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## Malaria Curriculum

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# Malaria Curriculum

Caroline Schairer

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## Scientific Background

### Objectives:

- I.) The students will be able to explain what malaria is, how one gets malaria, and how one prevents malaria through the creation of a brochure.
- II.) The students will be able to analyze and distinguish whether or not a patient has malaria, through the use of a case study.
- III.) The students will be able to compose a malaria prevention plan for their home using their knowledge and comprehension of malaria and various prevention measures.

### Lesson

#### I.) What is Malaria and How Do You Get It?

##### Objectives:

- 1.) The students will be able to explain the life cycle of malaria through the construction of a drawn model.
- 2.) The students will exhibit the knowledge through the construction of a drawn model that malaria is caused by a parasite within a female anopheles mosquito, and rid of the misconception that malaria is caused simply by being bitten by any given mosquito.

##### Scientific Background:

A misconception about malaria that many people have is that it is caused by simply getting bitten by a mosquito- that the mosquito is essentially malaria and that all mosquitos in that region are malaria. This, however, is not the case. Malaria is a pathogen, a parasite (*Plasmodium falciparum*) that lives in one major type of mosquito, a female Anopheles mosquito. This parasite lives on and in the female Anopheles mosquito, until the mosquito feeds on a human. As the mosquito feeds on a human, the parasite can enter the human, moving directly to the liver. Once the parasite is inside the liver, the parasite multiplies and is released to infect the red blood cells- which are produced in the liver. The parasite then rapidly reproduces inside the red blood cells, causing them to eventually burst. This process is what causes the illness and signs and symptoms of malaria. When another female Anopheles mosquito feeds on an infected human, the cycle begins all over again.

##### (Engage)

On the board, create a KWL chart. The KW will be filled out first, if possible leave the chart on the board, if not, make note of the KW for when the L is filled out later. Have the students either come up to the board or write on the board for them what they Know and what they Would like to know about malaria.

##### (Explore)

Take the students outside and allow them to look at the insects that may be present on the premises. Ask the students if they are able to identify any of the insects, without

touching them, and show them to the class. Once back in class, ask students to identify some animals that are dangerous to their health. Ask if they know of any insects that may be dangerous to their health. Put up a picture of a mosquito on the board (attachment A), does anyone know what this is?:

-does anyone know what some mosquitos can carry that make you sick? (malaria)

-does anyone know how the mosquitos make you sick? (mosquitos can carry a virus that can be put into the human bloodstream if they are bitten. This can make humans very, very sick)

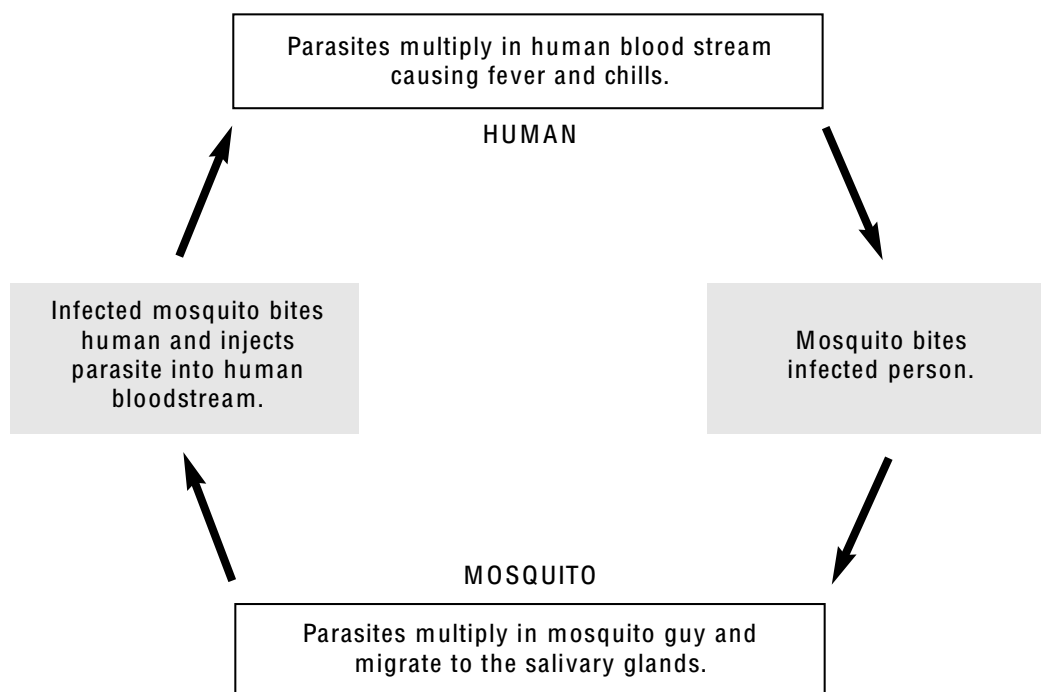
-does anyone know what a virus is? (a virus is something that is very small that when it comes in contact with the cells that make up your body, can make you very sick.)

