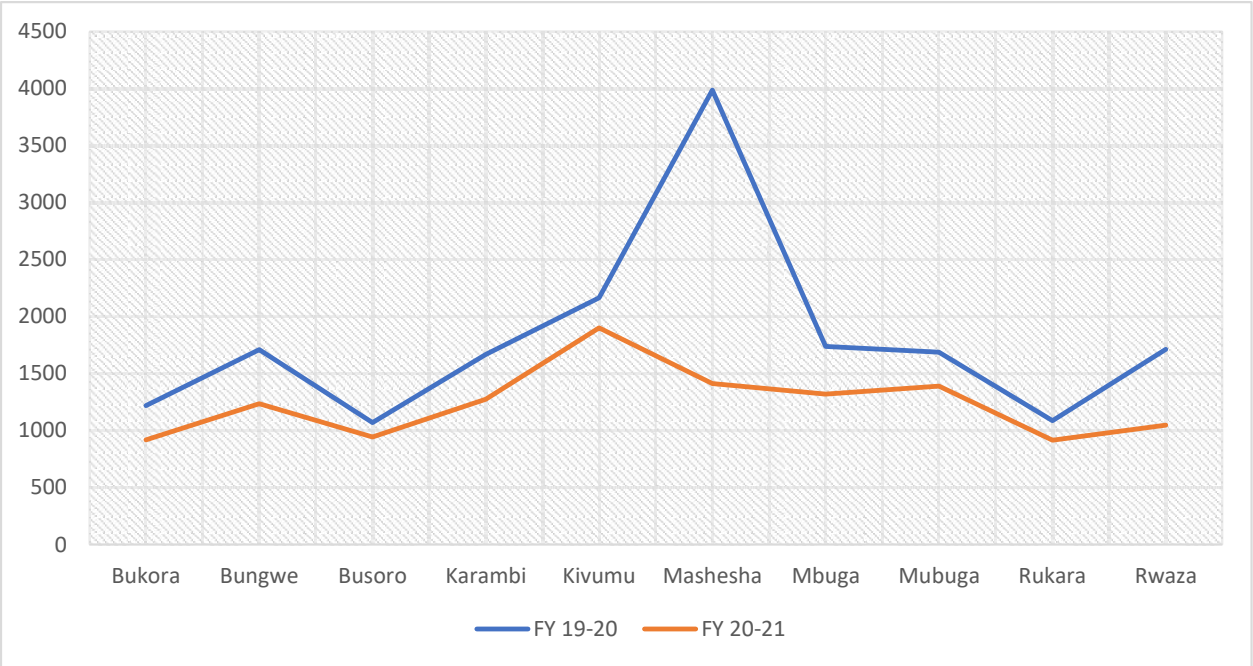
Table 9: Annual Average Rainfall, Temperature, and Humidity from ten Meteorological Stations from Entomological Sentinel Sites

District	Station	An. Max Temp	An. Min Temp	An. Mean Temp	An. Rainfall	R. Humidity (%)
Kirehe	Bukora	29,25	14,82	22,03	919,2	68,31
Burera	Bungwe	20,17	13,06	16,61	1233,7	66,25
Nyanza	Busoro	27,16	12,07	19.62	943,8	58,04
Ruhango	Karambi	25,78	14,37	20,08	1274,3	58,69
Rutsiro	Kivumu	24,31	10,75	17,53	1899,1	72,53
Rusizi	Mashesha	30,77	11,56	21,01	1411,48	70,78
Nyamagabe	Mbuga	22,51	12,67	17,59	1319,2	-
Karongi	Mubuga	25,61	13,23	19,31	1388,4	66,56
Kayonza	Rukara	26,44	16,61	21,53	915,8	64,27
Musanze	Rwaza	24,66	12,77	18,72	1047	59,82

This spatial variation of the three climatic variables (temperature, rainfall, and R. humidity) is mostly contributing to the distribution of *Anopheles* mosquitoes. Bukora (Kirehe District) and Rukara (Kayonza District) are the highest warmed stations with respectively 22.03°C and 21.53°C. The two stations of Kivumu (Rutsiro District) and Mashesha (Rusizi District) have registered high annual rainfall (between 1400-1900mm) and high relative humidity of 72.53% and 70.78% respectively. The comparison of the annual trends of rainfall between 2019-2020 and 2020-2021 shows a high decrease of annual rainfall depth in 2020-2021(2085.7mm of decrease) at the rainiest stations. However, malaria transmission should be still high in the area with high temperature (≥18 ≤ 35), rainfall (> 80 mm), and R. humidity (> 60%)[5] if prevention measures are not optimized.

[5] Ceccato P., Connor S. J., Jeanne I., Thomson M.C. Application of Geographical Information Systems and Remote Sensing technologies for assessing and monitoring malaria risk. *Parassitologia* .47.1 (2005), 81-96

Figure 10: Comparison of Rainfall 2019-20 and 2020-21



This indicates that Mashesha sentinel site is more likely to collect more mosquitoes compared to the other nine sites. Consequently, more than 79.9 % of all *Anopheles* collected in 12 sites were reported from Mashesha (Table11).

B. Maintenance of Insectary and Laboratory Animals

The susceptible Kisumu strain of *Anopheles gambiae* s.s. were maintained at the Mal&OPDD/RBC insectary based at national entomology laboratory of Kicukiro which comply with the WHO mosquito rearing standards. The total of 91,000 including *Anopheles gambiae s.s.* and wild Anopheles mosquitoes were supplied for the quality control activities or other purposes such as learning demonstrations. In total, 42,000 females *Anopheles gambiae s.s.* 2-5 days old were supplies for IRS quality control in sprayed districts. 13,000 females *Anopheles gambiae s.s.* 2-5 days old were supplies for LLINs WHO cone bio assays and 7000 wild mosquitoes 3-5 & 5-8 days old were also collected, reared at sentinel sites to be used in LLINs WHO cone bio assay and tunnel test as resistant colony. While 28,000 *Anopheles gambiae s.s.*

(males and Females, adults and larvae stages) were supplied in IVM TOTs training in all districts, world malaria day and in the training of TOTs on integrated Malaria Guidelines.

During the period of July 2020 to June 2021, the total of 127 Guinea pigs were kept at insectary for feeding mosquito colony and out of them 97 were supplied in the community to improve food deficiency for the poor families around the entomology laboratory. Current 30 are kept healthy and ready to supply blood for mosquitoes.

C. Capacity Building and Research

- IVM Capacity Building at District Level

Evidences show that stagnant water bodies from different environment settings such as the rice paddies, the channels, pits from mining sites, unused or old containers and land depressions were described as the mosquitoes breeding sites that causing the spread of malaria. Through the approach of IVM (pillars of social mobilization, capacity building and integration methods), from April-May 2021, the MOPDD in collaboration with five CSOs: SFH Rwanda, CARITAS, Pro-Femmes Twese Hamwe, URUNANA and RICH conducted an extensive 5 days' trainings of vector control TOTs from 30 districts. The main objective of the training of TOTs at district level was to empower the districts to carry out the cascade trainings of community-based organization and the community in general to physically identify mosquito larvae and thus implement effective environmental management and controlling mosquitoes from the source or breeding sites. The training used mixed training methods involving in class theories and in field practices for mosquito larval collection and their physical identification "learning by doing or seeing".

The trainings were organized in the Covid-19 context and 231 participants from 30 districts were trained in 2 consecutive shifts of 5 days from the following six sites: Huye and Muhanga for Southern Province; Karongi and Rubavu for Eastern Province; Nyamata and Rwamagana for the Eastern Province and Kigali City. The participants were identified in collaboration with districts and CSO partners. In total participants were occupying 17 positions from districts (43.3%), district hospitals (35.5%) and organization of cooperatives (21,2%) (Table 13.). The table 12 displays the repartition of participants per occupied position at his/her affiliated organization and per

province. The six positions are occupied 76.6% of the TOTs trained respectively, Hygiene and sanitation officers, Agronomists, Supervisors of Community Health Workers, Environment and Hygiene Officers, Representative of rice farmer cooperatives and Representative of cooperative of miners.

Table 13: Repartition of Trained IVM TOTs per Position and Affiliated Organization

#	Participant Positions, IVM Trainings	Affiliated Organizations	Total
1	Hygiene & Sanitation Officer (HSO)	District	27
2	Agronomist (AGR)	District	24
3	Forest and natural resources (F&NR)	District	1
4	Environment Officer (EO)	District	8
5	District Cooperative Officer (DCO)	District	8
6	District Community Mobiliser Officer (DCM)	District	11
7	Health Promotion and Disease Prevention (HP&DP)	District	7
8	DJAF	District	5
9	District Animal Resources Officer (DARO)	District	7
10	District Health Unit Director (DHUD)	District	2
	District Administration (43.3%)		**100**
11	CHWs Supervisor (CHW Sup)	DH	38
12	Environment and Hygiene Officer (EHO)	DH	40
13	Monitoring &Evaluation Officer (M&EO)	DH	3
14	Malaria Focal Person (MFP)	DH	1
	District Hospital level (35.5%)		**82**
15	Cooperative of Rice Farmers (CRFarm)	Cooperatives	22
16	Cooperatives of miners (Cmin)	Cooperatives	26
17	Cooperative Fish Farmers (CF Farm)	Cooperatives	1
	Community Cooperative's Organizations (21.2%)		**49**
	Total TOTs Trained		**231**

- **Evaluation of Bti Product Sprayed with Drones for Mosquito Larval Control**

An evaluation of larviciding using Bti product and sprayed with a combination methods of drones supplemented by hand application with Rice farmers was performed from July 2020 to April 2021 for a 10 months' period. The following

parameters were evaluated: The abundance and density of mosquito larvae, the bionomics of adult mosquitoes collected using HLC and PSC methods and malaria incidence reported from community health workers of the neighboring villages. The intervention of larviciding using Bti contributed to the reduction (a) abundance of anopheles larvae by 90.6%, (b) abundance of pupa stage by 99.6%, (c) anopheles larval density by 95.3%, (d) pupal density by 61,9%, (e) adult anopheles mosquitoes with HLC method by 80%, (f) adult anopheles mosquitoes with CDC-LT method by 73.4%, sporozoite infection rate due to *Plasmodium* parasite dropped down to zero infection out of 1670 samples tested with ELISA. In general, the larval source control using Bti speayed with drones contributed to 33.1% reduction of malaria incidence in addition to the impact of PBO nets and other vector control measures.

Strategy 1.2: Sustain Universal Access to LLINs

A. Long Lasting Insecticidal Bed Nets

As recommended by WHO, since December 2009 Rwanda embarked to achieve the LLINs Universal Coverage (UC) of the population at risk through the LLIN mass distribution of households and routine distribution to the most vulnerable groups (children of under five years old and pregnant women).

- **LLIN Reception, Quality Control and Distribution to Health Centers**

In the previous FY 2019-2020, RBC/MOPDD have received a total number of 6,181,872 LLINs over 7,527,453 LLINs rectangular which were procured with funds from Global Funds and USAID/PMI, and 1,345,581 LLINs remained were received during this FY2020-2021.

Before reception, the physical inspection was done by the technical team of RBC based on the ISO 2859-1 protocol and the Acceptance Quality Limit (AQL) of 2.5 for major defect and 4.0 for minor defects. All consignment has passed and recommended for the distribution

Also, due the full physical inspection conducted in the previous fiscal year for rejected lots in order to reject the number of LLINs not conforming to the quality requirements and to accept the number of LLINs fulfilling the quality requirements defined in the related contracts, LLINs intended to be distributed in routine ANC and EPI were

recommended to be repacked and resealed in order to facilitate their storage in good conditions at health centers, waiting the routine distribution to pregnant women attending the first visit of ANC and children of nine month receiving MR1 vaccine.

Table below shows the number of LLINs distributed from MPPD (later changed to Rwanda Medical Supply-RMS) to health centers per district for the mass campaign, routine ANC and routine EPI distribution.

Table 10. Number of LLINs Distributed from MPPD to Health Centers per District

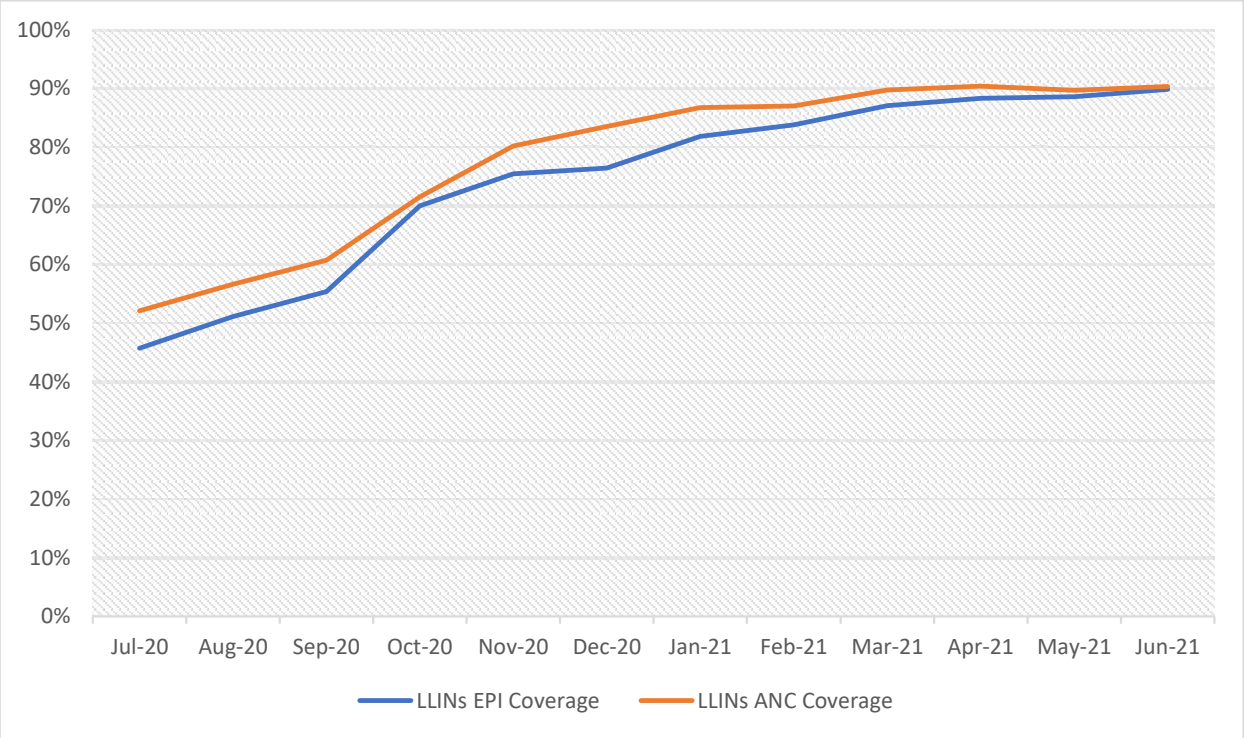
Donor	Type of LLINs	District	Period	LLINs Distributed			Total
				HHs	ANC	EPI	
GF	IG2 Nets	Muhanga	Oct-2020	-	1,050	1,200	2250
		Kilinda	Oct-2020	-	2,380	3,600	5980
		Rusizi	Oct-2020	-	7,700	7,700	15400
		Nyamasheke	Oct-2020	-	3,250	-	3250
PMI	PBO Nets	Nyarugenge	Oct-2020	-	14,550	16,450	31000
		Gasabo	Oct-2020	-	20800	24150	44950
		Rulindo	Oct-2020	-	5100	5700	10800
		Gicumbi	Oct-2020	-	850	800	1650
GF	Standard Nets	Kayonza	Oct-2020	185,350	11,800	11,800	208950
		Bugesera	Oct-2020	198,050	17,000	17,000	232050
		Gatsibo	Oct-2020	237,050	19,950	19,950	276950
		Rwamagana	Oct-2020	179,850	11,550	11,550	202950
		Kabutare	Oct-2020	173,650	11,300	11,300	196250
		Gisagara	Oct-2020	169,750	16,200	16,200	202150
Total				**1,143,700**	**143,480**	**147,400**	**1,434,580**

- **LLINs Distribution to Pregnant Women and Children Under 1 YO**

These strategies of LLINs distribution are integrated in Antenatal Care (ANC) package for maternal health and Expanded Program in Immunization (EPI) services to target pregnant women and children under five years. On a monthly basis, the distribution of LLINs was reported through the national Health Management Information System (HMIS)

During this fiscal year, the number of 284,588 LLINs was distributed to pregnant women over 362,301 who attended the first visit of antenatal care (78,5%) and the number of 243,249 LLINs was distributed to children under one year over 327,249 who attended MR1 (74,3%).

