Allocating Scarce Resources: The Case of Organ Transplantation

Four Key Questions to Always Ask Yourself

- What is the ethical question?
- What are the relevant facts?
- Who or what could be affected by the way the question gets resolved?
- What are the relevant ethical considerations?

Ethical Considerations Relevant to This Module*

<table>
<thead>
<tr>
<th>Ethical Consideration</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respect for Persons</td>
<td>Are some ways of distributing organs more respectful than others?</td>
</tr>
<tr>
<td>Harms and Benefits</td>
<td>What kinds of harms and benefits may come to people who need organs as a result of different organ-distribution policies?</td>
</tr>
<tr>
<td>Fairness</td>
<td>When there are not enough organs for people who need them, how should they be distributed?</td>
</tr>
<tr>
<td></td>
<td>What is the fairest way to distribute organs?</td>
</tr>
</tbody>
</table>

*Bold items are emphasized in this module.
At a Glance

Purpose and Rationale
Although the rules guiding the allocation (distribution) of a lifesaving treatment must be fair, there are many ways of understanding what it means to be fair. This module challenges students to grapple with their own notions of fairness and how those notions affect their decisions about what constitutes a fair allocation policy.

Overview
Keeping in mind the ethical principle of fairness, students consider how to allocate scarce medical resources. They begin by analyzing historical cases—involving insulin, penicillin, and dialysis—that raise issues relevant to resource allocation today. Then, they consider a current scarcity issue, allocating organs for transplantation.

To decide which of four hypothetical patients should receive a liver first, they identify the relevant facts and criteria and then select the criteria they think are most important. Finally, students review the liver-allocation policy in effect today and compare its criteria with the previous policy’s.

Learning Objectives
Students will
• recognize that although lives can be saved by using scarce medical resources, their scarcity means that ethical decisions have to be made about how to distribute them fairly;
• understand that while people agree that organs should be distributed fairly, determining which distribution criteria are fair is difficult;
• learn and define at least six possible criteria for allocating livers;
• identify which criteria they would prioritize in a liver-allocation policy; and
• understand the current liver-allocation policy and recognize the criteria it prioritizes.

Major Concepts
Through engagement with historical and hypothetical cases, participation in a simulation, and analysis of past and current United Network for Organ
Sharing (UNOS) policies, students learn at least six criteria that can be used to guide decisions about allocation when organs are scarce. One could prioritize those who

- are likely to live the longest if given the resource;
- are the sickest;
- are the youngest;
- are the most valuable to society;
- are least responsible for their disease; or
- win in a lottery.

Students discover the importance of fairness in organ-allocation decisions and the implications of allocation policies for all stakeholders. The UNOS policy for liver allocation for transplantation was changed in 1998, and the past and current versions prioritize criteria differently.

**Assessment Outcome**

As a final assessment, each student compares the new and old UNOS policies, ultimately deciding whether the new policy is an improvement over the old and making their own recommendations about how the policy could be further modified. Specific questions are included to guide students through this process.

**Key Science Knowledge***

- **Immunology:** factors that determine whether an organ is a good match
- **Liver:** function, reasons for failure, transplant statistics
- **Organ systems**
- **Transplant basics:** Which organs and tissues can be transplanted successfully? What factors help ensure a successful outcome?

*Bold items are explicitly addressed in this module.

**Teaching Sequence Preview**

**Day 1—Exploring Resource Allocation:** The main ethical question for this module is introduced: How can scarce resources be most fairly distributed? In a jigsaw activity, students share the details of the historical cases they read for homework on the distribution of a scarce biomedical resource—insulin, penicillin, or dialysis machines. They discuss criteria for allocating scarce resources and consider the idea of fairness. Students then examine the facts that are relevant to liver allocation for organ transplantation, including information about liver function, the causes of liver failure, and liver-transplant statistics.

**Day 2—Identifying Stakeholders and Taking Ethical Considerations into Account:** This day first focuses on two of the key questions students should ask themselves when confronted by any ethical choice: Who or what could be affected by the way the question gets resolved? and, What are the relevant ethical considerations? Students must determine the criteria to use to decide which of four hypothetical patients will receive the one available liver. Using the ethical consideration of fairness, students explain which criteria would result in a fair allocation recommendation, and they identify the relevant facts for determining who meets the criteria. They then identify the stakeholders beyond the transplant recipients.
Day 3—What Is Your Recommendation? Students decide which criteria they believe are most important and explain how they made the decision. Students are introduced to UNOS, compare past and current UNOS transplantation policies, and decide which policy is fairer and why.

In Advance

Preparing the Cards for Day 1, Activity 2

In Activity 2, students get cards that say “Received liver,” “Died while waiting,” or “Still waiting.” To make these cards, copy Master 3.4 onto card stock. One side of the cards will be blank, and students won’t be able to see through to the words from the blank side. Explain that everyone in class is a patient awaiting a liver transplant. Use the numbers in the table below to calculate how many of each card to make. The percentages in the first column approximate the actual percentage of people who receive livers, die while waiting, or continue to wait every year. So, for example, a 20-student class needs 7 “Received liver” cards, 2 “Died while waiting” cards, and 11 “Still waiting” cards.

