



Malaria

Investigation Guideline

Contents

CASE DEFINITION	1
LABORATORY ANALYSIS	2
EPIDEMIOLOGY	3
DISEASE OVERVIEW	3
NOTIFICATION TO PUBLIC HEALTH	4
INVESTIGATOR RESPONSIBILITIES	4
STANDARD CASE INVESTIGATION AND CONTROL	5
Case Investigation.....	5
Contact Investigation	6
Isolation, Work and Daycare Restrictions.....	6
Case Management.....	6
Contact Management	6
Environmental Measures.....	6
Education	6
MANAGING SPECIAL SITUATIONS	7
A. Outbreaks.....	7
B. No Recent Travel to Endemic Areas.....	7
C. Plasmodium falciparum Case	7
DATA MANAGEMENT AND REPORTING	8
ADDITIONAL INFORMATION / REFERENCES	9
ATTACHMENTS	9
CDC Malaria Case Surveillance Report	10
Fact Sheet (vs. 04/2015)	

Attachments can be accessed through the Adobe Reader's navigation panel for attachments. Throughout this document attachment links are indicated by this symbol ; when the link is activated in Adobe Reader it will open the attachments navigation panel. The link may not work when using PDF readers other than Adobe.

Revision History:

Date	Replaced	Comments
05/2015	01/2010	Added notification section and table of contents. Updated Laboratory Analysis Section. More details added to Investigators Responsibilities and Data Management. Reformatted Standard Case Investigation section to assist with EpiTrax system data entry. Reformatted fact sheet. Fixed or removed broken web links.

Malaria

Disease Management and Investigative Guidelines

CASE DEFINITION (CDC 2014)

Clinical Description for Public Health Surveillance:

The first symptoms of malaria (most often fever, chills, sweats, headaches, muscle pains, nausea and vomiting) are often not specific and are also found in other diseases (such as influenza and other common viral infections). Likewise, the physical findings are often not specific (elevated temperature, perspiration, tiredness). In severe malaria (caused by *P. falciparum*), clinical findings (confusion, coma, neurologic focal signs, severe anemia, respiratory difficulties) are more striking and may increase the suspicion index for malaria.

Laboratory Criteria for Case Classification:

- Detection of circulating malaria-specific antigens using rapid diagnostic test (RDT), OR
- Detection of species specific parasite DNA in a sample of peripheral blood using a Polymerase Chain Reaction (PCR) test (Note: Laboratory-developed malaria PCR tests must fulfill Clinical Laboratory Improvement Amendments [CLIA] requirements, including validation studies), OR
- Detection of malaria parasites in thick or thin peripheral blood films, determining the species by morphologic criteria, and calculating the percentage of red blood cells infected by asexual malaria parasites (parasitemia).

Case Classification:

Suspected:

- Detection of Plasmodium species by rapid diagnostic antigen testing without confirmation by microscopy or nucleic acid testing in any person (symptomatic or asymptomatic) diagnosed in the United States, regardless of whether the person experienced previous episodes of malaria while outside the country.

Confirmed:

- Detection and specific identification of malaria parasites by microscopy on blood films in a laboratory with appropriate expertise in any person (symptomatic or asymptomatic) diagnosed in the United States, regardless of whether the person experienced previous episodes of malaria while outside the country, OR
- Detection of Plasmodium species by nucleic acid test (that fulfills CLIA requirements) in any person (symptomatic or asymptomatic) diagnosed in the United States, regardless of whether the person experienced previous episodes of malaria while outside the country, OR
- Detection of unspiciated malaria parasite by microscopy on blood films in a laboratory with appropriate expertise in any person (symptomatic or asymptomatic) diagnosed in the United States, regardless of whether the person experienced previous episodes of malaria while outside the country

Criteria to Distinguish a New Case from an Existing Case:

- A subsequent attack experienced by the same person but caused by a different Plasmodium species is counted as an additional case.
- A subsequent attack experienced by the same person and caused by the same species in the United States may indicate a relapsing infection or treatment failure caused by drug resistance or a separate attack.