Figure 11. National Coverage of LLINs Distribution through ANC and EPI



The national LLINs distribution coverage increased along the fiscal year. This increase is linked to the availability of LLINs stocks for routine at health centers level and the involvement of five CSOs (one NGO per province) in the follow-up of indicators related to the LLINs distribution to pregnant women and children under one year through routine ANC and EPI

However, the distribution target through routine ANC and EPI which is 95% and above was not achieved because of stock outs in LLNIs in some districts (due to delays of LLINs procurements and delivery related to different challenges including the COVID-19 pandemic and the delay of the availability from USAID/PMI of funds intended to LLINs procurement from MOP19) or non-compliance of health facilities to the national guidelines.

- **LLINs Distribution to Households through Mass Campaign**

In addition to the routine LLINs distribution through ANC and EPI services, nets have been distributed to households through mass distribution campaign. The preparation of LLINs distribution began with the identification of household needs on the basis of which the quantification was elaborated in term of 1 LLIN by 2 household members and shared to the MPPD in charge of LLINs transportation from MPPD warehouse to health centers. Implementation of LLINs mass distribution campaign started from March 2019 to June 2020 in 23 districts and continued in the FY 2020-2021 in 7 remaining districts. This extension on the LLINs mass distribution was due to delay in LLINs procurement (COVID 19 Pandemic).

In this FY, a total of 1,329,888 LLINs were distributed to households of Rusizi, Gisagara, Huye, Bugesera, Rwamagana, Kayonza and Gatsibo districts.

Considering the COVID-19 Pandemic context, Malaria Program designed a mitigation and adaptative approach of LLINs distribution through door to door to prevent the risk of COVID-19 infection. In this new approach, communities are not called for gatherings in selected sites across districts area to receive LLINs but the distribution LLINs was done all CHWS in collaboration with local authorities at household level.

To reduce CHW exposure to COVID-19, preventive measures were recommended (Masks and handwashing at each household visit) and the number of CHWs was increased to 14,850 for the door-to-door distribution in remained 7 districts, from the initially planned 2,316 who would have worked at fixed distribution points where management of crowding would have been difficult.

The change in strategy required additional budget to cover the incentives for all CHWs.

Table 11. Mass Distribution of LLINs by District, FY2020-2021

District	Number of LLINs Distributed
Gatsibo	238360
Kayonza	185594
Rwamagana	196,158
Bugesera	194,205
Huye	172,198
Gisagara	107,689
Rusizi	235,684
Total	**1,329,888**

- **LLINs selling in the Private Sector**

Today, following the Ministerial Instruction of February 26th, 2018, regulating the distribution of LLINs for free of charges to the population in Ubudehe1,2 and selling of LLINs to the population in Ubudehe 3&4, LLINs are being distributed to those in need not covered through Mass campaigns and routine services.

During this FY, 3,392 LLINs were distributed through Social Marketing in different areas of the country through selling points, and Community-Based distribution (CBD) by CHWs and pharmacies.

PART II: MALARIA CASE MANAGEMENT

Objective 2: Maintain 100% prompt testing and treatment of all suspected malaria cases in line with national treatment guidelines by 2024

Diagnosis and treatment is a primary component in malaria control; the following activities were implemented through program strategies to improve access to early diagnosis and appropriate case management to reduce malaria morbidity and mortality.

In this FY 2020-2021, MOPD Division in collaboration with partners are strengthening health care providers in diagnostic testing to ensure that all patients with malaria are properly diagnosed and can receive timely and appropriate treatment. All suspected malaria cases are parasitological confirmed by either Malaria Rapid Diagnostic Test or Blood Smear, then malaria is categorized either, uncomplicated, simple malaria with minor digestif symptoms or severe malaria for the purpose of prescribing appropriate treatment.

Since October 2016, the roll out of Home-based Management of Malaria (HBM) to all ages since ,enabled Community Health Workers to provide timely treatment in the community for all cases of uncomplicated malaria, preventing severe malaria , and limiting malaria transmission. By following early diagnosis and treatment at all levels, all suspected malaria cases were tested and underwent appropriate management according to National malaria treatment guidelines.

Strategy 1: Provide Malaria Diagnosis to all Suspected Malaria Cases at all Levels

1. Update of Integrated Malaria Control Guideline

The Integrated Malaria Control Guidelines 4th.version, 2020 was validated and signed by the Ministry of Health. MOPD Division in collaboration with Impact Malaria and Ingobyi Project printed and disseminated 1600 hard to the public and private health facilities.

In line with the continuity of community case services delivery, different tools and guidelines were produced and distributed to all CHWs (Binomes) in USAID Ingobyi Project supported districts and identified districts as per table below.

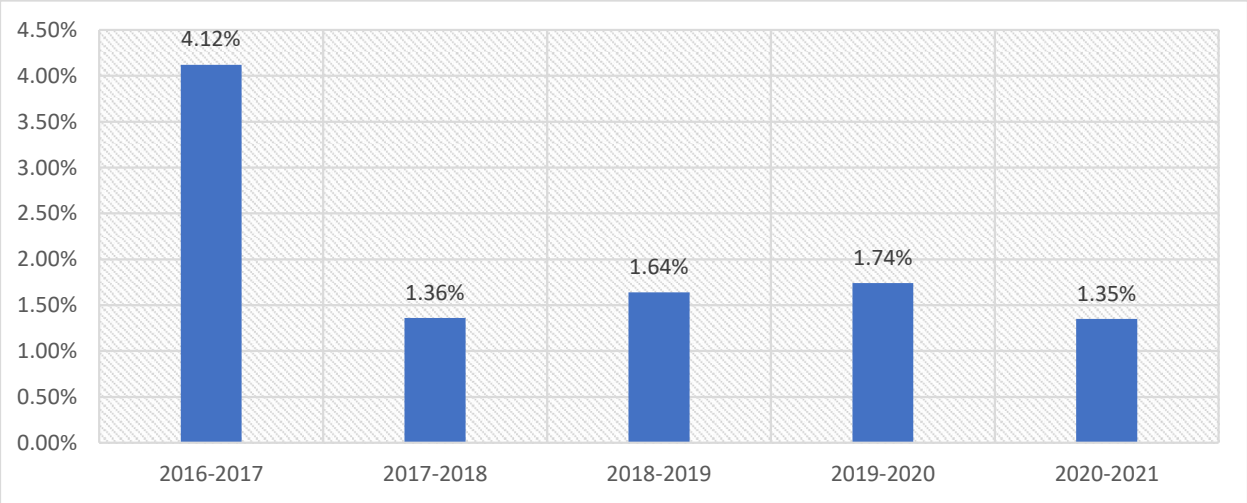
Table 12: Distribution of Malaria Commodities, Guidelines

S/N	Description	Quantity	Beneficiaries
1	Community registers for treating malaria in adults	9,755	CHWs/Binomes
2	Compilation register for iCCM and malaria in adult integrated for binomes	1,224	CHWs/Binomes
3	Monthly report	2,966	CHWs/Binomes

2. Quality Control of Blood Smears at District Hospitals

Malaria Diagnosis External Quality Assurance (EQA) is conducted by MOPDD through the parasitology section of microbiology Unit of the National Reference Laboratory to ensure the quality of malaria diagnosis in the national laboratory network.
In addition to routine laboratory quality assurance processes, EQA includes blinded slide retesting, proficiency testing, and on-site supervision.
Quarterly evaluation of the quality of thick and thin smear practices, Giemsa staining, and microscopy results are enforced in health facilities in Rwanda. Health center practices are supervised by the district hospital, and district hospitals are supervised by the NRL.

Figure 12: Quality Control Results, 2016-2021



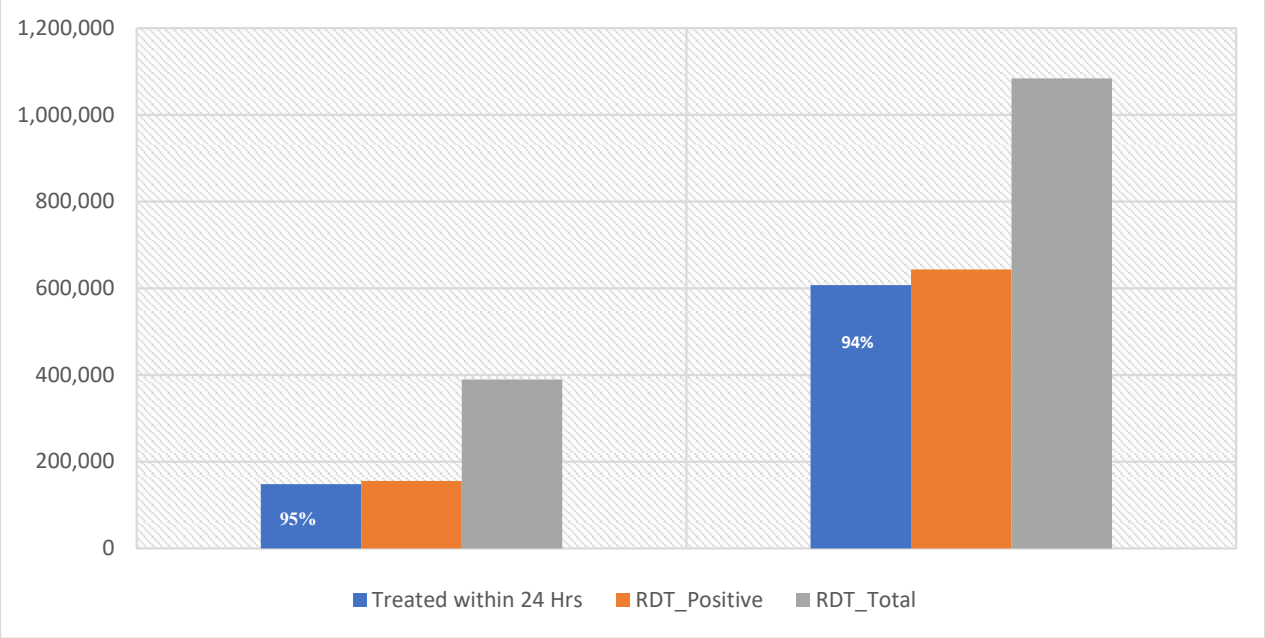
Among the 47 hospitals in which EQA/QC of blood smears was conducted during the FY 2020-2021 a decrease of 22% in hospital reading and was observed compared to FY2019-2020. Results over the years from 2016-2017 (4.12%) , 2017-2018 (1.36%), 2018-2019 (1.64%), 2019-2020 (1,74%), 2020-2021 (1.35%) remained below the cut off of 5% acceptable range with 6 district hospitals; Rwinkwavu (10%), Gatunda (7%), Rwanda Military Hospital (7%), Butaro (7%), Kinihira (7%), Kibogora (7%) and Munini (7%) exceeding the acceptable range in FY2020-2021. This figure includes only 2 quarters; the QA/QC quarter 1 and 2 were not conducted due to Covid19 pandemic.
Malaria program will continue to work closely with NRL to correct reported discrepancies in district hospitals through formative and refresher training during the next fiscal year 2021-2022.

Strategy 2: Strengthen Prompt Access to Treatment of Severe Malaria

1. **Case Management of Under 5 Years at Community Level**

Since 2005, community case management was limited to under five children, following the success from iCCM program , in 2016 the community case management was extended to children above five and adults countrywide as shown in tables below.

Figure 13: Community Malaria Case Management in Under 5 years and Adults, FY2020-2021



In all villages of the Country, 95% of children under five and 94% of children above five and adults are seeking treatment within 24 hours of onset of symptoms at community level.

