**ADDIS ABABA UNIVERSITY**
**COLLEGE OF HEALTH SCIENCES SCHOOL OF NURSING AND MIDWIFERY**

# TREATMENT OUTCOME OF SEVERE MALARIA AND ASSOCIATED FACTORS AMONG ADULTS ADMITTED IN ARBA MINCH GENERAL HOSPITAL, SOUTHERN NATION NATIONALITY AND PEOPLE REGION, ETHIOPIA, 2019

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**A THESIS TO BE SUBMITTED TO SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCE, SCHOOL OF NURSING AND MIDWIFERY IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTERS OF SCIENCE IN ADULTHEALTH NURSING**

**JUNE, 2019**
**ADDIS ABABA ETHIOPIA**

**ADDIS ABABA UNIVERSITY**
**COLLEGE OF HEALTH SCIENCES**
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# TREATMENT OUTCOME OF SEVERE MALARIA AND ASSOCIATED FACTORS AMONG ADULTS ADMITTED IN ARBA MINCH GENERAL HOSPITAL, SNNPR ETHIOPIA

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**JUNE, 2019**
**ADDIS ABABA, ETHIOPIA**

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This thesis by Solomon Kassa Bekele: Treatment outcome of severe malaria and associated factors among adults admitted in Arba Minch general hospital, Southern nation nationality and people region, Ethiopia, 2019 is accepted in its present form by the board of examiners as satisfying thesis requirement for the degree of masters in Adult Health Nursing

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## Acronyms and abbreviations

AKI: Acute kidney injury

ARDS: Acute respiratory distress syndrome

AMGH: Arba Minch general hospital

ASL: Above sea level

BSc: Bachelor of science

CDC: Communicable disease control

CI: Confidence interval

E.C: Ethiopian calendar

G.C: Gregorian calendar

GCS: Glasgow coma scale

SNNPR: Southern nation nationalities and peoples representative

SPSS: Statistical package for social science

WHO: World health organization

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## Abstract

**Introduction:** Malaria is a protozoan disease transmitted by the bite of infected female Anopheles mosquitoes. Progression to severe and fatal disease is largely but not entirely confined to Plasmodium falciparum infections. Despite remarkable progress in recent years, malaria remains a leading cause of sickness and death across much of sub-Saharan Africa. Malaria disproportionately impacts the rural poor, typically people who must walk for miles to seek treatment.

**Objective:** The aim of this study is to assess treatment outcome of severe malaria and associated factors among adults at Arba Minch general hospital, SNNPR, 2011 E.C.

**Methods:** Institution based retrospective cross-sectional study was conducted in Arba Minch General Hospital on February 2019. Data was collected from patient record whom admitted with severe malaria in the past 4 years from Sep. 2015 – Aug. 2018. Data was entered to Epidata 3.1. and then exported to SPSS version 25 for analysis. Bivariate and multivariate logistic regression was computed to assess statistical association between the outcome variable and independent variables using Odds Ratio; significant of statistical association was tested using 95% confidence interval (CI) and p value (<0.05).

**Result:** Out of 422 patients with severe malaria intended to be included in the study, 387 cases were actually involved with response rate of 91.7%. The mortality rate associated with severe malaria in the year between 2015-2018 at Arba Minch General Hospital was 5.7%. Co-morbidity, impaired consciousness and acidosis were significantly associated with mortality, at significant level of $P < 0.05$.

**Conclusion and recommendations:** co-morbidity, impaired consciousness and Acidosis were found to be poor prognostic indicators for patients with severe malaria, so priority should be given for those patients who came with such manifestations.

**Key words:** Severe malaria, Mortality, Outcome

# 1. Introduction

## 1.1. Background

Malaria is a protozoan disease transmitted by the bite of infected female Anopheles mosquitoes(1,2). Six species of the genus Plasmodium cause nearly all malarial infections in humans. These are Plasmodium falciparum, Plasmodium vivax, two morphologically identical sympatric species of Plasmodium ovale (curtisi and wallikeri), Plasmodium malariae, and—in Southeast Asia—the monkey malaria parasite Plasmodium knowlesi. While almost all deaths are caused by P. falciparum malaria, P. knowlesi and occasionally P. vivax can also cause severe illness(2).

Infection with malaria parasites may result in a wide variety of symptoms, ranging from absent or very mild symptoms to severe disease and even death. Malaria disease can be categorized as uncomplicated or severe (complicated). In general, malaria is a curable disease if diagnosed and treated promptly and correctly(3).

Progression to severe and fatal disease is largely but not entirely confined to P. falciparum infections Although they contribute much less than P. falciparum to the global burden of severe malaria, both P. vivax and P. knowlesi can also cause severe disease and they do kill(4).

In high-transmission areas, the risk for severe falciparum malaria is greatest among young children and visitors (of any age) from nonendemic areas. In other areas, severe falciparum malaria is more evenly distributed across all age groups(5).

The risk for severe vivax malaria is greatest among young children and people with comorbid conditions. Severe disease is rare in temperate areas and in returned travellers. It occurs in relatively high-transmission areas with chloroquine resistance. P. knowlesi malaria occurs mainly on the island of Borneo but has been reported in other South-East Asian countries. Local residents and travellers to or from this region are at risk for infection. It is transmitted mainly in forests and along forest fringes(5).

High parasitaemia is undoubtedly a risk factor for death from falciparum malaria, but the relation between parasitaemia and prognosis varies according to the level of malaria transmission. In low-transmission areas, mortality from acute falciparum malaria begins to increase with parasite

densities over 100 000/µl (~2.5% parasitaemia), whereas in areas of higher transmission much higher parasite densities may be well tolerated. Parasitaemia > 20% is associated with a high risk in any epidemiological context(5).

