Republic of Uganda, Makerere University Development Data

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This report was developed by the Ugandan National Malarial Control Programme (NMCP), Ministry of Health Uganda in partnership with Medicines for Malaria Venture (MMV), Child Health and Development Centre, Makerere University, and Development Data. The NMCP requested support from MMV for the production of a report that would provide insights on how to improve current severe malaria case management practices at level III and IV health centres in Uganda. The rapid assessment documented in this report provides a quick outline of insights on how severe malaria case management can be improved. The NMCP and MoH of Uganda has consented to place this report in the public domain via the Severe Malaria Observatory and to be shared among partners.

List of Acronyms

ACT	Artemisinin-based combination therapy
AIDS	Acquired immune deficiency syndrome
ANC	Antenatal care
ART	Antiretroviral therapy
CRD	Chronic respiratory disease
DBS	Dried blood spot
DTP	Diphtheria, Tetanus, Pertussis
EPI	Expanded programme on immunization
FGD	Focus group discussion
HC	Health Center
HIV	Human Immunodeficiency Virus
HMIS	Health management information system
IMEESC	Integrated management for emergency and essential surgical care
IMCI	Integrated management of childhood illness
IPT	Intermittent preventive treatment
ITN	Insecticide-treated bed nets
IV	Intravenous
MDR-TB	Multi-drug resistant tuberculosis
MNCAH	Maternal, neonatal, child, and adolescent health
NCD	Non-communicable disease
ORS	Oral rehydration solution
PMTCT	Prevention of mother-to-child transmission
RDT	Rapid diagnostic test
SARA	Service availability and readiness assessment
STI	Sexually transmitted infection
TB	Tuberculosis
UDHS	Uganda demographic and health survey
UNICEF	The United Nations Children's Fund
UNFPA	United Nations Population Fund
USAID	United States Agency for International Development
VTS	Voluntary Testing Services
WHO	World Health Organization

Contents

Executive Summary

The National Malarial Control Programme (NMCP), Uganda commissioned this rapid assessment to gather evidence to help improve management of severe malaria, especially at the primary levels of the health delivery system. This follows the adoption of injectable artesunate (Inj AS) as a first-line treatment for management of severe malaria in both children and adults; and the further expansion of management of severe malaria in children to include the use of rectal artesunate (RAS) as a pre-referral intervention. The rapid assessment explored how Uganda can enhance case management of severe malaria at primary level health facilities (III & IV) which are closest to communities and should serve as the first point of contact for health services for many people.

The objectives of the assessment were to explore the capacity of severe malaria service delivery at selected primary level health facilities, identify challenges and opportunities for improving service delivery and provide recommendations on how identified gaps can be addressed.

The assessment was limited to 13 health facilities, including six level IV, six level III health centres and the Children's Ward of Jinja Regional Referral Hospital (JRRH). Data used in the assessment was collected using multiple methods, including literature review, an audit of health facilities, and qualitative methods including health facility staff interviews, key informant interviews with village health teams, community level focus group discussions (FGDs), and consultation meetings with district and national stakeholders.

Results

Staff were performing the expected functions across all 13 health centres visited, including triaging patients, diagnosing and treating. Level III health facilities had shorter waiting times on average (between 5 and 30 minutes), while waiting times for some Level IV facilities were reportedly more than 2 hours. The quality of service provided by Level III facilities varied.

With regards to severe malaria management, most facilities mentioned that they had staff who had been trained in malaria microscopy or the use of RDTs. Most staff mentioned having received some form of training on Inj AS, while staff from only four of the 13 facilities mentioned that some training had been received for using RAS. Many were not aware of any training on RAS, nor on its use as pre-referral intervention. It was difficult to establish if a structured continuing medical education (CME) programme existed for health facility personnel in the four districts that were visited.

The first-line treatment for complicated malaria was mainly reported as Inj AS, however some health workers preferred to use quinine to artesunate. In many cases, stock outs were common; Inj AS was not available in three facilities and RAS was only available at three facilities. Shortages were attributed to irregular supply, especially at level III centres where the amount of stock is pushed out to health facilities in pre-determined amounts rather than requested based on need.

Discussion

The policy framework for the management of severe malaria in Uganda seems to be enabling adequate case management. However, results from this assessment point to critical gaps. The most important gap relates to policy guidance on which level should manage which manifestation of severe malaria,

resulting in variations in the range of services offered between and within level III and IV health facilities. Policy advises that Inj AS be used only at level IV health centres, but was also found at level III health centres.

Basing on the observed staffing levels, equipment and drugs available, both level III and IV facilities managed limited cases of severe malaria, and both referred cases they could not manage. However, results show limited knowledge on pre-referral interventions at level IV facilities, although these facilities both receive referred cases and refer those they cannot manage. Our results suggest that RAS is required at level IV facilities and all levels below it, and Inj AS may be required at both levels III and IV.

Improvements in drug supply and monitoring are possible. The assessment results show that commodities required for treating severe malaria were not consistently supplied as required. Stock outs of malaria diagnostic commodities (reagents, blood transfusion, glucose sticks, RDT kits, malaria blood slides etc) were interfering with the management of severe malaria.

Lastly, facility level data on caseload, morbidity and mortality show that malaria fatalities increase as one goes up the levels of the health delivery system, which was largely related to a suboptimal referral system. Referred cases of severe malaria are resulting in the fatalities, and associated failure to manage cases at primary levels of the health system could be contributing to delays that result in the deaths.

Conclusion

Our assessment concludes that the case management for severe malaria at levels III and IV in Uganda, has room for improvement. Inj. AS has reached both types of facilities, but without adequate support in terms of training, reference materials and referral. RAS is currently placed at level III centres but could also be beneficial at level IV.

Recommendations

1. NMCP should consider updating treatment guidelines and protocols to provide clarity on the range of severe malaria conditions that should be managed at level III and IV facilities; by:
    a. Ensuring adequate guidance
    b. Ensuring that there is capability to provide a minimum set of services.
    c. Rethinking and exploring the most appropriate positioning of RAS.
    d. Working closely with the National Medical Store (NMS) to ensure consistent supply of commodities required for the treatment and pre-referral management of severe malaria patients.
2. The Ministry of Health should urgently ensure that the minimum set of services stipulated in the national treatment guidelines is capable of being met by these facilities. This includes ensuring facilities can provide necessary services required for treatment and supportive care. District Health Offices should draw up or update their plans for in-service training to include all the aspects of severe malaria as per treatment guidelines. This should include the administration and management training for lead persons at each health facility.

3. The Ministry of Health should review the existing referral system for severe malaria with a view to strengthening it. This includes exploring the appropriate balance between contributions from health facility users and the government.
4. As a strategy to reducing fatalities associated with severe malaria, the NMCP should urgently promote measures to ensure that level III and IV health facilities strengthen their management of simple malaria, as well as engage with the National Drug Authority (NDA) to ensure that the drug distribution system works efficiently.
5. To achieve the reduction in mortality rates for severe malaria, Ministry of Health, NMCP and stakeholders should start prioritizing severe malaria death auditing.

1. Introduction and background

1.1 Introduction

Globally, malaria was responsible for an estimated 429,000 deaths in 2015, despite drastic reductions in mortality rates between 2010 and 2015.[1] A significant proportion of these deaths occurred in sub-Saharan Africa, where most countries are classified as endemic for malaria. Uganda falls under this classification which affects approximately 90% of the country's population.[2] The Global Technical Strategy (GTS) milestone for malaria for[3] 2020 includes a 40% reduction of malaria related deaths, which will require a greater focus on severe malaria[4] case management. Severe malaria typically occurs due to delayed treatment of uncomplicated malaria and is defined by clinical or laboratory evidence of vital organ dysfunction.