LABORATORY ANALYSIS

Testing for malaria is available through commercial clinical laboratories. The Kansas Health and Environmental Laboratory (KHEL) can assist with specimen submission to CDC for species confirmation and drug resistance surveillance.

Microscopy continues to be the "gold standard" for malaria diagnosis with thick smears used to detect the presence of parasites and thin smears used for species-level identification. Species-specific PCR is used when microscopists are unable to differentiate between species. Malaria antibody detection is not practical for routine diagnosis of acute malaria but maybe useful for certain situations, as described below.

Laboratories that have diagnosed a case of malaria should send a pre-treatment whole blood sample (EDTA) to CDC for species confirmation and evaluation for emerging drug resistance.

- **Microscopy, Species Confirmation and Drug Resistance Surveillance:**
 - Specimens: Thick and thin blood smears (at minimum two of each), along with whole blood collected in EDTA tubes.
 - Collection: Blood smears made at bedside and blood collected in EDTA (purple topped) tubes prior to any drug treatment.
 - Shipping: Consult your reference laboratory for shipping instructions.
 - Timing of collection: If initial blood smears test negative for Plasmodium species but malaria remains a possibility, the smear should be repeated every 12 to 24 hours during a 72-hour period.
 - For additional information on blood smears, reference CDC Blood Specimen Bench Aids in [attachments](#) or at www.cdc.gov/dpdx/malaria/
 - For additional information on confirmation and drug resistance surveillance refer to: www.cdc.gov/malaria/report.html
- **Serological testing:**
 - Specimen: Blood or serum (3-5 ml)
 - Collection: Clot separator blood tubes.
 - Prior to shipping: Before sending serological specimens to KHEL, contact Bureau of Epidemiology and Public Health Informatics (BEPHI) at 877-427-7317. Samples that meet these criteria will be forwarded to the CDC:
 - Blood donors whose recipients contracted malaria after transfusion;
 - Patients whose blood slides are repeatedly negative for malarial parasites, but febrile illness is strongly suspected to be malaria;
 - Specimens obtained as part of a CDC-approved research project;
 - Specimens to be standardized as controls in laboratories establishing malaria antibody testing programs; or
 - Prior arrangements made with the chief of the Malaria Branch, DPD.
 - Timing of collection: Acute serums obtained as soon as possible after the onset; convalescent collected 14-21 days after acute sample.
- For additional information and/or questions, call (785) 296-1620 or refer to online guidance at www.kdheks.gov/labs/lab_ref_guide.htm.

EPIDEMIOLOGY

Malaria is endemic throughout the tropical areas of the world with the highest prevalence found in sub-Saharan Africa, Central and South America, India, and parts of Oceania and Southeast Asia. Transmission may also occur in more temperate climates where *Anopheles* mosquitoes are present. Mosquitoes in airplanes flying from tropical climates have been the source of occasional cases; however, nearly all of the malaria cases reported in the United States are acquired abroad. Refer to the CDC Malaria Risk Map for further information on endemic areas: www.cdc.gov/malaria/map/index.html.

DISEASE OVERVIEW

A. Agent:

There are 4 *Plasmodium* species that cause malaria in humans including: *P. vivax*, *P. malariae*, *P. ovale* and *P. falciparum*.

B. Clinical Description:

Acute or subacute febrile disease, usually with episodes of chills and fever every 2-3 days, separated by afebrile periods. Malaria caused by *P. falciparum* may progress to jaundice, shock, renal failure, coma and death.

C. Reservoirs: Humans.

D. Mode(s) of Transmission:

Malaria is almost always transmitted by the bite of an infective female *Anopheles* mosquito. Transmission may occur through transfusions or the use of contaminated needles but these modes of transmission are rare.

E. Incubation Period:

Variable: 12 days for *P. falciparum*, 30 days for *P. malariae* and 14 days for *P. ovale* and *P. vivax*. Inadequate or inappropriate prophylaxis may lengthen.

F. Period of Communicability:

Malaria is not directly communicable from person-to-person except for congenital transmission; however, during parasitemia, the disease may be transmitted to other persons through blood transfusion or through shared contaminated needles. Infected human hosts may remain infectious for *Anopheles* mosquitoes for 1-3 years if they are not adequately treated.

