Module 4

The investigations in Module 4 of the *Detectives in the Classroom* curriculum prepare students to answer the fourth of five Essential Questions:

> What should individuals and society do when preventable causes of disease are found?

When students understand how to answer this question, they will be developing the fourth of five Enduring Understandings that provide the structural framework for the curriculum. The fourth Enduring Understanding is:

> When a causal association has been identified, decisions about possible disease prevention strategies are based on more than the scientific evidence. Given competing values, social, economic, and political factors must also be considered.

By completing the Module 1 investigations, students learned how health-related conditions and behaviors are not distributed uniformly in a population, that each has a unique descriptive epidemiology that can be discovered by identifying how it is distributed in a population in terms of person, place, and time. This descriptive epidemiology provides clues for formulating hypotheses. Students realized that descriptive epidemiology is only the first step and that formulating hypotheses is not the same as proving hypotheses.

By completing the Module 2 investigations, students learned that causal hypotheses could be tested by observing the exposures and diseases of people as they go about their daily lives. Testing is conducted by making and comparing risks and determining whether or not the exposure and the outcome turned up together, that is, whether or not the exposure and the outcome were associated with each other. This is called analytical epidemiology. Students learned about the methods used to test causal hypotheses and how the 2x2 table is used to numerically express the results of an analytical study.

By completing the Module 3 investigations, students developed their ability to interpret the results of analytical epidemiological studies, namely, the ability to evaluate why an association between an exposure and an outcome has been found. An association means that things are linked in some way that make them turn up together. When epidemiologists test hypotheses, they are interested in determining whether or not an exposure and an outcome turned up together. Students learned that a cause is something that produces an outcome and one reason why an exposure and an outcome turn up together could be because the exposure caused the outcome. However, causation is only one of several possible explanations for why an exposure and an outcome might turn up together in an epidemiological study. Other explanations that should be considered are chance, confounding, reverse time order, and selection bias.

Continuing on to the Module 4 investigations, one should remember that epidemiology has been defined as "the study of the distribution and determinants of health-related states or events in specified populations *and the application of this study to the control of health problems*." (JM Last, Dictionary of Epidemiology, 2nd edition). Once epidemiologic and other scientific evidence has been

weighed and a judgment has been made that the association between the exposure and the outcome is causal, it is theoretically possible to prevent the outcome by avoiding or eliminating the exposure.

The Module 4 investigations explore the role of epidemiology and other factors in the creation of disease prevention strategies.

Students will think about risk as a concept and as a reality by exploring their risk perceptions and those of their classmates. They will judge the acceptability of risks and again discover how their judgments may be different from those of their classmates. They will appreciate how these differences in perceptions and judgments about the acceptability of risk may influence the allocation of resources (time, energy, and money) for disease prevention strategies. Finally, students will create various strategies for preventing a specific health problem and assess the advantages and disadvantages of each strategy. In doing so, they will uncover that decisions about possible disease prevention strategies are based on more than the scientific evidence and that social, economic, and political factors must also be considered.

In **Investigation 4-1: Risk Perception,** students will discover the difference between real and perceived risk by putting in rank order the fifteen leading injury-related reasons why boys and girls, aged 10-14, visited emergency rooms in 2001. (National Center for Injury Prevention and Control, WISQARS Website, http://www.cdc.gov/ncipc/wisqars)

The table below presents a list of these reasons in alphabetical order:

Alphabetical List of Activities / Exposures

Bicycles
Cuts / Pierces
Dog Bites
Drownings / Near Drownings
Environmental
Falls
Firearms / Gunshots
Fires / Burns
Motorcycles
Motor Vehicles
Other Bites / Stings
Overexertion
Pedestrian
Poisonings
Struck By / Against

Each Epi Team is shown this table and given a deck of cards with each of the reasons written on a separate card. The Epi Teams are asked to arrange the cards in order, from the highest to the lowest risk of an emergency room visit.

Students are then shown the table below and asked to compare their perception of the risks with the actual risks and discover that their perceptions of various risks are not always the same as the actual risks. They will also discover the dramatic variations in risk for different “Activities / Exposures.” For example, the annual rate of injury-related visits due to “Falls” is about 1000 times greater than for “Drownings / Near Drownings.” Student may also discover risks that surprise them, such as the fact that visits due to “Overexertion” has one of the highest rates in this age group. Students then explore the impact that this difference might have on the allocation of resources to prevent visits to the emergency room for a particular reason.

