International migration and its contribution in the transmission of malaria in the Zimbabwean border districts.

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Abstract

Objective: This study aimed to provide evidence for policy and programming on malaria in Zimbabwe and other sub-Saharan countries. It also aimed to provide insight on how best to improve cross border collaborations in the prevention and control of malari*a.* ***Design and setting*:** A cross sectional mixed methods study design using both quantitative and qualitative approaches was conducted from February to April 2016 in the selected health facilities in Mutare and Mutasa districts of Zimbabwe. Quantitative methods included record review of administrative registers from 2012 to 2015 in the participating health facilities in the border districts of Mutasa and Mutare. Data on malaria test, the result of the malaria tests and sociodemographic data were abstracted from the register. Qualitative methods comprised of focus group discussions (FGDs) with the health centre committee members, patients (both sexes in one FGD) in the health facilities. A sample of 318 patient records was selected through purposive sampling.Univariate and bivariate analysis were done using Epi Info 7. Thematic analysis was employed in the analysis of qualitative data. ***Main outcome*:** The main outcome measure was the level of malaria attributable to international migration. ***Results*:** The proportion of malaria cases from Mozambique treated in Zimbabwe rose from 2.7% in 2013 to 5.1% in 2015. Males constituted 60% of patients from Mozambique and 75.5% of the patients aged from 5-34 years. Older children (12-59 months) were more susceptible to infections compared to younger ones. Being male (OR 1.29, 95% C.I 1.12-1.42) and being less than 5 years (OR 1.23 95%C.I 1.10-1.38) were significant risk factors for malaria transmission in Mutasa and Mutare. Participants in FGDs cited climate change as the main cause of an increase in malaria transmission. Other factors cited include resistance to indoor residual spraying; ineffective chemicals; poor diagnosis and insufficient drugs. ***Conclusions:*** The study revealed that international migration is a significant contributor to malaria transmission across bordering districts in Zimbabwe. It is imperative that the sub-Saharan governments intensify collaborative malaria prevention and control action and strategies. There is great need for continuous entomological surveillance to ensure that the different interventions across the countries are effectively managed through an evidence based approach.

Key-words: *International migration; Malaria transmission; Prevention and control*

BACKGROUND

Global efforts such as the malaria eradication campaign, 1956-69, and the millennium development goals have failed to eradicate malaria. Globally, 212 people fall sick from malaria. Poignantly, 90% of the malaria cases are in Africa. Furthermore, 90% of malaria-related deaths occur in Africa. South America, which has one of the largest wetlands, has overtaken Africa in malaria control. In Zimbabwe, malaria continues to be a public health problem, particularly in peripheral districts near the international borders with Zambia and South Africa. Every year, 600,000 to 800,000 people suffer from malaria (Ministry of Health and Child Care (MOHCC), 2012). Malaria is the fifth leading cause of mortality among pregnant women in Zimbabwe (MOHCC, 2014).

The predominant Malaria parasite in the country is Plasmodium falciparum which accounts for about 98% of all reported malaria cases. Plasmodium ovale and P. malariae account for the remainder (MOHCC, 2012). Malaria prevalence in Zimbabwe is seasonal, with peak incidence recorded between March and May (ZDHS, 2016). Manicaland (Eastern highlands) and Mashonaland East provinces (North East) constituted the predominantly malaria affected districts for the past 5 years. They both share a border with Mozambique. Treatment records at Zimbabwean health facilities reveal some patient names which are not native to Zimbabwe and these are hypothetically linked to Mozambique. Despite, international collaborations such as the MOZIZA, Mozambique, Zimbabwe and Zambia collaboration, the areas along the Zimbabwe-Mozambique boarder continue to bear the biggest burden of malaria (NMCP, 2014). Fig 1 is a summary of the steady malaria incidence in the five districts with the greatest malaria incidence in Zimbabwe.

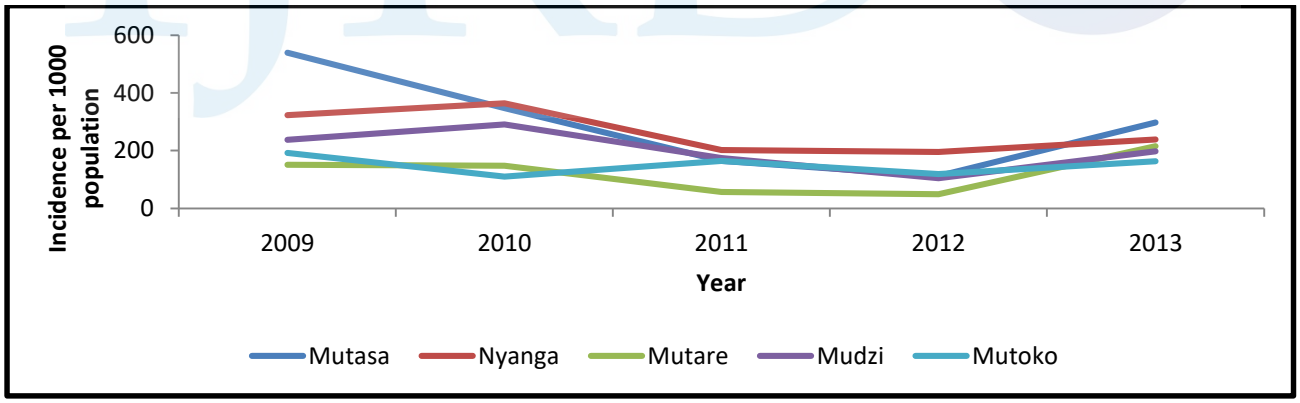


Figure 1: Malaria Incidence rates between 2009 and 2013 for the 5 districts most affected in 2013

(Adapted from the Zimbabwe National Malaria Control Program Database, 2014).

