



Personal Genetics Education Project

Ethical, Legal and Social Issues in Personal Genetics

Title: Direct-to-consumer genetic testing

Aim: What are the potential benefits of and concerns about genetic tests being sold directly to consumers?

Time: This lesson can be adjusted to fill 2 or 3 classes.

Guiding Questions:

- What motivates people to learn about their DNA? What are some common reactions to the information one can discover?
- If you were to learn about information contained in your genome, could that impact how you think about your identity?
- What are the benefits and challenges of people buying genetic analysis directly from a company, instead of the traditional approach of seeking information through a medical professional?

Learning Objectives:

By the end of the lesson, students will be able to:

- Analyze the benefits and risks of genetic testing.
- Evaluate why people seek genetic testing and genome sequencing.
- Discuss the issues surrounding direct-to-consumer genetic testing.

Materials: Articles and handouts.

Common Core Standards:

RH.9-10.6. Compare the point of view of two or more authors for how they treat the same or similar topics, including which details they include and emphasize in their respective accounts.

RH.9-10.8. Assess the extent to which the reasoning and evidence in a text support the author's claims.

RH.9-10.9. Compare and contrast treatments of the same topic in several primary and secondary sources.

RH.11-12.2. Determine the central ideas or information of a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas.

Background information and note to teachers:

Several years ago, a small number of companies in the United States began selling DNA testing kits directly to consumers (referred to as DTC) via the Internet. This market was made possible, in part, by the decreasing costs of genome analysis. In 2014, DTC testing generally does not produce a full genome sequence, like the Human Genome Project; rather, companies often look at sites in the genome that commonly differ between individuals, known as single nucleotide polymorphisms (SNPs). Companies offer a broad array of tests that report on a person's ancestry and health, as well as a number of other traits. Examples range from a person's ability to taste bitter flavors or the photic sneeze reflex (uncontrollable sneezing when exposed to bright light) to risk for developing heart disease or diabetes.

Whether people should be able to access their genetic information directly from a company is at the center of an on-going debate amongst doctors, patients, ethicists, politicians and regulatory bodies, such as the United States Food and Drug Administration (FDA). Some people with concerns about DTC testing think that people should only learn about their DNA from a doctor or genetic counselor to ensure that the results are clearly explained. Others argue that people should only learn about risks for disease that are "medically actionable," i.e. when screening, therapeutics or a change in lifestyle may prevent or treat the disease. People who support DTC testing often find these views paternalistic and think that people have a right to learn about their own DNA if they choose, even if the information they learn is not medically actionable or if the interpretation might change over time.

Some of the original concerns about DTC genetic testing have subsided over the years, while others persist. It was originally thought that health insurers might use the results of a genetic test to deny coverage or raise premiums or that employers could fire people based on their genetic information. Some of these fears were allayed in 2008 when the United States Congress passed the Genetic Information Nondiscrimination Act (GINA), prohibiting these possibilities. Questions linger about the absence of protections for long-term care and life insurance as well as about the accuracy and usefulness of the tests. Still, many companies continue to report the growth of their customer base.

It is an on-going question of whether DTC testing should be subject to the rules and safeguards associated with medical testing devices. In 2010, the FDA held hearings to explore the issue of regulation of genetic testing kits. Though reputable companies use laboratories that have been certified under CLIA (Clinical Laboratory Improvement Amendments), the FDA had concerns about the accuracy of information and counseling given to consumers. The FDA sent letters to a number of companies, and, as a result, some

companies left the market or shifted their strategy to require a physician to order the test. In 2013, the FDA ordered one of the leading DTC genetic testing companies to halt the sale of its product that returned health information to customers. In large part, this was because of the ambiguity of whether the genetic testing kit should be considered a medical device. As a medical device, it would be subject to the extensive rules and regulations that oversee safety and quality. In 2014, there is little agreement on the path forward for DTC testing. As companies close in on the goal of sequencing an entire human genome for \$1,000 (US), the technology to analyze DNA continues to develop more rapidly than the frameworks for how to access and share this information.

This lesson provides students the opportunity to explore the excitement and challenges related to the genetic testing industry. How do consumers react to genetic information gleaned from DTC services? What information can be learned through a DTC test, and do consumers need or want a doctor or genetic counselor to access this information?

Here is an outline of the resources and activities in this lesson.