(Explain)

Attempt to draw one or both of the following diagrams on the board (not the descriptions underneath, although those can be used as a reference:



## THE BASIC LIFE CYCLE OF A MALARIA INFECTION



Adapted from: [http://rbm.who.int/cmc\\_upload/0/000/015/372/RBMInfosheet\\_1.htm](http://rbm.who.int/cmc_upload/0/000/015/372/RBMInfosheet_1.htm)

### Key Factors in Malaria Infection:

- Mosquitoes tend to be active and feeding during the hours when people are asleep.
- Both humans and mosquitoes are used as hosts for the malaria parasite.
- Malaria goes from infection to onset of symptoms very rapidly; a matter of 9 days to a month, depending on the species of *Plasmodium*.
- Transmission differs in intensity depending on factors such as local rainfall patterns, location of mosquito breeding sites, and presence of various mosquito species. Some areas are malaria zones throughout the year, while others have malaria “seasons” that usually coincide with the local rainy season.

There are four species of parasite that lead to malaria in humans, all of the genus *Plasmodium*. Most malaria infections are caused by *Plasmodium falciparum*, the most severe and life-threatening form of the disease. Key malarial regions are also home to the most efficient, and therefore deadly, species of the mosquitoes of the genus *Anopheles*, the females of which transmit the disease.

(Elaborate/ Evaluate) Have the students split into groups of four to draw their interpretation of the life cycle of malaria.

### III.) What are the signs and symptoms? How do you treat malaria?

#### Scientific Background:

There are a variety of signs and symptoms of malaria.

Symptoms are subjective evidence of an illness, while signs are objective evidence of an illness. Some symptoms of malaria include: nausea, aches and pains, feelings of tiredness, chills, and weakness. Some signs of malaria include: fever, enlarged spleen, enlarged liver, increased respiratory rate, loss of blood, sweating, and vomiting. Something that is key for students to understand is that many of these signs and symptoms, can be mistaken for the common cold or flu. It is important that they seek medical attention, so that their blood can be tested to see if the virus is in their bloodstream. It is also important to seek medical attention as early detection leads to early treatment, the best way to prevent malaria from getting out of hand. The only way to maintain the proper treatment for malaria is through receiving a prescription from a doctor. The Roll Back Malaria Initiative has made this treatment, “artemisinin-based combination therapy,” less expensive, at around 1600 Tanzanian shillings per full course treatment (this is equivalent to around \$1). People are encouraged to go to the health clinics to receive this treatment.

#### Lesson Objectives:

- 1.) The students will be able to discriminate between signs and symptoms in a class activity where the given signs and symptoms are characteristic of malaria.
- 2.) The students will, as a result of a classroom debate, determine the proper treatment for malaria, given two different treatments (tribal remedies and medical care)
- 3.) Given a case study, students will be able to characterize signs versus symptoms, diagnose malaria, and determine a treatment plan for the patient.

#### A.) What are signs? What are symptoms?

##### Activity 1/ Engage:

Ask students for examples of how they feel when they are sick/ things they may experience when they are sick, write them on the board. The majority of these will probably be examples of symptoms. If so, include/write a few examples of signs on the board, such as: a rash, damaged organs, fever, and increased heart rate.

Ask the students to find a way to break these “things” into two groups. This should get students thinking about how some of these “things” are measurable, quantifiable, and objective (signs) and some of these “things” are not measurable and are more subjective. This requires students to think critically and and to hone in on the science process skill of classification. Give the students a good amount of time to work through to create the signs and symptoms groups. Younger students may need more guidance.

