

INTRODUCTION TO EPIDEMIOLOGY

1. Executive Summary

Introduction to Epidemiology is a high-school-level course designed to introduce students to the process of scientific inquiry and to encourage them to seek out truth, analyze the world around them, and design ways to change it.

Target Audience	11 th or 12 th Graders
Nature of the Material	Self-contained course (Units could be excerpted for use in other curricula.)
Prerequisites	Introductory coursework in biology and chemistry plus algebra II; additional coursework in probability and/or statistics desirable but not essential.
Time Required for Full Implementation	12 to 16 weeks (semester)

While the course focuses mainly on health and disease, the inquiry-based, "dive-right-in" approach can be incorporated into study in other disciplines as well as into the way in which students approach their daily lives. Although there is a small amount of lecture and presentation of the material, the main focus of this curriculum is to put students right in the middle of the topics and allow them to explore the subject without a rigid tour guide. Students work together on most of the tasks, drawing on one another's ideas and broadening not only the way they think, but how they communicate with their peers and express their ideas in both written and oral forms.

Students are assessed on their participation in daily discussions, their expression of ideas in a journal or notebook, and their completion of various group and individual projects. There are no traditional tests given in the course of the semester. The goal is not memorization but true learning and the application of that learning. This course challenges students to think, to apply their ideas to solve problems, and to explore their own attitudes and values.

The curriculum is designed as a self-contained course lasting one 12-to-16-week semester. While the main focus of the course is centered on scientific inquiry, interdisciplinary compo-

INTRODUCTION TO EPIDEMIOLOGY

nents help transfer the science into everyday life and make links to the way in which science shapes history and society. The course is organized into three units:

- What the Heck Is Epidemiology and What Can It Do for Me?
- Playing Detective: Investigating Infectious and Chronic Disease Epidemiology
- As Time Moves On and Technology Advances: More Uses for Epidemiology and Scientific Thinking

The material in this version of the curriculum is spread out over 12 weeks and assumes daily class sessions. However, more time could be given to projects and investigations if a school's calendar permits.

The curriculum is designed for students of average academic ability in the 11th and 12th grades of high school. However, the material covered and the assignments distributed can easily be modified to fit the needs of an honors student. Extension projects can delve deeper into course material and challenge students to design and implement investigational studies that are only described and debated (but not actually run) in this version of the curriculum.

Students enrolled in this course should have successfully completed an introductory course or courses in biology and chemistry as well as algebra II. Additional course work in probability and/or statistics is a plus, but not required. Students should also possess strong writing skills (demonstrated by an initial essay describing the student's interest in the course or other appropriate means), as well as an interest in medicine, health, or health-related fields of study.

2. Student Learning Goals

By the end of **Unit One**, students will:

- Be able to use the scientific method to solve problems, form and test hypotheses, and recognize that this type of inquiry can be applied to problem solving in any discipline
- Understand the importance of rates, ratios, and clearly charted data in epidemiology investigations
- Recognize the variety of evidence that epidemiologists must collect to determine the origin, agent, and route of transmission of an infectious disease
- Understand how a disease progresses in an individual over time and how prevention efforts can target specific stages of this progression
- Understand the roles that the host, agent, and environment play in the spread of disease and be able to trace the associated chain of infection
- Know how to design disease-prevention strategies and apply these strategies to chronic diseases and other societal problems such as violence and teen pregnancy
- Understand the historical significance of large-scale public health campaigns and epidemics

By the end of **Unit Two**, students will:

- Recognize that infectious diseases are a continuing problem among all human populations
- Be able to define and give examples of emerging and re-emerging infectious diseases
- Be able to explain how environmental changes, evolution of the microbe, and new scientific discoveries can affect the emergence of a disease
- Understand how the body fights infection, naturally and artificially (with vaccines)
- Have a better understanding of the political, social, historical, and personal issues associated with the emergence of a new disease
- Be able to describe the epidemiology of chronic diseases

- Be able to design studies to examine associations, quantify these associations with statistics, and analyze study design for strengths and weaknesses (such as bias and confounding)
- Understand the ethical issues associated with epidemiologic investigations and human trials
- Search for sound research in studies referenced in popular media sources
- Understand the fundamentals of an outbreak investigation
- Debate the civil rights of individuals during an outbreak or epidemic

By the end of **Unit Three**, students will:

- Understand that with advances in technology come new ethical questions and debates, as well as uses for research studies
- Understand the goals, successes, and failures of the Human Genome Project
- Be able to discuss the link between scientific discovery and public policy
- Understand the role of the environment in human health
- Understand that science can be abused, as in the case of biological weapons

Students will demonstrate their achievement of the goals through successful completion of individual and group projects, active participation in class discussions and related activities, and entries in individual journals. (See section 5, "Assessment.")

3. Requirements

Time Requirements	12 to 16 weeks with daily class meetings	This version is assumes 12 weeks
Facilities Requirements	Classroom for presentations, discussions, viewing video clips, etc. Access to science lab	Configuration permitting work groups to cluster is desirable
Equipment Requirements	VCR and Monitor Access to Internet-enabled computers (in classroom or computer center)	Computers in classroom desirable
Books (including textbooks)	Education Development Center. <i>The Blueprints of Infection: Insights in Biology</i> . Dubuque: Kendall/Hunt Publishing Company, 1998. (\$11.99) Garret, L. <i>The Coming Plague: Newly Emerging Diseases in a World Out of Balance</i> . New York: Penguin Books, 1994. (\$15.95) Gilbin, J. C. <i>When Plague Strikes: The Black Death, Smallpox, AIDS</i> . New York: Harper Collins Publishers, 1995. (\$7.95)	
Other Resources Required	Handouts, including articles, Web site downloads, worksheets, and similar materials, as referenced throughout section 4, "Content" Student Classroom Notebooks	See bibliography for books, articles, videos, Web sites, and other materials used by the author in the creation of this curriculum

4. Content

Class Organization:

The course is organized as a series of whole class lessons supplemented with numerous small group activities, discussions, projects, and debates. Time will also be spent in both the science lab and the computer center. Some of the smaller graded assignments are completed individually; however, the three large end-of-unit projects are completed in groups of four.

Lessons/Activities That Comprise Curriculum:

The following pages contain detailed timelines, including cross-references and/or links to necessary documents, guides for student, assignments, activities and projects, Web sites, and resources necessary for implementation. (A proposed guest speaker is included in one instance.)

Week 1.

	TOPIC	DISCUSSION QUESTIONS
Day 1	What is Epidemiology? An Introduction to Problem Solving	<ul style="list-style-type: none"> - What is epidemiology? Why study it? - What is an epidemic? How and why has this definition changed over the years? - What is a pandemic?
Day 2	The History of Epidemiology	<ul style="list-style-type: none"> - What were early conceptions of the cause of disease? - What are major milestones in public health (PH) history? - Who are some of the scientists who shaped epidemiologic thought?
Day 3	The Scientific Method	<ul style="list-style-type: none"> - What are the steps of the scientific method (SM)? - How are these steps used to solve problems (in any discipline)? - How did John Snow utilize the SM?
Day 4	The Scientific Method	<ul style="list-style-type: none"> - How do we support/refute a hypothesis? - How do we look for weaknesses in scientific evidence? - What is the best way to present scientific evidence?
Day 5	Measuring the Occurrence of Disease/ The Importance of Rates	<ul style="list-style-type: none"> - Why do we need to look at rates/ratios/proportions in epidemiology? - What is meant by the term "population at risk"? - How do graphs, tables, charts, and maps assist with investigations?

