Differences between hospitalized and non-hospitalized children 12 years and below with malaria in Kasangati, Uganda

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Master thesis in Medicine Gothenburg University

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Programme in Medicine

Gothenburg, Sweden 2015

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Abbreviations

ACT	Artemisinin combination therapy
IRS	Indoor residual spraying
ITNs	Insecticide treated nets
LLINs	Long lasting insecticidal nets
RDT	Rapid diagnostic test
RoU	Republic of Uganda
WHO	World Health Organization

Abstract

Background: Malaria is the second most common cause of death among children below the age of five, and the third most common cause of death among adults in Uganda. Early diagnosis and treatment within 24 hours after onset of symptoms are important to avoid uncomplicated malaria developing to severe malaria. One way to reduce unnecessary use of antimalarial drugs, which increases the risk of resistance is to test all patients with suspected malaria with RDTs or microscopy before treatment according to WHO's recommendations.

Aim: To find out what distinguish children with malaria that are admitted and children with uncomplicated malaria that are not admitted at Kasangati Health Centre.

Methods: A cross-sectional study where semi-structured interviews were conducted with caretakers of not admitted and admitted children 0-12 years with malaria, using a questionnaire and interpreters. Information regarding other current diseases and medication were taken from patient books and upper arm measurements were measured.

Results: More of the admitted children were receiving treatment within 12 hours from start of symptoms than outpatients (admitted 63% vs outpatients 20%) and admitted were more often coming to the health centre within 12 hours after start of first symptom (admitted 47% vs outpatients 8%). The admitted children had more diarrhea, general body pain, inability to sit up though she/he normally can, inability to play and rapid breathing. Admitted children had also more pneumonia than the outpatients (22% vs 3%).

Conclusions: Caretakers of children that are more severe ill choose to seek medical care faster. The admitted children had more symptoms of complicated malaria and more pneumonia than non-admitted children. Further studies should be done on community level to evaluate the situation of the whole population.

Background

Malaria killed 584,000 people in the world 2013, and of those 453,000 were children under the age of five years (1). Africa stands for 90% of all the deaths due to malaria(1). About 437,000 African children under the age of five died of malaria in 2013, and 16,000 children under five died of malaria in other parts of the world(1).

In Uganda, malaria is the second most common cause of death among children under five years old causing 13% of the deaths in 2013(2). In the whole population malaria was the third most common cause of death 2012, 5.6% died of malaria(2). There were over 1.5 million reported confirmed cases of malaria and more than 7000 deaths of malaria in Uganda in 2013(3) according to WHO. Malaria is according to the Ugandan ministry of health the disease causing most hospital based morbidity in Uganda, with almost 340,000 cases 2013/2014 and almost 240,000 were children below 5 years old(4).

Pathogenesis

Malaria is a communicable, parasitic disease transmitted by the bite of female Anopheline mosquito(5). There are five different species that cause human malaria; *Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae* and *Plasmodium knowlesi* but almost all deaths are caused by P. falciparum(6). The malaria parasites life cycle starts with sporozoites in the mosquito's saliva which are injected into the blood stream of a human being when being bitten by a mosquito. The sporozoites enter hepatocytes and develop to liver schizonts which burst sending upto 30,000 daughter parasites (merozoites) into the bloodstream. For P.falciparum this normally takes about 6-30 days, for other species it can take longer time. The merozoites invade erythrocytes, and the parasite goes through asexual divisions again, burst, infect new erythrocytes and so on. After some time a minority of the

merozoites develop to gametocytes (sexual form) and these are taken up by a mosquito when biting a human being, leading to that new sporozoites develop (5, 6).

People living in endemic areas, like nearly all of Uganda, with repeated exposure to malaria develop some degree of immunity, but never a total protection. This leads to that those with highest risk of severe malaria are children under the age of five, pregnant women and people with low immunity, such as HIV-positive(5).

Classification of malaria

Malaria can be divided into uncomplicated malaria and severe malaria. A patient with uncomplicated malaria often has fever, sometimes with 3 phases; cold, hot and sweating stages(7). This is less common in endemic areas were people develop a partial immunity(7). Other common symptoms and signs are loss of appetite, weakness, lethargy, vomiting, nausea, headache, joint pain, backache, general body pains, diarrhea, mild cough, malaise, dehydration and enlarged spleen(5, 7). Severe malaria is life threatening and needs medical care and admission. There can be many kinds of symptoms but the most important that should lead to admission is prostration, neurological impairment, impaired consciousness, respiratory distress, convulsions, severe anaemia (haemoglobin<5g/dl) and persistent vomiting. Prostration is when the patient is unable to sit up though she/he normally can or unable to feed or drink. Other symptoms could be a change of behaviour, drowsiness, confusion, circulatory collapse, hyperparasitemia (≥100,000 parasites/μL), hypoglycaemia, acidosis, oliguria, and hyperpyrexia. Symptoms like jaundice, bleeding tendency, renal failure, pulmonary oedema and haemoglobinuria, are more common among adults than children(5, 7).

In treatment of malaria early diagnosis and treatment within 24 hours after onset of symptoms are important to avoid uncomplicated malaria developing to severe malaria which can lead to

death. Malaria can also give long-term consequences on child development such as low birth weight, chronic anaemia, reduced growth and sever neurological complications.

Diagnostics

According to WHO's recommendation in 2010 all patients with suspected malaria shall be tested with rapid diagnostic tests (RDTs) or microscopy before treatment. This is one way to reduce the unnecessary use of antimalarial drugs(8).

Microscopy has been golden standard for malaria diagnosis. A thick blood slide is coloured with Giemsa stain after which it is possible to look after malaria parasites in the microscope. To find out what malaria species that causes the infection a thin blood slide is used(6). Malaria parasites are hard to find so to diagnose malaria with microscopy skilled microscopists, functional infrastructures and effective quality control are required(9).

When testing for malaria with RDT, blood taken from a finger-prick is used to detect specific antigens that are produced by the malaria parasite. After 15-30 minutes it is possible to get a positive or a negative result. There are many different kinds of RDT, some detect one single species (*P. falciparum* or *P.vivax*) and others detect several species (*P.falciparum, P.vivax, P. malariae* and *P.ovale).* Some advantages with RDT are that it is simple to perform and interpret, do not need expensive or complicated equipment, the result is obtained quickly and only little training is required which makes it easy to use on community level(10). The limitations of RDT is that it is not possible to count the number of parasites and RDT will not be able to detect parasites if there are very few (11). To count the parasites microscopy test is needed after a positive RDT.

Studies from Uganda and Zambia have shown that RDT is the most cost-effective method to correctly diagnose malaria in rural areas and primary health centres compared to microscopy and clinical diagnose(12, 13). The sensitivity of microscopy in one study from Indonesia was

91% and specificity was 71%(14), while in another study conducted in Uganda found a sensitivity of only 51%(15). RDT for P. falciparum has a sensitivity of between 78% and 100% in different studies and a specificity of 67% and 100%, but most of the P. falciparum tests fulfil the goal of >95% sensitivity (9, 16-20).

Malaria mortality decreases

Malaria mortality has decreased in the world by 47% since 2000 and among children in Africa the malaria mortality rate has decreased about 58% from 2000 to 2013 (21). One way to decrease the malaria mortality has been the "Roll back malaria" partnership which is a global framework of many countries working with coordinated actions to fight malaria(22). The "Roll back malaria"partnership's main objective is to work with interventions at country level through a "Malaria program" for every country. In the Ugandan "Malaria programme" vector control to decrease mosquito bites with indoor residual spraying (IRS), long lasting insecticidal nets (LLINs) and insecticide treated nets (ITNs) is included. Actions also are made to increase the use of ACTs instead of other antimalarials as first line treatment for uncomplicated malaria and training of health workers to use RDTs(23). Free distribution of ITNs and LLINs to pregnant women and children below the age of five at the health facilities and mass distribution campaigns going to the households has been one of National Malaria Control Programme's ways of preventing malaria (24).

Malaria in Uganda

In Uganda the *Plasmodium falciparum* parasite is responsible for almost all malaria sickness(3). There are two wet seasons in Uganda, one from April to May and one from October to November (according to information from Wakiso health department). The malaria transmission levels depend on temperature and rainfall. During the wet seasons the number of mosquitoes increases and consequently also cases of malaria increases. In most

parts of Uganda malaria transmission at high levels is perennial (year round) and has little seasonal variability. According to an Ugandan household study from 2012 the diagnostic testing is low, only 18% of children with fever had taken a malaria test(25).

Treatment of malaria

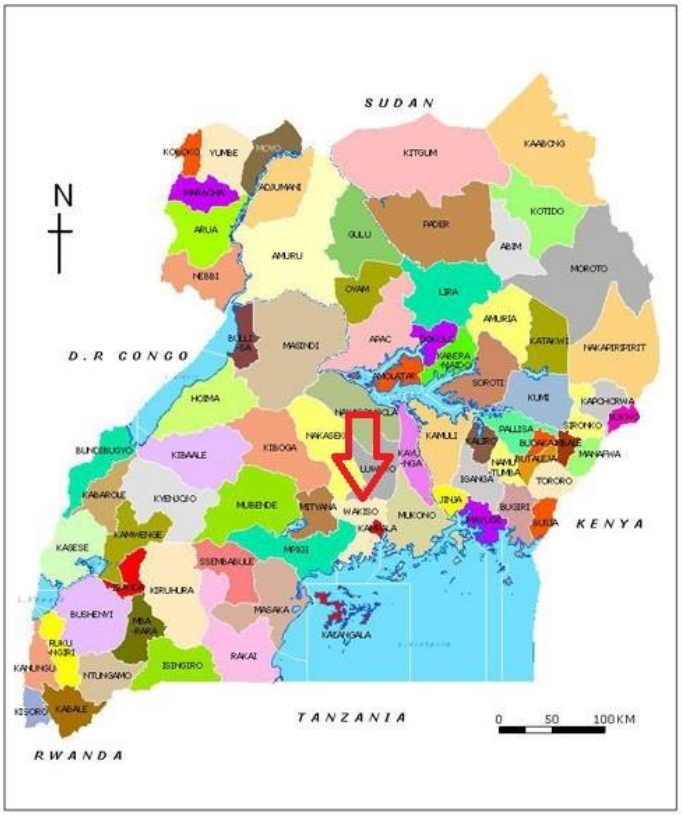
Before 2005, chloroquine and sulphadoxine/pyrimethamine were widely used as treatments for malaria in Uganda. In 2005 a study showed the risk of clinical treatment failure with chloroquine plus sulphadoxine- pyrimethamine among children under the age of five was between 34% and 67%(26). The same study showed that with amodiaquine plus sulphadoxine-pyrimethamine the risk was 13- 67%. A study on Ugandan children showed treatment failure of 48% with cloroquine plus sulphadoxine-pyrimethamine and 16% with amodiaquine plus sulphadoxine-primethamine(27). This was very high levels of treatment failures, and in 2005 the national malaria treatment changed to Artemisinin-based Combination Therapies (ACTs). Atemisinin have effect on all phases in the erythrocyte cycle(6).

