EPIDEMIOLOGY IN ACTION

1. Executive Summary

Epidemiology in Action is a Web-based curricular component consisting of four discrete units that can be incorporated into an integrated yearlong program including math, science, language arts, social studies, and health.

Target Audience	10th- or 11th-grade students, high school students age 14 and older
Nature of the Material	Component intended for integration in a yearlong program, also appropriate as an entry-level course to Advanced Placement Statistics, Psychology, and Biology courses
Prerequisites	At least 8th-grade-level reading ability and math skills
Time Required for Full Implementation	One quarter

The developer created epidemiology-related teaching materials, student activities, and resources designed to help students become proficient in the state of Washington's Essential Academic Learning Requirements (EALRS)—standards that focus on student understanding, rather than simple knowledge. She notes that all teachers have seen the student who has a great deal of knowledge, but only a limited understanding of how to apply it in the real world. To help students understand abstract ideas, they must have direct experience—experience that traditional textbook-based curriculum seldom encourages. Therefore, the student activities in Epidemiology in Action give students numerous opportunities to explain, interpret, and apply new knowledge and skills.

In addition, Epidemiology in Action asks students to use one of the most powerful tools in use by epidemiologists today, the World Wide Web. The state of Washington requires that students be proficient in the use of technology, and this curriculum encourages students to develop their skills[1]. Today, 87 percent of classrooms have Internet access, up from 3 percent in 1994, and the ratio of students to computers is 5.4 to 1[2]. Epidemiology in Action also helps teachers use the technology tools in their classrooms very effectively.

[1]Our state's technology EALRS are not included in this curriculum because they are still in draft form.
[2]Kleiner, Anne, and Elizabeth Harris. "Internet Access in U.S. Public Schools: 1994–2002," September 2002. National Center for Education Statistics. NCES Electronic Catalog 2002018, nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2002018.

2. Student Learning Goals

By the end of **Unit One**, students will be able to:

- Know the definition of epidemiology
- Identify the steps to investigating an outbreak
- Determine a hypothesis
- Apply terms used to describe disease
- Debate current health issues using new epidemiology knowledge
- Research past and present health issues

By the end of **Unit Two**, students will be able to:

- Analyze study data, in terms of who, what, when, where, and how
- Interpret study data, in terms of presentation, bias, and variables
- Recognize bias
- Identify the five most common types of epidemiological studies and describe their key components
- Discuss the advantages and disadvantages of the five types of studies

By the end of **Unit Three**, students will be able to:

- Construct and read the basic chi-square
- Calculate prevalence rates and incidence rates
- Calculate relative risk, odds ratio, and attributable risk
- Interpret these calculations in real studies

By the end of **Unit Four**, students will be able to:

- Apply previously learned skills to designing and conducting a hypothetical epidemiological study
- Plan and present a persuasive public-information campaign
- Integrate all skills learned in order to produce a product that reflects successful application of those skill

3. Requirements

Time Requirements	Approximately one quarter (32–40 55-minute class periods, spread out over four units)	As noted in section 4, "Content," teachers who wish to teach in more depth on particular topics should adjust time accordingly
Facilities Requirements	Classroom Web-enabled computers (one for three or four students), preferably in classroom	
Equipment Requirements	PowerPoint and Word	Access to a computer lab twice a week might suffice
Books (including textbooks)	None	
Other Resources Required	Access to Microsoft Windows 98, PowerPoint 2000, and Word 2000 for updating links	

At the time of development, all Web sites were current and links were working. The developer chose Web sites for their standing, reputation, and likelihood of persistence. However, the nature of the Web is change, and Web addresses should be checked and updated on a regular basis.

Teachers can easily change the hyperlinks to pages in both PowerPoint and Word by doing the following:

1. Find the new Web site and get its address.
2. Open the page/slide on which you want the new link to appear. Enter the cursor where you want the new hyperlink to go.
3. Pull down the Insert menu and choose Hyperlink.
4. Insert the new address where indicated and click OK.

