



## Activity 5

# Making Hard Decisions

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**Focus:** Students explore several CD-ROM-based resources to evaluate proposals to combat AIDS, VRSA, and measles and recommend one proposal to support.

**Major Concepts:** Infectious diseases have a devastating impact nationally and globally, but a variety of strategies can alleviate suffering due to these diseases. Because resources are limited, allocating funds among projects that address different diseases raises complex ethical questions. Understanding the relevant biological principles can help in making these difficult decisions.

**Objectives:** After completing this activity, students will

- understand that proposals to combat infectious diseases can be evaluated using several criteria,
- be able to provide a rationale for accepting or rejecting proposals based on the magnitude of the situation and their likely effectiveness,
- understand that different people will define and weigh criteria differently as they evaluate questions about allocating funds for specific purposes, and
- understand that it is possible for people to hold quite different positions on a controversial topic and still participate in a reasoned discussion about it.

**Prerequisite Knowledge:** Students should be familiar with problems in controlling infectious diseases, such as the evolution of drug resistance and the challenge of administering vaccines to a significant proportion of the population.

**Basic Science-Public Health Connection:** Basic research has led to effective treatments and preventive measures to control infectious diseases. In this activity students see that implementing these measures is challenging, both financially and logistically, and requires that difficult decisions be made.

Implementation also brings us full circle: The problems we discover as we attempt to control infectious diseases are new problems for research to address.

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The continuing—and growing—problem of infectious diseases in the world requires that money be spent to better understand the factors involved in infectious diseases and their spread, to alleviate suffering, and to prevent disease where possible. Much of the money spent in the United States to fight infectious diseases is federal money, allocated through well-established and closely monitored agencies and programs. Some of the money, however, is private money—money that is made available through the beneficence of private foundations and individual donors.

Whether the money is public or private, someone, somewhere, has to decide how to allocate it: to whom it will be given and why, and how it will be spent and where and when. These decisions are not easy. Frequently, they are made

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### At a Glance

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### Introduction

by carefully considering many competing requests for funds, and the decisions reflect the degree to which, in the minds of the reviewers, the requests meet the funding criteria that have been established for use of the money.

In this activity, students consider three proposals for spending \$5 million that a private foundation has made available to combat infectious diseases. Each proposal addresses a different infectious disease (AIDS; measles; and vancomycin resistant *Staphylococcus aureus*, or VRSA) and proposes different actions. Students use three reference databases on the CD-ROM to learn about each disease and evaluate the proposals on the basis of two criteria: magnitude (how important it is that the situation described in the proposal be addressed now) and effectiveness (how likely it is that the proposed project will address the situation successfully). Finally, students recommend which proposal to fund, provide reasons for their recommendations, and discuss differences in their evaluations as a way to understand how complex such decisions can be.

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### Materials and Preparation

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You will need to prepare the following materials before conducting this activity:

- Master 5.1, *Proposal Criteria Matrix* (make 1 copy per student)
- Master 5.2, *Proposal Summary Matrix* (make 1 copy per student)
- Master 5.3, *Reflection Questions* (make 1 transparency)
- *Emerging and Re-emerging Infectious Diseases* CD-ROM (1 per team)

Follow the instructions on page 31 to load the CD-ROMs on the computers students will use.

**Note to teachers:** If you do not have enough computers equipped with CD-ROM drives to conduct this activity, you can use the print-based alternative. To view and print the instructions and masters for this alternate activity, load the CD onto a computer and click the Print button on the main menu screen. The computer will display a screen showing the resources available for printing from the CD; click on the button labeled Non-CD Lesson Plan from the choices available for Activity 5, *Making Hard Decisions*. This will reveal the lesson plan and the masters for the alternate, non-CD-based lesson. Click Print again to print these resources.

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### Procedure

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- 1. Introduce the activity by saying something like, “We’ve been studying infectious diseases and the reasons why ‘new’ diseases are emerging and ‘old’ ones are re-emerging. What are some of those reasons? What steps can we take to avoid disease emergence and re-emergence? How can research contribute to better ways to control infectious diseases?”**

Reasons for disease emergence and re-emergence developed in the previous activities include environmental changes, indiscriminate use of antibiotics, and failure to vaccinate populations. Steps that can be taken to avoid disease emergence and re-emergence include carefully considering the impact of development in wilderness areas and being alert to

the possibility of pathogens having access to a new and/or larger host population, avoiding unnecessary uses of antibiotics, and increasing efforts to enforce vaccination. Research can help us develop better ways to recognize and understand new pathogens, create new or improved antimicrobial drugs to prevent or treat infection, develop new vaccines to protect individuals and the population, and discover new ways to prevent transmission of infection.

2. **Continue the discussion by saying something like, “Fighting infectious diseases requires money as well as knowledge. There is a limit, however, to the money that is available for this purpose. How do people decide where to invest money in fighting infectious diseases?” Entertain some answers, then explain that in this activity, students will consider proposals to fight three different diseases, investigate each of these diseases, and recommend one proposal to fund. Indicate that their recommendations will be based on two criteria, “magnitude” and “effectiveness,” which will be described in the activity. Their recommendations also must include reasons for funding one proposal but not the other two.**

In the first video segment (see Step 3), the representative of the funding agency explains that students’ recommendations are to be based on the criteria of magnitude and effectiveness, and gives examples of the questions that students must answer to determine the magnitude of each situation and how effective the proposed plan is likely to be. Those and additional questions related to magnitude and effectiveness also appear on Master 5.1, *Proposal Criteria Matrix*.

