

Malaria Investigation Guideline

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Malaria

Disease Management and Investigative Guidelines

CASE DEFINITION (CDC 1997)

A. Clinical Description for Public Health Surveillance:

- Signs and symptoms are variable; however, most patients experience fever. In addition to fever, common associated symptoms include headache, back pain, chills, sweats, myalgia, nausea, vomiting, diarrhea, and cough. Untreated *Plasmodium falciparum* infection can lead to coma, renal failure, pulmonary edema, and death. The diagnosis of malaria should be considered for any person who has these symptoms and who has traveled to an area in which malaria is endemic. Asymptomatic parasitemia can occur among persons who have been long-term residents of areas in which malaria is endemic.

B. Laboratory Criteria for Case Classification:

- Demonstration of malaria parasites in blood films.

C. Case Classification:

- Confirmed: an episode of microscopically confirmed malaria parasitemia 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.
- Probable (Internal KDHE Definition): Clinical and travel to malaria endemic area.
- Suspect (Internal KDHE Definition):
 - Clinical alone, or
 - Positive non-microscopic tests.

Note: An additional attack experienced by the same person while in the U.S. may be counted as an additional case if caused by a different *Plasmodium* species; but an additional attack caused by the same species may indicate a relapsing infection or treatment failure caused by drug resistance.

D. Laboratory Testing:

Call Epidemiologic Services at 877-427-7317 before sending any samples to the Kansas Health and Environment Laboratory (KHEL).

- Specimen: Thick and thin blood smears (at minimum two of each); Serology testing: Blood or serum (3-5 ml)
- Smears are read by KHEL staff with questionable cases referred to the National Malaria Repository, CDC, for confirmation of the diagnosis.
- Serology samples meeting the following criteria are forwarded to the CDC:
 - Blood donors whose recipients contracted malaria after transfusion;
 - Patients whose blood slides are repeatedly negative for malarial parasites, if 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 arrangement made with the chief of the Malaria Branch, DPD.

- Collection: Blood smears: prepared at bedside or blood collected in EDTA (purple topped) tubes. Serology: KHEL Serology kit with yellow top blood tubes or any other red topped, clot separator blood tubes.
- Timing of collection
 - Serology: Acute obtained as soon as possible after the onset; convalescent collected 14-21 days after acute sample.
 - Smears: 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 and/or questions, call (785) 296-1620 or refer to online guidance at www.kdheks.gov/labs/lab_ref_guide.htm.
- For additional information on blood smears, reference CDC Blood Specimen Bench Aids in Supporting Documents or at www.dpd.cdc.gov/dpdx/HTML/Malaria.htm.

E. Bioterrorism Potential: None.

F. 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.

INVESTIGATOR RESPONSIBILITIES

A. Investigation Related Tasks and Activities:

- 1) Confirm diagnosis with appropriate medical provider.
 - Before contacting the patient or family, first determine what information has been released about the patient's diagnosis and identify if the needed epidemiologic data can be found in the clinical record alone.
 - Obtain information that supports the [case definition](#), including travel to endemic areas.
 - Obtain information on any laboratory tests performed and results.
 - For hospitalizations, obtain medical records, including admission notes, progress notes, lab report(s), and discharge summary.
- 2) Conduct [case investigation](#) to determine the individual's at-risk activities and potential site of exposure; evaluate the possibility of additional cases.
- 3) Follow up with all confirmed cases and potential contacts to assure adequate treatment and/or medical screening, particularly those with the potentially fatal falciparum form of malaria.
- 4) Complete and submit the [CDC Malaria Case Surveillance Report Form](#) and report all cases and information that helps to confirm cases to the KDHE Office of Surveillance and Epidemiology, using established methods.

B. Notifications:

- 1) There are no special notifications or additional reporting requirements.
- 2) Mail or deliver notification letter and/or disease fact sheet to case and contacts (if appropriate and/or requested).

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 in persons working or living near international airports; 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/features/risk_map.htm.