4. Content

Lessons can be presented to the whole group, and activities can be completed either individually or in teams. (The developer's preference is for grouping students, particularly in a curriculum such as this one that offers so many interesting issues to discuss.)

Unit I

Synopsis

Students are introduced to epidemiology through a class-involvement activity that puts them immediately to work as "epidemiologists." Students research major world diseases to learn about epidemiology's history and to practice applying new concepts, and debate current health issues using epidemiological studies.

Key Concepts

- Definition of epidemiology
- Role of epidemiology in history
- Epidemiology's role today

Time Requirements

Time requirement for this unit is estimated at 10–12 55-minute class periods or equivalent. Teachers who wish to teach in-depth lessons on outbreaks, smallpox, traffic safety and auto fatalities, etc. should add days to this estimate accordingly.

Materials and Preparation

1. Plague Puzzle Activity

The point of this exercise is not to solve exactly where, when, and how this outbreak started. Students don't have enough information to do that. What they do have are clues with which to begin the investigation, which will ultimately lead them to a city of origin. (Use recommended Internet lesson plans to teach an in-depth lesson).

With this exercise, emphasize the gathering of data, and demonstrate how data can be analyzed to formulate hypotheses. Students should use the chi-square/data sheet to gather and collect information (see appendix). The teacher may want to actually have students begin practicing data analysis, which is addressed in detail in unit 3.

Notes to Teachers

- Term definitions and lecture outlines may be found on the PowerPoint slides (see appendix).
- Reproduce plague cards (see appendix) so that every member of the class has one. Distribute them in the following proportions:
  90% healthy
  10% infected — 8% from same city (put a red X on one or two of these to stand for advanced infection)
  2% from another city

2. Design a Disease Museum Assignment

The objective in this exercise is to create a museum-style display about a particular disease. Assign diseases to individuals or groups. Students research the disease, using suggested Internet sources, and then create displays, using words and pictures, to answer the questions on the Design a Disease Museum assignment sheet (see appendix).

Students can present this information on butcher paper or poster boards, which they can display at stations around the classroom. Alternately, they might make multimedia presentations to the rest of the class or create presentations that can run on individual computers using PowerPoint or another program.

Note to Teachers

- Term definitions and lecture outlines can be found on the PowerPoint slides (see appendix).

3. Debate, Data, and Current Issues Assignment

The activity provides students with an opportunity to practice defining a problem, researching and analyzing possible courses of action, presenting a solution, and persuading an intended audience to adopt it. Students use the Debate, Data, and Current Issues assignment sheet (see appendix) to organize their research and formulate their cases.

The teacher may recommend one or several mechanisms that students can use to present their cases, such as a panel discussion, a formal debate, or a question-and-answer session.

Notes to Teachers

- Term definitions and lecture outlines can be found on the PowerPoint slides (see appendix).
- Assign risk factors related to alcohol/drug use, teen violence, diet/nutrition, accidents, and/or AIDS/STDs to groups of students or to individuals. The list of risk factors can be expanded to include other behaviors of interest to adolescents, and the Web links included in the bibliography will be useful for that purpose.

Unit II

Synopsis

Using many examples of real and hypothetical studies, students practice analyzing, interpreting, and comparing study data. Students also learn to identify the key components of various types of epidemiological studies and the advantages and disadvantages of each.

Key Concepts

- Analyzing and interpreting statistics
- Recognizing bias
- Types of epidemiology studies and their uses

Time Requirements

Time requirement is estimated at 10–12 55-minute class periods. Teachers who wish to teach in-depth lessons on youth behavioral risk factors, teen pregnancy, substance abuse, or analyzing statistics should add days to this estimate accordingly.