G. Susceptibility and Resistance:

Susceptibility is universal except in humans with specific genetic traits. Tolerance to clinical disease is present in adults in endemic communities where exposure to infective *Anopheles* is continuous over many years.

H. Treatment:

Consultation with an infectious disease or travel medicine specialist is strongly recommended. The appropriate drug regimen depends upon the species and where infection was acquired. Assistance with management of malaria is available Monday-Friday, 9am-5pm, eastern time through the CDC Malaria Hotline at 770-488-7788 or 855-856-4713 toll-free. For emergency consultation after hours, call: 770-488-7100 and request to speak with a CDC Malaria Branch clinician. See [Managing Situation](#) for *P. falciparum* investigations.

NOTIFICATION TO PUBLIC HEALTH AUTHORITIES

Malaria infections shall be reported within seven days.

1. Health care providers and hospitals: report to the local public health jurisdiction or KDHE-BEPHI (see below)
2. Local public health jurisdiction: report to KDHE-BEPHI (see below)
3. Laboratories: report to KDHE-BEPHI (see below)

**Kansas Department of Health and Environment (KDHE)
Bureau of Epidemiology and Public Health Informatics (BEPHI)**

Phone: 1-877-427-7317

Fax: 1-877-427-7318

***(EpiTrax Users can report Malaria cases
with New CMR creation in EpiTrax.)***

Further responsibilities of state and local health departments to the CDC:

As a nationally notifiable condition, malaria cases require a STANDARD report to the Center of Disease Control and Prevention (CDC).

- **Local public health jurisdiction** will report information requested on the disease reporting forms as soon as possible, completing the forms within 7 days of receiving a notification of a report.
- KDHE-BEPHI will file an electronic case report the next regularly scheduled electronic transmission.
(KDHE-BEPHI files electronic reports weekly with CDC.)

INVESTIGATOR RESPONSIBILITIES

- 1) Report all confirmed and suspected cases to the KDHE-BEPHI.
- 2) Contact medical provider to collect additional information and confirm diagnosis using current case definition.
 - Collect all information requested in Step 1) of case investigation.
 - Ensure that case/proxy is aware of the diagnosis.
- 3) Conduct a case investigation to identify potential source of infection.
 - Complete an interview with the Malaria Case Surveillance Form.
- 4) Conduct contact investigation to identify additional cases.
- 5) Identify whether the source of infection is major public health concern.
 - *Was there no travel to a malaria endemic area?*
- 6) Conduct Case or Contact Management as needed.
- 7) Record data, collected during the investigation, in the KS EpiTrax system under the data's associated [tab] in the case morbidity report (CMR).
- 8) As appropriate, use the notification letter(s) and the disease fact sheet  to notify the case, contacts and other individuals or groups.

STANDARD CASE INVESTIGATION AND CONTROL METHODS

Case Investigation

- 1) Contact the medical provider who ordered testing of the case and obtain the following information. (This includes medical records for hospitalized patients.)
 - Confirm diagnosis using the [case definition](#).
 - Collect patient's demographics ([address](#), [birth date](#), [gender](#), [race/ethnicity](#), [primary language](#), and [phone number\(s\)](#)). [Demographic]
 - Record height and weight of patient. [Demographic]
 - Record [onset date](#) (approximate if exact date is not known) [Clinical]
 - Record [hospitalizations](#): location and duration of stay [Clinical]
 - Record outcomes: survived or [date of death](#) [Clinical]
 - Record pregnancy status for women. [Clinical]
 - Any history of malaria 12 months prior to this report? [Investigation – Complications]
 - Record clinical complications from the recent attack: cerebral malaria, renal failure, ARDS, Anemia (Hb<11, Hct<33), or other. [Investigation – Complications]
 - Transfusion of blood or blood products ≤ 2 years prior to onset. Include dates, places, lot numbers, and manufacturer. [Investigation – Exposure]
 - List therapy received (“Treatment given”) for this attack including date started and stopped. [Clinical]
- 2) Interview the case or proxy to help identify the source of the infection, focus the investigation within the incubation period of the specific infectious agent and on the following potential risks of disease transmission:
 - To identify residence in or travel to areas endemic for malaria, inquire about the following: [Investigation – Exposure]
 - Was there travel outside of Kansas 30 days before the illness began?
 - Did the patient travel in the U.S.? (If yes, City/State and dates)
 - Did the patient travel internationally? (If yes, City/Country and dates)
 - Was there travel/residence outside of the U.S. during the past 2 years?
 - If yes, and not recorded previously, record all countries, date returned to U.S., duration of stay in the foreign country
 - For travel from/to U.S, record:
 - Reason for travel of the most recent trip.
 - Length of time patient resided in U.S. prior to most recent travel.
 - Record YES or NO to patient's receipt of chemoprophylaxis prior to and during travel to prevent malaria. [Clinical]
 - Other risks to consider: Use of parenteral drugs and exposure to mosquitoes or other arthropod vectors during the incubation period. [Notes]
 - With no travel to endemic areas, see [Managing Special Situations](#).
- 3) Investigate epi-links among cases (clusters, household, co-workers, etc).
 - Inquire on the presence of other cases, include names.
 - For suspected [outbreaks](#) to Managing Special Situations section

