Prevalence and outcome of malaria among hospitalized children in Al Sabah Children Hospital, South Sudan

Article *in* South Sudan Medical Journal · December 2020

CITATION
1

READS
1,557

8 authors, including:

Justin Bruno Tongun
University of Bergen
20 PUBLICATIONS **249** CITATIONS
SEE PROFILE

Joseph Lako
University of Juba, Juba City, South Sudan.
20 PUBLICATIONS **36** CITATIONS
SEE PROFILE

SSMJ
SOUTH SUDAN MEDICAL JOURNAL

ISSN 2309 - 4605 eISSN 2309 - 4613

Volume 13. 5. December 2020

www.southsudanmedicaljournal.com

SPECIAL MALARIA ISSUE

New National Malaria Strategic Plan for South Sudan

- Community Intermittent Preventive Treatment in Pregnancy
- Malaria outcome in children at Al Sabah Children Hospital
- Non-adherence to standard malaria guidelines
- Artemisinin-resistant malaria and prevention strategies
- Malaria and impact of climate change
- Malaria and COVID-19: a case report
- Laboratory science in the battle against malaria

SSMJ

South Sudan Medical Journal

ISSN 2309 - 4605 eISSN 2309-4613 Volume 13 5 December 2020

A Publication of the South Sudan Medical Journal

Juba Teaching Hospital, P. O. Box 88, Juba, South Sudan

Email: admin@southernsudanmedicaljournal **Website:** www.southsudanmedicaljournal.com

Index and Copyright Information

EDITORIAL

RESEARCH ARTICLES

MAIN ARTICLE

CASE REPORTS

SHORT ITEMS

BACK COVER

FRONT COVER: Female anopheles mosquito

South Sudan's New National Malaria Strategic Plan 2021-2025 is a Game Changer

Dr. Harriet Akello Pasquale
Director
National Malaria Control Program, National Ministry of Health, Republic of South Sudan

Email:
harrietpasquale@gmail.com

The Ministry of Health of the Republic of South Sudan has just approved an ambitious 5-year National Malaria Strategic Plan 2020-2025 to control and prevent malaria, the third since South Sudan became an independent country in 2011. The launching ceremony on the 11th December 2020 was attended by senior officials of the Ministry of Health, the World Health Organization, UNICEF and malaria implementing partners. The Undersecretary of the Ministry of Health reiterated his government's commitment to mobilise resources to combat malaria, despite the country's economic hardship and immense natural disasters, which have triggered a call for humanitarian assistance for the population seriously affected by floods.

This plan is different from previous ones because the selected effective interventions are based on evidence generated locally. These include: Seasonal Malaria Chemoprevention (SMC) based on the excellent results from a Médecins Sans Frontières (MSF) Spanish study which showed a reduction in disease burden and death in children; shifting to more enhanced pyrethroid insecticide and the synergist piperonyl butoxide (PBO) insecticide treated nets (ITN) based on local evidence of widespread vector resistance to pyrethroid use in conventional ITNs; and scaling up Indoor Residual Spraying (IRS) for the protection of vulnerable populations in Internally Displaced Persons (IDPs) and refugee camps to include large municipalities with a high disease burden. Finally, the strategy taps into the private sector domain through collaborative public-private partnerships in order to introduce and promote marketing of innovative personal protective tools such as repellents in a form of lotions and mosquito coils. This addresses the issue of residual transmission due to outdoor biting as a result of possible change of mosquito behaviour driven by the South Sudanese culture of staying outdoors much of the night.

This strategy has bold and ambitious goals to reduce malaria morbidity and mortality by 80% from the 2019 levels and to reduce the malaria parasite prevalence by 50% from the 2017 levels. The plan has six main objectives to achieve by 2025:

1. To strengthen and sustain the management and coordination capacity of the malaria programme at all levels;
2. To protect 80% of the population at risk by recommended malaria prevention methods;
3. To achieve 100% parasitological diagnosis and treatment of all presented malaria cases according to the national guidelines;
4. To increase to at least 80%, community and health worker knowledge, attitudes and practices on malaria prevention and control;
5. To strengthen malaria emergency preparedness and ensure timely malaria control responses in all communities affected by conflict, natural disaster or epidemics;
6. To ensure 80% of health facilities routinely report on core malaria indicators.

The implementation of this plan will be done through a multi-sector approach, with focus on community-based interventions, derived by scaling up of the community based health system called the Boma Health Initiative (BHI) to improve access to interventions. To have sustainable interventions, the overall implementation of this plan will be based on *Three principles: One country strategy, One coordinating authority – the National Malaria Control Programme (NMCP), and One monitoring and evaluation framework.* It will be mainly driven and owned by the government, which is expected to invest more in health with increased support for malaria control and prevention. While partners are encouraged to mobilise additional resources to compliment government efforts, they are expected to align their plans to this strategic plan and use the one malaria monitoring and evaluation framework to track progress and the one coordination mechanism lead by the National Malaria Control Programme.

Regular reviews and studies will be conducted to monitor progress, to evaluate the impact of interventions and to generate evidence to support policy change.

We invite all potential donors, interested implementing partners, both national and international Non-Governmental Organizations, the private sector, and other government line ministries to support the implementation of this malaria strategic plan.

Impact of Community Intermittent Preventive Treatment in Pregnancy (C-IPTp) approach on the uptake of IPTp3+: a randomized controlled trial in Karagwe, Tanzania

Alen Kinyina,[1] Glorialoveness Lyimo[2] and Sarah Chamos[3]

1. Jhpiego, Tanzania
2. College of Health Science, School of Nursing and Public Health, University of Dodoma, Tanzania
3. Sekou-Toure Regional Referral Hospital, Mwanza, Tanzania

Correspondence:
Alen Kinyina:
alenkinyina@gmail.com

Submitted: May 2020
Accepted: September 2020
Published: December 2020

Citation:
Kinyina et al. Impact of Community Intermittent Preventive Treatment in Pregnancy (C-IPTp) approach on the uptake of IPTp3+: a randomized controlled trial in Karagwe, Tanzania. South Sudan Medical Journal 2020; 13(5):175-177

Abstract

Background: The low uptake of Intermittent Preventive Treatment in Pregnancy (IPTp) during pregnancy leads to millions of pregnant women who are not protected from malaria, hence contributing to preventable maternal and neonatal morbidity and mortality.

Objective: To determine the impact of the Community IPTp approach on increasing uptake of 3 or more doses of IPTp (IPTp3+).

Method: Pregnant women in the intervention group received Sulphadoxine-Pyrimethamine (SP) in the community. The control group continued to receive the IPTp at the health facility during routine antenatal care (ANC). All pregnant women received IPTp by Directly observed treatment (DOT).

Results: Of the pregnant women in the intervention group, 98.5%received IPTp3+ compared to 55.7% in the control group.

Conclusion: C-IPTp is an effective approach of increasing the uptake of IPTp3+ among pregnant women compared to using routine ANC visits.

Key words: IPTp3+, Sulphadoxine-Pyrimethamine, Tanzania, pregnancy, malaria.

Introduction

Malaria in pregnancy, albeit preventable, is a major problem in many endemic areas.[1] The effects of malaria in pregnancy include low birth weight, premature delivery, anaemia and stillbirth.[2, 3] In sub-Saharan Africa the prevalence of stillbirths resulting from pregnancy associated with malaria is up to 20%.[4] A major risk factor for infant mortality is low birth weight,[5] accounting for about 100,000 infant mortalities in Africa in 2004.[6] Provision of Intermittent Preventive Treatment in Pregnancy (IPTp) is recommended by the World Health Organization at each scheduled ANC visit in the 2nd and 3rd trimesters; these doses are administered at least four weeks apart by Directly Observed Treatment (DOT).[7]

Despite a high ANC visit coverage, IPTp uptake by pregnant mothers is still low in Tanzania.[8] Tanzania's National Malaria Control Programme (NMCP) in 2014 set a target of increasing the percentage of mothers reporting a live birth in the previous two years who received two or more doses of IPTp from 32% to 60% in 2016 and 80% by 2020.[9] In the Tanzania Demographic Health Survey 2015-2016 report, 35% pregnant mothers received at least two or more IPTp doses,[10] however in 2017 the Malaria Indicator Survey (MIS) report showed that the percentage of women who received two or more doses of IPTp was 56%.[11] The gap between the achievement in uptake of IPTp and the target, regardless of the efforts of scale up, represents the missed and unseen opportunities.

Table 1. Characteristics of participants who received IPTp in the community and at health facility.

Characteristic	Intervention group n=273 n (%)	Control group n=361 n (%)
Age years		
15-20	58 (21.2)	73 (20.2)
21-34	140 (51.3)	186 (51.5)
35-49	75 (27.5)	102 (28.3)
Parity		
Primipara	97 (35.5)	118(32.7)
Multipara	176 (64.5)	243(67.3)
Education level		
No formal education	5 (1.8)	9(2.5)
Primary	178 (65.2)	247(68.4)
Secondary	90(33)	105(29.1)
Number ANC Visits		
<4 visits	32 (11.7)	27(7.5)
≥4 Visits	241(88.3)	334(92.5)

Table 2. Coverage of IPTp in the Intervention and Control groups

IPTp uptake	Intervention group n=273 n (%)	Control group n=361 n (%)
Only IPTp1	0 (0)	29(8)
IPTp2	4(1.5)	131(36.3)
IPTp3+	269(98.5)	201(55.7)

Many studies of IPTp uptake have not reported on the impact of Community IPTp (C-IPTp) administration to increase adherence by pregnant women, although some have reported a higher percentage of ANC attendance as a means to increase IPTp uptake.[12]

The objective of this study was to assess the impact of C-IPTp in increasing IPTp3+ coverage compared to using routine ANC visits to increase coverage of IPTp.

Method

This study was conducted between December 2018 and September 2019. Four health centres of Karagwe district were assessed for study eligibility based on three factors: availability of a routine outreach program, trained staff and a reliable supply of SP for at least three months. Two health centres which met eligibility criteria were selected randomly one as a control and another as intervention. The intervention facility cared for women from three villages while the control facility cared for women from four villages in the catchments area. All villages in both control and intervention group have similar geographical characteristics and the distance from each village to the particular health centre is less than five kilometres.

Women who had already received the first dose of SP during a routine ANC visit and gave informed consent were eligible to participate in the study by receiving subsequent doses in the Community during planned outreach visits. Two enrolled or registered nurses visited the villages in planned two days a week an outreach service which was famously known in Kiswahili language as "Huduma za mkoba", SP were administered by DOT. Both facilities were given tablets and all staff were trained on how to collect the data using a designed Excel spreadsheet and on eligibility criteria for administering SP to pregnant women. Demographic data including parity, age and address we rerecorded during the uptake of the first dose of SP at the health facility. In the control area IPTp was given during scheduled routine ANC visits.

Results

Table 1 shows the age, parity, education, ANC visit, parity and distribution of women who received IPTp in the community and at the health facility. These factors were very similar between the groups.

As indicated in Table 2 the IPTp3+ uptake was much higher (98.5%) in the intervention group than in the control group (55.7%).

Discussion

C-IPTp effectively increases the uptake of IPTp3+. The coverage of C-IPTp in this study was higher than the national target of IPTp3+ uptake which is 80%.[9] The effectiveness of C-IPTp in increasing the uptake of IPTp by pregnant women was also reported in the study which was conducted in Malawi where the coverage increased from 41.5% to 82.9%.[13]

Several studies have evaluated the effectiveness of distributing SP by Community Health Workers (CHWs) and revealed the positive outcome of the C-IPTp approach and promoted ANC attendance because more women were receiving the reminder information of their appointments.[13,14,15] In Nigeria the C-IPTp approach that utilized CHWs to encourage pregnant women to attend ANC and IPTp uptake reported the increased number of pregnant women who received two or more doses of SP.[14]

Another qualitative study that was conducted in Uganda to explore ways to improve IPTp uptake demonstrated that pregnant mothers would feel more comfortable when they receive SP and information from their CHWs with whom they have established rapport,[15] also noted that the approach is cost effective and could increase both

IPTp uptake and ANC attendance.[15] The interviewed women in the same study reported that they preferred the community based approach because they do not have to travel to the facility which always requires husbands' permission.[15]

This study did not assess the impact of the C-IPTp approach on other ANC indicators such as ANC attendance which was reported to decrease in a similar study in Southern Malawi [13] where many women, after receiving IPTp in the community, ignored the ANC follow up visit believing that community services replaced the health facility visit. Transportation was another limitation because the nurses from the intervention facility used the motor vehicles hired from the community which are not suitable especially during the rainy season; they also used ambulances which contributed delays if the ambulance was being used to refer a patient.

Conclusion

C-IPTp is an effective approach to increase the uptake of IPTp3+ by pregnant women. It reaches many women living far from health facility or who are disabled and cannot attend monthly appointments.

This study provides government and stakeholders the evidence for the need to review the IPTp policy in order to reach the national target. The C-IPTp can be integrated with other already existing community outreach services such as the Expanded Programme on Immunization (EPI). However, further studies should be conducted to identify factors which influence the effectiveness of C-IPTp compared to routine IPTp.

Competing interests: None.

References

1. Aguzie ION, Ivoke N, Onyishi GC, et al. Antenatal practices ineffective at prevention of Plasmodium falciparum malaria during pregnancy in a sub-Saharan Africa Region, Nigeria. Trop Med Infect Dis. 2017;2:15.
2. Jhpiego. Prevention and Control of Malaria in pregnancy: reference manual. 3rd ed. Baltimore. 2018.
3. United Nations Children's Fund 2004. Low birthweight: country, regional and global estimates.
4. Lawn JE, Blencowe H, Waiswa P, et al. Stillbirths: rates, risk factors, and acceleration towards 2030. Lancet. 2016;387:587–603.
5. Beguy D, Elung'ata P, Mberu B, et al. Health & demographic surveillance system profile: the Nairobi urban health and demographic surveillance system (NUHDSS). Int J Epidemiol. 2015;44:462–71.
6. Guyatt HL, Snow RW. Impact of malaria during pregnancy on low birth weight in sub-Saharan Africa. Clin Microbiol Rev. 2004;17:760–9.
7. World Health Organization 2014. Policy brief for the implementation of intermittent preventive treatment of malaria in pregnancy using sulfadoxine–pyrimethamine (IPTp-SP). Geneva
8. van Eijk AM, Hill J, Larsen DA, et al. Coverage of intermittent preventive treatment and insecticide-treated nets for the control of malaria during pregnancy in sub-Saharan Africa: a synthesis and meta-analysis of national survey data, 2009–11. Lancet Infect Dis. 2013;13:1029–42.
9. Ministry of Health and Social Welfare. National Malaria Strategic Plan 2014–2020. 2014.
10. Ministry of Health CD, Gender, Elderly, Children MoH, National Bureau of Statistics, Office of the Chief Government Statistician, ICF. Tanzania demographic and health survey and malaria indicator survey (TDHS-MIS) 2015–2016. Dar es Salaam, Tanzania, and Rockville, Maryland, USA; 2016.
11. National Bureau of Statistics, MOH. Tanzania malaria indicator survey (TMIS) key indicators. 2017.
12. Nkoka O, Chuang T-W, Chen Y-H. Association between timing and number of antenatal care visits on uptake of intermittent preventive treatment for malaria during pregnancy among Malawian women. Malar J 2018;17:211.
13. Msyamboza KP, Savage EJ, Kazembe PN, et al.Community-based distribution of sulfadoxine–pyrimethamine for intermittent preventive treatment of malaria during pregnancy improved coverage but reduced antenatal attendance in southern Malawi Trop Med Int Health2009;14:183-189
14. Okeibunor JC, Orji BC, Brieger W, et al. Preventing malaria in pregnancy through community-directed interventions: Evidence from Akwa Ibom State, Nigeria. Malaria Journal. 2011;10(1):227-237.
15. Mbonye AK, Bygbjerg I, Magnussen P. Intermittent preventive treatment of malaria in pregnancy: Evaluation of a new delivery approach and the policy implications for malaria control in Uganda. Healthy Policy. 2007;81:228-241.

