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A prospective multisite severe malaria observational study in African children

Submission date
22/10/2024

Recruitment status
No longer recruiting

Registration date
01/11/2024

Overall study status
Ongoing

Last Edited
06/10/2026

Condition category
Infections and Infestations

[_] Prospectively registered
[X] Protocol
[X] Statistical analysis plan
[X] Results
[_] Individual participant data

Plain English summary of protocol

Background and study aims
In much of sub-Saharan Africa, malaria is the most common reason for children being admitted to the hospital and is a major cause of death in children under five. While it's believed that malaria rates have dropped due to control measures like bed nets and effective treatments, reports on hospital admission rates for malaria are mixed. Some show a decrease, while others show no change or an increase. This study aims to provide a clear picture of severe malaria admissions in children across multiple centers in Africa, using consistent definitions and data collected over several years.

Who can participate?
The study will include children aged 3 months to 15 years who are admitted to pediatric wards with malaria.

What does the study involve?
This study will take place in at least six sites across five countries. It will include two groups: 300 children per site with severe malaria (cases) and 100 children per site with non-severe malaria (controls). Basic data will also be collected from all other children admitted with non-severe malaria. Children already enrolled in this study or in a clinical trial will not be included.

Upon arrival at the pediatric ward, children with suspected malaria will be screened for severe malaria using a rapid diagnostic test and a malaria slide. Cases and controls will undergo a detailed clinical assessment and blood tests. An additional blood sample will be saved for future tests. Follow-up questionnaires and visits will be conducted at discharge, day 28, and day 180 to track outcomes like readmission and survival. No additional blood samples will be taken after enrollment, only malaria status will be checked during follow-up visits. For very sick children, verbal assent from parents/guardians will be sought, with written consent obtained once the child is stable.

What are the possible benefits and risks of participating?
Participants will not receive direct benefits from the study. However, the study will cover the cost of non-routine blood tests, and results will be available to the treating clinician. The study will also cover transport costs for follow-up visits, and parents/caregivers will be compensated

for their time. Any illnesses identified during follow-up visits will be treated or referred appropriately. Parents/guardians will receive health education during these visits. The study aims to improve understanding of severe malaria in children, which could lead to better care in the future.

Where is the study run from?
KEMRI Wellcome Trust Research Program in Kilifi, Kenya.

When is the study starting and how long is it expected to run for?
October 2019 to December 2026

Who is funding the study?
Wellcome (UK)

Who is the main contact?
Professor Kathryn Maitland, k.maitland@imperial.ac.uk

Contact information

Type(s)
Scientific, Principal investigator

Contact name
Prof Kathryn Maitland

ORCID ID
https://orcid.org/0000-0002-0007-0645

Contact details
Institute of Global Health and Innovation
Department of Cancer and Surgery
Room 1030, 10th Floor
QEQM
St Mary's Campus
London
United Kingdom
W2 1PG
+44 (0)20 33126230
k.maitland@imperial.ac.uk

Type(s)
Public

Contact name
Mr Eric Mwajombo

Contact details
KEMRI Wellcome Trust Research Programme
Kilifi
Kenya
PO Box 230

+254 709 983000
EMwajombo@kemri-wellcome.org

Additional identifiers

Protocol serial number
Grant Number 209265/Z/17/Z

Study information

Scientific Title
Severe MAlaria A Research and Trials consortium: A protocol for a prospective observational study

Acronym
SMAART-Obs

Study objectives
The null hypothesis is that there will be no differences in the severity spectrum or outcomes from severe malaria across 6 sites across 5 African countries.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 11/02/2020, Imperial College Research Ethics Committee (Room 221 Medical School Building St Marys Campus, London, W2 1PG, United Kingdom; +44 (0)207 594 1872; researchethicscommittee@imperial.ac.uk), ref: 20IC5695

Primary study design
Observational

Study design
Prospective observational study

Study type(s)
Diagnostic, Other

Health condition(s) or problem(s) studied
Severe Plasmodium falciparum malaria

Interventions
Current interventions as of 18/08/2025:

The primary aim is to characterise the contemporary epidemiology (including features at presentation, diagnostic and treatment pathway) of severe malaria in children in Africa presenting to hospital for admission, through conducting a prospective multicentre observational study across at least 6 sites in 5 countries. The study is enrolling (i) hospitalised children with severe malaria (cases): 300 per site and (ii) time-matched hospitalised children with non-severe malaria (controls): 100 per site. Both cases and controls will be followed over 6

months from admission. In addition, basic observation and in-hospital outcome data (but without follow up) will be collected from all other children admitted with non-severe malaria ('background').
This will also enable us to compare baseline characteristics of admitted children with severe and non-severe malaria; characterise time from presentation to the hospital 'gateway' to ward admission and time to first dose of parenteral artesunate to assess whether delays in definitive treatment may underpin malaria severity and estimate the incidence of significant post-discharge events to day-180 including readmission to hospital. In two sites in Uganda (Soroti Regional Referral Hospital and Dr Amboseli Hospital, Kalongo) admission samples (following consent) will be stored for batch genotyping for Kelch (PfK13) mutations of Plasmodium falciparum malaria (under the SMAART-CHARISMA substudy- see attached Protocol file v1.0 FINAL).

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Previous interventions:

The primary aim is to characterise the contemporary epidemiology (including features at presentation, diagnostic and treatment pathway) of severe malaria in children in Africa presenting to hospital for admission, through conducting a prospective multicentre observational study across at least 6 sites in 5 countries. The study is enrolling (i) hospitalised children with severe malaria (cases): 300 per site and (ii) time-matched hospitalised children with non-severe malaria (controls): 100 per site. Both cases and controls will be followed over 6 months from admission. In addition, basic observation and in-hospital outcome data (but without follow up) will be collected from all other children admitted with non-severe malaria ('background').
This will also enable us to compare baseline characteristics of admitted children with severe and non-severe malaria; characterise time from presentation to the hospital 'gateway' to ward admission and time to first dose of parenteral artesunate to assess whether delays in definitive treatment may underpin malaria severity and estimate the incidence of significant post-discharge events to day-180 including readmission to hospital. In two sites in Uganda (Soroti Regional Referral Hospital and Dr Amboseli Hospital, Kalongo) admission samples (following consent) will be stored for batch genotyping for Kelch (PfK13) mutations of Plasmodium falciparum malaria. Parasite clearance time and lactate clearance time will be monitored at 4 hourly using malaria blood films and point of care lactate (Stat Strip Lactate Test Strips, BioNova) for the first 24 hours and 8 hourly thereafter until lactate levels < 2 mmols and malaria slides are negative to allow us to track artesunate antimalarial activity and clinical severity overtime.

Intervention Type
Other

Primary outcome(s)
Current primary outcome measure as of 17/10/2025:
Data collected from patient records were used to measure:
In the SMAART study:
1. Mortality: in-hospital or subsequently through 6 months post-discharge (all-cause) and
2. Readmission to hospital within 6 months of enrolment, all-causes, and with a positive malaria rapid diagnostic test (RDT)
In the SMAART CHARISMA substudy:
1. Length of hospital stay (hours/days)

Previous primary outcome measure:
Measured using patient records:
1. Mortality: in-hospital or subsequently through 6 months post-discharge (all-cause) and
2. Readmission to hospital within 6 months of enrolment, all-causes, and with a positive malaria rapid diagnostic test (RDT)

Key secondary outcome(s)
Current secondary outcome measure as of 17/10/2025:
1. New episodes of potential malaria, defined by self-reported anti-malarial use, self-reported positive malaria rapid diagnostic test (RDT), and self-reported febrile illnesses at follow-up (both SMAART and SMAART CHARISMA)
2. In the Soroti and Kalongo sites, the prevalence of Kelch Mutations will be measured along with lactate clearance and parasite clearance of ring stage parasites
3. Transfusion requirement (SMAART CHARISMA)

In the SMAART CHARISMA substudy, the following safety outcomes are measured from patient records:
1. Mortality: in-hospital or subsequently through 6 months post-discharge (all-cause)
2. Readmission to hospital within 6 months of enrolment all causes, and with a positive malaria rapid diagnostic test (RDT)

Previous secondary outcome measure:
1. New episodes of potential malaria, defined by self-reported anti-malarial use, self-reported positive malaria rapid diagnostic test (RDT), and self-reported febrile illnesses at follow-up
2. In the Soroti and Kalongo sites, the prevalence of Kelch Mutations will be measured along with lactate clearance and parasite clearance of ring stage parasites