Figure 14: Impact of Extended HBM on Severe Malaria Cases and Malaria Mortality, 2014-June 2021

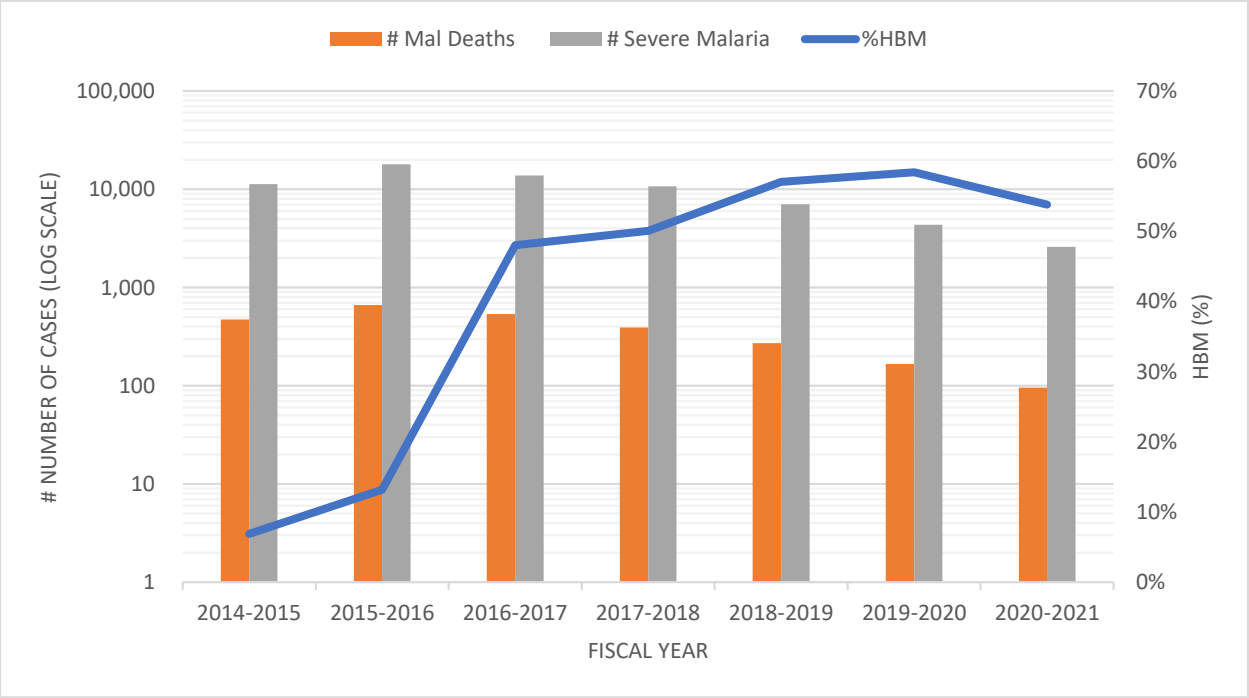
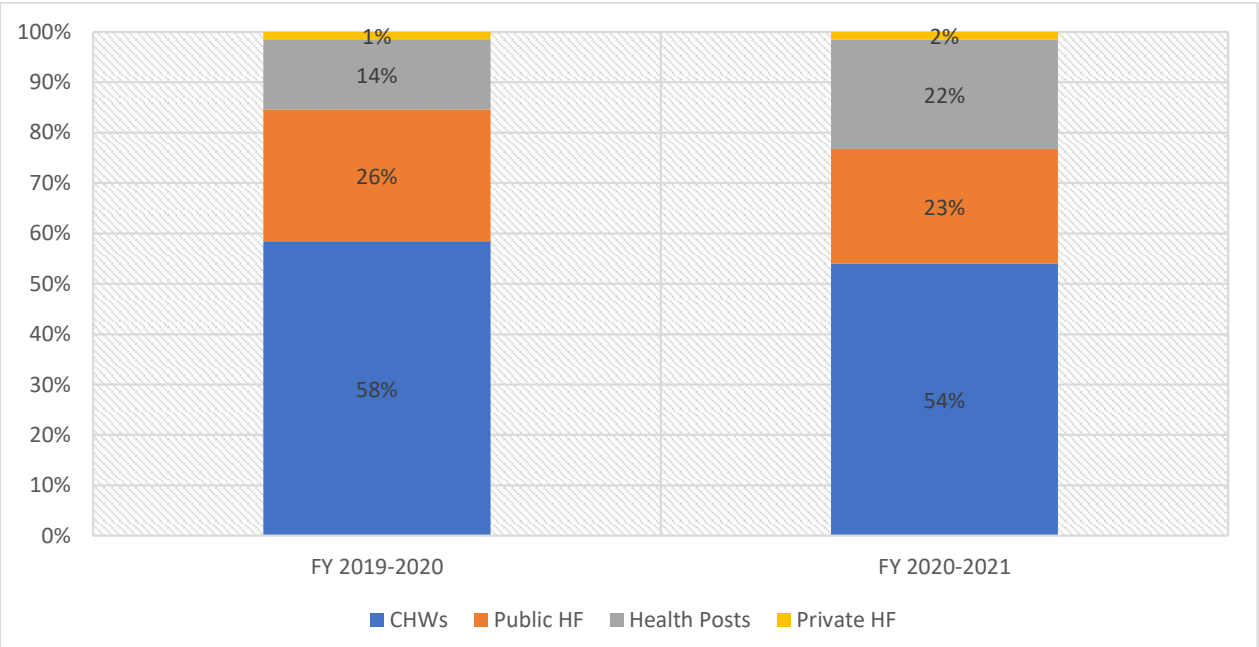


Figure 15: Proportion of Malaria Cases by Level of Services Delivery, FY 2019-20 to FY 2020-21



Since the scale up of Malaria Home based management intervention to above five children and adults, there was steady increase of the proportion of malaria patients who are seeking care in the community from 13% to 58% in 2015-2016 and 2019-2020 respectively. Although a slight decrease of the proportion of malaria cases treated in the community was observed in FY 2020-2021, the inverse trends decrease in severe malaria cases by more than 40.5%in FY 20-2021 and a decrease in Malaria death from 167 to 111 and indicate that the impact of early diagnosis and treatment on malaria outcome was not compromised. Hence the decrease of the proportion of malaria cases treated in Community in FY 2020-2021 is linked with an introduction of Health posts in the health system as a new strategy adopted by the GoR to scale up health services closer to the community and this alleviated a workload to the CHWs and increased the proportion of simple malaria cases treated at Health Post level from 11 % in FY 2019-2020 to 22% 2020-2021. Other factors such as stock out of malaria Rapid Diagnostic Tests due to delay of the November 2020 shipment may have contributed to the decrease of cases treated in the community.

Strategy 3: Strengthen Prompt and Correct Treatment of Simple (uncomplicated) Malaria at All Levels

1. **Strengthening of Community Case Management through Capacity Building**

In FY 2020-2021, the RBC/MOPD Division with its partners conducted a Home-Based Management (HBM) Supervision in 45 hospitals and 412 health centers to ensure malaria cases are managed correctly in the community. Community health environment officers (CEHO), Health Care providers and CHWs were mentored on malaria management, real time notification of malaria commodities stock management through RapidSMS, proper drug storage, availability of community health tools, adhering to treatment and RDT algorithms.
Below is the summary of supervisions conducted and beneficiaries:

Table 13: Community Supportive supervision in FY 2020-2021

Supportive Supervisions Conducted FY 2020-2021	
Staff supervised and level of Health Care	**Total Beneficiaries**
Community Health Workers	2,854
Health care providers	3,174
Community and Environmental Health Officer	412

2. Training of Community Health Workers

In assuring evidence based on capacity building of CHWs the MOPDD and its new partner PMI-Impact Malaria conducted a CHWs rapid assessment among selected health centers in Rusizi and Nyamasheke Districts. One of the findings was that 413 CHWs were new and not trained in case management. In order to respond to the identified needs, the MOPD Division in collaboration with Impact Malaria and Intrahealth/Ingobyi Activity conducted a training of trainers of CEHO, health care providers and Heads of Health Centers, CHWs.

Furthermore, based on the national malaria strategic plan and program supportive supervision recommendations, there was a need to strengthen the capacity of health providers in malaria diagnosis and case management.

Table 14: Capacity Building of Health Workers

SN	Training	Target Group	Achievement
1	Training of CHO, IMCI nurses on iCCM and HBMa	CEHO of HCs Head of Health Centers Nurses responsible of ICCM in Health Centers	126 CEHOs, 297 IMCI nurses were trained on
2	Training of new CHWs on iCCM and HBMa	New CHWs (Binomes) from 30 District Hospitals catchment area.	4816 new CHWs trained.
3	Training of CEHOs, head of Health Centers and IMCI nurses on Community mentorship	CEHOs, head of Health Centers and IMCI nurses	257 CEHOs, 259 IMCI Nurses, 248 Head of Health Centers were trained on Community mentorship
4	Community Mentorship of CHWs	CHWs from 30 Districts	18985 CHWs benefited from Community Health Mentorship on iCCM and HBMa.

Table 15: Training of Health Care Providers in Malaria Case Management

SN	Training	Target Group	Achievement
1	A two consecutive weeks of training: training of master trainers and Development of malaria training curriculum.	Specialists: Paediatricians Physicians Obstetric-Gynecologists Partners, staff from Rwanda university	23 were trained by malaria division staff and developed training tools for cascading knowledge gained to lower levels of health care
2	Training of clinicians on Integrated Malaria Control Guidelines.	Nurses (1 per Hospital) Doctors (1 per Hospital) CHWs Supervisors (1 per Hospital)	36 health care providers from (Gihundwe, Mibirizi, Kibogora, Bushenge, Kibuye, Kirinda, Mugonero, Gisagara, Kibirizi, Rutongo, Kinihira and Kirehe Hospitals) were trained and were able to adapt training tools for the training of health center, health posts and community health workers.
3	Training on malaria diagnosis. Species identification and parasites density quantification.	Laboratory Technicians	168 health centers laboratory technicians from Musanze, Burera, Ngororero, Nyabihu, Gisagara, Gakenke, Rutsiro, Gicumbi, Rulindo and Nyanza districts
4	Post training follow up of laboratory technicians from 5 districts.	Laboratory Technicians	34 health centers where at least 51 lab technicians were mentored

3. Implementation of the Therapeutic Efficacy Study (TES2020)

This activity is conducted every two years in collaboration with the NRL, MOPDD and IM as recommended by WHO to monitor first line antimalarial drugs in the country. Monitoring the efficacy of antimalarial medicines is a key component of malaria control. WHO recommends that national malaria control programs adopt antimalarial medicines with a parasitological cure rate of more than 95%. Protecting the efficacy of ACTs as the current first-line treatment for *P. falciparum* malaria is now among the top global public health priorities.

This study aims to evaluate the efficacy of artemether lumefantrine and dihydroartemisinin piperaquine for the treatment of uncomplicated malaria in 3 study sites across Rwanda.

The TES data collection was launched on 9th June 2021 in Masaka Health center followed by Rukara on the 10th and Bugarama study site on the 14th June 2021.

Screening started on 21st June 2021, weekly monitoring of the recruitment status and site visit showed that malaria cases decrease in all sites Bugarama, Masaka, and Rukara as per the below table (), zero malaria case in 268 suspected malaria cases screened in children under 5years old in all 3 sentinel sites. During the last week of June 2021, only one positive case was recorded in Rukara HC but was not recruited due to composite parasites observed in blood smear (*Plasmodium falciparum and ovale*).

Table 16: Therapeutic efficacy study screening in 3 sentinel sites

Week Sites	21-25 June	28-02 July	5-9 July	12-16 July	19-23July	26-30 July	Total
Bugarama	22	18	7	11	9	11	78
Masaka	18	7	2	2	1	6	36
Rukara	37	37	20	30	18	12	154
Total	77	62	29	43	28	29	268

Following these findings, discussion between the investigators team from MOPDD and I'M on how to involve the CHWs from high malaria endemic villages in order to increase chance of recruitment. This mitigation plan started on 6th July progressively in all 3 sites and we are observing the same situation, which may lead to delay in TES 2020 recruitment cases and increase implementation fees than previously planned.

4. Molecular Laboratory Strengthening at NRL

Need assessment was made at the National Reference Laboratory by all TES teams including CDC headquarter team led by Professor Udhayakhumar in August 2019. Prioritization of equipment and materials procurement for drug resistance laboratory analysis was done and delivered to NRL in March 2021: **A Dry Heat block, a Vortexer Genie 2, a Minus 20˚C Freezer, a 2-8˚C Fridge, a Micropipette set, a Multichannel Pipette 2-20 ul, QIAmp DNA Mini kit and a Thermal Cycler Dual.**

Renovation of malaria molecular laboratory in NRL premise is under process while waiting from NRL to receive the quotation. Installation and initiation of the molecular analysis is planned to start using TES 2020 samples as stipulated in the TES protocol.

Strategy 4: Ensure Quantification and Distribution of Quality Assured Malaria Commodities

1. Quality Control of ACTs and Artesunate

Mal& OPD Division in collaboration with GHSC-PSM and Rwanda FDA conducted the quality control of ACTs and Artesunate sampled across different supply chain levels including community. The objective of the activity was to assess the quality of antimalarial medicines after being stored and distributed throughout the supply chain levels. The sample collection of ACTs and Artesunate was conducted in November 2020 in 8 selected districts:Nyagatare, Kirehe, Burera, Ruhango and Gisagara, Rubavu and Rusizi and Gasabo representing all five Rwanda provinces. A total of 93 samples were collected by a team composed of staff from GHSC-PSM, RBC/Mal OPDD whereby 84 of them were ACTs (21 blisters for each of the four ACTs) and 9 vials of Artesunate.

Samples were sent to the selected testing laboratory named InphA Gmbh Medicine Control Laboratory through DHL. The testing took place between January and February 2021.
The results of the laboratory showed that all samples sent fell within the acceptable range, which means that samples tested are of good quality. These results give the country confidence that not only quality ACTs and Artesunate are being procured for Rwanda but also that the same quality is maintained during storage and distribution across different supply chain levels including the community

2. Quantification and Procurement of Malaria Commodities

Accurate quantification and timely initiation of procurement is key to ensure that malaria commodities are available at all levels of the supply chain and the stock level is always between the minimum and maximum levels.

During fiscal year 2020-2021, the Mal & OPDD Division in collaboration with all CPDS partners has managed to keep the stock available on the desired stock level through regular supply plan reviews, use of appropriate quantification tools and willingness of partners to support the entire process. Several quantification reviews took place over the reporting period to adjust the real need in malaria commodities. All needs identified during the quantification exercise and supply plan reviews were procured (as per the table below) through Rwanda Medical Supply (RMS) limited using Global Fund and Government of Rwanda funding and GHSC-PSM using PMI funding. Malaria commodities were routinely distributed to health facilities through RMS branches and finally from health Centers to the community.

Table 17: Malaria Commodities Procured in FY 2020/2021

Product	Quantity Procured	Source of Funds
Artemether-Lumefantrine 1x6, Blisters	222,720	PMI
Artemether-Lumefantrine 2x6, Blisters	213,870	PMI
Artemether-Lumefantrine 4x6, Blisters	480,000	PMI
Artesunate 60mg/Ml Vials	43,125	GOR
Artesunate 60mg/Ml Vials	22,095	PMI
Malaria RDTs	4,230,000	GF
Quinine 300mg Tablets	286,600	GOR

3. Validation of RMS Branch Reports and Distribution of Malaria Commodities

The objective of the validation of malaria commodities is to:

- Ensure that the RMS Branches and lower levels receive the right amount of malaria commodities at the right time.
- Ensure that RMS Branches are given the quantities they need to be stocked according to plan (stock to be between the minimum and the maximum levels) and that they receive feedback on the validation report. To ensure e-LMIS data accuracy is improved as the validation is currently based on the information found in e-LMIS.
- Rationalize the quantities available at the central medical store (RMS) in case of understock. This was done through the redistribution of commodities within districts not only to prevent stock out at RMS but also to avoid expiration of Malaria commodities.
- During the Fiscal Year 2020-2021, the validation exercise was handed over to RMS

Ltd. Staff from RMS were trained on the validation process by the Malaria &OPDD validation team.