Prevalence and outcome of malaria among hospitalized children in Al Sabah Children Hospital, South Sudan

Justin Bruno Tongun,[1,2] Amanda Billy Berto Madison,[1,2] Emmanuel Gore Lado,[2] Felix Tuli Nygura,[2] Joseph Daniel Wani Lako[3], Anthony Yosefo Lasuba,[3] Rose Ajak Costa[1] and Kenneth Lado Lino[5]

1. Department of Paediatrics and Child Health, College of Medicine, University of Juba, South Sudan
2. Al Sabah Children Hospital, South Sudan
3. Department of Biotechnology, College of Industrial and Applied Sciences, University of Juba, South Sudan
4. Department of Community Medicine, College of Medicine, University of Juba, South Sudan
5. Department of Biochemistry and Ophthalmology, College of Medicine, University of Juba, South Sudan

Correspondence:
Justin Bruno Tongun
tongunmafi@gmail.com

Submitted: September 2020
Accepted: November 2020
Published: December 2020

Citation:
Tongun et al. Prevalence and outcome of malaria among hospitalized children in Al Sabah Children Hospital, South Sudan. South Sudan Medical Journal 2020; 13(5):178-181

Abstract

Background: Malaria remains a public health concern and the leading cause of mortality in children aged under five years in South Sudan. Understanding the burden of malaria in children may assist in developing a strategy for mitigating and eliminating malaria. This would contribute to attaining the Sustainable Development Goals. We planned to determine the prevalence and outcome of malaria among hospitalized children in Al Sabah Children Hospital, South Sudan.

Methods: We carried out a retrospective analysis of hospitalized children in Al Sabah Children Hospital between January to June 2020. The data for this study were analysed using Stata version 11 to calculate the prevalence and outcome of malaria among these children during the study period.

Results: A total 781 children were recruited, of whom 777 contributed to the analysis (the others were excluded because of missing data). Overall prevalence of malaria was 78% among hospitalized children. Severe malaria alone affected 28%, while 50% had severe malaria in combination with other diseases. The highest death rate was amongst children from Munuki Block (11%, p= 0.001). Severe malaria alone and in combination was the diagnosis for 58% of the children who died. Severe malaria alone contributed to 14% of deaths.

Conclusion: Malaria remains the number one cause of mortality in hospitalized children in this paediatric hospital. It predominantly affects young children, who are also at the highest risk of dying. Measures envisaged to protect children during their first five years of life are likely to have the greatest impact.

Key words: malaria, children, Al Sabah Children Hospital, South Sudan

Introduction

Malaria is a life-threatening and a serious public health problem in South Sudan.[1] It is caused by *Plasmodium* parasites that are transmitted to humans through the bites of infected female Anopheles mosquitoes. There are four parasite species that cause malaria in humans, two of these species *P. falciparum* and *P. vivax* pose the highest risk.[2]

According to the World Malaria Report of 2019, there were 228 million cases of malaria globally. The estimated number of malaria deaths were 405,000 in the same year. The World Health Organization (WHO) report showed that Africa carries a high proportion of the global malaria burden. Overall, there were 93% of malaria cases and 94% of malaria deaths in Africa.[3] In the same year, children aged under five years were the most affected accounting for 67% of all malaria deaths globally.[3] Therefore, reducing the malaria burden would contribute to progress towards achieving the Sustainable Development Goals.[4]

In neighbouring Uganda, malaria accounts for 30–50% of all outpatient consultations and up to 35% of hospital admissions.[5] Another study in 2014 reported the prevalence of placental malaria to be 6% in Tororo Hospital in

Uganda.[6] Children under five years are the most affected.[3] Malaria is identified as a major public health problem due to the major complications such as cerebral malaria, severe anaemia, black water fever, drug resistance, and recurrent infections.[7-9] These are serious complications and treatment is often ineffective but blood transfusion is available for severe anaemia and can be lifesaving.[10]

In South Sudan, mortality among the under five-year old children stands at 105/1,000 live births, with many factors interacting and contributing to the poor health of children and little access to health services.[11] These factors include two-decades of war and the recurrent civil unrest affecting infrastructure, resources allocated for health, illiteracy, knowledge and awareness about health problems including malaria and other poverty related diseases such as TB, HIV/AIDS, and diarrhoeal diseases.

The lack of data on malaria is a knowledge gap that hampers the creation of appropriate policies targeting the disease in South Sudan. This study provides baseline information to assist the health authorities in development of polices that may reduce malaria burden. We aimed to determine the prevalence and outcome of malaria among children admitted to Al Sabah Children Hospital, South Sudan.

Method

Study Design

This was a retrospective cross-sectional study of children aged 0-17 years admitted to Al Sabah Children Hospital between January and June 2020. This hospital is located in Juba, the capital city, located in Central Equatoria State. It is the only functional specialist paediatric hospital in South Sudan. The hospital receives children from all over the country as well as from within Juba. The services offered include, but are not limited to, general outpatient and inpatient medical services, expanded programme of immunization (EPI), management of children with severe acute malnutrition with medical complications, and comprehensive HIV services. The hospital has a capacity of 150 beds. The outpatient department attends to about 300 children and admits about 50 children daily.

Sampling procedure

There were 3952 children admitted between January and June 2020. We selected the months of January, March and May which havea total of 1689 admitted children. We then carried outrandom sampling where 1 in 3 children were recruited for this study, but we also included all children who died in each selected month. This gave a total of 781 children of whom 777 contributed to the analysis (the others were excluded because of missing data). This sample size was calculated using Open Epi (http://www.openepi.com), assuming a prevalence of malaria of 50% for children. We assumed a precision of 5% and 95% confidence intervals.

Table 1. Demographic characteristics of children

Variable	n(%)
Sex	
Male	435(55.9)
Female	342(44.1)
Age	
<1 year	431(55.5)
1 year - <5 years	254(32.7)
5 years - <10 years	61(7.8)
10 years - <18 years	31(4.0)
Residential area	
Juba Block	99(12.7)
Kator Block	193(24.9)
Munuki Block	115(14.8)
Gudele Block	130(16.7)
Outside Juba	132(17.0)
Unknown	109(14.0)
Total	777(100.0)

Because not all survivors in each selected month were selected, we performed a weighted analysis, and the numbers presented below are weighted results.

Study Variables

The outcome variable was the proportion of children admitted with malaria and the independent variables included demographic characteristics such as age, sex and residential area. Pearson's chi-squared tests, corrected for weighting are presented where relevant.

Ethical approval

We obtained ethical approval from the Ethical Review Board of University of Juba.

Results

Table 1 shows that of the 777 children included, 56% were males and 44% were females. The vast majority (88%) were aged under five years. About 25% of the children were residents of Kator Block in Juba. Table 2 shows the distribution of diagnoses and disease outcome by the children's residential areas.

The prevalence of malaria was 78% and28% of the children had severe malaria. Severe malaria with no co-morbidities accounted for 14% of the deaths (Table 3).

Discussion

Our results showed that more than three quarters (78%) of those children admitted had malaria. This agreed with

Table 2. Distribution of diagnosis and disease outcome by children's residential areas

Residential Area	Juba Block	Kator Block	Munuki Block	Gudele Block	Outside Juba	Unknown	Total
	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
Diagnosis							
Malaria*	23(23.6)	65(33.8)	29(25.3)	32(24.5)	40(30.1)	26(23.9)	215(27.7)
M#. & gastroenteritis	14(14.0)	22(11.3)	16(14.0)	22(17.1)	11(8.7)	9(8.4)	94(12.1)
M. & sepsis	15(15.1)	17(8.7)	8(7.3)	13(10.3)	9(6.7)	5(4.6)	67(8.7)
M. & anaemia	10(10.1)	12(6.3)	6(5.0)	3(2.7)	14(10.4)	6(5.6)	51(6.6)
M. & pneumonia	9(9.3)	21(11.1)	13(11.0)	15(11.5)	8(6.4)	13(11.9)	79(10.2)
M. & dehydration	4(3.9)	5(2.6)	5(4.7)	3(2.1)	2(1.2)	3(2.8)	21(2.8)
M. & meningitis	2(2.3)	6(3.2)	3(2.7)	5(3.5)	5(3.5)	1(1.1)	22(2.8)
M. & severe acute malnutrition	0(0.0)	2(0.8)	2(1.7)	1(0.9)	3(2.3)	5(4.6)	13(1.6)
M. & other diseases	2(2.3)	10(5.3)	8(7.3)	6(4.7)	6(4.3)	10(8.8)	42(5.5)
Other diseases	19(19.4)	33(17.0)	24(21.0)	29(22.7)	35(26.4)	31(28.4)	171(22.0)
Outcome							
Alive	95(96.5)	182(94.3)	102(89.0)	124(95.6)	119(90.4)	97(89.5)	720(92.7)
Death	3(3.5)	11(5.7)	13(11.0)	6(4.4)	13(9.6)	11(10.5)	57(7.3)
Total	99(100.0)	193(100.0)	115(100.0)	130(100.0)	132(100.0)	109(100.0)	777(100.0)

*Area-diagnosis p = 0.2452, Area-outcome p = 0.0007 * almost all malaria cases admitted were severe malaria M# Malaria*

findings from a hospital in Mozambique where more than half of those admitted had malaria.[12] However, our finding is higher than that recorded in Uganda.[13] We also found that severe malaria alone without co-morbidities accounted for more than a quarter of the admitted children. This agrees with that of a recent study in a hospital in Yaoundé in Cameroon.[14]

In comparison with other residential areas, Kator block had the highest number of children admitted with malaria. However, this block had better clinical outcomes perhaps explained by being near to the hospital and hence had faster access to care. On the other hand, Munuki block and areas outside Juba recorded a higher mortality which is likely to be due to delayed treatment because of lack of transport.

Nearly two thirds of children who died in hospital were admitted with malaria. This agrees with findings from hospitalized children in Northern Zambia. In addition, mortality was high among children aged under five years - an experience similar to that in Uganda.[13]

Conclusion

Malaria remains the number one cause of admission and mortality in hospitalized children in this paediatric hospital in South Sudan. It predominantly affects young children who are at a high risk of dying. Measures envisaged to protect children from malaria during their first five years of life are likely to have a significant impact on child deaths.

We recommend that the Ministry of Health should increase public health preventive measures against malaria particularly in areas closer to the River Nile and expand health facility networks in order to facilitate access for children seeking health care.

Limitations

This study is limited by being a hospital-based study so does not represent the general population. The selected months are mostly in the dry season of the year and may be different in terms of disease burden from that in July to December which is the rainy season. It is also probable that the large number of children with unknown addresses may have distorted the analysis.

Acknowledgement. We thank Manal Juma, a statistician, for extracting the data from the hospital records.

Table 3. Distribution of ages and diagnosis against disease outcome

Variables	Outcome		
	Alive	**Death**	**Total**
	n(%)	n(%)	n(%)
Age			
<1 year	392(90.9)	39(9.1)	431(100.0)
1 year - <5 years	242(95.3)	12(4.7)	254(100.0)
5 years - <10 years	57(94.3)	3(5.7)	61(100.0)
10 years - <18 years	29(92.6)	2(7.4)	31(100.0)
Diagnosis			
Malaria	208(96.4)	8(3.6)	215(100.0)
M#. & gastroenteritis	91(96.0)	4(4.0)	94(100.0)
M. & sepsis	63(93.8)	4(6.3)	67(100.0)
M. & anaemia	46(89.6)	5(10.4)	51(100.0)
M. & pneumonia	76(95.2)	4(4.8)	79(100.0)
M. & dehydration	18(85.7)	3(14.3)	21(100.0)
M. & meningitis	21(94.7)	1(5.3)	22(100.0)
M. & severe acute malnutrition	10(81.8)	2(18.2)	13(100.0)
M. & other diseases	41(97.3)	1(2.7)	42(100.0)
Other diseases	147(85.7)	24(14.3)	171(100.0)
Total	720(92.7)	57(7.3)	777(100.0)

Outcome-age p = 0.0096, Outcome-diagnosis p < 0.0001, M# Malaria

References

1. Eyobo MB, Awur AC, Wani G, Julla AI, Remijo CD, Sebit B, et al. Malaria indicator survey 2009, South Sudan: baseline results at household level. Malaria Journal. 2014;13:45.
2. Milner DA, Jr. Malaria Pathogenesis. Cold Spring Harbor Perspectives in Medicine. 2018;8(1).
3. World Health Organization. World malaria report 2019 [cited 2020 July 31]. https://www.who.int/publications/i/item/world-malaria-report-2019.
4. United Nations. Sustainable development goals. New York: United Nations; 2015 [cited 2019 May 2]. Available from: http://www.un.org/sustainabledevelopment/summit/.
5. Ndyomugyenyi R, Magnussen P. Trends in malaria-attributable morbidity and mortality among young children admitted to Ugandan hospitals, for the period 1990-2001. Annals of Tropical Medicine and Parasitology. 2004;98(4):315-27.
6. Hangi M, Achan J, Saruti A, Quinlan J, Idro R. Congenital Malaria in Newborns Presented at Tororo General Hospital in Uganda: A Cross-Sectional Study. The American Journal of Tropical Medicine and Hygiene. 2019;100(5):1158-63.
7. Boyce R, Reyes R, Keeler C, Matte M, Ntaro M, Mulogo E, et al. Anemia was an Uncommon Complication of Severe Malaria in a High-Transmission Rural Area of Western Uganda. The American Journal of Tropical Medicine and Hygiene 2018;98(3):683-91.
8. Dayananda KK, Achur RN, Gowda DC. Epidemiology, drug resistance, and pathophysiology of Plasmodium vivax malaria. Journal of Vector Borne Diseases. 2018;55(1):1-8.
9. White NJ. Anaemia and malaria. Malaria Journal. 2018;17(1):371.
10. Burke M, Heft-Neal S, Bendavid E. Sources of variation in under-5 mortality across sub-Saharan Africa: a spatial analysis. The Lancet Global health. 2016;4(12):e936-e45.
11. Mugo NS, Agho KE, Zwi AB, Damundu EY, Dibley MJ. Determinants of neonatal, infant and under-five mortality in a war-affected country: analysis of the 2010 Household Health Survey in South Sudan. BMJ global health. 2018;3(1):e000510.
12. Quique B, Caterina G, Betuel S, Pedro A, Jahit S, Tacilta N, Azucena B, Ariel N, Eusébio M, Inácio M, John JA, Clara M, Pedro LA. Malaria in rural Mozambique. Part II: children admitted to hospitalMalar J. 2008; 7: 37.doi: 10.1186/1475-2875-7-37
13. Arthur M, Richard W, James K, Asadu S, Jane FN, Yasin K, Abner T, Jane FN, Damain R, Sarah GS, Grant D, Jimmy O, Alice K, Robert WS. The agespecific incidence of hospitalized paediatric malaria in Uganda. BMC Infect Dis. 2020; 20: 503. Published online 2020 Jul 13. doi: 10.1186/s12879-020-05215-z.
14. Chiabi A, Amandine D, Nguefack S, Evelyn M, Félicité ND, Fru FA.Severe malaria in Cameroon-pattern of disease in children at Younde Gynaeco-Obstetric and Paediatric hospital. J Infect Public Health. 2020.doi.org/10.1016/j.jiph.2020.02.038

Factors associated with non-adherence to standard diagnosis and treatment guideline in the management of malaria in pregnancy

Alen Kinyina,[1] Glorialoveness Lyimo,[2] and Sarah Chamos[3]

1. Senior Technical officer, Jhpiego Tanzania
2. Lecturer, College of Health Science, University of Dodoma,Tanzania
3. Medical Doctor, Sekou Toure Regional Referral hospital, Mwanza Tanzania.