The first line treatment for uncomplicated malaria in Uganda is arthemeter/lumefantrine or other ACTs recommended by WHO and the second line is peroral quinine (7). According to the guidelines severe malaria should be treated with parenteral quinine or alternatively parenteral artesunate or arthemeter. In a household survey 2009 it was shown that 21% of children under five with fever was treated with arthemeter/lumefantrine and in 2012 it had increased to 44%(25, 28). In the household study from 2012, 54% of the children under the age of five with fever had received antimalarial treatment and 83% of those had got ACTs(25). Children in more rural areas were more likely given ACTs than in urban areas while quinine was more common in urban region(25).

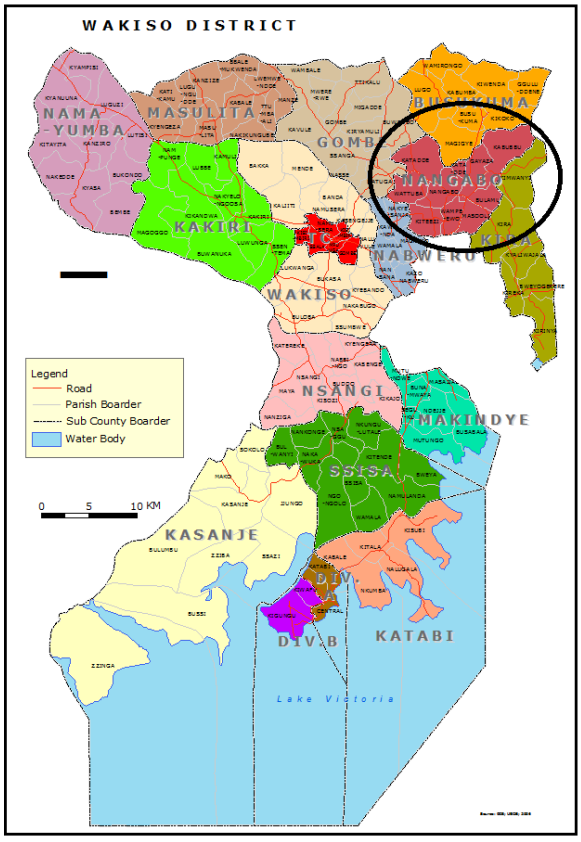
Kasangati health centre

Kasangati is a village situated approximately 1.4 kilometres north of Uganda's capital Kampala and is located in Wakiso district in the central one region (see map of Uganda). Wakiso district is the district with the largest population in Uganda, with more than 2 million inhabitans(29). The total population in all Uganda is almost 35 million(29). Wakiso have a warm and wet climate which can encourage disease outbreaks.

Map of Uganda



Map of Wakiso district



(Pictures from Wakiso district five year development plan 2011/12 – 2015/16).

Health care system

In Uganda hospitals and health centres are divided in different levels depending on what kind of medical care they can provide and if there is a doctor at the health centre. A health centre level 1 is only a village health team member. Health centre level 2 provides more medical care and have an outpatient department but no maternity ward and can only do antenatal care.

At a health centre level 3 they provide the same services but they also conduct deliveries. A health centre level 4 has an operating theatre for emergency, obstetric care, conducts deliveries, has antenatal care and an outpatient department. Then there are also different levels of hospitals offering more medical care. In Uganda there are public health care, private non for profit, private for profit and traditional healers. Kasangati Health centre, where the study was conducted, is a government health centre level 4.

Kasangati health centre offers basic primary health care, basic treatment, some emergency care and have a laboratory for common tests. There are an outpatient department, a ward for inpatient care, a diabetes clinic, an HIV clinic, maternity services and operating theatre where primarily emergency obstetric surgery is performed. Kasangati Health Centre is headquarter of the health sub district of Kyaddondo East, a district with around 460,000 inhabitants and with both semi-urban and rural areas(29). Kyaddondo East contains the two subcounties Kyadondo Nangabo, where Kasangati is situated (see map of Wakiso district) and Kira town council. The staff conclude of three doctors (two at all health centre – mostly at maternal health and one at the HIV-clinic), several clinicians, midwifes, nurses, nursing assistants, counsellors, pharmacology technician and laboratory technician. All services and treatment are supposed to be free, but if the health centre does not have the medication or have an open laboratory patients must buy medication or tests outside the health centre.

Management of malaria at Kasangati Health Centre

At Kasangati health centre, all patients with signs of malaria that come during daytime are tested for malaria with microscopic blood slide and/or Rapid Diagnostic Test (RDT). If the RDT is positive they always do a blood slide to count the number of parasites. A patient with a positive malaria test is always treated for malaria. If the RDT is negative the patients clinical presentation decides if the patient will be treated as clinical malaria (negative RDT but get

malaria treatment) or not. In Kasangati it is common with negative malaria tests though the children have malaria because of self-prescription of antimalarials before taking the test.

Patients coming in the evening, when the laboratory is closed, have to buy a malaria test outside the health centre (for example at a private clinic) before getting the treatment at the health centre. When coming in the night, patients are treated clinically if they have signs of malaria. If the children get very sick they are sent to the referral hospital Mulago in Kampala, and therefore it is not common that someone dies of malaria at Kasangati Health Centre.

At Kasangati Health Centre the diagnosis malaria and treatment for malaria are given from different staff categories depending who is at the health centre. During daytime usually a clinician decides the diagnosis, but when there are no clinician and during the evenings it can be a nurse or a nursing assistant.

Aim

The aim of the study is to find out what distinguish children with malaria that are admitted and children with uncomplicated malaria that are not admitted at Kasangati Health Centre regarding different factors such as duration before visit at the health centre, accessibility, social economic status and underlying diseases.

Specific objectives

To compare the following factors between admitted patients and outpatients with malaria:

- The duration of symptoms of malaria before coming to the health centre.
- The symptoms they had when coming to the hospital.
- To find out if they had been treated before coming to the health centre.
- The frequency of underlying diseases and malnutrition.
- The frequency of previous malaria and previous treatments.
- The socioeconomic status.
- The accessibility to health care.

Medical relevance

Malaria is the cause of much illness and deaths in Uganda. Most of the affected are children under the age of five. The study of the differences between the admitted children and outpatients can give information about what they can do at the hospital/health centre to prevent the children from getting severe malaria and die.

Method

Study design
A descriptive cross-sectional study of malaria episodes.

Study area
The study was conducted at Kasangati Health Centre, a Government health centre level IV in Uganda, during 8 weeks in February to April 2015.

Study population
The population that was studied was children 0-12 years old who was treated for malaria at Kasangati Health Centre (86 patients). There were two study groups, children that were hospitalized at Kasangati Health Centre because of malaria (admitted, 19 patients) were compared to children with malaria that did not have to be hospitalized (outpatients, 67 patients). A semi-structured interview was conducted with their parent or other person taking them to the health centre. All participants were asked to give their oral consent before answering the questions. Both children who had a positive malaria test and those who were treated for clinical malaria were included. The children with clinical malaria who had a negative malaria test, was because of clinical signs that indicate malaria decided to be treated for clinical malaria. Some patients, who came during the night when the laboratory was closed, were also treated for clinical malaria without taking a test and those were also included in the study.

Inclusion criteria
- Children 0-12 years old treated for malaria.
- Only included again if a new episode of malaria started more than 2 weeks after the last episode and the child had had one week of no malaria symptoms.

Data collection

Questionnaires were used to perform a semi-structured interview with the parent or other person taking the child to the health centre. The same questionnaire was used for both the outpatients and the admitted children. The questionnaires had both closed-ended, open-ended and multiple response questions (see appendix). There were 47 questions regarding social economic status, accessibility and availability to health care, duration of symptoms before coming to the health centre, symptoms, treatment before coming to the health centre and underlying diseases. The questionnaire was written in English and the interviews were hold in English with help of interpreters who translated to the local language Luganda. During the majority of the interviews an interpreter was used, but some interviews were hold solely in English. The interpreters/research assistants were members of the staff at Kasangati Health Centre. They participated in the collection of data and helped to find participants for the study.

A pilot questionnaire should have been tested during 3 days but because there were no patients with malaria during two of the days, the pilot study was only conducted during one day. After discussions with supervisors and interpreters/research assistants adjustments to the questionnaires were done.

Information regarding weight, positive or negative malaria test, other diseases right now and medication was collected from the medical records (the patient's book). The children's upper arms were measured to evaluate if the child was malnourished. The data collection was done during 7 weeks.

Six questionnaires was excluded from the study. Two of them were excluded because it was the same patient that came back to the health centre and it could not be ruled out that it was the same malaria episode as last time (the first episode was included in the study). One

questionnaire was excluded because no one followed the 11-year old girl to the health centre and when she tried to answer the questions herself it was very hard to evaluate the answers. Three was excluded because they were conducted at another health centre (Buwambo health centre). Buwambo health centre (more rural than Kasangati, also in Wakiso district) should also have been included in the study from the beginning but because of low number of patients there it was decided to concentrate on Kasangati health centre.

Data analysis/statistics

The data collected from the questionnaires, patient books and measurements were coded and analysed using IBM SPSS Statistics version 22. Testing of observed differences between the groups were done with Chi-square and Fischer's exact test. Because it was common with small sampling size<5 in a cell Fischer's test was mostly used. Statistical significant p-value was considered when $p<0.05$. Odds ratios were calculated on statistical significant differences.