4. Stock Status of Malaria Commodities, End June 2021

By the end of the FY 2020-2021, the stock status of malaria commodities was good in general as there were no products at risk of stock out. However, there was a slight overstock for ACTs and Artesunate due to decreased malaria cases.

Table 18: Stock Status of Malaria Commodities

Product	Qty (MPPD)	Qty (DPs)	Qty (HFs)	Stock all Levels	MoS all Levels	MOS (in Shipments)
A/L 1 x 6	139,590	76,422	77,485	293,497	19	7.8
A/L 2 x 6	149,220	100,625	64,600	314,445	12.7	7.45
A/L 3 x 6	93,810	117,832	106,020	317,662	12.5	3.8
A/L 4 x 6	813,660	111,516	163,457	1,088,633	16	4.4
Artesunate Inj.	71,526	25,858	18,125	115,509	16.9	12.6
Quinine Tab	161,200	133,910	220,804	515,914	10	3
Quinine Inj.	0	0	0	0	0	0
mRDTs	1,533,840	569,798	546,460	2,650,098	7.2	10

5. Monitoring of Stock Status

The monitoring of malaria commodities done on quarterly and monthly monitoring of malaria commodities helped to monitor on a regular basis the status of each commodity, calculate the month of stock that allows the program to know if products are between maximum and minimum required levels (9 months minimum and 12 months' maximum at national level).
In this year FY 2020-2021, the monitoring allowed the program to plan for redistribution of RDTs, Artemether-Lumefantrine 6x1 and Artemether-Lumefantrine 6x2 from districts with over stock (Nyagatare, Karongi and Rulindo for ACTs) to the districts in need of stock to minimize the risk of expiration.

7. Challenges

- Quinine injection was over-stocked due to the important decrease of malaria cases as a result of prevention measures as well as reduced severe malaria cases as a result of Home-Based Management. Efforts to donate Quinine to other countries through WHO were not successful since most countries are phasing out this

treatment as per the new WHO recommendations and therefore it expired in June 2021.

- There was a delay to deliver the RDT shipment that was expected in October 2020. It was received in February 2021, and that resulted in stock out of RDT at central level from January to February 2021.

- The Shipment of Artesunate injection that was received in November 2020 was procured under GF, while it should be procured on GOR funds. There was reallocation of funds on GOR in order to process the payment.

- Based on the stock at the end of June 2021 and the projected consumption, there is a risk of expiration for about 250,000 blisters of ACT 6x4 in February 2022. It is therefore recommended to look for countries which could use this stock and propose a donation.

General Statement:

Mal & OPD Division has made significant progresses in Case Management of Malaria cases during FY 2020-2021 through strengthening of malaria diagnosis to all Suspected Malaria cases at all Levels, ensuring prompt access to treatment of severe malaria, prompt and correct treatment of uncomplicated malaria at all levels and quantification and distribution of quality assured malaria commodities. As a result, severe malaria cases and deaths due to malaria reduced significantly.

PART III : MALARIA SURVEILLANCE AND EPIDEMIOLOGY

Objective 3: BY 2024, STRENGTHEN SURVEILLANCE AND REPORTING FOR COMPLETE AND TIMELY ACCURATE INFORMATION FOR APPROPRIATE DECISION MAKING AT ALL LEVELS

Strategy 3.1. Strengthen Malaria Routine Surveillance and Epidemic Preparedness and Response (EPR) at All Levels

1. Introduction

Malaria is by far the most common tropical parasitic disease today. It threatens at least four in ten people worldwide. It is a killer disease, especially in tropical Africa where 90% of the world's cases occur.

Today, Malaria remains also a major public health challenge in Rwanda, with the entire population at risk. From 2013, malaria morbidity has been increasing in Rwanda despite efforts deployed in malaria control activities.

A malaria surveillance system in a burden reduction setting collects data on malaria epidemiology to provide information for planning, implementing, and monitoring and evaluating malaria control interventions.

The establishment of a robust malaria surveillance and reporting system through strengthening routine HMIS and SISCOM reporting systems, improving monitoring and evaluation of the program implementation and promoting the generation and use of evidence to inform malaria programming is essential for the success of this strategic plan.

In addition, operational research such as Surveillance of antimalarial drug efficacy and drug resistance, Entomological surveillance and vector control monitoring, Malaria Indicator Surveys and other studies are conducted on regular basis to support evidence decision making to fight against malaria

2. Key Malaria Program Indicators

Health facilities reports malaria data on weekly and monthly basis through HMIS while community data are reported monthly through SISCOM system. Key malaria data includes malaria cases, malaria related deaths, malaria inpatients cases, testing and treatment.

Real time notification of stock out and severe malaria cases is done by community health workers via RapidSMS. The system enable them to treat without any interruption and hospitals and health centers to intervene in a timely manner in order to prevent deaths due to Malaria.

The program produce trends on key malaria indicators on monthly basis both at national and districts level in order to detect timely and respond to outbreaks.

The table below summarizes the key malaria indicators for the period 2020-2021 and performance compared to previous period:

Table 19: Key Malaria Program Indicators

Nº	Indicators	2018/19	2019/2020	2020/2021
1	Malaria Incidence per 1,000 persons per year	321	198	114
2	Slide Positivity Rate (%)	44	35	27
3	Uncomplicated Malaria Cases	3,973,973	2,495,890	1,481,698
4	Severe Malaria Cases	7,054	4,358	2,592
5	Malaria Deaths	272	167	96
6	Case Fatality Rate (per 100,000 Malaria cases)	6.8	6.7	6.5
7	Proportion of malaria cases treated at community level (HBM)	57%	58%	54%

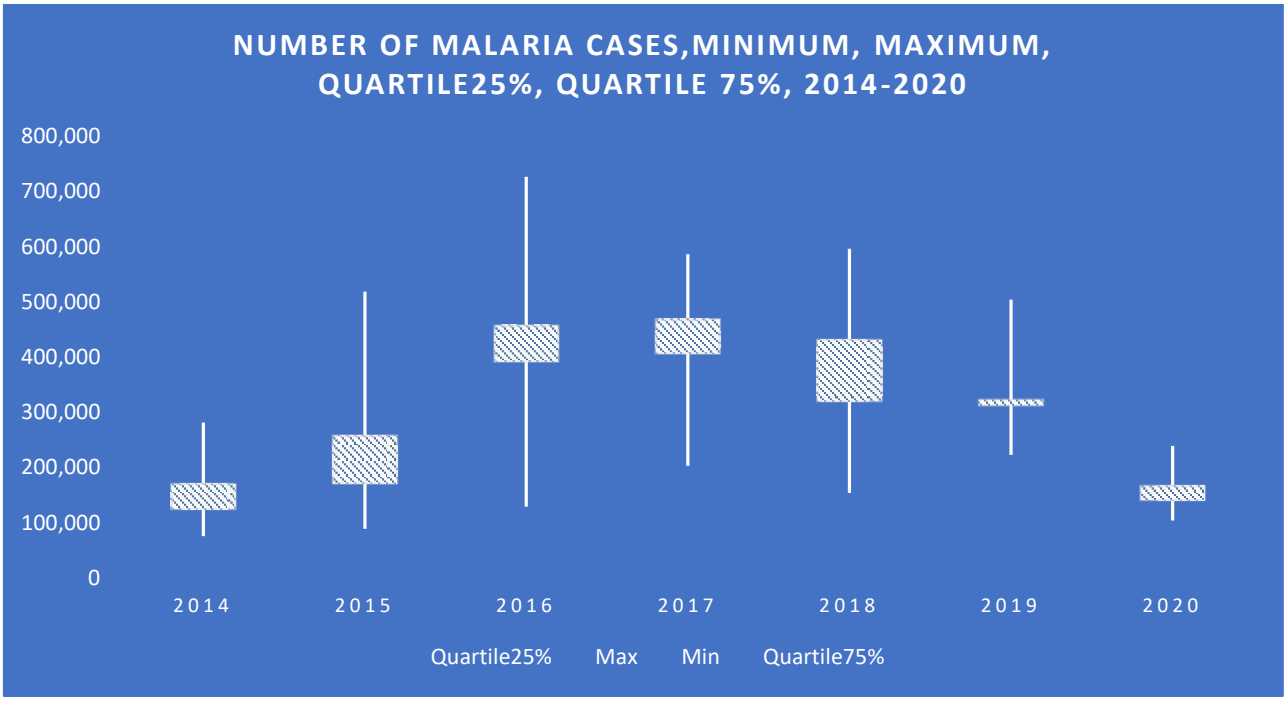
Key Malaria Program Successes

- 41% Reduction of in Malaria Incidence from 2019/2020 to 2020/2021
- 40% Reduction in Un-complicated Malaria Cases from 2019/2020 to 2020/2021
- 40% Reduction in Severe Malaria Cases from 2019/2020 to 2020/2021
- 42% Reduction in Malaria Deaths from 2019/2020 to 2020/2021
- Today, 54% of all malaria cases are being treated at Community Level by CHWs compared to 58% during the FY 2019-2020

Summary Statistics of Malaria Cases, 2014-2020

The graph below gives summary statistics on malaria cases reported on monthly basis since 20214. It shows the minimum cases, the maximum malaria cases and the interval interquartile, where the box represent the concentration of 50% of malaria monthly cases. We observed a progressive decrease of malaria cases since 2016 to 2020. The maximum number of malaria cases notified in 2016 was 726,433 while in 2020; it was 239,093. The minimum monthly number of malaria cases was 129,192 in 2016 and 104,035 in 2020. Fifty percent of monthly malaria cases lies between 391,666 and 457,365 in 2016 while in 2020, 50% of malaria cases 140,929 and 167,502 cases.

Figure 16: Summary Statistics of Malaria Cases, 2014-2020

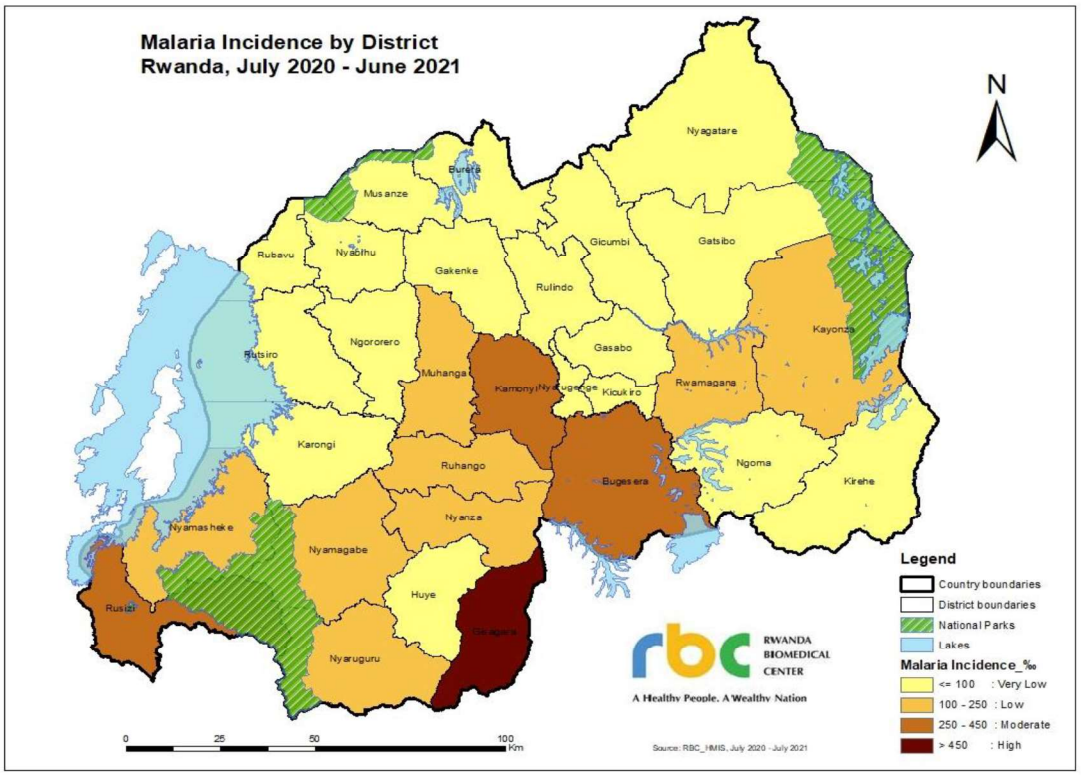


3. Malaria Incidence

Malaria incidence has been calculated using medium projected of population 2021. Data shows that the national malaria incidence in Rwanda reduced from 199 cases per 1,000-person year in 2019-2020 to 114 cases per 1,000-person year FY 2020-2021.
Nine districts have incidence above the national average (incidence per 1000 persons per year): Gisagara, Bugesera, Kamonyi, Rusizi, Kayonza, Nyamasheke, Ruhango, Rwamagana, Nyaruguru and Nyamagabe district.

The following districts have incidence bellow 100 per 1000 persons per year: Kirehe, Kicukiro, Gakenke, Gicumbi, Ngoma, Nyarugenge, Rulindo, Rutsiro, Ngororero, Rubavu, Huye, Nyagatare, Gatsibo, Musanze, Burera and Nyabihu districts. The Map bellow show more details of malaria incidence per districts
The maps below showed that Gisagara district remain high incidence of malaria despite IRS. The program have analyzed the situation and proposed to change the period to conduct IRS from February in previous year to September because the pics of malaria is between October and December.
Country wide, 23 (6%) sectors have high malaria incidence (450 per 1000), 32 sectors (8%) have moderate, 89 (21%) have low malaria incidence and 272 (65%) have very low incidence (<100).