Correspondence:
Alen Kinyina
alenkinyina@gmail.com

Submitted: May 2020
Accepted: November 2020
Published: December 2020

Abstract

Background: Non adherence to National Malaria Diagnosis and Treatment Guideline (NMTG) in the treatment of malaria in pregnancy contribute to the increase of poor maternal health and birth outcome effects related to malaria infections.

Objective: To determine the contributing factors for non-adherence to NMTG among the health care workers (HCWs) in public dispensaries and health centres in Kilimanjaro region.

Method: A cross sectional study in which the health care workers attending pregnant women were interviewed; 179 participants from 60 dispensaries and 16 health centres were interviewed between February and April 2018. Data management and analysis were performed using Statistical Package for Social Sciences (SPSS) version 20 for Window (SPSS Inc., Chicago, IL, USA).

Results: In this study 37.4% of the participants were not adhering to NMTG during the management of malaria cases in pregnancy. After controlling for potential confounders, factors which were associated with non-adherence to NMTG were; client overload (AOR=3.025; 95%CI 1.136-7.162; p-value=0.009) and inadequate supply of Rapid diagnostic tests (RDTs) (AOR=3.15; 95% CI 1.14-9.559; p=0.000).

Conclusion: Factors which are associated with non adherence to standard malaria diagnosis and treatment guideline are inadequate supply of diagnostic tests and clients overload in the public health facilities.

Key words: Malaria, Guideline, Non-adherence, pregnancy

Introduction

Poor adherence to standard malaria diagnosis and treatment guidelines has resulted to the spread of antimalarial drug resistance.[1] This exposes more pregnant women to malaria, which increases the risk of poor health outcomes for mothers and infants.[2] Placental parasitaemia can cause maternal anaemia and low birth weight, both of which are risk factors for neonatal mortality.[3] In areas of Africa where malaria is endemic, the World Health Organization (WHO) recommends three approaches to malaria prevention and control: - uptake of Intermittent Preventive treatment in Pregnancy (IPTp), - sleeping under an insecticide-treated bed net (ITN), - effective clinical diagnosis and treatment of malaria.[4]

However, in many countries more emphasis has been put on increasing the IPTp uptake as a means of preventing malaria in pregnancy,[4] while other strategies like effective diagnosis and treatment are running slowly.[5]

In sub-Saharan Africa, reports indicate different levels of adherence to malaria diagnosis and treatment guidelines.[6] Effective malaria case management is a key strategy of malaria control and elimination.[6] Accurate clinical assessment,

Citation:
Kinyina et al. Factors associated with non-adherence to standard diagnosis and treatment guideline in the management of malaria in pregnancy. South Sudan Medical Journal 2020; 13(5):182-186

confirming the disease by light microscopy or the malaria rapid diagnostic test by testing blood samples must be done in all suspected malaria cases before treatment.[7] Tanzania introduced the National Standard diagnosis and treatment guidelines for malaria in 2006 and revised these in 2014.[8] However, in some parts of Tanzania, clinical diagnosis of fever is widely used by healthcare providers to diagnose malaria.[5,8] In Tanzania there are few studies on adherence to malaria diagnosis and treatment guidelines among health care workers (HCWs).[9]

Therefore, this study was designed to determine factors associated with non-adherence by HCWs to standard diagnosis and treatment guidelines in treatment of malaria in pregnancy.

Method

This was a descriptive cross-sectional study, involving HCWs (nurses which included midwives and clinical officers) who are attending pregnant women at public health centres and dispensaries in the Kilimanjaro region, Tanzania. It was conducted from February to May 2018. A structured questionnaire was used to interview 179 participants from 60 dispensaries and 16 health centres. These facilities were sampled based on the criteria of being public health facilities, attended by pregnant women, and with a laboratory available for diagnosing malaria with Rapid Diagnostic Tests (RDT) or microscopy. Referral hospitals were not included. The identification of facilities with these criteria were tracked via the District Health Information System (DHIS). The participants were all HCWs who are attending pregnant women, are involved in the management of malaria in pregnancy, and who were on duty on the date of interview.

Adherence to National Malaria Diagnosis and Treatment Guideline (NMTG) meant doing the malaria RDT or a blood smear. If the result is positive, only recommended anti-malarial drugs are prescribed; if the result is negative no anti-malarial drug is given.[6]

Non-adherence to NMTG is when a client is suspected of malaria and a RDT or a blood smear is not done; or the result for the test is negative but she is still given an anti-malarial drug; or the result of the test is positive but no anti-malarial drugs are given or an incorrect anti-malarial or incorrect dose is prescribed.[6]

Data management and analysis were performed using Statistical Package for Social Sciences (SPSS) version 20 for Window (SPSS Inc., Chicago, IL, USA). Descriptive analysis was done by using frequencies and percentages. Odds Ratios with corresponding 95% Confidence intervals (CI) are presented and a p value of less or equal to 0.05 was considered statistically significant. Multivariate logistic regression analysis was used to examine independent factors associated with non-adherence.

Table 1. Demographic characteristics of 179 HCWs

Variables	n(%)
Age	
<25	43(24)
26-35	72(40.2)
>35	64(35.8)
Cadre	
Enrolled nurse*	87(48.6)
Nurse officer*	63(35.2)
Clinical officer	29(16.2)
Work place	
Health centre	67 (37.4)
Dispensary	112(62.6)
Work experience	
<2 years	36(20.1)
2-5 years	54(30.2)
>5 years	89(49.7)
Received on job training on use of NMTG	
Yes	59(33)
No	120(67)

** In Tanzania there is no differentiation between nurses and midwives*

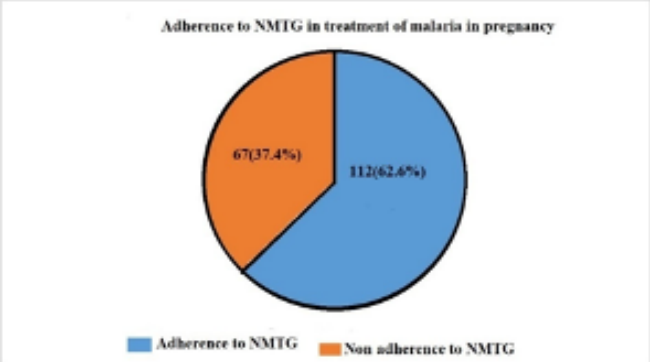


Figure 1. Adherence and non-adherence to NMTG

Results

One third 72 (40.2%) of the participants were aged 26-35 years. Almost half were enrolled nurses 87(48.6%); 112 (62.6%) were working in a dispensary; 89 (49.7%) had work experience of more than five years and 120 (67%) had no on-job training on NMTG (Table 1).

Figure 1 shows that 112 (62.6%) of participants were adhering to NMTG while 67 (37.4%) were not.

Various factors were significantly associated with non-

Table 2. Factors associated with non-adherence to NMTG in treatment of malaria in pregnancy n= 67 (37.4%)

Variables	n (%)	Chi-square	P value
Age			
<25 years	10(14.9)	5.321	0.069
26-35 years	32(47.8)		
>35 years	25(37.3)		
Cadre			
Enrolled nurse	38(56.7)	3.523	0.172
Nurse officer	20(29.9)		
Clinical officer	9(13.4)		
Work experience			
<2 years	14(20.9)	10.307	0.005
2-5 years	23(34.3)		
>5 years	30(44.8)		
Received on job training on use of NMTG			
Yes	11(16.4)	1.226	0.186
No	56(83.6)		
Clients overload			
Yes	45(67.2)	14.748	0.000
No	22(32.8)		
Inadequate supply of Diagnostic test (RDTs)			
Yes	41(61.2)	9.049	0.003
No	26(38.8)		
Inadequate supply of malaria drugs (ACT)			
Yes	36(53.7)	11.031	0.000
No	31(46.3)		

adherence to NMTG in the treatment of malaria in pregnancy. They included client overload per health worker ($\chi2=14.748$, p=0.000), inadequate supply of diagnostic tools ($\chi2=9.049$, p=0.003), inadequate supply of malaria drugs (ACT) ($\chi2=11.031$, p=0.000), and experience of more than 5 years ($\chi2=10.307$, p=0.005) (Table 2).

After controlling for potential confounders, factors which were associated with non-adherence to NMTG included client overload (AOR=3.025; 95%CI 1.136-7.162; p=0.009) and inadequate supply of RDTs (AOR=3.15; 95% CI 1.14-9.559; p=0.000).

Discussion

In this study 37.4% of participants were not adhering to NMTG during the treatment of malaria in pregnancy; the various factors associated with this prevalence are client overload and an inadequate supply of RDT. Due to patient overload the HCWs use only clinical assessments to confirm malaria and prescribe anti-malarial drugs without a blood test. This finding is similar to that of the study in the Kamuli district of Uganda to determine the factors affecting adherence to national malaria treatment guidelines among public healthcare workers. This study found that the health practitioners always confirm malaria without performing malaria diagnostic test by RDTs or blood smear when patients present with fever.[6] The same study noted that the provision of malaria RDTs could play a great role in reducing the persistent problem of malaria misdiagnosis and reduced risk of malaria under-treatment.[6]

Inadequate supplies of RDTs are due to budget constraints in most of the health centres and dispensaries; this finding is also similar to that of a study in the Kibaha district of Tanzania where stock-outs of RDTs and staff shortages accounted for the low testing rate of patients.[9] The lack

Table 3. Multivariate logistic regression table on factors associated with non-adherence to NMTG

Variable	Non adherence n(%)	AOR	95%CI	P value
Clients overload				
Yes	45(67.2)	3.025	1.136-7.162	0.009
No	22(32.8)	1		
Work experience				
<2 years	14(20.9)	1		
2-5 years	23(34.3)	0.451	0.054-4.629	0.472
>5 years	30(44.8)	0.086	0.020-0.910	0.387
Inadequate supply of diagnostic tests (RDTs)				
Yes	41(61.2)	3.15	2.14-9.559	0.000
No	26(38.8)	1		
Inadequate supply of malaria treatment drugs (ACT)				
Yes	36(53.7)	3.073	0.149-8.275	0.315
No	31(46.3)	1.197	1.075-1.518	0.117

of association of other factors such as age of HCWs, work experience, lack of on-job training and level of education is consistent with other studies on this subject.[6,10] However, it is contrary to the study which was done to explore malaria diagnosis and treatment practices following introduction of rapid diagnostic tests in Kibaha District, Coast Region, Tanzania. This noted work experience and on-job training influences the adherence to NMTG.[9]

Work experience and receiving on-job training in this study are not associated with non-adherence to NMTG. The reason may be due to the fact that many HCWs were trained in the use of NMTG at college. At least 55% of HCWs have work experience of under five years, which indicates that they completed their college studies after the introduction of NMTG which was last updated in 2014.[8] Conversely, the on-job training may have been of inadequate quality in terms of practice; also, there may have been too few trained HCWs to show a difference in impact.

This finding, however, concurs with that of a Ugandan study which found that HCWs who had been providing services for a shorter period were more likely to conform to the malaria treatment policy than those who had been providing services for longer period.[11] Similarly, in a study that was conducted in Kenya on health worker performance demonstrated that in-job training alone is not enough to improve performance in the prescribing of drugs; the study recommended supervision and post-training follow-up to improve clinical practice.[12]

Conclusion

Generally, 37.5% of HCWs are not adhering to NMTG in the management of malaria in pregnancy. The factors associated with non-adherence to NMTG are client overload and inadequate supplies of RDTs in the health facilities.

We recommend that the government and stakeholders note that emphasizing only IPTp uptake during pregnancy cannot eliminate the poor birth outcomes related to malaria infections; elimination of malaria strategies should also put emphasis on adherence to standard malaria diagnosis and treatment guidelines as one of the key components of malaria prevention and control strategies. Increasing fund allocation to the dispensaries and health centres to employ staff and procure RDTs is also recommended.

References

1. World Health Organization 2018. Artemisinin resistance and artemisinin-based combination therapy efficacy status report.
2. United States Agency for International Development. Preventing malaria during pregnancy in sub-Saharan Africa: Determinants of effective IPTp delivery. September 2013.
3. Omer SA, Idress HE, Adam I et al. Placental malaria and its effect on pregnancy outcomes in Sudanese women from Blue Nile State. Malar J 2017;16:374.
4. World Health Organization. Implementing Malaria in Pregnancy Programs in the Context of World Health Organization Recommendations on Antenatal Care for a Positive Pregnancy Experience. 2018.

5. Budimu A, Emidi B, Mkumbaye S et al. Adherence, awareness, access, and use of standard diagnosis and treatment guideline for malaria case management among healthcare workers in Meatu, Tanzania. Journal of Tropical Medicine February 2020. DOI: 10.1155/2020/1918583

6. Bawate1 C, Carter STC, Nsajju B, Bwayo D. Factors affecting adherence to national malaria treatment guidelines in management of malaria among public healthcare workers in Kamuli District, Uganda. Malar J 2016;15:112

7. World Health Organization. Guidelines for the treatment of malaria, Geneva, Switzerland, 3rd edition, 2015.

8. Ministry of Health and Social Welfare (MoHSW). National guideline for diagnosis and treatment of malaria, Tanzania, 2014.

9. Mubi M, Kakoko D, Ngasala B et al. Malaria diagnosis and treatment practices following introduction of rapid diagnostic tests in Kibaha District, Coast Region, Tanzania. Malaria Journal 2013;2:1–8

10. Selemani M, Masanja MI, Kajungu D, et al. Health worker factors associated with prescribing of artemisinin combination therapy for uncomplicated malaria in rural Tanzania. Malar J 2013;12:334.

11. Ucakacon PS, Achan J, Kutyabami P, Odoi AR, Kalyango NJ: Prescribing practices for malaria in a rural Ugandan hospital: evaluation of a new malaria treatment policy. Afric Health Science Journal 2011;11(S1):S53–S59.