Completion date
31/12/2026

Eligibility

Key inclusion criteria
1. Children aged 3 months to 15 years
2. Admitted to hospital with P. falciparum malaria defined by a positive ParacheckTM rapid diagnostic test
3. History of fever by self-report or documented abnormal temperature at screening (fever or hypothermia, axillary temperature >37.5˚C or <36˚C)
4. Caregiver provides written informed consent, including for 6-month follow-up for severe malaria cases and non-severe malaria controls
5. Cases are defined as having either one or more of World Health Organization (WHO) Group 1 or 2 severity features or Teule Criteria
5.1. WHO clinical severity features include
5.1.1. Impaired consciousness: prostration (also Teule criteria) or coma
5.1.2. 2 or more convulsions within the last 24 hours
5.1.3. Respiratory distress (also Teule criteria)
5.1.4. Compensated or decompensated shock
5.1.4.1. Compensated shock is defined as capillary refill ≥3 s or temperature gradient on leg (mid to proximal limb), but no hypotension
5.1.4.2. Decompensated shock (hypotension) is defined as systolic blood pressure <70 mm Hg in children

5.1.5. Jaundice
5.1.6. Dark or cola coloured urine (blackwater fever)
5.2. WHO laboratory severity criteria, consisting of
5.2.1. Haemoglobin <5g/dl (also Teule criteria) (if routinely done)
5.3. Teule criteria consist of one or more of
5.3.1. HIV (standard test for all hospitalised children)
5.3.2. Impaired consciousness: prostration or coma (also WHO clinical criteria)
5.3.3. Respiratory distress (also WHO clinical criteria)
5.3.4. Haemoglobin <5g/dl (if routinely done) (also WHO clinical criteria)

For practicality, and to reduce potential bias, recruitment of controls (children admitted with malaria without the above features) will occur on Mondays and Thursdays only

Participant type(s)
Patient

Healthy volunteers allowed
No

Age group
Child

Lower age limit
3 Months

Upper age limit
15 Years

Sex
All

Total final enrolment
1985

Key exclusion criteria
1. Already enrolled into a clinical trial
2. Previously enrolled in this observational study

Date of first enrolment
28/08/2021

Date of final enrolment
30/06/2024

Locations

Countries of recruitment
Ghana

Kenya

Mozambique

Uganda

Zambia

Study participating centre
St Pauls Hospital
Luapula Province
Nchelenge
Zambia
P.O. Box 71769

Study participating centre
Soroti Regional Hospital
Hospital Road
Soroti
Uganda
P.O. Box 289

Study participating centre
Dr Ambroseli Hospital
Hospital Road
Kalongo
Uganda
P.O. Box 47

Study participating centre
Kilifi County Hospital
KEMRI Wellcome Trust Research Programme,
Hospital Road
Kilifi
Kenya
P.O. Box 230

Study participating centre
Manhica Health Research Centre (CISM)
Av.Julius Nyerere, Estrada regional numero 470, Bairro Namuinho
Manhica
Mozambique
P.O. Box 1929

Study participating centre
Komfo Anokye Teaching Hospital (KATH)
Department of Child Health, Kwame Nkrumah University of Science and Technology, Bantama High Street
Kumasi
Ghana
P.O. Box 1934

Sponsor information

Organisation
Imperial College London

ROR
https://ror.org/041kmwe10

Funder(s)

Funder type
Charity

Funder Name
Wellcome

Alternative Name(s)

Funding Body Type
Private sector organisation

Funding Body Subtype
International organizations

Location
United Kingdom

Results and Publications

Individual participant data (IPD) sharing plan
We have a data sharing plan for investigator and external requests. Data from the SMAART study will be shared according to a controlled access approach (outlined above) in accordance

with Wellcome (the funders) policy based on the following principles:
No data should be released that would compromise an ongoing study.
There must be a strong scientific or other legitimate rationale for the data to be used for the requested purpose.
Investigators who have invested time and effort into developing a trial or study should have a period of exclusivity in which to pursue their aims with the data before key trial data are made available to other researchers.
The sources required to process requests should not be under-estimated, particularly successful requests which lead to preparing data for release. Therefore, adequate resources must be available to comply promptly or at all, and the scientific aims of the study must justify the use of such resources. Data exchange complies with Information Governance and Data Security Policies in all of the relevant countries.

IPD sharing plan summary

Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article		03/06/2026	06/10/2026	Yes	No
Protocol file	version 2.1	10/10/2022	31/10/2024	No	No
Protocol file	version 1.0	28/07/2023	18/08/2025	No	No
Statistical Analysis Plan	version 1.0	20/10/2024	31/10/2024	No	No