Materials and Preparation

Notes to Teachers

- The link on slide 6, Behavioral Risk Factor Surveillance System CDC (apps.nccd.cdc.gov/brfss/page.asp?yr=2000&state=US&cat=EX), includes data comparing physical activity by state. The developer included her own state (Washington) and compared it to a state in another region (Kansas), but teachers can customize the visual by using data from their own states. Students can then practice hypothesizing, in terms of causes of the differences, and talk about how they might test those hypotheses in a real study. (For example, people in Washington State report more physical activity than people in Kansas. Could the weather make the difference? Do geographical features, such as bodies of water for water activities or nearby mountains for winter activities, contribute to the differences? How could we find out if our hypotheses are correct?) This site includes data on many other risk factors that may be of interest to youth, and the data is presented in an easily accessible way.

- The link on slide 33, Boozing and Brawling on Campus: A National Study of Violent Problems Associated with Drinking over the Past Decade (www.indiana.edu/~engs/articles/boozing.htm), contains the full text of the report on Dr. Engs's study. It is an excellent example of how studies are presented in journal articles. It is clear and very easy to follow, and the data charts offer many opportunities for students to practice concepts from this entire curriculum. The study includes chi-squares, for example, before and after analysis. This site also uses (but doesn't explain) more-complicated statistical analyses, such as t-table analysis, useful to teachers who will be teaching more-advanced statistics than those covered in this curriculum.

1. Study the Stats Assignment

Working in groups of two or three, students search out two studies (from two different sources) performed on two similar populations. (The Web sites listed in the bibliography can be useful starting points.) Possible study topics include cancer, smoking, drugs/alcohol, teen violence, and health/nutrition.

Using the assignment worksheet in the appendix as a guide, students evaluate the data, its analysis, and its presentation. They determine how and when the data was collected, what instrument (such as a survey) was used, and how it was analyzed and presented. In short, they compare/contrast the two studies, in terms of the who, what, when, where, and how. In particular, students try to identify

- How the studies differed in terms of what they measured (age, time, risk factors, etc.)
- How the researchers may have introduced bias into their research
- Any possible confounding variables that may have affected the results

Students present their findings to the rest of the class in a written report, an oral presentation, or both.

Note to Teachers

- Term definitions and lecture outlines can be found on the PowerPoint slides (see appendix).

2. Name That Study Assignment

This activity provides students with the opportunity to learn about and identify different types of studies (case control, experimental, descriptive, cohort, and cross-sectional). They review the descriptions of nine different studies (see appendix for assignment sheet) and assign each to the category in which it fits best. Students must be prepared to defend their categorization, as well as to explain how such a study design would be an advantage or a disadvantage in studying the population in question.

In addition, the students think up a hypothetical study that they might perform on another population using a particular type of study design. They must be ready to explain why they think the particular type of design would be well suited to their hypothetical study.

Notes to Teachers

- Term definitions and lecture outlines can be found on the PowerPoint slides (see appendix).
- Teachers may want to gather other graphs from more studies like the ones on the last two slides and review them with the class as a whole to give students more practice before they complete the assignment sheet.
- This assignment provides a good opportunity to review other topics covered previously, particularly in terms of disease frequency, forming hypotheses, identifying bias, etc.
- The developer suggests that students work on this assignment in groups of two or three, since it covers a great deal of new material and students will benefit from discussing the pros and cons of possible answers.
- Below is the answer key to the assignment worksheet:

1 = Case control

2 = Experimental

3 = Descriptive

4 = Cohort

5 = Experimental

6 = Cross-sectional

7 = Cohort

8 = Cross-sectional

9 = Descriptive

Unit III

Synopsis

Students learn basic mathematical skills used for epidemiology studies. They will learn to calculate measures of frequency and measures of correlation and will practice calculating and interpreting these measures by analyzing data in real studies and creating hypothetical examples.

Key Concepts

- Calculating measures of frequency and correlation
- Analyzing and interpreting statistics

Time Requirements

Time requirement is estimated at 6–8 55-minute class periods. Teachers who wish to teach in-depth lessons on HIV/AIDS, substance abuse, arsenic poisoning, and/or more-advanced statistical measures of correlation should add days to this estimate accordingly.