Once groups are created, if this has not already been done, put the names to the two groups: signs and symptoms and provide the following explanations:

Sign: What happens to the patients body that can be measured, usually by a doctor or nurse. (quantitative or objective)

Symptom: Something felt by the patient, not measured, such as a headache or chest pain, etc. (qualitative or subjective)

B.) Write the following signs and symptoms on the board (without labels) (Explore):

Signs: fever, larger spleen, larger liver, heavy breathing, loss of blood, sweating, vomiting

Symptoms: nausea, aches and pains, feelings of tiredness, chills, weakness,

Ask the students to divide the words into groups of signs and symptoms. Upon breaking these up into signs and symptoms, ask students if they have ever known anyone who has experienced any of these symptoms? Have they ever experienced any of these symptoms? Do they know any illness that might be associated with any of these signs and symptoms?

(Explain) These signs and symptoms are characteristic of malaria. The symptoms are something that many people would usually brush off as the common cold or flu. The signs, however; lead one to believe that something more serious is occurring. Ask the students if they can tell, without going to the doctor, if they have some of the given signs. Since one can not tell if they have some of the given signs without going to the doctor, it is very easy for malaria to go untreated due to misinformation. A key measure to surviving from malaria is early detection. The longer an infected individual goes untreated, the longer the virus has to spread through the individual's body and the more difficult the case is to treat.

C.) Treatment for Malaria (Elaborate)

Write on the board the following two treatments for malaria:

Using plants to treat malaria within a tribe

Going to a health clinic to receive treatment that costs 1,600 TSH

Break the students into two groups and have them debate what treatment is most effective to treat malaria. At the end of the debate, have the students vote for which treatment they believe is best for treating malaria.

Following the debate, discuss the following information about malaria treatment with the students:

-The only way to get rid of malaria is through seeking out treatment by a medical professional, you cannot treat malaria on your own.

-To truly find out if an individual has contracted malaria, the individual must have his/her blood tested for traces of the virus in the blood stream- something that cannot be done in a village.

-Upon confirmation of malaria in the bloodstream, there is one majorly effective treatment “artemisinin-based combination therapy” (ACT). It is key to maintain this treatment for the appropriate and prescribed amount of time- this has to be prescribed by a doctor.

-According to Roll Back Malaria, ACT has been made more available to the general population in terms of price. For children, ACT costs 1,600 TSH (\$1) for a full treatment course. This was made possible through the World Health Organization and a leading pharmaceutical company.

-Oftentimes drug-store shopkeepers recommend drugs for those suffering from malaria that are neither the most appropriate nor the most effective.

-As a patient, it is important to seek the medical attention of a trained professional. Some shopkeeper may be trained in which drugs to appropriately distribute for malaria, so to find out the shopkeepers knowledge and expertise when it comes to malaria.

D.) Evaluate:

Give the students a case study:

Vanessa has been exhibiting a range of signs and symptoms. She has been having headaches and other body aches for the past few days and vomited this morning. Last night she awoke in a cold sweat and could not make it to school this morning as she was very weak. Vanessa’s mother felt her forehead for a fever and she was very warm (this means she had a fever). As a side note, Vanessa has a bump on her right arm that is very itchy.

List the signs and symptoms (separately).

Write a hypothesis as to what you believe is wrong with Vanessa. (A hypothesis is a possible explanation for why an occurrence may have happened).

Based on your hypothesis, describe what you believe Vanessa should do next.

IV.) How can you prevent malaria?

Scientific Background:

There are a few ways to prevent the spread and contraction of malaria. The United States was able to eradicate malaria completely in 1951. Many different organizations, including: President’s Malaria Initiative, Roll Back Malaria Partnership, and Malaria No More have been working to provide countries who are vastly affected by malaria with the tools to prevent it. The most widely used preventative measures are mosquito nets, mosquito repellent, and anti-malaria medication. People who travel to Tanzania take medication to prevent malaria, while natives do not. Mosquito nets are typically soaked in mosquito repellent and are arranged around beds to prevent mosquito bites in the middle of the night- the height of mosquito action. Mosquito repellent can be applied in various ways. Mosquito nets, clothing, bedding, etc. could be soaked in mosquito repellent, while



mosquito repellent can also be directly applied to the body. Anti-malarial medication, such as malarone, is a drug that reduces a person's likelihood of contracting malaria. Mosquitos congregate in moist areas, especially in pools of standing water. It is important to either stay away from or remove these pools of standing water. Wearing clothing that covers most of the body also helps prevent mosquito and human contact.

Lesson Objectives:

1.) The students will devise a prevention plan for an orphanage for the prevention of malaria, using their understanding of the various prevention methods that exist to prevent malaria.

2.) Students will use what they know about malaria prevention to determine what they need to improve with malaria prevention at home, in a written reflection.