Number of Cards to Make for Classes of Different Sizes

<table>
<thead>
<tr>
<th>Card</th>
<th>Actual percentage of people in each situation</th>
<th>20 students</th>
<th>25 students</th>
<th>30 students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received liver</td>
<td>≈35%</td>
<td>7</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Died while waiting</td>
<td>≈10%</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Still waiting</td>
<td>≈55%</td>
<td>11</td>
<td>14</td>
<td>17</td>
</tr>
</tbody>
</table>

Copies, Equipment, and Materials

<table>
<thead>
<tr>
<th>Activity</th>
<th>Photocopies and Transparencies</th>
<th>Equipment and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Module Homework</td>
<td>1 copy of Master 3.1, 3.2, or 3.3 for each student</td>
<td>—</td>
</tr>
</tbody>
</table>

Day 1

<table>
<thead>
<tr>
<th></th>
<th>1 marker, chart paper for teacher use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>1 marker, chart paper for teacher use</td>
</tr>
<tr>
<td></td>
<td>1 card made from Master 3.4 (on card stock, if possible) for each student</td>
</tr>
<tr>
<td></td>
<td>1 copy each of Masters 3.5 and 3.6 for each student</td>
</tr>
</tbody>
</table>
### Activity Photocopies and Transparencies Equipment and Materials

<table>
<thead>
<tr>
<th>Activity</th>
<th>Photocopies and Transparencies</th>
<th>Equipment and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>(optional) 1 transparency of the completed graph from the Answer Key to Master 3.6* for the class</td>
<td>1 overhead projector, chart paper, 1 marker for teacher use</td>
</tr>
<tr>
<td>4</td>
<td>1 copy of Master 3.7</td>
<td>1 marker, chart paper for teacher use</td>
</tr>
<tr>
<td>5</td>
<td>1 copy of Master 3.8 for each student</td>
<td>1 marker, chart paper for teacher use</td>
</tr>
<tr>
<td>6</td>
<td>1 copy of Master 3.9 for each student</td>
<td>1 marker, chart paper for teacher use</td>
</tr>
<tr>
<td>7</td>
<td>—</td>
<td>1 marker, chart paper for teacher use</td>
</tr>
<tr>
<td><strong>Day 3</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 8        | 1 transparency of Master 3.9 for the class | • 1 overhead projector, chart paper, 1 marker for teacher use  
|          |                                 | • 5 small stickers for each student  
|          |                                 | (stickers can all be the same color; you can also use small self-stick notes) |
| 9        | • 1 transparency of Master 3.10 for the class  
|          | 1 copy each of Masters 3.10 and 3.11 for each student | 1 overhead projector, chart paper, 1 marker for teacher use |
| **Final Assessment** | 1 copy of Master 3.12 for each student | — |


### Masters

- Master 3.1: Historical Case 1—Allocating Insulin
- Master 3.2: Historical Case 2—Allocating Penicillin
- Master 3.3: Historical Case 3—Allocating Dialysis Machines
- Master 3.4: Cards for Day 1, Activity 2
- Master 3.5: Liver and Liver-Transplant Fact Sheet
- Master 3.6: The Liver and Liver Transplants—Checking for Understanding
- Master 3.7: Patient Profiles
- Master 3.8: Additional Patient Information
- Master 3.9: Identifying Allocation Criteria and the Relevant Facts
- Master 3.10: The United Network for Organ Sharing (UNOS)—Two Policies
- Master 3.11: Comparing the Past and Current UNOS Policies
- Master 3.12: Final Assessment

### Teacher Support Materials*

- Answer Keys (Samples) for Masters 3.6, 3.9, and 3.11
- Pros and Cons of Prioritizing a Single Criterion

1. Introduce the module by telling students that they are going to study fairness in the allocation (distribution) of scarce, lifesaving biomedical resources.

2. Explain that to prepare for the next class, each student will read one historical case and answer the questions on the case handouts as homework. Each case describes a historical situation in which a person or group of people had to decide how to distribute a scarce, lifesaving medical resource.

3. Tell students that the purpose of the homework is to begin to think about fair ways to allocate scarce biomedical resources.

4. Explain that the facts have changed since the time of these historical cases. Penicillin, insulin, and dialysis machines are no longer scarce. Students’ analysis of these old cases will help them understand today’s allocation challenges, however.

5. Distribute Master 3.1: Historical Case 1—Allocating Insulin, Master 3.2: Historical Case 2—Allocating Penicillin, and Master 3.3: Historical Case 3—Allocating Dialysis Machines. Each student should receive just one case.

In Activity 1, you will divide the class into groups of three. In each group, there will be one student who has read Case 1, one who has read Case 2, and one who has read Case 3. Each student will brief the other two students on the case he or she read for homework.

**TEACHING STRATEGIES: Differentiated Instruction**

Although each of the case studies is written to be accessible to a range of high school students, Cases 1 and 2 are a bit shorter and more concrete than Case 3. Additionally, most students may be more familiar with diabetes and antibiotics (the topics of Cases 1 and 2, respectively) than with dialysis and kidney failure (Case 3). You might consider this information when assigning the case studies.

6. Tell students to decide how they would have allocated the resources before they move to page 2 and answer the second question.

7. Tell students that they should come to class ready to explain their case to two peers.
**Day 1: Exploring Resource Allocation**

**Purpose**

Day 1 introduces students to this ethical question: How can scarce resources be most fairly distributed? Students explore their ideas about fairness as they learn about three historical cases where medical resources were scarce and decide who should receive the resources. Students understand that to address this ethical question, they need to know certain relevant facts.

**Activity 1:**

**Historical Cases—Learning from Past Allocation Experiences**

Estimated Time: 20 minutes

**Procedure**

1. Remind students that they should begin by defining the ethical question they will be considering over the next three days: How can scarce resources be most fairly distributed?

   You may want to emphasize the following points:
   - Scarcity is an issue for many different resources—medical procedures, medications, organs for transplant, and vaccines.
   - Scarcity arises whenever need exceeds supply.
   - The theme of scarcity and fairness arose in all three historical cases. After scientists determined the benefits of the treatments (insulin, penicillin, and the dialysis machine), demand for them quickly exceeded the supply.

   **Fairness:** Sharing benefits, resources, risks, and costs equitably.

2. Divide the class into groups of three students, each of whom read a different case.

3. Ask each student to brief the other group members on the case that he or she read (What was the resource? Why was it valuable?) and its outcome (How was the resource allocated?).

4. Tell students that they each have two or three minutes to present just the facts of their case. Ask them to keep their opinions about the fairness of the cases’ outcomes to themselves for the moment.