Figure 17: Malaria Incidence (per 1000) by District and Sector, FY 2020-21



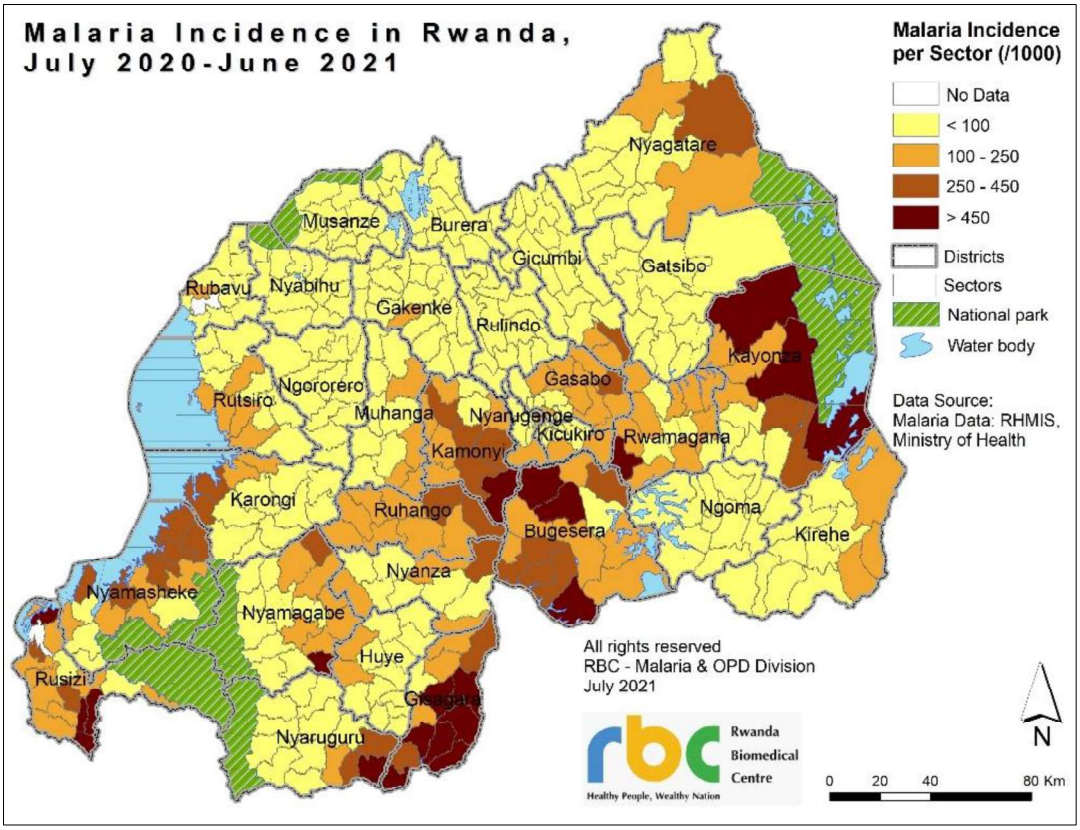
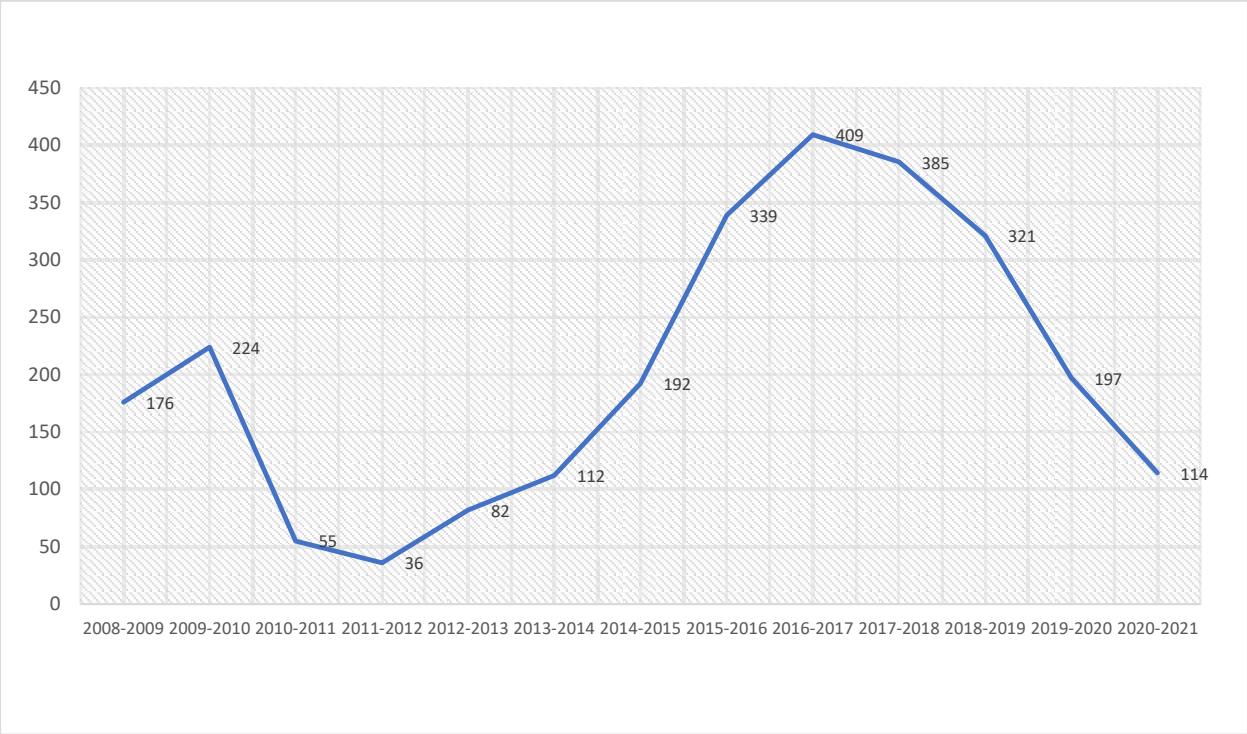


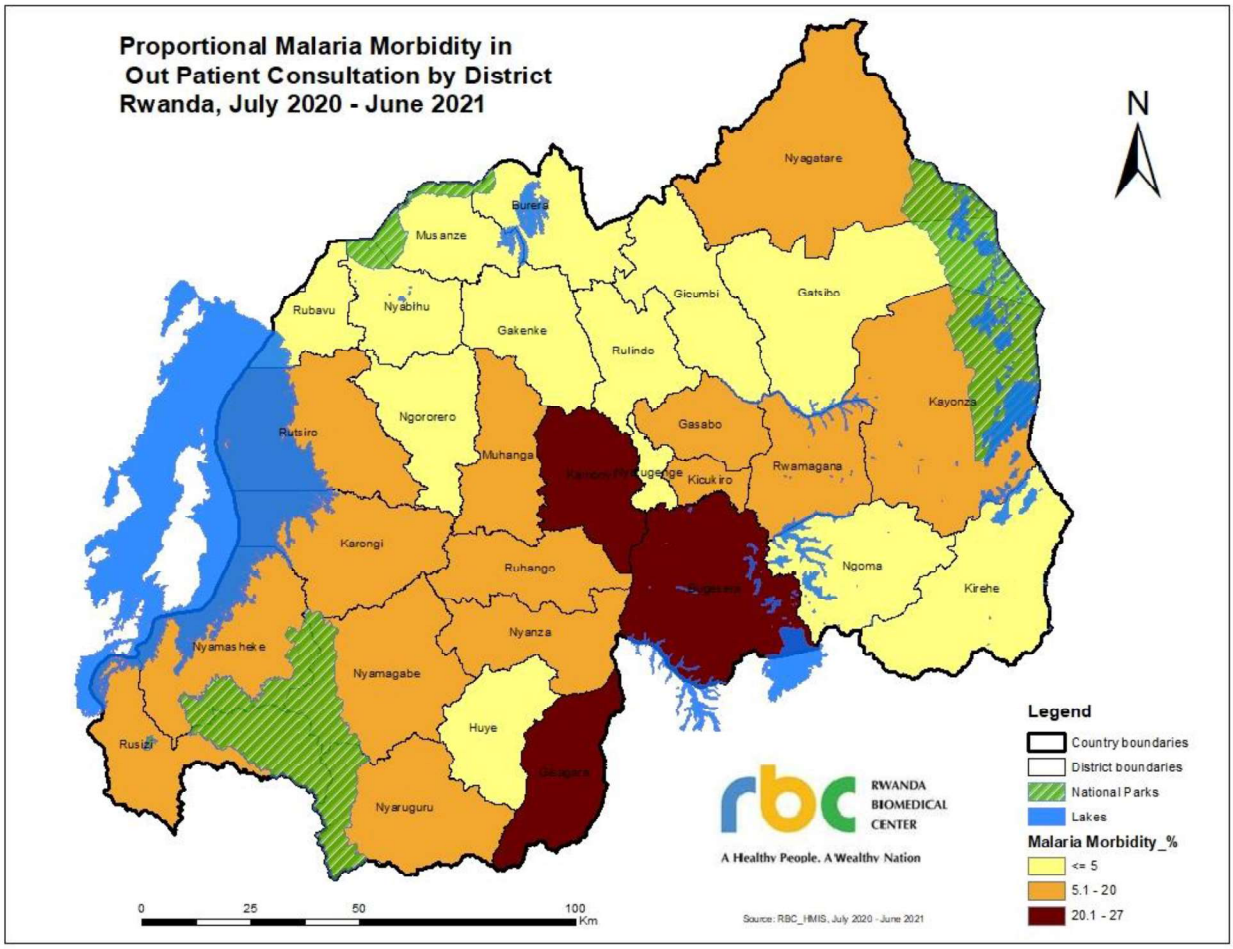
Figure 18: Trends in Malaria Incidence per 100 Persons Year, FY2012-2013-FY 2020-2021



4. Malaria Morbidity

During the FY2020-2021, malaria OPD cases represents 9% of all OPD new cases of consultation compared to 13 % of all of individuals attending outpatient's consultation in health facilities during the fiscal year 2019-2020. The proportional morbidity of malaria varies across districts from 1% in Nyabihu, Musanze, Ngoma, Rulindo and Burera districts to more than 20% in Gisagara, Kamonyi, Bugesera districts.

Figure 19: Malaria Proportional Morbidity by District in the FY 2020-2021



5. Malaria Test Positivity Rate

During the FY 20202-2021 at total of 5,577,600 lab tests were performed compared to 7,168,149. This includes 2,801,070 blood smears exams and 2,776,530 Rapid diagnostic tests. The number of RDTs done by community health workers is 1,470,307 representing 26% of all malaria tests performed. The overall slide positivity rate is 27% compared to 34.5% for last fiscal year. The slide positivity rate was 54% and 17 % respectively at community and health facility level compared to 63% and 22% during the FY 2019-2020.

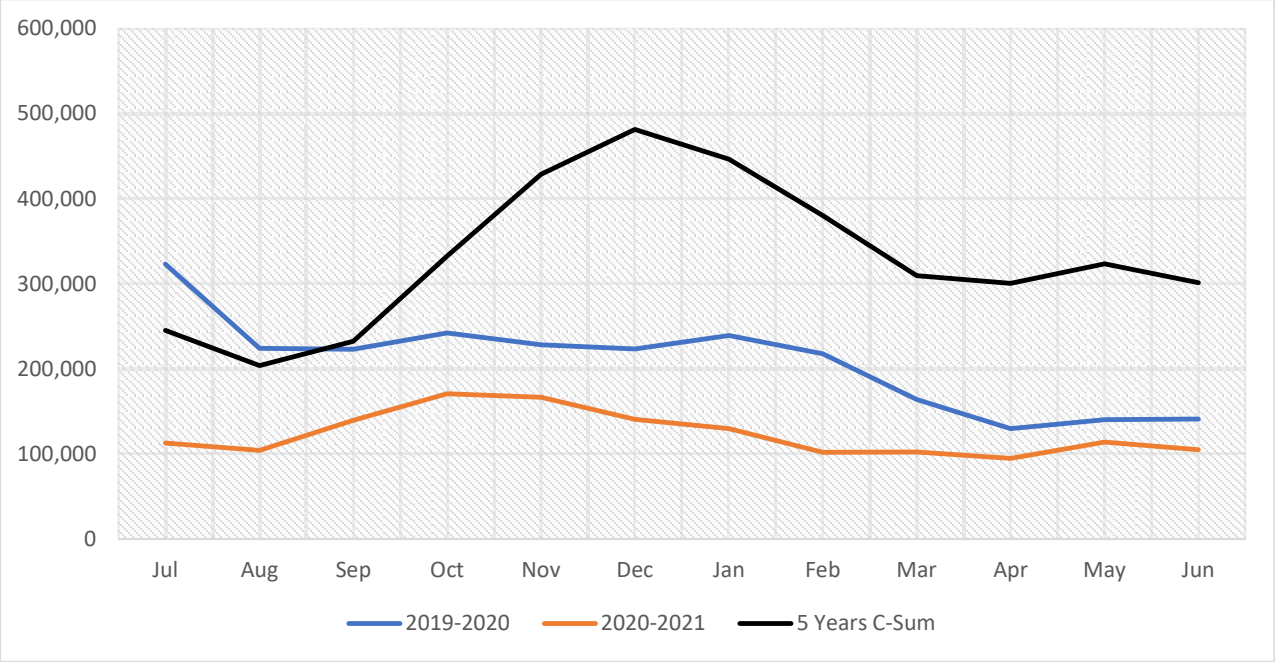
6. Uncomplicated Malaria Cases

From July 2020 to June 2021 a total of 1,481,698 outpatients Malaria cases were notified including 797,745 (54%) malaria cases treated at community level. The private health facilities account for 22,369 (1.5%) and 321,217 (21.7%) treated by private health posts.

Under5 children account for 240,813 mal cases (16%) and Pregnant Women 9,784 (0.7%).

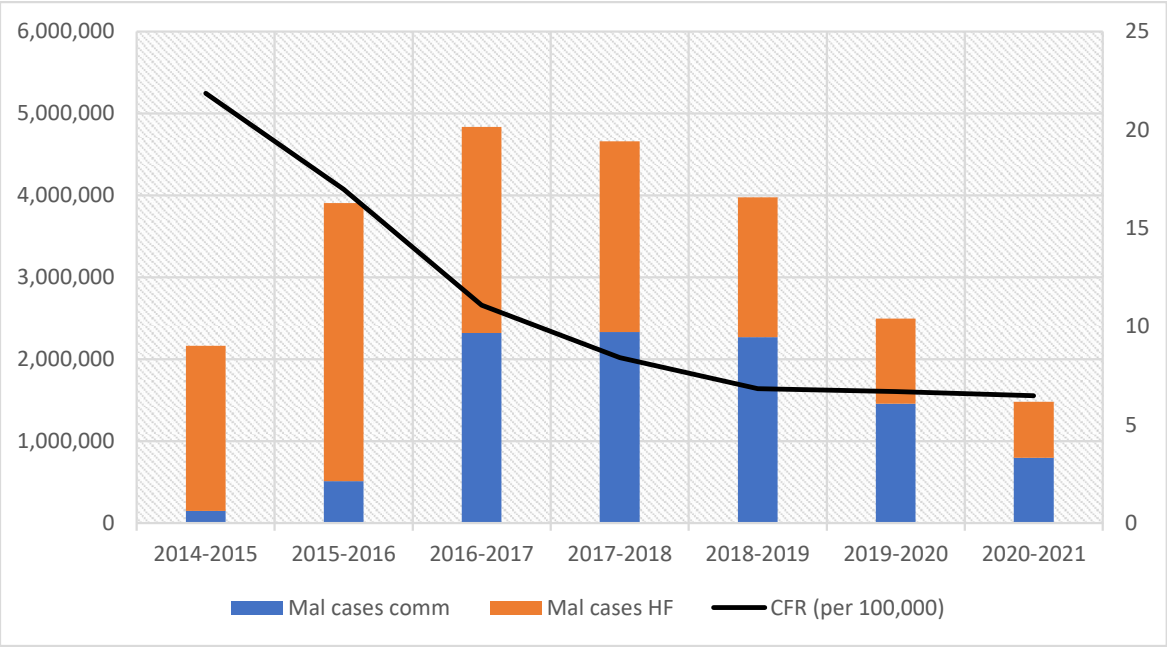
The graph below shows the monthly trends of malaria cases of FY 2020-2021 compared to the monthly average cases for the last 5 years using C-sum method. We noticed a reduction of malaria cases during the FY 2020-2021 compared to last 5 years.