1. Reading for students (page 3)
2. Do Now exercise (pages 3-4)
3. "Panel of Experts" debate (pages 4-7, handouts on pages 9-11)
4. Homework assignment (page 7, handout on page 12)
5. List of additional resources (pages 7-8)
6. Short quiz (answer key on page 8, handout on page 13)

Reading for students:

For homework, students should read John Tierney's January 2011 *New York Times* article, "[Heavy Doses of DNA Data, With Few Side Effects](#)." The article discusses the impact on people when they learn about their genetic information, including whether or not they have a genetic predisposition for diseases such as Alzheimer's or breast cancer. Students will use the article as the basis for an in-class writing exercise as well as a debate.

Activities: Do Now exercise (10 minutes), "Panel of Experts" debate (65-70 minutes)

Part 1: Do Now exercise - Homework response (10 minutes)

Students write about and then discuss the *New York Times* homework article using a specific strategy, called 3-2-1, from Facing History and Ourselves. This technique will clarify points from the article and inform any students who have not done the reading.

Have students answer the following questions in their journal or on a separate piece of paper. Then, spend a few minutes discussing their responses as a class to ensure they understand the main ideas of the article.

- Three things that they learned from the article.
- Two questions that they still have.
- One aspect of the text that they found interesting or surprising.

Part 2: Panel of experts testifying before Congress (65-70 minutes)

One of the central objectives of this lesson is for students to think about the ways people can learn about their DNA and the implications for themselves, their families and society. For this activity, students will research different opinions about DTC genetic testing and role-play a Congressional hearing.

The hearing is for Senators to learn about the potential benefits and implications of genetic analysis as they decide whether new laws governing the sale of genetic tests are needed. Students will be assigned a role with a specific viewpoint and an accompanying article (or more than one, if time allows). After researching their positions, students will testify before Congress using a variation on a debate format. Students will debate the various perspectives around learning about one's DNA and what role, if any, the government need to play in overseeing safety and reliability of genetic testing. Even though students become an "expert" on their perspective, they should listen carefully during debate to hear all sides before forming their own opinions. The discussion following the debate will allow them to voice their personal opinions based on the research they have done and new information they have.

Step 1: Assigning characters

Break students into 7 groups of 3-4 students. Assign each group of students to one of the seven characters from the list below, and distribute the handout on pages 9-10 that explains each character in more detail. Each "character" comes with a pre-assigned perspective on the issues that the group will represent in the debate. This role-play has a large number of characters that can be modified depending on class size; e.g. you could easily have one Senator instead of two.

The characters are as follows:

Characters who support direct-to-consumer (DTC) genetic testing (Panel A):

1. Doctor A - Believes DTC testing is beneficial
2. Patient A – Wants access to DTC genetic testing
3. Founder of a DTC company
4. Senator A – Leaning toward supporting DTC testing; questions witnesses

Characters who are against or doubtful of DTC genetic testing (Panel B):

5. Doctor B - Thinks genetic testing through a doctor is valuable, but is skeptical of DTC testing
6. Patient B – Against DTC genetic testing
7. Senator B – Is skeptical of DTC tests; questions witnesses

Step 2: Researching positions (20 minutes)

Next, distribute the articles, listed below, that each student needs to read to learn about the issues they will be discussing. Assign students the article(s) that will provide information about their point of view; if time allows, assign at least one reading with the opposite point of view. If you only have 2 days, assign one reading; if you have 3 days, include additional readings.

Also, distribute the Congressional Testimony worksheet (page 11 of this document) for students to complete while doing their research and hand in after the debate.

Articles in support of DTC genetic testing (Panel A):

- [Genetic testing brings heart hope](#) (video), *BBC News*, 2010 (Doctor A, DTC Founder)
- [How Do People Respond to Bad Genetic News? Just Fine.](#), *Singularity Hub*, 2010 (Doctor A, Patient A)
- [Learning of Alzheimer’s Risk Seems To Do No Harm](#), *New York Times*, 2009 (DTC founder, Patient A)
- [Genetic Testing Raises Questions of Patients' Reactions](#), *News & Observer*, 2010 (Patient A, DTC Founder)
- [Angelina Jolie’s double mastectomy highlights tough decisions on genetic screening](#), *Boston Globe*, 2013 (Patient A, Senator A)
- [American Medical Association: You Can't Look At Your Genome Without Our Supervision](#), *Wired*, 2011 (Senator A, Doctor A)

Articles against/doubtful of DTC genetic testing (Panel B):