Malaria in Uganda is a disease of serious public health concern. Nearly all infections are attributable to *P. falciparum,* the most virulent species of Plasmodial species that cause disease in humans. The impact and cost of malaria on the people and economy of the country is significant.[5] The country has the sixth highest number of malaria deaths in the world, with as many as 16 million cases reported annually, resulting in over 10,000 deaths. Costs of care alone can be as high as US$3.88 per person per month, and an average household uses about 3% of its income to manage each episode of malaria. Additional costs are incurred at individual, household, community and national level to prevent malaria.

Uganda has made significant progress in managing cases of malaria, including severe malaria. However, there is an urgent need to ensure that severe malaria case management is improved further. Clinically diagnosed malaria remains the leading cause of morbidity and mortality, accounting for 30-50% of outpatient visits at health facilities, 15-20% of all hospital admissions, and up to 20% of all hospital deaths.[6]It is assumed, although there is no data available, that a high percentage of malaria deaths occur at home but are not reported.

Recently, severe malaria case management practices have been subject to considerable improvements, including the adoption of injectable artesunate (Inj AS) as a first line treatment for the management of severe malaria in both children and adults. Additionally, in situations where optimal care for severe malaria cannot be availed, rectal artesunate (RAS) has been adopted as a pre-referral intervention. In 2011, the NMCP, Uganda adopted Inj AS as the first line treatment for severe malaria in children and adults, with actual implementation of the policy taking place in 2013.[7] As a result, through training and

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[1] WHO World Malaria Report 2016
[2] Ministry of Health Uganda, 2017
[3] WHO Global Technical Strategy for malaria 2016-2030.
[4] See https://www.severemalaria.org/severe-malaria/what-is-severe-malaria
[5] Government of The Republic of Uganda, Ministry of Health, Uganda Malaria Reduction Strategic Plan 2014-2010.
[6] Ministry of health, Republic of Uganda (2017). National Malaria Control Program. Available on: http://health.go.ug/programs/national-malaria-control-program
[7] David Sears, Ruth Kigozi, Arthur Mpimbaza, Stella Kakeeto, Asadu Sserwanga, Sarah G Staedke, Michelle Chang, Bryan K Kapella, Denis Rubahika, Moses R Kamya and Grant Dorsey; 2013, Malaria Journal 2013Journal2013, Anti-

modifying the commodity supply chain, efforts have been directed at improving severe malaria case management practices at level III and level IV primary health centres, where the capacity increases with increasing levels, and at higher level health facilities based on the new treatment guidelines.

1.2 About the rapid assessment

This rapid assessment was commissioned by NMCP to determine the capacity and management practices at primary levels of the health care system. It was undertaken by a team of eight researchers[8] and four assistants. The assessment was planned as an activity of the NMCP and implemented within three weeks to explore how Uganda can enhance case management of severe malaria at primary level health facilities (III & IV). Ethical approval for this study was obtained from the Ministry of Health, Vector Control Division, Research and Ethics Committee University.

This assessment was designed to provide much-needed insights into case management of severe malaria at the primary levels of the health system in Uganda. In keeping with Uganda Malaria Reduction Strategic Plan 2014-2020, the Ministry of Health through NMCP seeks to reduce by 2020 annual malaria deaths from the 2013 levels to near zero. By end of 2018, Uganda seeks to achieve and sustain that at least 90% of malaria cases in the public and private sectors and community level receive prompt diagnosis and treatment. The Ministry has set as priorities the review of the policy for severe malaria case management at primary level centres to provide guidance on management at these and other different levels of health care system.

Rationale of the assessment

Current severe malaria treatment guidelines are ambiguous as to where patients with severe malaria should be managed, although they indicate that patients with severe malaria be availed treatment at the earliest opportunity depending on a facility's capability[9]. Therefore, there is an urgent need to clarify where and how severe malaria can best be managed, particularly at primary level facilities where the capacity to manage severe malaria remains uncertain. National and regional public hospitals, where care for severe malaria is most optimised, are often situated far apart and need to rely on a functional referral system to serve distant communities. According to the 2014 Uganda Hospital and Health Facility 4 Census Survey, "there were 147 hospitals and 188 Level IV primary care facilities in Uganda – representing about one hospital and HC Level IV for 100,000 people".[10] The radius of 100,000 people can leave excessive travel times for much of the population, especially those that use level III and II health facilities as the first point of care. Even then, most health facility Level IVs (96% in 2014) indicated that they referred patients to the next higher level, leading to additional travel time and costs[11]. Given the great distances that patients may travel and the rapid progression of the disease, there is a need to

malarial prescription practices among outpatients with laboratory-confirmed malaria in the setting of a health facility-based sentinel site surveillance system in Uganda. Available at https://malariajournal.biomedcentral.com/articles/10.1186/1475-2875-12-252

[8] The team comprised a team leader (from Development Data), lead researcher (from Makerere University), two malaria programme response experts (from NMCP); two senior clinical officers (from Jinja Regional Referral Hospital), a malaria adviser (from Development Data); and a technical support official from MMV.

[9] Uganda Clinical Guidelines 2016 & Malaria treatment policy

[10] Uganda Hospital and Health Facility IV Census Survey 2014. Uganda Ministry of Health.

[11] Uganda Hospital and Health Facility IV Census Survey 2014. Uganda Ministry of Health.

better equip primary level health facilities with the ability to properly manage or refer patients presenting with severe malaria.

Additionally, quality of care at facilities below level IV is limited by their functional capacity, among other factors. Levels I to IV are a tiered system of health centres which are closer to the community and handle a range of services from community outreach (Level I or village health teams- VHTs) to caesarean section (Level IV). Currently, the minimal amount of services that can be provided at primary level facilities foregoes the potential for early treatment or care of severe malaria patients. Furthermore, Uganda's referral system is weak and patients often delay seeking care or ignore secondary or tertiary care due to high costs involved. To overcome this system challenge, evidence is needed to support the hypothesis that there is potential to introduce case management of severe malaria at primary level facilities that are closer to communities, especially at level III.

The objectives of the assessment were to:

1. Explore the capacity of severe malaria case management at primary level health facilities (LIII, LIV) , and identify severe malaria knowledge and practice gaps among health workers
2. Explore care-seeking practices of patients with severe malaria
3. Identify challenges and opportunities for improving service delivery at primary levels
4. Provide recommendations on how identified gaps can be addressed

2. Rapid assessment methods

2.1 Framework for assessment

This assessment was conducted as a rapid assessment.[12]The Ugandan Clinical guidelines (based on WHO guidelines for case management of severe malaria) were adopted as the standard against which assessments were made. Severe malaria was defined as occurrence of one or more complications from the disease as defined by WHO[13], in the presence of *P. falciparum* asexual parasitaemia (see table in Annex 1), and upon exclusion of alternative causes of similar syndromes.

2.2 Data collection methods

Data used in the assessment was collected using multiple methods, including literature review, an audit of health facilities, and qualitative methods including health facility staff interviews, key informant interviews with village health teams, community level focus group discussions, and consultation meetings with district and national stakeholders).

A modified version of the Ministry of Health, Uganda Clinical Audit Tool for severe malaria was adapted to assess each health facility. The WHO guidelines on management of severe malaria were used as the "standard" against which assessment findings were compared. Assessments were made on each facility's capacity (personnel, drugs, equipment and training) to manage common forms of severe malaria as defined in the 2016 Uganda Clinical Guidelines.

2.2.1 Facility Audits

An audit of the capacity of each health facility in the management of severe malaria was conducted. The assessment checked the availability of a range of competencies, medicines and commodities that are required to manage severe malaria. The range of drugs and commodities included Inj AS, RAS, intramuscular (IM) artemether, intravenous (IV) quinine, artemisinin-based combination therapies (ACTs) tab quinine, tab paracetamol, IV diazepam, Rectal diazepam, IV phenobarbitone, IV dextrose 50%, IV dextrose 5%, normal saline, ringer lactate, and lubricant jelly.