Figure 20: Trends in Malaria Cases, Rwanda, FY 2019-2020, 2020-2021 and 5 Years back monthly average



Note: The 5 years average was calculated using C-Sum method.

Figure 21: Malaria Cases per Level of Services Delivery and Cases Fatality Rate, 2013-2021



Strategy 3.4. Strengthen Severe Malaria Notification and Malaria Death Audits

1. Severe Malaria Cases

Over the reporting period, 2,592 cases of severe malaria were reported at the facility level compared to 4,358 in the FY 2019-2020 representing a 40% reduction of severe malaria cases. This indicates that interventions such home based treatment of children and adults that contributed to early diagnosis and treatment have been successful in decreasing the number of severe cases and consequently the number of malaria deaths. The free treatment of poor people in Ubudehe Category I and II also removed the financial barriers for access to health care.

2. Malaria Mortality

Over the FY 2020-2021, 96 malaria deaths were recorded following hospitalization for severe malaria compared to 167 deaths in the FY 2019-2020. The number of malaria deaths was 37 among under5, which represents 38% of all malaria deaths. Report from malaria deaths audit shows that 70% had severe malaria cerebral form and 23% severe malaria anemic form. The decrease in malaria deaths may be a result of the malaria HBM interventions and the free treatment of malaria for Category I and II of Ubudehe and the quality of care at health facility level.

In the FY 2020-2021, the proportional mortality due to malaria represented 1 % of all deaths with the highest rate in Bugesera (6%), Rusizi (4%), Gisagara (4%) and Nyaruguru district (3%).

Strategy 3.5. Improve Reporting from the Private Sector and Sustain Public Sector Reporting

1. Introduction

Malaria data are reported through the Health System Information System (HMIS) on weekly and monthly basis. As part of health system strengthening mechanism, Rwanda Biomedical Centre (RBC) has adopted reinforcement of availability of services and health policies, capacity building of health worker through mentorship, on-job training, Integrated Supportive Supervision & Data Quality Assessment (ISS/DQA) as well as Malaria death audit. In this perspective, the various health facilities reported as usual the data related to Malaria cases and the completeness rate was 97.6% during the year 2020_2021 and the on-time reporting was 95,8%.
During the FY 2020-2021, Malaria program in collaboration with HMIS team included new data elements in Malaria dataset (fever cases, number of patients who received ACTs, Quinine and Artesunate).

2. Capacity Building

- **Supportive Supervision and Mentorship**

District/provincial Hospitals catchment area where selected Health Centers and community health workers receive supportive supervision visit. All district/ provincial hospitals was visited and 128 (25%) health centers were selected among 510 health centers countrywide. Key findings showed that at District /Provincial Hospitals 100% of them use blood smear to diagnose malaria and the national protocols on the malaria case management were available in all visited hospitals, 93 % of the hospitals visited had malaria deaths audit reports available for that period of assessment (July-September 2020)

At Health Center level, the supportive supervision for malaria services focused mainly on malaria case management and prevention and on reporting using the IDSR system. The supportive supervision at HCs revealed that 90.5% of visited HC had malaria case data fully uploaded in the e-IDSR system, malaria treatment in health centers was 100 % based on parasitological confirmation, 92.6% of visited health center had the national malaria

treatment guidelines. 95.2% of HCs visited had functioning microscopes to diagnose malaria.
In regards of different findings from all levels, the following recommendations were proposed

- The district in collaboration with MOPDD should organize a training of health care providers on updated National malaria treatment guideline include malaria case management and malaria in pregnancy
- The MOPDD should continue to make an advocacy on malaria drugs, commodities and materials in order to avoid stock out as well as unfunctional materials
- The MOPDD should support and make an advocacy on the availability of microscopy or repairing those found unfunctional in the mentioned health centers
- The MOPDD should regularly share malaria program updates, data and current instructions related to malaria program in order to reinforce a joint malaria interventions implementation and avoiding program disparities
- The Malaria supportive supervision tool must be digitalized in order to facilitate the quality of data collection, analysis and reporting.
- The MOPDD to avail and disseminate new National malaria treatment guidelines in all health facilities and all instructions related to malaria prevention, despite COVID-19 challenges, the district hospitals in collaboration with MOPDD should prioritize a training of health care providers on updated National malaria treatment guideline in early quarters of FY2022.
- The MOPDD should support and make an advocacy on the availability of microscopy or repairing those found unfunctional in the mentioned health centers,
- The MOPDD should organize a comprehensive training of health care providers on neglected tropical disease and avail the NTD treatment and guidelines, tools and emergency drugs like rabies vaccine and serum ant venom at identified health centers and in all Rwanda Medical Supply at District level.

The Malaria supportive supervision tool must be digitalized in order to facilitate the quality of data collection, analysis and reporting

- **Mentorship on the Follow up of RapidSMS**

Electronic system designed to allow effective and real-time communication for action by community health workers to health facilities and this, to report pre-stock outs, stock outs, drugs replenishment and severe malaria cases encountered in the community. This alert from community health workers allows the health facilities to act on time and prevent stock outs of antimalarial drugs used by community health workers and to support these community health workers to treat and evacuate severe malaria cases to health facilities.

During this reporting period, Mal&OPDD in collaboration with PMBES Division updated the follow-up process of severe Malaria notified by CHWs and a mentorship of 186 clinicians, Data Managers and CEHOs from 70 HCs on the new approach of follow up process of severe malaria cases notified by CHWs at HC and Hospital level was conducted. Gaps identified include the lack of follow up by HC and Hospital staff (clinical page was not filled), lack of supervision of CHWs by the Health Center staff, malaria commodities at risk of expiration due to unexpected decrease of malaria cases.

- **Training on RMNCAH & Malaria Scorecard Decentralization**

The scorecard aims to alert different leaders to progress and gaps in their countries' efforts to fight again malaria and urge them to take appropriate action to combat malaria. The training on the scorecards use for the peripheral health authorities was intended to guide, orient, and alert them to the threats that malaria would present at any time and finally the measures to be taken to thwart these threats.
The training was organized in November 2020. The targeted staff included Director General of Hospitals, Monitoring and Evaluation Officers and Data Managers in all Hospitals and the number of participants was 126 persons.

- **Data Quality Assessment**

Data quality assessment is a routine activity carried out by the central level / MOPDD where a team of supervisors from central level, implementing partners, team up with staff from hospitals and health centers to verify the completeness and concordance between the data reported in the HMIS system and malaria treatment registers, pharmacy registers as well as malaria diagnostics registers. The different indicators including but not limited on malaria cases treated, positive tests and drugs distributed. We conduct also the triangulation between the above mentioned indicators. The main objective of this data quality assessment is to check if there are any errors in the data reporting and finally make correct where they are needed. Furthermore, the data quality assessment session includes an orientation on indicators definitions, data reporting, data quality check and also serves as mentorship for the continuous data quality improvement.

In this reporting period, the DQA was conducted in 41 health facilities and 177 villages for malaria in community. The results from health facilities show that 34 that represent 84% of health facilities visited have acceptable reporting errors (less than 5%) remaining 7 (16%) health facilities have data discrepancies that is above 5%. This show a need of more support in data reporting and documentation and validation before submission in national HMIS.

The communities DQA results displays also a similar data findings where 147 (83%) villages visited with acceptable errors (less than 5%) and 30 (17 %) have an overall discrepancies that is greater than 5%.
The main recommended were as follows:

- Correct use of national malaria treatment guidelines,
- District Hospitals to conduct regular DQA at Health centers and communities,
- Continue regular supportive supervision and mentorship on malaria data management especially new indicators at health center and communities.
- Provide appropriate malaria DQA tools to the HFs in order to facilitate HFs to report malaria suspected cases,
- District hospital to provide a technical support on quantification of malaria commodities including RDTs requested/ distributed/ used.
- Conduct monthly data validation at health facilities and community's levels.

a. Triangulation of Malaria Cases Reported at Health Center

During the period July 2020-June 2021, on monthly basis, the program conduct triangulation of malaria data. Triangulation was conducted at health centers and community levels and consisted of comparing numbers of malaria cases treated against registered malaria positive tests and distributed ACTs. Data were extracted from HMIS and SISCom systems and compared to those in respective registries. At the community health workers level, data quality assessments compared data from
CHWs registers and reports submitted to CHWs Cell Coordinators. With all the health centers assessed, discrepancies were observed between malaria cases treated and positive tests as well as between positive tests and consumed ACTs. With positive tests as a reference, malaria cases treated were at 98% of malaria positive tests. ACTs were given to 96% of malaria positive tests.

b. Comparison of ACT dispensed (HMIS and Distribution Pharmacy)

Data Quality for this area was carried out by comparing monthly consumption data at HCs captured in pharmacy Registers to related data elements reported in HMIS.
Fifty-nine percent of HCs were in acceptable discrepancies ranges of below 5%, and 36% beyond 10% between reported data and verified data.

c. Comparison of Positive Tests, Malaria cases and ACTs dispensed at community level

At the community health workers' level, the assessments compared data between treated cases, the number of positive tests and prescribed ACTs by CHWs.
Considering positives tests as a reference, the number of treated patients was 0.9% more than counted positive tests, and about 0.3% ACTs were not prescribed to positive cases.

d. Positive tests (RDTs) in Community: Discrepancies between monthly hardcopy reports and CHWs registers

Comparing positive RDTs data recorded in registers against reports submitted by the two community health workers to their cell coordinators, this exercise found that 76% of HCs had discrepancies below 5% and 14% HCs beyond 10%.

e. ACTs- Discrepancies between monthly hard copy report and CHWs Registers

The number prescribed ACTs in the CHWs registers was compared to the number in the reports that the community health workers submitted to their cell coordinators. Overall, 79% of health centers reported discrepancies at a 5% level compared to 76% reported last year. Discrepancies at 10% were observed in 12% of health centers.

- **Tools Development**

Reporting template for Malaria at Health Center has been revised and it's now capturing all the data elements in a single dataset. This aimed at reducing errors for monthly reported data in HMIS
Strengthening the use of the eLMIS system has also been a strategy to improve data quality and ensure the continual supply of commodities in Health facilities. eLMIS is an Electronic Logistics Management Information System (eLMIS) is a revolutionary and cost-effective health data management system aimed at ensuring greater product safety and better health outcomes for populations.

- **Challenges**

The major challenges that were faced regarding with the strengthening of the health system was the pandemic Covid-19 that perturbed the calendar regarding with the supportive supervision and data quality assessment that were planned to be conducted from central level to Health Facility.

Strategy 3.6. Develop And Implement an Operational Research Agenda for Malaria

In line with improving the quality of malaria related services, the malaria program regularly conducts researches. In this reporting period, the following research projected have been implemented:

Study Title	**Status**
Therapeutic Efficacy Study	Implementation ongoing
Estimating the Malaria Prevention Impact of New Nets: Observational Analyses to Evaluate the Evidence Generated During Piloted New Nets Distribution In Rwanda	Implementation ongoing
Assessing the Durability of Long Lasting Insecticidal Treated Nets (LLINs) Post Mass Distribution in Rwanda	Implementation ongoing

PART IV: PROGRAM COORDINATION AND MANAGEMENT

Objective 4: By 2024, Strengthen Coordination, Collaboration, PSM and Effective Program Management

The focus of the program in this plan is to maintain the achievements so far and move forward to further reduce the burden of malaria. The program has put more efforts to develop and strengthen collaborative and partnership initiatives to accelerate malaria prevention and control in Rwanda and the region. The following are the strategies used to achieve the above objective.

STRATEGY 4.1: MOBILIZATION OF ADEQUATE FINANCIAL RESOURCES

During this reporting period, the program received a total budget of US$53M from the GF following the successful submission of its Malaria Proposal for the Period July 2021-June 2024
In the same period, Malaria Program successful submitted the proposal to USAID PMI for MOP22 with a total proposed budget of US$19M.
In addition, with support from ALMA, the programme conducted the Malaria Program Success Stories and Malaria Scorecard Documentation for advocacy and resources mobilization.

Conduct Malaria Matchbox Assessment

Following the recent Rwanda Malaria Program concept note submission to GF for the new grant July 2021-June 2024, it was recommended to conduct an assessment of Malaria Vulnerable Groups, gender and equity for malaria services in Rwanda using RBM Malaria Matchbox Tool. This Assessment was conducted (support from RMB and ALMA) from April to June 2021 and the final report with key recommendations and action plan proposed. This will serve as a national reference to address gaps and challenges in malaria control for vulnerable groups but also as a resource mobilization tool.

STRATEGY 4.4: STRENGTHEN REGIONAL COLLABORATION

In this reporting period from July 2020 to June 2021, EAC Partner States and DRC launched the Great Lakes Malaria Initiative (GLMI) Strategic Plan 2021-2025.

Photo: Launch of the GLMI Strategic Plan 2021-2025, Nairobi-Kenya

This first ever regional strategic plan was endorsed by the EAC Health Ministers Council in April 2021 and its action plan developed in June 2021 with financial support from SFH Rwanda and SC Johnson.

In the same context, with support from ALMA, the GLMI Malaria Scorecard was developed by all Partner States to monitor progress and ensure accountability towards achieving the regional goals and targets.

Today, the fully costed GLMI Strategic Plan and its Action Plan is ready for implementation.

Community PBF and Working with NGOs, Scorecards for CSOs

Following the recommendation from the Malaria Program Review to expand the Performance Based Financing (PBF) to Community Health Workers providing malaria control services in Rwanda, a list of Program Indicators was proposed to monitor the work of CHWs dedicated to malaria control at community level (Binomes) in all districts.

Working with 5 Local NGOs (SFH Rwanda, Pro-Femmes Twese Hamwe, RICH, Caritas Rwanda and Urunana DC) deployed in all 4 Provinces and Kigali City to support Malaria SBCC Activities, all 30,000 Bonomes were oriented on Key Malaria Program Indicators to be evaluated on quarterly basis.

List of CHWs Indicators

SN	Indicator Name	Frequency	Source of Data
1	Proportion of Malaria Cases Treated by CHWs (HBM Performance)	Quarterly	HMIS at HC
2	Proportion of Households Visited	Quarterly	CHWs Forms
3	Proportion of Pregnant Women who received LLINs in ANC Services	Quarterly	HMIS at HC
4	Proportion of U1 who received LLINs in EPI	Quarterly	HMIS at HC

As per the final Local NGOs (CSOs) Performance Evaluation, these indicators helped improving the coverage in LLINs for Pregnant Women and children under 1 year as per Figure 1.