Ethical considerations

Ethical permission for this study was acquired by the leaders of the district of Wakiso. An informed verbal consent was obtained of all participants before interviews were conducted and participation in the study was voluntary. After talking to supervisor Dr Ivan Nyenje it was decided that a verbal consent was more suitable than a written informed consent at this setting because many of the parents to the children are illiterate. No patient identity data was collected to avoid identification outside the clinic. The results are presented in a way that makes it impossible to identify individual patients. All patient data, including identity, will be treated confidentially, and the data gathered will not be used for any other purpose than for this study.

Results

Patient characteristics

The total number of participants was 86, and 44 of the children were girls and 42 were boys. 65% was below the age of five and 35% was 5-12 years. There were no significant differences between the sexes and age groups. The mean age was 3.9 years(median 3.0 years; range 4 Months to 12 years 1 month). For girls the mean age was 3.7 years (median 2.7 years, range 4 months to 11 years). For boys the mean age was 4.0 years (median 3.0 years, range 6 months to 12 years 1 month).

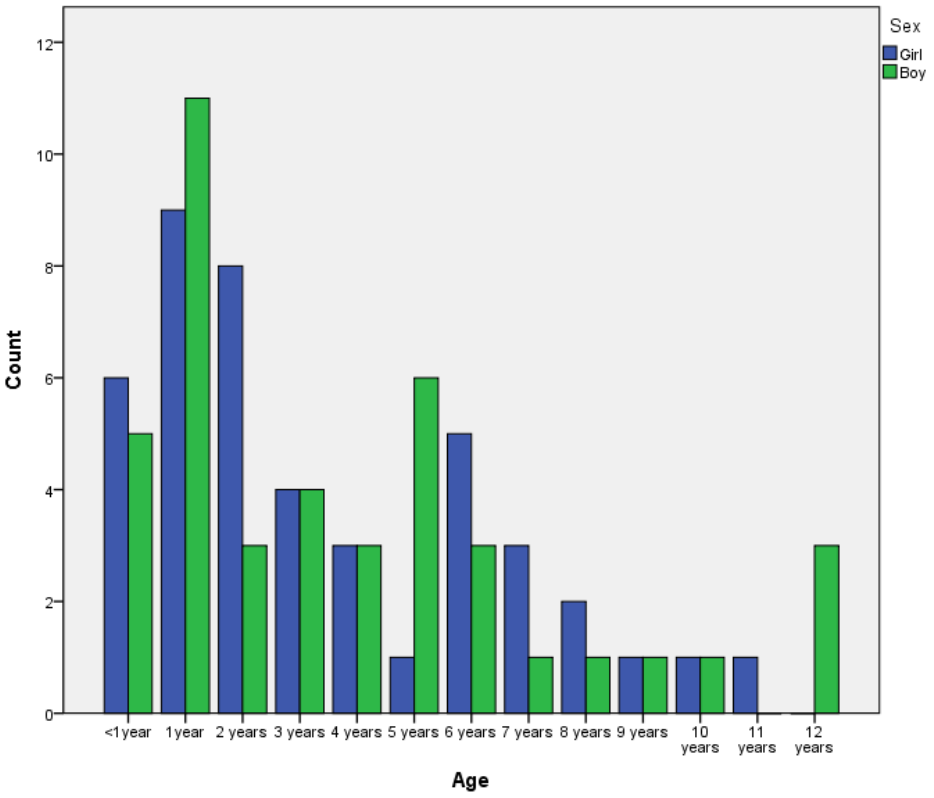


Figure 1. Age distribution among girls and boys.

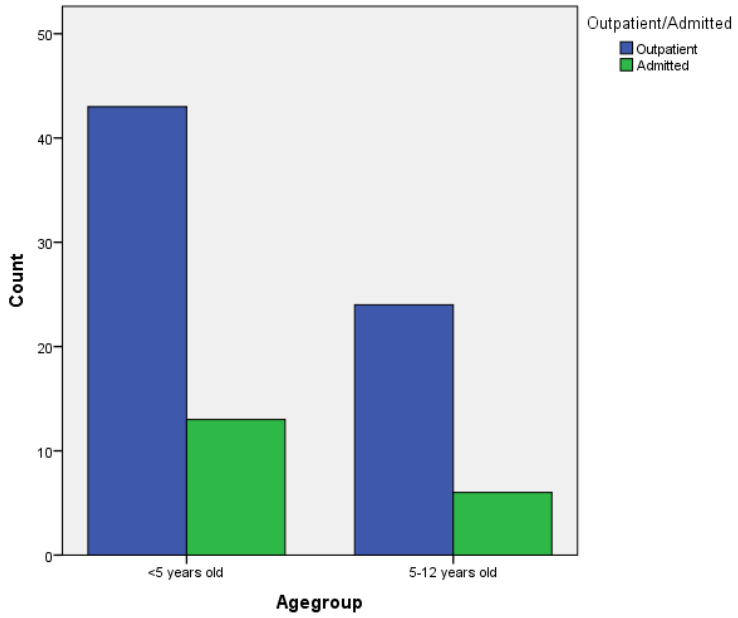


Figure 2. Age distribution in outpatients and admitted.

As shown in fig 2 most of the children included in the study were below the age of five. Among children below five years 23% was admitted and among children 5-12 years 20% was admitted (no significant difference).

The majority of the responders were caretakers of the child (91%) with no significantly difference between admitted and outpatients were shown. Most of the responders were mother to the child (78%), only 4% were father, 6% grandmother, 9% other relatives and 3% other. Regarding relation to the child no significant difference between outpatient and admitted was found. In table 1 it is shown that most parents had gone to secondary school, but there were no significant differences between parents to admitted children and outpatients. Majority of the mothers were housewifes (43%) and among the fathers self-employment was most common occupation (52%). No significant differences in mother's or fathers level of education or occupation between outpatients and admitted children could be shown.

Table 1.
Sociodemographic information about the participants answering the questionnaire

Category		Outpatient % within outpatients (count)	Admitted % within admitted (count)	Total number	Total %
Child´s sex		n=67	n=19	n=86	
	Girl	54% (36)	42% (8)	44	51%
	Boy	46% (31)	58% (11)	42	49%
Mother's highest level of education		n=53	n=17	n=70	
	Primary school	42% (22)	41% (7)	29	41%
	Secondary school	55% (29)	53% (9)	38	54%
	Tertiary school	2% (1)	0%	1	1%
	University	2% (1)	6% (1)	2	3%
Father's highest level of education		n=38	n=13	n=51	
	Never gone to school	5% (2)	0%	2	4%
	Primary school	13% (5)	23% (3)	8	16%
	Secondary school	63% (24)	62% (8)	32	63%
	University	8% (3)	0%	3	6%
	Do not know	11% (4)	15% (2)	6	12%
Mother's occupation		n=53	n=17	n=70	
	Government employee	4% (2)	0%	2	3%
	Private business employee	15% (8)	6% (1)	9	13%
	Self-employed	17% (9)	41% (7)	16	23%
	Unemployed	11% (6)	6& (1)	7	10%
	Housewife	43% (23)	41% (7)	30	43%
	Peasant	9% (5)	6% (1)	6	9%
Father's occupation		n=38	n=13	n=50	
	Government employee	3% (1)	8% (1)	2	4%
	Private business employee	39% (15)	46% (6)	20	40%
	Self-employed	55% (21)	38% (5)	26	52%
	Peasant	3% (1)	8% (1)	2	4%

There were no significantly differences in income, residence or living conditions, see table 2. The currency in Uganda is Ugandan shilling (USh), and 10,000 USh is equivalent to 27 Swedish crowns or 3.3 US dollars (according to themoneyconverter.com 16 May 2015). In Uganda you can buy a 50 cl soda for 1000Ush and a pineapple cost between 1000-2000Ush.

Table 2 Economy and living conditions

Category		Outpatient % within outpatients (count)	Admitted % within admitted (count)	Total number	Total %
Total income in Ugandan shilling		n=66	n=19	n=85	
	<50 000	15 % (10)	11% (2)	12	14%
	50.001-100.000	11% (7)	32% (6)	13	15%
	100.001-200.000	20% (13)	16% (3)	16	19%
	200.001-500.000	27% (18)	26% (5)	23	27%
	500.001-1.000.000	11% (7)	11% (2)	9	11%
	>1.000.000	5% (3)	0%	3	4%
	Do not know	12% 88)	5% (1)	9	11%
Living conditions		n=66	n=19	n=85	
	Hut	2% (1)	0%	1	1%
	Brickhouse	68% (45)	89% (17)	62	73%
	Apartment	11% (7)	0%	7	8%
	Living in the home of relatives/friends	20% (13)	11% (2)	15	18%
Residence		n=65	n=19	n=84	
	Urban	11% (7)	0%	7	8%
	Periurban	65% (42)	74% (14)	56	67%
	Rural	25% (16)	26% (5)	21	25%
Number of people in your household		n=65	n=19	n=84	
	2-4	37% (24)	37% (7)	31	37%
	5-9	62% (40)	53% (10)	50	60%
	10-14	2% (1)	11% (2)	3	4%
Number of children in the home below the age of five		n=65	n=19	n=84	
	0	12% (8)	5% (1)	9	11%
	1	35% (23)	32% (6)	29	35%
	2	32% (21)	58% (11)	32	38%
	3	18% (12)	5% (1)	13	16%
	4	2% (1)	0%	1	1%

Significantly more of the admitted got artesunate injection (admitted 91% vs outpatients 20%, $p<0.001$) and significantly more of the outpatients received artemeter + lumefantrine (80% outpatients vs 9% admitted, $p<0.001$). Significantly more of them with a positive malaria test got artesunate injection (positive 64% vs negative 10%, $p<0.001$) and significantly more of them with a negative malariatest did only get coartem (artemeter+lumefantrine) (positive 63% vs negative 90%, $p<0.001$).