**Note**

This curriculum supplement encourages students to always ask themselves four key questions and to take at least three core ethical considerations into account whenever they analyze an ethical issue. The questions and considerations are shown graphically on the poster that comes with this supplement. Displaying the poster prominently in your classroom helps keep students focused on these important concepts.
**TEACHING STRATEGIES: Jigsaw Technique**

Day 1 begins with a modified jigsaw activity, in which small groups of students are responsible for sharing with each other the different case studies they read for homework. Ask students to proceed directly to groups in which only one student has read each case study. If you have more than 20 minutes for this whole activity, ask students who read the same case study to form groups first. This gives students a chance to discuss the case and their reactions with one another. Then, students can proceed to their jigsaw groups and share the different readings with one another. For the jigsaw groups, you can have students meet in groups of four or five instead of groups of three so that struggling students have a peer in the group who has read the same article. Emphasize that both students who read the case must contribute to the small-group discussion.

5. After about 10 minutes, bring the class back together and engage students in a discussion of the fairness of the cases’ outcomes.

6. Begin with the insulin case. Ask students, “What do you think would have been the fair way to distribute insulin when it was in such short supply?”

   The class will generate a list of possible criteria that could be used to distribute a scarce resource.

7. Create a list on chart paper or the board with the heading “Possible Criteria for Allocating a Scarce Resource,” and keep track of students’ responses.

   Responses might include
   - use a lottery system,
   - give the insulin to the sickest patients, and
   - give the insulin to the youngest patients.

8. Students may disagree about whether a particular criterion is relevant. Let them know that they will return to this issue throughout the module.

   For now, simply keep the list of criteria on the board or chart paper.

9. Ask students for the pros and cons of how Fredrick Banting distributed the insulin.

   - A pro response might be, “Banting was correct when he gave priority to his own clinic and the hospitals in his city. His team was the first to develop insulin and had the right to decide to use it to benefit Toronto first.”
• A con response might be, “The sickest people didn’t necessarily get the drug, since they might not have lived close enough to go to the hospitals in Toronto.”

10. Transition to a full-class discussion of the criteria the dialysis committee used to decide who had access to dialysis. Ask students, “Is it fair to consider one’s social worth—or value to society—as a criterion?”

This question will help students assess the fairness of a policy that considers criteria that most people find irrelevant or inappropriate. Students might respond to this question in several ways:

• Some might think it is fair because it maximizes the long-term benefits to society. For example, surgeons are very valuable to society because they save others. If surgeons have priority for medical procedures such as dialysis, more people will benefit in the long run.

• Some might think it is unfair because all people are equally valuable. These students would find that it is inappropriate to consider a person’s value to society when deciding how to distribute a scarce medical resource.

• Still others might argue that some forms of social worth should count, while other forms should not. For example, some people might think it is fair for an allocation policy to give priority to people like firefighters and police officers so they are available to help others. Yet, the same people might think it is not fair for a policy to prioritize someone with a lot of children over someone with few or no children.

Be sure to add social worth to the criteria on the chart or board if it is not already listed.

11. Engage students in a discussion of the penicillin case and the guidelines of the Committee on Chemotherapeutic and Other Agents (COC). Use this case to show that a policy is not fair when it fails to consider relevant criteria.

The COC did not consider some key criteria, such as how long a person would likely live after receiving the penicillin.

12. Explain to students that the COC distributed the penicillin primarily on the basis of how sick the patient was and secondarily on the basis of advancing scientific knowledge.

Be sure to add the criterion “sickest” to the board, if it is not already there.

13. Ask students, “Is there anything else that the COC should have considered? Why or why not?”

Tip from the Field
Students might disagree about the meanings of the terms social worth and value to society. Let them discuss this briefly, but refocus them quickly on the larger question, Should one consider value to society when allocating a scarce resource? You might want to tell them that the committee’s decision-making process was very controversial at the time and still is today. Some people believe that it was wrong. Others believe that priority should be given to some people—such as the surgeons mentioned in Step 10 or emergency medical technicians (EMTs)—because they have the ability to save many lives.
Some students might think that the COC should also have considered how long a person would live if they received the penicillin. Add new criteria that come up in discussion to the list (for example, “likely to have lived the longest after penicillin treatment”).

14. Explain that on Day 3, students will discuss in more detail which of these criteria are relevant to allocating scarce medical resources. Remind them that fair allocation policies include all relevant criteria—not just some relevant criteria—and do not include irrelevant or inappropriate criteria.

15. Tell students that in the rest of the module, they will consider a very contemporary problem: allocation of organs for transplantation.

**Activity 2:**
**Allocating Organs for Transplantation—What Are the Relevant Facts?**
**Estimated Time: 25 minutes**

**Procedure**

1. Tell students that in the United States, the United Network for Organ Sharing (UNOS) determines organ-allocation policies. Students will examine past and current UNOS liver-allocation policies on Day 3.

2. Explain to students that livers—like all organs that are transplanted—are in short supply, and ask them to think about what a national policy that governs how to allocate them should be.

3. Inform students that they will carry out a brief activity that conveys the current situation with liver transplants in the United States.

4. Place one card (created beforehand using Master 3.4: Cards for Day 1, Activity 2) on each student’s desk, with the outcome side face down. Tell students not to turn the cards over. See In Advance on page 3-4 for the number of cards you should make and how many students should receive each type of card.

5. Explain to students that they are patients awaiting liver transplants. Tell them they will soon find out what their situation is as a patient.
6. Create a three-column table on chart paper or the board with these column heads (left to right): “Question,” “Predicted %,” and “Actual %.”

Your chart should resemble the following example:

<table>
<thead>
<tr>
<th>Question</th>
<th>Predicted %</th>
<th>Actual %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over the next 12 months, what percent of you will receive a liver—10%, 35%, or 55%?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over the next 12 months, what percent of you will die while waiting for a liver—10%, 35%, or 55%?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At the end of the next 12 months, what percent of you will still be alive but will not have received a liver—10%, 35%, or 55%?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Give students a minute to silently jot down their predictions (10%, 35%, or 55%) for the answer to each question.