Laboratories at health facilities were assessed based on the expected standards that would enable personnel to manage cases of severe malaria and this included: 1) whether health personnel had been trained in malaria diagnostic procedures and met the qualifications to perform a malaria RDT and microscopy in the past 2-3 years, 2) whether the laboratory had an External Quality Assurance (EQA) certificate, 3) ability to test for Haemoglobin levels, and 4) the presence of a fridge for blood storage,.

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[12] Rapid assessment is defined as intensive, team-based qualitative inquiry using triangulation, iterative data analysis, and additional data collection to quickly develop a preliminary understanding of a situation from the insider's perspective. See for example, http://methods.sagepub.com/reference/sage-encyc-qualitative-research-methods/n365.xml

[13] The list includes cerebral malaria; severe anaemia; respiratory distress; hypoglycaemia; circulatory collapse; renal failure; spontaneous bleeding; repeated convulsions; acidosis; haemoglobinuria; pulmonary oedema; and/or supporting manifestations: impaired consciousness; jaundice; prostration; severe vomiting; severe dehydration; hyperpyrexia; threatening abortion.

2.2.2 Qualitative methods

The information gathered from the health facility audit was augmented using semi- structured key informant interviews (KIIs) with health personnel in charge of the facilities. At the community level, KIIs were conducted with village health teams (VHTs). Focus group discussions were conducted with up to eight members of each community served by an health facility included in the assessment. A focus group session was conducted at sub-regional level with representatives from participating health facilities to triangulate findings from the health facilities. This was followed by a national level meeting where a broad base of malaria stakeholders (Government, UN, NGOs and private sector) was invited to share initial findings and discuss recommendations.

2.3 Health facilities included in the assessment

Coverage was limited to a carefully selected geographical area located in the Busoga sub-region, equivalent to the East Central region of Uganda. The assessment was conducted at 13 health facilities, including six level IV, six level III health centres and the Children's Ward of Jinja Regional Referral Hospital (JRRH). The facilities that were assessed are found in 4 districts in the Busoga sub-region (Figure 1), an area with very high malaria prevalence at 53.1 % (Ref UDHS 2016). Preliminary review of health facility census and HMIS data guided the choice of health facilities that were assessed. This information was also used at inception to develop a comprehensive field schedule and tools. Sensitisation meetings with national and district level health personnel were conducted at that stage.

Figure 1: Map showing Location of assessment districts and facilities.

2.4 Assessment reach

The range of people met is presented in the table below.

Table 1: Range of stakeholders informing the rapid assessment

Respondent	Details of data collected	Number of respondents met
Health facilities	Audit of personnel, laboratories, drugs and equipment.	30
Health facility staff interviews	KI interview with health workers, in charge of facilities, DHOs, clinical officers, and Health Information Assistants	15
Village health teams	Key informant interviews with VHTs in LIII, LIV health centres surveyed	10
Community level	FGDs with up to eight men, women and community leaders in from each facility visited	40
District stakeholders	Consultation meeting with DHOs, personnel in charge of health facilities, and VHTs	15
National stakeholders	Consultation meeting with stakeholders, including NMCP, MoH, UNICEF, UNITAID, USAID, CDC, WHO, CHAI etc.	20

3. Findings

3.1 Malaria morbidity and mortality in the assessed facilities

The assessment began by exploring uncomplicated and severe malaria caseloads at surveyed facilities for the year 2016. Data collected included: 1) total attendance, 2) malaria outpatient cases, 3) referrals, 4) admissions and 5) deaths from the six level III and six level IV facilities (see Table 4 and Table 5 in the Appendix). The proportion of outpatient malaria cases was generally high at Level III and IV centres; highest at Butagaya HC III for patients aged 0-4 years (82.1%) and above five years (74.1%), and lowest at Bupadhengo for both age categories (32.9% and 25.7% respectively). The proportion of malaria cases ranged between 61% and 78% for level IV centres.

For malaria admissions the total number of malaria admissions varied by type of facility and, as expected, was highest at level IV health centres in Jinja RRH (3,550) followed by Nankandulo (2,910) and Namwendwa (1,777). The number of admissions was lower at level III health centres, including Irongo (35) and Mayuge (131). Of all admissions, the proportion of deaths attributable to malaria was generally low at all sites (< 3%) with the exception of Kigandalo (10.6%) and Kityrera (11.2%) – both Level IV centres. At Jinja hospital, the proportion of deaths was 3.5%

The findings show that Level III health centres received as many malaria cases as level IV, and both types of facilities had few referrals coming in and out. However, Level IV facilities were admitting significantly more cases, and recording higher numbers of deaths; while level III facilities were referring out higher numbers of patients.

3.2 Staffing levels

We collected information on types of staff that were present at each health facility to confirm if the actual staffing level conformed to approved norms. Staffing levels at the 12 level III and IV facilities that were visited were largely consistent with approved norms. In all the level III facilities visited, there was 100% availability of the highest ranked officer (2 clinical officers each), while there was at least one of the expected two medical officers in 5 of the 6 Level IV facilities visited (see table 6 in the annex). There were some exceptions, such as Namwenda health centre IV that did not have a medical officer and some that seem to be overstaffed, such as Mayuge with 12 nurses instead of the approved 6.

In all of the centres visited, staff were performing expected functions, including triaging patients, diagnosing and treating. Functional triage systems were in place in all the 13 facilities visited. Based on patient reports, Level III health facilities had shorter waiting times on average (between 5 and 30 minutes), while waiting times for some Level IV facilities (Kiyunga, Nankandulo, Namwendwa and Kityerera) were reportedly more than 2 hours. Even for serious cases that were triaged appropriately, waiting times for actual care was lengthened by the time taken to perform tests before treatment could be provided.

The quality of service given in Level III facilities varied per facility. Some of the challenges at facility level related to differences in administrative approaches. Where the facility had a good administration and leadership, drugs and commodities tended to be available all the time, and health workers seemed happy to provide treatment services. Poor facility administration in some facilities visited was mentioned as a major reason for drug stock-outs and poor relationships with communities.

Health service access was impacted by the operational hours of all facilities that were visited. On paper, level III and IV centres are designed to open 24 hours a day, but in practice, staff availability outside working hours was significantly reduced to one or two health workers on standby (this may be the expectation) to receive and handle emergency cases only. Staffing levels were reportedly much lower at night and during weekends, limiting the number of severe malaria cases that could be managed. Outside normal working hours, health personnel prioritised maternal emergencies.

3.3 Training and capacity development

Jinja District's Health Master Plan for 2017 acknowledges the high "availability of competent, skilled and qualified staff" in most positions. It also mentions the development level of the human resource department and use of an annual reward system as strengths. However, the same masterplan points out some weaknesses in appraisal systems and inadequate funding to retain skilled personnel. It mentions limited in-service training, especially at the primary levels.

Problems that are mentioned in district masterplans were confirmed during the health centre visits. With regards to severe malaria management, most staff had received training in administering Inj AS (IV or IM) and malaria diagnosis. Ten out of 13 facilities mentioned having received some form of training on Inj AS. Only 4 facilities, all level III, mentioned that some training had been received for RAS. None of the level IV centres mentioned training in use of RAS. Discussions with health personnel at Level IV centres showed that many were not aware of any training on RAS, nor on its use in pre-referral intervention. Staff in 8 centres had been trained in Inj AS administration and use over the past 3 years. However, one level III (Wabulungu) and one Level IV (Kigandalo) mentioned that none of their staff had

ever been trained. These two centres mentioned that Inj AS had been provided and staff learnt how to use the medicines on the job. All but one facility had been trained in use of Malaria RDTs and microscopy.