Week 1.

CLASSWORK/ ACTIVITIES

HOMEWORK

-
1. Video Clips: *Outbreak, A Civil Action, And The Band Played On* (See appendix for student worksheet.)
 2. Activity: Defining Epidemics (See appendix for student worksheet.)
-

When people of different age groups hear the word epidemic, what diseases come to mind? (See appendix for interview assignment.)

-
1. Discuss Interview Assignment. What are some reasons for changing health patterns?
 2. Activity: History of Epidemiology and Public Health Scavenger Hunt. (See Appendices for student worksheet.)
-

1. Finish Internet Scavenger Hunt
2. Writing- In your opinion, which person had the greatest impact on public health today?

-
1. Create class timeline of PH milestones.
 2. Class reading: "Disease Detectives: Cholera" (*Blueprints of Infection*, pp. 1-5)
 3. Activity: John Snow and the Cholera Epidemic of 1854 (parts 1 and 2) at www.hydroville.org
-

Complete team worksheet for parts 1 and 2.

-
1. Activity: John Snow and The Cholera Epidemic of 1854 (parts 3 and 4). Discuss findings at end of each part.
 2. Activity wrap-up: How did John Snow's investigation use approaches of today?
-

Writing: If you were investigating an epidemic today, how would your study be different? What would you do that John Snow did/could not?

-
1. Discuss the use of spot mapping, rates, and proportions in the John Snow case.
 2. Define measures of mortality and morbidity. Why do we need them?
 3. Activity: Begin Practice Questions-Rates. (See appendix for problems.)
-

Complete Practice Problems.

Week 2.

	TOPIC	DISCUSSION QUESTIONS
Day 1	Measuring the Occurrence of Disease/ The Importance of Rates	- How can specific figures, such as mortality rates, attack rates, and incidence and prevalence, help public health scientists monitor disease?
Day 2	The Natural History of Disease	- How does a disease progress in an individual over time? - What are the differences between infectious and noninfectious diseases? - What is an incubation period?
Day 3	Dynamics of Disease Transmission	- What exactly is being spread from person to person? - What roles do host, agent, and environmental factors play in the spread of disease?
Day 4	The Infectious Disease Process/The Chain of Infection	- What is the chain of infection? - What is a reservoir? A portal of entry/exit?
Day 5	Agents of Disease	- How do viruses, bacteria, and parasites cause disease? - How is the agent spread? What symptoms does the agent cause? What is the biology of the agent? What is the treatment?

Week 2.

CLASSWORK/ ACTIVITIES

HOMEWORK

-
1. Review practice problems.
 2. Each student makes a chart in his notebook of the measures of morbidity and mortality and how to complete calculations.

Writing: Analyzing Newspapers for Epidemiologic Investigations (See appendix for assignment sheet.)

Discuss the stages our body goes through when we get sick.

Discuss the epidemiologic triad of disease. Brainstorm factors relating to host, agent, environment, and vector that influence disease transmission.

Reading: "The Natural History of Infectious Diseases" by Rob DeSalle, available at www.pbs.org/fredfriendly/epidemic/perspective/pages/Essay.pdf

Through reading about transmission of bubonic plague, define a "chain of infection." Identify the causative agent, the vector, the reservoir, and the mode of transmission. Class will complete a chain for Lyme disease.

1. Reading: "It's a Small World," section 4 of Epidemic! The World of Infectious Disease at www.amnh.org/exhibitions/epidemic/section_04/index.html
2. Reading: "Bacteria and Viruses and Parasites, Oh My!" (*Blueprints of Infection*)

-
1. Discuss the biology of each type of agent.
 2. Activity: On board, create a table that compares each type of infectious agent: bacteria, virus, parasite, and prion. (See appendix for sample table.)

Reading: "The Prion Diseases" by Stanley Pruisner in *Scientific American*

Week 3.

	TOPIC	DISCUSSION QUESTIONS
Day 1	Biology of A New Agent- The Prion	<ul style="list-style-type: none"> - How does the scientific community respond when an infectious agent appears that does not fit into any category of known agents? - What exactly is a prion?
Day 2	Who Dun it? Disease Causation	<ul style="list-style-type: none"> - How do we know an agent is the cause of disease? - How might we prove causation in noninfectious diseases?
Day 3	How Do We Pass Disease Along?	<ul style="list-style-type: none"> - What data did John Snow collect that suggested how cholera was spread? - Might we see the same pattern of illness in cancer or heart disease? - Why do we need to know how disease is spread? Discuss disease prevention.
Day 4	Disease Prevention	<ul style="list-style-type: none"> - What is the purpose of a control in an experiment? - What do results tell you about the spread of infectious disease? What approaches can you think of to stop the spread?
Day 5	Levels of Disease Prevention	<ul style="list-style-type: none"> - What do you consider prevention? <p>Students will get to the three levels by describing prevention for infectious disease and other epidemics such as cancer, teen violence, and homicide.</p>

Week 3.

CLASSWORK/ ACTIVITIES

HOMEWORK

Video: *The Brain Eater* (NOVA).
Add prion information to infectious-agents chart.

Reading: "Microbes and Disease: Making the Link" at www.amnh.org/exhibitions/epidemic/section_05/secfive_pg_02.html

-
1. Discuss Koch's postulates. Apply the rules to determine whether a disease is caused by an infectious agent.
 2. What about chronic disease causation? What's a risk factor?

1. Activity: "Outbreak!" lab (*Blueprints of Infection*, pp. 18–21)

Investigate the spread of infection through direct contact.

Writing: In notebooks, write a prediction of the results of the investigation.

-
1. Examine/discuss lab results.
 2. "Outbreak!" lab (part 2). Propose a hypothesis about preventing the spread of the disease and design an experiment to test the hypothesis

Writing: Outline an experiment to test your prevention hypothesis.

-
1. Discuss prevention. How did you attack the problem?
 2. As a class, brainstorm prevention at all three levels for one communicable and one noncommunicable disease.

Activity: Make a 3 x 3 prevention grid (3 different diseases, a prevention strategy at each level). (See appendix for sample grid.)

Week 4.

	TOPIC	DISCUSSION QUESTIONS
Day 1	Public Health Measures to Prevent Disease	<ul style="list-style-type: none"> - Which of the three levels of prevention has the greatest impact on reducing disease transmission? - Given what you have learned about the life cycle of disease agents, what are some large-scale measures that help control the spread of disease?
Day 2	Primary Prevention: Screening and Detection	<ul style="list-style-type: none"> - What are the values of screening tests? How do they aid in the control of both infectious and chronic diseases? - Does the test identify people with the disease accurately enough to be used?
Day 3	To Screen or Not to Screen?	<ul style="list-style-type: none"> - Does the use of the screening test result in better health for the population? - What kinds of thoughts, behaviors, and conditions prevent people from participating in health screenings?
Day 4	Unit Project- The Case of the Killer Congestion	
Day 5	Unit Project- The Case of the Killer Congestion	

Week 4.