Materials and Preparation

Notes to Teachers

- Term definitions and lecture outlines can be found on the PowerPoint slides (see appendix).
- This unit is an introduction to the basic statistics used in many epidemiology studies. While this curriculum has been designed for use by teachers in many disciplines, the math teachers out there will surely want to go further in terms of statistical measures of correlation. This is also a good place to review/teach other mathematical concepts such as central tendency, mean, mode, median, standard deviation, etc.
- Note about slides 12 and 13: The developer included information about arsenic poisoning because the neighborhood in which her school is located has been affected by the poisoning, which continues to be the subject of ongoing studies at the University of Washington. Teachers

may wish to customize these two slides if they can incorporate references to any ongoing studies of environmental pollution in their areas; students will be more interested since it's about their own neighborhood.

Show What You Know Assignment

This activity provides students an opportunity to see how various statistical measures are used in real research applications. Using the statistical databases already introduced in the class, students search for studies in which they can identify the following types of statistical measures:

1. A chi-square
2. A prevalence rate—calculate, if necessary
3. An incidence rate—calculate, if necessary
4. An example of relative risk—calculate, if necessary
5. An example of odds ratio—calculate, if necessary
6. An example of attributable risk—calculate, if necessary

(Note that students may find examples where the measures have already been calculated, or they may construct them by working backward or forward with a set of data.) Students should be prepared to explain what each statistic means in terms of the data they are looking at, as well as to document correctly where the data comes from.

Next, students are instructed to create two hypothetical studies, using each of the six statistical measures in one of the two studies. For their hypothetical studies, they also identify the target population and the type of study.

Unit IV

Synopsis

In this unit, students put it all together when they use what they've learned to research, study, and propose an idea designed to control/prevent a health problem.

Key Concepts

- Application of epidemiology knowledge and skills
- The role of epidemiology in influencing public policy and behavior in terms of health

Materials and Preparation

Notes to Teachers

- Assignment steps can be found on the PowerPoint slides (see appendix).
- Teachers may want to create a Word document containing all the Web sites introduced throughout the course. If that document is copied onto students' computers, they can open their browsers and access all the sites they've already seen.

Putting It All Together Assignment

In this culminating project, students will research a health issue, propose a hypothesis, design and conduct a hypothetical study, analyze hypothetical and real data, and write up their findings. (Ruth Engs's study shows a good example of how to write up research findings; see the bibliography.)

In addition, they plan and present a public-information campaign, in which they communicate their findings to the public. See the appendix for the assignment sheet.

5. Assessment

Unit I

Plague Puzzle demonstrates proficiency in

- Using mathematics to investigate situations, formulate questions, and define problems
- Knowing and applying the skills and processes of science and technology

Design a Disease Museum demonstrates proficiency in

- Gathering and sharing knowledge in everyday and mathematical language
- Using advanced search strategies
- Reading from a variety of sources for a specific purpose
- Communicating ideas clearly and effectively

Debate, Data, and Current Issues demonstrates proficiency in

- Using mathematics to investigate situations
- Gathering, organizing, interpreting, and sharing information in everyday and mathematical language
- Analyzing health information

Unit II

Study the Stats demonstrates proficiency in

- Interpreting data in terms of where it came from, who collected it, when the data was collected, how the data was collected, and what the data measures
- Identifying and being able to describe bias and confounding-variable problems in data

Name That Study demonstrates proficiency in

- Identifying and describing five types of epidemiological studies
- Discussing the advantages and disadvantages of each type of study, and applying this understanding by choosing types of studies for particular purposes

Unit III

Show What You Know demonstrates proficiency in

- Constructing and reading a chi-square
- Calculating prevalence and incidence rate, relative risk, odds ratio, and attributable risk
- Identifying and describing five types of epidemiological studies
- Identifying and interpreting basic measures of frequency and correlation in real studies