PART V: SOCIAL BEHAVIOR CHANGE COMMUNICATION

Objective 5: By 2024, 85% of the Population Will Have Correct and Consistent Practices and Behaviors towards Malaria Control Interventions

1. Introduction

In July 2020, Government of Rwanda through Ministry of health received an additional Grant from The Global Fund which aligned with the existing operational plan of July 2018-June 2021, to support Malaria SBCC Interventions.

Subsequently, in November 2020, Rwanda Biomedical Centre signed Framework Agreements with five successful CSOs assigned in the five provinces as follows: **Urunana DC**: City of Kigali; **Pro-Femmes/Twese Hamwe**: Northern Province; **SFH Rwanda**: Eastern province; **RICH**: Southern province; **CARITAS Rwanda**: Western Province, to implement RBF Malaria SBCC Strategic Interventions in Rwanda until June 2021, which marks the end of the Grant (2018-2021).

2. Strengthen the Malaria SBCC Framework

During this year, MOPDD in collaboration with malaria implementing partners, local leader at province and district level as well as DG of hospital conducted CHWs (Biomes) and local leader technical orientation meeting on malaria SBCC interventions in order to increase awareness around malaria burden disease in community, call for support and appropriation from local leaders and community members to address the gap in SBCC around Malaria prevention and control strategic interventions and increase CHWs and local leaders involvement in the program implementation. In total, the 139/145 are attended.

This fiscal year, the quick assessments was conducted in collaboration with malaria implementing partners to map out Malaria hotspot in country wide. This activity was conducted to inform RBC/Malaria Division and guide Malaria Control Interventions, a study was conducted to garner an understanding about these areas/hotspots and related influencing factors to facilitate, targeted planning and strategic implementation. The

results of this Quick assessment was disseminated in different meetings at National, Provincial and Districts levels for decision making to address the gaps in Malaria prevention and control as indicated by the research.

3. Increase Awareness on the Communities' Role in Malaria Prevention and Control

In the last FY2020-2021, social mobilization strategies on malaria SBCC through various communication strategies were used at Provincial, District, Sector, and community levels, to promote community ownership in malaria prevention and control, which is considered as a key aspect that will help to fast track the current "Kurandura Malariya bihera kuri njye" slogan.

During this fiscal year, the different meetings were organized and were the platform where all challenges were discussed by all concerned parties plotting channels and solutions for both short and long term. The attendance was successful in quarterly review meeting at 98% and annual review meeting at 99%.

The Community health workers conducted households in their respective cells in order to educate the community the proper use of LLINs, vector control and management by environmental cleaning. The **83%** (2,435,835/2,928,663) of households were visited. Malaria district supervisors supported health care providers to conduct **700** malaria health education sessions alongside facility staff reaching **43960 clients** in **509** health centers. At health center level, the supervision was helpful to address the problem identified in LLIN distribution in ANC and EPI services. The Visits through supportive supervision in collaboration with PSF to Hotels/Lodges on Malaria prevention and control were conducted: **69** hotels and **121** lodges were reached.

To increase mobilization about malaria prevention and control interventions, the Radio talk shows **48**, audio spots **396**, video clips **34**, radio sketches **8**, radio soap opera **20** episodes, and umuhoza radio magazine **3 were conducted. In this stage, the communication for social mobilization change on malaria prevention was also conducted and the participation was at 106%** (114/108) and Production and dissemination of IEC materials including Malaria Booklet **(34,513)**, Banners produced **(36)**, Pull up banners **(10),** Branded face masks **(76,542),** T-shirts **(5560**), CHWs' households checklist visits **(2,288,623),** raincoats **(2,368).**

4. Increase Advocacy for High Level Support to Sustain Malaria Prevention and Control Interventions

This year has been remarkable in advocating for malaria prevention and control. Stakeholders at all levels are committed to achieve the Government's goal as far as malaria prevention and control is concerned, by including malaria prevention and control measures in their routine agenda.

RBC-Malaria Division in partnership with Civil Society Organizations (CSOs) successfully organized the World Malaria Day on 25th April 2021, whereby Rwanda joined the rest of the World to celebrate World Malaria Day (WMD) with a Theme "**Zero Malaria Starts with Me**".

The celebration of the World Malaria Day in Rwanda presented as:

a) An opportunity to combine efforts in the community mobilization to fight against malaria through an increased awareness of the community and all stakeholders in malaria response and providing malaria prevention and control interventions in all districts.

b) A chance to shine a spotlight on the global effort to control malaria.

c) An occasion to highlight the need for continued investment and sustained political commitment for malaria prevention and control

Photo: Celebration of the WMD 2021, Bugesera

5. Promote Community Engagement in Malaria Prevention and Control Interventions

SBCC activities implemented by CSOs led to good outcomes regarding early diagnosis and treatment at community level. Malaria messages on malaria prevention and control were developed and disseminated through various communication channels. The disseminated messages focused on creating awareness on the role of community in malaria prevention and control, including sleeping under Long Lasting Insecticides Nets (LLINs), Households environmental hygiene to eliminate mosquito peri-domestic breeding sites, seeking early treatment… The interventions below were used to disseminate malaria prevention messages.

- Conduct community mobilization on Malaria prevention and control in hot spots using mobile sound system. **92%** (236/256) of the planned sessions were implemented successfully.
- **D**isseminating Malaria prevention messages through Bulk SMS **100%** (560,000/560,000) messages were disseminated.
- School based campaign on malaria prevention and control, to disseminate messages through poem, songs, sketch, and cartoon, and have reached 5,177 students.
- Training of religious leaders on malaria specific messaging: **82%** (296/360) were trained on the subject matter
- Mainstreaming Malaria messaging through preaching and teaching and other religious gatherings: It was achieved at **100% (16/16)** were visited.
- Annual consultative meetings at district level, with District Interfaith Committees, local authorities, and stakeholders to share updates/progress related to malaria prevention and control: **103%** (360/369)

Despite the achievement, there are some challenges encountered during this fiscal year such as COVI-19 pandemic, the Rapid SMS system, the stock out of Malaria commodities for CHW's and the behavior change must take much time to achieve the results. As lesson learnt, SBCC is key pillar in malaria prevention and control. The partnership with CSOs and local leaders involvement supported in increasing of RBF/Malaria indicators.

Table 20: KEY SBCC MALARIA ACTIVITIES IMPLEMENTED DURING THE YEAR 20/21

No	Activities Implemented by MOPDD and All its Partners	Total
1	Organize the SBCC meeting interventions for Malaria prevention and control at district level	1,263
2	Conduct annual review meetings at district level	796
3	Organize the SBCC meeting interventions for Malaria prevention and control at provincial	139
4	Quarterly Progressive review of Community SBCC Activities implementation and performance at DH level	316
5	Conduct a rapid assessment to map out Malaria high risk areas and the actual related gap to inform SBCC interventions	5
6	Technical orientation meeting of CHWs and local leaders on Malaria SBCC interventions at sector level	29,886
7	Support CHWs for community engagement in Malaria prevention and control	29,508
8	Conducting households visits on LLINs utilization and IVM	2,435,835
9	Conduct targeted supervision visits to health centers with low coverage of LLINs distribution in ANC and EPI Programs to boost the coverage of LLINs distribution	303
10	Organize 2 days Training of religious leaders on malaria specific messaging	296
11	Training of farmers cooperatives rice, cattle, fisheries, poultry, Mines, Security organs on malaria prevention and control	387
12	Conduct Training of trainers on IVM	242
13	Mainstreaming Malaria messaging through preaching and teaching and other religious gatherings	16
14	Organizing interreligious gatherings on malaria messaging	31
15	Organizing targeted Malaria IEC sessions at community level through existing community platforms	114
16	Conduct community mobilization on Malaria prevention and control in hot spots using mobile sound system	236
17	Organize Radio talk shows (	48
18	Production of educative video spots with key Malaria messages to be used on social media and other platforms	34
19	Production and Airing radio spots on (LLIN utilization, Malaria Early treatment, environmental management and HBM)	396
20	Disseminating Malaria prevention messages through Bulk SMS	560,000
21	Production of IEC materials (Booklets)	34,513
22	Production of IEC materials (Banners)	36
23	Production of IEC materials (Pull up banners)	10
24	Production of IEC materials (Branded face masks)	76,542
25	Production of IEC materials (T-shirts)	5,560
26	Production of IEC materials (households visit forms)	2,288,623
27	Production of IEC materials (raincoats)	2,368
28	Organize annual consultative meetings at district level, with District Interfaith Committees, local authorities and stakeholders to share updates/progress related to malaria prevention and control	369
29	Carry out quarterly Supportive supervision in collaboration with PSF to Hotels/Lodges on Malaria prevention and control.	30
30	Organize school based campaign on malaria prevention (organize football competition-Malaria prevention challenge school competition)	1,812

PART VI: NEGLECTED TROPICAL DISEASES & OTHER PARASITIC DISEASES

1. Introduction

In Rwanda, Neglected Tropical Diseases ("NTDs"), include intestinal worms–Ascariasis, Trichuriasis and Hookworm, Schistosomiasis (SCH), Scabies and other ectoparasites (Tungiasis or Jigger disease), Podoconiosis, Leprosy, Rabies, Snakebite envenoming (SBE), Trachoma, Taeniasis/Cysticercosis, Mycetoma, Lymphatic filariasis, Onchocerciasis and Human African Trypanosomiasis (HAT). Other parasitic diseases (OPDs) include amibiasis and giardiasis.

In 2018, 1.13 million school-age children and 2.7 million adults were requiring treatment for schistosomiasis, 5.05 million pre-school and school-age children and 3.47 million adults at risk were requiring treatment for intestinal worms. Other NTDs&OPDs affecting some communities include taeniasis/ cysticercosis, scabies with >50,000 cases annually, podoconiosis with an estimated >6000 cases, tungiasis, snakebites envenoming and rabies mainly from dog bites. At-risk populations—children, rural, and low-income—are at the greatest risk. Most NTDs&OPDs cases can be prevented through proven interventions and behaviours, including improving hygiene, sanitation, and the quality of water.

The Republic of Rwanda seeks to eliminate NTDs, which continue to pose a threat to the health and social and economic development.

By 2024, Rwanda plans to achieve the following objectives:

Objective 1: By 2024, eliminate the following NTDs as a public health problem in Rwanda: schistosomiasis, Human African Trypanosomiasis, Onchocreciasis, Trachoma, Lympatic filariasis, Yaws, Leprosy

Objective 2: By 2024, eliminate podoconiosis (ibitimbo) in endemic Districts with <1% prevalence of untreated podoconiosis among individuals aged ≥ 15 years and > 95% of lymphoedema cases are treated adequately

Objective 3: reduce by 100% death related to rabies (Zero death of dog-mediated rabies)