It was difficult to establish if there was a structured continuing medical education (CME) for health facility personnel in the four districts that were visited. Laboratory personnel, for example, mentioned in 11 of the 13 centres that they based their practice on knowledge gained from school or on the job self-training using their own resources. Most staff had not undergone re-fresher training in management of severe malaria based on the new treatment guidelines. Similarly, most lab personnel had not undergone formal training in malaria microscopy and RDT.

When asked how staff were coping without adequate training, most depended on "on the job training" or on self-training using the most current version of SM Malaria Treatment Charts (where available). Despite the apparent absence of structure or coordination of training, most health workers demonstrated knowledge on how to use severe malaria medicines. In three different centres, health workers mentioned that they relied on studying the information leaflets that accompanied the drugs. In 6 centres, clinical officers and some nurses mentioned that they felt adequately capacitated to administer IV artesunate because they were able to refer to the national guidelines or the internet (where they could check the WHO website).

3.4 Availability of reference materials

The Uganda Clinical Guidelines 2016 (pg 198) and Integrated Management of Malaria Manual 2015, give guidance to health workers on management of severe malaria, including management of complications. Health workers are expected to have access to these documents for reference at each health facility, and consult these documents when in doubt or when clarity is required. However, these reference materials were largely not available in any centres. Seven out of 13 centres had clinical guidelines, 4 out of 13 centres had the most current versions of the uncomplicated malaria treatment charts, 6 out of 13 had the most current versions of the severe malaria treatment charts, and only one had the most current versions of integrated management of malaria (See table 7 in the Appendix). One Level III (Bupadhengo) and two level four centres (Budondo and Kiyunga) did not have any reference materials at all. To administer drugs correctly, staff in these centres relied on the internet and leaflets enclosed in medicine packaging and oral information among health workers. Regardless, staff demonstrated high knowledge levels of treatment options.

Table 2: Availability of reference materials

Health Centre	Most current version of UM Malaria Treatment Charts	Most current version of SM Malaria Treatment Charts	Most current version of Integrated Management of Malaria	Clinical guidelines
Level IV Health Centres				
Butagaya	x	x	√	√
Irongo	x	x	x	√
Mayuge	√	√	x	√
Wabulungu	√	√	x	√
Bupadengo	x	x	x	x
Kitayundwa	x	√	x	x

Level IV Health Centres				
Budondo	x	x	x	x
Kiyunga	x	x	x	x
Kityerera	x	x	x	√
Kigandalo	x	√	x	√
Nankandulo	√	√	x	√
Namwendwa	x	x	x	x
Jinja RRH	√	√	x	√

√= Available; **x**= not available

3.5 Treatment of severe malaria

3.5.1 Reported treatment practices

We checked the availability of essential drugs for managing uncomplicated and severe malaria. For uncomplicated malaria, the first line treatment was correctly reported as ACTs (Coartem® [artemether-lumefantrine] in particular) by virtually all health workers. The first line treatment for complicated malaria was reported as Inj AS (inj. Quinine as alternative) by staff in 11 of the 13 centres. Health workers in 11 out of 13 centres reported using Inj AS during pregnancy (given in all the trimesters). Other malaria treatment options mentioned include artemether, and RAS. In one health facility, staff seemed to suggest that RAS could be used for both uncomplicated and severe malaria, and that it could be used interchangeably with IV artesunate. In two centres, some health workers preferred administrating quinine instead of artesunate and believed it to be more effective than Inj AS in children. In these centres, Quinine was administered with 5% dextrose to counteract hypoglycaemia, especially in minors per guidelines[14]. Supportive treatment included paracetamol, multivitamins and septrin in case of a co-infection.

There were instances where health personnel favoured quinine over artesunate (even though artesunate was the first line regimen with Quinine as the alternative). Centres which preferred quinine had the dextrose 5%. These health workers reported giving Inj AS in the last two trimesters of pregnancy only.

Manifestations such as hyper-parasitaemia, multiple convulsions and jaundice were managed at level III centres while coma (BCS $\leq$ 2), respiratory distress, shock, pulmonary oedema and abnormal bleeding could not be managed. At Level IV centres, impaired consciousness and prostration could be managed, however cases of comma, respiratory distress, shock, pulmonary oedema and abnormal bleeding are difficult to manage at level IV centres and below, unless the relevant equipment and supplies are in place (see table 8 in the appendix). Laboratory equipment and supplies thus further limit the range of conditions that can be managed at level III and IV centres.

RAS (50mg) was found at Butagaya and Wabulungu (level III centres) where it was used as pre-referral intervention as well as a starting dose in treating severe malaria cases presenting convulsions.

[14] WHO Model Prescribing Information: Drugs Used in Parasitic Diseases - Second Edition, 1995.

Knowledge on RAS and its usage at these centres was high, more than at level IV where it is currently not dispensed.

Figure 2: Sample of RAS available at level III centres

From the focus groups, it was established that many patients do not complete dosages and often stop treatment when they feel better. In some cases, malaria was not completely treated, and became severe. Left over drugs are kept for future use, or shared.

3.5.2 Availability of severe malaria drugs and commodities

The assessment team checked the availability of several essential uncomplicated and severe malaria medicines. First line treatment for uncomplicated malaria was available in all centres. For severe malaria, however, Inj AS was not available in two level III and one level IV facility. Blood transfusion equipment and oxygen were not available at any of the level III centres. Two level IV centres did not have this equipment, although they should be equipped according to national recommendations. RAS was available at two level III centres and at the medical store of Jinja Regional Referral Hospital. IV diazepam was available at all level IV centres and in two level III centres. One level IV facility, Mayuge, had run out of both Inj AS and RAS, and did not have IV or rectal diazepam. This facility did have ACT tablets (*Coartem*) and tabs Quinine, but had run out of items such as paracetamol, IV cannula and fluid giving sets.

Table 3: Availability of selected Severe Malaria drugs

Item	Level III (N= 6 centres)	Level IV (N= 6 centres)	Jinja Referral Hospital (Children's wing only)
IVArtesunate	67%	83%	Yes (at the store)
Rectal Artesunate (50mg)	33%	0%	Yes (at the store)
IM Artemether	0%	0%	Yes (at the store)
IV Quinine	0%	0%	Yes (at the store)
ACT tabs (Coartem, etc)	100%	100%	yes
Tab Quinine	83%	83%	yes
Tab Paracetamol	83%	83%	yes
IV Diazepam	17%	100%	yes
Rectal diazepam	50%	67%	yes
IV Phenobarbitone	0%	17%	no
IV Dextrose 50%	83%	100%	yes
IV Dextrose 5%	83%	100%	no

Normal Saline	83%	100%	yes
Ringer lactate	50%	83%	yes
Lubricant jelly	0%	50%	no
Oropharyngeal tubes	0%	17%	yes
NGT	0%	33%	yes
Oxygen	0%	67%	yes
IV cannula	83%	100%	yes
Fluid giving sets	67%	83%	yes
Blood giving set	0%	83%	yes
Drip stand	83%	100%	yes

The assessment's results show that essential severe malaria drugs as outlined in the Uganda Essential Medicines and Health Supplies List (2016) were not available in some of the health centres that were assessed. In many cases, stock-outs were common. Discussions with health workers revealed that there are several issues with drug availability. Shortages were attributed to an irregular supply, especially at level III centres where the amount of stock is pushed out to health centres rather than requested based on need. At this level, health personnel reported a common practice for community members to come for malaria treatment as soon as they knew that a delivery of drugs had been made. Patients would report malaria-like symptoms even if an RDT or microscopy would not confirm as such. This practice, aimed at obtaining drugs for future use, was quite common and leading to artificial shortages of essential medicines. Some health workers respond by telling patients that they were out of drugs even when they had them, risking strained relations between communities and health care workers and reducing trust in the health delivery system.