8. Bring the class back together. Read each question aloud and ask students for a quick show of hands: “How many of you picked 10%? How many picked 35%? How many picked 55%?” Write their answers in the Predicted % column.

9. Tell students to turn their cards over to find out their status. As they do this, write the correct percentages in the Actual % column.

The following is an example of what a completed chart for a class of 20 might look like. Again, the numbers will be different based upon the size of your class.

<table>
<thead>
<tr>
<th>Question</th>
<th>Predicted %</th>
<th>Actual %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over the next 12 months, what percent of you will receive a liver—10%, 35%, or 55%?</td>
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<tr>
<td>At the end of the next 12 months, what percent of you will still be alive but will not have received a liver—10%, 35%, or 55%?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. Engage students in a *brief* discussion of their reactions to their status, the actual percentages, and the current scarcity of livers.

**Tip from the Field**

Watch your time on this activity. You need only spend a few minutes on it.
11. Explain to students that they will need more information about liver transplants to evaluate allocation policies. Remind them that gathering the relevant facts and concepts is always one of the first steps bioethicists take as they contemplate an ethical question.

12. Give each student a copy of Master 3.5: Liver and Liver-Transplant Fact Sheet and a copy of Master 3.6: The Liver and Liver Transplants—Checking for Understanding.

13. As a class, read the first six scientific questions and answers on Master 3.5.

14. Give students time to begin working—in small groups—on Master 3.6, which will be tonight’s homework. Master 3.6 checks students’ understanding of relevant facts about liver transplants.

See Teacher Support Materials
A sample answer key for Master 3.6 is available online at http://science.education.nih.gov/supplements/bioethics/teacher.

Assessment

Having students work in groups on these questions gives you an opportunity to circulate around the room and gauge students’ understanding as they work. This assignment not only reviews some of the relevant facts learned during class, but adds new facts and concepts such as survival-rate statistics for deceased-donor liver transplants, cold ischemic time, the relevance of and geographic distance from the transplant center, and reasons for liver failure. Master 3.6 also incorporates skills involving graphing and interpreting data.

Closure

Remind students of the importance of understanding the relevant facts and criteria. Students will need to apply these concepts as they work through Days 2 and 3 of the module. Announce that during the next session, the class will review the answers to the homework and examine liver-allocation scenarios. These scenarios will bring up ethical questions that demand good comprehension of the facts and concepts that students are reviewing and learning for homework.

Homework

Make sure that each student has a copy of Masters 3.5 and 3.6. Students should finish reading them for homework and complete answers to the questions on Master 3.6.
# Organizer for Day 1: Exploring Resource Allocation

## Pre-Module Homework (Required)

**Estimated Time: 5 minutes**

Tell students that they are going to study fairness in the allocation of scarce, lifesaving biomedical resources, starting with tonight’s homework.

**Page 3-6, Steps 1–3**

Explain that analyzing the homework’s historical cases will help students understand allocation challenges today, even though the cases’ treatments are no longer scarce.

**Page 3-6, Step 4**

Give each student one copy of **Master 3.1, Master 3.2, or Master 3.3**. Students should come to the next class ready to explain their case to two peers.

**Page 3-6, Steps 5–7**

## Activity 1: Historical Cases—Learning from Past Allocation Experiences

**Estimated Time: 20 minutes**

Have students define the module’s ethical question: How can scarce resources be most fairly distributed?

**Page 3-7, Step 1**

Divide students into groups of three, each of whom read a different case. Ask each student to brief group members on the facts and outcome of his or her case. Tell students to keep their opinions to themselves for now.

**Page 3-7, Steps 2–4**

After about 10 minutes, bring the class back together and discuss the fairness of the cases’ outcomes, starting with the insulin case.

**Page 3-7, Steps 5–6**

Create a chart titled “Possible Criteria for Allocating Scarce Resource,” and keep track of students’ responses.

**Page 3-8, Steps 7–8**

Ask students for the pros and cons of how Banting distributed the insulin. Then ask, “Is it fair to consider one’s ‘social worth’—or ‘value to society’—as a criterion?”

**Page 3-8, Steps 9–10**

Next, discuss the penicillin case and the COC’s guidelines. This case shows that a policy is not fair when it fails to consider relevant criteria.

**Page 3-9, Step 11**

Explain that the COC distributed the penicillin primarily on the basis of how sick the patient was and secondarily on the basis of advancing scientific knowledge.

**Page 3-9, Step 12**

Ask, “Is there anything else that the COC should have considered? Why or why not?” Remind students of what constitutes a fair allocation policy.

**Page 3-9, Steps 13–14**

Tell students that in the rest of the module, they will consider a very contemporary problem: allocation of organs for transplantation.

**Page 3-10, Step 15**

## Activity 2: Allocating Organs for Transplantation—What Are the Relevant Facts?

**Estimated Time: 25 minutes**

Tell students that UNOS determines organ-allocation policies. Ask them to think about what a national policy that governs how to allocate livers should be.

**Page 3-10, Steps 1–2**
Inform students that they will now carry out a brief activity that conveys the current situation with liver transplants in the United States.

Place one card (created using Master 3.4) on each student’s desk, with the outcome side face down. Explain that students are “patients” awaiting liver transplants. Tell them not to turn the cards over yet.

Create a three-column chart with these column heads: “Question,” “Predicted %,” and “Actual %.” Give students a minute to silently jot down their predictions.

Read each question aloud, ask students for a quick show of hands for each answer, and record the answers in the Predicted % column.

Tell students to turn their cards over. As they do so, write the correct percentages in the Actual % column.

Engage students in a brief discussion of their reactions to their status, the actual percentages, and the current scarcity of livers. Explain that they need more information before they can evaluate allocation policies.

Give each student a copy of Master 3.5 and a copy of Master 3.6. As a class, read the first six scientific questions and answers on Master 3.5.