There is no defined border/demarcation separating the two countries and citizens of either nation can easily cross borders without formal documentation. This is a preferred choice as opposed to travelling more than 10km to access health facilities in their native country, Mozambique. Consequently, the influx of immigrants seeking health care at Zimbabwean health facilities further exerts strain on Zimbabwean health care resources which currently are not budgeted to cover this extra catchment population.

The majority of malaria cases have been noted to be coming from neighboring countries to the east and the north and these contribute considerably to the national burden. Zimbabweans along the borders frequent the Mozambican side for business (usually to buy goods for resale). Their Mozambican counterparts (male and female alike) cross into Zimbabwe in search of casual labour in the neighboring commercial farms. Ultimately, this scenario exerts more pressure on Zimbabwean resources (material and human). The aim of this study was to examine the role of international migration in the transmission of malaria in the Zimbabwean border districts of Mutasa and Mutare in the period from 2012 to 2015. The objectives of the study were: to describe demographic characteristics of patients who presented with malaria symptoms and were tested for malaria parasites in health facilities in the border districts of Mutasa and Mutare from 2012 to 2015, describe the incidence of malaria in the border districts of Mutasa and Mutare from 2012 to 2015, examine the factors associated with malaria infection in Mutasa and Mutare districts and to determine the level of malaria that is attributable to international migration in Mutasa and Mutare districts

MATERIALS AND METHODS

A cross sectional mixed methods study design using both quantitative and qualitative approaches was conducted from February to April 2016 in the selected health facilities in Mutare and Mutasa districts of Zimbabwe.Quantitative methods included record review of administrative registers from 2012 to 2015 in the participating health facilities in the border districts of Mutasa and Mutare. Data on malaria test, the result of the malaria tests and sociodemographic data were abstracted from the register. Qualitative methods comprised of focus group discussions (FGDs) with the health centre committee members, patients (both sexes in one FGD) in the health facilities. Key informant interviews (KII) were held with the health officials in charge of the health facilities and other senior health officials. In all, a total of 2 FGDs (Each with 10 participants) and 19 KIIs were held. Patients who presented with symptoms of malaria, attending health facilities in Mutasa and Mutare districts from 2012 to 2015 constituted the study population. Key health personnel from sampled health facilities catchment areas and members of the District Health Executive committees in the two districts were interviewed.

A minimum sample size of 289 patient records was calculated basing on anecdotal evidence from the Ministry of Health and Child Care, National Malaria Control Program, 2014, attributes at a minimum 60% and maximum 90%, of recorded malaria cases in the border districts of Manicaland due to irregular cross-border immigrants travelling 3 to 5 Km from Mozambique to seek health services in nearby Zimbabwe. This averages at 75% irregular cross-border migrants served at local Zimbabwean health facilities with worst acceptable rate of 5% at 95% confidence level. Adjustment of the sample size was done using a typical attrition factor; 1.10 to a sample size of 318 patient records using purposive sampling. Burma Valley and Rumba clinic were selected from Mutare district. St Peters's, Sagambe and Rupinda Clinics were selected from Mutasa district all being very close to the Mozambican border. Proportionate sampling according to the official catchment population was used to calculate the sample size per health facility catchment area.

Interviewer administered questionnaires were used to collect information from patients. The questionnaire gathered information on demographic characteristics of the patients, country of residence, place of residence, mobility history and history of malaria infection. A review of the district health information records and facility registers provided information on demographic characteristics

of patients presented with malaria symptoms, number of patients tested for malaria, numbers of confirmed cases and the number of those who tested negative.

A key informant guide was used to solicit information from the focal persons in the ministry of health at provincial, district and primary health care facility levels and each FGD solicited information from local stakeholders. A checklist was used to carry out an environmental assessment of localized foci for malaria transmission (e.g. stagnant water bodies – ponds, pools, swampy areas, empty cans, watermelon shells, cattle hooves' 'prints' etc.). Information on health service related factors such as accessibility of services (distance and user fees), quality of service, Indoor Residual Spraying, availability of Insecticide Treated Nets were gathered from appropriate personnel like the Environmental Health Technician through interviewer administered questionnaires.

Behavioural factors that could possibly lead to malaria infection were assessed through questionnaires (e.g. tending to the crop fields overnight, shelling of legumes without protective clothing late in the evening, praying and sleeping in the open, mosquito infested grounds). Besides collecting information on possible reasons for perennially high incidence rates of malaria in the border districts and the sudden sharp increase in the incidence rate in 2013, interviewer administered questionnaires were used to establish the existence of cross border collaborative initiatives in the prevention and control of malaria in the target districts.

Data was captured in Microsoft excel and Access. Univariate and bivariate analysis were done using Epi Info 7. Thematic analysis was employed in the analysis of qualitative data. Permission to carry out the study was provided by the Provincial Medical Director, Manicaland Province (PMD), the Health Studies Office(HSO); Joint Research Ethics Committee for University of Zimbabwe College of Health Sciences and Parirenyatwa Group Hospitals and the Medical Research Council of Zimbabwe. Informed written consent was obtained from all persons who were interviewed during the study period. Participants were free to refuse to participate without any consequences arising from their refusal. Confidentiality of responses was assured and maintained. All data collected remained anonymous as no names were written on the data collection tools.

RESULTS

Secondary Data

Records review of 6646 patients whose addresses were of Mozambican origin and registered at the Outpatient Department in five health facilities in Mutare (Burma Valley and Vumba clinic) and Mutasa (Rupinda, Sagambe, and St Peters) districts were conducted for the period 2012 to 2015 (Table 1). These were further captured electronically to form a database/dataset in Epi-Info. Records review of all people, inclusive of Zimbabwean and Mozambican dissent, who were treated for any ailment and specifically for malaria across the five health facilities, was also conducted. Most patients recorded in Mutasa district were from St Peters clinic. Burma valley clinic in Mutare district constituted the highest proportion of patients that were treated for any disease (Table 1).