3.5.3 Availability of lab equipment

A check list on availability of basic equipment required at the triage centre showed that in Level III Centres, thermometers, glucometers and suction equipment were generally not available, or if available not in a working order[15]. Six centres had functional glucometers, but most of these did not have glucose strips. All centres offered malaria testing services using either microscopy or RDT. Haemoglobin testing was available at nearly half of all centres. Blood transfusion service were not available at any of the level III health centres. However, two level III centres offered blood grouping services. Two level IV centres, Budondo and Kiyunga did not offer blood transfusion services.

3.6 Referral of cases of severe Malaria

3.6.1 Referral from the community

The referral system for cases of severe malaria starts at the community level where the decision to seek care often rests with the head of the household, usually the male. Women that participated in focus group discussions reported that they would need to seek permission from their husbands to take a sick child to the health facility. In emergency cases that occur when the husband is absent, however, they go without the permission. Delays at the community level were reported to be common, as elaborated by

[15] A glucometer that did not have glucose strips was regarded as not functional.

one village head: when the husband is away, cases of uncomplicated malaria can deteriorate before a woman can make the decision to take the child to a health facility.

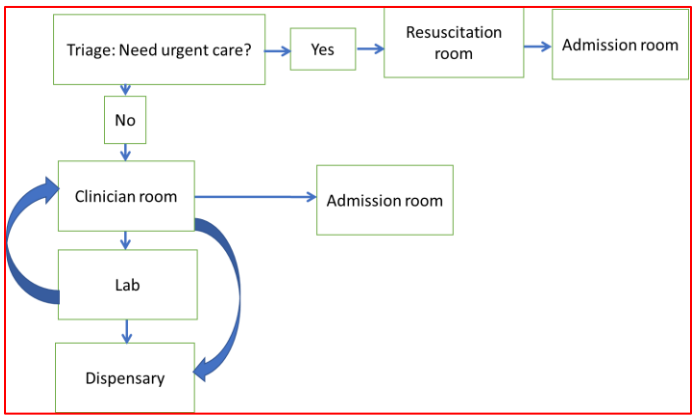
VHTs assist in the identification of cases and refer clients with severe malaria to health centres. Discussions with these community members pointed to several issues that hinder the smooth functioning of the referral system between community and health facility. Many community members did not have ready access to a motivated VHT, and this sometimes led to uncomplicated malaria progressing to severe malaria. Where there were recent stock-outs of drugs at a facility, patients with uncomplicated malaria tended to seek treatment using traditional medicines or from community drug pharmacies, thereby increasing the chance of developing severe malaria.

Community members raised several misconceptions, showing that apparent high knowledge levels were not transforming to a change in behaviour and practice. FGDs revealed that communities widely use traditional responses to the management of severe malaria. In the case of convulsions, for example, they use onions while others apply sugar to the skin and give a sugar solution to control hypoglycemia. Often, households first use freely available herbs for treatment and only consider formal healthcare if the situation becomes worse. Management of fever (by use of wet towels) was common and often accompanied by referral to a health facility.

> *According to a community member, "If I go to the facility at 8 am, I find that there is a delay at outpatients, a delay at the testing point and a delay at the dispersing point. So, I have to plan to be at the facility for the whole day. At the community drug shop it is instant service. The drug shops are nearer so there is no cost of transport."*

Data from the HMIS shows that referrals 'in' and 'out' of health centre level IIIs were low (<1% of all attendances) at all sites and across all age categories. This pattern was similar for Level IV health centres which referred in and out less than 2% of cases. Health Facility Level IIIs receive most patients by self-referral from communities. This was confirmed in the 6 Level III centres visited, where very few patients were referred from VHTs or Level II health centres. Discussions with health personnel at district level revealed that several level III health centres did not admit patients due to limited space and beds and the few admission beds were usually reserved for pregnant women. Severely ill patients were referred to higher level centres, attracting further delays and costs. Community members cited this problem as contributing to delays in seeking care. The general approach that was observed at the health centres is presented below.

Figure 3:Observed actions at the health facility



Level IV health centres referred patients to the relevant hospitals (district hospitals and the Regional Referral Hospital). Staff at level IV centres pointed out that several patients self-referred to private centres due to stock-outs of critical supplies such as blood and long waiting times at hospitals. The quality of care at private centres was regarded as varied, and Jinja RRH staff pointed out that some of their most severe cases were referrals from private health providers. Most private centres are not an affordable option.

4. Discussion

4.1 Severe malaria case management policy issues

The results from this assessment confirmed critical gaps in the policy framework for the management of severe malaria in Uganda. Foremost, there is a lack of guidance on how various manifestations of malaria should be managed at the various levels of the health system in the Uganda Clinical Guidelines (2016). The policy statement details the approaches for case management and recommends referral of any complications that cannot be managed locally. This blanket approach to management, though attempting to cater for facilities without capacity to manage malaria, could easily be abused by the very centres without capacity to manage severe malaria. Based on our assessment we noted that some primary level facilities can manage some forms of severe malaria. It is evident that treatment of severe malaria using Inj AS is happening at level III health centres, but with some limitations. Based on the staffing, drug availability and equipment capacity, severe malaria cases presenting multiple convulsions and jaundice can be managed at Level III health centres. This indicates that policy could potentially be extended from the current recommendation of level IV centres to include the management of severe malaria at level III centres, given correct training, guidance and necessary commodities and supplies.

The national guideline and protocols also fail to make clear recommendations with regards to the placement of pre-referral intervention at primary level centres. The results show limited knowledge on pre-referral intervention at level IV centres although these centres receive referred cases and also refer out cases beyond their capacity. Two level III centres have been recorded as administering RAS, both as a pre-referral and as a starting dose, which suggests that policy should either offer guidance to both level III and IV level centres in RAS use, or issue corrective action to limit RAS use for pre-referral intervention. Given challenges with the referral system and associated delays, adjusting policy and support to promote RAS use in primary level centres could improve outcomes of patients that are referred to centres located far from their first point of care.

Another policy disconnect relates to the different order systems that exist for essential drugs between level III and IV health centres. Level IV centres have more human resource capacity and are thus able to manage their inventory system and order essential drugs (pull system). Level III and primary level centres largely rely on a push system and as a result, these centres often experience stock-outs of Inj AS and RAS, likely due to the 3-month fixed supply cycle, and artificial shortages associated with hoarding. Adjusting policy to allow for a pull system in level III centres, either by partnering procurement with level IV centres or independently, may improve the supply situation in level III centres and alleviate the lack of trust that was recorded between patients and primary level health centres due to hoarding. However, this discussion required input from district level health planners who have adequate insights into what is required for each facility.

Lastly, while mortality rates were recorded by health centres, there was no additional information available about these deaths (final cause and circumstances). The health policy stipulates a requirement for maternal death audits, but there is no mandatory requirement to audit severe malaria deaths unless they occur in pregnant women. This limits the ability of this assessment, limits the ability for the NMCP and other stakeholders to make appropriate analyses on malaria related death and results in severe malaria cases receiving little attention. For example, we established that at level III health centres,

admission beds were reserved for maternal emergencies while severe malaria cases were referred. Altering this mind-set and increasing the emphasis placed on severe malaria mortality could persuade health centres to devote more resources to these patients.

Importantly, alongside the guidance given in policy, it is essential to ensure that health centres are following through with the necessary support and follow-up. For example, although health policy stipulates waiting times of less than 30 minutes for emergencies, including severe malaria cases, there is evidence that health centres are not giving the necessary priority to such cases and this may lead to unnecessary deaths. In both level III and IV centres, health personnel mentioned that waiting times were within the stipulated 30 minutes for severe malaria cases, but patients at higher levels of the delivery system disagreed. The significant differences in reported waiting times between Level III and Level IV centres points to the challenges associated with the management of severe malaria: patients experience more delays at the higher levels of the health system where severe malaria can be managed adequately. Careful planning and management of cases at primary levels is needed to increase efficiency and reduce the case load at higher levels of the system.

