Case Teaching Notes

for

"Breast Cancer Risk: Using Real Medical Histories to Rank Genetic and Environmental Influences"

by

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Introduction / Background

This case study takes a multi-faceted approach to explore risk factors for breast cancer. After students complete a preparatory reading assignment, they then assess the medical histories of several women, rank their overall risk for breast cancer, and make recommendations for risk reduction.

This case study was written for an introductory non-science majors class. It has also been used in an introductory science majors biology class and could easily be used in upper division courses (e.g. genetics, physiology) to explore the biological and biochemical basis underlying various risk factors.

The initial idea for the case came from an exploration of the National Cancer Institute's Website (http://www.cancer.gov), which presents an interactive risk assessment tool for various cancers, including breast cancer.

Objectives

The objectives for this case study range from lower level "learn and understand" goals to higher order application and synthesis goals.

Introductory Course Goals:

- To learn about various risk factors for breast cancer and to assess whether a risk factor is controllable or uncontrollable.
- To use provided clinical histories to assess the overall cancer risk of four different women, and then rank these women based on overall breast cancer risk.
- To make recommendations for each woman on how she should act to reduce her breast cancer risk.

Possible Goals for Upper Division Courses (e.g. Genetics, Physiology, Biochemistry):

- To learn about the cellular roles of BRCA1 and BRCA2.
- To articulate the pathways of estrogen synthesis in pre-menopausal and post-menopausal women.
- To understand the basis for oral contraceptives and hormone replacement therapy (HRT).
- To describe the technical aspects of the BRCA1 and BRCA2 gene tests.
- To explain the significance and limitations of positive and negative BRCA1 and BRCA2 gene tests on overall risk of breast and ovarian cancer.
- To search the primary literature for studies that attempt to link epidemiological data on diet and cancer risk to a biological basis underlying such epidemiological observations, then present the key experiments to the class.
- Given a written (narrative) family history, to draw a pedigree for that family and to determine the apparent mode of inheritance (for breast cancer or another type of cancer).

Possible Affective Goals:

- To defend a position on the merits and challenges of genetic testing while taking into consideration factors such as genetic discrimination, insurance issues, what to do with the information, interpersonal dynamics in a family with a strong history of cancer, cost, etc. (This could be accomplished in a debate format.)

- Make a "Health Change Checklist" articulating what personal health and behavioral changes you can make to reduce your breast cancer risk (or general cancer risk). (As this is a personal exercise, it may be best carried out as an individual, reflective assignment.)
- For courses with a service-learning component, students could produce an informational pamphlet on breast cancer risk factors and how screening can be accessed in the local area. (Is there a free screening service offered by the state or county? Is there an information website or "hotline" that could be promoted in the local community?)

Classroom Management

This case study has three components: a preperatory reading assignment (out-of-class), an in-class discussion and analysis, and a follow-up assignment.

Preparatory Reading Assignment

As an understanding of breast cancer risk factors is critical for the in-class risk assessment component, students are given a preparatory reading assignment and a series of specific questions. Students are asked to bring typed answers to the class meeting in which discussion will take place to ensure that they are prepared for full participation. One week should be sufficient to complete the "prep assignment." Answers to these questions are provided in a separate Answer Key.

Various appropriate reading materials are available. We have successfully used "ABC of breast diseases. Breast cancer—epidemiology, risk factors and genetics" (McPherson et al, 2000). This is a review article that is written at a level that should be accessible to a variety of students. In our original class, students already had some background on cancer and associated vocabulary (e.g., hyperplasia, dysplasia, metastasis). Depending on the background of the students, a vocabulary/definition list could be included with the article. However, the reading questions can also be used to help non-science students focus on the "big picture" and not get lost in unfamiliar vocabulary.

In another introductory class (a general introductory biology class for science majors), specific readings from the American Cancer Society have been assigned:

- What are the Risk Factors for Breast Cancer?
  http://www.cancer.org/docroot/CRI/content/CRI_2_4_2X_What_are_the_risk_factors_for_breast_cancer_5.asp
- Do We Know What Causes Breast Cancer?
  http://www.cancer.org/docroot/CRI/content/CRI_2_4_2X_Do_we_know_what_causes_breast_cancer_5.asp

An alternative source for preparatory reading material is the National Cancer Institute (NCI) at http://www.cancer.gov, particularly "What you need to know about breast cancer—Risk factors" at http://www.cancer.gov/cancertopics/wyntk/breast/page4.

In-Class (Group) Activity

The in-class activity can be carried out in a 50-minute session. Students should come to class with their prep assignment completed. The class session begins with an opportunity for students to interact and discuss the prep assignment (approximately 5 minutes). The prep assignment is then collected before the in-class activity begins.

Groups of students are then assigned one of four different "profiles," each in the form of a medical history of a female subject. Note that three of these medical histories are based on actual patients, which contributes to the authenticity of this case. Letting students know that these profiles are based on actual published reports may deepen their interest. However, in our experience, typically students are already quite interested in this topic because of its prevalence in the media and in the population, which means that many students will have had some kind of connection with a person with breast cancer.

In small classes, students can be broken into four groups total, with each group working with one of the four profiles. In larger classes, it may work better to divide students into multiple groups of four, and to have each group work on one of the four profiles (resulting in overlap). Each group can analyze all the aspects of the medical history, and

in larger classes, each group can comment on one aspect of the medical history so that each profile is analyzed in a group-wise fashion.

Each group should review their assigned profile and determine whether each item of the medical history elevates the risk of breast cancer, reduces the risk or has no effect on risk. After approximately 15 minutes each group in turn presents their profile and assessment to the entire class (in large classes, each group may present one aspect of the medical history of a given profile). This should take another 15–20 minutes. Each group then presents their profile to the entire class (e.g. on the blackboard or on paper easel sheets), and reviews the risk contribution of each item of the medical history.

Once all the profiles have been presented and are available to the entire class, the class works together to agree on a ranking of the relative breast cancer risks of the subjects. The ranking requires discussion and evaluation of the individual profiles by the entire class. The lowest risk patient sorts out quite easily, but there should be some discussion about the highest-risk patients. In large classes, the teacher could ask students to vote with their clickers to establish an initial ranking of each subject. These initial rankings could then be followed-up with an in-class discussion.

In our experience with both an instructor-led class and with undergraduate peer-led workshops, students came well prepared to assess the risk factors and had lively and informed discussions about the relative rankings (see Answer Key for assessments and ranking).

Follow-up (Individual) Activity

After the collective ranking and discussion have taken place, students are asked to individually prepare a written recommendation for the profile that they initially reviewed in their group. In a 50-minute class, this can be assigned as a take home assignment. In a 75-minute class, this can be done during the last 15–20 minutes of the class meeting. The recommendations are meant to minimally address both health and behavioral aspects of breast cancer risk reduction, as well as specific screening recommendations, based on the medical history of their particular profile. Students should be encouraged to discuss (as appropriate for the course) screening and screening frequency, behavioral choices (e.g., hormone use, diet and exercise), genetic screening and prophylactic measures (see Answer Key).

Optional

As three of the four profiles used in this case study were based on published reports from the *New England Journal of Medicine*, a brief follow-up was provided to the class during the following class meeting to let them know "what really happened." This follow-up was done at the request of the students, who expressed a desire to know the outcome of each scenario.

Answer Key

Answers to the questions posed in the case study are provided in a separate answer key to the case. Those answers are password-protected. To access the answers for this case, go to the key. You will be prompted for a username and password. If you have not yet registered with us, you can see whether you are eligible for an account by reviewing our password policy and then apply online or write to answerkey@sciencecases.org.

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