Table 1: Distribution of the all patients that presented at the targeted health facilities in Mutare and Mutasa Districts, 2012-2015

Variable	District	2012	2013	2014	2015
	Mutare	17472	29196	21078	16247
	Mutasa	18555	31696	36921	21619
	Health Facility				
Mutasa District	Rupinda	2147	4609	5239	4578
	Sagambe	10396	11684	13559	5667
	St Peters	6012	15403	18123	11374
Mutare District	Burma	15312	25380	17536	12207
	Vumba	2160	3816	3542	4040

(Source: MOHCC District Records Review at Mutare and Mutasa 2012-2015)

3.1.2 Distribution of all patients treated in Mutare and Mutasa Districts by nationality from 2012-2015

The proportion of all Mozambican patients who received treatment for any disease at Zimbabwean health facilities (Mutare and Mutasa) gradually increased from 3.9% in 2012 to 4.7% in 2015. Figure 2 below summarizes the findings.

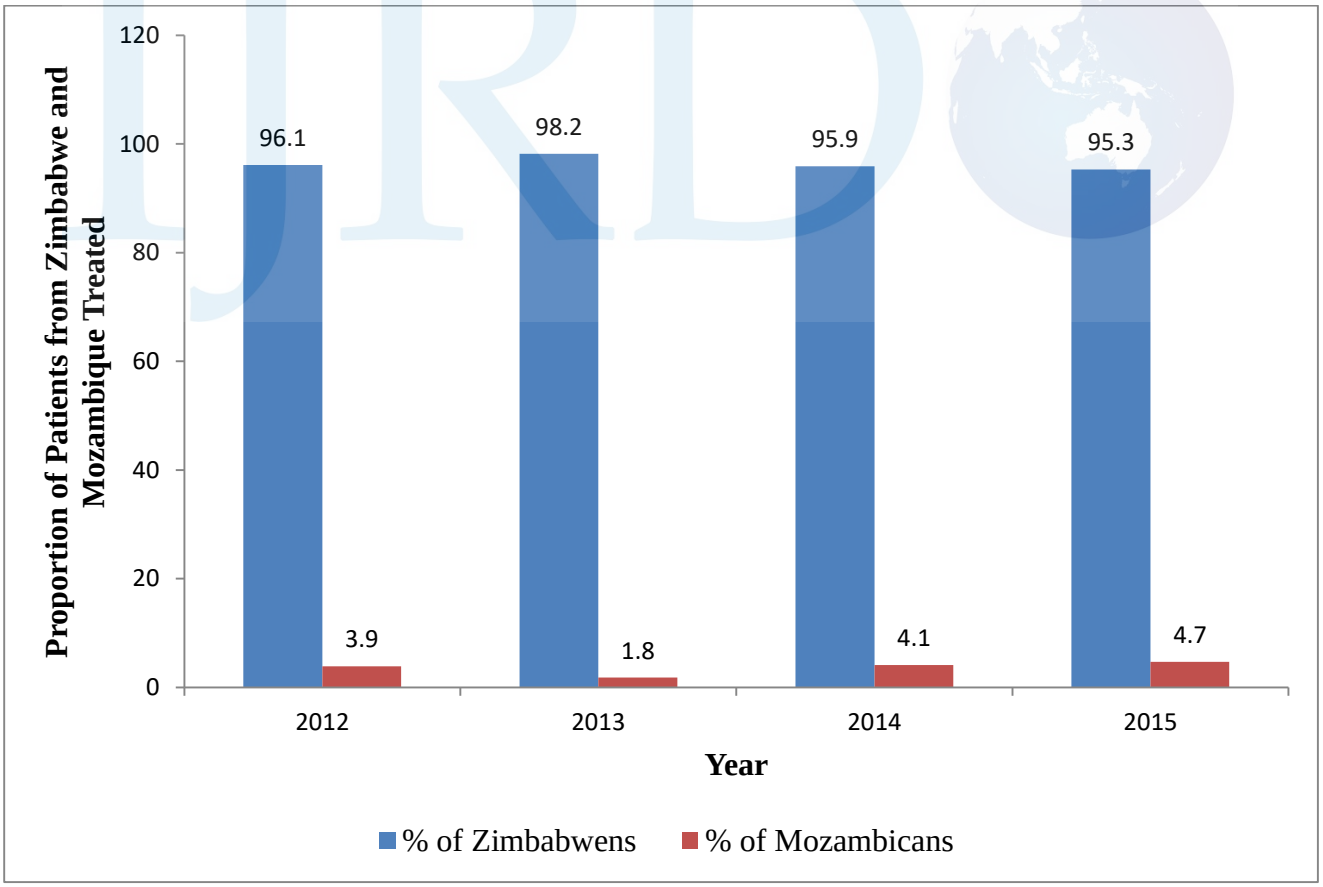


Figure 2: Distribution of all patients treated in Mutare and Mutasa Districts by nationality from 2012-2015 ***(****Source of Data: MOHCC District Records and Electronic Dataset from Health Facility records, 2012-2015)*

Malaria cases presented at health facilities in Mutasa and Mutare Districts by nationality

The proportion of malaria cases from Mozambique that were treated at Zimbabwean health facilities increased from 2.7% % in 2013 to 5.1% in 2015 (Table 2).

Table 2: All Malaria cases presented at health facilities in Mutasa and Mutare Districts by Nationality

Year	All Malaria cases presented at Health facilities (Mutasa and Mutare)	Zimbabwe		Mozambique	
		n	(%)	n	(%)
2012	11130	10519	(94.5)	611	(5.5)
2013	20329	19772	(97.3)	557	(2.7)
2014	25947	24897	(96.0)	1050	(4.0)
2015	12337	11702	(94.9)	635	(5.1)

(Source of Data: MOHCC District Records and Electronic Dataset from Health Facility records, 2012-20)

3.1.4 Age distribution of adults from Mozambique treated in Mutasa and Mutare districts of Zimbabwe from 2012-2015

Males constituted 60% of all patients from Mozambique treated in Mutasa and Mutare districts of Zimbabwe from 2012-2015. Approximately, 75.5% of Mozambican patients, treated in Mutasa and Mutare districts were aged from 5-34 years. Table 3 show sample distribution by age group.