CLASSWORK/ ACTIVITIES

HOMEWORK

-
1. Split into pairs and critique prevention strategies from homework assignment.
 2. Brainstorm/discuss major campaigns that have led to the prevention of disease (water monitoring and fluoridation, sewage, animal control, vaccinations).
-

Writing: Name all the screening tests you can think of. What do they attempt to detect? What are the positive and negative aspects of each?

-
1. Brainstorm: Students rank and rate screening tests from most reliable to least reliable.
 2. Introduce the concepts of sensitivity and specificity, and false positives and negatives; complete practice problems.
-

Find and read articles on the debate over mammograms

-
1. Review homework problems.
 2. Activity: Debate the value of mammograms. Also debate the discussion questions about the overall value of screening.
-

Reading: "The Case of the Killer Congestion" (*Blueprints of Infection*, pp. 33–35)

Activity: Students work in groups of four to analyze four data sources, pinpoint a cause of the disease, and produce a report on their scientific process and thinking.

Students work on their projects.

1. Reading: "Prologue" (*When Plague Strikes*, pp. 1-7)

Week 5.

	TOPIC	DISCUSSION QUESTIONS
Day 1	Emergence of Infectious Disease	<ul style="list-style-type: none">- What is the difference between an emerging and a re-emerging disease?- What is the impact of infectious disease on human populations?
Day 2	Emergence of Infectious Disease	<ul style="list-style-type: none">- What is the difference between an emerging and a re-emerging disease?- What is the impact of infectious disease on human populations?
Day 3	Emergence of Infectious Disease/ Environmental Change	<ul style="list-style-type: none">- Discuss the social, political, and natural factors that influence the emergence of disease.- Discuss the consequences in society of the emergence of disease.- Talk about disease treatments and early prevention efforts.
Day 4	Host Immunity/ Vaccinations	<ul style="list-style-type: none">-How does your body fight infection?
Day 5	Vaccinations	<ul style="list-style-type: none">- What is a vaccination? How was the technology discovered?- How does immunization prevent disease?

Week 5.

CLASSWORK/ ACTIVITIES

HOMEWORK

Activity: Deadly Diseases Among Us, Disease Cards classification. Lesson plans are available at NIH Web site (science.education.nih.gov/supplements/nih1/diseases/guide/pdfs.htm).

Reading: "The Black Death" (*When Plague Strikes*, pp. 11–46)

Video: *Ebola! The Plague Fighters* (NOVA).
What are some factors that may have assisted the emergence of Ebola?

Writing: What are some of the factors that lead to the emergence of Ebola? To plague?

Activity: Disease Detectives. Lesson plans are available at NIH Web site (science.education.nih.gov/supplements/nih1/diseases/guide/pdfs.htm).

Reading: "Smallpox" (*When Plague Strikes*, pp. 57–104) and "The Pathogens are Coming" (*Blueprints of Infection*, pp. 131–132)

-
1. Discuss the structure and function of the human immune system and relate this functioning to specific infectious invaders.
 2. Introduction to vaccinations. Relate to smallpox discussion. Relate to smallpox discussion

Writing: Ask your parents about your vaccination history and research two of your boosters on the Internet. How could you contract this disease? What are the symptoms? How effective is the vaccine?

-
1. Discuss childhood vaccinations.
 2. Project: WebQuest travel-vaccination pamphlet (See appendix for detailed instructions.)

Continue working on WebQuest project.

Week 6.

	TOPIC	DISCUSSION QUESTIONS
Day 1	Does Everyone Need to Be Vaccinated?/Herd Immunity	<ul style="list-style-type: none"> - Can immunizing a significant proportion of a population against a disease prevent epidemics? Do we have to vaccinate everyone? - What is herd immunity?
Day 2	Treatment of Infectious Agents/Bacterial Resistance	<ul style="list-style-type: none"> - How can the re-emergence of some diseases be linked to evolution of the infectious agents?
Day 3	Treatment of Infectious Agents/Bacterial Resistance	<ul style="list-style-type: none"> - How can the short-term health needs of patients sometimes interfere with the long-term considerations of public health? How should we address this conflict?
Day 4	Presentation of Travel-Medicine Project	<ul style="list-style-type: none"> - How can travel medicine help protect a traveler on vacation to various locales? - What are some of the main public health concerns associated with international travel?
Day 5	The AIDS Epidemic/ <i>And The Band Played On</i>	<ul style="list-style-type: none"> - What are some factors associated with the emergence of the AIDS epidemic?

Week 6.

CLASSWORK/ ACTIVITIES

HOMEWORK

1. Introduce the concept of herd immunity.
2. Activity: Protecting the Herd. Lesson plan is available at NIH Web site (science.education.nih.gov/supplements/nih1/diseases/guide/pdfs.htm).

1. Writing: Summarize the findings of the activity in a paragraph or two.
2. Reading: "The Return of Tuberculosis in a New, More Menacing Form" by S. Hall

Video activity: *Debi's Story*. Complete worksheet on Debi French's battle with TB from Superbugs: An Evolving Concern, available at NIH Web site

Worksheet: Antibiotic Concerns (master 3.4), available at NIH Web site

(science.education.nih.gov/supplements/nih1/diseases/guide/activity3-2.htm).

(science.education.nih.gov/supplements/nih1/diseases/guide/masters.htm)

1. Discussion: Homework worksheet
2. Activity: Role-play scenario related to the problem of bacterial resistance; video: *Epidemic! A Fred Friendly Seminar*, available at www.fredfriendly.org/epidemic

Finish travel-medicine project.

Students will present their pamphlets to the class and explain their findings as if speaking to a patient.

Reading: "AIDS" (*When Plague Strikes*, pp. 117–187)

1. Reading: Epilogue (*And The Band Played On*)
2. AIDS pretest/discussion: modes of transmission
3. Video: *And the Band Played On* (begin)

Reading: "The Origin of AIDS" (*The Coming Plague*, pp. 281–389)

Week 7.

	TOPIC	DISCUSSION QUESTIONS
Day 1	The AIDS Epidemic/ <i>And The Band Played On</i>	- What are some factors associated with the emergence of the AIDS epidemic?
Day 2	The AIDS Epidemic/ <i>And The Band Played On</i>	- Why wasn't the AIDS epidemic formally recognized until the mid-80s even though the disease was visible at the beginning of the decade?
Day 3	Politics, People and the AIDS Epidemic	- What are some of the political, societal, personal, and cultural issues surrounding the unfolding of the AIDS epidemic? How did these issues affect the containment of the epidemic? In the movie, people are slow to accept and acknowledge what is happening. Why? What are the forces preventing acceptance? What are the consequences of this denial stage?
Day 4	Comparing Epidemics	<ul style="list-style-type: none"> • Are we destined to repeat the same mistakes during disease outbreaks? Are we always looking for someone to blame? - How does the appearance of disease affect and-change the course of history?
Day 5	Introduction to Unit Project: Emerging Diseases	

Week 7.

CLASSWORK/ ACTIVITIES

HOMEWORK

Video: *And The Band Played On* (continue)

Begin outlining paper: Compare the plague, smallpox, and AIDS epidemics: three different diseases that evoked eerily similar political, social, and cultural reactions.