12. Wasunna B, Zurovac D, Bruce J, Jones C, Webster J, Snow RW. Health worker performance in the management of paediatric fevers following in-service training and exposure to job aids in Kenya. Malar J 2010; 9:261

Malaria Resources

COVID-19 threatens global progress against malaria, warns UN health agency

UN News 30 November 2020 https://news.un.org/en/story/2020/11/1078752

Gaps in life-saving interventions are undermining efforts to curb malaria, amid fears that the coronavirus pandemic could set back the fight against the disease even further, the UN World Health Organization (WHO) has said.

According to the World Malaria Report the situation is particularly concerning in high-burden countries in Africa. As in past years, the African region accounted for more than 90 per cent of the overall disease burden. The region has made much progress since 2000, reducing its malaria death toll by 44 per cent – from an estimated 680,000 to 384,000 – but the pace has slowed in recent years, particularly in countries with a high disease burden. A funding shortfall at both the international and domestic levels poses a "significant threat" to future gains.,

In 2020, the COVID-19 pandemic emerged as an additional challenge for essential health services worldwide. Though most malaria prevention campaigns were able to move forward without major delays, WHO voiced concerns that even "moderate disruptions" in access to treatment could lead to a considerable loss of life.

Matshidiso Moeti, WHO Regional Director for Africa, underlined the need to ensure that malaria programmes are sustained and expanded. "COVID-19 threatens to further derail our efforts to overcome malaria, particularly treating people with the disease. Despite the devastating impact COVID-19 has had on African economies, international partners and countries need to do more to ensure that the resources are there to expand malaria programmes which are making such a difference in people's lives," she said.

Malaria Prevention Strategies in South Sudan

Harriet Akello Pasquale
Director,
National Malaria Control Program
National Ministry of Health
Republic of South Sudan

Correspondence:
Harriet Akello Pasquale
harrietpasquale@gmail.com

Submitted: November 2020
Accepted: December 2020
Published: December 2020

Abstract

The whole of South Sudan is endemic for malaria, with high transmission in the country throughout the year. Malaria is the leading cause of illness and death in children under five years. In 2019, the malaria incidence (all ages) was estimated at 246 per 1,000 populations (239 per 1,000 for children under-five -years) representing 5,067,464 cases.

Vector control is a key intervention for malaria prevention with Insecticide Treated Nets (ITN) being the main method used by the population. Chemoprevention for malaria for pregnant women is mainly administered through ante-natal clinics. Seasonal malaria chemoprevention is a new strategy that South Sudan has just piloted in Yambio.

By 2014-2019, 6,397,512 ITNs had been distributed. However, the 2017 Malaria Indicator Survey showed that only about 41.7% of children aged under five years had slept under an ITN the previous night, and that only 27% of households owned at least one ITN for every two people. There has been increases in the percentage of pregnant mothers receiving 2 doses of Intermittent Preventive Treatment in Pregnancy (IPTp2).

It is recommended that the Ministry of Health train entomologists and technicians for vector surveillance, and that the National Malaria Programme conduct entomological surveillance and insecticide resistance monitoring and create stratification maps using entomological data.

Key words: malaria prevention, South Sudan, Insecticide Treated Net (ITN), vector control, Intermittent Preventive Treatment in Pregnancy (IPTp).

Introduction

The whole of South Sudan is endemic for malaria, with high transmission in the country throughout the year. Malaria accounts for about 66.8% of all health facility visits in the outpatient departments 30% of all hospital admissions and 50% of all cause of deaths in the hospitals. Malaria is the leading cause of illness and death in children under five years.[1] Malaria transmission is all year-round, peaking at the end of the annual rainy season from June to November. Transmission is higher in the southern parts of the country compared with the northern parts.[2]

In 2019, the malaria incidence (all ages) was estimated at 246 per 1,000 populations (239 per 1,000 for children under-five -years) representing 5,067,464 cases. This was significant increase (43%) from 2013 when incidence stood at 171 per 1,000 populations.[4] Over this same period, malaria mortality (all ages) increased marginally from 45 per 100,000 to 49 per 100,000 population - Health Management Information Systems (HMIS) reports.[3]

Vector control is a key intervention for malaria prevention in South Sudan. Long lasting insecticidal nets (ITNs) are the main method used by the population. Indoor residual spraying and larval source management including larviciding are used on a limited scale mainly in refugee camps and camps hosting internally displaced persons. In addition, South Sudan also implements malaria

Citation:
Pasquale. Malaria Prevention Strategies in South Sudan. South Sudan Medical Journal 2020; 13(5):187-190

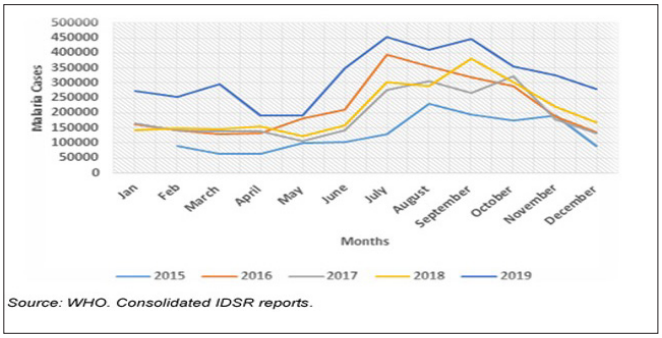


Figure 1. South Sudan Trends of malaria transmission (HMIS report 2015-2019 [2,4])

chemoprevention for special vulnerable populations such as pregnant mothers and children under five years of age.

ITNs are distributed through mass campaigns conducted every three years. The mass campaigns target all households in the whole country. To complement the mass campaigns and ensure that they are always available in the community, ITNs are also distributed through other continuous distribution channels. These include through the Expanded Programme of Immunization (EPI) at the time a child receives her third dose of pentavalent vaccine, through a woman's first visit to the ante-natal clinic (ANC) and through emergency distribution whenever there is displacement of populations.

Chemoprevention for malaria (Intermittent Preventive Treatment in Pregnancy - IPTp) in pregnant women is mainly administered through ANCs. All pregnant women (except those allergic to sulpha components, or on cotimoxazole for HIV IO prophylaxis) are given at least 3 doses of Sulphadoxine Pyremethamine starting from the second trimester.

Seasonal malaria chemoprevention (SMC) is a new strategy that South Sudan has just piloted in Western Equatoria state in Yambio[5]). SMC targets children aged 3 to 59 months who receive a complete treatment of antimalarial drug on a monthly basis for 4 to 5 months during the peak malaria transmission using a combination of Sulphadoxine Pyremethamine and Amodiaquine. SMC is now included in our malaria prevention strategy in the new National Malaria Strategic Plan 2020 – 2025 - see Editorial and figure 4.

Early access to a prompt and effective malaria diagnosis and treatment within 24 hours of onset of treatment can interrupt malaria transmission. Malaria Case management is also a core malaria intervention in South Sudan. Malaria Parasitological diagnosis is mainly done using rapid diagnostic test at all health case levels. Microscopy is used mainly in major hospitals and Primary Health care centres. However, 50% of cases are still clinically diagnosed. Malaria RDT testing is rolled out at the community level to improve patient care by community health workers. Malaria is treated using an artemisinin combination treatment. The first line treatment for malaria in South Sudan is Artesunate Amodiaquine, Dehydroartesunate piperaquine is an alternative treatment used mainly in private health facilities. Arthemether Lumefantrine is the second line treatment for malaria. Severe malaria is mainly treated with artesunate injection for during the critical stage of illness and as soon as the patient recovers, the treatment is completed with a full cause of Artesunate amodiaqune or Arthemether lumefantrine. Other drugs used for treating severe malaria are Quinine and Arthemether injections.[6]

Despite the universal coverage in ITNs and usage of Indoor Residual Spraying (IRS) in targeted areas of South Sudan, the scale up of malaria diagnosis and treatment, current evidences show that these core interventions have not had significant impact to interrupt malaria transmission. Malaria incidence continue to rise from 171 per 1000 population in 2013 to 251 per 1000 population in 2019. [2,4] The number of recorded malaria deaths also increased from 1,321 deaths in 2013 to 4,873 in deaths in 2019. This has called for a need of exploring other innovative interventions to complement the core intervention. The new malaria strategic plan is an opportunity to do things differently.

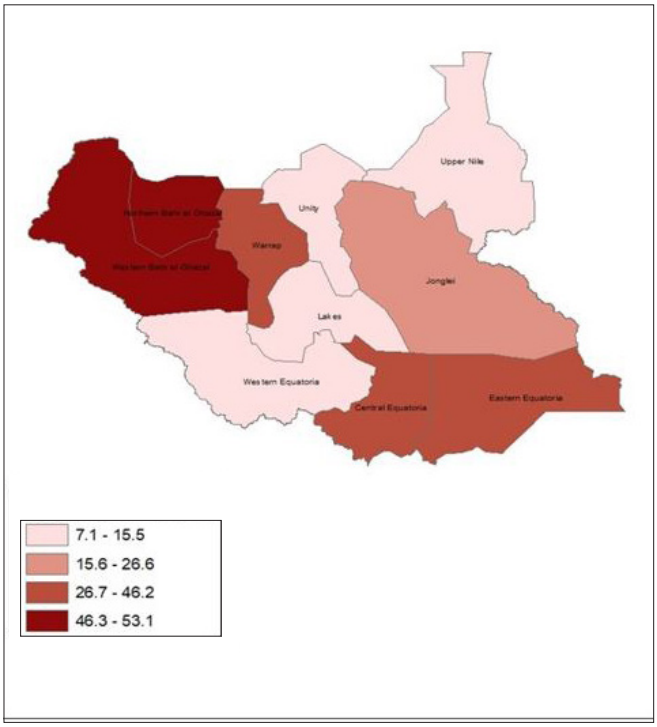


Figure 2. South Sudan Malaria Epi map 2017 from Malaria Indicator Survey prevalence data

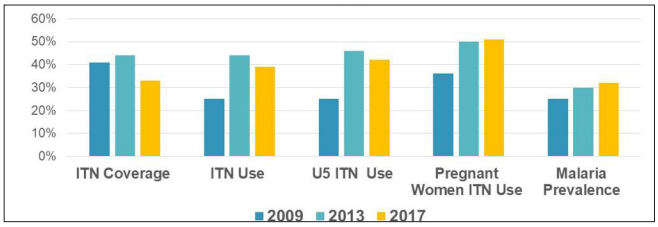


Figure 3. Malaria Intervention coverage [2,4]

Main Achievements

By 2014-2019, 6,397,512 ITNs had been distributed. The Malaria Strategic Plan (MSP) of 2014/15-2020/21 (revised in 2017) targeted 85% of under-five-year-old children to sleep under a net, and 95% ownership of at least one net per household.[7] However, the 2017 Malaria Indicator Survey (MIS),[2] showed that only about 41.7% of children aged under five years had slept under an ITN the previous night, that only 27% of households owned at least one ITN for every two people. There were no gains in ITN coverage as the percentage of pregnant women who slept under an ITN the previous night stayed flat at 50% and 51% in 2013 and 2017 respectively.[2, 4]

The MSP targeted 5% of the population on to be protected by IRS in the past 12 months, but the MIS 2017 did not capture any IRS indicator to assess progress of implementation. However, the Mentor Initiative has conducted IRS in a few selected areas in PoCs (Protection of Civilians) in Bentiu and Malakal and refugee camps in Maban and Jamjang and in the host communities of Bunj and Maban. The insecticide used currently is Actellic.

There was an increase from 25.8% in 2013 to 56.6% 2017[2,4] in the percentage of pregnant mothers receiving two doses of Intermittent Preventive Treatment in Pregnancy (IPT2) and ITN distribution through routine ANC.

There was an increase in the uptake of IPTp3+ (IPTp3 or more doses) among pregnant women during the implementation period: A total of 2,740,000 doses were distributed between 2014 to 2019 through the focused antenatal care as part of the IPTp package for malaria prevention during pregnancy. There was close collaboration between the National Malaria Control Programme (NMCP) and the Reproductive and Maternal Health services to ensure optimum uptake of IPTp3+. Midwives from the public sector were trained to promote and provide IPTp3+ services.

The policy guidelines for the implementation of the malaria vector control guidelines were developed. Annual assessments, mapping and larviciding of breeding sites during the dry season in PoCs (Malakal and Bentiu) and refugee camps (Maban) were done by trained community workers through a collaborating partner.

Challenges and recommendations

Challenges include:

- Measurement of entomological impact indicators was not planned during the 2014-2020 malaria strategic plan. Entomological surveillance and insecticide resistance monitoring were planned but not implemented. As such it is not possible to adequately assess the impact of the vector control interventions implemented in South Sudan
- Limited capacity (human and infrastructure) for entomological impact assessments. A few entomology technicians have been trained but they are not adequately resourced to conduct simple entomological surveillance.

It is recommended that:

- The Ministry of Health engage and/or train

Figure 4. Launch ceremony for the new National Malaria Strategic Plan 2021 - 2025 at the Ministry of Health (Source: WHO South Sudan)

entomologists and technicians for sentinel sites or county level to facilitate vector surveillance, and the monitoring and evaluation of vector control activities in a timely manner.

- The National Malaria Programme should conduct entomological surveillance and insecticide resistance monitoring and create stratification maps using entomological data.
- The Ministry of health should explore scale up implementation of other vector control intervention such as IRS, larviciding and environmental management among others to prevent the spread of insecticide resistance from the widely used pyrethroid treated ITNs especially in areas where no impact has been documented with ITN alone

References

1. Integrated Disease Surveillance and response (IDSR) and DHIS-2 data 2019
2. South Sudan Malaria Indicator Survey 2017.
3. Health Management Information Systems (HMIS) reports - 2015-2019
4. National Malaria Control Programme. Malaria Indicator Survey 2013
5. Médecins Sans Frontières Operational Centre Brussels. Seasonal Malaria Chemoprevention study Draft report
6. South Sudan malaria case management Guidelines and training manual Republic of Sudan Federal Ministry of Health Directorate of Preventive Health Services. Malaria Case Management Training Manual, Part I Learner's Guide; Part II Tutor's Guide. New Version
7. Ministry of Health, Republic of South Sudan, South Sudan Malaria Control Strategic Plan 2014/16- 2021/22. Ministry of Health, Republic of South Sudan, Health Sector Development Plan 2012-2016.

Malaria Resources

Preventive malaria treatment among school-aged children in sub-Saharan Africa: a systematic review and meta-analyses

Cohee et al. Lancet October 2020 DOI: https://doi.org/10.1016/S2214-109X(20)30325-9

The burden of malaria infection in sub-Saharan Africa among school-aged children aged 5–15 years is underappreciated and represents an important source of human-to-mosquito transmission of Plasmodium falciparum. Additional interventions are needed to control and eliminate malaria. We aimed to assess whether preventive treatment of malaria might be an effective means of reducing P falciparum infection and anaemia in school-aged children and lowering parasite transmission.

Preventive treatment of malaria among school-aged children significantly decreases P falciparum prevalence, anaemia, and risk of subsequent clinical malaria across transmission settings. Policy makers and programme managers should consider preventive treatment of malaria to protect this age group and advance the goal of malaria elimination, while weighing these benefits against potential risks of chemoprevention.

Back to school for malaria prevention: a new tool in the era of malaria elimination?

Eijk and Hill Lancet October 2020 DOI: https://doi.org/10.1016/S2214-109X(20)30347-8

Children aged 5–15 years predominantly have the highest risk of asymptomatic malaria and gametocytaemia, and yet low use of long-lasting insecticide treated nets, which puts them at risk. …

Currently, there is no WHO recommendation for malaria prevention among school children in sub-Saharan Africa. The systematic review by Lauren Cohee and colleagues offers the first comprehensive review and meta-analyses of the effects of different prevention strategies on outcomes in school children.