Table 3: Age distribution of adults from Mozambique treated in Mutasa and Mutare districts of Zimbabwe from 2012-2015

Age in years category in years	Frequency n=5097 (%)
5-14	1281 (25.1)
15-24	1294 (25.4)
25-34	1018 (20.0)
35-44	694 (13.6)
45-54	350 (6.9)
55-64	247 (4.8)
065+	213 (4.2)

(Source: Electronic Dataset for Mozambican Nationals, from Mutare and Mutasa Health Facility records, 2012-2015)

3.1.5 Children in the older age groups (12-23months and 24-59 months)

Older Mozambican children (12-23 months and 24-59 months) were more susceptible to infections compared to those younger**.** While infections among the older children increased gradually over the period under review, the opposite was true for younger age groups (0-5 months and 6-11 months) (Figure 3)

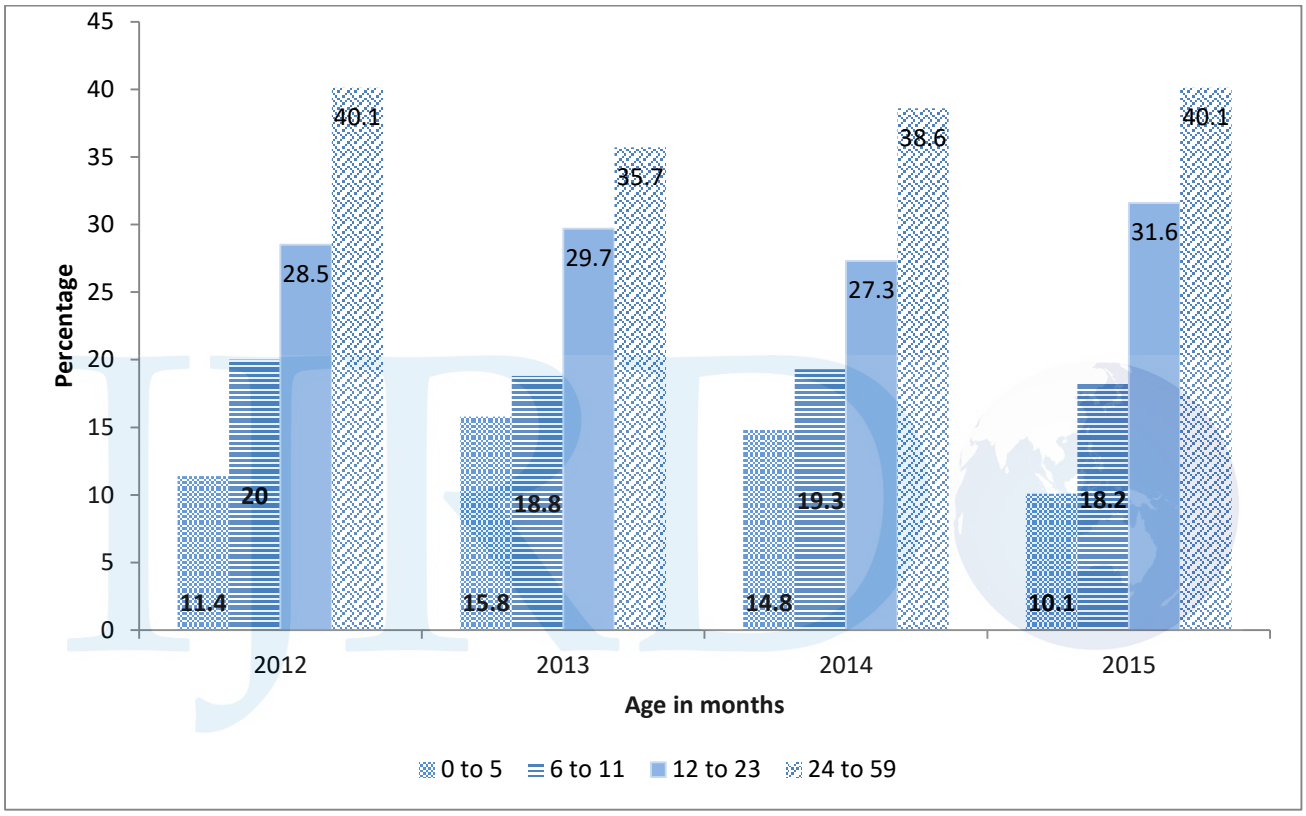


Figure 3: Age distribution of all children (0 to 59 months) from Mozambique treated in Mutasa and Mutare districts of Zimbabwe from 2012-2015, n=1549

(Source: Electronic Dataset for Mozambican Nationals, from Mutare and Mutasa Health Facility records, 2012- 2015)

Distribution of all patients from Mozambique treated in Zimbabwe by health facility and malaria status from 2012 to 2015

The majority of patients were recorded in Mutasa district (Table 4).