According to 2014 WHO criteria, severe malaria is defined as one or more of the following, occurring in the absence of an identified alternative cause, and in the presence of P. falciparum asexual parasitaemia(4):

1. Impaired consciousness: A Glasgow Coma Score <11 in adults
2. Acidosis: Severe acidosis manifests clinically as respiratory distress – rapid, deep and laboured breathing
3. Hypoglycaemia: Blood or plasma glucose <2.2 mM (<40 mg/dl)
4. Severe malarial anaemia: A haemoglobin concentration <5 g/dl or a haematocrit of <15%
5. Prostration/extreme weakness: inability to walk or sit up without assistant. This is the milder and benign end of the neurological manifestations spectrum, potentially dangerous unless treated urgently.
6. Renal impairment (acute kidney injury): Plasma or serum creatinine >265 lM (3 mg/dl) or blood urea >20 mM
7. Jaundice: Plasma or serum bilirubin >3 mg/dl
8. Pulmonary oedema: Radiologically confirmed, or oxygen saturation <92% on room air with a respiratory rate >30/min, often with chest indrawing and crepitations on auscultation
9. Significant bleeding: Including recurrent or prolonged bleeding from nose gums or venipuncture sites; haematemesis or melaena
10. Shock: Compensated shock is defined as capillary refill ≥3 s or temperature gradient on leg (mid to proximal limb), but no hypotension.
11. Hyperparasitaemia: P. falciparum parasitaemia >10%

### 1.2. Statement of problem

The World malaria report 2017 showed that progress against malaria has stalled in many countries, and that the world was unlikely to achieve the WHO Global technical strategy for malaria morbidity and mortality targets for 2020. Since the beginning of global malaria fight still now the attempts are on a cross road(6).

In 2017, an estimated 219 million cases of malaria occurred, compared with 239 million cases in 2010 and 217 million cases in 2016. Even though there was an estimated 20 million fewer malaria cases in 2017 than in 2010, data for the period 2015–2017 highlight that no significant progress in reducing global malaria cases was made in this timeframe(6).

Although there was remarkable progress in recent years, malaria remains a leading cause of sickness and death across much of sub-Saharan Africa. Majorly malaria impacts the rural poor, typically people who must walk for miles to seek treatment. It is also a leading cause of absenteeism among employees, increased health care spending, decreased productivity, and approximately 50 percent of all preventable school absences in Africa. Malaria helps to trap families in a vicious cycle of disease and poverty(7).

Majority of malaria cases in 2017 were in the WHO African Region (200 million or 92%), followed by the WHO South-East Asia Region with 5% of the cases and the WHO Eastern Mediterranean Region with 2%.Fifteen countries in sub-Saharan Africa and India carried almost 80% of the global malaria burden. Five countries accounted for nearly half of all malaria cases worldwide: Nigeria (25%), Democratic Republic of the Congo (11%), Mozambique (5%), India (4%) and Uganda (4%). In 2017, there were an estimated 435 000 deaths from malaria globally, The WHO African Region accounted for 93% of all malaria deaths in 2017(6).

The 2017 WHO age adjusted death rates estimates associated with severe malaria reported that, in Africa total of 43 countries including Ethiopia are under high death rate. Ethiopia account 5.43 deaths per 100,000(8).

Malaria is a major public health problem in Ethiopia despite relatively low malaria prevalence compared to most other malaria-endemic countries in Africa. Unstable malaria transmission patterns make Ethiopia prone to focal and multifocal epidemics that have on occasion caused

catastrophic public health emergencies. Malaria is seasonal in most parts of Ethiopia, with variable transmission and prevalence patterns affected by the large diversity in altitude, rainfall, and population movement(9).

In 2014/2015, the total number of laboratory-confirmed plus clinical malaria cases in Ethiopia were 2,174,707(10). Another study conducted on mortality rates of malaria in Ethiopia during 2015 showed the total number of deaths associated with malaria was 1561 which is a significant number suggesting an attempt should be done to bring down deaths(11). So this shows that malaria is a problem on Ethiopia.

Some studies conducted in different regions of the Ethiopia suggested that malaria is still a problem in the country, for instance a retrospective study conducted in Amhara region concluded that: malaria continued to be one of the major public health problem. Moreover, there was no successive yearly reduction in its prevalence. Therefore, efforts are required to reduce the disease burden through continuous monitoring and evaluation of control measures in the study area(12).

## 2. Literature review

### 2.1. Treatment outcome of severe malaria among adults

A 17 year retrospective study conducted in London from 1994-2010 among adults age >18 who came to hospital of tropical disease showed that, a total of 1616 diagnosed with malaria among those only 124 patients were diagnosed with severe malaria. From the patients who diagnosed with severe malaria 119 (96%) patients fully recovered and the remaining 5(4%) patients were dead(13)

A prospective, observational study conducted in Latur, Maharashtra, India during the period from November 2013 to October 2015, on clinical profile and outcome of severe falciparum malaria 110 cases of severe malaria found a mortality rate of 13.63%(14).

A 7 year (between 2006-2012) retrospective case control study conducted in Thailand Bangkok showed that the number of total malaria cases of 255. From the total cases the number of severe malaria was 104 and the remaining 151 were diagnosed with non-severe malaria. There was no report of death from those who were admitted during the time interval (2006-2012)(15).

Finding from another 7 weeks surveillance study during 2011-2012 at Queen Elizabeth hospital Malawi showed that out of 765 patients with malaria 28 (3.6%) patients diagnosed with sever malaria and none of them died(16).

A descriptive hospital-based study conducted at Kassala Hospital, eastern Sudan, during two transmission seasons (between August and December, 2011 and 2012) to investigate the presentation/manifestation of severe malaria caused by P. falciparum or P.vivax showed that A total of 139 adult patients (80 males, 57.6%) with a mean (SD) age of 37.2 (1.5) years presented with severe P. falciparum (113, 81.3%) or P. vivax (26, 18.7%) malaria. Out of the total severe malaria cases the number of death were 3 (2.1%) (17).

A study conducted at Gondar university hospital north west Ethiopia on Treatment outcome of severe malaria in adults with emphasis on neurological manifestations from September 1998-august 2004 sowed that there were 408 cases of severe and complicated malaria, out of those 116 (28.4%) had died(18).

## 2.2. Factors associated with treatment outcome of severe malaria among adults

The prognosis in severe malaria is determined by the number of vital organ systems that are involved and the severity of their dysfunction. Mortality is increased in the elderly and also in pregnant women. While the quality of intensive care support is an important determinant of outcome, by far the most important factor is the specific antimalarial drug treatment. Treatment must be given as early as possible in the evolution of a potentially lethal infection(4).

A 17 years retrospective study in London on severe imported malaria among adults showed that a total of 124 patients were diagnosed with severe malaria and among those 5 patients were dead which is a mortality rate of 4%. Among the five patients confirmed dead only 1 cause of death be directly attributed to malaria, the other four deaths were associated with cardiac arrhythmias, high dose inotropes, and prolonged ICU stay. All five were acidotic, all had AKI, three had either seizure or GCS <11 and two developed ARDS(13).