Give students time to begin working—in small groups—on Master 3.6.

Closure: Remind students of the importance of understanding the relevant facts and criteria. Announce that in the next session, the class will review the answers to the homework and examine liver-transplant scenarios.

Homework: Finish reading Master 3.5 and filling out Master 3.6.

Involves copying a master
Day 2: Identifying Stakeholders and Taking Ethical Considerations into Account

Purpose

Day 2 introduces students to four patients who need a new liver. Students develop criteria for fairly allocating livers for transplantation using the relevant facts. This approach enables students to understand the role of relevant facts in coming to a decision about an ethical question. During Day 2, students also consider who has a stake in the decision besides the liver recipient.

Activity 3: Checking for Understanding

Estimated Time: 10 minutes (or less)

Procedure

1. Ask students to choose a partner and compare their answers with the homework questions in Master 3.6.

2. After about five minutes, bring the class back together and ask students, “Do you have any questions about the homework?”

See Teacher Support Materials

A sample answer key for Master 3.6 is available online at http://science.education.nih.gov/supplements/bioethics/teacher.

3. (Optional) Display a transparency of the completed graph from the Answer Key for Master 3.6, and note that the sex of the patient makes only a small difference in how long the patient will live after the transplant.

Activity 4: Liver-Transplant Case Studies

Estimated Time: 10 minutes

Procedure

1. Explain to students that they will be reading about four patients who are waiting for a liver transplant.
2. Tell them that one liver has become available, and all of the patients’ immune systems would accept this liver equally well.

3. Distribute a copy of Master 3.7: Patient Profiles to each student, and give students five minutes to silently read the cases and get acquainted with the four patients.

4. Bring the class back together and take five minutes to respond to questions about the cases before moving on to Activity 5.

**ACTIVITY 5:**
**Identifying Allocation Criteria and Relevant Facts**

Estimated Time: 20 minutes

**PROCEDURE**

1. Explain to students that they will now use case studies to identify the criteria they believe should be included in a fair policy for allocating livers for transplantation.

   These very specific case studies will help students focus on the ethical consideration of fairness as they identify criteria. The case studies are the building blocks for ultimately arriving at a fair liver-allocation policy that is applicable to all cases and not just these four patients.

2. Tell students that they will be part of a committee advising a doctor about which of the four patients should get the liver. What would be most fair? Ask them to be ready to explain their reasons.

3. Remind students that the ethical question at hand is, How can scarce resources (in this case, a liver) be most fairly distributed? Write the question on the board or chart paper as a concrete reminder of the goal of the activity.

4. Create a large two-column chart, and record on it the criteria and relevant facts that students mention. The left side of the chart is for the criteria, and the right side of the chart is for the relevant facts for determining who meets the criteria.

**See Teacher Support Materials**

A sample answer key for Master 3.9, available online at [http://science.education.nih.gov/supplements/bioethics/teacher](http://science.education.nih.gov/supplements/bioethics/teacher), contains a list of sample criteria along the top row to help guide you, should you need to prompt students to think about what the criteria are.
Below are two examples of conversations between a student and teacher.

**Example 1**

STUDENT: “The liver should go to Mario, since he is likely to live the longest after a liver transplant.”

_Thus, the criterion is “will likely live the longest after transplant.” Record this on the left side of the chart._

TEACHER: “What facts do you need to know in order to determine who will likely live the longest?”

STUDENT: “How old the person is and the person’s other medical problems.”

_Write these facts on the right side of the chart._

**Example 2**

STUDENT: “The liver should go to Luke, since he will die in two weeks without it.”

TEACHER: “So you think the liver should go to the sickest person (the person who will die the soonest without a transplant)?”

_Thus, the criterion is “sickest” (left side of the chart), and the facts relevant for determining who meets the criteria (right side of the chart) are “When patient will die without a transplant.”_

At this point, the chart should include the following information:

<table>
<thead>
<tr>
<th>Possible Criteria</th>
<th>Relevant Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whoever will likely live longest after transplant</td>
<td>Age of patient, patient’s other medical problems, distance from the transplant center</td>
</tr>
<tr>
<td>Whoever is the sickest</td>
<td>When patient will die without transplant</td>
</tr>
</tbody>
</table>

5. **As students identify each criterion, prompt them to consider which facts are relevant for determining whether a patient meets the criterion.** For example, if a student claims, “whoever has waited the longest should get it,” ask the student, “What facts do you need to know in order to determine who has waited the longest for the liver?” This should prompt the student to respond with “time on the waiting list.”

Your chart should look something like this:

<table>
<thead>
<tr>
<th>Possible Criteria</th>
<th>Relevant Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whoever will likely live longest after transplant</td>
<td>Age of patient, patient’s other medical problems, distance from the transplant center</td>
</tr>
<tr>
<td>Whoever is the sickest</td>
<td>When patient will die without transplant</td>
</tr>
<tr>
<td>Whoever has waited the longest</td>
<td>Time spent on waiting list</td>
</tr>
</tbody>
</table>
6. If it does not naturally arise, ask students to consider whether the organ should go to the sickest person. Then, ask students which of the four patients is the sickest. Students will soon realize that they need additional information to answer these questions.

7. Hand out a copy of Master 3.8 to each student, and ask them to read it over. This master has the additional information about each patient that they will need to determine who is likely to live the longest, who is the sickest, and so on.

The next steps should help students become more familiar with the connection among the criteria, the facts relevant to the criteria, and the case studies.

8. Tell students that it’s time for them to connect the criteria, the relevant facts, and the case studies. Announce that you will select a criterion from the chart and that students must figure out who would get the organ if that criterion were prioritized (that is, deemed the most important one).

9. State that the class will now prioritize the criterion “whoever is sickest.” On the board or chart paper, write the following: Who gets the liver if we prioritize the criterion “whoever is sickest”?