Unit IV

Putting It All Together demonstrates proficiency in

- Applying new skills in designing and conducting a study
- Planning and presenting an effective public-information campaign
- Integrating all skills learned and producing a product that reflects successful application of those skills

6. Alignment of Content and Standards

As shown in the following table, the curriculum is grounded in specific state standards:[3]

Unit I	**Math**	
	3.2	Use mathematics to investigate situations, formulate questions, and define problems
	3.4	Communicate knowledge and understanding in both everyday and mathematical language to gather, organize, interpret, represent, and share information
	3.5	Understand how mathematical ideas connect to real-life situations
	Science	
	2.3	Understand the nature of scientific inquiry
	3.2.1	Develop abilities necessary to do scientific inquiry
	3.2.2	Apply science knowledge and skills to solve problems or meet challenges
	Social Studies	
	Inquiry/Info Skills 1.1	Use advanced search strategies
	Inquiry/Info Skills 1.1.2	Create a product that uses social studies content to support findings
	Language Arts	
	Reading 3.1	Locate, analyze, and interpret material to investigate a question, topic, or issue
	Writing 2.2	Write to communicate research findings

[3] "Essential Academic Learning Requirements." Office of Superintendent of Public Instruction, Washington, 12 October 2002.

Unit II	**Math**	
	1.4.3	Understand and make inferences based on the analysis of experimental results
	2.1.3	Investigate situations and identify what information is missing or extraneous
	Science	
	3.2.1	Develop abilities necessary to do scientific inquiry
	Social Studies	
	Inquiry/Info Skills 1.1.3	Evaluate reliability, credibility, and validity of information from a variety of social studies sources
	Inquiry/Info Skills 1.1.3	Interpret outlines, charts, graphs, maps, tables, timelines, and decision-making grids that explain problems and/or construct solutions
	Critical Thinking Skills 3.1.3	Define and clarify a problem, compare and contrast, validate data using multiple sources
	Language Arts	
	Reading 1.5.3	Read, analyze, and use informational materials to demonstrate understanding and expertise; analyze the validity of electronic information
	Communication 4.3	Evaluate implications of the choices that were made in the construction of media texts
	Health	
	Health 1.3	Analyze and evaluate the impact of real-life influences on health

Unit III	**Math**	
	1.1.3	Understand and apply the concepts of ratio and proportion
	1.1.3	Calculate rate and other derived and indirect measurements
	1.2.3	Understand that the precision and accuracy of measurement is affected by the measurement tools and calculating procedures
	1.4.3	Understand the nature of scientific inquiry
	Science	
	3.2.1	Develop abilities necessary to do scientific inquiry
	Social Studies	
	Inquiry/Info Skills 1.1.3	Interpret outlines, charts, graphs, maps, tables, timelines, and decision-making grids that explain problems and/or construct solutions
	Language Arts	
	Reading 1.5.3	Read, analyze, and use informational materials to demonstrate understanding and expertise; analyze the validity of electronic information
	Writing 1.2.3	Use specialized vocabulary relevant to a specific content area

Unit IV	**Math**	
	1.4.3	Use statistics to support different points of view
	1.4.3	Collect data using appropriate methods and technology
	1.4.3	Organize and display data in appropriate forms such as tables, graphs, scatter plots, and box plots
	1.4.3	Understand and make inferences based on the analysis of experimental results
	2.1.3	Investigate situations and identify what information is missing or extraneous
	Science	
	3.2.1	Develop abilities necessary to do scientific inquiry
	3.3	Understand the nature and contexts of science and technology
	Social Studies	
	Inquiry/Info Skills 1.1.3	Read, analyze, and use informational materials to demonstrate understanding and expertise; analyze the validity of electronic information
	Critical Thinking Skills 3.1.3	Define and clarify a problem, compare and contrast, validate data using multiple sources
	Language Arts	
	Reading 1.5.3	Read, analyze, and use informational materials to demonstrate understanding and expertise; analyze the validity of electronic information
	Communication 2.1	Analyze and evaluate the effectiveness of resources to develop topic and support
	Communication 2.1	Identify, select, and use appropriate communication skills
	Health	
	Health 1.3	Analyze health and safety information to develop health plan based on life goals

7. Bibliography

Unit I

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http://hopkins-id.edu/.