The results deserve review by policy makers to identify what further evidence is needed before recommending school-based malaria programmes, and discussion with national programmes on how school-based strategies might be funded and implemented. Importantly, malaria preventive strategies in schools will have health and educational benefits for children and can also contribute to reductions in community transmission. That is a goal worth fighting for.

Artemisinin-resistant malaria and a prevention strategy

Francis M Malwal
University of Juba, College of Medicine, Department of Pharmacology

Correspondence:
Francis M Malwal
francismalwal@gmail.com

Submitted: October 2020
Accepted: October 2020
Published: December 2020

Abstract

Malaria is a widely spread infectious disease and claims many lives annually in the African region. Therefore, prevention and effective therapy are significantly crucial for the successful reduction of malaria morbidity and mortality. However, recently emerging artemisinin-resistant parasites in Southeast Asia, South America, and Rwanda have raised concern globally. Studies have established that artemisinin-resistant is associated with a mutation in the Kelch13 (K13) propeller domain of malaria parasites. This mutation delays malaria parasite clearance from the bloodstream to more than three days following ACT's therapy.

The objective of this paper is to alert authorities and researchers to the upcoming threat of artemisinin-resistant and recommend prevention strategies. Health authorities need to invest more in malaria prevention, enforcing existing laws, monitoring emerging resistance, and its impacts. Moreover, healthcare professionals can play a vital role by adhering to malaria treatment guidelines, avoiding monotherapy, and promoting antimalarial adherence

Keywords: Artemisinin, resistant, malaria, prevention, strategy

Introduction

Globally, malaria is the most widely spread infectious disease, with 228 million cases and an estimated 405,000 deaths in 2018. Unfortunately, the African region carries a disproportionately high share of the malaria burden.[1] For instance, in 2018, almost 93% of malaria cases and 94% of deaths were from the African region. *Plasmodium falciparum* is responsible for 99.7% of malaria cases in Africa making this region the most affected in the world.[1]

The campaign of the World Health Organization (WHO) to eradicate malaria began in the 1950s. Despite this effort, drug-resistant parasites developed and resulted in the failure of response to chloroquine in endemic areas. The development of chloroquine-resistance prompted the WHO to introduce an artemisinin-based combination therapy (ACTs).[2]

Currently, the ACTs are recommended by the WHO as the first and second-line therapy of uncomplicated P. falciparum malaria and chloroquine-resistant *P. vivax* malaria.[1]

However, recently emerging parasite resistance to artemisinin in Southeast Asian countries and Rwanda has raised concerns globally since there is no alternative drug to replace ACTs if they become ineffective.[3, 4]

This review article focuses mainly on artemisinin resistance because of its significant role in the treatment of P. falciparum malaria and what should be done to slow down artemisinin resistance.

Artemisinin-based Combination Therapy (ACTs)

ACTs combine an artemisinin derivative with a partner drug (companion drugs). The artemisinin derivatives include dihydroartemisinin, artesunate, and artemether: partner drugs include lumefantrine, mefloquine, amodiaquine, sulfadoxine/pyrimethamine, piperaquine, and chlorproguanil/dapsone.[5]

Citation:
Malwal. Artemisinin-resistant malaria and a prevention strategy. South Sudan Medical Journal 2020; 13(5):191-192

The ACTs have dual actions (immediate and long) against malaria parasites. While the fast-acting artemisinin derivative clears the parasites from the bloodstream within three days of ACT's therapy, the long-acting partner drug clears the remaining parasites. This synergism has made ACTs the most efficacious antimalarial drugs with a profound record of morbidity and mortality reduction. [6]

Artemisinin Resistance (AR)

Artemisinin-resistance (AR) defines a delay in malaria parasite clearance from the bloodstream following ACTs treatment. Consequently, the artemisinin compound becomes less effective in clearing malaria parasites within three days.[4]

Recent studies have established that parasites' resistance mechanism developed against the artemisinin compound is associated with a mutation in the Kelch13 (K13) propeller domain of malaria parasites, affecting only the parasites' ring stage in humans.[4,7] Parasites carrying K13 have been reported in Southeast Asia, South America and Rwanda.[8, 9]

It is important to note that recent molecular studies have shown that the partial artemisinin-resistance in Rwanda emerged independently and did not come from South Asia.[4] The emerging artemisinin resistance in Rwanda was associated with poor treatment practice, inadequate adherence to the prescribed antimalarials, the widespread use of artemisinin-based monotherapy, and substandard drugs.[4]

It is important to note that ACTs are still significantly efficacious antimalarial drugs and can cure malaria as long as the partner drug is still effective.[4] However, the slow clearance of parasites from the bloodstream of a patient treated with ACTs adds significant dependence on a companion drug, increasing the parasite's chances to develop resistance to ACTs and subsequently causing treatment failure.

The main strength of ACTs is embodied in the dual-effect as a deterrent mechanism against parasite resistance. Unfortunately, this defence mechanism began to crack in Southeast Asia, where ACTs have started to fail, and the emergence of mutated parasites in Rwanda. All these are signs of the inevitable development of artemisinin resistance. The world should think about alternative plans before the storm hits Africa, where the global burden of malaria morbidity and mortality is greatest.

Prevention strategy

The development of new treatment takes enormous efforts and resources. However, many strategies can be applied here, starting from the African health authorities and their partners, healthcare professions, and population. The health authorities need to focus more on fighting malaria through prevention, outlawing substandard drugs as well as enforcing existing laws, monitoring emerging resistance, and assessing their clinical impacts in collaboration with international partners.

Moreover, healthcare professionals can play a vital role by adhering to malaria treatment protocols and guidelines, avoiding monotherapy, and promoting adherence to prescribed medications and reporting to authorities any suspicious cases of treatment failure. Finally, the population needs to continue prevention measures such as using mosquito nets and mosquito repellent, and adhering to a prescribed medication.

References

1. World Health Organization. Malaria. accessed on Sep 30, 2020
2. Wang J, Xu C, Liao FL, et al. A Temporizing Solution to "Artemisinin Resistance". N Engl J Med 2019; 380:2087-2089 DOI: 10.1056/NEJMp1901233
3. Dondorp AM, Nosten F, Yi P, et al. Artemisinin resistance in Plasmodium falciparum malaria [published correction appears in N Engl J Med. 2009 Oct 22;361(17):1714]. N Engl J Med. 2009;361(5):455-467. doi:10.1056/NEJMoa0808859
4. World Health Organization. Malaria Q&A on artemisinin resistance
5. Artemisinin-based combination therapy. Malaria Consortium
6. Barnes KI, Durrheim DN, Little F et al. Effect of artemether-lumefantrine policy and improved vector control on malaria burden in KwaZulu-Natal, South Africa. PLoS Med. 2005 Nov;2(11):e330. doi: 10.1371/journal.pmed.0020330. Epub 2005 Oct 4. PMID: 16187798; PMCID: PMC1240068.
7. Haldar K, Bhattacharjee S, Safeukui I. Drug resistance in Plasmodium. Nat Rev Microbiol 2018;16:156-70.
8. Inoue J, Jovel I, Morris U, et al. Absence of Plasmodium falciparum K13 Propeller Domain Polymorphisms among Field Isolates Collected from the Brazilian Amazon Basin between 1984 and 2011. Am J Trop Med Hyg. 2018 Dec;99(6):1504-1507. doi: 10.4269/ajtmh.18-0554. Epub 2018 Sep 27. PMID: 30277206; PMCID: PMC6283514.
9. Uwimana A, Legrand E, Stokes BH. et al. Emergence and clonal expansion of in vitro artemisinin-resistant Plasmodium falciparum kelch13 R561H mutant parasites in Rwanda. Nat Med 2020;26:1602–1608.

Additional Resource

World Health Organization. Report on antimalarial drug efficacy, resistance and response: 10 years of surveillance (2010-2019)

A literature review about the impact of climate change on malaria in South Sudan

Diana A. Androga
MSc. in Global Health
South Sudan

Correspondence:
Diana Androga
androgitadiana@gmail.com

Submitted: June 2020
Accepted: July 2020
Published: December 2020

Abstract

Mortality from malaria remains high in Africa despite constant efforts to combat the disease. By the end of 2018, fatalities were estimated to be 380,000 per year. This literature review covers papers on the management of malaria and the impact of climate change on the disease in South Sudan.

PubMed and the South Sudan Medical Journal website were searched using the MeSH terms (Medical Subject Headings): malaria, prevalence, epidemiology, diagnosis, medication, prevention, strategies, policies, South Sudan, chemoprophylaxis, immunity. Fifteen studies were included in the final review. Information was extracted on climate change, mosquito activity and management of malaria. Seeking improvements in the treatment and prevention of malaria is an on-going task. New strategies are needed aimed at tackling climate change and the elimination of the disease.

Introduction

PubMed was searched using the MeSH terms of malaria or prevalence or diagnosis or medication or prevention or strategies or policies or South Sudan or chemoprophylaxis or immunity or humans. Filters were on humans, free full text, in English, up to five years old, clinical studies and trials, journals, multicentre studies, observational studies. The MeSH terms were also used as keywords to search the South Sudan Medical Journal. Searches were also performed on some of the references of the primary research studies. Fifteen studies were included in the review, based on the keywords and the topics.

The impact of malaria

Malaria is a heavy burden on health systems particularly in parts of Africa and Asia.[1] In 2018, malaria cases were estimated at 228 million worldwide, with 93% in Africa. P. falciparum causes 99.7% of infections in Africa, 50% in South East Asia, 71% in the Eastern Mediterranean and 65% in the Western Pacific.[2]

Malaria affects particularly children and pregnant women. In countries with a moderate or high burden of malaria, anaemia is found in 61% of children aged under five years.[2] It is a frequent reason for school absenteeism. Expectant mothers may have asymptomatic infections, with parasites sequestered in the placenta.[2] Malaria in pregnancy can result in premature birth, low birth weight and death of new-borns. Among the survivors there is a risk of damage to physical and cognitive development.[2]

Malaria and climate change in South Sudan

In South Sudan, malaria is the leading cause of illness and mortality, accounting for 70% of the weekly reported deaths in 2017.[3] Malaria is endemic in 95% of South Sudan. It occurs throughout the year and is worse during the rainy season. The Malaria Consortium in 2019 reported that malaria was responsible for 20 to 30% of health facility visits, 30% of admissions and was a leading cause of mortality.[4]

Citation:
A literature review about the impact of climate change on malaria in South Sudan. South Sudan Medical Journal 2020; 13(5):193-195

Climate change leads to inconsistent patterns of rains. High rainfall often results in severe flooding in parts of Equatoria, Upper Nile and the Bahr el Ghazal regions. This causes serious damage to housing and crops. The floodwaters are good breeding grounds for mosquitoes, leading to the higher transmission of malaria and other communicable diseases like cholera, typhoid and dysentery.[5]

In August 2019 OCHA[6] reported that, as the rains intensified, cases of malaria increased leading to high rates of illness and death, especially among children. Malaria accounted for 68% of the disease reported in health facilities, and 72% of deaths in the under five-year olds.[6] Additionally, cases of malaria were noted to have increased from 2013-2017 in 19 counties across the country. Other challenges in diagnosis, treatment and prevention measures were identified: the absence of antimalaria drugs causing people to resort to the use of herbal medicines, conflicts, few health workers and poor road conditions.[6]

Health care models for malaria

The Integrated Primary Health Care (iPHC) Model proposed by Joseph and Hakim[7] shows how malaria treatment and other healthcare services can reach rural areas where 95% of the population resides. This health model combines five aspects: Public Heath, Clinical Services, Universal Registration, Physical Building and Training.

Public health service provision requires collaboration with the local administrative structures, chiefs, community leaders, non-governmental organisations and other organisations tackling malaria.[7] Strategies are needed for malaria control, especially during the flooding seasons, for example, by digging drains in community areas to avoid stagnant water and so the breeding of mosquitoes, and spraying residual water.

Laboratory facilities at Primary Health Care Centres (PHCC) are essential to provide accurate diagnosis before starting appropriate antimalarial treatment.[7] Training allows the PHCCs to be run by health workers such as laboratory assistants, nurses, and clinical officers, so that patients attending in a critical condition can be treated better and a referral system set up.[7]

An efficient medical records system facilitates monitoring and surveillance of malaria.

Mosquito activities and climate change

Beck-Johnson et al[8] noted that rising temperatures and other changes in climate have an impact on vectors and may lead to an increase of some diseases. The developmental stages of the plasmodium parasites and the adult mosquito are temperature dependent. Existing mosquito control measures need to be re-assessed.

The variations in the local climate of the regions in South Sudan affect the epidemiology of diseases. South Sudan has two different climate conditions, a hot semi-arid climate and a tropical climate.

Mukhtar et al[9] indicate that the weather and rainfall do influence malaria, as the disease was noted to be more prevalent in Central Equatoria State region where it is tropical, a more favourable climate for mosquitoes than it is in the Western Bahrghazel region.[9]

They modelled the population dynamics of Anopheles gambiae mosquitoes in relation to rainfall and temperature, using data from these two distinct climatic regions of South Sudan and proposed likely values for R0, the basic reproduction number, under different climatic conditions. Existing malaria control strategies and health service provision are based on historic climate patterns, but such modelling is now needed to inform future, climate change resilient strategies and provision.

Also, low, or heavy rainfalls were shown to reduce the number of immature mosquitoes still developing from the eggs, larvae, and pupae. Suitable measures should consider the local climate of the area.[9] Hence, understanding climate change informs on the transmission of malaria. A deeper understanding of climate change may lead to more knowledge on how mosquitoes behave, subsequently how malaria is transmitted. This in turn helps the design of effective interventions.[9]

Other methods that are available include the linear regression (LR) method by Benedette et al[10], who evaluated a novel method for detecting exceptional increases in case numbers in the absence of useful historical records, using only eight weeks of current data.[10] This method may be useful in South Sudan where reliable historical records may not exist, and historical records may not be a guide to future disease incidence due to climate change and variation in the occurrence of malaria.[10] Better ways of recording and storing data are needed, in order to assess and interpret disease occurrence; this can also aid in observing the changes in disease patterns that are influenced by climate change.