Contact Investigation

Contacts are defined as those exposed to a potential source of infection, the Anopheles mosquito vector or to the blood of the parasitemic case. Consider:

- Travel companions are investigated as contacts
- Persons who shared intravenous drug paraphernalia with a case are at risk.

Isolation, Work and Daycare Restrictions

No specific restrictions. Use standard universal precautions with patients.

Case Management

Access the [Investigation: Malaria Follow up Form] to record the following:

- 1) At the start of the patient's malaria treatment, record all the prescription and over-the-counter medicines the patient had taken during the 2 weeks before starting the treatment.
- 2) Seven days after treatment was started, record whether or not all signs or symptoms of malaria resolved without additional malaria treatment.
- 3) Four weeks after the patient started treatment, follow-up with case to assure compliance with treatment.

- List all prescriptions and over the counter medicines the patient took during the 4 weeks after starting therapy.
- Record is the medicine for malaria was taken as prescribed.
- Record any adverse events the patient experienced within the 4 weeks after receiving malaria treatment.

- 4) Report any changes in patient status. (i.e., death, dismissal from hospital, completion date of treatment) on the [Clinical Tab].

Figure 1: Malaria Form Links

Forms in Use	Forms
Malaria Form	Malaria
Malaria Follow Up Form	Please list
QI Fields Form (core only) v. 2	

Contact Management

- 1) If a history of needle sharing is obtained from the case, investigate and treat all persons who shared the equipment.
- 2) In transfusion-acquired malaria, all donors must be located and their blood examined for malaria parasites and for anti-malarial antibodies; parasite-positive donors should receive treatment.
- 3) Consider testing asymptomatic travel companions as well.

Environmental Measures

None.

Education

- 1) Information on malaria risk, prevention, and treatment for travelers:
 - CDC's Travelers' Health Web site www.cdc.gov/travel
 - CDC's Travelers' Health Information Service: call 1-877-FYI-TRIP

- CDC's Malaria Web site www.cdc.gov/malaria
- 2) Personal Protective Measures for travelers to endemic areas:
- Follow the follow a CDC-recommended prophylaxis regimen
 - Use insecticide-impregnated mosquito nets while sleeping;
 - Remain in well-screened areas;
 - Wear protective clothing; and
 - Use mosquito repellents containing DEET, reapplying as needed

MANAGING SPECIAL SITUATIONS

A. Outbreaks:

- 1) Outbreak definition: One or more cases for which a known risk factor (i.e., recent travel to an endemic area) cannot be identified should be considered a potential outbreak and adequate resources applied to the investigation.
- 2) Notify KDHE immediately, 1-877-427-7317.
- 3) Active case finding will be an important part of any investigation.

B. No Recent Travel to Endemic Areas:

- Consult with KDHE-BEPHI about any case that does not have a history of recent travel to an area endemic for or experiencing a recent outbreak of malaria.

