

LESSON:

Taking Action on Passive Smoking

Summary: Students read a summary article on the association between secondhand smoke and breast cancer. Then they analyze the scientific arguments and problems reported in the article. Finally, they write a letter that either agrees or disagrees with the need to increase funding for research in this area.

Lesson Type: Focus Lesson—This lesson type develops students' skills and topical understanding by having them read and interpret information from an in-depth article.

EHP Article: "Secondhand Suspicions: Breast Cancer and Passive Smoking"
EHP Student Edition, June 2007, p. A137–A143
<http://www.ehponline.org/members/2007/115-3/focus.html>

Objectives: By the end of this lesson, students should be able to

1. describe the status of research regarding the association between breast cancer and secondhand smoke;
2. explain how confounding variables make it difficult to link secondhand smoke and breast cancer; and
3. write a letter to an elected official serving in a national capacity.

Class Time: 60–90 minutes

Grade Level: 11–12

Subjects Addressed: Language Arts, Statistics, Health, Biology, Anatomy/Physiology

► **Prepping the Lesson (45 minutes)**

INSTRUCTIONS:

1. Download the entire June 2007 *EHP Student Edition* at <http://www.ehponline.org/science-ed/2007/junfull.pdf> or just the article "Secondhand Suspicions: Breast Cancer and Passive Smoking" at <http://www.ehponline.org/members/2007/115-3/focus.html>.
2. Read the article.
3. Review the Instructions and Student Instructions.
4. Look up addresses for U.S. congressional legislators, if necessary.
5. Make copies of the Student Instructions.

MATERIALS (per student):

- 1 copy of the June 2007 *EHP Student Edition*, or 1 copy of "Secondhand Suspicions: Breast Cancer and Passive Smoking," preferably in color
- 1 copy of the Student Instructions
- Access to computer terminals for typing letters and looking up legislator contact information and other details (optional)

VOCABULARY:

- active smoking
- aneuploid
- breast cancer
- carcinogen
- case-control studies
- cohort
- diploid



- DNA adduct
- ductal breast cancer
- epidemiology
- estrogens
- histopathology
- industrialized country
- karyotypic
- menopausal/premenopausal
- mutation
- prospective cohort studies
- relative risk
- secondhand smoke/passive smoking
- single-nucleotide polymorphism
- sudden infant death syndrome (SIDS)
- toxicology

BACKGROUND INFORMATION:

The article provides sufficient background information for this lesson.

RESOURCES:

Environmental Health Perspectives, Environews by Topic page, <http://ehp.niehs.nih.gov/>. Choose Cancer, Smoking/Secondhand Smoke

English Plus (English language and formatting resource), <http://www.englishplus.com/grammar/00000149.htm>. Link given is specifically for business letter writing

U.S. House of Representatives, Write your representative, <http://www.house.gov/writerep/>

U.S. Senate homepage, <http://www.senate.gov/> (choose "Senators" to obtain contact information)

► Implementing the Lesson

INSTRUCTIONS:

1. Ask students if they know some of the causes of breast cancer. Explain that they will be reading an article and completing an activity about breast cancer. You may or may not choose to ask if any students know someone who has had breast cancer, as this may bring up sensitive information.
2. Ask how many students have written a letter to an elected official. Chances are few have. Probe further about their experience with writing business letters to gauge how much guidance to provide on this portion of the lesson.
3. Hand out the article and the Student Instructions.
4. Have students complete the Student Instructions individually.
5. You may wish to stop students after they complete Step 3 to discuss concepts and their ideas about the article, and to check their understanding before they begin writing the letter.
6. Proofread, correct, and send the students' letters. Await a response, and ask students to bring replies into class.

NOTES & HELPFUL HINTS:

1. The lesson directs students to write to the U.S. Congress, so national funding should be the focus of their letters. The instructor may want to look up the contact information for the local area's senators and representatives in advance of the lesson, if computer access is not readily available for students to do this during the lesson.
2. Students could complete this lesson as homework if the vocabulary wouldn't be too challenging for them.
3. Encourage students to highlight/underline as they read and make notes in the margins. The article is fairly content-dense and it may be easier for students if they can more easily find portions in the text to use as they write their letters.



4. Students may submit a copy of their letter for review before it is sent (and then send after corrections), or they may send their letter and turn in a second copy with the completed Student Instructions.
5. This lesson requires that students send their letters, not merely write them. If your school cannot provide stamped envelopes, it may also be necessary for students to bring a stamped, addressed envelope.
6. The *EHP* Science Education website has several lessons that complement this lesson. “Calculating Your Odds for Disease” (February 2007) asks students to calculate odds ratios based on data from research on smoking and breast cancer; see <http://www.ehponline.org/science-ed/lessons2007.html>. “Risk Factor Roulette” (June 2005) asks students to identify risk factors for several diseases including breast cancer; see <http://www.ehponline.org/science-ed/lessons2005.html>.