The management of malaria in South Sudan

Mosquito nets are commonly used for the prevention of malaria in South Sudan. A 2017 malaria survey by the Ministry of Health and the National Malaria Control programme reported that the percentage of households owning at least one mosquito net was 79% in urban areas and 61% in rural areas.[11] The highest coverage of households using Insecticide Treated Nets (ITNs) was in Central Equatoria, where two persons share one mosquito net in 45% of the households. Despite the use of ITNs being high, there is a slight decrease from 66% in 2013 to 63% in 2017.[11] Although the household

ownership of at least one mosquito net is high in the areas for the Protection of Civilians (PoC), only 15% of PoC households and 6% of IDP households have an ITN for every two household members.[11]

The treatment of malaria varies depending on the level of complication presented. Azairwe and Achan in 2011 [12] described the treatment of uncomplicated malaria in South Sudan - which should be treated immediately to prevent progression to severe, potentially fatal, disease. Azairwe and Achan's paper[12] also dealt with treatment failure arising from drug-resistance, non-adherence or use of substandard medicines.[12]

The existence of current recommended treatments for malaria does not guarantee future success. Parasites have developed resistance to currently available drugs, which may worsen with time.[2] Further changes in climate may result in an increase in the number of malaria-transmitting mosquitoes.[13] Thus new strategies should be considered, for example, the RTS, S vaccine being piloted in Kenya, Ghana, and Malawi, which provides partial protection for young children against P. falciparum.[14] There has been a reduction by 29% of severe malaria in the children in the age range 5-17 months, who were given 4 doses of the RTS, S vaccines. Among these children, the vaccine prevented approximately 4 out of 10 (39%) malaria cases over 4 years of follow-up. Admission rate due to severe malaria also declined. This vaccine has been incorporated in the routine immunisation programme, in the countries conducting the pilot.[15] Once the pilot programme is complete, introducing it into South Sudan may play a great role by contributing to the in reduction of malaria morbidity and mortality.

Conclusion

To reduce the occurrence and stop the spread of malaria in South Sudan, new strategies that consider climate change as a major factor need to be considered. It is necessary to understand the climate where malaria thrives, by adapting methods that control the vector in addition to continuing appropriate use of anti-malarial drugs and close monitoring of the health system.

References

1. World Malaria Report at a glance.
2. World Health Organization. World Malaria Report 2019. Geneva; 2019.
3. World Health Organization South Sudan. WHO strategizes to address the worsening challenge of the malaria burden in South Sudan. 2018.
4. Malaria consortium. Fact sheet. 2019;035 (September):1–3.
5. Kenyi EE. Public health impacts and responses to floods. S Sudan Med J 2020;13(1):22–23.
6. OCHA. South Sudan situation report 2019. 2019.
7. Joseph VV, Hakim E. Integrated Primary Health Care (iPHC) for developing countries: a practical approach in South Sudan. S Sudan Med J 2019;12(2):44–47.
8. Beck-Johnson LM, Nelson WA, Paaijmans KP, et al. The effect of temperature on Anopheles mosquito population dynamics and the potential for malaria transmission. PLoS ONE 2013;8(11):79276.
9. Mukhtar AYA, Munyakazi JB, Ouifki R. Assessing the role of climate factors on malaria transmission dynamics in South Sudan. Math Biosci 2019;310:13–23.
10. Benedetti G, White RA, Pasquale HA, et al. Identifying exceptional malaria occurrences in the absence of historical data in South Sudan: a method validation. Public Heal Action 2019;9(3):90–95.
11. MOH. Republic of South Sudan Malaria Indicator Survey (MIS) 2017. Juba; 2017.
12. Azairwe R, Achan J. Malaria in South Sudan 4: treatment of uncomplicated P. falciparum malaria. S Sudan Med J 2011;4(2):30–32.
13. Pasquale H, Jarvese M, Julla A, et al. Malaria control in South Sudan, 2006-2013: strategies, progress and challenges. Malar J 2013;12:374.
14. WHO. Malaria: retreat of a centuries-old scourge in. Ten years in public health, 2007–2017. World Health Organization, Geneva; 2017:45–54.
15. World Health Organization Q&A on the malaria vaccine implementation programme.

Atypical presentation of COVID-19 in a diabetic patient with malaria-like symptoms: case report

Abrar Bakry Elmalik,[1] Mohamed Eltayieb Elawad,[2] Alaa Eltayieb Elawad Ahmed[3] and Ibrahim A. Ali[4]

1. Medical student, Faculty of Medicine, Omdurman Islamic University, Khartoum, Sudan
2. Medical student, Faculty of Medicine, National Ribat University, Khartoum, Sudan
3. Faculty of Nursing, Sharjah University, Sharjah, United Arab Emirates
4. Assistant Professor of Physiology, Faculty of Medicine, The National Ribat University, Khartoum, Sudan

Correspondence:
Ibrahim Abdelrhim Ali
hemamedicine@gmail.com

Submitted: July 2020
Accepted: August 2020
Published: December 2020

Citation:
Elmalik et al. Atypical Presentation of COVID-19 in Diabetic Patient, with Malaria-like Symptoms: case report. South Sudan Medical Journal 2020; 13(5):196-199

Abstract

Since the emergence of the coronavirus (COVID-19) pandemic beginning in China in 2019, all health workers have faced a difficult challenge. One challenge is a clinical picture in some cases, where the presenting symptoms do not fit with the usual pattern. In this report, we present a case whose initial symptoms were headache, dizziness, and vomiting suggesting malaria bearing in mind that the patient was from Sudan, where there is a high incidence of malaria.

These unusual symptoms may be attributed to the presence of the receptor ACE2, in various body systems. The mild pathological course may be related to the patient's age and the fact that diabetic patients are less likely to develop lung injury, hence the absence of respiratory symptoms.

We recommend that physicians are alert to the variety of different presenting features of COVID-19 and test with Polymerase Chain Reaction (PCR) whenever there is doubt.

Introduction

COVID-19 is a viral disease that infects the respiratory system, and usually, a patient suffers from high fever, fatigue, headache, cough, and shortness of breath.[1] This pandemic carries a staggering burden in terms of expenditure on detection, prevention, and treatment, in addition to the loss of life and collapse of the health systems.[2] However, many reports have recorded unusual clinical features such as diarrhoea, abdominal pain, testicular pain, and stroke-like symptoms.[3,4]

The unusual clinical features cause confusion to the unwary clinician with delayed diagnosis and poorer outcomes. This is especially so if the clinical features are similar to a common disease in the region such as malaria in Sudan, where, despite the lack of statistical studies incidence is estimated at about nine million cases, and the mortality rate about three million cases a year. Thus, malaria is an endemic disease in Sudan.[5]

This report presents a case of COVID-19 infection with unusual symptoms and hence emphasises the need to add these features to those when COVID-19 must be considered.

Case Report

A 23-year old female living in Sudan complained of three days of headache and dizziness and vomiting for one day before hospital admission. The moderate bitemporal headache was of sudden onset with a feeling of pressure over the left eye. A day prior to admission, she felt suddenly dizzy that was worse when she lay down and improved on standing, and associated with vomiting after eating. She has type-1 diabetes and is on an insulin pump. She said that she had been in hospital recently with symptoms of hypoglycaemia. A blood sugar level was 50 mg/dl (Reference range 80 – 140 mg/dl). She received 50% dextrose intravenously and was discharged on the same day. The patient told us that she had not complained of headache, dizziness, and vomiting with those characteristics before. Nor did those symptoms appear in her family. She also denied that mosquitoes were in her area, distant travel, or recent direct contact

Table 1. Changes in symptoms since the day of COVID-19 confirmation (Day 8 of the initial admission)

The evening of the first day	Dizziness, cough and severity of the sore throat increases as the moderate headache and repeated sneezing persist
Day 2 and 3	Fatigue and fever intensity increase, previous symptoms persist
Day 4	Fever gradually improving and shortness of breath is emerging again
Day 5	A severe headache reappeared, dizziness and vomiting improved
Day 6 to 8	Mild fever with a less severe headache
Day 9	The disappearance of fatigue and improvement of the general situation but dry cough and sore throat continue
Day 10	The dry cough became productive and sore throat began to improve
Day11 to 13	Continued productive cough
Day 14	Improvement of productive cough began
Day 15	Mild fever reappears

with a COVID-19 patient.

On examination her pulse rate was 117 beats per minute, respiration rate 17 breaths per minute, temperature 36.9 °C, blood pressure 110/70 mmHg, oxygen saturation 98%. Examination of the nervous system was normal (GCS 15), the cardiovascular system was normal, chest auscultation was clear. However, there was tenderness in the epigastric and periumbilical regions. A peripheral blood film (PBF) for malarial parasites was negative. Other tests showed:

White blood cells (WBCs) was 9×10^9 /L(Reference range 4.5 – 11×10^9 /L)

Lymphocyte was 1.2×10^9 /L(Reference range 1.5 – 4.5×10^9 /L)

Monocyte was 0.3×10^9 /L(Reference range 0.2 – 0.8×10^9 /L)

Eosinophils was 0.2×10^9 /L(Reference range 0 – 0.4×10^9 /L)

CRP was 1.2 mg/dL (Reference range 0 -1 mg/dL)

ESR was 23 mm in one hour (Reference range 1 – 20 mm in one hour)

In spite of the negative slide for malarial parasites she was treated empirically for malaria with Artemether-Lumefantrine (80/480) tablets, twice daily for three days.

After seven days from admission, the dizziness and vomiting improved. However, the patient began to complain of a mild fever but less severe headache. The next morning, she complained of a dry cough, sore throat, shortness of breath, and repeated sneezing and COVID-19 was suspected. A nasopharyngeal swab was taken and a PCR test was positive for COVID-19 infection.

The patient was isolated. Paracetamol 500 mg tablets were given as required., Vitamin-C one tablet daily to reduce the damage extent that COVID-19 cause, Vitamin-D capsules 400 IU per day to enhance the immunological function, azithromycin 500 mg on day 1, then 250 mg on days 2-5 due to its antiviral effect and immunity boost, and dextromethorphan hydrobromide was given to ease cough. It was also recommended that an oxygen cylinder be brought for use on demand.

The patient was closely monitored and adequate nourishment was ensured. The changes in symptoms are summarised in Table 1.

Discussion

This case draws attention to the fact that COVID-19 may present as a mild to moderate illness free from complications. Later it may develop into a more serious condition. COVID-19 has been classified into the mild, severe and critical categories listed in Table 2.[6]

In another study, diabetic patients appeared to be less susceptible to acute lung injury and the development of acute respiratory distress syndrome (ARDS).[7, 8]

Respiratory complications are among the most serious complications with a high mortality. The age of a patient and severity of the disease are directly related.[9]

The delay in the diagnosis of COVID-19 because of the unusual initial symptoms exposed doctors and healthcare workers and family members to an increased risk of infection especially since she had visited the hospital twice before the correct diagnosis was made. This is of course in addition to her probable infectivity during a preceding asymptomatic period.

Fever is the most common symptom, followed by cough then fatigue.[10] But it is now realised there are a variety of other symptoms about which the clinician must be aware. The basis for this variation in presentations may be related to ACE2, as several studies have mentioned. This receptor

Table 2. COVID-19 classification according to severity[6]

Mild	Absent or mild pneumonia.
Severe	Shortness of breath, respiratory rate more than 29/min, oxygen saturation less than 94%, lung infiltrate 50% within 24 to 48 hours, or PaO2/FiO2 ratio less than 300.
Critical	Respiratory failure, multiple organ failure, or septic shock.

is responsible for the formation of vasodilator peptides and found in many places in the human body, including the digestive system and brain hence possibly causing vomiting, headache, and dizziness.[11,12]

Consideration of the differential diagnoses is crucial when presented with non-specific symptoms that might be caused by a number of infectious diseases, especially if they are common in the region. In Thailand, which is a tropical area, it is likely that COVID-19 will be confused with tropical diseases. A series of cases (48) were reported with a petechial rash, and thrombocytopaenia which were initially thought to indicate dengue fever.[13]

In our case the main complaints in the first presentation were headache, dizziness, and vomiting, symptoms that could indicate malaria, neurological disease, or meningitis. However, the neurological examination was normal. Although the peripheral blood film did not show malarial parasites, it is clinical practice in Sudan to consider a diagnose malaria if eosinophils are more than or equal to 0.2, and there are increased monocytes. However, the normal WBCs, low lymphocyte count, and increased ESR and CRP indicate a coronavirus.[14,15]

Conclusion

This case adds to our knowledge about the presentations of COVID-19 and how they might mimic other conditions, malaria in particular. Some differentials of the WBCs such as high monocyte and eosinophils counts suggested a diagnosis of malaria.

We recommend that clinicians should be alert to the possibility of COVID-19 whenever a patient presents with non-specific features and make modifications to the triage system to include recorded unusual symptoms. If there is any doubt a test for COVID-19 should be requested especially if the patient has another condition (e.g. diabetes, chronic respiratory disease) that puts them into a higher risk group that should be managed by intensive care. A delayed diagnosis may increase the severity of the disease, resulting in complications and even death. In addition, the risk of further spread of infection is increased.

References

1. Tian S, Hu N, Lou J, et al. Characteristics of COVID-19 infection in Beijing. Journal of Infection April 2020;80(4):401-406.
2. Livingston E, Bucher K. Coronavirus disease 2019 (COVID-19) in Italy. JAMA 2020;323(14):1335-1335.
3. Kim J, Thomsen T, Sell N, Goldsmith AJ. Abdominal and testicular pain: An atypical presentation of COVID-19. American Journal of Emergency Medicine July 2020;38(7):1542.E1-1542.E3
4. Avula A, Nalleballe K, Narula N. et al. COVID-19 presenting as stroke. Brain, behavior, and immunity 2020;87:115-119.
5. Abdalla SI, Malik EM, Ali KM. The burden of malaria in Sudan: incidence, mortality and disability–adjusted life–years. Malaria Journal 2007 Dec 1;6(1):97.
6. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. JAMA 2020 Apr 7;323(13):1239-42.
7. Honiden S, Gong MN. Diabetes, insulin, and development of acute lung injury. Critical Care Medicine 2009;37(8): 2455.
8. Yu S, Christiani DC, Thompson BT et al. Role of diabetes in the development of acute respiratory distress syndrome. Critical Care Medicine 2013:41(12):2720.
9. Onder G, Rezza G, Brusaferro S. Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. JAMA 2020;323(18):1775-1776.
10. Wang D, Hu B, Hu C et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus–infected pneumonia in Wuhan, China. JAMA 2020;323(11):1061-1069.
11. Zou X, Chen K, Zou J, Han P, Hao J, Han Z. Single-cell RNA-seq data analysis on the receptor ACE2 expression reveals the potential risk of different human organs vulnerable to 2019-nCoV infection. Frontiers of Medicine. 2020 May 9;14(2):185-92.

12. Doobay M, Talman LS, Obr TD. et al. Differential expression of neuronal ACE2 in transgenic mice with overexpression of the brain renin-angiotensin system. American Journal of Physiology-Regulatory, Integrative and Comparative Physiology 2007; 292(1):R373-R381.

13. Joob B, Wiwanitkit V. COVID-19 can present with a rash and be mistaken for Dengue. Journal of the American Academy of Dermatology. 2020 May;82(5):e177.

14. Elsayid M, Elbasheer MA, Othman AA, Belal RH, Elfaki TE. Estimation of complete blood count and platelets indices in Sudanese patients with malaria. American Journal of Research Communication. 2017;5(1):29-38.

15. Fan BE, Chong VC, Chan SS, Lim GH, Lim KG, Tan GB, Mucheli SS, Kuperan P, Ong KH. Hematologic parameters in patients with COVID-19 infection. American Journal of Hematology. 2020 Jun;95(6):E131-4.

Malaria Resources: Women and children

Deleterious effects of malaria in pregnancy on the developing fetus: a review on prevention and treatment with antimalarial drugs

Saito et al. Lancet October 2020 DOI: https://doi.org/10.1016/S2352-4642(20)30099-7

All malaria infections are harmful to both the pregnant mother and the developing fetus. One in ten maternal deaths in malaria endemic countries are estimated to result from *Plasmodium falciparum* infection. Malaria is associated with a 3–4 times increased risk of miscarriage and a substantially increased risk of stillbirth. Current treatment and prevention strategies reduce, but do not eliminate, malaria's damaging effects on pregnancy outcomes.