Prospective observational study on clinical profile and prognostic indicators in adults hospitalized with severe malaria caused by different plasmodium species at Sardar Patel medical college Bikaner, India among 40 patients with severe malaria showed that, the mortality rate was significantly associated with lower hemoglobin level, higher total leukocyte count, blood urea, serum creatinine, serum bilirubin, parasite density, lower platelet count, Multiple Organ Dysfunction and lower Glasgow Coma Scale(19).

A prognostic indicators in adults admitted with severe falciparum malaria in western Thailand during 1986-2002 showed that the proportion of patients fulfilling the WHO 2000 definition of severe malaria was 78.1%, and their mortality was 10%. Mortality in patients given parenteral artesunate or artemether (16/317, 5%) was lower than in those given parenteral quinine (59/442, 13%). Mortality was higher with increasing age for those treated with quinine but not for those treated with artemisinins. The post-admission development of complications such as oliguria, seizures or pulmonary oedema and the use of ventilation, lumbar puncture, transfusion and inotropes, were all associated with death with p value less than 0.05 in multiple logistic regression(20).

A multicenter trial conducted in Bangladesh, Myanmar, India, and Indonesia from June 2003 through May 2005 on the Relationship between Age and Mortality Associated with Severe malaria revealed that the mortality increased stepwise, from 6.1% in children (age, <10 years) to 36.5% in patients aged >50 years. Compared with adults aged 21–50 years, the decreased risk of death among children and the increased risk of death among patients aged >50 years was independent of the variation in presenting manifestations. Coma and metabolic acidosis did not vary with age and were the strongest predictors of a fatal outcome. The number of severity signs at hospital admission also had a strong prognostic value(21).

With use of data from a trial conducted in Southeast Asia (*n*=868) to predict the outcome of severe malaria in adults, acidosis (base deficit) and cerebral malaria (measured as Glasgow Coma Score) were the main independent predictors of outcome. This study suggest that patients presented with altered level of consciousness and acidosis had poor prognosis(22).

A descriptive hospital based study conducted in Kassala Hospital Sudan between august 2011 and December 2012 showed that a total of 139 adult patients admitted with severe malaria (P. falciparum (113, 81.3%) and P. vivax (26, 18.7%) malaria). Among the total of severe malaria cases 3 patients died due to severe P. falciparum and none died from severe vivax infection. One had cerebral malaria, the second had renal impairment, jaundice and hypoglycaemia, and the third had repeated convulsions and hypotension(17).

Treatment outcome of severe malaria in adults with emphasis on neurological manifestations at Gondar University Hospital, north west Ethiopia during 1998-2004 showed that Cerebral malaria accounted for 58.1% of the deaths and it was the most significant independent variable predicting poor outcome. Other poor prognostic indicators were late presentation to the hospital, acidotic breathing, pulmonary edema, shock or/hypotension, hyperparasitemia, rural residence and age 40 years and above in adults(18).

### 2.3. Conceptual framework

This conceptual framework on the factors affecting treatment outcome of severe malaria among adults is developed by referring different literatures related to this study(4)(18)(20)(21). It shows the possible independent variables which can affect the outcome variable which is treatment outcome. The arrows indicate the influence of one variable on the other variable.

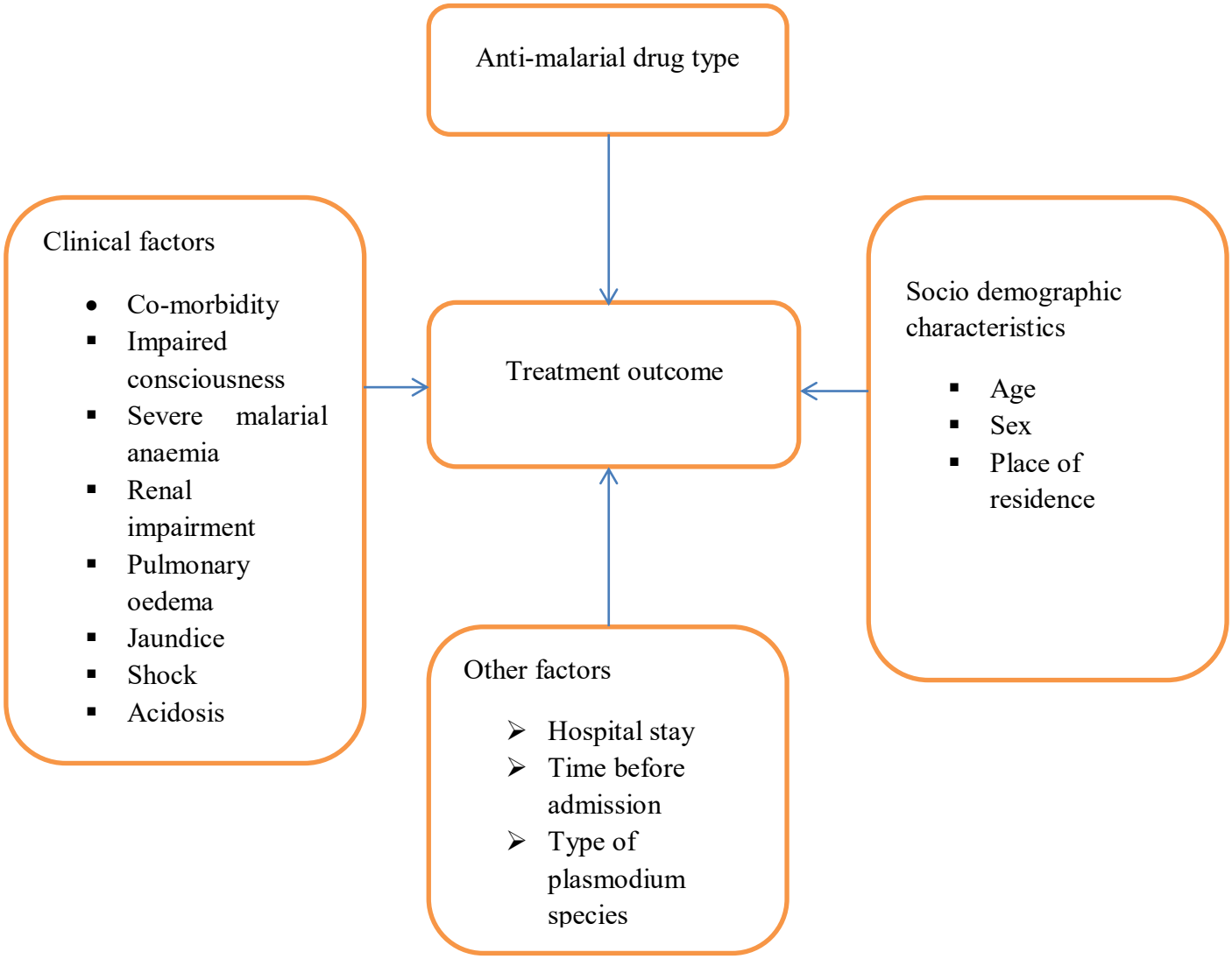


Figure 1: Conceptual framework of treatment outcome of severe malaria and associated factors among adults

## 2.4. Significance of the study

This study is aimed at identifying the treatment outcome of patients with severe malaria and associated factors which will help to contribute on the prevention and management of severe malaria, the study will also help to set plan on the future program of severe malaria treatment. Further it will be used as a baseline for other studies.