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 24 hours a day through the CDC Malaria Hotline (770-488-7788). See [Managing Situation](#) for *P. falciparum* investigations.

STANDARD CASE INVESTIGATION AND CONTROL METHODS

Standard investigation activities include the following:

- 1) Confirmation of diagnosis using [case definition](#).
- 2) Collection of demographic data (birth date, county, sex, race/ethnicity)
- 3) Collection of clinical information and laboratory results.
- 4) Determination of risk factors and transmission settings. (i.e., travel, outdoor activity, use of repellent or mosquito netting)

Standard investigation **includes** completion of the [General Investigation Form\(s\)](#) and [CDC Malaria Case Surveillance Report Form](#):

A. Case Investigation - Identify Potential Source of Infection:

To help identify the source of the infection, the investigator should focus their investigation within the incubation period of the specific infectious agent and on the following potential vectors or indicators of disease transmission:

- Residence in or travel to areas endemic for malaria 4 years prior to onset.
 - List countries and cities, dates of stay and any prophylactic medication.
 - With no travel to endemic areas, see [Managing Special Situations](#).
- Transfusion of blood or blood products \leq 2 years prior to onset. Include dates, places, lot numbers, and manufacturer.
- Use of parenteral drugs. Exposure to mosquitoes or other arthropod vectors during the incubation period, include dates and places.
- Presence of other cases, include names and locations.

B. Contact Investigation – Identify Exposed Individuals / Populations:

- Contacts are those exposed to a potential source of infection, the Anopheles mosquito vector or to the blood of the parasitemic case.
 - Travel companions are investigated as contacts
 - Persons who shared intravenous drug paraphernalia with a case are also at risk.

C. Isolation, Work and Daycare Restrictions

- None.

D. Case Management, Including Follow-up of cases:

- Follow-up to assure compliance with treatment.

E. Contact Management, Including Protection of Contacts:

- If a history of needle sharing is obtained from the case, investigate and treat all persons who shared the equipment.
- 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.
- Consider testing asymptomatic travel companions as well.

F. Environmental Measures:

- None.

G. Education:

- 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
- 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. No Recent Travel to Endemic Areas:

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

B. *Plasmodium falciparum* Case:

- The high prevalence of chloroquine resistance among *P. falciparum* parasites, as well as the potential severity of the 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.

C. Information for Non-English Speaking Cases and Contacts:

- Spanish: CDC Podcast (1 minute):
www2a.cdc.gov/podcasts/player.asp?f=7849

DATA MANAGEMENT AND REPORTING TO THE KDHE

A. Organize, collect and report data with the General Investigation Form(s) and CDC Malaria Case Surveillance Report Form (reported via fax).

B. Report data electronically via KS-EDSS and by fax; use the KS-EDSS Disease Name = **Malaria, Plasmodium spp.**, and include.

- All essential data that was collected during the investigation, especially data that helps to confirm or classify a case.
- All information collected on the General Investigation form(s) and CDC supplemental form (reported by fax).

ADDITIONAL INFORMATION / REFERENCES

- A. Treatment / Differential Diagnosis:** Red Book: 2009 Report of the Committee on Infectious Diseases. 28th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2009: 438-444.
- B. Epidemiology, Investigation and Control:** Heymann. D., ed., Control of Communicable Diseases Manual, 18th Edition. Washington, DC, American Public Health Association, 2004.
- C. Case Definitions:** CDC Division of Public Health Surveillance and Informatics, Available at: www.cdc.gov/ncphi/diss/nndss/casedef/case_definitions.htm
- D. Kansas Regulations/Statutes Related to Infectious Disease:** www.kdheks.gov/epi/regulations.htm
- E. Guidelines for Arbovirus Surveillance Programs in the United States (CDC 1993).** Available at: www.cdc.gov/ncidod/dvbid/Arbor/arboquid.pdf
- F. ASTO Mosquito Control Resources:** www.astho.org/index.php?template=mosquito_control.html
- G. Additional Information (CDC):** www.cdc.gov/health/default.htm