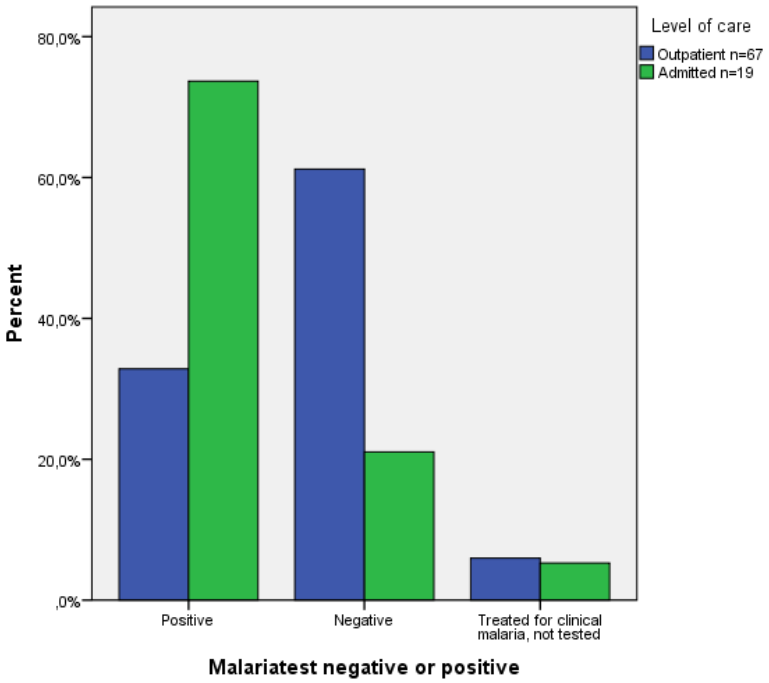


Figure 3 Results of malaria test in outpatients and admitted children

As shown in figure 3 significantly more of the admitted patients had a positive malaria test (74% vs 33%, p=0.003). 39% of the patients with a positive malaria test were admitted while significantly fewer, only 9%, of those with a negative malaria test were (p=0.003) A child with a positive test was 5.73 times more likely to be admitted (OR 5.73; 95% CI: 1.83-17.93, p=0.003).

Accessibility, availability and acceptability of care

Most of the children (63%) lived 1-5km from Kasangati health centre, 20% lived less than 1km and 17% lived 6-10km from the health centre. No significant difference could be shown between admitted and outpatients (p=0.932).

Twenty-eight percent went on foot to the health centre, 29% by bus/taxi, 37% by bodaboda, 1% with both bodaboda and bus/taxi, 2% by neighbours/friends bodaboda and 2% by their own bodaboda. “Bodabodas” is motorcycles that are used as taxix and are one of the most

common way of transport in Uganda. No significant difference could be seen between the outpatients and admitted regarding way of transport (p:0.227) or travel costs (p:0.153).

Among all the children 69% had visited other place of medical care before coming to the health centre. 33% had gone to a private clinic, 31% to the pharmacy/self-prescription, 4% to another government health centre and 1% to a traditional healer. There were no significant difference between outpatients and admitted (p=0.981).

Medications before coming to the health centre

Among all the children 62% had been given medication because of fever before coming to the health centre, no significant difference was shown among outpatients and admitted (p=1.00).

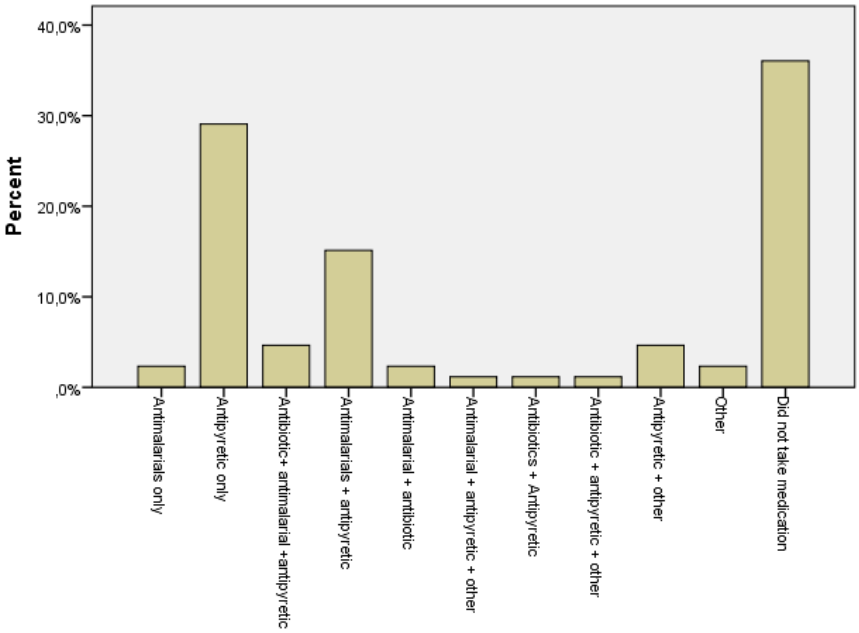


Figure 4. Medication because of fever before coming to the health center

Figure 4 shows the distribution of medication taken. Other mentioned medications include magnesia, herbs, black charcoal, pink tablet, vitamin c and zinkid. As shown in table 3 more than a quarter of all children, 28%, had been given antimalarials before coming to the health

centre, 9% had received antibiotics and 55% antipyretics. No significant difference regarding medication before visit at the health centre could be shown between outpatients and admitted.

Table 3. Medication before visit at the health centre

Treatment before visit	Outpatient n=67	Admitted n=19	Total n=86
Antimalarials	18/67 (27%)	6/19 (32%)	24/86 (28%)
Antibiotics	5/67 (8%)	3/19 (16%)	8/86 (9%)
Antipyretic	37/67 (55%)	10/19 (53%)	47/86 (55%)

Many of the participants that had been giving the child medication before coming to the health centre had bought it at a private clinic (42%), 16% bought medication at a pharmacy, 7% at a drugshop, 24% had medications before, 7% got medications from neighbour/relative/friend and 4% did not know where the medication was bought. No significant difference between the groups were shown (p=0.534).

Time to antimalarial treatment

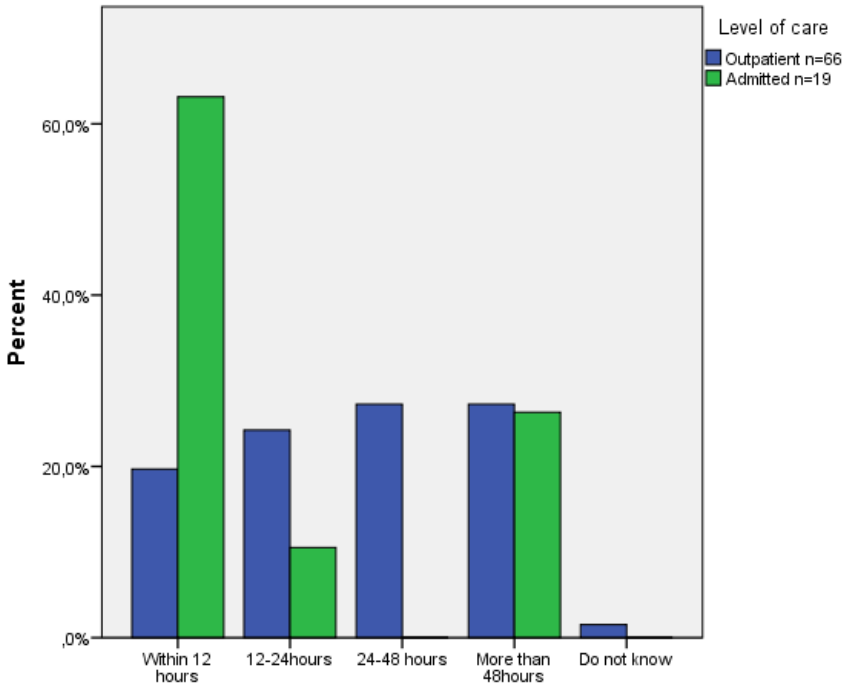


Figure 5. Time to antimalarials after getting first symptom of malaria

The admitted patients were significantly more often receiving treatment within 12 hours from start of symptom (outpatients 20% vs admitted 63%, p=0.001), see fig 5. Among all children

29% got malaria treatment within 12 hours, 21% got it after 12-24 hours, 21% between 24-48 hours and for 27% it took more than 24 hours to get malaria treatment. No significant differences could be shown between time to malaria treatment after first symptom and malaria test result or the sex of the child.

For the patients that lived further from the health centre (6-10km) there was a tendency towards longer time to malaria treatment and more waiting more than 48 hours after first symptoms before the child got treatment (p: 0.092). 47% of those who lived 6-10km from the health centre waited more than 48 hours and only 23% of the children living 0-5 km did wait that long. Of the children living 6-10km from the health centre only 13% received malaria treatment within 12 hours while 33% of children living 0-5km from the health centre did. No significant differences could be shown regarding time to malaria treatment and the child's mother's highest level of education (p:0.366).

Diagnostic test before visit at the health centre

Only three of the 86 children had taken a diagnostic test before coming to the health centre. Two of them had taken antimalarials before coming to the health centre but only one of them had a positive malaria test. The one who did a test before coming to the health centre but did not take antimalarials before had a negative test then.

Time to health centre

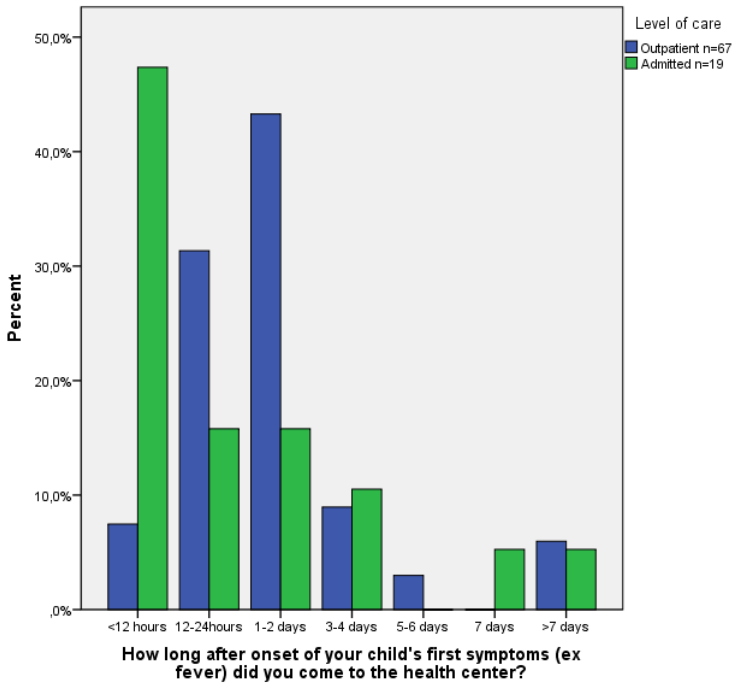


Figure 6. Time to health centre after first symptom

As shown in figure 6 a significant difference in time from first symptom to coming to the health centre between outpatients and admitted (p: 0.001). 47% of the admitted came to the health centre within 12 hours while only 8% of the outpatients did (total 16%).