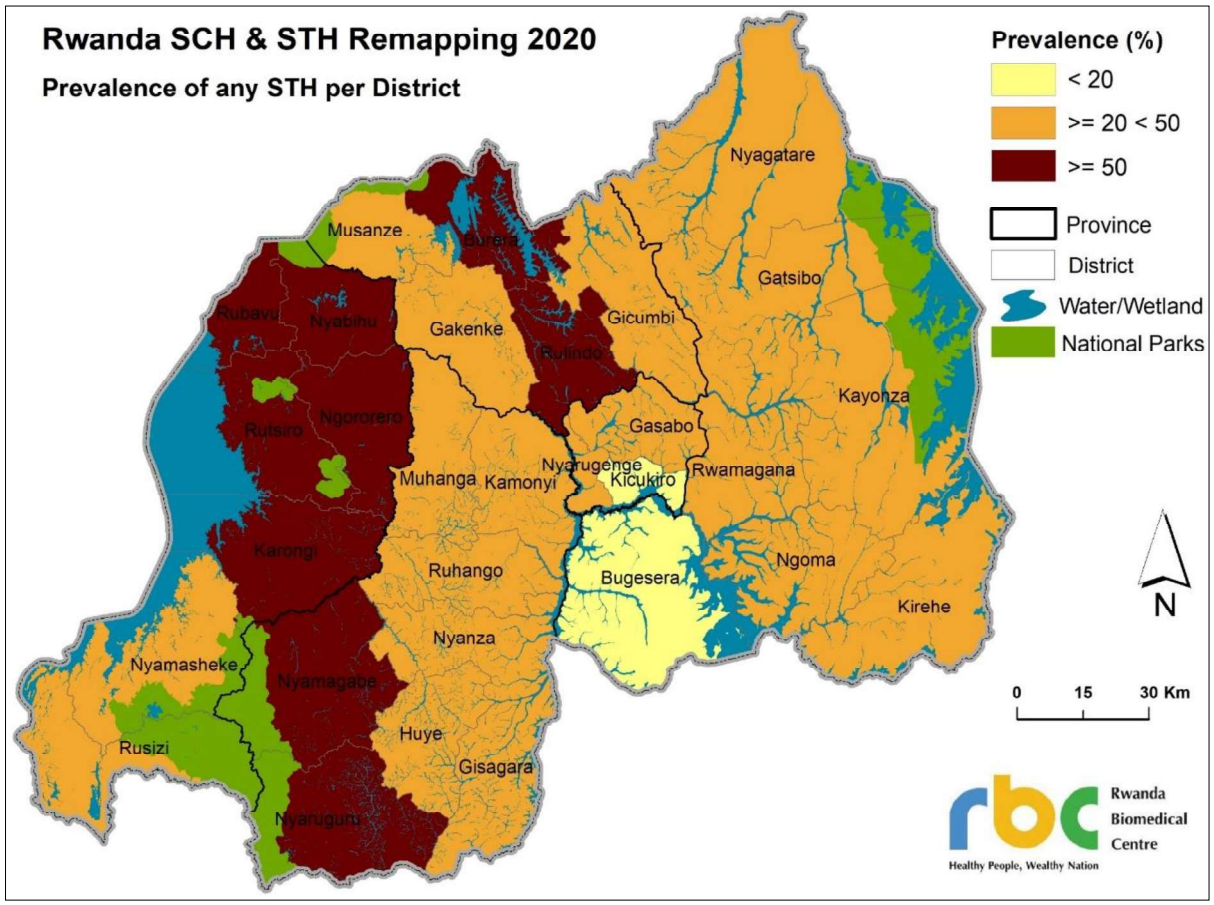
Objective 4: By 2024, reduce

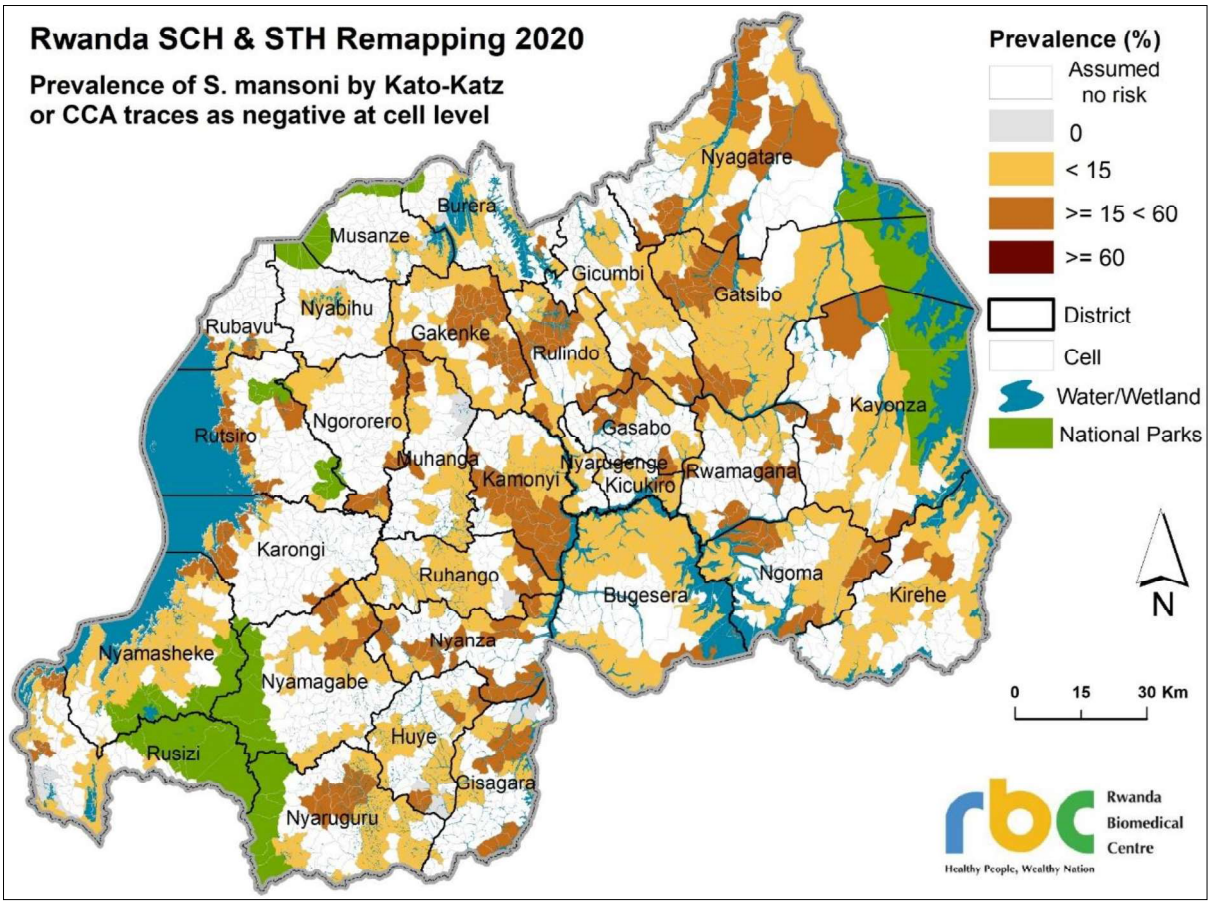
- to <20% the prevalence of intestinal worms
- by 20% the morbidity of tungiasis (jigger disease),
- by 25% the morbidity of scabies and Cysticercosis/Taeniasis
- by 50% the morbidity and mortality of snake Bites Envenoming

The following section provide details of this FY achievements.

2. The community-based re-mapping of STH and Schistosomiasis

In 2007/2008 initial mapping, the national prevalence of intestinal worms was 66% in and after 6 years it was reduced to 45% in 2014 in children aged 5-15years. After another 6 years (in 2020) of preventive and curative interventions, we conducted an innovative national community-based re-mapping survey for STH and schistosomiasis and we included all age groups. For the prevalence of STH, we found that adults (16years and above) are most affected by STH with 48% than School aged children -SAC (5-15years old) with 41% and Pre-SAC with 31%.





The no significant decline of the prevalence of STH after 6 years of interventions can be explained by different hypotheses including: 1) adults are not treated in MDA and continue to serve as parasites' reservoir that quickly contaminate treated children (the 2020 remapping survey found that STH are most prevalent in adults with 48% than in children (children aged 12-59 months have 31% and those aged 5-15 years have 41%); 2) Low efficacy of Albendazole to Trichuris trichiura (a species among STH) which is very prevalent in 10 districts, and 3) gaps in Water, Sanitation and Hygiene (WASH) and behavior change.

These findings justify the need of adults' mass deworming. Consequently, a new MDA strategy was developed. For Schistosomiasis, microscopic and immunological findings showed that 132 villages (44%) among 300 villages surveyed had the prevalence of 10% and above (range 10-56.7%). When applying the prevalence to cells adjacent to surveyed villages (surrounding water bodies), we found that 1016 cells are in need of Mass Drug Administration. In the 2021-2022 FY this new MDA strategy will start to be implemented and an orientation meeting is planned with all districts.

3. Mass Drug Administration (Mass Deworming)

The FY 2020/2021 was marked by the first country owned mass decentralized deworming campaign whose operational costs were owned by the country -Rwanda being the first country to own total operational costs of Mass Drug Administration in the Sub-Saharan Africa. The ownership of MDA implementation costs by the country was possible because the drug distribution has been decentralized down to village level and it was integrated within existing community and school platforms. At village it was integrated with monthly growth monitoring in under-5 children and weekly village gathering whereas in schools it was integrated with the existing education programme. During this decentralized deworming campaign, other maternal-child health interventions were integrated.

The coverage of Mass Deworming against STH & schistosomiasis was >95% in the targeted population.

4. Multi-Sector Response to NTDs

For an effective control and elimination of NTDs&OPDs, Rwanda Biomedical Centre requested all relevant institutions to nominate a representative to the NTD Sub-TWG that is in-charge of designing, implementing and monitoring cross-cutting activities to eliminate NTDs. This year (May 2021) was marked by the development of a joint annual operation plan for 2021-2022 with activities to be implemented in each represented institution with a regular follow-up, monitoring and evaluation.

5. Awareness Activities

On 30th January 2021, Rwanda joined different countries to celebrate World NTD Day. Its celebration in Rwanda was marked by different awareness activities including live radio and TV talk shows, lighting of the dome (Kigali Convention Centre), Did You Know (DYK) were disseminated via Tweeter and an article on NTDs status in Rwanda was published.

6. Drugs Coordination

During this reporting year, Rwanda has received donations of anthelminthic drugs for deworming including adults and the 3rd round deworming in children under-5 from high endemic districts.

Table 21: Details for deworming medicines received during 2020-2021FY

MDA Medicine	Target Population	Quantities Received (in Tablets)	Donor
Mebendazole	Adults aged 16 years and above	14,772,000	Johnson& Johnson through END Fund
	12-59 months old	3,124,000	WHO
Albendazole 400 r	12-59 months old	750,000	Vitamin Angels through Home for Hope Rwanda
	5-15 years old	7,532,000	WHO
Praziquantel 600mg	5-15 years old in 127 endemic sectors	3,384,000	WHO
	5-15 years old in 127 endemic sectors	3,996,000	WHO

7. Submission of HAT Elimination Dossier to WHO

Following 4 years of active and passive surveillance no case was detected in 16 sentinel sites from historically endemic areas of National Akagera Park (ANP). The passive surveillance activity in last 4 years saw 646,420 blood smear tested with zero HAT case. On average, each year 162,605 blood smears were performed.

Stakeholders (RBC, RAB, MINAGRI, RDB, ANP, FAO, WHO) developed a dossier requesting WHO to validate Rwanda as having eliminated HAT as a public health problem. Ministry of Health approved and submitted the dossier in April 2021.

PART VII: FINANCING THE MALARIA AND NTD PROGRAMS

1. Introduction

The financing of Malaria Strategic Plan becomes a high priority for the GoR. The MSP is funded by the Government of Rwanda, the Global Fund for HIV & AIDS, TB and Malaria Results Based Financing (GF), the US President's Malaria Initiative, END Fund and WHO.

Through SMART FMIS (Integrated Financial Management Information System), data of the actual financial report were generated given that HRTT captured so far budget and expenditures of the reporting period. To facilitate the collection of financial information for this year's report, a separate data collection process was adopted using for Global Fund grant and Government contribution; and directly from in country office for PMI.

2. Public and External Funding Sources for Malaria Program

Below a summarized table illustrates the malaria budget by source of funding with: PMI followed by GoR, Global Fund and END FUND for Fiscal year 2020-2021. The current total expenditures are amounting to USD 78 868 431 which represents 99,99% of total budget of USD 78 868 835.

Table 22 : Malaria Budget and Expenditures by Source of Funds, FY2020-2021

Funding Sources	Opening balance in USD	Initial Budget for FY 2020-2021	Revised Budget for in USD FY 2020-2021	Expenditures in USD for FY 2020-2021	Budget Execution Rate in %
GLOBAL FUND	8 058 796	21 588 744	29 647 540	29 647 540	100,0%
PMI		18 000 000	18 000 000	18 000 000	100,0%
GoR		30 729 213	30 729 213	30 856 856	100,4%
END Fund		492 082	492 082	364 035	74,0%
TOTAL	**8 058 796**	**70 810 039**	**78 868 835**	**78 868 431**	**99,99%**

3. Government Expenditures by MTEF Chapter for Fiscal year 2020-2021

The total GoR contribution to malaria expenditures is USD 30 729 213, from this budget the total expenditures are USD 30 856 856 represents 100,4% of total budget.

As presented in Table below, of the total expenditure was allocated to : (i) Compensation of employees, (ii) Use of goods and services, (iii) Acquisition of fixed assets, (iv) Subsides (v) Grants (vi) Social assistance and (vii) Other expenditures MTEF Chapter.

Table 23 : Government Expenditures by MTEF Chapter for Fiscal Year 202-2021

MTEF Chapter	Budget for FY 2020/21 in USD	Expenditures for FY 2020/21 in USD	Variance in USD	Performance in %
21 Compensation of employees	14 155 958	13 738 915	417 043	97%
22 Use of goods and services	5 090 021	4 967 654	122 367	98%
23 Acquisition of fixed assets	3 235 923	3 179 337	56 586	98%
25 Subsides	188 181	188 181	0	100%
26 Grants	2 354 342	2 573 910	- 219 567	109%
27 Social assistance	3 547 450	3 295 576	251 874	93%
28 Other expenditures	2 157 337	2 913 283	- 755 945	135%
Total	**30 729 213**	**30 856 856**	**- 127 642**	**100,4%**

4. Global Fund Contribution to Malaria Program

The Global Fund contribution for the FY2020–2021 was USD 29 647 540 the total amount was spent 100%.

Table 24: GF Expenditures by NSP Budget Categories for FY2020/2021

GF Budget Categories	Opening Balance in USD	Initial Budget for FY 2020-2021 in USD	Revised Budget for FY 2020-2021 in USD	Expenditures for FY 2020-2021 in USD	Variance in USD	Budget Execution in %
1.0 Human Resources (HR)		431 829	381 782	381 782	0	100%
10.0 Communication Material and Publications (CMP)		1566252	2 275 960	2 275 960	0	100%
11.0 Indirect and Overhead Costs		124 248	120 127	120 127	0	100%
2.0 Travel related costs (TRC)		3 898 375	3 761 058	3 761 058	0	100%
4.0 Health Products - Pharmaceutical Products (HPPP)		1 193 507			0	NA
5.0 Health Products - Non-Pharmaceuticals (HPNP)	8 058 796	13 089 098	21 872 170	21 872 171	0	100%
7.0 Procurement and Supply-Chain Management costs (PSM)		1 285 434	1 236 442	1 236 442	0	100%
Total	**8 058 796**	**21 588 744**	**29 647 540**	**29 647 540**	**0**	**100%**

5. PMI Expenditures for the Fiscal Year 2020-2021

The PMI contribution for malaria expenditures went specifically to malaria preventive intervention and to malaria case management interventions. The budget for preventive interventions was spent mainly on the procurement of LLINs and IRS. The total budget of USD 18 000 000 was executed at 100%.

Table 25 : END FUND Expenditures by Cost Category, FY2020-2021

Activity	Budget for FY 2020-2020 in USD	Expenditure s for FY 2020-2021 in USD	Balance in USD	Execution Rate in %
Conduct SCH/STH community-based remapping	492082	364035	128047	74%
Total	**492 082**	**364 035**	**128 047**	**74%**

The budget of END FUND was executed at the 74% the variance of Frw 128 047 will be spent next Fiscal Year 2021-2022.

6. Conclusion

The overall MOPDD Budget Execution for Fiscal Year 2020-2021 is at 99,99%.

PART VIII: MALARIA PERFORMANCE FRAMEWORK

Table 26: Malaria Program Performance Framework

ITEMS	INDICATORS	Baseline	Year of Baseline	2020-2021 Target	2020-2021 Results	%
Goal	**Impact Indicators**					
Goal: By 2024, reduce malaria morbidity and mortality by at least 50% of the 2019 levels.	Annual Parasite Incidence per 1,000 persons	321	2018-19	281	114	100%*
	Inpatient malaria deaths per 100,000 persons per year	2.1	2018-19	2	0.74	100%*
	Number of confirmed malaria deaths	264	2018-19	231	96	100%*
Objective 1:						
By 2024, at least 85% of population at risk will be effectively protected with preventive interventions	Proportion of structures in targeted areas that received indoor residual spraying (IRS) during the reporting period	98%	2018-19	98%	99.53%	100%*
	Proportion of population protected by indoor residual spraying within the last 12 months in targeted districts	98.%	2018-19	75%	99.48%	100%*
Objective 2:	**Outcome Indicators**					
Objective 2: All suspected cases are promptly tested and treated in line with national guidelines	Proportion of suspected malaria cases that receive a parasitological test at public sector health facilities	NA	2018-19	90%	100%	100%*
	Proportion of suspected malaria cases that receive a parasitological test at the community level	NA	2018-19	90%	100%	100%*
	Proportion of confirmed malaria cases that received first-line antimalarial treatment according to national guidelines at public sector health facilities	100%	2018-19	100%	98.5%	98%
	Proportion of confirmed malaria cases that received first-line antimalarial treatment according to national guidelines at the community	100%	2018-19	99%	100%	100%*
Objective 3:	**Outcome Indicators**					
Objective3: By 2024, strengthening surveillance and reporting in order to provide complete and timely accurate information for appropriate decision making at all levels	Proportion of public health facilities submitting malaria indicators timely	95,8%	2018-19	96%	92%	96%
	Proportion of public health facilities submitting complete report on malaria indicators	97,6%	2018-19	98%	99%	100%*
	Proportion of private health facilities submitting complete report on malaria indicators	51%	2018-19	55%		

Note: * Where the achievement is over 100%, results were presented as 100%