Table 4: Distribution of all patients from Mozambique treated in Zimbabwe by health facility and malaria status from 2012 to 2015

Health Facility	2012		2013		2014		2015	
	Malaria +ve	Malaria -ve	Malaria +ve	Malaria –ve	Malaria +ve	Malaria -ve	Malaria +ve	Malaria –ve
Rupinda	11	100	11	160	60	331	24	287
Sagambe	459	600	65	114	100	190	422	508
St Peters			235	131	724	633	119	206
Burma	28	58	43	63	28	41	2	4
Vumba	113	38	205	74	142	123	68	126
District								
Mutasa	470	704	310	405	882	1150	565	997
Mutare	141	92	247	137	168	164	70	130

(Source of Data: Electronic Dataset from records of five Health Facilities in Mutare and Mutasa, 2012 to 2015)

Incidence (per 1000 population) of malaria cases by health facility and districts in Manicaland province, Zimbabwe, 2012-2015

The incidence of malaria has generally been increasing over the period 2012 to 2014, declining thereafter (2015). Rupinda had the lowest case load of malaria over the four years reviewed (2012 to 2015), while Sagambe and Burma valley clinics recorded higher figures. While the incidence has generally been low in Vumba, there was a sharp peak in 2014 (Table 5).

Table 5: Incidence (per 1000 population) of malaria cases by health facility and districts in Manicaland Province, Zimbabwe, 2012-2015

Health Facility	2012	2013	2014	2015
Rupinda	47	182	227	194
Sagambe	423	1982	1942	444
St Peters	380	1248	1569	925
Burma	1399	1891	160	1280
Vumba	56	46	2163	40
District				
Mutasa	309	1154	998	987
Mutare	659	875	1263	597

(Source of Data: MOHCC District Records, 2012-2015)

Figure 4. shows that the incidence of malaria has generally been on the rise since 2012, before going on a decline in 2015, albeit sharply in Mutare and slightly in Mutasa districts.

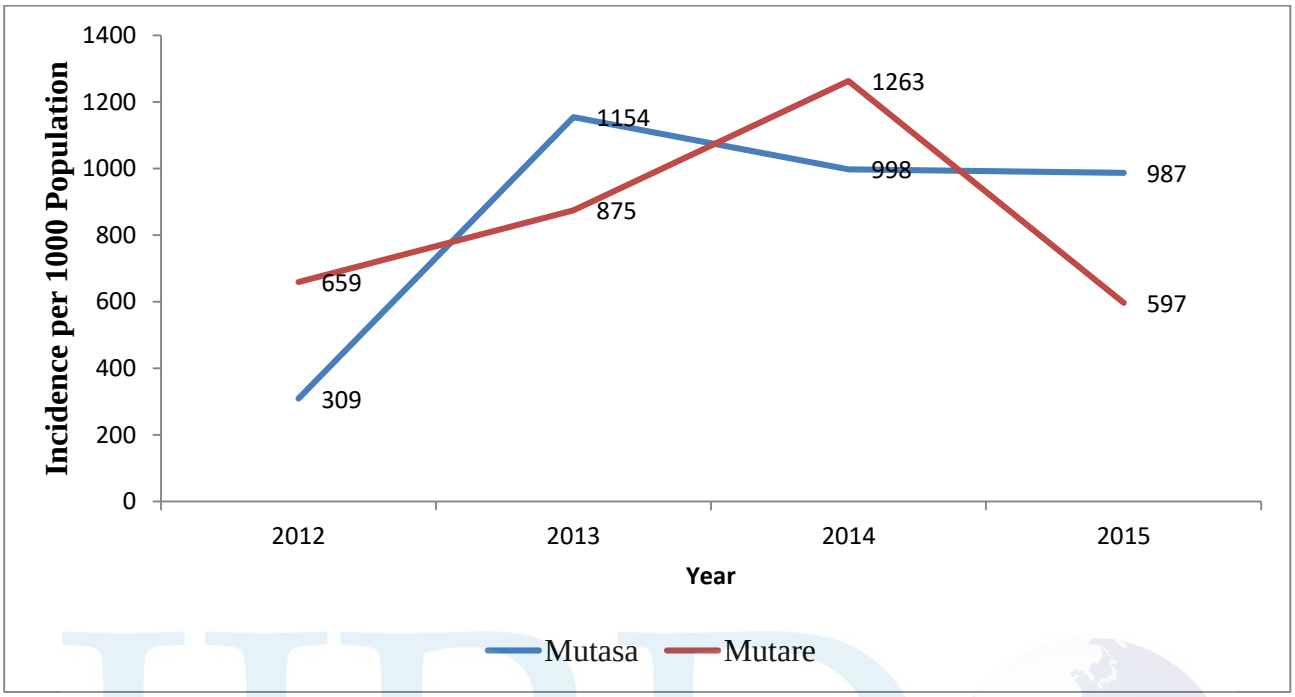
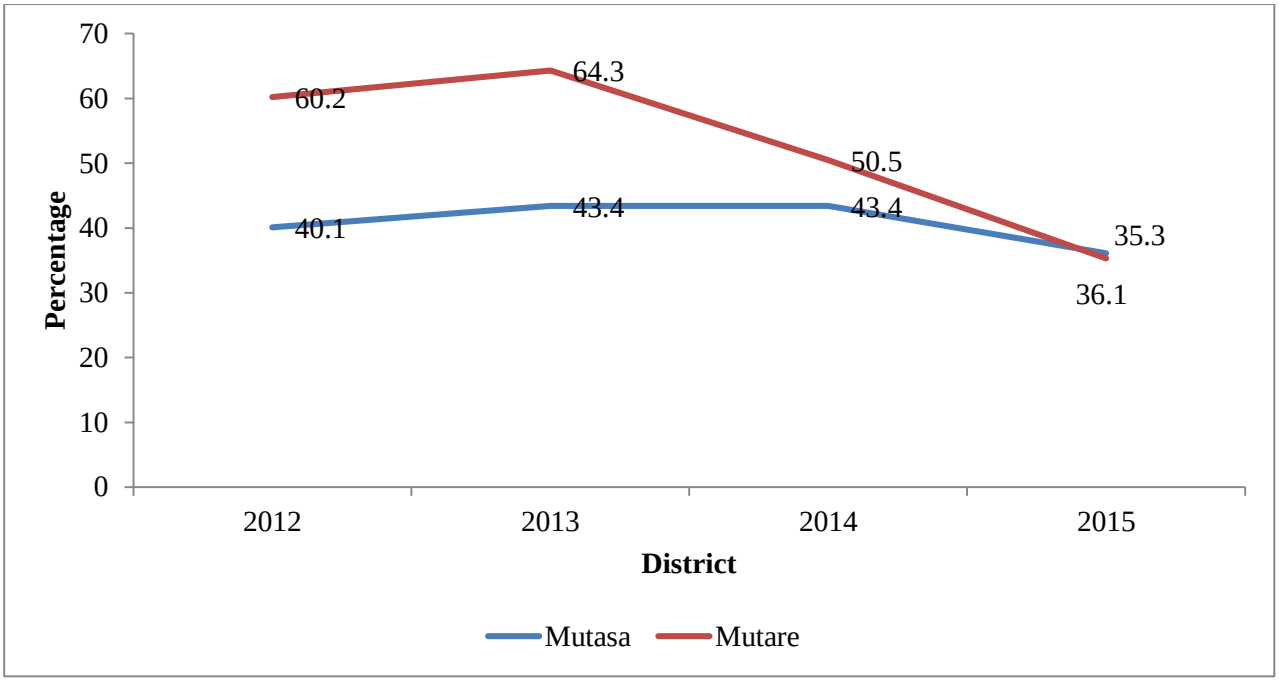