▶ Aligning with Standards

SKILLS USED OR DEVELOPED:

- Classification
- Communication (notes, written)
- Comprehension (reading)
- Critical thinking and response
- Research

SPECIFIC CONTENT ADDRESSED:

- Breast cancer
- Secondhand smoke
- Human health
- Letter writing
- Scientific research and funding

NATIONAL SCIENCE EDUCATION STANDARDS MET:

Science Content Standards

Unifying Concepts and Processes Standard

- Systems, order, and organization
- Evidence, models, and explanation
- Change, constancy, and measurement

Science as Inquiry Standard

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Life Science Standard

- The cell
- Molecular basis of heredity
- Matter, energy, and organization in living systems
- Behavior of organisms

Science in Personal and Social Perspectives Standard

- Personal and community health
- Environmental quality
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges

History and Nature of Science Standard

- Science as a human endeavor
- Nature of scientific knowledge



▶ Assessing the Lesson

- Step 2:**
- a. What evidence is cited in the article that shows a connection between exposure to secondhand smoke and the incidence of breast cancer? Describe the scientific studies done that show a connection.
- There are about the same number of studies linking breast cancer to passive smoking as there were linking lung cancer to passive smoking in 1986.
 - More of these studies are statistically significant than were those that looked at lung cancer, and the estimated risk for breast cancer is higher.
 - Several studies show that toxicants from cigarette smoke reach rodent mammary tissue and can impact DNA, the first step in carcinogenesis.
 - Of the more than 50 carcinogens in passive smoke, approximately 20 are mammary carcinogens.
 - Women who are regularly exposed to passive cigarette smoke increase their relative risk of developing breast cancer before age 50 by 68–120%.
 - The biological explanation for how secondhand smoke could cause breast cancer is considered highly plausible.

- b. Does all of the evidence provided in the article indicate a convincing correlation between exposure to secondhand smoke and the incidence of breast cancer?

No, the evidence in the article provides mixed results, some of which support a link between secondhand smoke and cancer and some of which do not. One researcher challenged the results of animal studies linking tobacco smoke to cancer since the animal cancers don't show the same histopathology as those of humans. The 26 epidemiological studies on the topic have mixed results, some of which show no association, some a strong association, and some a weak association. Some researchers question the association of secondhand smoke to breast cancer because active smoking has not yet demonstrated a casual link to breast cancer in epidemiological studies. Active smoking is more likely to cause higher exposures to the chemicals in cigarette smoke and should show an association before secondhand smoke. More recent studies, however, have found elevated risk for breast cancer among smokers.

Explain why you are or are not convinced of a connection.

Answers will vary.

- c. List three or more factors given in the article that could also be variables in determining a connection between exposure to secondhand smoke and breast cancer.
- Alcohol use
 - Duration of exposure
 - Age at exposure
 - Menopausal status
 - Amount of exposure
 - Estrogen levels (hormone replacement therapy)
 - Time between puberty and birth of first child
 - Obesity
 - Place exposed (in the home, workplace, etc.)



d. How does a prospective cohort study differ from a case-control study?

Prospective cohort studies look at a population of individuals at a point in time and follow them over the years into the future to see who does and does not get disease. Exposure histories are recorded over time. Case-control studies look at individuals at a point in time who have the disease and a matched group of similar individuals who do not have the disease. Exposure histories are developed by looking at historical records or asking individuals to recall past events. Findings of cohort studies are generally considered to be stronger, because they determine exposure information before disease onset. This type of study requires more resources, though, and may track participants over a longer period of time. Case-control studies are subject to someone who has developed a disease recalling information correctly, since inclusion in the study is determined after someone has a disease.

Step 3:

a. Identify three factors described in the article that make it difficult to conclude through scientific study that breast cancer may be linked to secondhand smoking.

- There are many possible variables that can impact the occurrence of breast cancer.
- Not all studies investigate the same factors.
- There is not a standard definition for "exposure."
- Not all studies collect data in the same way (use the same questions, methods, or duration of time).
- There is a political interest in making/not making this determination.
- It is difficult to compare rodent results to human females.
- It is not ethical to cause breast cancer in humans, so true manipulation of variables is not possible in human populations.
- Other answers that are well founded may be accepted.

b. Many different scientists are working to determine if there is a higher chance of getting breast cancer due to exposure to secondhand smoke. What institutions are working on this scientific question? Is each a private company, government entity, nonprofit organization, or educational facility? List the institutions and their type.