Video: *And The Band Played On* (conclude)

-
1. Discuss the epidemiology of the AIDS epidemic and reactions to the movie.
 2. Discuss the biology of AIDS, particularly why making a vaccine is so difficult.

Finish Paper

Finish discussing the AIDS epidemic. Incorporate findings of the paper. What were the similarities and differences in all three epidemics?

Reading: "Emerging Diseases"
(*Blueprints of Infection*, pp. 95–99)

Activity: Introduction to the unit project
(See appendix for assignment instructions.)

Begin research on project/organize groups.

Week 8.

	TOPIC	DISCUSSION QUESTIONS
Day 1	Chronic-Disease Epidemiology	- How do we examine disease without a clear-cut cause?
Day 2	Study Design: The Case-Control Study	- What is a risk factor? How can you tell if a certain factor is associated with a given disease without a clear-cut microbial cause? - What are the basic components of the case-control study?
Day 3	Study Design: The Case-Control Study	- What are the fundamentals of a case-control study? - Remind students of the case-control study used in <i>And The Band Played On</i> (can be used with infectious diseases).
Day 4	Study Design: The Cohort Study	- What are the risk factors for heart disease? How can we prove it?
Day 5	Study Design: The Cohort Study	- What are the fundamentals of a cohort study?

Week 8.

CLASSWORK/ ACTIVITIES

HOMEWORK

Write associations on the board (i.e., smoking and lung cancer, cell phone use and brain cancer). Students rank the degree to which they believe each. How can you prove it?

Reading: "Research on Smoking and Lung Cancer: A Landmark in the History of Chronic Disease Epidemiology" (*Yale Journal of Biology and Medicine*)

1. Discuss the basic biology of cancer.
2. Outline the case of lung cancer and smoking.
3. Students will brainstorm the study set-up to get at the basics of the case control.

1. Chart the fundamentals of the study design and the strengths and weaknesses of the approach.
2. Discuss measures of association: the odds ratio.

Practice problems: Calculating the odds ratio; what does it mean? (See appendix for Practice Problems: Calculating Risk part 1.)

1. Discuss the basic biology of heart disease.
2. Brainstorm risk factors of heart disease. How do we know they are risk factors?
3. Introduce Framingham Heart Study.

Reading: *You Changed America's Heart* at NIH Web site
www.nhlbi.nih.gov/about/framingham/

1. Chart the fundamentals of the study design and the strengths and weaknesses of the approach.
2. Discuss measures of association: relative risk.

1. Practice problems: Calculating relative risk; what does it mean? (part 2 of previous worksheet)
2. Writing: Compare cohort and case-control studies. When would you use each?

Week 9.

	TOPIC	DISCUSSION QUESTIONS
Day 1	Study Design: Case Control vs. Cohort	- When do you use a case-control study? A cohort study?
Day 2	Study Design: Clinical Trials	- What is a clinical trial? - What is a placebo? - What is randomization? - What are the ethical issues associated with clinical trials?
Day 3	Other Study Designs	-What is an ecologic study? -What is the value of a cross-sectional study?
Day 4	Biases and Confounding	- What are some of the problems inherent in epidemiology studies? - What are some potential biases in these studies? How does the press lend to the unreliability of some study results?
Day 5	Statistics/Analyzing Associations in Epidemiology Studies	- What are some of the statistical values/tests that help describe the power of epidemiologic associations?

Week 9.

CLASSWORK/ ACTIVITIES

HOMEWORK

Compare the two types of study design. Provide the class with scenarios and ask them whether they would best be investigated with a case-control or cohort study. What are the strengths and weaknesses of each in the case?

Writing: Design a study using members of your school community as participants. Describe what you are looking at and how you would conduct your study.

-
1. Use cholesterol drug studies as an example of clinical trials.
 2. Read clips about the Tuskegee experiment/Jesse Gelsinger (gene therapy death) to start discussion on ethics in human studies.

Complete the Name That Study worksheet. (See appendix for worksheet.)

-
1. Describe the strengths and weaknesses of ecologic and cross-sectional studies.
 2. Activity: In groups, read abstracts from issues of *American Journal of Epidemiology*. Determine basic framework of study.

Reading: "Epidemiology Faces Its Limits" (*Science*, July 1995)

-
1. Discuss cancer risks from Science article. Does the RR really show you an association?
 2. Introduce assignment: Analyzing Research in Popular Media Sources (See appendix for assignment.)

Work on Analysis Project

Guest speaker gives an intro to biostatistics, which includes p-values, chi-square, measures of association.

Work on Analysis Project

Week 10.

	TOPIC	DISCUSSION QUESTIONS
Day 1	The Outbreak Investigation	
Day 2	The Outbreak Investigation	<ul style="list-style-type: none"> - What is a case-definition? - What is an epidemic curve? How can this curve assist in an outbreak investigation?
Day 3	The Outbreak Investigation	
Day 4	The Outbreak Investigation/ Public Health and the Rights of the People	<ul style="list-style-type: none"> - What's the public's right to know when an outbreak may be occurring? - Can people be detained against their will if considered contagious? - Do you have the right not to be vaccinated even if your choice may cause harm to others?
Day 5	The Outbreak Investigation	<ul style="list-style-type: none"> -How do disease detectives investigate public health situations? -How can we put together data from various sources to solve scientific phenomenon?

Week 10.

CLASSWORK/ ACTIVITIES

HOMEWORK

1. Discuss Analyzing Research in Popular Media Sources.

Reading: "Steps of an Outbreak Investigation" at EXCITE Web site
www.cdc.gov/excite/classroom/outbreak_steps.htm#steps

Activity: Simulated outbreak assignment. Read and analyze the data in the scenario about a disease outbreak at a local picnic in *An Introduction to Community Health* (pp. 55–57).

Work on Outbreak Assignment

Reading: "Ebola" (*The Coming Plague* pp. 100-153)

1. Discussion of reading: What steps were taken in the outbreak in the piece?
2. Introduce "A Drug-Disease Outbreak" (*Epidemiology Kept Simple*, pp. 256–258).

Complete Outbreak Investigation Assignment

Video: Clips from *Epidemic! A Fred Friendly Seminar*. Lead a discussion on the media's responsibility to the public in an outbreak.

1. Writing: Write a 3-to-5-minute news story on a possible outbreak of Ebola on a plane headed for your town.

2. Reading: "Toxic Shock Syndrome" (*The Coming Plague*, p. 390)

1. Discuss toxic shock outbreak.
2. Activity: Work on various Science Olympiad questions regarding outbreak investigations at EXCITE Web site (www.cdc.gov/excite/disease_detectives/sample/index.htm). Go over one as a class).

Complete Science Olympiad question on Ebola hemorrhagic fever at EXCITE Web site (www.cdc.gov/excite/disease_detectives/sample/ebolaQ.htm).

Week 11.