Generally, areas located less than 2,000 meters above sea level (<2,000m) in altitude are considered malarious areas(23). The study area (Arba Minch) is at an elevation of 1285 meters above sea level,(24) which makes it to be malarious area and there are frequently reported cases of malaria.

The 2014-2020 Ethiopians national malaria strategic plan for malaria put that by 2020, achieve near zero malaria death in all malarious areas of the country(25). So to achieve this strategic plan conducting this study is one helpful contribution. Finally as there is no previous research done on this study area on treatment outcome of severe malaria, it is therefore very mandatory to conduct the study.

# 3. Objectives

## 3.1.General objective

- To assess treatment outcome of severe malaria and associated factors among adult patients admitted in Arba Minch General Hospital during September 2015 to August 2018.

## 3.2.Specific objectives

- To assess the treatment outcome of severe malaria among adult patients admitted in Arba Minch General Hospital during September 2015 to August 2018.
- To identify factors associated with the treatment outcome of severe malaria among adult patients admitted in Arba Minch General Hospital during September 2015 to August 2018.

# 4. Methods and material

## 4.1. Study area and period

The study was conducted at Arba Minch General Hospital. Arba Minch General Hospital is one of the hospitals in Ethiopia in which both preventive and curative cares are provided. It is a general hospital located in Arba Minch town, Gamo Gofa zone, SNNPR, 505 km, south of Addis Ababa with an elevation of 1285 meters ASL(26). Arba Minch General Hospital officially commenced its functioning in 1955 E.C. (1963 G.C.), and has currently been delivering its health care services in the medical, surgical, gynecological, pediatrics wards, and through a total of 324 beds. The study was conducted from March to June 2019 G.C.

## 4.2. Study design

Institution based retrospective cross-sectional study was used. As the aim of this study is to report on the treatment outcome and the associated factors on severe malaria so data on the past management and outcome of treatment on severe malaria is best addressed by reviewing patients record.

## 4.3. Source population

All adult patients' with severe malaria admitted in Arba Minch General Hospital.

## 4.4. Study population

All adult patients with severe malaria admitted in Arba Minch General hospital during September 2015 to August 2018.

## 4.5. Eligibility criteria

### 4.5.1. Inclusion criteria

Adult patients age ≥18 diagnosed with severe malaria

### 4.5.2. Exclusion criteria

Patients who had incomplete medical record

### 4.6. Sample size determination and sampling technique

#### 4.6.1. Sample size

Sample size was determined by the number of patients whom admitted during the time period from September 2015 to August 2018 and it is found that a total of 630 patients with severe malaria were admitted in this time period. Sample size was calculated using single population proportion sample size determination method by assuming 50% of case fatality to yield the maximum representative sample size with 95% confidence interval.

$$n = \frac{(Z_{\alpha/2})^2 * p\,(1-p)}{d^2}$$

**Where:-**

n= required sample size

z= critical value at 95% CI (1.96)

p= prevalence rate, since the magnitude of mortality is not known, p is taken as 50% i.e 0.5

Margin of error (d) to be 5% (d = 0.05)

$$n = \frac{(1.96)^2 * 0.5(1-0.5)}{(0.05)^2} \qquad n = \mathbf{384}$$

Adding 10% for lose to follow up and incomplete medical record to 384 = **422**

Therefore a total of **422** samples were used to conduct this study

#### 4.6.2. Sampling technique

The records and charts of patients with severe malaria over the past four years period, from September 2015 to August 2018 was retrieved from the record room by taking medical record number from adult medical ward patient admission and discharge registration log book. Then based on the inclusion criteria counting those who have complete medical record were enrolled to the study.