No significant relation between malariatest result and time from first symptom to coming to the health centre was found (p: 0.353) or between child's sex and time to the health centre (p:0.964).

Problems that made it hard to come to the health centre

Table 4 show which problems the participants had to come to the health centre, no significant differences was found between the groups. The most common problem was "can't afford the journey to the health centre"(27%). One other problem to come to the health centre than is shown in table 4 that was mentioned by one parent was that when they came to Kasangati Health centre on a Saturday no one was there because the clinician was just leaving. Then they went to a private clinic and no one was there either.

Table 4. Problems that made it hard to come to the health centre

Problem		Outpatient % within outpatients n=66	Admitted %within admitted n=19	Total n=85	P-values
Live far from the health centre		20% (13)	21% (4)	20% (17)	1,00
Hard to find someone to take care of your other children/or the household		**15% (10)**	**37% (7)**	**20% (17)**	**0,052**
Can't afford the journey to the health centre		24% (16)	37% (7)	27% (3)	0,38
Can't afford the treatment at the health centre		9% (6)	16% (3)	11% (9)	0,41
Do not trust the health care system		2% (1)	0% (0)	1% (1)	1,00
Problem to find transport		**6% (4)**	**16% (3)**	**8% (7)**	**0,18**
Thought the child would be better	*Total*	12% (8)	0% (0)	9% (8)	
	Thought the child would be better with panadols but no improvement.	6% (4)[A]	0% (0)[A]	5% (4)[A]	
	Thought the child would be better with antimalarials (+more) but no improvement	5% (3)[3] [A]	0% (0)[A]	4% (3)[A]	
	Thought the child would be better (no medication mentioned), but no improvement.	2% (1)[A]	0% (0)[A]	1% (1)[A]	
Thought/someone had said that no one worked at the health centre during weekends/public holidays		6% (4)	5% (1)	6% (5)	0,34
Didn't have time		5% (3)	0% (0)	4% (3)	0,34
No money[1]		8% (5)	21%[2] (4)	11% (9)	
I did not have any problems		**30% (20)**	**11% (2)**	**26% (22)**	**0,14**

N=85. One outpatient is missing. Tendencies has fat types.

[1] Participants answers: No money (3 outpatients), no money to take a diagnostic test (1 admitted and 1 outpatient – the husband was not at home and she needed to pay for a blood test at a clinic outside the health centre), no money/cannot afford to take the child to a private clinic (3 admitted), cannot afford to pay for the lab tests for typhoid (outpatient)

[2]One of them always take her children to a private clinic, but now she had no money. One other had not enough money for care at a private/better hospital (at the health centre they have to wait long time and there are few doctors.)

[3]One of them also got antibiotics, not only antimalarials and antipyretic.

[A] Percentage counted out of all outpatients/admitted.

Reasons for seeking medical care at a health centre

As shown in table 5 no significant differences between outpatients and admitted could be found regarding why they chose to seek medical care at a health centre.

Table 5. Reasons for seeking medical care at a health centre

Why did you choose to seek medical care at a health centre?		Outpatient % within outpatient (n=67)	Admitted % within admitted (n=19)	Total (n=86)	P-value
My child was so sick		21% (14)	21% (4)	21% (18)	1.00
My child was getting worse		69% (46)	63% (12)	67% (58)	0.782
Relative, friend or neighbour told me to		18% (12)	0% (0)	14% (12)	0.061
Person with health care education told me to		4% (3)	16% (3)	7% (6)	0.119
Health centre is near[1]		13% (9)	11% (2)	13% (11)	1.00
Free treatment[1]		15% (10)	16% (3)	15% (13)	1.00
No improvement though given medication[1]	Total	10% (7)	11% (2)	10% (9)	0.790
	Given antimalarials	7% (5)[2]	11% (2)[2]	8% (7)[2]	
	Given other medication	3% (2)[2]	0% (0)	2% (2)	

N= 86. No one is missing

[1]Not an alternative in the questionnaire – mentioned as a other alternatives

[2]Within all participants in the study

Some other mentioned reasons for why they did choose to seek medical care at a health centre were that they *wanted to test the child before getting treatment* or *to get treatment*(n=14), *had no money/cheaper at health centre* (n=11), *trust government health facilities/do not trust private clinics/health centres have professional health workers* (n=9), *always bring the children to the health centre for health services* (n=3), *people at church told her to go the health centre if the child has fever* (n=1) and *media had told to seek medical care before give medication at home* (n=1).

Symptoms

The symptoms that the children had when they came to the health centre are shown in table 6 and 7. The admitted children had significantly more diarrhea (p: 0.016), general body pain (p: 0.047), inability to sit up though she/he normally can (p: 0.005), inability to play (p: 0.018) and rapid breathing (p: 0.008).

Table 6 The children's symptoms at arrival

Symptoms	Outpatients Percentage of outpatients that have the symptom (n=67)	Admitted Percentage of admitted that have the symptom (n=19)	Total patients (n=86)
Fever	87%	100%	90%
Sweats	27%	37%	29%
Chills	49%	53%	50%
Nausea	39%	47%	41%
Vomiting	55%	79%	60%
Diarrhea	**31%***	**63%***	**38%**
Cough	57%	79%	62%
General malaise	57%	68%	59%
Headache	37%	47%	40%
General body pains	**25%***	**53%***	**31%**
Inability to sit up though she/he normally can	**22%****	**58%****	**30%**
Inability to feed or drink	55%[1]	74%	59%[1]
Inability to play	**46%***	**79%***	**53%**
Impaired consciousness	4%	5%	5%
Rapid breathing	**33%****	**68%****	**41%**
Convulsions	16%[2]	5%	14%[2]
Stomach pain[3]	*25%*	*16%*	*23%*
Difficulty breathing[3]	*1%*	*0%*	*1%*
Joint pain[3]	*3%*	*11%*	*5%*
General body weakness[3]	*3%*	*0%*	*2%*
Loss of weight[3]	*3%*	*0%*	*2%*
Flue[3]	*18%*	*37%*	*22%*
Cold[3]/ Runny nose[3] /Throat pain[3]	*7%*	*0%*	*6%*
Other[4]	*12%*	*5%*	*10%*

[1] Inability to feed or drink + Reduced ability to feed or drink + Vomit everything she/he eats.

[2] Convulsions + Small convulsions + possible convulsions

[3]Not an alternative in the questionnaire – mentioned as a other alternatives

[4] Outpatients: Pale eyes, reddening of the eyes, pus in the ears, swollen fontanelle, fast heartbeat, skin rash, cheeks getting big (malnourished child), oversleeping. One admitted child: just crying

Flue and cold/runny nose/throat pain are not symptoms of malaria but reported by the caretakers.

*p<0.05 **p<0.01

As table 7 shows it was more likely that the child would be admitted if she/he had diarrhea, general body pain, was unable to sit up though she/he normally can, was unable to play or had rapid breathing.

Table 7. Odds ratios for getting admitted

Symptom	OR (95% CI)	P-value
Diarrhea	3.76 (1.29 to 10.90)	0.01
General body pain	3.27 (1.14 to 9.39)	0.03
Inability to sit up though she/he normally can	4.77 (1.62 to 13.99)	0.005
Inability to play	4.35 (1.31 to 14.50)	0.02
Rapid breathing	4.43 (1.48 to 13.23)	0.01

Table 8 below show which symptoms that made them come to the health centre, no significant differences could be shown between the groups. Most common symptoms that made them come to the health centre were fever (60%), vomiting (42%), diarrhea (15%) and cough (14%).

Table 8. Which of your child's symptoms made you come to the health centre?

Symptoms	*Outpatients %within outpatients (n=67)*	*Admitted %within admitted (n=19)*	*Total (n=86)*	*P-value*
Fever	63% (42)	53% (10)	60% (52)	0.439
Vomiting	37% (25)	58% (11)	42% (36)	0.122
Diarrhea	13% (9)	21% (4)	15% (13)	0.471
Cough	15% (10)	11% (2)	14% (12)	1.00
General malaise	10% (7)	5% (1)	9% (8)	0.678
Inability to sit up though she/he normally can	1% (1)	5% (1)	2% (2)	0.395
Inability to feed or drink	4% (3)	5% (1)	5% (4)	1,00
Impaired consciousness	0% (0)	0% (0)	0% (0)	
Convulsions	10% (7)	0% (0)	8% (7)	0,340
Nausea	4% (3)	0% (0)	3% (3)	
Stomachpain	10% (7)	11% (2)	10% (9)	1,00
Jointpain	1% (1)	5% (1)	2% (2)	
General weakness	4% (3)	11% (2)	6% (5)	
Headache	7% (5)	5% (1)	7% (6)	1,00
Flue	6% (4)	5% (1)	6% (5)	1,00
Chills	3% (2)	0% (0)	2% (2)	1,00
Other[1]	15% (10)	0% (0)	17% (10)	

[1]Other include one respondents answer: General body pain, inability to play, rapid breathing, pale eyes, swollen fontanelle, sweating a lot, skinrash, loss of weight, cheeks getting big, not feeling well, mother suspected cerebral malaria.

Underlying diseases

No significant differences between outpatients and admitted was shown regarding earlier malaria and malaria treatment (p: 0.466 and p:0.495), 80% of all the participants had been treated for malaria before.

Among the children that had been treated for malaria before 77% had taken a diagnostic test before treatment that time, no significant differences was shown between outpatients and admitted (p=0.39). Of those who had taken a diagnostic test 24% had got a negative test result but been treated for malaria anyway.

18% of the children had been admitted before because of something else than malaria, but totally there were no significant differences between the groups (outpatients 18% vs admitted 16%, p: 1.00). The reasons for admissions earlier in life is shown in table 9.
Pneumonia in prior admission was significantly more common among admitted patients than outpatients (2% of outpatients vs 16% admitted, total 5%, p=0.016). The only chronic disease was asthma and the asthma patient was an outpatient.