Reviewing evidence generated from meta-analyses, systematic reviews, and observational data, this first paper in this Lancet Series aims to summarise the adverse effects of malaria in pregnancy on the fetus and how the current drug treatment and prevention strategies can alleviate these effects.

Although evidence supports the safety and treatment efficacy of artemisinin-based combination therapies in the first trimester, these therapies have not been recommended by WHO for the treatment of malaria at this stage of pregnancy. Intermittent preventive treatment of malaria in pregnancy with sulfadoxine–pyrimethamine is contraindicated in the first trimester and provides imperfect chemoprevention because of inadequate dosing, poor (few and late) antenatal clinic attendance, increasing antimalarial drug resistance, and decreasing naturally acquired maternal immunity due to the decreased incidence of malaria.

Alternative strategies to prevent malaria in pregnancy are needed. The prevention of all malaria infections by providing sustained exposure to effective concentrations of antimalarial drugs is key to reducing the adverse effects of malaria in pregnancy.

Treatment and prevention of malaria in children

Ashley and Poespoprodjo. Lancet October 2020 DOI: https://doi.org/10.1016/S2352-4642(20)30127-9

Malaria disproportionately affects children younger than 5 years. Falciparum malaria is responsible for more than 200 000 child deaths per year in Africa. For the treatment of malaria in children, paediatric dosing recommendations for several agents, including parenteral artesunate and dihydroartemisinin–piperaquine, have belatedly been shown to be suboptimal.

Worsening antimalarial resistance in Plasmodium falciparum in the Greater Mekong Subregion threatens to undermine global efforts to control malaria. Triple antimalarial combination therapies are being evaluated to try to impede this threat. The RTS,S/AS01 vaccine gives partial protection against falciparum malaria and is being evaluated in large, pilot studies in Ghana, Malawi, and Kenya as a complementary tool to other preventive measures.

Seasonal malaria chemoprevention in west Africa has resulted in declines in malaria incidence and deaths and there is interest in scaling up efforts by expanding the age range of eligible recipients. Preventing relapse in *Plasmodium vivax* infection with primaquine is challenging because treating children who have G6PD deficiency with primaquine can cause acute haemolytic anaemia. The safety of escalating dose regimens for primaquine is being studied to mitigate this risk.

The temporal and spatial incidence and transmission of malaria in South Sudan (2011-2018)

Iboyi Amanya Jacob

Department of Pathogen Biology, School of Public Health, Southern Medical University, Guangzhou, Guangdong Province PR-China.

Correspondence:
Iboyi Amanya Jacob
amanyajazy@yahoo.com

Submitted: August 2020
Accepted: October 2020
Published: December 2020

This is a summary of an original public health research thesis that was submitted in 2019 to the Department of Pathogen Biology, School of Public Health, Southern Medical University, Guangzhou, Guangdong Province PR-China. The thesis (with all analyses, figures and references) is available from Iboyi Amanya Jacob amanyajazy@yahoo.com

Introduction: A variety of factors, including settlement structure, climate and environmental issues, influence the temporal and spatial distribution of malaria. The aim of this research was to investigate these spatio-temporal factors from 2011 to 2018 in South Sudan and relate them to malaria control programmes and so inform decision-making.

Method: All cases, clinically diagnosed or microscopically confirmed, were extracted from the Ministry of Health's database. These data were correlated with climatic, geographic (spatial) and seasonal factors. This enabled the definition of clustering patterns.

Results: A total of 12,290,614 malaria cases were reported in the eight years of the study. The numbers were 1,810,835 in 2011, and 2,068,518 in 2015 with a peak at 2,640,439 in 2014. The average incidence was 3.33/10,000 people. Incidence peaked at 3.97/10,000 in 2014, and declined to 2.81/10,000 in 2015. Figure 1 shows the incidence of cases over the study period and Figure 2 shows the monthly incidences.

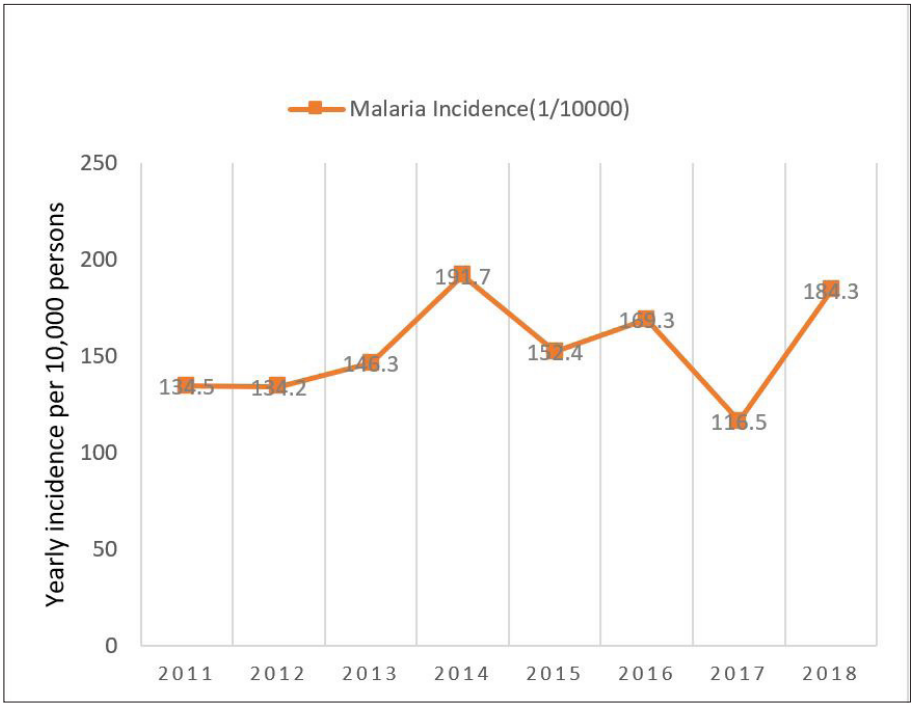


Figure 1. Incidence of malaria per 10000 people in all counties 2011 - 2018

Citation:
Jacob. The temporal and spatial incidence and transmission of malaria in South Sudan (2011-2018). South Sudan Medical Journal 2020; 13(5):200-202

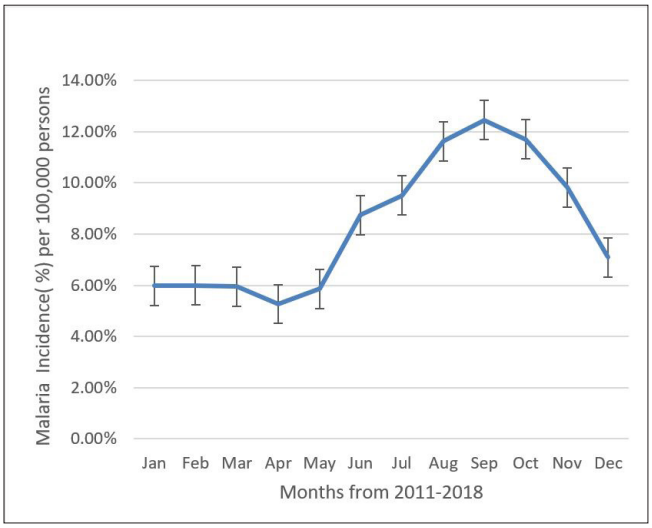


Figure 2. Monthly incidence of cumulative cases of malaria 2011-2018

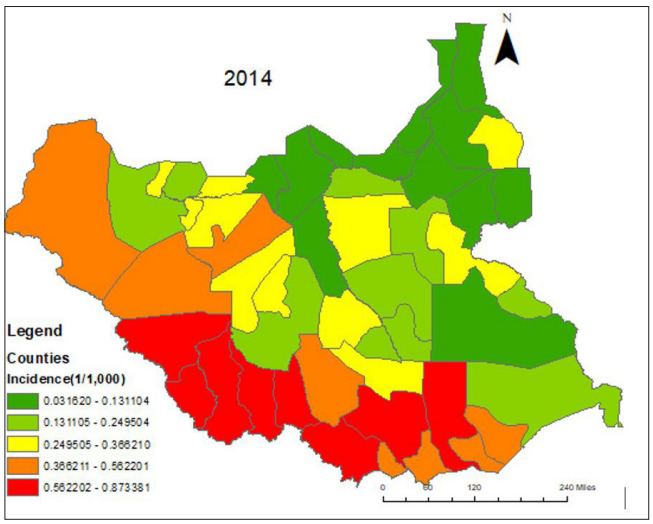


Figure 4. Incidence of malaria cases per 1

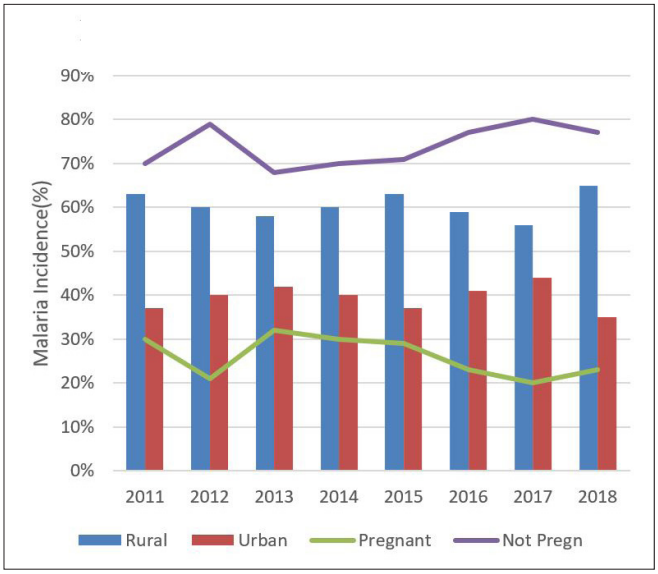


Figure 3. Malaria incidence by residence and pregnancy status.

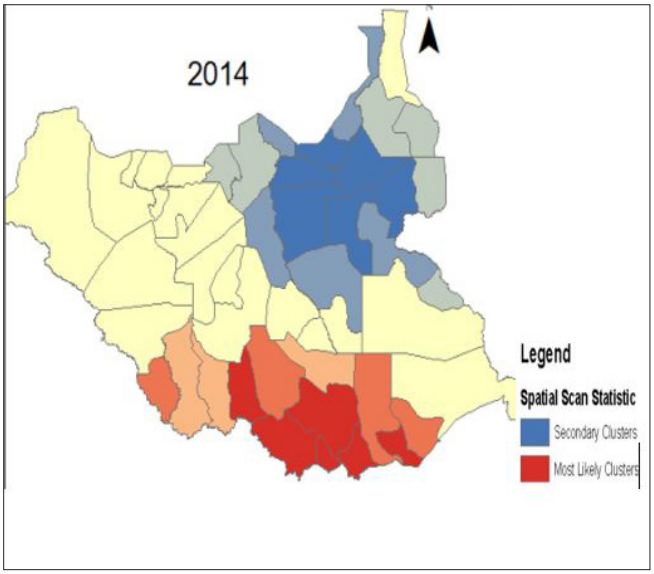


Figure 5. Hot-spots and Clusters of malaria incidences in 2014

About half (56.3%) of the cases were aged under five years; 56.4% were females and 43.6% were males. Figure 3 shows incidence by residence and pregnancy status.

Figure 4 shows spatial distribution of malaria in 2014 (the year of highest incidence) and Figure 5 the clusters and hotspots for the same year.

Rainfall was related to incidence (rho =0.82; P<0.001) (Figure 6) as was humidity (rho = 0.58, P< 0.048). However there did not appear to be a significant link with temperature (rho= -0.301 P<0.341).

Discussion: Knowing the temporal and spatial distribution of malaria and the root causes of the increasing disease burden helps in targeting prioritized strategies to eradicate malaria.

Major factors most significantly associated with malaria transmission in South Sudan are rainfall and humidity. Monthly malaria incidence increased as rain intensifies with incidences beginning to rise in June, sharply peaking in August to October and declining in November as rain diminishes. Our study found that the malaria distribution was more clustered in the southern region of the country than in the north, and that the southern region was the area with a high incidence of hotspots of malaria with a significant correlation with meteorological conditions.

The groups especially affected were under-five year olds and pregnant women. In 2014, malaria in the under-fives year olds accounted for more than half of the total cases in South Sudan; this could be attributed to high rates of malnutrition, anaemia and diarrhoeal diseases making these children more susceptible to malaria infection and

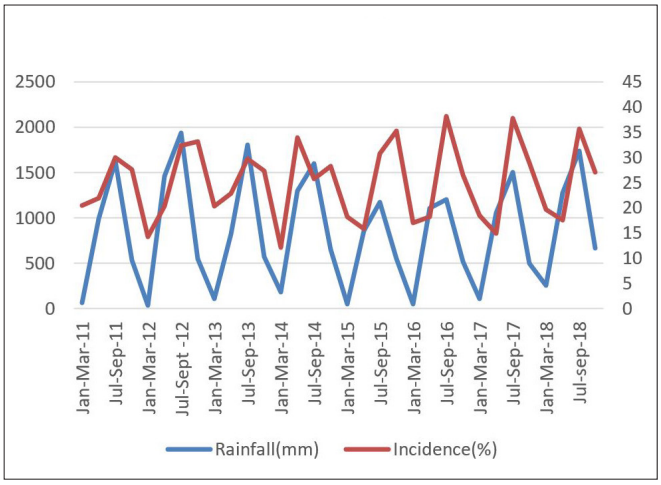


Figure 6. Relationship between malaria incidences and rainfall from 2011-2018

death; our analysis showed that malaria is more severe in this age group. Females are particularly exposed to infection when collecting fire-wood, and drawing water; rural areas reported more cases than urban ones. Women are felt to be at higher risk than men which might be related to gender differences in ownership of resources, access to education, health care seeking behaviours, and mosquito net usage.

Our spatiotemporal analysis is important in determining the epidemiology of vectors, and to provide management strategies because it focused on basic planning units (counties) which are the smallest geographic locations targeted to rural populations.

Trend analyses showed that malaria control in South Sudan during the period of our study was very weak and the country was vulnerable to outbreaks because there had been ongoing violence that caused deterioration in public health services.

Conclusion: More information on malaria prevalence, spatiotemporal distribution and its associated factors are vital to focus and improve malaria programme interventions. Our results indicate the importance of linking these findings with malaria control programmes.

Taking into account weak public health system, difficult geographic terrain, rising trade and peoples' movements, inadequate vector control interventions, and observed relationships between climatic variables and vectors, the findings concluded that climate changes intensify the risk of outbreaks in hard-to-reach areas, if other non-climatic drivers of parasite-borne infection remain constant.

There appears to be a knowledge gap regarding mosquito nets ownership and utilization and there needs to be more focus on health education programmes and mosquito net supply. Overall, efforts and resources are called for improving coverage among vulnerable populations.

Malaria Resources

World Malaria Report 2020

World Health Organization https://www.who.int/publications/i/item/9789240015791

The 2020 edition of the World malaria report takes a historical look at key milestones that helped shape the global response to the disease over the last 2 decades – a period of unprecedented success in malaria control. The report features a detailed analysis on progress towards the 2020 milestones of WHO's global malaria strategy and a special section on malaria and the COVID-19 pandemic.