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www3.cancer.gov/atlasplus/index.html.

National Foundation for Infectious Diseases, Recommended Web Sites and Virtual Library of Diseases.
www.nfid.org/library/general.html.

National Center for Statistics and Analysis of the National Highway Traffic Safety Administration (NHTSA), Fatality Analysis Reporting System.
www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/fars.html.

NHTSA, Research and Development.
www-nrd.nhtsa.dot.gov/.

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www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSF2000/2000ydrive.pdf.

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www.niaid.nih.gov/newsroom/focuson/tb02/tb.htm.

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ojjdp.ncjrs.org/.

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cumicro2.cpmc.columbia.edu/PICO/PICO.html.

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www.pbs.org/wgbh/amex/influenza/.

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Unit II

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Unit III

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www.popnet.org/.

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www.tpchd.org/eh/arsenic/arsenic.htm.

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University of Minnesota Epidemiology, Nutritional Epidemiology Research.
www.epi.umn.edu/research/nutri.shtm.

8. Appendix

PowerPoint Visuals

Introduction

Links on these visuals were current and working at the time of development. However, Web site URLs do change. Teachers will want to check the links before launching the Web sites before a student audience. They may also wish to substitute other sites to illustrate or localize particular points.

Teachers can easily change the hyperlinks on any page in both PowerPoint and Word by doing the following:

1. Find the new Web site and get its address.
2. Open the page/slide on which you want the new link to appear. Place the cursor where you want the new hyperlink to go.
3. Pull down the Insert menu and choose Hyperlink.
4. Insert the new address where indicated and click OK.

Remember that most Web site material is copyrighted. Web sites do vary considerably in their policies about usage. Check each Web site's policies before reproducing content to make sure you are in compliance with its particular rules regarding usage.

Unit I
Plague Puzzle

Sample Plague Puzzle Cards

Unit I
Student Worksheet

Plague Puzzle

In any study, the first thing epidemiologists do is gather information. We will want to know the disease distribution, or how the cases are spread across a population by gender, age, geography, etc.

In our class population, how are cases spread across the population by gender, age, geography?

	INFECTED	NOT INFECTED	TOTAL
MALE			
FEMALE			
AGE 13-15			
AGE 16-19			
LONDON			
PARIS			
SEATTLE			
NEW YORK			

Unit I
Student Assignment Sheet

Design a Disease Museum

Research the disease assigned. Develop the answers to the following questions. Present the answers in words and pictures in a museum-style display.

- How was the disease discovered, and what was/is the case definition?
- Give at least two real-life examples of researchers using the steps in an outbreak investigation.
- What were/are the disease distributions, determinants, and frequency?
- Was/is the disease outbreak endemic, epidemic, or pandemic, and why?
- Before researchers figured it out, what were some of the hypotheses about the disease causes?
- What impact did this disease have, historically, on the course of world events?
- Present one real-life account of someone who suffered/suffers from the disease.
- Create one visual that summarizes data: a bar graph, pie chart, etc. Make sure to cite the source of your data correctly.
- Include pictures/artwork related to the disease.
- Make sure to include correct documentation for all other sources.

Unit I
Student Assignment Sheet

Debate, Data, and Current Issues

To explore how epidemiology studies influence decision making, take your assigned risk factor and examine epidemiological data that sheds light on the current situation. Use the recom mended Web sites and/or other sources of information.

After you have done your research, recommend action. You may decide to recommend a change that you think needs to be made, based on the data, or you may want to recommend against a change that someone else has proposed. The change you recommend may lie within the power of a government, the schools, families, communities, etc. to make.