Figure 1: Incidence of malaria cases from Mozambique treated in Mutare and Mutasa districts of Zimbabwe from 2012-2015

(Source of Data: MOHCC District Records, 2012-2015)

3.1.8 Trends in malaria cases from Mozambique in Mutasa and Mutare district, 2012-2015

Both Mutasa and Mutare districts recorded decreasing trends of malaria cases over the period reviewed ($p<0.05$) (Figure 15).



Mutare Chi=37.7, p=0.00. Mutasa Chi=3.90, p=0.048

Figure 2: Trends in malaria cases from Mozambique in Mutasa and Mutare district, 2012-2015

Distribution of malaria cases from Mozambique treated in Mutare and Mutasa districts of Zimbabwe by months of years from 2012-2015

Over the four year period from 2012 to 2015, malaria cases reached a peak in the rainy season, reaching a low in winter.

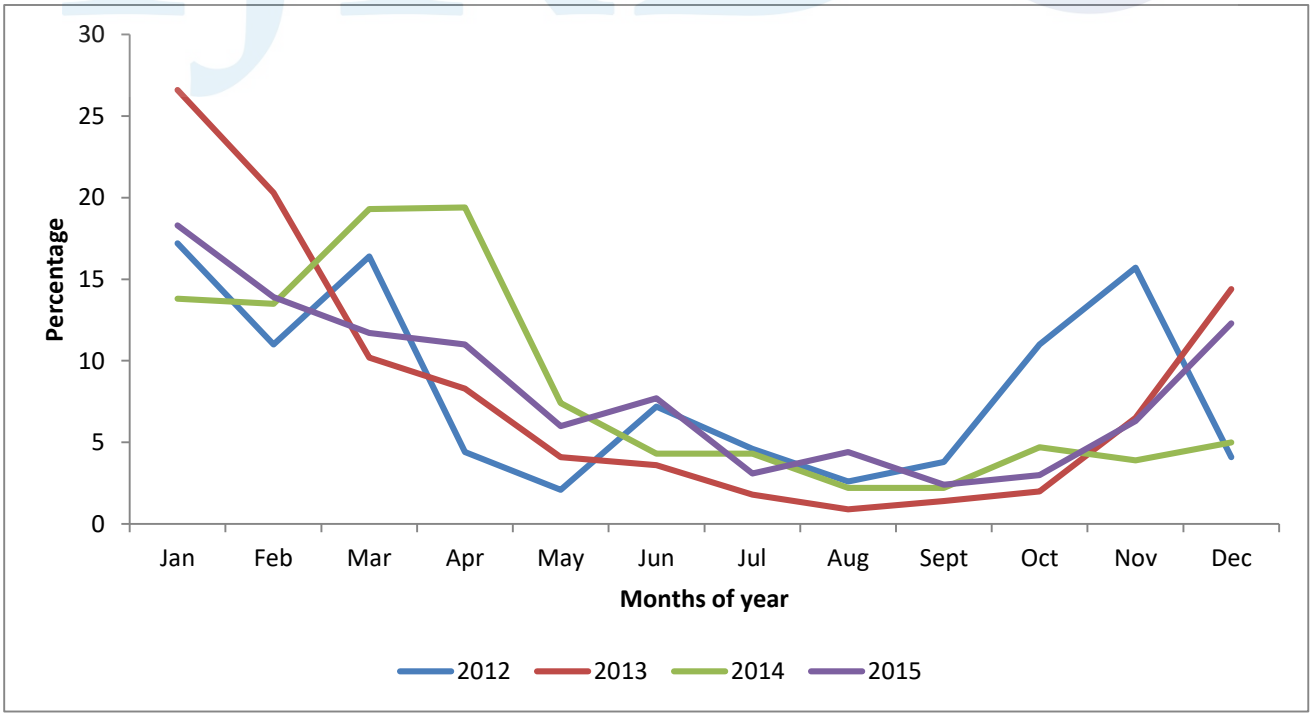


Figure 3: Distribution of malaria cases from Mozambique treated in Mutare and Mutasa districts of Zimbabwe by months of years from 2012-2015

Factors associated with malaria infection among Mozambicans receiving treatment in Mutasa and Mutare districts of Manicaland Province, Zimbabwe, 2012-2015

Being male (OR 1.29 95% CI 1.12-1.42) and being less than 5 years (OR 1.23 95% CI 1.10-1.38) were significant risk factors for malaria transmission in Mutasa and Mutare districts (Table 6).