10. Ask students to rank the four patients according to who is sickest and to state the facts they used to determine this. Place the ranking on the left-hand side of a chart (under “Who is sickest?”) and the relevant facts on the right-hand side of the chart. Your chart should look similar to the following. If it does not, remind students that “sickest” means who will die first in the absence of a transplant.

<table>
<thead>
<tr>
<th>Who is sickest? (#1 is sickest)</th>
<th>Relevant Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Luke</td>
<td>He may die within the next two weeks.</td>
</tr>
<tr>
<td>2. Emily</td>
<td>She may die within the next three months.</td>
</tr>
<tr>
<td>3. Anita</td>
<td>She may die within the next nine months.</td>
</tr>
<tr>
<td>4. Mario</td>
<td>He may die within one year.</td>
</tr>
</tbody>
</table>

11. Ask students, “Given this ranking, who gets the liver if we prioritize the criterion ‘whoever is sickest’?”

12. Tell students that they will now prioritize the criterion “whoever will likely live the longest after transplant” and state the facts they used to determine this.

13. On the chart paper or board, create a two-column table and place the ranking on the left (under “Who will likely live the longest post-transplant?”) and the relevant facts on the right.
Your chart should look similar to this:

<table>
<thead>
<tr>
<th>Who will likely live the longest post-transplant? (No. 1 will live longest)</th>
<th>Relevant Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mario</td>
<td>He will likely live 53 years post-transplant.</td>
</tr>
<tr>
<td>2. Anita</td>
<td>She will likely live 33 years post-transplant.</td>
</tr>
<tr>
<td>3. Emily</td>
<td>She will likely live 10 years post-transplant.</td>
</tr>
<tr>
<td>4. Luke</td>
<td>He will likely live 3 years post-transplant.</td>
</tr>
</tbody>
</table>

14. Ask students, “Given this ranking, who gets the liver if we prioritize the criterion ‘who will likely live the longest post-transplant’?”

15. Point out that there are many facts relevant to determining who will likely live the longest, such as the patient’s age, other medical problems, and likeliness to follow medical treatments after the transplant.

You might want to note that even though Anita and Emily are not that far apart in age, Anita’s estimated lifespan is 33 more years if she receives the transplant, while Emily’s is only 10 more years if she receives the transplant.

16. Have students look at both charts and reflect on who in each case would get the liver transplant. The goal is for students to realize that there is a direct connection between the criterion prioritized and the liver recipient.

**Activity 6:**
Preparing for the Homework Assignment

**Estimated Time:** 5 minutes

**Procedure**

1. Distribute Master 3.9: Identifying Allocation Criteria and the Relevant Facts to students, and ask them to copy the criteria from the board or chart paper into the blanks along the top of the chart in Master 3.9.

The following is a sample of how the top of the Master 3.9 chart will look after students write in the criteria that you recorded on the board or chart paper during Activity 5. The wording of the criteria or the criteria themselves might vary, based on your class’s discussion, but these criteria represent different ways of thinking about fairness.
2. Explain that, as homework, students will need to decide which facts in the left-hand column are relevant to each criterion listed across the top, and that they should place a check mark in those boxes where the fact is relevant.

See Teacher Support Materials
A sample answer key for Master 3.9 is available online at http://science.education.nih.gov/supplements/bioethics/teacher.

3. Complete the first column together as a full class. Then, tell students to complete the chart and answer the reflection question at home and come to the next class ready to share their charts and insights.

**Activity 7:**
Identifying the Stakeholders—Who or What Could Be Affected by the Way the Question Gets Resolved?

Estimated Time: less than 5 minutes

**Procedure**

1. Tell students that they have now seen that determining who receives an organ depends on the allocation policy.

   For example, a policy that prioritizes giving the liver to the sickest benefits some patients, whereas a policy that prioritizes giving the liver to the one likely to live the longest benefits others.

2. Ask students, “Are there other people besides the patients themselves who are stakeholders in this decision? Who?”

   Students should identify parents, children, other family members, employers, and so on. The goal is simply for students to realize that the patients are not the only people who will be affected by the decision.
**Closure**

Underscore that our society has developed decision-making rules—policies—to guide allocation decisions. Policy makers must think carefully about which criteria they think are fairest and try to anticipate how the policies will affect people like Anita, Mario, Emily, Luke, and related stakeholders. Tomorrow, students will have an opportunity to compare two national liver-allocation policies that have prioritized different criteria.

**Homework**

Students should complete the Master 3.9 chart and answer the reflection question. Remind students to bring their completed charts with them to the next class.

**Extension (Optional)**

Engage students in discussing the pros and cons of a criterion that they may remember from Historical Case 3. Ask them, “Do you think the fact that someone has children or family members who depend on them is a relevant criterion? Why or why not?”
## Organizer for Day 2: Identifying Stakeholders and Taking Ethical Considerations into Account

### Activity 3: Checking for Understanding
**Estimated Time: 10 minutes (or less)**

Ask students to choose a partner and spend five minutes comparing answers to the homework questions in *Master 3.6.*

Ask, “Do you have any questions about the homework?”

(Optional) Display the transparency of the completed graph from the Answer Key for Master 3.6, and note that the sex of the patient makes only a small difference.

### Activity 4: Liver-Transplant Case Studies
**Estimated Time: 10 minutes**

Tell students they will now read about four patients awaiting a liver transplant. One liver is available, and all of the patients would accept this liver equally well.

Give each student a copy of *Master 3.7* and five minutes to read it.

Bring the class back together, and respond to any questions about the cases.

### Activity 5: Identifying Allocation Criteria and Relevant Facts
**Estimated Time: 20 minutes**

Explain that students will now identify criteria to use in a fair liver-allocation policy.

Tell students that they will be part of a committee advising a doctor about which of the four patients should get the liver. What would be most fair? Explain.

Remind students of the ethical question at hand: How can scarce resources be most fairly distributed? Display the question.

Create a large two-column chart, and record on it what students say about the criteria and the facts related to whether a patient meets the each criterion.

Ask students to consider whether the organ should go to the sickest person, and then, which of the four patients is the sickest?