- [What are the risks and limitations of genetic testing?](#), Genetics Home Reference, U.S. National Library of Medicine, updated 2014 (Doctor B)
- [American Medical Association letter to FDA](#), 2011 (Doctor B)
- [It's Legal For Some Insurers To Discriminate Based On Genes](#), *National Public Radio*, 2013 (Patient B, Doctor B)
- [Genetic Testing for Women: When DNA Screenings Lead To Devastating Mistakes](#), *Huffington Post*, 2013 (Doctor B, Senator B, Patient B)
- [Gene test mix-up brings scrutiny to industry](#), *San Francisco Chronicle*, 2010 (Senator B, Patient B)

Step 3: Congressional Testimony (40 minutes)

Each group of students (or the teacher) will choose one person to be the main speaker who must be able to answer the questions asked by the senators. You may want to assign the other students in the group to act as "aides," so that they can add to what the speaker says. This will hold all students accountable for the work and also ensure that the answers are as thorough as possible.

Below is our suggested format to assign roles for and structure the debate. To create other roles for students within each group, refer to [Assigning Roles](#) from Facing History and Ourselves.

Opening Statement Presenter:

One speaker from each group creates a short opening statement, but does not offer specific information. For example, a speaker from Panel A might say, "We support DTC testing because of points X, Y and Z." The teacher may want to identify one person as a Congressional aide who introduces the topic as part of the testimony.

Topic Presenters:

These are two or three speakers who create and present the main arguments for the group. Each presenter provides details to support their argument; the goal of such details is to provide evidence to support points X, Y and Z. Each presenter covers a different aspect of the issue.

Questioners:

This role can be formalized or the teacher can open up a period for questions from the other students in the class.

Closing Statement Presenter:

One speaker from each group presents a closing statement. This presenter summarizes the main arguments and does not present new information.

Audience:

Some teachers choose to invite another class (often from a different grade, so they are more impartial) to watch the debate and vote on which side was more persuasive. If that is not possible, the students in the class can vote on whether DTC genetic testing should be allowed, after the teacher explains why they should be impartial in their judgment.

Step 4: Wrap-up (5-10 minutes)

After students have testified in the role of their character, give them the opportunity to discuss their own reactions and opinions to the topic. Ask if they have changed their minds from what they originally believed and why.

Homework assignment:

Have students write one page (or longer) explaining their personal opinion about whether they think the benefits of knowing about one's genetic predisposition toward disease outweigh the risks. Students should use the information learned in preparing for and participating in the debate to explain their argument. They also should address the following questions, included on a handout on page 12:

1. Would you want to know more about your own genetic make-up? Why do you or do you not want to know this information?
2. Should people be allowed to order a direct-to-consumer kit to learn about their genetic make-up on their own, or should people have to go through a doctor? Explain.
3. Should the government regulate (create rules for) the sale of direct-to-consumer genetic tests? Explain.

Additional resources for teachers:

["Cancer Free at 33, but Weighing a Mastectomy,"](#) September 2007, by Amy Harmon, *New York Times*.

["My DNA Results Spur Alzheimer's Anxiety at \\$12,000 Cost,"](#) November 2012, by John Lauerma, *Bloomberg*.

["What can we learn from the human genome?,"](#) a series on genetics, *Slate*.

["Inside 23andMe founder Anne Wojcicki's \\$99 DNA revolution,"](#) October 2013, by Elizabeth Murphy, *Fast Company*.

["My risk-benefit ratio for personal genetics,"](#) January 2014, by Virginia Hughes, *Phenomena*, *National Geographic*.

"Direct-to-consumer genetic testing" quiz answer key (see page 13 for quiz):

1. C
2. F
3. T
4. Reasons to be excited to learn about one's DNA might include:
 - Learning information about traits or health risks could enable a person to act in a positive way to prevent illness or seek out early treatments.
 - Learning about one's ancestry, particularly for people who are adopted or are disconnected from biological relatives, might reveal interesting histories that were previously unknown.

Reasons to be hesitant to learn about one's DNA might include:

- Learning health information that is not easily acted upon or treated might be stressful.
- Learning DNA-based ancestry information might contradict one's personal or cultural understanding of family history.

Student handout – what is your role in the debate?

Panel A:

1. **Doctor A** believes direct-to-consumer (DTC) genetic testing is beneficial to patients.

- How could DTC tests improve healthcare for patients?
- How can these tests give people a better understanding of their genetics and their health?
- How might DTC testing save money and lives?

2. **Patient A** supports DTC genetic testing.