Mosquitoes Don't Social Distance: Continuing the fight against malaria during the COVID-19 pandemic

Hand washing, mask wearing, and social distancing might help protect families from COVID-19, but it won't protect them from the world's deadliest animal. Mosquitoes don't disappear during a pandemic. And about half of the world's population lives in an area (such as South Sudan) where a mosquito bite could lead to malaria, which keeps kids out of school, parents out of work, and killed 405,000 people in 2018.

Shortly after COVID-19 was declared a pandemic, global health experts modelled its potential impact on malaria programmes — and the projections weren't good. The modelling suggested that if COVID-19 were to significantly disrupt prevention campaigns and access to antimalarial medicines, malaria deaths could double in 2020 and wipe out decades of hard-fought progress.

A major spike in malaria cases could also overwhelm health systems in malaria-affected countries and compromise their ability to effectively respond to COVID-19.

See more at https://medium.com/usaid-2030/mosquitoes-dont-social-distance-66606aead25e

The role of laboratory science in the battle against malaria in South Sudan

Ahmed Eltaj Elhag
Student and Researcher, State University of New York: Albany, NY, USA

Correspondence:
Ahmed Eltaj Elhag
ahmed.sudan1921@gmail.com

Submitted: April 2020
Accepted: September 2020
Published: November 2020

Introduction

When discussing the challenges surrounding malaria in South Sudan the focus tends to be on the availability of medical supplies, health care infrastructure, and social stigma. However, one important aspect that is sometimes overlooked is the role of laboratory science and diagnostics in both the control and prevention of malaria. This article describes the role of laboratory science in combating malaria and recent developments in South Sudan.

The role of laboratory science in battling malaria

The COVID-19 pandemic has highlighted the importance of diagnostics and laboratory science in the battle against infectious diseases. The following is a brief overview of the more prominent functions of the laboratory service in relation to malaria.

1. Improve diagnosis: The World Health Organization (WHO) recommends the prompt diagnosis of all patients suspected of having malaria through the use of microscopy or malaria rapid diagnostic tests (RDT).[1] Early diagnosis of malaria facilitates better management and surveillance of the disease. Unfortunately, these techniques are often difficult to attain in many African nations due to the limitations faced by medical laboratory professionals.

2. Prevent misdiagnosis: A misdiagnosis is simply an incorrect diagnosis and often occurs with malaria because the symptoms are not specific and mimic other diseases. Without a precise diagnosis there remains a barrier to effective control of malaria in many communities. The consequence is a wastage of limited antimalarial drugs on patients who do not have the disease. The American National Health Institute (NIH) reported that such occurrences lead to the "...raising the cost of treatment…" [2] In nations, where the availability of these resources is highly limited it is of great importance that they be conserved.

3. Prevent the development of drug resistance: The American Journal of Clinical Pathology has written extensively on how inaccurate diagnostics lead to the widespread and unnecessary use of antimalarials which in turn leads to parasites developing resistance to these treatments. [3] Improving diagnostics with 95% sensitivity and 95% specificity may potentially prevent 100,000 deaths and about 400 million unnecessary treatments each year.[3]

Improving laboratory science in South Sudan is a critical step to moving towards a future free of malaria.

Recent developments in laboratory science in South Sudan

In South Sudan there have been positive developments in recent years. For example, in 2019 the South Sudan Ministry of Health launched an advanced curriculum for a Diploma in Medical Laboratory Sciences.[4] The introduction of this diploma marks a major development for the people of this country. Since 2012 three more health sciences institutes that provide education and training in Medical Laboratory Science have been established making a total of six.[4]

This programme will provide South Sudan with future laboratory professionals and enhance collaboration with the organizations that helped develop this diploma such as Amref Health Africa, the African Society of Laboratory Medicine (ASLM) and the Center For Disease Control.

References

1. World Health Organization. Malaria Diagnostic Testing.
2. Fogarty International Center, U.S. National Institutes of Health (NIH) Malaria Misdiagnosis
3. Long EG. Requirements for Diagnosis of Malaria at Different Levels of the Laboratory Network in Africa. Amer J Clinical Pathology 2009;131 (6):858–860.
4. Amref Health Africa, Launch of revised curriculum for Diploma in Medical Laboratory Sciences News

Citation:
Elhag. The role of laboratory science in the battle against malaria in South Sudan. South Sudan Medical Journal 2020; 13(5):203

Training in malaria microscopy and South Sudan's first malaria slide bank

Jacopo M. Rovarini (jacopo.rovarini@amref.it), **Songok Jackson, Jane Y. Carter, David Isaboke, Stephen Munene, Andrea Bollini and Morrish Ojok** Amref Health Africa, South Sudan

Charles Mazinda, Laboratory Focal Person for Malaria, National Malaria Control Programme, South Sudan.

Wilson Sebit, Laboratory Manager, Parasitology Laboratory, Public Health Laboratory, Juba, South Sudan

Dear Editor,

Given that malaria in South Sudan is endemic in 95% of the country and contributes significantly to overall mortality (sixth cause of death),[1] we feel that malaria deserves greater consideration by scholars, institutions, organizations and the public alike.[2]

Several initiatives for tackling malaria are currently being implemented across the country by numerous health organisations. These include the improvement of malaria diagnosis based on clinical presentation and quality assured laboratory diagnosis using rapid diagnostic tests (RDT) and microscopy. Despite the practical advantages of adopting RDTs, microscopy remains the accepted standard for clinical diagnosis in resource-constrained settings.[3,4] However, quality assured malaria microscopy requires basic laboratory infrastructure, a power source, well maintained equipment, a regular supply of quality reagents, and competent microscopists.

In February 2020, Amref Health Africa conducted two Refresher Training in Laboratory Diagnosis of Malaria courses in Juba at the Public Health Laboratory targeting microscopists from Ministry of Health hospitals and primary healthcare centres from greater Equatoria and Bahr el Ghazal regions of the country. When competence in malaria microscopy was assessed among the 24 microscopy trainees, none attained a competence level that would ensure an accurate malaria diagnosis. Instead, all the trainees achieved only the equivalent of Level 4 (the lowest grade) using the World Health Organization (WHO) grading system.[5] A similar result was recorded in training courses in 2017.[6] Microscopists with WHO Level 1 certification (the highest grade) achieve malaria parasite detection in at least 90% of samples, correctly identify malaria parasite species in ≥90% of samples, and perform a correct parasite count in at least 50% of samples. Higher levels of competence in malaria microscopy are therefore urgently needed to improve malaria diagnostic services in South Sudan.[7]

The current limited competence of malaria microscopists in South Sudan undermines the optimal performance of malaria diagnosis at health facilities. Amref Health Africa is therefore planning to conduct further refresher training and competence assessments in malaria microscopy, and, at the same time, establish South Sudan's first National Malaria Slide Bank. A malaria slide bank is a repository of well-characterized, high-quality reference malaria slides that are used for malaria training as well as in quality assurance programmes.[8] The malaria slide bank will be established with the technical support of Amref Health Africa's Regional Laboratory Programme based in Kenya, which is in the process of setting up a regional malaria slide bank facility through the rigorous WHO process of slide validation and polymerase chain reaction (PCR) testing. The combination of standardised training activities with ongoing quality assurance and support supervision of microscopists has been shown to enhance accuracy of malaria diagnosis in clinical settings.[9,10]

Thanks to a grant from the Italian Agency for Development Cooperation [AID 011817/03/5] and with the endorsement and collaboration of the Ministry of Health of the Republic of South Sudan, Amref Health

Africa in South Sudan has secured the necessary financial and institutional support to carry out these integrated interventions to improve the standard of malaria diagnosis in the country. We look forward to engaging a wider range of health partners to enable them to benefit from in-country, high quality malaria microscopy training and quality assurance services provided through the National Malaria Control Programme.

References

1. Institute for Health Metrics and Evaluation – University of Washington. South Sudan. Accessible at the following link: http://www.healthdata.org/south-sudan
2. UN OCHA – South Sudan, Humanitarian Needs Assessment 2020. UN OCHA; 2019.
3. Visser T, Daily J, Hotte N et al. Rapid diagnostic tests for malaria. Bulletin of the World Health Organization, Geneva; 2015. Accessible at the following link: www.who.int/bulletin/volumes/93/12/14-151167/en/
4. Berzosa P et al. Comparison of three diagnostic methods (microscopy, RDT, and PCR) for the detection of malaria parasites in representative samples from Equatorial Guinea. Malaria Journal 2018;17:333.
5. Amref Health Africa & MoHSS. Refresher Training Course in Laboratory Diagnosis of Malaria – Course Report. Juba; 10-21 February 2020.
6. Amref Health Africa and MoHSS. Malaria Microscopy Refresher Training. Juba; 24-28 July 2017.
7. Bosman A. WHO Technical Consultation on External Competence Assessment of Microscopists for Malaria. Malaria Policy Advisory Committee Meeting - World Health Organization, Geneva; 10-12 April 2019.
8. World Health Organization. Malaria Microscopy Quality Assurance Manual – Version 2. Geneva; 2016; 91.
9. Odhiambo F et al. Factors associated with malaria microscopy diagnostic performance following a pilot quality-assurance program in health facilities in malaria low-transmission areas of Kenya. Malaria Journal. 2017;16:371
10. Diallo MA et al. Quality control of malaria microscopy reveals misdiagnosed non-falciparum species and other microscopically detectable pathogens in Senegal. Ann Clin Microbiol Antimicrob. 2018;17:8.

Malaria Resources

Celebrating success – LLIN distribution in South Sudan during COVID-19

Summarised from the Malaria Consortium blog of 28 July 2020

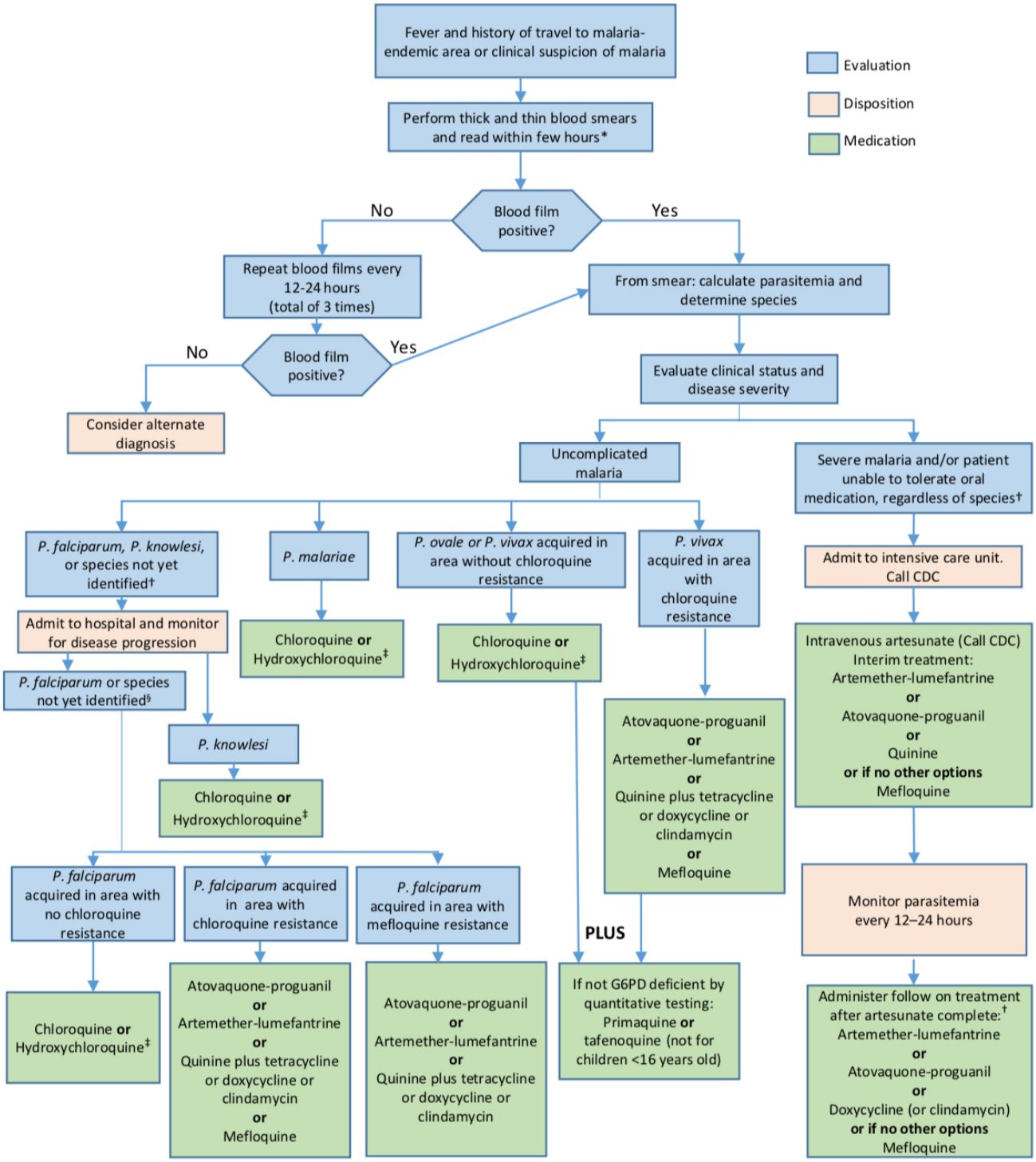
Working with the South Sudan National Malaria Control Programme (NMCP) and Population Services International (PSI), Malaria Consortium recently completed a successful long-lasting insecticidal net (LLIN) distribution campaign in Northern Bahr el Ghazal state of South Sudan. The campaign distributed 980,000 LLIN, reaching more than 1.8 million people in over 300,000 households.

Supported by the collaborative efforts of partners at every stage of the distribution, Malaria Consortium rapidly implemented a series of new measures to ensure LLIN distribution has continued during the pandemic.

Social Behaviour Change Communication (SBCC) is a critical component of successful LLIN campaign delivery and especially important during a pandemic. Health messaging around both malaria and COVID-19 was broadcast to communities on radio talk shows and jingles, and communicated through Information, Education and Communication materials. As part of the training for campaign volunteers, an SBCC component was taught that emphasised key malaria prevention health messages and raised awareness of COVID-19. The recipients of the training were then able to disseminate this information through interactions with their communities during the distribution. These adaptations were implemented rapidly and as a result not everyone initially understood the risks of COVID-19 and the need to adapt the LLIN distribution, reinforcing the need for strong health messaging and protocols for sanitising and washing hands. Strong community leadership, effective training and the combined efforts of all partners helped to address the lack of understanding within communities of the risks posed and helped make the campaign a success.

Algorithm for Management of Malaria

CDC Malaria Hotline: (770) 488-7788 or (855) 856-4713 (toll-free) Monday–Friday 9am–5pm EST
(770) 488-7100 after hours, weekends, and holidays



Footnotes

*If rapid diagnostic test performed, smear should also be performed with results available as soon as possible

† If species later identified as *P. vivax* or *P. ovale*, add primaquine or tafenoquine if not G6PD deficient by quantitative testing

‡Drug options for chloroquine-resistant *P. falciparum* may be used