Only one of the children was diagnosed HIV- positive and had antiretroviral treatment, and that child was admitted. All but one of the children had been breastfed, most of them 19-24 months (24%) or were still breastfeeding (24%). The difference between outpatients and admitted were not significant (p:0.637).

Significantly more of the admitted children's caretakers reported symptoms of flue (p= 0.04). However, this is hard to evaluate because flue and malaria have many symptoms in common and it is hard to evaluate how much the caretakers can differ malaria from flue. Other

mentioned current diseases was asthma (one outpatient), HIV (one admitted), skindisease/skinrash/skininfection (three outpatients, one admitted), abscess in genital region (one outpatient), coryza (one outpatient), pneumonia (one admitted) and swollen fontanelle (one outpatient).

None of the children had tuberculosis, kidney disease, diabetes, cancer or heart disease according to the parent/the one answering the questionnaire. One patient had asthma and used inhaler for asthma regularly.

Table 9. Cause of admission during earlier hospital/health centre visit

Cause of admission	Outpatients (n=66) % within all outpatients	Admission (n=19) % within all admission	Total (n=85) % within all outpatients	P-value
Pneumonia	1 (2%)[2*]	3 (16%)*	4 (5%)	0.016
Diarrhea	1 (1%)	0 (0%)	1 (1%)	1.00
Asthma	1 (1%)	0 (0%)	1 (1%)	1.00
Chest pain, cough	1 (1%)[1]	0 (0%)	1 (1%)[1]	0.73
Cough	3[1] (5%)	0 (0%)	3 (4%)[1]	
Other infections[3]	4 (6%)	0 (0%)	4 (5%)	
Convulsions, not malaria	1 (1%)	0 (0%)	1 (1%)	0.73
Drank alcohol	1 (1%)	0 (0%)	1 (1%)	0.73
Have been admitted, do not know why	1 (1%)[2]	0 (0%)	1 (1%)	0.73
Total number of admissions	12[1] [2] (18%)	3 (16%)	15[1] [2] (18%)	

[1]One with cough both in "Cough" and in "Chest pain and cough"
[2]Same person had both pneumonia and have been admitted one more time but do not know why.
[3]Include measles, chicken pox, respiratory tract infection and infection+malaria
*p<0.05

In table 10 the child's diseases now according to the patient book is reported. Significantly more of the admitted patients had pneumonia than the outpatients (22% vs 3%, p: 0.018). Most common disease at the same time as malaria was respiratory tract infection (31%).

Table 10. Current diseases and malaria complications/symptoms except malaria according to the patient book

	Outpatient (n=66) % within outpatients	Admitted(n=18) % within admitted	Total (n=84)	P-value
Diagnose				
Respiratory tract infection	35%	17%	31%	0.16
Cough	17%	22%	18%	0.73
Pneumonia*	**3%***	**22%***	**7%***	**0.018**
Gastro-intestinal disease[1]	3%	6%	4%	
Other infections[2]	5%	6%	5%	
Flue	2%	11%	4%	0.12
Dehydration	0%	6%	1%	
Skinrash	2%	0%	1%	
Malaria complications/symptoms				
Hyperparasitemia	8%	22%	11%	0.094
Malaria partially treated	0%	6%	1%	0.21
Anaemic[3]	5%[3]	0%	4%	
Vomiting everything	0%	6%	1%	
Fever	2%	0%	1%	1.00
Diarrhea	12%	22%	14%	0.28
Joint pain and abdominal pain	0%	6%	1%	

*p<0.05

[1]2 outpatients with gastroenteritis, 1 admitted patient with typhoid (outbreak of typhoid in Kampala and also in Wakiso district during the time of the survey).

[2]Other infections include one outpatient with coryza, one outpatients with candidiasis, one outpatient with bacterial infection, one admitted who was suspected to have tuberculosis.

[3]One patients maybe anemic

Deworming only reported in the question about which medication the children take now.

One of the outpatients below 5 years was severely malnourished and two outpatients and one admitted below 5 years was in risk of malnutrition, see table 11.

Table 11. Malnutrition among children <5 years

Upperarm measure	Outpatient n=43	Admitted n=13	Total N=56
Severely malnourished Red <11.5cm	1 (2%)	0 (0%)	1 (2%)
Risk of malnutrition Yellow 11.5-12.5cm	2 (5%)	1 (8%)	3 (5%)
No malnutrition Green >12.5cm	40(93%)	12 (92%)	52(93%)

Many of the children took other medications except antimalarials as is shown in table 12. There was no significant difference between the groups regarding taking antibiotics or not, but significantly more of the admitted patients took two or more antibiotics, while outpatients more commonly only took one antibiotic (p: 0.001). Medications because of cough or respiratory tract infection were significantly more common among outpatients (p:0.036). Different kind of fluids was more common in the admitted group (p: 0.047).

Table 12. Current medication

Medication	**Outpatient n=67**	**Admitted n=19**	**Total n=86**
Antibiotic	63%	58%	62%
One antibiotic	**54%****	**16%****	45%
Two antibiotics	**7%****	**32%****	13%
More than two antibiotics	**1%****	**11%****	3%
Cough/Respiratory tract infection medication	**57%***	**26%***	50%
Oral rehydration salts + zinc	13%	26%	16%
Paracetamol/Diklofenak/painkillers[1]	69%	58%	66%
Deworming (mebendazole/albendazole)	16%	11%	15%
Antifungal (Clotrimazole/Metronidazole)	3%	0%	2%
Antihistamine (piriton)	6%	5%	6%
Steroids[2]	3%	0%	2%
Syrup haemoforte	4%	0%	3%
Ferro B	1%	0%	1%
Vitamines[3]	4%	16%	7%
Herbs	3%	0%	2%
Ringerlactate/Sodiumlactate fluid	**0%***	**11%***	2%

*p:<0.05

**p<0.001

[1]57 of the patients took panadols, only one outpatient took diklofenak and one admitted took painkillers.

[2]Prednisoline and hydrocortisone included.

[3]Vitamine C, Vitamine A and multivitamins included.

Discussion

The aim of the study was to find out what distinguished children with malaria that were admitted and children with malaria that were not admitted at Kasangati Health Centre. Main differences that were found was that more admitted children were receiving malaria treatment within 12 hours, came to the health centre within 12 hours after first symptom and several severe symptoms were more common among admitted children. However, few earlier studies have been made looking at the differences between hospitalized and non hospitalized children with malaria and therefor it is also interesting to look at the whole group of participants.

One significant difference between outpatients and admitted children was that more of the admitted children were receiving treatment within 12 hours from start of symptoms (admitted 63% vs outpatients 20%) and more often coming to the health centre within 12 hours after start of first symptom (admitted 47% vs outpatients 8%). A possible explanation could be that admitted children are sicker (according to results from this study several malaria symptoms were more common among admitted) and therefor brought for medical care earlier by their caretakers compared to less sick children like the outpatients. If so, that is a very good sign that the sicker children often get to medical care within 12 hours. However, studies in Mozambique showed in contrast that the outpatients had shorter duration of fever (median 1 versus 2 days) before coming to the hospital(30, 31).

In total, 71% of the children received antimalarials within 48 hours (29% within 12 hours, 21% after 12-24hours and 21% after 24-48 hours) which is higher than in other studies (25, 32-35). In a Ugandan household survey from 2012, 44% of children under the age of five with fever got antimalarials the same or next day(36% got ACTs the same or next day)(25) and in a study from Tanzania 66% children below the age of five with fever got antimalarials the same or next day(32). A study conducted in rural parts of Kenya in 2006 showed that 23.3%

of febrile children got antimalarials within 48 hours(33), while in rural Burkina Faso 33% got modern antimalarials within 24 hours(34). In Uganda 13.7% of children below the age of five with fever got malaria treatment within 24 hours of a village health team 2009/2010(35). The difference could be explained by that in our study only those who sought medical care were included. Moreover, in our study we only included malaria patients while other studies included all patients with fever. Further, the age groups are not the same and our study was conducted in a peri-urban area while many other studies were conducted in rural areas with often longer way to health care and sometimes a lower level of education among caretakers.

Admitted children had significantly more diarrhea, general body pain, inability to sit up though she/he normally can, inability to play and rapid breathing. Prostration (inability to sit up or stand up), sever respiratory distress or difficulty breathing and severe dehydration (which can be caused by diarrhea) are mentioned as danger signs of severe malaria in Ugandan guidelines and this result confirm that those are often followed when deciding to admit a child(7). Inability to play can be a sign of prostration and therefor it is not surprising that these children are more likely to be admitted. Convulsions and impaired consciousness are also signs of severe malaria but in this study though there were no difference between admitted and non admitted regarding those symptoms. General body pain which were more common among admitted is not mentioned as a sign of complicated malaria.

In our study 58% of the admitted children were unable to sit up though she/he normally can which correspond to prostration observed in 55% of severe malaria patients in a study about admitted children in Mozambique, but in that study only 14.9% of the total number of admitted children were prostrated(31). In our study 68% of the admitted had rapid breathing which is much higher than reported respiratory distress in the study from Mozambique

(11.1% of admitted children, 41.1% of severe malaria patients)(31). One possible explanation for this is that we relied rely on reports from caretakers while the study from Mozambique relied on reports from physicians or medical officers. Probably, not all reported rapid breathing would have been classified as severe as respiratory distress if seen by a physician.

Significantly more of the admitted children had a positive malaria test (74% admitted vs 33 % outpatients) which shows that more of the admitted children had a verified malaria. Also significantly more of the admitted and the children with a positive malaria test got artesunate injection. This indicates that artesunate injections were mainly given to children with verified malaria.

When it comes to chronic underlying diseases there were no big differences between outpatients and admitted, very few patients had a chronic disease or was malnourished. Only two chronic diseases were found, one outpatient with asthma and one admitted with HIV. In other studies HIV prevalence among children with severe malaria has been higher with 12% in Kenya(36) and 16% in Malawi(37), but among adults with malaria in Ethiopia it was 4.2% and no different from the HIV prevalence in general population(38).