- American Cancer Society (nonprofit)
- California Environmental Protection Agency Office of Environmental Health Hazard Assessment (government)
- City University of New York (educational)
- Fox Chase Cancer Center (nonprofit) *
- Health Canada Division of Epidemiology and Cancer Prevention (government)
- International Agency for Research on Cancer (nonprofit)
- Johns Hopkins Bloomberg School of Public Health (educational)
- M.D. Anderson Cancer Center, University of Texas (educational) *
- National Cancer Institute (government) *
- National Institute of Environmental Health Sciences (government)
- Northern California Cancer Center (nonprofit) *
- Public Health Agency of Canada (educational)
- University of California, San Francisco, Medical School (educational)
- University of Kansas Medical Center, Department of Pharmacology (educational)
- University of Oxford Cancer Research UK Epidemiology Unit (educational)
- World Health Organization (nonprofit)

An asterisk (*) indicates students will have difficulty determining the affiliation of a particular entity without Internet access, and this should be considered in the assessment.



- c. Government entities receive funding directly from the government based on an annual budget. These budgets may go up or down each year depending on the allocated level of funding. Educational facilities often conduct research using funds from a grant. The grants are normally awarded on a competitive basis. Grants can come from the government or from private funds. How might these methods of receiving funds impact the ability of scientists to carry out experiments?

There is always a limited number of dollars available to conduct health research, and there are many worthy research projects needing funding. Health research dollars must also compete with other needed national, social, political, and research goals; as a result, funding is often decided on the basis of priority. When funds are limited, the number and types of science studies are usually restricted to some degree.

Step 4: Write a letter to your Congressperson that either agrees or disagrees with increasing funds available to do research on the relationship of secondhand smoke to breast cancer incidence. Be sure to cite some of the scientific studies that have already been done on this topic. Give at least three reasons defending your viewpoint. Your letter should be no more than one page, and should be in the proper format for writing a letter.

Responses will vary depending on whether a student agrees with increased funding or not. Assess the letter based on the structure of the letter (format) and inclusion of justification for funding (or not funding) based on at least three points from the article. You could also assess spelling and grammar, if desired. A brief sample follows:

1234 Home Address Way
My Town, US 99999

June 1, 2007

Senator Smith's Address

Dear Senator Smith:

My name is John Doe, and in my high school science class I've recently learned how secondhand smoke might be a cause for breast cancer. We read an article about research that has already been done, and it explains that there are many factors that might show a link, but that more research needs to be done. There are more than 50 different carcinogens in cigarette smoke, and approximately 20 of them cause changes in mammary tissue. Some studies have shown that secondhand smoke is one of many possible causes of breast cancer. Women who regularly encounter secondhand smoke increase their risk of developing breast cancer before age 50 by more than 50% (and some studies suggest up to 120%). I urge you to consider increasing funding for research of this possible link so that a clear answer can be found. Thank you for your consideration.

Sincerely yours,
John Doe

► Authors and Reviewers

Authors: Amy Leonard and Lisa Pitman, Rosenstiel School of Marine and Atmospheric Sciences, University of Miami

Reviewers: Stephanie Bishop, Susan Booker, Erin Dooley, Laura Hemminger, Stefani Hines, Barry Schlegel, and Joseph Tart

Give us your feedback! Send comments about this lesson to ehpscienced@niehs.nih.gov.



Taking Action on Passive Smoking

Step 1: Read the article “Secondhand Suspicions: Breast Cancer and Passive Smoking.” As you read, it may be helpful to highlight portions you think are important or write questions you have in the margins.

Step 2: a. What evidence is cited in the article that shows a connection between exposure to secondhand smoke and the incidence of breast cancer? Describe the scientific studies done that show a connection.

b. Does all of the evidence provided in the article indicate a convincing correlation between exposure to secondhand smoke and the incidence of breast cancer? Explain why you are or are not convinced of a connection.



- c. List three or more factors given in the article that could also be variables in determining a connection between exposure to secondhand smoke and breast cancer.

- d. How does a prospective cohort study differ from a case-control study?

- Step 3:**
- a. Identify three factors described in the article that make it difficult to conclude through scientific study that breast cancer may be linked to secondhand smoking.



- b. Many different scientists are working to determine if there is a higher chance of getting breast cancer due to exposure to secondhand smoke. What institutions are working on this scientific question? Is each a private company, government entity, nonprofit organization, or education-related facility? List the institutions and their type.
- c. Government entities receive funding directly from the government based on an annual budget. These budgets may go up or down each year depending on the allocated level of funding. Educational facilities often conduct research using funds from a grant. The grants are normally awarded on a competitive basis. Grants can come from the government or from private funds. How might these methods of receiving funds impact the ability of scientists to carry out experiments?

Step 4: Often, when people feel strongly about an issue, they contact their local representatives. Depending on the issue, it may be appropriate to contact a local, state, or national representative. These people are elected by voters, whom they represent in governmental decision making. Most research funding comes from the federal government.

Write a letter to your Congressperson that either agrees or disagrees with increasing funds available to do research on the relationship of secondhand smoke to breast cancer incidence. Be sure to cite some of the scientific studies that have already been done on this topic. Give at least three reasons defending your viewpoint. Your letter should be no more than one page, and should be in the proper format for writing a letter.