### 4.7. Sampling procedure

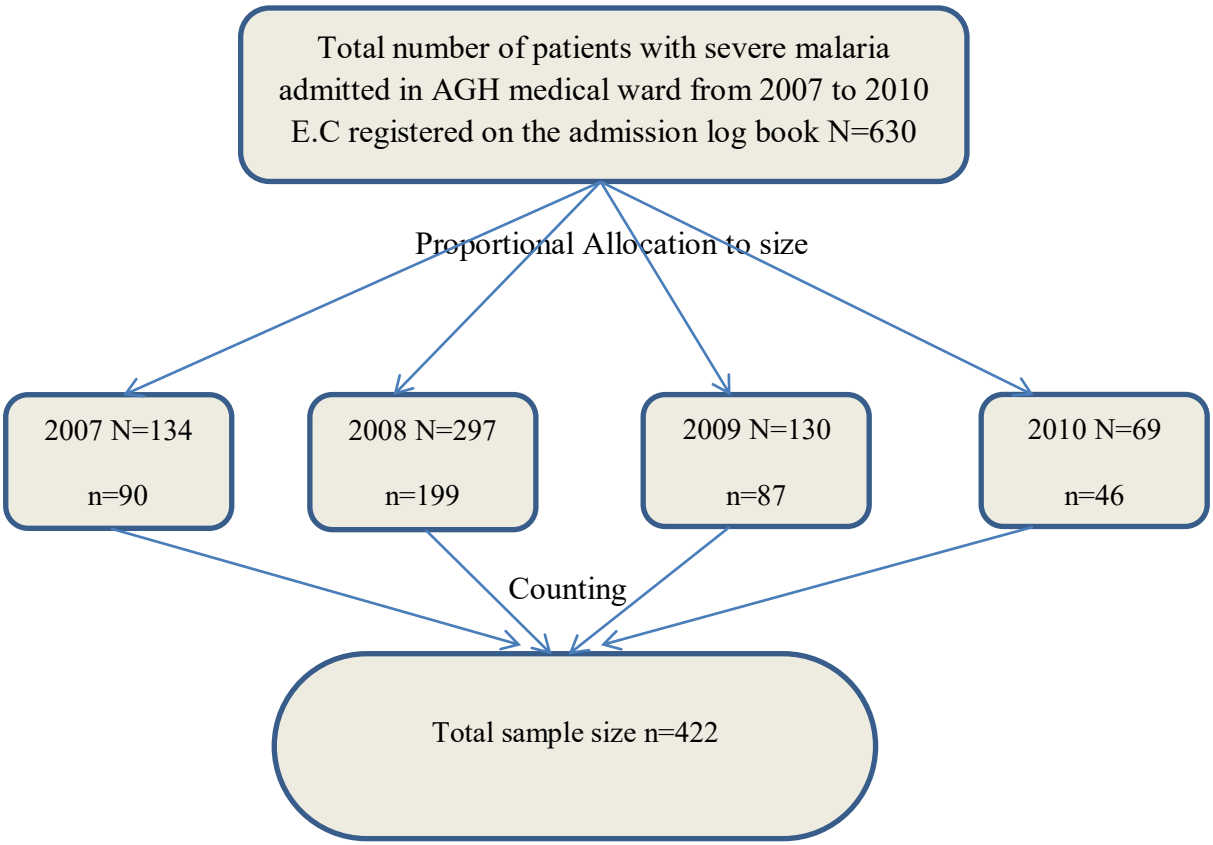


Figure 2: Schematic presentation of the sampling procedure to select study participants

### 4.8. Study variables

#### 4.8.1. Dependent variable

- Treatment outcome of severe malaria considered as death or recovery

#### 4.8.2. Independent variable

- Clinical factors: Co-morbidity, Impaired consciousness, Severe malarial anemia, Renal impairment, Pulmonary oedema, Jaundice, Shock, Acidosis
- Demographic factors: Age, place of residence
- Anti-malaria drug type
- Other factors: Hospital stay, Time before admission, Type of plasmodium species

### 4.9. Data collection method

#### 4.9.1. Data collection instrument

Data was collected using a pretested, adopted checklist which enables to dig out every possible information from patient's record.(18)(19) The checklist contains three parts: the first part is about the patient's demographic characteristics, the second part is clinical profile of the patient and other related factors and the third part is about patient's treatment outcome.

The data collection format is prepared in English.

#### 4.9.2. Data collection procedure

Data was collected by 4 diploma nurses and supervised by 2 BSc nurses whom work in the hospital. During the data collection period principal investigator did continuous monitoring and supervision.

### 4.10. Data quality

To assure data quality the format was adopted from internationally published literatures. And data collection was done by 4 trained diploma nurses and was supervised by 2 trained BSc nurses and by the principal investigator. In addition the format was pretested on 5% of the total cases

(severe malaria). Each day of data collection the collected data was checked for its completeness by the principal investigator. And also the exclusion criteria was considered.

### 4.11. Data processing and analysis

After the data collection the data was entered to EpiData- version 3.1. and then exported to SPSS version 25 for analysis. Descriptive statistic was performed to summarize results using tables. In Bivariate analysis variables having value less than 0.25 was entered in to multivariate logistic regression to assess statistical association between the outcome variable and independent variables, Odds Ratio was calculated to measure the magnitude of association using 95% confidence interval (CI) and p value (<0.05).

### 4.12. Operational definition

**Treatment outcome:** is considered as death or recovery (18,20,27).

**Time before admission:** duration of time since onset of symptom to seeking of treatment.

### 4.13. Ethical consideration

Formal letter was obtained from Research Ethics Committee of Addis Ababa University Collage of Health Science school of Nursing and Midwifery and it was submitted to, Arba Minch town health bureau, Arba Minch General hospital medical director and for record room personnel to obtain legal ethical clearance.

### 4.14. Dissemination of the result

Finally the result will be presented to Addis Ababa university college of health science school of nursing and midwifery as partial fulfillment of master's degree in adult Health nursing.

The findings will be also presented in different seminars, meetings, and workshops as well as further effort will be made to publish the findings on peer reviewed journal. Hard and soft copies will be made available in the library of AAU, for graduate students as well as for other researchers and reader.

# 5. Result

## 5.1. Socio demographic characteristics of study participants

In this study a total of **422** samples were considered first but it actually included a total of **387** sample with a non-response rate of **8.3**%. From the total of 387 patients with severe malaria in the year between 2007-2010 E.C, 231(59.7%) and 156(40.3%) were male and female respectively. The mean age was 26.16 (SD ±9.9), majority of respondents 289(74.7%) lie in between the age group 18-27 years. Almost many 361(93.3%) of patients with severe malaria came from area of high transmission and 26(6.7%) from low transmission area. Table 1 below shows details of socio demographic variables.

Table 1: Socio-demographic characteristics of patients with severer malaria admitted in Arba Minch general hospital from 2007-2010 E.C, N=387

| Variable | Category | Frequency | % |
|---|---|---|---|
| Age | 18-27 | 289 | 74.7 |
| | 28-37 | 36 | 9.3 |
| | 38-47 | 43 | 11.1 |
| | 48-57 | 11 | 2.8 |
| | >=58 | 8 | 2.1 |
| | Total | 387 | 100.0 |
| Sex | Male | 231 | 59.7 |
| | Female | 156 | 40.3 |
| | Total | 387 | 100.0 |
| Place of residency based on transmission rate | low transmission (Altitude >2000 m. ASL) | 26 | 6.7 |
| | High transmission(Altitude <2000 m. ASL) | 361 | 93.3 |
| | Total | 387 | 100.0 |

### 5.2. Clinical and other related factors

Out of 387 cases, almost all 357(92.2%) of patients had come to hospital in a ≤5 days since the onset of sign and symptoms but 30(7.8%) of patients had come lasting more than 5 days. From the total of 387 cases of severe malaria, more than half 214(55.3%) had single WHO defined severity indicator and the remaining 173(44.7%) had 2 or more overlapping severity indicator during admission. Table:2 below, shows in details of clinical and other related factors.