Kansas Disease Investigation Guidelines

General Investigation Form

Investigation Information		
Case Type: <input type="checkbox"/> Human Case <input type="checkbox"/> Non-human Case	Disease Name: _____	
Classification: <input type="checkbox"/> Suspect <input type="checkbox"/> Probable <input type="checkbox"/> Confirmed	KS-EDSS Investigation ID: _____	
Outbreak: <input type="checkbox"/> Yes <input type="checkbox"/> No	Outbreak Name: _____	Outbreak #: _____
Onset Date: _____	Diagnosis Date: _____	Report Date: _____
Assigned to (Investigator): _____	Patient Died: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown	
Patient Information		
Name Type: <input type="checkbox"/> Default/Common <input type="checkbox"/> Legal <input type="checkbox"/> Maiden <input type="checkbox"/> Nickname		
Last: _____	First: _____	Middle: _____
Street: _____	City/State: _____	Zip: _____
Evening Phone #: _____	Daytime Phone #: _____	
Sex: <input type="checkbox"/> Failure to Report <input type="checkbox"/> Female <input type="checkbox"/> Male <input type="checkbox"/> Other <input type="checkbox"/> Transexual <input type="checkbox"/> Unknown		
Race: <input type="checkbox"/> American Indian or Alaska Native <input type="checkbox"/> Asian <input type="checkbox"/> Black or African American <input type="checkbox"/> Native Hawaiian or Other Pacific Islander <input type="checkbox"/> White <input type="checkbox"/> Unknown		
Hispanic / Latino Ethnicity: <input type="checkbox"/> Yes <input type="checkbox"/> No		
Date of Birth: _____	Age: _____	Age Unit: <input type="checkbox"/> Days <input type="checkbox"/> Weeks <input type="checkbox"/> Months <input type="checkbox"/> Years
Parent Information (if under 18)		
Last: _____	First: _____	Middle: _____
Street: _____	City/State: _____	Zip: _____
Evening Phone #: _____	Daytime Phone #: _____	
Work / Occupation or School / Grade		
Worksites / School: _____		
Occupations / Grade: _____		
Travel History		
1st	Destination: _____	Depart Date: _____ Return Date: _____
2nd	Destination: _____	Depart Date: _____ Return Date: _____
3rd	Destination: _____	Depart Date: _____ Return Date: _____
4th	Destination: _____	Depart Date: _____ Return Date: _____

Supplemental Laboratory Report Form

Lab Reports

Laboratory Name: _____

Lab Report Date: _____

Ordering Provider Name: _____

Phone: _____

Facility: _____

Specimen Accession Number: _____

Specimen Collection Date: _____

Organism Name: _____

Organism Species: _____

Organism Serogroup: _____

Organism Serotype: _____

PFGE Results

Pattern 1 KS: _____

Other State: _____

CDC: _____

Pattern 2 KS: _____

Other State: _____

CDC: _____

Pattern 3 KS: _____

Other State: _____

CDC: _____

Additional Results Information

Reported Test Name:

Coded Result:

Text Result:

Numeric Result:

Comments:

Supplemental Contact Form

Contacts

Last: _____ **First:** _____ **Middle:** _____

Street: _____ **City/State:** _____ **Zip:** _____

Evening Phone #: _____ **Daytime Phone #:** _____ **E-mail:** _____

Sex: Failure to Report Female Male Other Transexual Unknown

Race: American Indian or Alaska Native Asian Black or African American Native Hawaiian or Other Pacific Islander White Unknown

Hispanic / Latino Ethnicity: Yes No

Date of Birth: _____ **Age:** _____ **Age Unit:** Days Weeks Months Years

Worksites / School: _____

Occupations / Grade: _____

Exposure Information

Contact Type: Household Sexual Other: _____ **Partner / Cluster Code:** _____

Date of First Exposure: _____ **Date of Last Exposure:** _____ **Frequency:** _____