	TOPIC	DISCUSSION QUESTIONS
Day 1	Molecular Epidemiology: The Risk in Our Genes	<ul style="list-style-type: none"> - What is the Human Genome Project? - How can epidemiologic studies be used to investigate the role of our genes in disease? -What are diseases you know with proven genetic risks?
Day 2	Molecular Epidemiology: The Risk in Our Genes	<ul style="list-style-type: none"> -What are the anticipated benefits of genetic research? -What are some of the ethical, social, and legal implications (ELSI) of this new knowledge?
Day 3	Genethics: How Much Do We Really Want to Know?	<ul style="list-style-type: none"> - Who has the ultimate right to your genetic information? - What are the ethical issues associated with genetic testing? Should we test? -If we could change our genes, should we?
Day 4	Nature vs. Nurture: What's Genetic? What's Environmental?	<ul style="list-style-type: none"> - What determines our likes, dislikes, personality and susceptibility to disease? -How can we study the role of our genes? -What are twin, adoption and migration studies?
Day 5	Environmental Epidemiology	<ul style="list-style-type: none"> -What are some of the determinants of disease in our social and physical environment? -How would you study the effect of second hand smoke? Chemicals in water?

Week 11.

CLASSWORK/ ACTIVITIES

HOMEWORK

-
1. Background on genetics: Video clips from *Cracking The Code of Life* (NOVA)
 2. Discuss the Human Genome Project (HGP). Show PowerPoint presentation available at HGP Web site (www.ornl.gov/hgmis/publicat/primer2001/index.html).
-

Reading: "Genomics and Its Impact on Medicine and Society" at HGP Web site (www.ornl.gov/hgmis/publicat/primer2001/primer11.pdf)

Activity: Public Policy: Genetics and Alcoholism at BSCS Web site (www.bsccs.org/pdf/projects/Hgn1/HGN1Part3.pdf)

Reading: "Genetic Screening: Triumphs, Problems, and Controversies" (*Journal of Public Health Policy*, winter 1991)

-
1. Video: Clips from *Gattaca*. Discuss future genetics.
 2. In groups, complete ethics case studies at NOVA Web site for teachers (www.pbs.org/wgbh/nova/teachers/activities/2809_genome_03.html).
-

Writing: Compose a 1–2 page essay describing the ethics issues involved with one of the day's cases.

Activity: Analyzing twin studies. Lesson plan is available at DiscoverySchool.com (school.discovery.com/lessonplans/programs/naturenurture/).

Complete Twin Study Assignment

-
1. Discuss environmental influences in disease.
 2. Video: Clip from *A Civil Action*
 3. Brainstorm environmental links to disease that students are aware of (sun, asbestos, lead, etc.). In groups, propose environmental epidemiology studies.

Writing: Design a prospective study for skin cancer among the school population.

Week 12.

	TOPIC	DISCUSSION QUESTIONS
Day 1	Other Use For Epidemiological Studies: Medicines That Backfire	- Introduce final unit project. Design a problem set (like those of the Science Olympiad). Incorporate names, dates, methods, outbreak investigation, study design, and stats.
Day 2	Resurgence of Infectious Agents	- What diseases have we eradicated? How? - Do we have to worry about them coming back?
Day 3	Biological Warfare	-How can disease be used as a weapon?
Day 4	Final Questions/Peer Review/Course Wrap-Up	- Does the final question you are working on address all of the main requirements outlined in the assignment?
Day 5	Final Questions/Peer Review/Course Wrap-Up	

Week 12.

CLASSWORK/ ACTIVITIES

HOMEWORK

Activity: Students conduct Internet research to determine what a set of items has in common. How did epidemiological studies assist with each problem? (See appendix for What Do the Following Have in Common? and Unit Project: Design a Science Olympiad Question.)

Complete Research

Discussion: Should we keep samples of the diseases we have eradicated? Why or why not?

Reading: "The Demon in the Freezer" by Richard Preston (*The New Yorker*) available at cryptome.org/smallpox-wmd.htm

1. Video: *Bioterror* (NOVA)

Work on Final Questions

2. Class reading: Excerpt from *The Cobra Event*. Discuss risks and precautions after September 11th.

1. Finish discussion on biological weapons.

Edit Final Questions

2. Complete peer review of final questions in groups of 2, with students editing and critiquing their partners' question.

1. Share Final Questions

2. Course Evaluation

5. Assessment

Students demonstrate their knowledge and skills through:

- Completion of ten small individual assignments/activities (25% of final grade) and three large group projects (25% of final grade)
- Writings in their course notebook/journal (25% of final grade)
- Active participation in numerous class activities, discussions, and debates (25% of final grade)

Students are expected to use what they know and apply this information to novel situations. There are no traditional assessments or tests administered in the course.

The following tables display recommended scoring rubrics:

90% +	80% +	70% +	60% +	Less than 60%
<i>Exemplary</i>	<i>Strong</i>	<i>Capable</i>	<i>Developing</i>	<i>Limited</i>
Demonstrates a full understanding and use of the central concepts and ideas	Demonstrates essential understanding of the central ideas and concepts	Demonstrates partial but limited understanding of the central ideas and concepts	Demonstrates little or no understanding of the central ideas and concepts	Completion of task was entirely insufficient and showed no thought or research
Recorded work communicates thinking clearly, using some combination of written, symbolic, and visual means	Recorded work communicates thinking clearly, but some pieces may be missing	Recorded work may be incomplete, misdirected, or not clearly presented	Recorded work is difficult to comprehend	

Graded Activity Rubric Participation Rubric

Students can receive a maximum of 5 points per week. Final participation grade will be determined by the number of total points earned/60 points

5	4	3	2	1
Well prepared for each class, attempts to answer teacher-generated questions, adds outside information to the class when relevant Makes excellent use of class time to work on labs, assignments, and projects	Prepared for class, attempts to answer teacher-generated questions Good use of class time to work on labs, assignments, and projects	Occasionally not prepared for class (no pencil, notes, etc.), often listens but doesn't volunteer info Could use class time more wisely (interrupts at times or has irrelevant conversation)	Often not prepared for class, listens with blank expression or doesn't pay attention Gives up easily, is not engaged, has difficulty remaining on task	Rarely prepared, no significant work done, minimal or no effort to participate Creates interruptions, does not remain on task

Class Notebook Rubric

Students can receive a maximum of 5 points per week. Final notebook grade will be determined by the number of total points earned/60 points

5	4	3	2	1
All assignments are complete. Work shows great thought and is displayed neatly. Notebook is handed in on time.	Most assignments are complete. Work shows a good deal of thought and is relatively neat. Notebook is handed in on time.	More than one of the weeks' assignments is missing or incomplete. Work seems rushed and does not display consistent effort. Notebook is handed in on time.	More than one of the weeks' assignments is missing or incomplete. Work seems rushed and does not display consistent effort. Notebook is handed in late.	Most or all assignments are incomplete. No effort displayed in the preparation of the work. Notebook is handed in late.