4.2 Placement for injectable and rectal artesunate based on capacity

Injectable AS was available at level III and IV health centres, however there were clear variations in the range of services offered between and within these health facility categories. According to WHO recommendations, manifestations that cannot be managed by a health facility should be referred upwards, with the opportunity for provision of pre-referral intervention with RAS if the length of time it takes to get to the referral centre is over 6 hours. Following the design of the Ugandan health system, level IV centres should be able to transfuse blood and therefore manage severe anaemia, although we found out that even when this is the approved norm, the services may still not be available. Regardless, conditions such as acidosis and renal impairment require hospital (Level V) care. Considering these WHO recommendations and looking at practical evidence, RAS should be required at Level IV downwards, with Inj AS required at levels III and IV.

FGDs confirmed that severe malaria cases were being identified by some iCCM-trained VHTs at the community level as well. Although level II health centres were not covered in this assessment, they manage cases of uncomplicated malaria and refer severe cases and use of the recommended pre-referral intervention. If the government could ensure sensitization of the primary level health workers and VHTs to the current guidelines of managing pre-referral patients with severe malaria, RAS could carefully be made available at these levels as well, taking due care that it is strictly used for pre-referral intervention only.

The way the health system is designed, level IV health centres should serve a population that is five times bigger than that of a Level III centre (100,000 vs 20,000 people respectively.) Data from the assessed centres does not seem to support this design, as some Level III centres such as Kitayundwa received more outpatient attendances than some Level IV centres. In fact, the average number of outpatient attendances in Level IV and Level III centres visited were similar, indicating possible similarities in numbers of severe malaria cases that are handled. The distribution of patients (and the suspicion that more severe cases were opting for Level IV care) could explain why there are longer waiting times at level IV centres - a problem that can be resolved if more capacity is developed for level III centres.

4.3 Training and capacity development

The absence of continuing medical education covering severe malaria could be impacting case management negatively. There seems to be a knowledge and skills gap in the management of severe malaria and its complications, especially at level III and IV centres. Training of health facility staff does not seem to have been coordinated for all areas of severe malaria, and within centres, there seems to be no clear programmes to encourage on the job training and supervision. There was some anecdotal evidence of this: some community members mentioned poor communication by health workers, and not being given explanations as to why they had to go to a higher-level facility, nor on how serious their condition could be. Some were not given basic information on the location of these referral centres either, and often opted to go back home, worsening their situation. Adequate training and capacity development can reduce differences in quality of service offered by centres that are at the same level (currently manifesting as absenteeism, unavailability for work, acceptability and 'accommodativeness' of health workers and services).

We observed that staffing levels were close to approved norms, meaning that variations in quality of service were resulting from issues other than staffing levels. Improvements in quality of service at both level III and IV is possible. For example, counter-referral forms (which are currently not widely used) can be emphasised to improve the referral system. Where they exist, they can be used to provide feedback to primary level centres. Improved communications between patients and referring and receiving centres can improve the referral experience without requiring significant resources. This can positively impact caseloads at higher level centres as more patients will use the systems as designed (fewer patients will opt to self-discharge or skip certain care levels). These issues can be addressed without need to inject significant resources.

4.4 Drugs and equipment

Improvements in drug supply and monitoring are possible. The assessment results show that commodities required for treating severe malaria were not consistently supplied as required. Stock-outs of malaria diagnostic and supportive care commodities (reagents, blood transfusion, glucose sticks, RDT kits, malaria blood slides etc.) were putting a challenge on the management of severe malaria. Essential severe malaria drugs were not always available and in many cases, stock-outs were common. Shortages caused by an irregular supply can be avoided, and can lead to improved confidence in the health delivery system.

The RAS product in circulation is not among those that have been quality assured by WHO or Global Fund. NMCP confirmed that the RAS in circulation was purchased soon after Uganda adopted the WHO RAS strategy, at a time when WHO had not yet quality-assured any RAS product. To get started, Uganda opted to use RAS that had been certified by the Uganda National Drug Authority. The National Medical Stores (NMS) is in the processing of clearing the old stock of RAS, before new RAS stock (presumably quality-assured by Global Fund) is ordered.

There is a lack of blood transfusion services at some level IV centres, despite this being a national requirement. This negatively impacts the management of severe malaria cases because the referral system is lengthened at a cost to the patient. This in turn increases fatalities as the time taken to manage complications such as severe anaemia is much longer (due to referral and waiting time at

congested hospitals). Even if policy is not adjusted to allow for increased services at primary level centres, it should be ensured that the minimally recommended services are available.

4.5 Referral system

Inefficiency in the health referral system is apparent, especially at primary levels. Data show that malaria fatalities increase as one goes up the levels of the health delivery system. Two things can be concluded from this observation: 1) referred cases of severe malaria are resulting in the observed deaths, and 2) poor severe malaria management practices at primary level facilities contributing to delays in appropriate care.

The referral system that was observed seems weak and driven by the patient, with little support from the public health delivery system. Delays at the community level are a result of delays in making the decision to seek care (often waiting on men to decide). At the facility level, the present system has several challenges which include limited support for transport and logistics, especially at level III and IV centres where there is no formal government support for transport and ambulances. Transport and logistic support is passed onto the patient, including costs met by health workers that accompany patients. Cost of fuel is often met by the patient, even in centres where the vehicle exists.

With limited resources for transport to public health facilities, patients tend to increase reliance on community drug shops (often providing the wrong diagnosis) and use of traditional herbs and remedies. Community pharmacies were popular because of their proximity to households and their ability to sell cheaper drugs (often selling partial prescriptions to clients with limited funding). Most community pharmacies did not test for malaria, but instead provided multiple drugs (for pain relief, antimalarial, antibiotics, antifungals etc.) at once.

5. Conclusions and recommendations

5.1 Conclusions

The assessment has established that guidelines do not adequately define the level of health facility where severe malaria should be managed, resulting in a grey area. This ambiguity in guidelines has inadvertently contributed to misdistribution of resources and supplies, compromising quality of severe malaria case management, particularly at primary level facilities resulting in increased mortality.

Health centres are not necessarily delivering the same quality or range of services, neither are services delivered commensurate to the level. Injectable artesunate, the first line treatment for severe malaria, is currently available at level III upwards, although this does not align with policy, nor has been WHO-prequalified or TGF-ERP approved. Rectal artesunate is also available at level III, yet, the WHO only recommends RAS where Inj AS is not available. Some level III centres manage severe malaria cases whereas others don't. RAS is not available at level IV centres, yet they currently also refer patients if they are not able to sufficiently manage patients. Placement of both Inj AS and RAS at level III and IV health centres should thus be discussed further by the MoH and NMCP.

Some level IV centres lack approved functions such as blood transfusion and oxygen, which reduces the range of services that they can offer. There is a limited availability of guidelines, treatment charts and training to support health workers. Additionally, other than making the decision to refer services, referral services are non-existent at level III and IV health centres, with patients having to bear the transport costs of referral.

5.2 Recommendations

1. NMCP should consider updating treatment guidelines and protocols to provide clarity on the range of severe malaria conditions that should be managed at level III and IV centres by:

    a. Ensuring adequate guidance;
    b. Ensuring that there is capability to provide a minimum set of services;

    a. Placing RAS and pre-referral training at all centres that offer pre-referral interventions. This currently includes health centres II, III and IV, indicating that the NMCP may need to rethink and explore the most appropriate the positioning of RAS;

    b. Working closely with the National Medical Store (NMS) to consistently supply the commodities required for the treatment and pre-referral management of severe malaria patients.