Prepare a presentation designed for your intended audience in which you

- State the problem
- Share the data
- Note what the data does not say (for example, how might it be misleading?)
- Explain what change you're proposing/not proposing
- Tell your audience why this change should/should not be made

Be sure to document your sources correctly.

Unit II
Student Assignment Sheet

Study the Stats

1. Search out two studies (from two different sources) performed on two similar populations. Use any of the information sources introduced so far as starting points, or find your own sources. Suggested study health topics include cancer, smoking, drugs/alcohol, teen violence, health/nutrition issues, etc. Be sure to document the source(s) of your information correctly.

2. Find out how both studies got their information. How was it collected? When was it collected? Who collected it? What instruments (such as a survey) did the researchers use to collect information? How did they analyze and present their data? Compare/contrast the two studies in terms of the who, what, when, where, and how.

3. Determine how the studies differed in terms of what they measured (age, time, risk factors, etc.).

4. Identify how the researchers may have introduced bias into their research, and discuss possible confounding variables that may be affecting results. Give at least three examples of places where bias could be lurking in this study, and two examples of potential confounding variables that may call the results into question.

Present your findings to the class as directed.

Unit II
Student Assignment Sheet

Name That Study

1. Review the following descriptions and decide if each study can be best categorized as experimental, descriptive, cohort, case control, cross-sectional, or a combination.

2. Defend your choice with two reasons.

3. How is this design an advantage/disadvantage in a study of this population?

4. What would be a hypothetical study that you might perform that would be suited to a particular type of study design? Explain why this design would be best for this type of study.

Case 1: A researcher divides a population of teenagers who are 16–18 years old into those who have asthma and those who don't. He also collects data on the same teenagers about suspected risk factors, such as air quality, smoking in the home, levels of stress, flu and colds, and diet. He compares the two groups in terms of how the risk factors relate to the presence or absence of asthma.

Case 2: After researching data on the relationship between adequate sleep and the development of infections, a school district sets a later start time for one high school in the district, leaving the start times at other high schools the same. The district collects and analyzes information from school nurses and the county health department on the rate of influenza reported, both for the previous school year and for the entire year that one school has a later start time. Then they compare the rate of influenza reported for the later-start school to last year's and this year's data for the schools with regular start times.

Case 3: Every year administrators conduct a school-wide survey on student drug and alcohol use. Once they collect the data, they compare the proportion of students in 9th, 10th, and 11th grade who have reported using targeted substances, and they track the changes over time by comparing this year's answers to previous year's responses. Based on their data, they set goals and propose intervention and prevention programs to address targeted issues.

Case 4: Researchers identify a random sample of U.S. 16-year-olds and survey them on dietary habits. Then researchers track this group of adolescents for the next 40 years and gather data about who develops targeted cancers. Researchers statistically analyze the early-in-life data and the later-in-life data, looking for relationships between exposure to risk factors and development of the targeted cancers.

Case 5: Researchers want to study whether a new follow-up outpatient treatment program in addition to the traditional inpatient program for recovering teenage alcoholics is more effective than the traditional in-patient treatment program alone. One group of teenagers is assigned to the traditional program without the new outpatient program, and the other group is assigned to the traditional program along with the new outpatient treatment program. Participants are then tracked during the next two years, and data is collected on how many of them relapse.

Case 6: Researchers survey a random sample of adolescents who ride bicycles. They gather data on the use of safety helmets. They also collect data on how many accidents riders have had in the past month and compare the data of helmet wearers/nonwearers.

Case 7: The school choir attends a local service club's luncheon, and several members of the choir (and the service club) develop food poisoning. To figure out which food caused the illness, health officials survey all people who attended the luncheon, collecting data on who ate which food and who got sick. They use statistics to determine attack rate and compare rates for different foods.