Unit Project Rubric

90%	80% +	70% +	60%	Less than 60%
<i>Exemplary</i>	<i>Strong</i>	<i>Capable</i>	<i>Developing</i>	<i>Limited</i>
<p>Student presents a clear, specific understanding of the topic. The final product is well organized, flawlessly edited, and well thought out. All questions are answered accurately. High interest and excitement leads the student to an investigation that reaches far beyond the requirements. Student reads related materials and uses many sources of information for reports and/or presentation.</p>	<p>Student presents a clear, specific understanding of the topic. The final product is well organized, flawlessly edited, and well thought out. All questions are answered accurately. High interest and excitement leads the student to an investigation that reaches far beyond the requirements. Student reads related materials and uses many sources of information for reports and/or presentation.</p>	<p>Student meets assignment expectations. The final product has minor organizational problems and contains some editing issues. The student understands the assignment, but puts a minimal amount of effort into the completion of the project. He/she uses the number of resources required.</p>	<p>Student does not completely understand the topic. The project is occasionally incomplete and lacks organization. Many editing errors are evident. Some resources are used, but it is not clear what the student understands. Some of the information included by the student is not important to the topic. Student does most of what is required, but nothing more. Some of the work may not be finished. Tasks are not done carefully and the information from the resources is not used.</p>	<p>Student use of the topic is not shown. Steps through the process are not followed. Work does not meet requirements. Parts are missing. Overall, the student fails to grasp new concepts covered in the topic.</p>

6. Alignment of Content and Standards

The learning goals identified in section 2 center around the idea of providing students with a sound background in scientific inquiry, as well as basic biological concepts such as the molecular basis of heredity; evolution; factors associated with the maintenance of human health; and the historical, political, and social factors associated with science as a process. The learning activities described in section 4 are intended to help students achieve those goals and designed to stretch and expand their ability to think, question, and investigate.

The following table aligns the goals and activities with the relevant National Science Education Standards.

NATIONAL SCIENCE EDUCATION STANDARDS

LEARNING GOALS AND ACTIVITIES

Standard A: As a result of activities in grades 9–12, all students should develop abilities necessary to do scientific inquiry and understandings about scientific inquiry

Correlation to Introduction to Epidemiology: Scientific Inquiry for the High School Student

- | | |
|--|-----------------------------------|
| • Identify questions and concepts that guide scientific investigations | Week 1, 2, 4, 7, 8, 9, 10 |
| • Design and conduct scientific investigations | Week 1, 4, 8, 9, 10, 12 |
| • Use technology and mathematics to improve investigations and communications | Week 1, 8, 9, 11, 12 |
| • Formulate and revise scientific explanations and models using logic and evidence | Week 1, 3, 4, 5, 8, 9, 10, 12 |
| • Recognize and analyze alternative explanations and models | Week 1, 4, 8, 9, 10 |
| • Communicate and defend a scientific argument | Week 1, 4, 5, 9, 10 |
| • Gain an understanding of scientific inquiry | Week 1, 3, 4, 5, 8, 9, 10, 11, 12 |

Standard C: As a result of their activities in grades 9-12, all students should develop understanding of the molecular basis of heredity.

- In all organisms, the instruction for specifying the characteristics of the organism are carried in DNA
- Changes in DNA (mutations) occur spontaneously at low rates

should develop understanding of biological evolution.

- Species evolve over time

should develop understanding of the interdependence of organisms.

- Human beings live within the world's ecosystems

Correlation to Introduction to Epidemiology: Scientific Inquiry for the High School Student

Week 11

Week 11

Week 6

Week 5

Standard E: As a result of activities in grades 9-12, all students should develop abilities of technological design and understandings about science and technology

- Scientists in different disciplines ask different questions, use different methods of investigation, and accept different types of evidence to support their explanations; many scientific investigations require the contributions of individuals from different disciplines
- Science often advances with the introduction of new technologies
- Creativity, imagination, and a good knowledge base are all required in the work of science and engineering
- Science and technology are pursued for different purposes

Correlation to Introduction to Epidemiology: Scientific Inquiry for the High School Student

Week 5, 7, 10

Week 5, 11

Week 1, 3, 8, 9

Week 1, 6, 10, 12

Standard F: As a result of activities in grades 9-12, all students should develop understanding of personal and community health.

- The severity of disease symptoms is dependent on many factors, such as human resistance and the virulence of the disease-producing organism
- Personal goals, peer and social pressures, ethnic and religious beliefs, and understanding of biological consequences can all influence decisions about health practices

Correlation to Introduction to Epidemiology: Scientific Inquiry for the High School Student

Week 2, 5, 6

Week 6, 7, 10, 11

natural and human-induced hazards

Week 1, 2, 5, 6, 11, 12

science and technology in local, national , and global challenges

- Progress in science and technology can be affected by social issues and challenges
- Humans have a major effect on other species

Week 4, 6, 7, 10, 11, 12

Week 6

Standard G: As a result of activities in grades 9-12, all students should develop understanding of

- Science as a human endeavor
- Nature of scientific knowledge
- Historical perspectives

Correlation to Introduction to Epidemiology: Scientific Inquiry for the High School Student

Week 1, 4, 6, 7, 8, 9, 10, 11, 12

All

Week 1, 5, 6

7. Bibliography

Required student texts

Education Development Center. *The Blueprints of Infection: Insights in Biology*. Dubuque: Kendall/Hunt Publishing Company, 1998.

Garrett, L. *The Coming Plague: Newly Emerging Diseases in a World Out of Balance*. New York: Penguin Books, 1994.

Gilbin, J. C. *When Plague Strikes: The Black Death, Smallpox, AIDS*. New York: Harper Collins Publishers, 1995.

Additional books used in the course or in the preparation of the curriculum:

Gerstman, B. Burt. *Epidemiology Kept Simple: An Introduction to Classic and Modern Epidemiology*. Hoboken: John Wiley & Sons, 1998.

Gordis, L. *Epidemiology*. Philadelphia: W. B. Saunders Company, 1996.

McKenzie, James F., Robert R. Pinger, and Jerome E. Kotecki. *An Introduction to Community Health*. 4th ed. Boston: Jones and Barlett Publishers, 2002

Preston, R. *The Cobra Event*. New York: Random House, 1998.

Shilts, R. *And The Band Played On: Politics, People, and the AIDS Epidemic*. New York: Penguin Books, 1988.

Stolley, P. and T. Lasky. *Investigating Disease Patterns: The Science of Epidemiology*. New York: Scientific American Library, 1995.

Stolley, P. and T. Lasky. *Investigating Disease Patterns- The Science of Epidemiology*.
New York: Scientific American Library, 1995.

Articles used in the course:

Hall, S. "The Return of Tuberculosis in a New, More Menacing Form." *The Race Against Lethal Microbes: A Report From The Howard Hughes Medical Institute* (1996).

Natowicz, M., and J. Alper. "Genetic Screening: Triumphs, Problems, and Controversies."
Journal of Public Health Policy (winter 1991): 475–491.

Preston, R. "The Demon in the Freezer." *The New Yorker* (July 12, 1999): 44–61.

Pruisner, S. "The Prion Diseases." *Scientific American* (August 1996): 48–57.

Taubes, G. "Epidemiology Faces Its Limits." *Science* 296 (July 1995): 164–169.

White, C. "Research on Smoking and Lung Cancer: A Landmark in the History of Chronic Disease Epidemiology." *Yale Journal of Biology and Medicine* 63 (1990): 29–46.