Nature of Exposure: _____ **Comments:** _____

Testing and Treatment Information

Clinic Code: _____ **Examination Date:** _____

Examination Test: _____ **Examination Result:** _____

Prophylaxis/empiric treatment date: _____ **Drug / Dosage:** _____

Provider (Name / Facility): _____

Disposition and Diagnosis Information

Initiation Date: _____ **Disposition Date:** _____ **Disposition:** _____

Diagnosis: _____ **Referral Type:** Patient Provider **Post-test Counseled :** Yes No

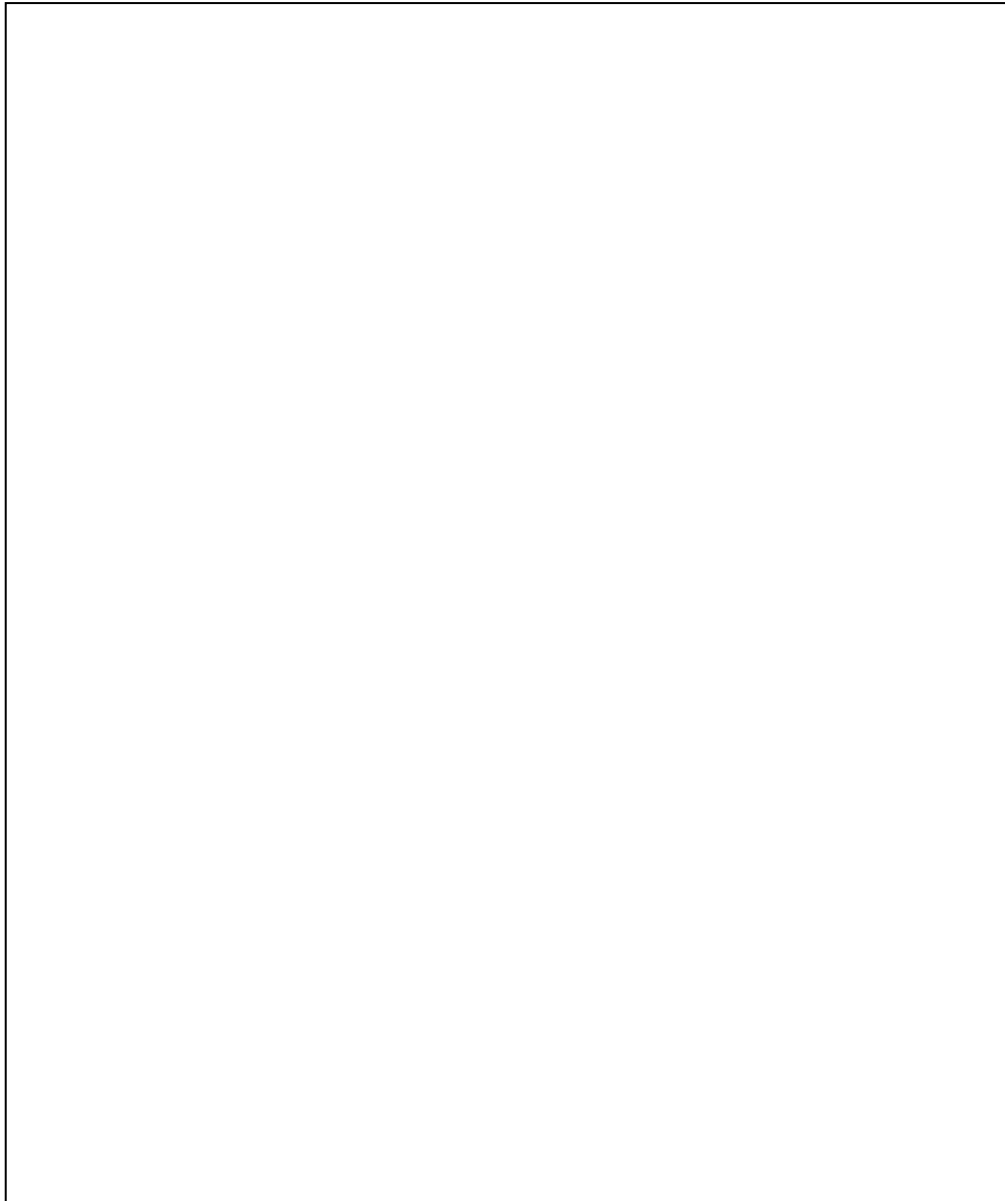
Currently Assigned To: _____ **Follow-up Date:** _____