Table 2: Clinical, laboratory and other related factors of severe malaria at Arba Minhch General Hospital 2007-2010 EC. N=387

| **Variable** | **Category** | **Frequency** | **%** |
|---|---|---|---|
| Time before admission | <=5 days | 357 | 92.2 |
| | >5 days | 30 | 7.8 |
| | **Total** | **387** | **100.0** |
| Patients manifestation during admission *(one or more alternatine is possible)* | Prostration/extreme weakness | 232 | 38.3% |
| | Hyperparasitaemia | 185 | 30.5% |
| | Severe malarial anaemia | 49 | 8.1% |
| | Impaired consciousness | 45 | 7.4% |
| | Acidosis | 25 | 4.1% |
| | Renal impairment | 24 | 4.0% |
| | Shock | 19 | 3.1% |
| | Hypoglycaemia | 18 | 3.0% |
| | Significant bleeding | 6 | 1.0% |
| | Jaundice | 3 | 0.5% |
| | **Total** | **606** | **100.0%** |
| Treatment taken | Quinine | 53 | 13.7 |
| | Artisunate | 334 | 86.3 |
| | **Total** | **387** | **100.0** |
| Site of drug administration | Intravenous | 384 | 99.2 |
| | Intramuscular | 3 | .8 |
| | **Total** | **387** | **100.0** |

| | | | |
|---|---|---|---|
| Is there any other associated | No | 344 | 88.9 |
| disease | Yes | 43 | 11.1 |
| | **Total** | **387** | **100.0** |
| Type of malarial species | Falcipharum | 350 | 90.4 |
| | Vivax | 30 | 7.8 |
| | Both | 7 | 1.8 |
| | **Total** | **387** | **100.0** |

### 5.3. Treatment outcome, Case fatality and clinical and other related factors of severe malaria

Of all 387 cases of severe malaria more than half 365(94.3%) had recovered and 22(5.7%) had died. The overall case fatality rate was 5.7% (22/387). The gender specific case fatality was 5.1% (12/231) in males and 6.4% (10/156) in females. Out of 22 deaths 10(45.4%) had at least impaired consciousness, 11(50%) had co-morbidity. Table 3 shows in detail.

Table 3: Case fatality and clinical and laboratory manifestations of severe malaria in Arba Minch general hospital, 2007 – 2010 EC. N=387

| Manifestation | Cases | Deaths | Case fatality rate (%) |
|---|---|---|---|
| Impaired consciousness | 45 | 10 | 22.2 |
| Acidosis | 25 | 5 | 20 |
| Hypoglycaemia | 18 | 2 | 11.1 |
| Severe malarial anaemia | 49 | 3 | 6.1 |
| Prostration/extreme weakness | 232 | 10 | 4.3 |
| Renal impairment | 24 | 1 | 4.1 |
| Shock | 19 | 3 | 15.7 |
| Hyperparasitaemia>10% | 185 | 6 | 3.2 |
| Co-morbidity | 43 | 11 | 25.6 |
| Age >=40 | 52 | 8 | 15.4 |
| Time before admission >5days | 30 | 7 | 23.3 |

### 5.4. Factors affecting death associated with severe malaria

Table 4 below shows, Impaired consciousness, acidosis, and co-morbidity found to be significantly associated with death related to severe malaria, p value less than 0.05.

Cases that have impaired consciousness are 4.175 times more likely to die than those who don't have (CI =1.265-13.782, P=0.019). Cases that have acidosis are 5.735 times more likely to die than those who don't (CI =1.265-13.782, P= 0.019). And cases that had co-morbidity are 13.163 times more likely to die than those who don't have (CI= 4.168-41.575, P=0.000).

Table 4: Factors affecting death associated with severe malaria among adults admitted in Arba Minch general hospital during 2007-2010 EC.

| Variable | Category | COR (95% CI) | AOR (95% CI) | P-value |
|---|---|---|---|---|
| Age >=40 | Yes | 4.169 (1.655-10.503) | 2.776 (0.825-9.339) | 0.099 |
| | No | 1 | 1 | |
| Place of residency based on transmission rate | Low transmission | 1 | 1 | |
| | High transmission | 3.465 (1.080,-11.119) | 0.265 (0.058-1.218) | 0.088 |
| Time before admission >5days | Yes | 6.939 (2.574 18.703) | 2.231 (0.643 7.744) | 0.206 |
| | No | 1 | 1 | |
| Impaired consciousness | Yes | 7.857 (3.167 19.494) | **4.175 (1.265 13.782)*** | **0.019** |
| | No | 1 | 1 | |
| Acidosis | Yes | 5.074 (1.699-15.155) | **5.735 (1.339 24.554)*** | **0.018** |
| | No | 1 | 1 | |
| Shock | Yes | 3.444 (0.923-12.850) | 0.921 (0.159-5.351) | 0.927 |
| | No | 1 | 1 | |
| Hyperparasitaemia | Yes | 0.390 (0.149-1.018) | 0.370 (0.114-1.204) | 0.099 |
| | No | 1 | 1 | |
| Treatment taken | Artisunate | 1 | 1 | |
| | Quinine | 2.537 (0.946-6.808) | 2.573 (0.741-8.929) | 0.137 |
| Is there any other associated disease | Yes | 10.406 (4.184-25.880) | **13.163 (4.168-41.575)*** | **0.000** |
| | No | 1 | 1 | |

## 6. Discussion

In Ethiopia clinical malaria incidence rate has dropped from an average of 43.1 cases per 1000 population annually between 2001 and 2010 to 29 cases per 1000 population between 2011 and 2016. Death associated with malaria has declined from 2.1 deaths per 100,000 population between 2001-2010 to 1.1 deaths per 100,000 population between 2011-2016 given the new policy of free malaria prevention and treatment which address the poor whom are more prone to the infection(28).

There is no recent study conducted in Ethiopia on treatment outcome of severe malaria among adults. Thus this study had tried to assess treatment outcome of severe malaria among adults admitted in Arba Minch general hospital during 2007 -2010 EC. Southern Ethiopia. It is necessary to identify factors influencing treatment outcome of severe malaria and reduce the risk of mortality associated with the disease.

The present study included 387 patients with severe malaria and revealed that 59.7 % of cases were male and 40.3% were female with higher male to female ratio of 1.48:1 which is nearly similar to a study conducted in India Maharashtra which shows a male to female ratio of 2.23:1(19). And unlike to a study conducted in Gondar referral hospital with male to female ratio of 0.83:1(18).