Pneumonia was significantly more common among admitted patients (22% of the admitted children vs 3% of the outpatients), and also more common as reason for prior admission in the admitted group. Malaria is a risk factor for bacteraemia, but especially for Gram negative infections(39) while *S.pneumoniae* causing pneumonia is a gram positive bacterium. The proportion of bacteraemia infections among admitted children with malaria have been between 4.6% and 6% in studies from Kenya, Malawi, Ghana and Mozambique(36, 37, 40, 41). The prevalence of pneumonia and pneumococcus is also common in other studies. In a

study from Ghana *Streptococcus spp* only where 13% of the bacteraemia infections(40) and in a study from Mozambique it was 26.3% of all bacteraemia that was *S.pneumoniae*(41). In our study pneumonia is a clinical diagnose while in the other studies a blood culture has been made to evaluate the amount of bacteraemia, making it not possible to compare these studies. The clinical picture of pneumonia and malaria overlap extensively with symptoms like fever, cough and rapid breathing, making it hard to evaluate the true cause of the illness only looking at clinical picture. This is seen in a study from Uganda where 30% of all children at health centres fulfilled criteria for both pneumonia and malaria only using a classification form, and 37% of the children with malaria also had pneumonia(42) which more correspond to the numbers in this study. However, pneumococcus is hard to cultivate and many that has pneumococcus can still get a negative culture making that kind of study not showing the whole truth either.

When it comes to medications significantly more of the admitted patients took two or more antibiotics and fluids also suggesting that the admitted children had more co-infections (like pneumonia) than outpatients. Cough/respiratory tract infection medication were more common among outpatients indicating that these problems were more common among outpatients, but it is hard to evaluate because the symptom cough was more common among admitted children.

It was common to visit other health care before coming to the health centre, 69% had visited other health care before coming. This is higher than in a study from 2013 in Uganda where only 4.9% sought health care from more than one source(43) . In my study the use of private clinics first (33%) and government health centre (35%; 31% had not visit health care before coming and 4 % gone to a government health centre) is much higher than in a household

survey from 2012 where 15% went to private clinic first and only 13% went to public sector (most people first source of advice and treatment was at home)(25). This could possibly be explained by that in our study only those who came to a public government health centre were included, and many that only went to private health care or never seek health care were not included. Private clinics has been shown to be the most common first place to seek treatment in Uganda in several studies (43, 44). In a study from 2013 had 58.4% first went to private care, 41.6% went to public and no one went to a traditional healer in the region Central 1 (where Kasangati belongs to)(43). Another study from 2009 showed that 62.7% went to private clinic or drugshops first and 33.1% went to public health care(44).

In our study 62% had given the child medication because of fever before coming to the health centre which is a high number, especially when 28% had given antimalarials and almost everyone of them without taking a malaria test first. Taking antimalarials without taking a test increases unnecessarily antimalarials intake and increases the risk of emergence of resistance to the medication. Resistance of *P. falciparum* to ACTs has still not been seen in Africa but with unnecessarily use of the drugs the risk increases(3). Our study was conducted in a malaria endemic area and therefor it is not surprising that it is common with self-prescription of antimalarials and analgesics**.** The self-prescription in this study is somewhat lower than in other studies; in a study from northern Uganda 75.7% practiced antimicrobial self-prescription(45) and in two studies from Sudan it was 73.9% (43.4% took antimalarials) respective 81.8%(46, 47). According to a study in Nigeria 85% practiced self-medication, where 15.9% used only antimalarials, 26.5% used only analgesics, 22.4% took antimalarial-analgesics, 15.3% antimalarial-analgesic-antibiotics and 10% antibiotic-analgesics(48).
The number of self-medication with antimalarials of 28% in this study is comparable with coartem(artemeter-lumefantrine) being 27.3% of the self-medicated drugs in the study from

Northern Uganda, but there only 11.2% of the participants used antimalarials for curing fever, headache, lack of appetite and body weakness(45). In the studies from Sudan and Nigeria the self-medication with antimalarials was 11.4%, 48.1% and 53.6%(46-48). An explanation to a different result in this study is that this is a study among children with malaria, and the other studies were the participants adults in household studies or outpatients, which could lead to the conclusion that children less often get self-medication and more often parents sought care for their children. Because some of the participants had been to a private clinic before coming to the health centre, all of them had not been self-medicating so the numbers of self-medication in this study probably should be less high. More studies on what kind of antimalarial drugs people use to see if national guidelines with ACTs as first line medication are implemented is needed.

In our study most medicines were bought at a private clinic (42%) and totally 65% had bought it either in private clinic, pharmacy or drugshop. This correspond to 68.8% of respondents in one of the studies from Sudan got drugs from private pharmacies(47), but in the other study from Sudan 80.5% got drugs from there(46). In the Ugandan study 68.4% obtained medication from a drugshop (only 7% in my study)(45). A household study from Uganda showed that 47% got antimalarial from private sector, 36% got antimalarials from the public non for profit sector and 23% had the medication already at home(25) but this is hard to compare to this study because in this study only medication before coming to public health facility is studied.

In order to get a more whole picture of the situation in the area a community based study on duration before treatment and medical care, socioeconomic status, accessibility and prior treatment should be done to also aim to review the children that never comes for medical care

or seek private health care. To investigate the frequencies of underlying diseases and co-infections among children with malaria in this area studies using laboratory equipment would give a clearer picture of the situation.

Strengths and weaknesses

One strength of this study is that both a questionnaire and information from the patient book were used to get a more whole picture. The amount of information in the patient books about other diseases varied a lot though depending on who was examining the child, but all the medications for that visit were always registered. In the patients book though, earlier visits or chronic diseases was almost never found, so for this the information was fetched in the semi-structured interviews.

The use of semi-structured interviews instead of only distributing a questionnaire made it possible to make sure that the respondent comprehended the questions, to explain questions that was hard to understand and gave the study a qualitative aspect.

The weaknesses of the study were many. The use of several interpreters may resulted in a risk that information was lost in the translation and that they interpreted in different ways. To avoid this two of the most used interpreters participated in the process of making the final questionnaire and all questions were explained thoroughly for them. There were certain risks of that the interpreters (who work at the health centre) presence during the interviews affected the honesty in the participants' answers and made them hide facts in shame or fear of that their treatment would be affected.

Another weakness of the study was the small number of participants (only 86 and of them only 19 that were admitted), making it hard to get statistically proven findings. The study was

conducted during the end of the dry season and start of the wet season when there are more malaria cases. One reason of the small number of malaria cases could have been that the wet season started later than usual, but also that the number of malaria cases has decreased in the last years(21).The study was also made on both children with a positive malaria test and those who were treated for clinical malaria, making it hard to evaluate if all the children really had malaria.

One limitation is that this is a cross-sectional study making it impossible to know and exclude the possibility that some of the outpatients developed severe malaria and later were admitted at the health centre or at the hospital.

Finally, in this study only the one's that seek medical care at a government health centre is included, and those who do not seek medical care at all, take medications at home or go to a private clinic are not included making it hard to evaluate some of the answers. The most severe malaria cases are not included in the study either because they were referred to the hospital. In a study from 2013 conducted in all Uganda 81.8% of the children below five years with fever sought advice and treatment and in central region 1 (where Kasangati is situated) it was 85.2%(43). Same study shows that in central region 58.4% seek medical care at a private facility and only 41.6% goes first to a public facility. This means that almost 15% of the children with fever never seek advice or treatment and even more do not come to the public health centre. Those who do not seek medical care probably is a quite different group that could have less availability to health care.

Conclusions

Our main conclusions were

- Admitted children were more often treated within 12 hours and came more often to the health centre for medical care within 12 hours suggesting that parents with children that are more severe ill choose to seek medical care faster than parents to children with less severe illness.
- Children living >6km from the health centre tended to receive treatment later.
- Admitted children had more diarrhea, general body pain, inability to sit up though she/he normally can, inability to play and rapid breathing suggesting that the admitted children had signs of complicated malaria.
- Pneumonia were more common among admitted children. No differences were found between outpatients and admitted regarding chronic underlying diseases.
- No difference were found between outpatients and admitted children regarding treatment before coming to the health centre but in total as many as 28% had taken antimalarials before coming to the health centre.
- No differences were found between outpatients and admitted children regarding socioeconomic status, accessibility to health care and previous malaria.
- These results implicate that the people in the area need more education about seeking care and test for malaria within 12 hours after the child gets sick before taking antimalarials, especially those living further from the health centre. Interventions to improve the accessibility of health care and education about malaria could be needed in the area further from the health centre. Further studies should be done on community level to evaluate the situation of the whole population.

Populärvetenskaplig sammanfattning

Skillnader mellan inlagda barn med malaria och barn i öppenvården med malaria i Kasangati, Uganda

I Uganda är malaria ett stort problem och är den sjukdom som orsakar störst sjuklighet i landet. Det är den näst vanligaste orsaken till död bland barn under 5 år och den tredje vanligaste orsaken till död bland vuxna. Malaria kan delas in i okomplicerad malaria och svår malaria, där en okomplicerad malaria utan behandling kan leda till svår sjukdom och död. Tidig diagnos och behandling inom 24 timmar efter första symptom är viktigt för att undvika att detta sker. Dock är det vanligt att folk tar antimalarialäkemedel i tron att de har malaria trots att de inte har det, vilket ökar risken för att resistens mot antimalarialäkemedel ska uppstå. Att testa allas blod som har misstänkt malaria med ett så kallat Rapid Diagnostic Test (RDT) eller mikroskopi före de får behandling mot malaria är ett sätt att förhindra detta.

Denna studie har utförts på ett hälsocenter i Kasangati, en by 1,4km utanför Ugandas huvudstad Kampala. Studien har undersökt om det finns några skillnader mellan inlagda barn upp till 12 år med malaria och de barn med malaria som kommer till hälsocentret och får behandling men som inte behöver läggas in. Studien har tittat på olika faktorer som tid till behandling, symptom, socioekonomi, underliggande sjukdomar och tillgång till hälsovård. Intervjuer med hjälp av enkäter genomfördes med barnens föräldrar eller annan person som hade ansvar för dem och information om samtidiga sjukdomar hittades i patientböcker.