Risk Factors

Pregnant: Yes No **If Yes, # of Weeks:** _____

Risk factors for complications in contact: None Pregnant Woman HIV Seropositive Unimmunized Index case is a super-spreader

Child younger than 5 Age > 65 Otherwise immunosuppressed (s/p transplant, high dose steroids, etc)



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

- Monday – Friday, 8:00 am to 4:30 pm, EST: call 770-488-7788 (Fax: 770-488-4465)
- 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 Travelers' Health Web site <http://www.cdc.gov/travel>
- CDC's Travelers' Health Information Service: call 1-877-FYI-TRIP
- CDC's Malaria Web site <http://www.cdc.gov/malaria>

***Health Information for International Travel* is available from the Public Health Foundation:**

Call 1-877-252-1200, or order on line at <http://www.phf.org>

Public Health Fact Sheet

Malaria

What is Malaria?

Malaria is a serious and sometimes fatal disease caused by a parasite that commonly infects a certain type of mosquito which feeds on humans. Each year 300-500 million cases of malaria occur and more than 1 million people die of malaria. Most deaths occur in young children. It is relatively uncommon in the United States with only 1,300 cases of malaria are diagnosed in the United States each year. The vast majority of cases in the United States are in travelers and immigrants returning from malaria-risk areas, many from sub-Saharan Africa and South Asia.

Who gets Malaria?

Any person living in or traveling to a country where malaria is present is at risk for contracting the disease. Malaria is endemic in Asia, Africa and Central and South America.

How is Malaria spread?

Malaria is spread by the bite of an infected *Anopheles* mosquito. It may also be transmitted by transfusion of blood from infected people or by the use of contaminated needles or syringes.

What are the symptoms of Malaria?

Symptoms of malaria include fever and flu-like illness, including shaking chills, headache, muscle aches, and tiredness. Nausea, vomiting, and diarrhea may also occur. Malaria may cause anemia and jaundice (yellow coloring of the skin and eyes). Infection with one type of malaria, *Plasmodium falciparum*, if not promptly treated, may cause kidney failure, seizures, mental confusion, coma, and death.

How soon after exposure do symptoms appear?

For most people, symptoms begin 10 days to 4 weeks after infection, although a person may feel ill as early as 7 days or as late as 1 year later. In two types of malaria (*P. vivax* and *P. ovale* infections), parasites can remain dormant in the liver for several months up to about 4 years after a person is bitten by an infected mosquito. When these parasites come out of hibernation and begin invading red blood cells ("relapse"), the person will become sick.

When and for how long is a person able to spread Malaria?

Person-to-person transmission does not occur. Untreated or inadequately treated cases may be a source of mosquito infection for 1-3 years depending on the strain of infection.

This fact sheet is for information only and is not intended for self-diagnosis or as a substitute for consultation. If you have any questions about the disease described above or think that you may have an infection, consult with your healthcare provider. This fact sheet is based on the Centers for Disease Control and Prevention's topic fact sheets.

What is the treatment for Malaria?

Due to the changing pattern of drug-resistant strains, current treatment recommendations need to be obtained from an infectious disease physician or your local or state health department.

What can be done to prevent the spread of Malaria?

Since malaria is not native to the United States, exposure to American citizens occurs most frequently during foreign travel to malaria-risk area. It is very important to contact health officials to determine the proper preventive drug therapy. The liberal and frequent use of mosquito repellents as well as using a bed net can be very effective in preventing mosquito bites.

Where can you get more information?