Table 6: Factors associated with malaria infection among Mozambicans receiving treatment in Mutasa and Mutare districts of Manicaland Province, Zimbabwe, 2012-2015

Factor	Exp Stat	Cases n=2854 (%)	Controls n=3778 (%)	Odds Ratio 95% CI	P value
Male	Yes	1240 (43.5)	1411 (37.4)	1.29	**0.00**
	No	1614 (56.5)	2367 (62.6)	1.17-1.42	
Being aged less than 5 years	Yes	735 (25.8)	830 (22.0)	1.23	**0.00**
	No	2119 (74.5)	2948 (78.0)	1.10-1.38	

Entomological surveillance

Before 2014, the two districts used to spray houses using pyrethroid. On bio-assays the decay rate was so fast that it dropped to below 80% in 60 -90 days instead of 6-7 months. Resistance and sustainability tests were done and it was confirmed that mosquitoes had become resistant to the chemical. The chemical was changed to organophosphate.

Decrease in malaria cases

Key informants reported that IRS became effective when they started using organophosphate as the mosquitoes had become resistant to pyrethroid. They reported that the introduction of organophosphates saw a decrease in malaria cases. The key informants also attributed the reduction in malaria cases to an increase in mosquito nets distribution. They reported that mosquito nets are no longer given to only pregnant women but to everyone in the community. Another reason given for reduced malaria cases was the increase in IRS coverage in the districts (Table 6). This was above the WHO standard of 80% even though this was still below the national target of 95%. However, the key informants reported that there is still no IRS in Rupinda.

Table 7: IRS Coverage in Mutasa and Mutare district, 2012-2014

Year	Coverage's (%)	
	Mutare	**Mutasa**
2012	94.9	80.0

2013	94.6	91.0
2014	95.5	92.0

Qualitative data

Causes of malaria transmission

Climate

Climatic conditions were cited as the main cause of malaria transmission, as there were increased cases of malaria in the rainy season. Furthermore, temperature increase due to heat wave was associated with increased number of malaria cases.

Resistance to indoor residual spraying (IRS)

Participants reported that residents reject mosquito nets citing side effects such as nuisance, shortness of breath and irritation. Some households are not sprayed due to religious beliefs.

Ineffectiveness of chemicals

Some participants said that some of the chemicals used were ineffective and reported that the potency is not 9 months as it is supposed to be but only 3 days to 4 days in some cases.

Poor diagnosis

Some of the participants reported that there was poor diagnosis of malaria by Village Health Workers (VHWs) in the community. There were reports that some malaria cases were not detected and some talked about recurrence of illness soon after treatment.

Insufficient drugs

FGDs revealed that there are insufficient medicines such as Coartemeter in Mozambique. Some of the participants also reported that malaria drugs were sold in the black market in Mozambique and at times they are of poor quality. Some participants reported that control of these medicines is very poor in Mozambique.

The role of migration

Participants reported that they go to Mozambique to work in the farms or buy goods for resale and get mosquito bites when they are there. Both Zimbabweans and Mozambicans cross borders for casual labour. They also cited that Mozambicans go to Zimbabwe for treatment and vice versa. The participants reported that there was no spraying in Mozambique which makes people more vulnerable to malaria. Moreover, they reported that social factors such as inter-marriages and religion also make people cross the borders.

Strategies by the district authorities for prevention and control of malaria in the community

Health education

St Peter's community members mentioned that they were educated on filling potholes, correctly disposing of empty containers and grass cutting. Furthermore, they reported that there was training malaria focal persons in the community as well as "edutainment", which involved drama on malaria prevention at shops.

Perceptions on the role of the government

Participants from St Peter's further reported that there is long distance between their communities and the nearest health care facility, hence the need for a sub clinic. In addition, they reported difficulties in getting transport to the health facility and suggested that the local ambulance at the clinic needed to be repaired to assist people in need of emergency attention to the hospital. Participants further raised the fact that the laboratory technician who do microscopy occasionally lacks adequate resources and needs refresher training /on job skills strengthening. They further mentioned that community members needed constant replacing of mosquito nets. A nurse who was present confirmed shortages of Rapid Diagnostic Test kits (RDT) and medicines at the health centre. Participants also suggested that the government should ensure constant supply of material resources such as drugs and surgical materials. Participants identified the need for collaborative action between the district governments in the border communities. They mentioned the need for community health education in Zimbabwe to be shared across neighboring Mozambican community. In addition, the participants suggested that the district government should also spray neighboring Mozambique communities to reduce transmission of malaria in the districts that share international border with Mozambique.

Thematic analysis result of FGD in Burma valley clinic of Mutare district

Causes of malaria transmission

Abundance of water bodies and tall grasses were reported as responsible for malaria transmission in the Burma valley community. Participants further reported the noticed decrease of malaria in the district between 2014 and 2015.

The role of migration

Frequent movement from Zimbabwe to Mozambique and vice-versa was cited as another reason for malaria transmission. The participants reiterated that they cannot stop going to Mozambique as it helps them in their livelihood. They mentioned that the main problem is that there is no IRS in Mozambique even though the country is at risk of malaria.

Pressure on local health care services

Participants from Burma Valley cited that Mozambicans go to Zimbabwe for treatment. They reported that their local clinic provided services to Burma Valley, Nhowe and Makovere wards in Mozambique. Participants from Burma valley expressed their wish for Mozambique to be also sprayed, knowing that cross border movement between Mozambique and Zimbabwe cannot be prevented, as this is an important source of livelihood for the residents of the two countries.

Key informants interviews

Government officials at different levels were interviewed as key informants to understand their perception of the role of migration in malaria transmission in Mutare and Mutasa districts. The key informants included health officials at provincial, district and local government levels, who are involved with malaria control program or with patients presented with malaria in clinics.