Studien fann att det var vanligare bland inlagda barn att ha fått läkemedel mot malaria inom 12 timmar efter första symptom och att ha kommit till hälsocentret inom 12 timmar efter första symptom. Symptomen på svår malaria som diarré, oförmåga att sitta upp trots att barnet normalt kunde det, oförmåga att leka och snabb andning var vanligare bland de inlagda

barnen. Även generell kroppssmärta var vanligare bland de inlagda barnen. De inlagda barnen hade även mer lunginflammation jämfört med barn som inte lades in.

Studiens resultat tyder på att föräldrar till barn som är svårt sjuka söker medicinsk vård och ger läkemedel mot malaria tidigare än föräldrar till barn med mindre svår sjukdom. Det behövs fler nya studier för att kontrollera detta.

Acknowledgements

Josefin Henrysson for your never ending support and friendship. Without you the time in Uganda wouldn't have been as great as it was.

Supervisor Prof. Rune Andersson for your support from planning to analysing and writing the thesis. Thank you for all your answers on the many questions sent by email during the study.

Supervisor Dr Ivan Nyenje for your support during the study, answering all questions and help with practical things in Kasangati.

Robert, Amina and Sam –Thank you for all your hard work interpreting and helping me find all the malaria patients, without you I would never been able to do this study.

Health staff at Kasangati Health centre: For always being so helpful and nice during our time at Kasangati health centre and letting me be a part of the clinical work when there were no malaria patients.

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Appendix A

Parent questionnaire

A study of malaria among children, Uganda

Elisabeth Olsson, Medical student at Sahlgrenska Academy, Gothenburg University, Sweden

Supervisors: Dr Ivan Nyenje, Kasangati Government Health Centre, Kasangati, Uganda and Prof. Rune Andersson at Sahlgrenska Academy, Gothenburg University, Sweden.

Verbal consent _____
Patient/ID nr:_____

□Kasangati Health Centre
□Buwambo Health Centre

Malariatest □ Positive
□ Negative

□Outpatient
□Admitted

□Weight_____

□Upper arm measure_____

---

1) **Do you speak English?**
   □ Yes □ No
2) **Your child's sex:**
   □ Girl □ Boy
3) **Child's Age: _____**
4) **Are you the caretaker of the child?**
   □Yes
   □No
5) **Relation to the child:**
   □ Mother
   □ Father
   □Grandmother
   □Grandfather
   □ Friend
   □ Neighbor
   □ Other, specify (also your sex)

_____

6) **Your marital status**
   □ Married – monogamous
   □ Married - polygamous
   □ Single
   □ Seperated/Divorced/Widowed
7) **The child´s mother´s highest level of education:**
   □ Never gone to school
   □ Primary school
   □ Secondary school
   □ Tertiary institution
   □ University
   □ Do not know
8) **The child´s father´s highest level of education**
   □ Never gone to school
   □ Primary school
   □ Secondary school
   □ Tertiary institution
   □ University
   □ Do not know
9) **The child's caretakers level of education (if not mother or father)**
   □ Mother and/or father is the caretaker
   □ Never gone to school
   □ Primary school
   □ Secondary school
   □ Tertiary institution
   □ University
   □ Do not know

10) The child´s mother´s occupation:

□ Government employee
□ Private business employee
□ Self-employed
□ Unemployed
□ Retired
□ Student
□ House wife
□ Peasant
□ Other
Specify:_____
□ Employed, state type of work;_____

11) Child´s father´s occupation

□ Government employee
□ Private business employee
□ Self-employed
□ Unemployed
□ Retired
□ Student
□ Peasant
□ Other
Specify:_____
□ Employed, state type of work_____

12) The child's caretakers occupation (if not mother or father)

□ Mother and/or father is the caretaker
□ Government employee
□ Private business employee
□ Self-employed
□ Unemployed
□ Retired
□ Student
□ Peasant
□ Other, specify:_____
□ Employed, state type of work_____

13) Total income/month in your whole household (Ush)

□<50 000
□50,001-100,000
□100,001-200,000
□200,001- 500,000
□500,001-1,000,000
□>1,000,000
□ Do not know

14) Living conditions:

□ Hut
□ Brickhouse
□ Apartment
□ Living in the home of relatives/friends
□ No stable place to live
□ Other:
_____

15) Residence

□ Urban
□ Periurban
□ Rural

16) Please state the number of people in your household?

_____

17) How many children in your home are below the age of five?

_____

Knowledge, accessibility, availability, acceptability of care

18) Do you know any signs and symptoms of malaria?

_____
_____
_____
_____
_____
_____

19) What do you think is the treatment for malaria?

_____
_____
_____

20) How far from Kasangati/Buwambo Health Centre do you live?

□Less than 1km (<0,6miles)
□1-5km (0,6-3,1miles)
□6-10km (3,7-6,2 miles)
□11-15km (6,8-9,3 miles)
□More than 15km (>9,3miles)

21) How did you travel to Kasangati/Buwambo Health Centre?

□On foot
□By bicycle
□By bus/taxi
□By car
□By bodaboda
□ Other (please specify)-

_____

22) How much did the travel to the health center cost? Specify

_____

23) Have you and your child visited anyone for medical care before coming to Kasangati/Buwambo Health Centre?

□No

□ Yes, another hospital (please specify which)_____
□ Yes, village health team /community health worker
□ Yes, private health facility
□ Yes, government health center
□ Yes, pharmacy/self prescription
□ Yes, traditional healer
□Yes, Other (please specify)_____

24) Have your child got any medication because of fever before coming to the health center?

□Do not know
□No
□Yes
Can you specify which medication:

_____

□ Antibiotics
□ Antimalarials
□ Antipyretic ex.Aspirin/panadol
□Other (specify)-

_____
□ Do not know

25) Where did you buy medication?

□Drug shop
□Ordinary shop (specify)_____
□Private facility/ clinic
□ Pharmacy
□Other (specify)-_____
□ Do not know
□ Did not buy medication

26) When your child got the first symptoms (like fever), how long did it take you to get malaria treatment?

□ Within 12 hours
□12-24 hours
□24-48 hours
□ More than 48 hours
□ Do not know

27) If your child did get antimalarials before coming to the health center: Did she/he take a diagnostic test before?

□ Yes. It was positive
□ Yes. It was negative
□ No
□ Did not get antimalarials

28) If your child did not get antimalarials - Did your child take a diagnostic test before coming to the health center?

□ Yes. It was positive
□ Yes. It was negative
□ No
□ Did get antimalarials

29) Why did you choose to seek medical care at a health center?

□My child was so sick
□My child was getting worse
□ Relative, friend or neighbor told me to
□ Person with health care education told me to
□ Other

specify_____

_____

_____

_____

_____

_____

30) How long after onset of your child´s first symptoms (ex fever) did you come to the health center?

□<12 hours
□12-24 hours
□1-2 days
□3-4 days
□5-6 days
□ 7 days
□>7 days

31) What symptoms did your child have when she/he came to the health center?

You can fill in several of the boxes.

□ Fever
□ Sweats
□ Chills
□ Nausea
□ Vomiting
□ Diarrhea
□ Cough
□ General malaise
□ Headache
□ General body pains
□ Inability to sit up though she/he normally can
□ Inability to feed or drink
□ Inability to play
□ Impaired consciousness
□ Rapid breathing
□ Convulsions
□ Other. Specify_____

32) Which of your child's symptoms made you come to the health center?

□ Fever
□ Vomiting
□ Diarrhea
□ Cough
□ General malaise
□ General body pains
□ Inability to sit up though she/he normally can
□ Inability to feed or drink
□ Inability to play
□ Impaired consciousness
□ Rapid breathing
□ Convulsions
□ Other. Specify_____

33) Which problems did you have that made it hard to come to the health center? You can fill in several of the boxes.

□ Live far from a hospital
□ Hard to find someone to take care of your other children/or the household
□ Can´t afford the journey to the hospital
□ Can´t afford the treatment at the hospital
□ Do not trust the health care system
□ Other difficulties (specify):

_____

_____

_____

_____

□ I did not have any problems

Underlying diseases

34) Have your child had malaria before?

□ Yes, less than one year ago.
□ Yes, more than one year ago
□ Yes, do not know when
□ No
□ Do not know

35) Have your child been treated for malaria before?

□ Yes, less than one year ago
□ Yes, more than one year ago
□ Yes do not know when
□ No
□ Do not know

36) If your child been treated for malaria before – did your child take a diagnostic test before treatment?

□ Yes, it was positive
□ Yes, it was negative
□ Yes, I do not know if it was positive or negative
□ No
□ Do not know

37) How many times in your child's lifetime have she/he received malaria treatment?

_____

38) Have your child been admitted to hospital before because of something else than malaria? You can fill in several of the boxes

□Do not know
□No
□ Yes because of….
□Pneumonia
□ Diarrhea
□ Tuberculosis
□ Injury, accident
□ Kidney disease
□ Diabetes
□ Cancer
□ Heart disease
□ HIV
□ Sickle cell anemia
□ Other chronic disease. Specify_____
□Other. Specify_____

39) Is your child diagnosed HIV positive?

□ Yes
□ No
□ My child has not been tested for HIV
□ My child has not been tested for HIV, but the mother was tested negative during pregnancy

40) Has your child been breastfed?

□ Yes, if yes how many months:_____
□ Is still breastfeeding
□ No
□ Do not know

41) Does your child have another disease except malaria now? You can fill in several of the boxes.

If so wich:

□ Tuberculosis
□ Kidney disease
□ Diabetes
□ Cancer
□ Heart disease
□ Cough
□ Diarrhea
□ Other.

Specify_____

_____

_____

According to the medical record- Does the child have another disease now?_____

_____

42) Does your child take any medication except antimalarials now?

If so which:

_____

43) Does your child take any medication regularly?

If so which:

_____

44) How often did your child sleep under a mosquito net last week?

□ Every night
□ More than 4 nights
□ Less than 4 nights
□ Not at all
□ Do not know

45) Is the mosquito net that your child slept under treated with a treatment?

□ Yes
□ No
□Do not know
□ Did not use a net

46) During what season does your child sleep more often under a mosquito net?

□ Rainy season
□ Dry season
□ Use it during the whole year
□ Never use it
□ Do not know

47) Has anyone come into your home to spray the walls against mosquitos in the last year?

□ Yes
□No
□Do not know

Thank you for your participation!