Websites used in the course:

Emerging and Re-emerging Infectious Diseases: NIH Curriculum Supplement Series
Grades 9-12.

www.science.education.nih.gov/supplements/nih1/diseases/default.htm

Epidemic! A Fred Friendly Seminar. Companion website to the PBS Broadcast.

www.pbs.org/fredfriendly/epidemic/

Epidemic! The World of Infectious Disease. American Museum of Natural History.
Companion website to the 1999 exhibition.

www.amnh.org/exhibitions/epidemic/

Excellence in Curriculum Integration through Teaching Epidemiology (EXCITE). Centers for Disease Control and Prevention.
<http://www.cdc.gov/excite/>

Framingham Heart Study: 50 Years of Research Success. National Institutes of Health.
www.nhlbi.nih.gov/about/framingham/

Human Genome Project Information. DOEgenomes.org.
http://www.ornl.gov/TechResources/Human_Genome/home.html

Hydroville. Home of the Curriculum Project at Oregon State University.
www.hydroville.org

Mapping the Human Genome: High School Curriculum. Biological Sciences Curriculum Study (BSCS).
http://www.bsccs.org/cp_hs_mod_mhg.html

NOVA Online: Teachers. A companion website to the PBS/WGBH television series.
<http://www.pbs.org/wgbh/nova/teachers/>

Videos used in the course:

A Civil Action. Dir. Steven Zaillian. Touchstone, 1999.

And The Band Played On. Dir. Roger Spottiswoode. HBO Studios, 1993.

Bioterror. NOVA. WGBH Boston Video, 2001.

Cracking the Code of Life. NOVA. WGBH Boston Video, 2001.

Gattaca. Dir. Andrew Niccol. Columbia/TriStar, 1997.

Outbreak! Dir. Wolfgang Peterson. Warner Studios, 1995.

The Brain Eater. NOVA. WGBH Boston Video, 1998.

8. Appendices and Student Assignment Sheets

[Student worksheet for video-viewing (Day 1/Week 1)]

How Are They Solving The Mystery??

You will watch three sets of video clips from movies dealing with the investigation of an outbreak of disease or mystery illness. For each movie

- Describe the process used by the main characters in gathering data about the given epidemic.
- What conclusions do they make from their observations? What other evidence do they need to collect? Why?
- Is it all “too Hollywood”? How do you think the methods in the movie compare with those utilized by real-life scientists and disease detectives?

When you have watched clips from all three movies, use the back of the sheet to list any commonalities between each investigation.

Outbreak!

A Civil Action

And The Band Played On

[Student homework "Interview Assignment" (Day 1/Week 1)]

Defining Epidemics

Assignment: When you hear the word epidemic, what diseases come to mind? Ask this question to 8–10 people you know, allowing them time to think and give you an answer. Be sure to find people of different age groups (your parents, grandparents, aunts/uncles, friends, siblings). List their answers and ages in your notebook. Answer the following questions:

- Are there any answers that surprise you?
- How do the answers of the oldest people interviewed compare with those of the youngest?
- Why do you think there has been such a change?

Adapted from McKenzie, J. F., R. R. Pinger, and J. E. Kotecki. *An Introduction to Community Health*. 4th ed. Boston: Jones and Barlett Publishers, 2002.

[Student homework "Interview Assignment" (Day 2/Week 1)]

History of Epidemiology and Public Health Scavenger Hunt

As we begin our study of epidemiology, we must first examine the beginnings of the science and investigate the people who have contributed to how we study and maintain the public's health. You may be familiar with some of these names, but as you read more into their lives and achievements, think about how their work and discoveries shaped our vision of health and the modern science of epidemiology.

Assignment: Using any resources in the library (books, encyclopedias, Internet resources), identify the contributions of each of the following people to modern science and describe how they have provided strength to the study of epidemiology

1. Sir William Petty and John Graunt (17th century)

2. Louis Pasteur (19th century)

3. Robert Koch (19th century)

4. Sir Joseph Lister (19th century)

5. William Farr (1807-1883)

6. John Snow (19th century)

7. Florence Nightingale (1820-1910)

8. Edward Jenner (17949-1823)

9. Sir Karl Popper (20th century)

10. Dr. Richard Doll and Dr. Bradford Hill (20th century)

[Class Assignment: "Practice Problems-Rates" (Day 5, Week 1)]

Practice Problems- Rates

Complete the following questions/problems in your notebook.

1. Look at the data in table 3.17. What conclusion can you draw about the risk for acquiring tuberculosis for populations in each age group? Now examine Table 3.18. Which age groups exhibit the highest disease rates? Explain why it is important to calculate rates to report disease outbreaks accurately.

2. There are 346 students at Institute of Notre Dame. During March and April, 56 pupils were absent with chickenpox. What is the attack rate for chickenpox at IND? The 56 pupils who were absent had 88 brothers and sisters at home. Of the 88 siblings, 19 developed chickenpox. What was the attack rate among these children. Of the 75 total cases of chickenpox, one child died. Calculate the case-fatality rate for chickenpox in this epidemic.

3. In an epidemic in Sample City (population 100,000- 60,000 males and 40,000 females) there were 600 cases (350 male, 250 female) of a severe disease. There were 70 deaths (all male) due to this disease and 880 deaths due to causes other than the specific disease. Calculate the following:

- a. crude death rate
- b. cause-specific mortality rate
- c. case fatality rate
- d. case fatality rate for males

Table 3.17
Reported Tuberculosis Cases, by Age Group, Low Socioeconomic Area, City of Dixon, 1960

Age Group in Years	Number of Cases	Age Group in Years	Number of Cases
0-4	7	35-44	6
5-14	7	45-54	9
15-24	6	55-64	8
25-34	10	65+	7

Table 3.18
Reported Tuberculosis Cases and Incidence Rates per 100,000, Low Socioeconomic Area, City of Dixon, 1960

Age Group in Years	Number of Cases	Population of Age Group	Rate*
0-4	7	8,638	81.0
5-14	7	13,098	53.4
15-24	6	10,247	58.5
25-34	10	8,680	115.2
35-44	6	7,528	79.7
45-54	9	6,736	133.6
55-64	8	4,534	176.4
65+	7	4,075	171.8
Total	60	63,536	94.4

*Example: 7 cases ÷ 8,638 population × 100,000 = 81.0.

[Student homework "Interview Assignment" (Day 1/Week 2)]

Analyzing Newspapers For Epidemiologic Investigations

Assignment: Find an article in a media source (the New York Times, the Baltimore Sun, any local newspaper, Time magazine, etc.) on a topic related to epidemiology. In a one- or two-page essay, summarize the findings and discuss how the article illustrates the use of the scientific method and the approach of epidemiology to the study of disease (health conditions) in populations.

- Take note of any graphs or tables that were used in the article. What are they saying about the research findings?
- Are the working hypotheses presented by the authors supported by the data? Why or why not?
- What measures of morbidity and mortality were used to describe the situation? What is the importance of such rates in the investigation?

*Please make sure to staple the article you used to your final essay.

[Classroom Activity: Sample Table (Day 5/Week 2)]

Charting the “Enemies”

Type of Infectious Agent	How The Agent is Spread	Symptoms the Agent May Cause	Biological Characteristics of the Agent	Methods of Treatment
Bacteria				
Virus				
Parasite				
Prion				

[Homework Assignment: Sample Table (Day 5/Week 3)]

Levels of Prevention

For each of the following diseases, describe a prevention strategy for each of the three levels.

(Note: You may need to do some basic research on the natural history/modes of transmission of the disease before you design your prevention efforts.)