(Engage) Begin by asking the students if they have any experience with preventative measures of malaria. Do they do anything at home that would suggest the prevention of this virus? How many of the students use mosquito nets around their beds at home? (it would be very useful to bring in a mosquito net to show students and demonstrate its use.)

(Explore) Ask the students, in groups, to devise a plan that they think would help to prevent malaria. After this discussion, have the groups share what they would do/ how they would try to prevent malaria with the class.

(Explain) Teacher will explain preventative measures to students (write on board):

- Mosquito nets: nets that have been dipped in repellent to keep mosquitos away from people while they are sleeping.

- Medication: there are some different medicines that people can take to help to keep them from getting malaria. This is not for residents, but for travelers.

- Bug repellent: something that you put on your body that keeps mosquitos away.

- Remove and/or stay away from standing water.

- Wear clothing that covers most of the body.

- Also explain to students that none of these measures alone will completely protect someone from getting malaria. Mosquito nets, medication, and bug repellent, however, do a very good job of protecting people from malaria.

(Elaborate/Evaluate) Have students write how their home works to prevent malaria. Also have them create a plan for how their home and community could work to prevent malaria, using the given worksheet (attachment 2). In this activity, students are given a scenario for their community, in which they are given 100,000 TSH (1600 TSH = \$1 US) for malaria prevention. Students are also given the costs for each of the prevention methods and must allocate the money appropriately. They must also come up with a creative way to help prevent malaria in their community.

V.) What are the global impacts of malaria?

Scientific Background:

While approximately 2 million people die annually from this virus, malaria is very preventable. So preventable, in fact, that the United States was able to pronounce national elimination of the virus in 1951 (CDC). While this virus is preventable, many developing countries have neither the means nor the education to eliminate this virus. There have been many programs put into place to help developing countries eliminate malaria, including the President's Malaria Initiative, Roll Back Malaria Partnership, Malaria No More, and Kilimani Sesame Street Malaria Outreach Campaign. These programs, among many others, have helped to reduce the amount of individuals infected by malaria in the past ten years by 50 percent (Montez, 2011). While Kilimani Sesame Street Malaria Outreach Campaign focuses on the education of pre-school age students, many of the other programs focus on the equally vital aspects of providing preventative measures and treatments to much of the population, as well as focusing on educating mothers. While what these programs do is exceedingly important and clearly very effective, what seems to be missing from them is the education of school age children on malaria. After looking at each of the primary science books, I found that there is very little, if nothing at all on malaria. I also asked my students how many of them have had malaria before, and found that the majority of them had. In talking with teachers, I found that some find it unnecessary to discuss malaria at school as parents believe they have it under control, while others believe it is very necessary because malaria is both over and under- diagnosed. Malaria is most prevalent in equatorial regions, such as Tanzania- due to the warmer climate. Mosquitos thrive in warm and wet conditions making many regions of Tanzania optimal locations for the malaria virus to spread. Optimal locations also include low elevation. Malaria and dengue fever (another virus carried by mosquitos) are most abundant along the Tanzanian coast, where the warm and moist Indian Ocean air and low elevation create the perfect habitat for mosquitos. Other, higher elevation locations in Tanzania, such as Mount Kilimanjaro and Ngorongoro Crater are not home to mosquitos.

Lesson Objectives:

- 1.) The students will be able to identify where in the world malaria is the most common, based on proximity to the equator and the climate.
- 2.) The students will be able to generalize where in Tanzania malaria is the most prevalent, given various locations and a map of Tanzania.
- 3.) The students will be able to infer and determine which age groups are most prominently affected by malaria, given their general health.

(Engage)

-Print out/ bring a map of the world (Map 1). Have students place stickers or color where on the map they think malaria is the most common.

-Afterwards:

- ask students why they placed the stickers in/colored the areas they did.
- what about those areas is different from the areas they did not color/place stickers?

-Following their answers, pass around the map with the areas colored in of where malaria is the most prevalent. Have students volunteer to name what these areas are. Have students also volunteer to predict why they believe these areas are the most prevalent. Ask students what the pattern is of where these are located? Why would malaria thrive the most towards the equator? Do they think mosquitos like warm air or cold air the best? Do they think mosquitos like moist air or dry air the best? If mosquitos like warm and moist air, where might the best location for them to live be?

-Malaria is most prevalent in countries that are closest to the equator and that have a large amount of moisture in the air. After the rainy season in Tanzania is when malaria is the most abundant, as mosquitos can easily find habitats to thrive among pooled water.

