Title: Save Lives Now or Save Lives Later? The Dilemma of DDT and Malaria

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Description: This is a case study about spraying DDT to control Malaria-carrying mosquitoes to reduce the disease burden of Malaria.

Case Study: Lagos, Nigeria. When she was seven years old, Bola was playing soccer outside with some friends and her little brother, Tolu, when he unexpectedly passed out. After crying for help, Bola’s family took Tolu to the hospital where they conducted a blood test and learned that he had malaria. The hospital sent him home with oral medication. Tolu seemed to get worse over the next few days, shivering, vomiting, and having sore joints and horrible headaches. Five days after the hospital visit, Tolu went into a coma. Three days later, Tolu’s family had to deal with his death.

Bola is now 14 years old. For the past 2 years her town has received a spray treatment infused with DDT to the inside walls of the buildings every 6 months. The incidence of malaria has decreased by 80% since the treatment started. However, Bola has heard a rumor that the next DDT spray treatment might be the last. Bola is terrified that if this happens, she may succumb to the same destiny that her younger brother did seven years ago.

The statistics of deaths by malaria are staggering. Malaria impacts approximately 40% of the world population and has the greatest impact in underdeveloped countries, such as those in Central and South America, South-East Asia and Sub-Saharan Africa.

- 300-500 million people worldwide are infected with malaria each year
- In the malaria-infected areas of Africa, there are roughly two deaths per minute, yielding 990,000 deaths annually
- Children in Africa account for 90% of those who die from malaria

Dichlorodiphenyltrichloroethane, more commonly known as DDT, is a chemical that kills and deters disease-carrying mosquitoes that transmit yellow fever, typhus and malaria. In 1962 Rachel Carlson authored Silent Spring, which first brought to light claims not yet supported by scientific evidence, that DDT and other synthetic insecticides damage wildlife and the environment, and might even act as a potential carcinogen (cancer-causing agent). While DDT has been shown to build up in the fatty tissues of animals and cycles into and through the environment, there is no evidence that DDT has caused direct harm to humans. While Carlson is applauded for exposing the potential dangers of DDT, statistics remind us that over one million people worldwide die from the insect that could be warded off by the use of DDT.

DDT is relatively inexpensive. When considering the countries that are most affected by malaria, statistics reveal that they are underdeveloped. At this time, no effective vaccine to prevent malaria within the financial means of these countries has been established. On top of its relatively low cost, applying DDT is easy to apply, as it is simply sprayed. The application of DDT has also had dramatic impacts on the decline of global malaria occurrences. In the 1950s before Carlson’s book came out, malaria was eradicated from the United States through the use of DDT. Other locations around the world have also dramatically decreased in their number of malaria cases from its use. Conversely, since
Carlson’s account came to the forefront and citizens became concerned by DDT’s impact on humans and the environment, the number of people who contract malaria has increased.

**DDT builds up.** DDT is a very stable compound and takes a long time to decompose. This means that once it enters one part of an ecosystem, it can cycle through water, air, soil and living organisms. Researchers have verified that DDT builds up in animal tissues, which will enter the food chain. When animals with DDT in their fatty tissues are consumed by other organisms, those levels will accumulate as they move further up the food web, therefore leading to larger concentrations higher up the food chain and have potentially adverse effects on the organisms that are not the intended target for the chemical. Along with this, scientists have tied DDT exposure has been tied to the thinning of eggshells, which reduces the survival rate in species such as bald eagles, hawks, falcons, pelicans and osprey.

**DDT has other impacts on species.** Another concern regarding the use of DDT is that some mosquito populations have developed resistance to DDT and will not be killed by its exposure. This leads to the question of whether all mosquito populations, including those that carry malaria, could potentially follow this same path. Studies have also shown that the residue left behind by DDT sprays increase the activity level of bed bugs, which are a parasite. Although there has been no direct link to DDT causing harm to humans, scientists deem it necessary to err on the side of caution, as we all know that it is better to be safe than sorry, as we have already learned from the ozone layer, asbestos and PCBs. In 1972 the U.S. Environmental Protection Agency (EPA) banned the use of DDT for these reasons (excluding emergency purposes that are legally regulated and closely monitored).

**The problem.** As indicated by the World Health Organization (WHO), there is a dilemma facing our globe: on the one hand, far too many people are being negatively affected by malaria and need an affordable and effective remedy; on the other hand, there is concern to be so reliant on a chemical whose far-reaching impacts we have only yet to determine. We need to seriously evaluate the impacts of both choices and determine which direction we should lead humankind in our generation and those to come.

**Ethical Question:** Should we allow spraying of DDT against Malaria in selected places? Think about this, in particular, in the context of the #1 canon of the engineering code of ethics.

**Guiding Questions:**
1. Do any of the fundamental theories of ethics that we have discussed impact our decision making?
2. Who should be responsible for making decisions to these questions?
3. Who are the stakeholders?
4. What are some potential solutions?
### Teacher Resources / Background

#### Ethical Arguments

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<th>Ethical principle</th>
<th>Pro (Yes)</th>
<th>Con (No)</th>
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| Maximize Benefits/Minimize Harms | - There are many harms from malaria that could be alleviated if DDT helped get rid of the major vector:  
  - Costs of treating malaria are currently at approximately $12 billion annually.  
  - Funding for malaria could decrease by $2 billion annually (resulting in more deaths). Upwards of 500 million are affected directly by malaria and over one million die each year.  
  - There are many benefits:  
    - There is no evidence that DDT has caused direct harm to humans.  
    - DDT has a low cost, while being very effective in killing and/or repelling mosquitoes.  | - There are many harms from DDT  
  - It is a very stable chemical and takes a long time to decompose and can cycle through water, air, soil and living organisms.  
  - As DDT is deposited into the fatty tissues of an organism, DDT levels will accumulate as they move up the food web, therefore, leading to larger concentrations higher up the food chain.  
  - It has resulted in thinning of egg shells  
  - Some mosquito populations have developed resistance to DDT and are unaffected. This leads to the question of whether all mosquito populations could potentially follow this same path.  
  - Leaves a deposit/residue on huts and makes bed bugs more active  
  - The threat of being used for purposes beyond its intended use. This would further increase the concentration of DDT put into organisms and the environment.  
  - Precautionary principle. It is better to be safe than sorry and once we discover the potentially negative impacts of DDT, it may be too late. Good reminders of why to err on the side of caution include asbestos, ozone layer and PCBs. |
| Justice                   | - A vaccine to prevent malaria has not been created yet, especially one within the financial range affordable to underdeveloped countries, which suffer most from malaria. This will offer a relatively inexpensive way to prevent malaria – other well-off countries have already used it and helped eradicate endemic malaria – why should that be denied from the countries with the highest burden? | - Many upcoming chemical development companies are hoping to develop the up and coming “better” alternative to DDT for the prevention of malaria and other parasitic diseases... this means that money is a perpetuating factor in this race! – the companies might get benefits instead of the people. |
Background – Extra Information for Teachers

Extra Resources

References