In this study, adult population age group between 18-27 (74.7%) are more presented with severe malaria, similar to a study conducted in Gondar referral hospital which is higher among age group 20-29 (36.5%) and in India Maharashtra which is again higher among age group 20-29 (34.55%)(18,19). This occurred most likely because of an active working age group which makes them vulnerable to infection.

The current study revealed that almost all (93.3%) of cases with severe malaria had come from higher transmission area which is an altitude of less than 2000 m. above sea level(23). This shows it is fact that malarial infection is higher in malaria endemic area.

Out of 387 cases 214(55.3%) cases had single severity indicator and 173(44.7%) cases had two or more overlapping severity indicators. Taking in consideration of the overlapping features of severe malaria presenting sign and symptoms, prostration/extreme weakness was seen in the

majority of cases accounted 38.3% and hyper-parasitemia seen among 30.5% of the cases. This is consistent with the findings of a study conducted in Malawi Blantyre Queen Elisabeth hospital(16). Other presenting features in decreasing order were severe malarial anemia, impaired consciousness and acidosis.

Regarding of the malarial species, P. falciparum predominates which accounted for 90.4% of the cases and P. vivax accounted 7.1% of the cases which is comparable to the study conducted in Gondar referral hospital(18).

In this study the overall mortality rate associated with severe malaria was 5.7% (22/387) which is lower than similar study conducted in Gondar referral hospital during 2006 and a prospective observational study conducted Maharashtra, India which was 28.4% And 13.63% respectively(18,19). This difference in mortality shows an improvement on the treatment regimen possibly the newly used Artemisinin derivative (artisunate) anti-malarial treatment.

Case fatality rate was highest among patients with co-morbidity (25.6%) than late comers lasting >5 days (23.3%), impaired consciousness (22.2%), acidosis (20%) and shock (15.7%). In the current study impaired consciousness and acidosis were two of poor prognostic indicators which was consistent with the study conducted in Gondar referral hospital(18). Co-morbidity is another poor prognostic indicator which was again consistent with findings of a study conducted in western Thailand (20).

## 6.1. Strength and limitations of the study

### Strength of the study

- The study tried to identify factors affecting death associated with severe malaria as there was no resent study conducted on this area it helps to update existing knowledge.
- The study was conducted in malaria endemic area where there was adequate cases found which satisfied the required sample size.

### Limitations of the study

- Since it was retrospective study, all the possible independent variables are not fully addressed.
- Inadequacy of related literatures to compare and discuss some findings.
- As it was cross-sectional study, doesn't show the cause and effect relationship.

## 7. Conclusion

This study showed that severe malaria is one of a major burden of Arba Minch general hospital. Except for pulmonary edema and convulsion many of the WHO severity indicators were observed among cases admitted during 2007-2010 EC. The overall mortality rate associated with severe malaria was 5.7%. Co-morbidity, impaired consciousness (GCS<11) and acidosis were the major determinant of treatment outcome (death).

## 8. Recommendations

**For policy makers**

- Policy makers should prepare a score card to prioritize patients based on the presenting severity indicators specially for patients who came with

**For hospitals**

- Hospital administration should work on providing an intensive care unit to treat patients who came with severe and complicated malaria.

**For health care professionals**

- Should identify and treat patients with severe malaria especially for those who came with impaired consciousness, acidosis and comorbidity.
- Create awareness for patients who visit the hospital on the prevention of the transmission of malaria.
- Set a program on malaria during health education and they should strength existing program

**For patients**

- Patients must come to health facility as early as possible whenever they feel sick.

**For future research**

- Future studies should conduct a prospective study which helps to include every possible independent variables and come with more findings.
- The current study showed impaired consciousness, acidosis and comorbidity were the major determinant of mortality but doesn't show why those patients most likely to die than the others, so further study is needed to investigate the reason behind.
- As there is no sufficient research done in Ethiopia and even Africa on severe malaria among adults further similar studies are mandatory.

## References


1. Hinkle, L. Cheever H. text book of medical surgical nursing. 13th ed. 2014.
2. J.Larry Jameson DLKDLL, editor. principles of internal medicine. 20th ed. 2018. 1575-1579 p.
3. CDC report on severe malaria [Internet]. Available from: https://www.cdc.gov/malaria/about/disease
4. Health I, Malaria RB. WHO Severe Malaria. 2014;19:7–131.
5. WHO. Management of severe malaria, a practical hand book. 3rd ed. 2012.
6. World malaria report 2018. 2018.
7. President US, Initiative M. The President ' s Malaria Initiative. 2018;(April).
8. WHO. Age adgusted death rates estimates [Internet]. 2017. Available from: http://www.worldlifeexpectancy.com/cause-of-death/malaria/by-country/
9. EPHI. Ethiopian National malaria indicator survey. 2015.
10. FMOH health and health related indicators. Version 1. 2007;1:1–66.
11. Deribew A, Dejene T, Kebede B, Tessema GA, Melaku YA. Incidence , prevalence and mortality rates of malaria in Ethiopia from 1990 to 2015 : analysis of the global burden of diseases 2015. Malar J. 2017;1–7.
12. Alelign A, Tekeste Z, Petros B. Prevalence of malaria in Woreta town , Amhara region , Northwest Ethiopia over eight years. 2018;1–6.
13. Marks ME, Armstrong M, Suvari MM, Batson S, Whitty CJM, Chiodini PL, et al. Severe imported falciparum malaria among adults requiring intensive care : a retrospective study at the hospital for tropical diseases , London. BMC Infect Dis. 2013;
14. Mundhe R, Karale MS, Usendi C, Yadav S. Clinical profile and outcome of severe P . Falciparum malaria. 2016;3(4):1034–8.
15. Sagaki P, Thanachartwet V, Desakorn V, Sahassananda D, Chamnanchanunt S, Chierakul W, et al. Clinical Factors for Severity of Plasmodium falciparum Malaria in Hospitalized Adults in Thailand. 2013;8(8).
16. Segula D, Frosch AP, Sanjoaquin M, Taulo D, Skarbinski J, Mathanga DP, et al. Prevalence and spectrum of illness among hospitalized adults with malaria in Blantyre , Malawi. 2014;1–6.
17. Abdallah TM, Abdeen MT, Ahmed IS, Hamdan HZ, Magzoub M, Adam I. Severe Plasmodium falciparum and Plasmodium vivax malaria among adults at Kassala Hospital , eastern Sudan. 2013;1–7.

18. Mengistu G, Diro E. Treatment outcome of severe malaria in adults with emphasis on neurological manifestations at Gondar University. 2007;(May).