Give each student a copy of *Master 3.8.* State that the class will now connect the criteria, the relevant facts, and the case studies.

Ask students to prioritize the criterion “whoever is sickest” by ranking the four patients by who is sickest and then to state the facts they used to determine this.

Ask, “Given this ranking, who gets the liver if we prioritize ‘whoever is sickest’?”

Next, tell students to prioritize “whoever will likely live the longest after transplant” and state the relevant facts.
On the board or chart paper, create a two-column table and place the ranking on the left (under “Who will likely live the longest post-transplant?”) and the relevant facts on the right (under “Estimated number of years to live post-transplant”).

Ask students who would get the liver now. Point out that there are many facts relevant to determining who will likely live the longest.

Have students reflect on who in each case would get the liver transplant. They should realize that this depends on which criterion in prioritized.

**Activity 6: Preparing for the Homework Assignment**  
**Estimated Time: 5 minutes**

Distribute Master 3.9 to students. Ask them to copy the criteria into the blanks along the top of the master.

Explain the homework: to place a check mark in the boxes where a fact is relevant to the criterion in each column and answer the reflection question. Complete the first column together in class.

**Activity 7: Identifying the Stakeholders — Who or What Could Be Affected by the Way the Question Gets Resolved?**  
**Estimated Time: less than 5 minutes**

Tell students that they have now seen that determining who receives an organ depends on the allocation policy.

Ask students, “Are there other people besides the patients themselves who are stakeholders in this decision? Who?”

**Closure:** Underscore that our society has developed decision-making rules—policies—to guide allocation decisions.

**Homework:** Complete the chart and answer the reflection question on Master 3.9.

**Extension (Optional):** Discuss the pros and cons of a criterion that they may remember from Historical Case 3. Ask them, “Does the fact that someone has family members who depend on them is a relevant criterion? Why or why not?”

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**Notations:**
- **M** involves copying a master
- **T** involves making a transparency
**DAY 3: What Is Your Recommendation?**

**Purpose**

Students use their new understanding of fairness and allocation of scarce resources to decide which criteria are fairest and explain how they reached that decision. Students also use their new understanding to decide whether past and present allocation policies are fair.

**Activity 8:**

**Weighing the Criteria**

**Estimated Time:** 20–25 minutes

**Procedure**

1. In pairs or small groups, have students compare their answers on the Master 3.9 chart. They should not yet share their thoughts about the reflection question.

2. Bring the class back together, and display the transparency of Master 3.9.

3. Review the homework with the class. List the relevant criteria students mention across the top of the transparency, making sure to discuss any that seemed to generate confusion or questions during the small-group work.

4. After the discussion, make a vertical list of the criteria from the top of the chart on Master 3.9 down the left side of a piece of chart paper.

**Teaching Strategies: Small Groups**

If you have a large class, you may wish to create one sheet per 5 to 10 students, instead of one sheet for the entire class to share. Having multiple sheets will make it easier for all students to place their stickers within a shorter amount of time. If you use multiple sheets, you should create one chart for yourself on which you can tally all of the other sheets.
5. Ask students, “Which criteria do you think are the most important? Why?”

6. Have students turn to a neighbor, and give each student one minute to share his or her preliminary thoughts. Students may single out one criterion or may discuss a few different criteria that they believe are the most important.

See Teacher Support Materials
A guide that shows pros and cons associated with each criterion is available online at http://science.education.nih.gov/supplements/bioethics/teacher. This guide is meant to help you keep the conversation lively, not to be an answer key or a student handout.

7. Bring students back together, and give each student five stickers. They will use these stickers to indicate which criteria they think are more important than others.

8. Instruct students to walk up to the chart paper and place one or more of their stickers to the right of the criteria that they think should be considered in a fair policy of organ allocation.

For example, students could put all five stickers next to just one criterion, or two next to one and three next to another. When the students are done, make sure to stand back and see how the class distributed the stickers. If you used multiple sheets of chart paper, be sure to tally the total number of stickers for each criterion from each sheet on a single sheet to create a horizontal bar graph. If you used a single sheet, the students should have inadvertently created the bar graph themselves.

9. Note which criterion got the most stickers. Ask students, “Why do you think so many of you believe that this criterion is so important?”

10. Note which criterion got the fewest stickers. Ask students, “Why do you think so many of you believe that this criterion is less important than the other criteria?”

11. Emphasize that popular criteria are not necessarily better than criteria that received fewer votes.

You might want to use the following points to amplify this concept:

- Reasonable people are likely to disagree in the way they prioritize, and sound ethical reasoning is not a popularity contest that can be settled by voting.
- It is interesting to see the range of views in the room, and it is important to realize that prioritizing different criteria can and often does have different consequences.
- Different people are likely to receive a scarce resource depending on which criterion is prioritized.
- It is important to think carefully about these consequences when coming up with reasons for what would be most fair.
**Activity 9: Understanding Past and Current UNOS Policies**

**Estimated Time:** 15–20 minutes

In this activity, students will have a chance to compare the past and current UNOS policies. Ultimately, they will decide which is better, and they will make recommendations about how the policy should be further modified.

**Procedure**

1. **Display the transparency of page 1 of Master 3.10: The United Network for Organ Sharing (UNOS)—Two Policies, and read the top paragraph (about UNOS) aloud.**

   Remind students that the reason UNOS divides the country into local and regional areas is to minimize cold ischemic time (the time between when an organ has been removed from a donor and when it is transplanted into the recipient’s body). For livers, the medically acceptable limit for cold ischemic time is 12 hours. Flying a liver from New York to California takes many hours, for example, significantly lowering the chance of transplant success.

2. **Uncover and read aloud “Pre-1998 UNOS Liver-Allocation Policy,” Facts 1 and 2.**

3. **Ask students which ethical criteria were given priority in this policy.** Students will likely mention criteria such as “whoever is sickest,” “whoever lives closest,” and “whoever has been waiting the longest.”