(Explore)

- We know that mosquitos like to live in a warm and moist environment. So if we look at a map of Tanzania, where in Tanzania might they like to live the best?

-Provide students with the map of Tanzania (map 1). Allow them to spend some time to think about it- by themselves- then share with a partner, then share with the class- where in Tanzania might mosquitos like to live out of the following regions (write on the board)? Where might mosquitos not like to live?

-Arusha

-Ngorongoro Crater

-Serengeti

-Manyara

-Dar Es Salaam

-Tanga

-Zanzibar

-Moshi/Mt. Kilimanjaro

Areas like Dar Es Salaam, Tanga, and Zanzibar are where mosquitos would most like to live, due to their very moist climates- as they are coastal regions. Arusha, Serengeti, and Manyara are also areas where mosquitos will congregate- though not as many, due to slightly higher elevation and drier climate. Mosquitos do not live at Ngorongoro Crater, nor do they live at Mt. Kilimanjaro- due to the high elevation.

(Elaborate)

-Draw or write the following people on the board:

-children

-men

-women

-pregnant women

-the elderly

Have students come up and mark which person they think is most likely to get malaria.

The elderly, children and pregnant women are most likely to get malaria. Ask students why they think this is. (this is because their bodies are the weakest at fighting off sickness)

Ask students if they know if there are any programs to help get rid of malaria...

There are the following:

- Roll Back Malaria Partnership
- President's Malaria Initiative
- Malaria No More
- Kilimani Sesame Street Outreach Campaign

Tell students that these programs have worked together to provide mosquito nets, repellent, education, and treatment at more available prices and even for free, reducing the number of people that have gotten malaria by 50% in the past ten years, meaning half as many people have gotten malaria in the past ten years.

(Evaluate) (MOST SUMMATIVE ASSESSMENT)

In pairs, have students create a brochure about malaria including the following topics:

- What is malaria? How does one get it?
- What is a sign? What is a symptom? What are some signs and symptoms of malaria?
- What are ways that malaria can be prevented? How can you work to prevent malaria?
- What areas are most widely affected by malaria around the world? Which areas in Tanzania are most likely to be affected by malaria? Which areas in Tanzania are least likely to be affected by malaria? Why are these areas most widely affected?
- Which people are most likely to get malaria?

Name: \_\_\_\_\_

### You Make the Rules! Malaria Prevention in Your Community

**Directions:** You own an orphanage just outside of Arusha. Lately there has been an increase in the amount of children suffering from malaria in your orphanage. It is the end of the rainy season and there are many puddles that have pooled on the ground and in the garbage. The national government of Tanzania is going to give you 100,000 TSH to help prevent malaria at your orphanage, and you need to figure out how best to use the money. There are 25 adults and children living at your orphanage that all need aid in preventing malaria. No one has mosquito nets nor bug repellent. Below are the prices for various prevention and treatment methods, you decide how you want to spend your money... spend it wisely!

1 Mosquito net.... 1,600 TSH

\*\*\*\*If you buy 10 or more mosquito nets, they become 1,000 TSH a piece

Malaria "treatment" plant..... 30,000 TSH

1 Bottle of mosquito repellent (1 bottle is enough for 5 people)..... 5,000 TSH

1 Light jacket for body protection.... 2,000 TSH

\*\*\*\*If you buy 10 or more light jackets, they become 1,500 TSH a piece

Work crew to remove puddles..... 15,000 TSH

ACT (Malaria treatment) for 1 person.... 1,600 TSH

#### Working Space:

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#### Final Decision:

How many mosquito nets? \_\_\_\_\_ Cost \_\_\_\_\_

How many malaria "treatment" plants? \_\_\_\_\_ Cost \_\_\_\_\_

How many bottles of mosquito repellent? \_\_\_\_\_ Cost \_\_\_\_\_

How many light jackets? \_\_\_\_\_ Cost \_\_\_\_\_

Will you use the work crew to remove puddles? Cost \_\_\_\_\_

How many ACT? \_\_\_\_\_ Cost \_\_\_\_\_

Total Cost \_\_\_\_\_

Reflection:

Why did you decide to spend your money as you did?

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Prevention Creation:

You are now working as a scientist. You are trying to create a new way to prevent malaria, using anything!!! What would you do? Be creative!

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At Home Prevention:

Now that you know how malaria is best prevented, what are some ways that you can improve how you and your family work to prevent malaria at home?

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