You may want to indicate to students that there are valid reasons for recommending each proposal. Explain that this activity is like “real life” in that we frequently have to make difficult choices among several “good” options (or among several “bad” options).

Magnitude of the problem and effectiveness of the proposed approach are two criteria that are typically applied in making decisions about a plan to address a societal problem. With regard to infectious disease, magnitude refers to the current burden of illness, as well as the potential for this burden to increase in the future. Effectiveness refers to how well the proposal will alleviate the serious consequences of the disease.

A third criterion—means—often is used to make decisions about plans to address societal problems. Means refers to how well we can accomplish the actions described in the plan. For example, proposing that we spend money to distribute a “cure” for AIDS is not realistic because no cure is available at this time. In this activity, students consider means as part of their evaluation of the second criterion, effectiveness. That is, if a team judges a proposed project to have high “effectiveness,” the team believes there are means available to accomplish it.

Most funding agencies have an established review process and evaluation criteria for proposals submitted to them. NIH uses a peer review



This is an opportunity for students to review what they learned in the previous activities and for you to assess their understanding informally. For a more formal assessment of student understanding, ask students to write individual responses to the questions.



Basic research has contributed to the public health management of all three of these diseases. Research on the measles virus in the 1950s and 1960s led to the development of a vaccine to prevent the disease. Research into HIV replication revealed vulnerable points in its infectious cycle, leading to the proteases now used to increase both the quality and the length of life for those who are HIV-positive. Research demonstrating that antimicrobial resistance genes can be passed from one bacterial species to another alerted health officials to the need for increased surveillance for resistant pathogens and reinforced the need to use antimicrobials prudently and to conduct research to develop new, more effective drugs.

system, that is, external scientists familiar with the health issues, techniques, and research models in the proposals review and make recommendations about the scientific merit of the proposals. NIH specifies five major criteria for evaluation of proposals: significance (similar to the criterion of “magnitude” in the activity), approach (similar to “effectiveness”), innovation, experience of the principal investigator(s), and institutional support for the project.

- 3. Organize students into their teams and direct them to watch the video segments *Introducing the Proposals* and *Proposal 1*, *Proposal 2*, and *Proposal 3* on the CD-ROM, then to proceed directly into their research using the databases on the CD-ROM. Tell the teams that they have 30 minutes to complete their work.**
- 4. Distribute Master 5.1, *Proposal Criteria Matrix*, and Master 5.2, *Proposal Summary Matrix* as students begin their work and tell them that at the end of the 30 minutes, each team should be prepared to announce its recommendation and explain its rationale to the class.**

While the student teams are conducting their research, move among them to make sure they understand each situation and the questions they are to answer. For example, ask them what each group of applicants proposes to do (AIDS applicants: produce and distribute drugs to HIV-positive individuals; measles applicants: produce and distribute vaccine to susceptible people around the world; VRSA applicants: develop new drug therapies against *Staphylococcus aureus*).

- 5. Ask each team to identify a spokesperson to tell the class which proposal the team recommends and the reason it selected that proposal. As the teams report their decisions, tally the number recommending each proposal.**
- 6. Invite students to look at the results of the tally and ask them if they can explain the differences, considering that each team worked with the same information.**

Students may respond with comments such as “We thought that, even if the plan had problems, AIDS is so terrible that we should support any plan that could possibly help” or “We thought that the measles plan had a pretty sure chance of working, whereas the others weren’t as likely to be effective.” Encourage this kind of discussion and point out that some teams gave more weight to the “magnitude” criterion and others gave more weight to the “effectiveness” criterion.

If all teams recommended the same proposal, tell them that other evaluators may well have recommended different proposals. Give them some possible rationales for those recommendations and ask them what explanation they can give for the different choices.

7. Display a transparency made from Master 5.3, *Reflection Questions*, and ask each team to work together to list as many responses to each question as they can. Conclude the activity by asking each team to give one of its answers and list it on the transparency.

**Question 1 How did understanding the biology of infectious diseases help you make your decision?**

Students may indicate that understanding how natural selection leads to the evolution of antibiotic-resistant bacteria helped them evaluate the likelihood of the emergence of VRSA, or that understanding herd immunity helped them assess the effectiveness of a vaccination program to eliminate measles.

**Question 2 What else did you consider in making your decisions?**

Students may say that they felt it was important to consider the number of people affected by the disease, or the impact the disease would have on the families of the victims (for example, “AIDS orphans”) or on the countries where the victims live (for example, the loss of productivity due to illness and death of AIDS victims in their prime working years).



Step 7 addresses the activity’s major concept. Students should understand that making policy decisions about spending money to combat infectious diseases is complex and there is typically no one “right” decision. Students also should recognize that understanding the biology underlying such diseases can help inform the decisions that ultimately are made.