C. *Plasmodium falciparum* Case:

- The high prevalence of chloroquine resistance among *P. falciparum* parasites, as well as the potential for severe illness, makes chloroquine alone usually a poor choice for therapy.
- Chloroquine does have some anti-parasitic properties, so depending on the level of resistance, it may reduce the parasite levels sufficiently and make the patient feel better while setting the stage for potential treatment failure.
- If a *P. falciparum* case is only treated with chloroquine, verify the treatment information and discuss treatment options with the case physician.
- Additional treatment information can be found at:
www.cdc.gov/malaria/diagnosis_treatment/index.html

DATA MANAGEMENT AND REPORTING TO THE KDHE

- A. Accept the case assigned to the LHD and record the date the LHD investigation was started on the **[Administrative]** tab.
- B. Organize and collect data, using appropriate data collection tools including:
- The CDC [Malaria Case Surveillance Report](#) can be used to collect information.
 - Alternatively, investigators can collect and enter all required information directly into EpiTrax **[Investigation]**, **[Clinical]**, **[Demographics]**, **[Epidemiological]** tabs.
 - During outbreak investigations, refer to guidance from a KDHE epidemiologist for appropriate collection tools.
- C. Report data collected during the course of the investigation via EpiTrax.
- Verify that all data requested on the [Malaria Case Surveillance Report](#) has been recorded on an appropriate EpiTrax **[tab]**, or that actions are completed for a case lost to follow-up as outlined below.
 - Some data that cannot be reported on an EpiTrax **[tab]** may need to be recorded in **[Notes]** or scanned and attached to the record.
 - Paper report forms do not need to be sent to KDHE after the information is recorded and/or attached in EpiTrax. The forms should be handled as directed by local administrative practices.
- D. If a case is lost to follow-up, after the appropriate attempts to contact the case have been made:
- Indicate 'lost to follow-up' on the **[Investigation]** tab with the number of attempts to contact the case recorded.
 - Record at least the information that was collected from the initial reporter.
 - Record a reason for 'lost to follow-up' in **[Notes]**.
- E. Once the investigation is completed, the LHD investigator will record the date the investigation was completed on the **[Administrative]** tab and click the "Complete" button. This will trigger an alert to the LHD Administrator so they can review the case before sending to the state.
- The LHD Administrator will then "Approve" or "Reject" the CMR.
 - Once a case is "Approved" by the LHD Administrator, BEPHI staff will review and close the case after ensuring it is complete and that the case is assigned to the correct event, based on the reported symptoms reported. (Review the [EpiTrax User Guide, Case Routing](#) for further guidance.)