- Your Local Health Department
- Kansas Department of Health and Environment, Epidemiologic Services Section at (877) 427-7317
- <http://www.cdc.gov/malaria/faq.htm>
- Your doctor, nurse, or local health center

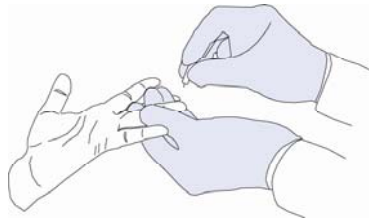
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Preparation of blood smears

Blood collection for thick or thin blood smears

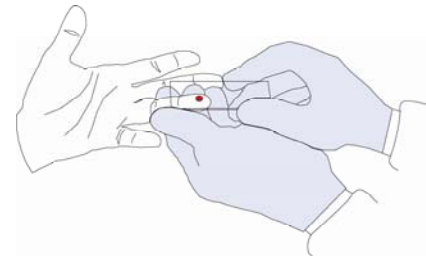
Capillary blood obtained by fingerstick:

1. Label pre-cleaned slides (preferably frosted-end) with patient's name (or other identifier), date and time of collection.
2. Wear gloves.
3. Clean slides with 70 to 90% alcohol and allow to dry. Do not touch the surface of the slide where the blood smear will be made.
4. Select the finger to puncture, usually the middle or ring finger. In infants, puncture the heel.
5. Clean the area to be punctured with 70% alcohol; allow to dry.



6. Puncture the ball of the finger, or in infants puncture the heel.

7. Wipe away the first drop of blood with clean gauze.
8. Touch the next drop of blood with a clean slide. Repeat with several slides (at least two thick and two thin smears should be made). If blood does not well up, gently squeeze the finger.



For venous blood obtained by venipuncture:

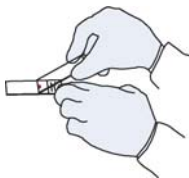
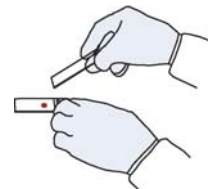
1. Label collection tubes and pre-cleaned slides (preferably frosted-end) with the patient's name (or other identifier), date and time of collection.
2. Clean the site for blood collection well using 70% alcohol; allow to dry.
3. Collect the venous blood in a vacuum tube containing anticoagulant (preferably EDTA); alternatively, collect the blood in a syringe and transfer it to a tube with anticoagulant; mix well.
4. Prepare at least two thick smears and two thin smears as soon as possible after collection.

Laboratory diagnosis of malaria

Making thick and thin blood smears

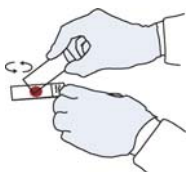
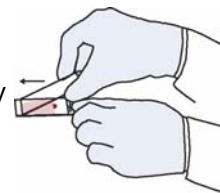
1. Whenever possible, use separate slides for thick and thin smears.

2. Thin film (a): Bring a clean spreader slide, held at a 45° angle, toward the drop of blood on the specimen slide.



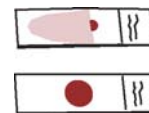
3. Thin film (b): Wait until the blood spreads along the entire width of the spreader slide.

4. Thin film (c): While holding the spreader slide at the same angle, push it forward rapidly and smoothly.



5. Thick film: Using the corner of a clean slide, spread the drop of blood in a circle the size of a dime (diameter 1-2 cm). Do not make the smear too thick or it will fall off the slide. (You should be able to read newsprint through it.)

6. Wait until the thin and thick films are completely dry before staining. Fix the thin film with methanol (100% or absolute) and let it dry completely before staining. The thick film should not be fixed.



7. If both thin and thick films need to be made on the same slide, fix only the thin film with methanol. The thick film should not be fixed.



For a video of how to make a thick smear, please visit the DPDx website at:

http://www.dpd.cdc.gov/dpdx/HTML/Frames/DiagnosticProcedures/body_dp_bloodthickavi.htm

For a video of how to make a thin smear, please visit the DPDx website at:

http://www.dpd.cdc.gov/dpdx/HTML/Frames/DiagnosticProcedures/body_dp_bloodthinavi.htm



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