2. The Ministry of Health should urgently ensure that the minimum set of services stipulated in the national treatment guidelines is capable of being met by these centres. This includes ensuring centres can provide necessary services required for treatment and supportive care. District Health Offices should draw up or update their plans for in-service training to include all the

aspects of severe malaria as per treatment guidelines. This should include the administration and management training for lead persons at each health facility.

3. The Ministry of Health should review the existing referral system for severe malaria with a view to strengthening it. This includes exploring the appropriate balance between contributions from health facility users and government.
4. As a strategy to reducing fatalities associated with severe malaria, NMCP should urgently promote measures to ensure that level III and IV health centres strengthen their management of simple malaria, including engagement with the National Drug Authority (NDA) to ensure that the drug distribution system is working efficiently.
5. To achieve the reduction in mortality rates that have been set for severe malaria, Ministry of Health, NMCP and stakeholders should start prioritizing severe malaria death auditing.

References

1. Uganda Ministry of Health, Uganda National Malaria Control Policy**,** June 2011
2. Uganda Ministry of Health Integrated Management of Malaria Training, A Practical Guide for Health Workers**.** National Malaria Control Programme (NMCP), June 2015.
3. Uganda Ministry of Health and USAID/Uganda Health Supply Chain Program. Supply Chain Systems for Community Health Programs in Uganda: Situation Analysis. Submitted to the Ministry of Health by Management Sciences for Health. 2016.
4. REPUBLIC OF UGANDA, Essential Medicines and Health Supplies List for Uganda (EMHSLU), 2016
5. Uganda Ministry of Health, National Health Facility Master List- A complete list of all health centres in Uganda. Division of Health Information (DHI), June 2017
6. Uganda Bureau of Statistics (UBOS) and ICF International. 2015. Uganda Malaria Indicator Survey 2014-15. Kampala, Uganda, and Rockville, Maryland, USA: UBOS and ICF International
7. Uganda Bureau of Statistics (UBOS). 2014. Uganda National Household Survey 2012/2013. Kampala Uganda; UBOS.
8. WHO: Antimalarial drug combination therapy: report of a WHO technical consultation. Geneva, Switzerland: World Health Organization; 2001.
9. Kaula H, Kiconco S, Komuhangi A, Atuhairwe C, Basaza R, Adherence to integrated management of malaria guidelines in Ugandan lakeshore health centres: what has gone wrong? International Health Sciences University, 2017.
10. Nanyunja M, Nabyonga Orem J, Kato F, Kaggwa M, Katureebe C, Saweka J: Malaria treatment policy change and implementation: the case of Uganda. Malar Res Treat 2011, 2011:1–14.
11. Memusi D, Machini B, Waqo E, Kiptui R, Njiri P, Amboko B, Zurovac D. Monitoring Quality of Inpatient Malaria Case Management at Kenyan County Hospitals – Round 1 Survey. Malaria Control Program, Ministry of Health, Kenya, June 2016.
12. Tougher S, Mann AG, Group AC, Ye Y, Kourgueni IA, Thomson R, Amuasi JH, Ren R, Willey BA, Ansong D, et al: Improving access to malaria medicine through private-sector
13. Subsidies in seven African countries**.** *Health Aff (Millwood)* 2014, **33:**1576-1585.
14. Ye Y, Arnold F, Noor A, Wamukoya M, Amuasi J, Blay S, Mberu B, Ren R, Kyobutungi C, Wekesah F, et al: The Affordable Medicines Facility-malaria (AMFm): are remote areas benefiting from the intervention? *Malar J* 2015, **14:**398.
15. World Health Organization. World Malaria Report**.** 2012.
16. Uganda National Malaria Control Policy. Ministry of Health, Uganda. June 2011National Policy on Malaria Treatment 2005. http://www.health.go.ug/mcp/NationalPolicyonMalariaTreatment(07_03_06).pdf

Annexes

Tables and figures referenced in the report

Table 4: Epidemiological definition of severe malaria used in the assessment

It is an immediate threat to life and is therefore a medical emergency. Malaria is regarded as severe if there are asexual forms of *P. falciparum* in blood plus one or more of the following complications in the table below.

Classical definition of severe malaria (ICD10 CODE: B50.0, B50.8)

COMPLICATION	CRITERION FOR DIAGNOSIS
Defining manifestations	
Cerebral malaria	Deep coma (unable to localise a painful stimulus), Normal CSF, *parasitaemia*
Severe anaemia	Hb <5g/dL with *parasitaemia* (<7g/dL in pregnancy)
Respiratory distress	Tachypnoea, nasal flaring and intercostal recession in a patient with *parasitaemia*
Hypoglycaemia	Blood glucose <40 mg/dL (2.2 mmol/L) with *parasitaemia*
Circulatory collapse	Clinical shock (systolic pressure <50 mmHg for children and <80mmHg for adults, with cold peripheries, clammy skin) with *parasitaemia*
Renal failure	Urine output <12 ml/kg in 24 hours and plasma creatinine >3.0 mg/dL, with *parasitaemia*
Spontaneous bleeding	P*arasitaemia* with unexplained spontaneous bleeding (haematemesis, melaena, or prolonged bleeding from nose, gum or venipuncture site
Repeated convulsions	2 or more convulsions in 24 hours, with *parasitaemia*
Acidosis	Deep (acidotic) breathing and plasma bicarbonate <15 mmol/L, with *parasitaemia*
Haemoglobinuria	*Parasitaemia*, haemoglobin in urine (dark coloured urine but no RBC's)
Pulmonary Oedema	Deep breathing, fast breathing, laboured breathing (nasal flaring, intercostal recession and chest indrawing), Cheyne stokes breathing
Supporting manifestations (some other signs in addition to above complications)	
Impaired consciousness	*Parasitaemia* with depressed level of consciousness but can localize a painful stimulus, or change of behavior, confusion, drowsiness
Jaundice	*Parasitaemia* with unexplained jaundice
Prostration	Unable to sit, in a child normally able to do so or unable to drink in one too young to sit
Severe vomiting	Vomiting everything, not able to drink or breastfeed
Severe dehydration	Sunken eyes, coated tongue, lethargy, inability to drink
Hyperpyrexia	Temperature >39.50 C, with *parasitaemia*
Hyperparasitaemia	Parasite count >250,000 /µL, >10%
Threatening abortion	Uterine contractions and vaginal bleeding

Table 5: Summary of key malaria data from surveyed centres : 2016.

Facility	Total Outpatient							
	Attendances, N		Malaria cases, n (%)		Referred in cases, n (%)		Referral out cases, n (%)	
	0-4 yrs	>5yrs	0-4 yrs	>5yrs	0-4 yrs	>5yrs	0-4 yrs	>5yrs
Level III health								
Bupadhengo	6702	19590	2205 (32.9%)	5039 (25.7%)	3 (0.04%)	6 (0.03%)	2 (0.02%)	10 (0.05%)
Butagaya	3559	9519	2924 (82.1%)	7055 (74.1%)	0	0	17 (0.47%)	36 (0.37%)
Irongo	2651	7701	2005 (75.6%)	4393 (57.0%)	0	1 (0.03%)	23 (0.8%)	23 (0.2%)
Kitayundwa	11196	31930	3409 (30.4%)	12468 (39.0%)	0	0	7 (0.06%)	89 (0.2%)
Mayuge	5187	17396	3184 (61.3%)	6782 (38.9%)	1 (0.01%)	3 (0.01%)	47 (0.9%)	45 (0.2%)
Wabulungu	5503	11789	3607 (65.5%)	7492 (63.5%)	0	1 (0.8%)	0	36 (0.4%)
Level IV health centres								
Budondo	4887	14171	2989 (61.1%)	4826 (34.0%)	2 (0.02%)	1 (0.01%)	43 (0.8%)	66 (0.4%)
Kiyunga [16]								
Nankandulo	7219	26141	5200 (72.0%)	15340 (58.6%)	164 (2.2%)	179 (0.6%)	98 (1.3%)	118 (0.4%)
Namwendwa [17]	1516	5778	1187 (78.3%)	3225 (55.8%)	0	8 (0.1%)	0	0
Kityerera	7252	18564	4417 (60.9%)	8110 (43.6%)	268 (3.7%)	377 (2.0%)	86 (1.1%)	278 (1.5%)
Kigandalo	9245	24540	6152 (66.5%)	9792 (39.9%)	13 (0.1%)	25 (0.1%)	16 (0.1%)	19 (0.08%)

Source: Facility level HMIS forms (Form 105).