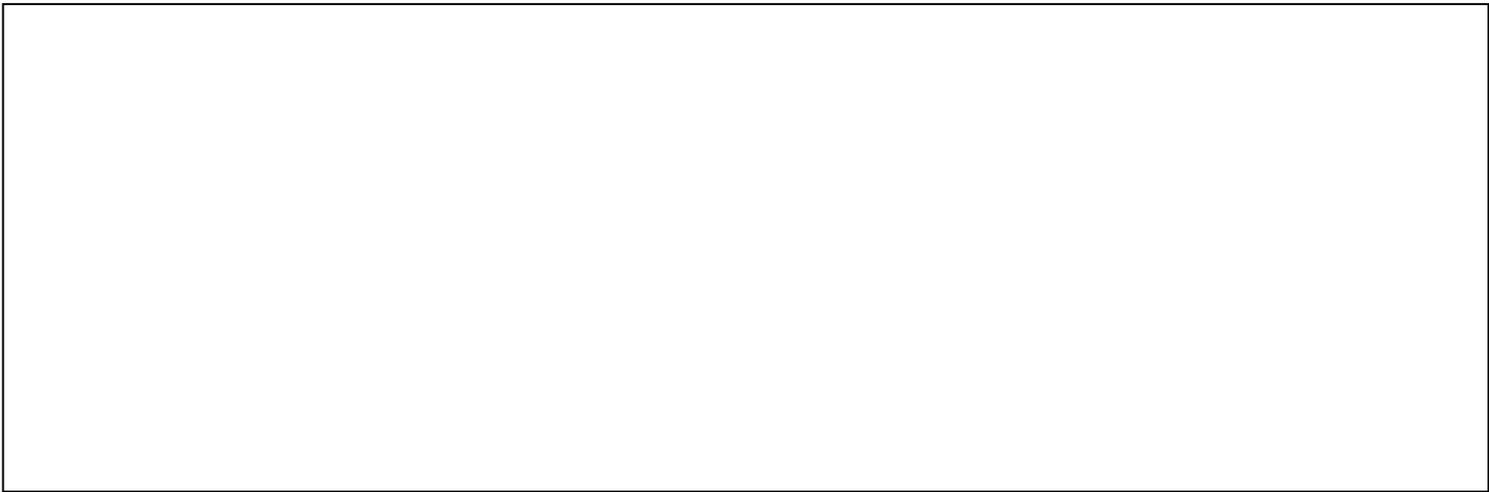
ADDITIONAL INFORMATION / REFERENCES

- A. **Treatment / Differential Diagnosis:** American Academy of Pediatrics. Red Book: Report of the Committee on Infectious Disease, 29th Edition. Illinois, Academy of Pediatrics, 2014.
- B. **Epidemiology, Investigation and Control:** Heymann. D., ed., Control of Communicable Diseases Manual, 19th Edition. Washington, DC, American Public Health Association, 2010.
- C. **Case Definitions:** CDC Division of Public Health Surveillance and Informatics, Available at: www.cdc.gov/nndss/
- D. **Kansas Regulations/Statutes Related to Infectious Disease:** www.kdheks.gov/epi/regulations.htm
- E. **Chain of Custody:** KDHE Chain of Custody Standard Operating Guide, www.kdheks.gov/cphp/operating_guides.htm
- F. **ASTO Mosquito Control Resources:** www.astho.org/Programs/Environmental-Health/Natural-Environment/Vector-Borne-and-Zoonotic-Diseases/Vector-Borne-and-Zoonotic-Disease-Resources/Main/
- G. **Additional Information (CDC):** www.cdc.gov/health/default.htm

ATTACHMENTS

To view attachments in the electronic version:

1. Go to <View>; <Navigation Pane>; <Attachments> – OR – Click on the “Paper Clip”  icon.
2. Double click on the document to open.



Physicians and other health care providers with questions about diagnosis and treatment of malaria cases can call CDC's Malaria Hotline:

- Monday – Friday, 9:00 am to 5 pm, EST: call 770-488-7788 or 855-856-4713 (Fax: 404-718-4815)
- Off-hours, weekends, and federal holidays: call 770-488-7100 and ask to have the malaria clinician on call paged.

Information on malaria risk, prevention, and treatment is available at:
CDC's Malaria Web site <http://www.cdc.gov/malaria>

Part II (to be complete 4 weeks after treatment)

Please list all prescription and over the counter medicines the patient had taken during the 2 weeks **before** starting their treatment for malaria.

Please list all prescription and over the counter medicines the patient had taken during the 4 weeks **after** starting their treatment for malaria.

Was the medicine for malaria treatment taken as prescribed? No, doses missed Yes, no doses missed Unknown

Did all signs or symptoms of malaria resolve without any additional malaria treatment within 7 days after treatment start?
 Yes No Unknown

If yes, did the patient experience a recurrence of signs or symptoms of malaria during the 4 weeks after starting malaria treatment?
 Yes No Unknown

Did the patient experience any adverse events within 4 weeks after receiving the malaria treatment? Yes No Unknown

(If Yes): Event description	Relationship to treatment suspected*	Time to Onset since treatment start	Fatal?	Life-Threatening?	Other Seriousness?***
1 _____	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 _____	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 _____	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 _____	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 _____	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

* Suspected means that a causal relationship between the treatment and an adverse event is at least a reasonable possibility, i.e., the relationship cannot be ruled out.

*** A *serious* adverse event is defined as an event which is fatal or life-threatening, results in persistent or significant disability/incapacity, constitutes a congenital anomaly/birth defect, is medically significant (i.e., jeopardizes the patient or may require medical or surgical intervention), or requires inpatient hospitalization or prolongation of existing hospitalization.