Case 8: A community collects data on the rate of violent crime among adolescents who are 16–18 years old from the police department and the county juvenile-detention center. They compare rates in neighborhoods to data on average family income, free- and reduced-cost-lunch enrollees in neighborhood schools, number of after-school programs, and availability of community activity programs geared to youth, such as the YMCA. Then, based on the data, the community develops programs for youth designed to reduce rate of juvenile crime

Case 9: For her statistics class, a high school student collects data on state rates for car accidents involving alcohol and adolescents. She also collects data from state databases on arrests for underage drinking violations for each county. Her data show a connection between fewer underage-drinking arrests and more alcohol-related traffic accidents involving teens in certain counties. Based on her work, she proposes that all counties enforce underage-drinking laws as strictly as the counties that have fewer accidents.

Unit III
Student Assignment Sheet

Show What You Know

Step 1:
Using the statistical databases already introduced, find real examples of the following things. Then, explain what that statistic means in terms of the data you are looking at.

Note: You may find examples where the statistics are already calculated, or you may construct them by working backward/forward with a set of data. For each example, document correctly where the data comes from.

1. A chi-square
2. A prevalence rate—calculate, if necessary
3. An incidence rate—calculate, if necessary
4. An example of relative risk—calculate, if necessary
5. An example of odds ratio—calculate, if necessary
6. An example of attributable risk—calculate, if necessary

Step 2:
Create two hypothetical studies in which you use all of these statistical measures. You don't have to use all six in each study, but you must use each measure at least once in one study or the other. For your hypothetical study, identify the following: target population and type of study.

Unit IV
Student Assignment Sheet

Putting It All Together

To apply all you've learned and try your hand at understanding and preventing health and safety problems, complete the following steps:

Step 1: Choose
Choose a health/safety problem to investigate. Please choose a problem that you have a personal interest in (maybe something that has become interesting to you as you have been working on this unit) and that will have research available through easily accessible databases.

Step 2: Research
Find studies that have already been conducted on your subject. Find at least two different types of studies (descriptive, case control, cross-sectional, cohort, or experimental). Describe these studies by identifying who, what, when, where, and how. Correctly document the source for your statistics. Identify in the studies at least one measure of each of the following (these can be from different years, different samples, etc.): prevalence of the condition, incidence of the condition.

Step 3: Hypothesis
Consider all you know and all you have learned about your health/safety condition, including possible risk factors. Then write a carefully considered hypothesis, in terms of one risk factor you could test that has not, to your knowledge, been tested so far in any of the studies you've read.

Step 4: Study Design
Once you have your hypothesis, design a study you could do that would support your hypothesis. Imagine that time, money, and all logistical considerations are no object; you have all the resources you need at your disposal. In your study design, address the following questions:

- Who would be your subjects, and how would you select them? How would you avoid bias?
- From where would you get your data, and how would you collect it? How would you avoid bias?
- What type of study would you use, and why would it be the best for this type of study?
- What would be some confounding variables that might affect your results, and how would you prevent them from doing that?

Step 5: Statistics

This step consists of two parts.

Part 1:
How would you analyze your hypothetical data once you've collected it? Create hypothetical statistics (what might you find if your hypothesis proved correct?) and calculate two hypothetical examples of the statistical measures you would use to determine the validity of your hypothesis. Present your hypothetical findings using the best format for the type of analysis you conducted (pie chart, bar/line graph, etc.).

Part 2:
Collect real data on some aspect of your health/safety condition. (The data does not have to specifically address your entire hypothesis, but it must relate.) This can be data from the sources used in the course, from other sources widely available, or from original data you collect. Then analyze this data using appropriate statistical measures and present your findings using the best format for the type of analysis you conducted (pie chart, bar/line graph, etc.).

Step 6: Action

Imagine that your hypothetical results have proven to be statistically significant. What changes will you recommend that people, organizations, companies, and countries make, and why? Design a plan to communicate your findings and your recommended changes to the world. As a part of this plan, complete your project by designing a persuasive poster, similar to historical posters on health issues, about your condition.