	Primary Prevention	Secondary Prevention	Tertiary Prevention
Skin cancer			
AIDS			
Cholera			

[WebQuest Project: (Day 4/Week 6)]

The Travel Doctor: A WebQuest

Students will design informational pamphlets (using computer software such as MS Publisher) describing the vaccinations and health precautions necessary to ensure a disease-free trip to one of twelve international destinations.

[Unit Project Assignment: (Day 5/Week 7)]

Emerging and Re-emerging Diseases

Unit Project

Assignment: Bill Gates has decided to donate 100 million dollars towards a public health effort. Your job is to thoroughly research an emerging or re-emerging disease, design and describe prevention efforts you wish to have funded, and convince a panel of judges that your policy and your disease deserve the monetary backing.

Presentations will take place at the end of the semester and must be formal and professional, with accurate data and clear visuals. You will have six weeks to complete this assignment. Your presentation should be developed in accordance with the guidelines that appear in the group project featured in yesterday's reading assignment ("Emerging Diseases," *Blueprints of Infection*, pp. 95–99).

[Unit Project Assignment: (Day 5/Week 7)]

Practice Problems - Calculating Risk*

Part I: The Odds Ratio

1. Describe why and when you use the odds ratio to establish causation.

2. Compute the odds of disease for two groups (exposed and not exposed). Consider the risk of developing breast cancer for women related to the age at which they had their first child.

First child at age 25 or older?	Breast cancer	No Breast Cancer	Total
Yes	31	1,597	1,628
No	65	4,475	4,540
Total	96	6,072	6,168

- a) Compute the odds of breast cancer in women having their first child at 25 or older.
- b) Compute the odds of breast cancer for women having their first child before age 25.
- c) Compute the overall odds ratio. What does this value mean?

3. Given the following data, calculate the odds ratio of illness associated with eating watermelon.

Became Ill	Ate Watermelon	Did Not Eat Watermelon	Total
Yes	72	115	187
No	5	112	127
Total	77	237	314

Part II: Relative Risk

1. A cohort study was conducted to study the association of coffee drinking and anxiety in a population-based sample of adults. Among 10,000 coffee drinkers, 500 developed anxiety. Among 20,000 adults who do not drink coffee, 200 cases of anxiety were observed. What is the relative risk of anxiety associated with coffee use?
2. Of 2,872 people who had received radiation treatment in childhood because of enlarged thymus, cancer of the thyroid developed in 24 and benign thyroid tumor developed in 52. A comparison group consisted of 5,055 children who had received no such treatment (brothers and sisters of those who had received radiation treatment). During the follow-up period, none of the comparison group developed thyroid cancer, but benign thyroid tumors developed in 6. Calculate the relative risk for benign thyroid tumors.
3. In a study of a disease in which all cases that developed were ascertained, if the relative risk for the association between a factor and the disease is equal to or less than 1.0, then what can be said about this association?

*Some questions adapted from Epidemiology by Leon Gordis and EXCITE website (Fundamentals of Biostatistics in Epidemiology/Science Olympiad Questions)

[Homework Assignment: (Day 2/Week 9)]

Name That Study Design*

Assignment: Read each of the following scenarios and identify the type of study design being described. Write a sentence or two describing how you came to your conclusion.

1. Smoking histories are obtained from all patients entering a hospital who have lip cancer and are compared with smoking histories of patients with cold sores who entered the same hospital.
2. The entire population of a given community is examined, and all who are judged free of bowel cancer are questioned about their diet and eating habits. These people are then followed for several years to see whether their eating habits can predict their risk of developing bowel cancer.
3. To test the value of vitamin C in preventing colds, high school students are randomly assigned to two groups: one given 500 mg of vitamin C daily, and one given a placebo. Both groups are followed to determine the number and severity of their colds in the winter season.

4. The physical examination records of incoming freshmen of 1950 at Epidemiology University are examined in 2002 to see whether the freshmen's recorded height and weight at the time of admission were related to their chance of developing heart disease.

5. Questionnaires are mailed to every 10th person in a city's phone book. Each person is asked to provide his or her age, sex, and smoking habits and to describe the presence of any respiratory symptoms during the preceding seven days.

*Adapted from "Epidemiology for Public Health Practicioners" by Robert H. Friis

[Homework Assignment: (Day 4/Week 9)]

Analyzing Research in Popular Media Sources

Although popular magazines and newspapers frequently cite research-study statistics and describe experimental findings, these articles often lack the details of study design and the explanation of the variables assessed that provide the reader with a real understanding of the results. The everyday reader may look to these sources for guidance on child rearing, information on human behavior, data on an emerging disease, statistics on a new medication or medical procedure, or data on a new product. Popular sources are most likely not trying to mislead the public; however, in making the results more accessible or more understandable to the average reader, writers may leave out or give a cursory explanation of important details, leaving the public with only small amounts of usable information and incomplete figures. In this assignment, you will provide a review of research presented in popular magazines and newspapers, examine study design, and analyze what a reader can conclude definitively from the data presented.

Assignment: Find three references to research studies or data in popular magazines (*Parents*, *Psychology Today*, *Good Housekeeping*, etc.) or newspapers. For each item, describe the experimental design and evaluate the strengths and flaws of the research. Is the study design explained or are statistics quoted without an explanation of where they came from? Is there any reference to how data was collected? Do they tell you anything about the participants (number, age, etc.)? Do you see any potential biases in the way the data may have been collected or represented? Do the results sound reasonable? Do they actually tell you anything?

Example: In a 1998 article, "Girls Who Want to Diet," published in *Good Housekeeping* magazine, the authors begin by saying: "Research shows that by the time girls reach the ripe old age of 11, between 50 and 80 percent of them have dieted." Reading on you will find that the article never describes this "research." Nowhere does it state the number of girls enrolled in the study. Wouldn't the results mean more if this study involved a cohort of 1,000 girls rather than only 10? And 50 to 80 percent? Doesn't that seem like a huge range? Can we really infer anything from such a crazy statistic?

You should describe your findings in an essay of three to five pages. Make sure to include an introduction to the assignment as well as a final conclusion. You should attach the actual research references to your final paper.

[Unit Project (Day 1/Week 12)]

What Do The Following Have In Common?

Using the Internet as a resource, determine what the following items have in common. How do they relate to our study of epidemiology?

- X-rays
- DES (diethylstilbestrol)
- L-tryptophan
- Thalidomide
- Cholesterol-lowering agent, MER-29
- Polio vaccine (administered in 1955)

[Unit Project Week 12]

Unit Project: Design a Science Olympiad Question

Students will work in groups of four to create a multipart assessment in the style of the contest questions. The question must test the participants' knowledge of

- Developing and testing hypotheses
- The natural history of disease and the chain of infection
- Types of study design and the associated measures of association
- The steps of an outbreak investigation
- Rates and proportions
- Analysis of information and data contained in a written passage and in graphical form

You may design your question in whatever format you choose. However, you must start out with some type of data and information for the test taker to read and analyze. You may fabricate this information or, if you are ambitious, you will scan the CDC's *Morbidity and Mortality Weekly Report (MMWR)* files and design your question using actual outbreak information.

You should also include a tiebreaking question based on disease facts, historical trivia, famous names, etc. Have fun with that one!