- How can discovering your risk for developing a disease help you to prepare before you start to have symptoms (if you ever do)?
- Should Congress be allowed to say you cannot have direct access to your own genetic information? If you cannot have access, who can?

3. **The founder of a DTC company** thinks that personal genetics is the future of medicine and that DTC testing creates informed, engaged citizens who can partner with their healthcare professionals to improve their lives and health.

- Why should reputable companies like ours be scrutinized because some other DTC companies might be unethical or make claims they cannot prove?

4. **Senator A** is leaning toward supporting DTC tests and questions witnesses.

- Do we have the right to say people cannot learn about their own genetic information? Is it patronizing to think adults who seek this information cannot handle what they learn?

Panel B:

1. **Doctor B** thinks genetic testing through a doctor is worthwhile, but is doubtful about the usefulness of direct-to-consumer (DTC) kits. Doctor B knows that many doctors are unprepared to interpret genetic information*.

- Will patients be able to understand the results without help from a doctor?
- How helpful is it to know about genetic risks from a test? Family medical history is still the best tool to predict health risks.
- Since many common diseases or conditions are not caused by a single genetic variant (change), how useful do you think these tests are for most people?

*An article by Klitzman et al, entitled "Attitudes and Practices Among Internists Concerning Genetic Testing" in the February 2013 issue of *Journal of Genetic Counseling*, explored the readiness of internists to provide genetic information to patients. The journal is not accessible to the public so relevant statistics are included here:

"We surveyed 220 internists from two academic medical centers about their utilization of genetic testing. Rates of genetic utilizations varied widely by disease. Respondents were most likely to have ordered tests for Factor V Leiden (16.8%), followed by Breast/Ovarian Cancer (15.0%). In the past 6 months, 65% had counseled patients on genetic issues, 44% had ordered genetic tests, 38.5% had referred patients to a genetic counselor or geneticist, and 27.5% had received ads from commercial labs for genetic testing. Only 4.5% had tried to hide or disguise genetic information, and <2% have had patients report genetic discrimination. Only 53.4% knew of a geneticist/genetic counselor to whom to refer patients. Most rated their knowledge as very/somewhat poor concerning genetics (73.7%) and guidelines for genetic testing (87.1%). Most felt needs for more training on when to order tests (79%), and how to counsel patients (82%), interpret results (77.3%), and maintain privacy (80.6%)."

2. **Patient B** opposes DTC genetic testing.

- Imagine a person who wants to know about his or her DNA finds out he or she has a high likelihood to develop a serious disease. How might this person react to this news without it being explained by a doctor?
- What if my family member takes a test and finds out something that impacts me, too, but I do not want to know?

3. **Senator B** is skeptical of DTC tests.

- How can we protect consumers from being harmed or cheated by these tests?
- How do we know the tests are accurate if they are not regulated?
- Even though Congress passed the Genetic Nondiscrimination Information Act (GINA), might health insurers or employers still try to discover genetic information about people? Could this hurt people trying to buy life or long-term disability insurance, both of which are not covered by GINA?

Name _____

Date _____

Congressional Testimony worksheet

Arguments that support my group's position	Arguments that oppose my group's position	Supporting details from the article(s) we read
1.	1.	1.
2.	2.	2.
3.	3.	3.

Student Handout: Homework assignment

Please write a one page (or longer) explaining your personal opinion on whether or not you think the benefits of knowing about one's genetic predisposition toward disease outweigh the risks. Please use the information learned in preparing for and participating in the debate to explain your argument. Your essay should address the following questions:

1. Would you want to know more about your own genetic make-up? Why do you or do you not want to know this information?
2. Should people be allowed to order a direct-to-consumer kit to learn about their genetic make-up on their own, or should people have to go through a doctor? Explain.
3. Should the government regulate (create rules for) the sale of direct-to-consumer genetic tests? Explain.

Name _____

Date _____

“Direct-to-consumer genetic testing” quiz

1. Deciding to learn about your own DNA is a) not possible until you are 18
b) can only be undertaken with your doctor c) is increasingly easier because of technology advances and dropping costs d) is a good way to find out all the diseases you are ever going to get in your lifetime.
2. When a person finds out they have an increased risk for Alzheimer’s disease, this information always causes long-term mental harm to the person. T/F.
3. Genetic testing kits that consumers can buy online (called direct-to-consumer tests) offer people the chance to discover information about their potential risk for certain diseases and information about their ancestry. T/F
4. Describe one reason why an individual might be excited to learn about his or her DNA and one reason why that person might have some hesitations?