4. **Ask students which ethical criteria are not included.** Students will likely mention criteria such as “whoever will likely live the longest” and “whoever has most worth to society.” Students may also make note of the fact that the policy doesn’t judge people on the basis of age or the reason why they have experienced liver failure.

5. **Ask students, “Do you think the past UNOS policy was fair?” First, have students, working in pairs, share their thoughts for one minute each. If you have time, bring the class back together for a very brief discussion.**

   Here, students might say that inappropriate criteria were considered, appropriate criteria were not considered, or appropriate criteria were considered but given too much or too little weight. The goal is simply to provide a few minutes for student reflection. Students will have more time to consider this question as part of the module’s final assessment.

6. **Uncover and read aloud “Current UNOS Liver-Allocation Policy,” Facts 1 and 2, on page 2 of the Master 3.10 transparency.**
7. **Ask students which ethical criteria are given priority in this policy.** Here, students will mention "whoever is sickest" and "whoever lives closest."

8. **Ask students which ethical criteria are not included.** Here, students will likely make note of the fact that the new policy doesn’t prioritize "whoever has been waiting the longest."

9. **Ask students how the current and past policies are similar and how they are different.**

10. **Give each student a copy of Master 3.10 and Master 3.11: Comparing the Past and Current UNOS Policies.** Go over the Master 3.11 instructions, and then give students about five minutes to work in pairs or small groups to fill out the master.

    For example, the current policy prioritizes the criteria of “whoever is sickest” over the criteria of “whoever lives the closest,” whereas the reverse was the case in the past policy, so students would fill out the diagram accordingly. Students may also make note of the fact that there are now more objective criteria with which to measure “degree of sickness.”

**See Teacher Support Materials**


11. **Ask students whether they think the current UNOS policy is fair.** First, have students work in pairs, giving each student one minute to share his or her thoughts. If you have time, bring the class back together for a very brief discussion.

    As they did when discussing the past policy, students might say that inappropriate criteria were considered, appropriate criteria were not considered, or appropriate criteria were considered but given too much or too little weight. The goal here is simply to provide a few minutes for student reflection. Students will again have more time to consider this question as part of the module’s final assessment.

12. **Ask students, “With respect to fairness, is the current policy an improvement over the past policy? Why or why not?”**

    Students might say that the current policy is fairer because it prioritizes the criterion of “whoever is sickest” over the criterion of “whoever lives the closest.” Students might also note that there are now more objective criteria with which to measure “degree of sickness,” and so it is fairer. Again, do not worry about providing much time for this; students will have more time to consider the questions as part of the final assessment.
See the Introduction

Consider referring to Table 1, Assessing Student Justifications, on pages 10–11 of the Introduction. This table will help you evaluate how comprehensively and rigorously students handled the Final Assessment assignment.

**CLOSURE**

Reinforce to students that the goal of this module (and the other modules in this supplement) is *not consensus*. Instead, the goal is well-supported decision making using both scientific content and ethical considerations. In this module, students used scientific content about livers and transplants to form well-justified stances about fair liver allocation.

**Final Assessment**

Give each student a copy of Master 3.12: Final Assessment. You may decide to ask your students to answer all or just several of the questions. The first two questions directly reinforce class discussions and activities, whereas the remaining questions extend beyond class discussions and activities. These remaining questions demand that students apply their understanding to new situations that they probably have not yet directly considered in class.
Organizer for Day 3: What Is Your Recommendation?

**Activity 8: Weighing the Criteria**  
Estimated Time: 20–25 minutes

In pairs or small groups, have students compare their answers on the Master 3.9 chart. Bring the class back together, and display the transparency of Master 3.9.

Review the homework with the class. Then, on the left side of chart paper, make a vertical list of criteria from the top of the Master 3.9 chart.

Ask students, “Which criteria do you think are the most important? Why?” Give students one minute each to share their thoughts with a neighbor.

Give each student five stickers. Tell students to place one or more stickers to the right of the criteria they think should be part of a fair organ-allocation policy.

Note which criterion got the most—and which, the fewest—stickers. Ask students why they think that so many classmates believe that this criterion is so important (or so unimportant).

Emphasize that popular criteria are not necessarily better than criteria that received fewer votes.

**Activity 9: Understanding Past and Current UNOS Policies**  
Estimated Time: 15–20 minutes

Display a transparency of Master 3.10, covering up all but the top paragraph. Read the paragraph (about UNOS) aloud.

Uncover and read aloud Pre-1998 UNOS Liver-Allocation Policy, Facts 1 and 2.

Ask students which ethical criteria were given priority in this policy. Which were not included?

Ask, “Do you think the past UNOS policy was fair?” Give students one minute to share their thoughts with a partner. If you have time, discuss briefly as a class.

Uncover and read aloud Current UNOS Liver Allocation Policy, Facts 1 and 2.

Ask students which ethical criteria are given priority in this policy. Which are not included?

Ask students to compare the current and past policies.

Give each student a copy of Master 3.10 and Master 3.11. Go over the instructions on Master 3.11, and then give students about five minutes to work in pairs or small groups to fill out that master.
<table>
<thead>
<tr>
<th>Step</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Ask students whether they think the current UNOS policy is fair. First, have students work in pairs, giving them one minute each to share their thoughts. If you have time, discuss briefly as a class.</td>
</tr>
<tr>
<td>12</td>
<td>Ask students, “With respect to fairness, is the current policy an improvement over the past policy? Why or why not?”</td>
</tr>
<tr>
<td></td>
<td><strong>Closure:</strong> Reinforce that the goal of this module is not consensus. It’s well-supported decision making using scientific and ethical considerations.</td>
</tr>
<tr>
<td></td>
<td><strong>Final Assessment:</strong> Give each student a copy of Master 3.12. You may decide to ask your students to answer all, or just some, of the questions.</td>
</tr>
</tbody>
</table>

*Involves copying a master*  
*Involves making a transparency*