[16] No HMIS data at the facility.

[17] First six months data not recorded for this facility

Table 6: Total number of inpatients malaria cases and deaths, 2016

Health centres	Total malaria					
	Admissions All	**Admissions 0-4 years**	**Admissions ≥ 5 yrs**	**Deaths All**	**Deaths 0-4 years**	**Deaths ≥ 5 yrs**
Level III health centres						
Bupadhengo	108	62	46	0	0	0
Butagaya (LIII)[18]						
Irongo	35	33	2	0	0	0
Kitayundwa[17]						
Mayuge	131	70	61	2 (1.5%)	2 (2.8%)	0
Wabulungu	70	34	36	2 (2.8%)	2 (5.8%)	0
Level IV health centres						
Budondo (LIV)	798	430	368	0	0	0
Kiyunga [19]	644	338	306	1 (0.1%)	1 (0.3%)	0
Nankandulo	2910	2047	863	13 (0.4%)	9 (0.4%)	4 (0.4%)
Namwendwa [20]	1777	1397	380	5 (0.2%)	4 (0.2%)	1 (0.2%)
Kityerera	71	18	53	8 (11.2%)	0	8 (15.0%)
Kigandalo	131	59	72	14 (10.6%)	9 (15.2%)	5 (6.95)
Jinja Regional Referral Hospital[21]	3550	1580	1970	128 (3.6%)	59 (3.7%)	69 (3.5%)

Source: HMIS

Table 7: Staffing levels at centres that were assessed.

Health facility	**Medical officer**[22]	**Clinical Officers**	**Nurses**[23]	**Nursing assistants**	**Laboratory staff**	**Non-medical personnel**[24]
Level III health centres						
Approved Staffing Norms	**0**	**2**	**6**	**3**	**3**	**5**
Bupadengo	0	2 (100%)	8 (133.3%)	1 (33.3%)	5 (166.7%)	3 (60.0%)
Butagaya	0	2 (100%)	6 (100%)	2 (66.7%)	2 (66.7%)	5 (100.0%)
Irongo	0	2 (100%)	6 (100%)	1 (33.3%)	2 (66.7%)	4 (80.0%)
Kitayundwa	0	2 (100%)	6 (100.0%)	2(66.7%)	3 (100.0%)	6 (120.0%)
Mayuge	0	2 (100%)	12 (200%)	2 (66.7%)	4 (133.3%)	10 (200.0%)

[18]No data in HMIS, data not being collected
[19] no HMIS data at the facility.
[20] first six months data not recorded for this facility
[21] Receives cases from all centres in the sub-region.
[22] Jinja RRH has a Senior Consultant, 2 medical officers and 5 Medical Officer Interns
[23] Enrolled midwifes, Specialist Pediatric Nurses, Registered nurses, Registered midwifes, Comprehensive nurses.
[24] including CHAs, records assitancts, VHTs

Wabulungu	0	2 (100%)	5 (83.3%)	1 (33.3%)	3 100.0%)	5 (100.0%)
Level IV health centres						
Approved Staffing Norms	**2**	**6**	**17**	**5**	**5**	**11**
Budondo	2 (100.0%)	2 (33.3%)	20 (117.6%)	7 (140.0%)	3 (60.0%)	10 (90.9%)
Kiyunga	1 (50.0%)	5 (83.3%)	16 (94.1%)	4 (80.0%)	4 (80.0%)	10 (90.9%)
Nankandulo	2 (100.0%)	4 (66.7%)	14 (82.4%)	1 (20.0%)	3 (60.0%)	12 (109.0%)
Namwendwa	0	3 (50.0%)	17 (100.0%)	1 (20.0%)	4 (80.0%)	27 (245.4%)
Kityerera	1 (50.0%)	3 (50.0%)	11 (64.7%)	2 (40.0%)	4 (80.0%)	5 (45.4%)
Kigandalo	2 (100.0%)	2 (33.3%)	8 (47.1%)	2 (40.0%)	6 (120.0%)	10 (90.9%)
Approved Staffing Norms for RRHs	40	14	116	-	12	35
Jinja RRH (childrens wing only)[25]	8	5	25	5	8	3

Table 8: Centres mentioning that staff had been formally trained

In-Service Training past 3years	IV Artesunate	Rectal Artesunate Suppository	Malaria RDT	MalariaMicroscopy
Level III Health Centres				
Butagaya	✓	✓		
Irongo			✓	✓
Mayuge	✓	✓	✓	✓
Wabulungu		✓	✓	✓
Bupadengo	✓		✓	✓
Kitayundwa	✓	✓	✓	✓
Level IV Health Centres				
Budondo	✓		✓	✓
Kiyunga	✓		✓	✓
Kityerera	✓		✓	✓
Kigandalo			✓	✓
Nankandulo	✓			✓
Namwendwa	✓		✓	✓
Jinja RRH	✓		✓	✓

[25] The staffing numbers were collected for the children's wing only. The figures given for the approved staffing norms refer to the entire regional referral hospital, including the children's wing.

Table 9:Variations in case management of severe malaria at different levels of the health system

Frequency	Clinical /laboratory manifestations	Prognostic value	Facility where patient can be managed (Mx) or Referred (Rx)					
			RRH	D-Hosp	Level IV	Level III	Level II	VHT
+++	Coma (BCS ≤2)	+++	Mx	Mx	Rx	Rx	Rx	Rx
+++	Impaired consciousness (BCS ≥3)	+++	Mx	Mx	Mx	Rx	Rx	Rx
+++	Respiratory distress	+++	Mx	Mx	Rx	Rx	Rx	Rx
+++	Multiple convulsions	+++	Mx	Mx	Mx	Mx	Rx	Rx
+++	Prostration	+	Mx	Mx	Mx	Rx	Rx	Rx
+/-	Shock	+++	Mx	Mx	Rx	Rx	Rx	Rx
+/-	Pulmonary oedema	+++	Mx	Mx	Rx	Rx	Rx	Rx
+/-	Abnormal bleeding	+++	Mx	Mx	Rx	Rx	Rx	Rx
+	Jaundice	++	Mx	Mx	Mx	Mx	Rx	Rx
+++	Severe anaemia	+++	Mx	Mx	Mx	Rx	Rx	Rx
+++	Hypoglycaemia	+++	Mx	Mx	Mx	Rx	Rx	Rx
+++	Acidosis	+++	Mx	Mx	Rx	Rx	Rx	Rx
+++	Hyperlactataemia	+	Mx	Mx	Mx	Rx	Rx	Rx
+/-	Renal Impairment	+++	Mx	Mx	Rx	Rx	Rx	Rx
+/-	Hyper-parasitaemia	+++	Mx	Mx	Mx	Mx	Rx	Rx

On scale from + to + /- indicates infrequent :
RRH=Regional referral hospital; D-hosp=District hospital

Mx =complete management of patient (IV Artesunate +management of complications)
Rx =Refer patient with opportunity for provision of pre-referral intervention with Rectal Artesunate

List of people at the national stakeholder meeting

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