Ranked List of Activities / Exposures by Annual Risk of Emergency Room Visit *

Struck By / Against	3,715	
Falls	3,543	
Overexertion	1,497	
Cuts / Pierces	946	
Bicycles	711	
Motor Vehicles	567	
Other Bites / Stings	322	
Dog Bites	242	
Fires / Burns	126	
Poisoning	121	
Pedestrian	107	
Motorcycles	90	
Firearms / Gunshots	9	+
Environmental	8	+
Drownings / Near Drownings	2	+

* Annual risk of emergency room visit per 100,000 10-14 year old boys and girls. Annualized national estimates are based on emergency department estimates from 1/1 through 12/31/2001.

+ Injury estimate unstable because of small sample size

In **Investigation 4-2: Acceptable Risk,** students will become familiar with the concept of "acceptability of risk." This term is used to characterize the degree to which an individual or a society is willing to tolerate the existence of a factor that poses danger of physical or psychological illness or injury. For young people, it is enlightening for them to think about risk in terms of whether they think it is acceptable, in contrast to adult-world opinions and messages that may be imposed upon them. Even in a small group of students in a class, it is common for some of the students to consider a personal risk entirely acceptable while others find it quite unacceptable. Examples of such a risk are smoking, drinking alcoholic beverages, and eating junk food.

To help students uncover their differences in the acceptability of various risks, each student will independently list three activities he/she thinks are risky but would still do as an adult and three other activities he/she thinks are risky and would not do as an adult. The lists are discussed and students discover that it is possible for the same activity to be on both lists. Students are then challenged to identify what it is about a particular risk that makes it acceptable or unacceptable and begin to develop a list of considerations that help them make judgments about the acceptability of risk. For example, students may list such considerations as:

1) How dangerous the risk really is.
2) Whether or not it is something they are told by adults to avoid.
3) Whether or not it is something that they cannot individually control.
4) Only older people are at risk; it does not happen to young people.

In **Investigation 4-3: Acceptable Risk Considerations,** students compare and contrast their acceptable risk considerations with those that have been suggested by others. Students then apply the criteria to specific risks. Students learn that there are many ways to judge the acceptability of a risk and how a list of criteria can be used to help guide this complex judgment process. See table below:

Acceptable Risk Considerations * / Rationale / Examples			
	Considerations	Rationale	Examples
1.	Is the risk assumed voluntarily?	Less acceptable if involuntary	Secondhand smoke vs. cigarette smoking
2.	Are alternatives available?	Less acceptable if alternatives are available	Unsafe toys vs. urban traffic
3.	Is it natural or man-made?	Less acceptable if man made	Chemical spill vs. earthquake
4.	Risk certain or uncertain?	Less acceptable if certain	Drunk driving vs. cellular telephone
5	Catastrophic or common hazard?	Less acceptable if a catastrophic hazard	Airplane crash vs. automobile crash
6.	Likely or unlikely to be used as intended?	Less acceptable if likely to be misused	Guns vs. microwave
7.	Non-occupational or occupational?	Less acceptable if risk is borne by the general population	Air quality standards vs. exposure standards in a workplace
8.	Fair or unfair?	Less acceptable if the risk is borne by one group	People living near a chemical plant vs. company executives

* "10 Bi-polar Considerations for Judging the Acceptability of a Risk," from WW Lowrance, Of Acceptable Risk; William Kaufmann, Inc., Los Altos, CA, 1976 and "Outrage Factors," from Peter Sandman, Responding to Community Outrage: Strategies for Effect Risk Communication, American Industrial Hygiene Foundation, Fairfax, VA, 1993.

Investigation 4-4: Risk Management Strategies, is divided into two parts. In Part 1, students develop a personal and societal risk management strategy to reduce the level of risk posed by carrying heavy backpacks. In Part 2, students continue to develop and refine their societal risk management strategy, critique their strategies in terms of their considerations for judging the acceptability of a risk, and propose their strategy to appropriate stakeholders.

In **Investigation 4-5: Concept Connections,** students identify the important concepts that need to be understood in order to answer the fourth Essential Question: "What should individuals and society do when preventable causes of disease are found?" Each Epi Team then creates a Concept Map that depicts and explains how the concepts connect to each other. At the conclusion of this investigation, students will realize that they have developed the fourth Enduring Understanding of *Detectives in the Classroom:* "When a causal association has been identified, decisions about possible disease prevention strategies are based on more than the scientific evidence. Given competing values, social, economic, and political factors must also be considered."