Factors influencing malaria transmission

Rejection of IRS

The key informants reported that some of the people have not changed their behaviour. Some still work late in the farms and some misuse the mosquito nets they receive. They reported that some people lock their doors to avoid their rooms from being sprayed in fear of side effects of the chemical such as itching.

Non- spraying

The key informants further mentioned that malaria outbreaks were experienced in the non-sprayed areas in these districts

Role of migration in risk of malaria transmission

Corroborating with reports from the FGDs, the key informants reported that there are malaria cases that come from Mozambique. The key informants blamed international migration as a factor influencing malaria transmission in the district. They re-iterated that there is a lot of movement between Zimbabwe and Mozambique due to cross border labour migration to work in the farms. Intermarriages between the two countries were further cited as a reason for international migration. The key informants mentioned that travelling to Mozambique presents risk of malaria transmission. They reported that IRS is not done in Mozambique and they only give mosquito nets to pregnant women. The key informants further highlighted that some Mozambicans do not complete their malaria treatment and present to the Zimbabwean hospitals with complicated cases. The key informants reiterated that there is need for cross border collaborative activities between the two countries to effectively reduce the incidence of malaria in the cross border communities.

DISCUSSION

This study reviewed all recorded patients that were treated for any disease in selected health facilities in Mutare and Mutasa districts from 2012 to 2015. Over this period, most of these patients were recorded in Mutasa district because three out of five facilities that were selected into the study are from this district. Most patients recorded in Mutasa district were from St Peters clinic, which has the largest catchment area in the district. Among all facilities that were selected into the study, Burma valley clinic in Mutare district constituted the highest proportion of patients that were treated for any disease. Mutare district is larger than Mutasa district by population size and Burma valley clinic serves the largest catchment area among all facilities selected into the study (ZDHS 2010/11).

Mozambican patients who received treatment for any disease at Zimbabwean health facilities (Mutare and Mutasa) gradually increased over the period reviewed. Mozambicans living close to the border are located far away from health facilities in their country. Zimbabwean health facilities are more accessible and user friendly to them. So, they continue to come in their numbers every year. Since the proportion was expressed over the total number of patients that were seen in these facilities, the increase could be due to corresponding decrease in case burden in Zimbabwe over the period. The proportion of patients who received treatment for any disease at Zimbabwean health facilities sharply decreased to 1.8% in 2013. Zimbabwe held its elections in 2013 and this could have scared Mozambicans from coming for services for security reasons.

The proportion of malaria cases from Mozambique that were treated at Zimbabwean health facilities increased from 2013 to 2015. The incidence of malaria cases from Mozambique has generally been increasing over the period 2012 to 2014. Rupinda had the lowest case load of malaria over the four years under review (2012 to 2015), while Sagambe and Burma valley clinics recorded higher figures. Key informants revealed that Mozambicans health authorities do not conduct IRS their communities along its border with Zimbabwe. The level of education regarding transmission of malaria among the Mozambican citizens who participated in FGDs was very low. One of the participants mentioned that "Mozambicans are resistant to Malaria".

Zimbabweans receiving treatment decreased from 2012 to 2015. In support of this, key informants reported a similar trend. This could be attributed to efforts the Zimbabwean government is putting towards epidemiology and disease control. Key informants revealed that community members, for example in St Peter's, were educated on filling potholes, correctly disposing of empty containers and grass cutting. Furthermore, there was training of malaria focal persons in the community as well as "edutainment" which involved drama on malaria prevention at shops.

IRS became effective when organophosphates started being used in Zimbabwe instead of pyrethroid which mosquitoes had become resistant to. This saw a decrease in malaria incidence since this use. Over the four year period from 2012 to 2015, malaria cases from Mozambique reached a peak in the rainy season, reaching a low in winter confirming facts in literature that malaria is a seasonal disease

Males constituted most of all patients from Mozambique treated in Mutasa and Mutare districts of Zimbabwe from 2012-2015. This is contrary to what is in literature that more women than men are

likely to seek health services (CDC, 2014). According to IOM on Gender, Migration and Remittances, more men than women are involved in migration (IOM, 2014). Therefore it could be that most migrant Mozambicans seeking health services in Zimbabwe are men.

Most Mozambican adults (5+ years) treated in Mutasa and Mutare districts over the period reviewed were aged from 5-34 years. Therefore, children and young people were the ones migrating to receive health service. The elderly could either have developed some resistance to some of these diseases or they could be having little energy to seek health services. In terms of under-fives, older Mozambican children (12-23 months and 24-59 months) were more susceptible to infections compared to those that were younger. Trend lines showed that while infections among the older children increased gradually over the period reviewed, the opposite was true for younger age groups (0-5 months and 6-11 months). In fact, older children were also more susceptible to malaria although the case load decreased gradually over the period. Older children are more active and engage riskier behaviours or practices that expose them to illnesses than younger children.

International migration was blamed as a cause of malaria transmission. There is a lot of movement between Zimbabwe and Mozambique due to cross border trading, intermarriages and labour migration to work in the farms. IRS is not done in areas close the Zimbabwean border in Mozambique and pregnant women are only given mosquito nets. This explains why migration has a role in malaria transmission in Zimbabwe.

Climatic conditions, exposure to mosquitoes, environmental conditions, abundance of water bodies and resistance to indoor residual spraying or lack of it are some of the factors responsible for malaria transmission in Mutare and Mutasa districts. Similar findings were made by Norma Mugwagwa et al on malaria outbreak investigation in Mutasa district in 2014.

It is recommended to conduct collaborative international and local malaria prevention and control action between the district governments in the border communities, including health education and IRS. Health-workers should lobby for buy-in from community leaders to ensure that all residents have their homesteads sprayed and do not abuse LLITNs. More health facilities are needed close to boarders to cater for international migrants. Malaria equipment and supplies should cater for Mozambican citizens close to the border with Zimbabwe. Actively, involving politicians, in countries sharing boarders, in malaria control may be more effective in eliminating malaria.

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