19. Gupta BK, Gupta A, Nehra HR, Balotia HR, Meena SL, Kumar S. Clinical Profile and Prognostic Indicators in Adults Hospitalized with Severe Malaria Caused by Different Plasmodium Species. 2015;45–50.

20. Newton PN, Stepniewska K, Dondorp A, Silamut K, Chierakul W, Krishna S, et al. Prognostic indicators in adults hospitalized with falciparum malaria in Western Thailand. Malar J [Internet]. 2013;12(1):1. Available from: Malaria Journal

21. Dondorp AM, Lee SJ, Faiz MA, Mishra S, Price R, Tjitra E, et al. The Relationship between Age and the Manifestations of and Mortality Associated with Severe Malaria. Clin Infect Dis. 2008;

22. Hanson J, Lee SJ, Mohanty S, Faiz MA, Anstey NM, Charunwatthana P, et al. MAJOR ARTICLE A Simple Score to Predict the Outcome of Severe Malaria in Adults. 2010;50:679–85.

23. NATIONAL STRATEGIC PLAN FOR MALARIA PREVENTION CONTROL AND ELIMINATION IN ETHIOPIA 2011 – 2015. (August 2010,Addis Ababa).

24. Wikipedia [Internet]. Available from: https://en.wikipedia.org/wiki/Arba_Minch

25. Admasu K, Ghebreyesus TA. Ethiopia Malaria Policy Landscape 2017 notable events in national policy and financing for malaria 2014 – 2020 National Strategic Plan goals and targets. 2020;(December 2017):1–7.

26. Arba Minch [Internet]. 2018. Available from: http//en.m.wikipedia.org/wiki/Arba_Minch

27. Bin A, Zubairi S, Nizami S, Raza A, Mehraj V, Rasheed AF, et al. Severe plasmodium vivax Malaria in Pakistan. 2013;19(11):1851–4.

28. Taffese HS, Hemming-schroeder E, Koepfli C, Tesfaye G, Lee M, Kazura J, et al. Malaria epidemiology and interventions in Ethiopia from 2001 to 2016. 2018;1–9.

# Annex 1: Information Sheet

**Addis Ababa University, College of Health Sciences, Department of Nursing and Midwifery, Graduate Studies**

**Dear manager!**

Here, I the undersigned, at Addis Ababa University College of Health Sciences, School of Allied Health Science, Department of Nursing and Midwifery Graduate Study Program, currently I will be undertaking research on a topic entitled as treatment outcome of severe malaria and associated factors among adults admitted in Arba Minch General hospital from September 2007 to august 2010 E.C. For this study, this Hospital will be selected so before, you need to know all necessary information related to the study which will be detailed as follows.

**Purpose of the study:** the purpose of this study is to assess treatment outcome of severe malaria and associated factors among adults in AGH

**Participants to be included**: all patients with severe malaria admitted during September 2007-august 2010 E.C whom are sampled by systematic sampling technique will be included in the study.

**Benefits and risk of the study:**

**Benefits**: this study has an input on disclosing the factors which affect treatment outcome of severe malaria which will benefit in the future management of severe malaria.

**Risks**: The study will be conducted by investigating patients chart. There is no possible risk associated with participating in this study.

**Confidentiality**: patients name will not be written in this form and any information will not be disclosed to third party.

Solomon Kassa (BSc), Signature_____

## Annex 2: A format to assess patient's record admitted in AGH with severe malaria

**Table 6: Demographic characteristics of study participants**

| Item NO. | Demographic characteristics | Alternatives | Code |
|---|---|---|---|
| 1 | Age | _____year | |
| 2 | Sex | Male | 1 |
| | | Female | 2 |
| 3 | Place of residency | | |

**Table 7: Clinical profile of the study participant**

| Item NO. | Question | Alternative/answer | code | Skip |
|---|---|---|---|---|
| 1 | Time before admission | | | |
| 2 | Patients manifestation during admission *(one or more alternatine is possible)* | **Impaired consciousness:** A Glasgow Coma Score <11 in adults | 1 | |
| | | **Acidosis:** Severe acidosis manifests clinically as respiratory distress – rapid, deep and laboured breathing | 2 | |
| | | **Hypoglycaemia:** Blood or plasma glucose <2.2 mM (<40 mg/dl) | 3 | |
| | | **Severe malarial anaemia:** A haemoglobin concentration <5 g/dl or a haematocrit of <15% | 4 | |
| | | **Prostration/extreme weakness:** inability to walk or sit up without assistant. This is the milder and benign end of the neurological manifestations spectrum, potentially dangerous unless treated urgently. | 5 | |
| | | **Renal impairment**:Plasma or serum creatinine >265 lM (3 mg/dl) or blood urea >20 mM | 6 | |
| | | **Jaundice:** Plasma or serum bilirubin >3 mg/dl | 7 | |
| | | **Pulmonary oedema:** Radiologically confirmed, or oxygen saturation <92% on room air with a respiratory rate >30/min, often with chest indrawing and crepitations on auscultation | 8 | |
| | | **Significant bleeding:** Including recurrent or prolonged bleeding from nose gums or venipuncture sites; haematemesis or melaena | 9 | |

| | | | | |
|---|---|---|---|---|
| | | **Shock:** Compensated shock is defined as capillary refill ≥3 s or temperature gradient on leg (mid to proximal limb), but no hypotension. | 10 | |
| | | **Hyperparasitaemia:** P. falciparum parasitaemia >10% | 11 | |
| 3 | Treatment taken *(one or more alternatine is possible)* | Quinine | 1 | |
| | | Artisunate | 2 | |
| | | Both artisunate and quinine | 3 | |
| 4 | Site of drug administrati on | Intravenous | 1 | |
| | | Intramuscular | 2 | |
| 5 | Length of hospital stay in days in days | | | |
| 6 | Is there any other associated disease | Yes | 1 | |
| | | No | 2 | Skip to 8 |
| 7 | If yes to item NO.6 specify | | | |
| 8 | Type of malarial species | P. falciparum | 1 | |
| | | P. vivax | 2 | |
| | | Both | 3 | |

**Table 8: Treatment outcome**

| Item No. | | | Code | Skip |
|---|---|---|---|---|
| 1. | Does the patient recovered | YES | 1 | |
| | | NO | 2 | Item 2 |
| 2. | If NO specify | Confirmed dead | 1 | |
| | | Referred to other hospital | 2 | |