Diabetes in the Family: A Case Study

by Tyrell Hardtke

University of Washington

In collaboration with the Centers for Disease Control and Prevention's
Paula Yoon

Students examine a case study of a woman with a family history of diabetes and create a "family health portrait" that will assess her risk of developing type 2 diabetes. Using the family health portrait to record the woman's family history, students identify her genetic, behavioral, and environmental risk factors for type 2 diabetes and make recommendations for lifestyle changes.

Disclaimer: The findings and conclusions in this report are those of the author(s) and do not necessarily represent the views of the Centers for Disease Control and Prevention.

Diabetes in the Family: A Case Study

by Tyrell Hardtke
University of Washington
Seattle, Washington

Summary

Students examine a case study of a woman with a family history of type 2 diabetes and create a "family health portrait" that will assess her risk of developing diabetes. Using the family health portrait to record the woman's family history, students identify her genetic, behavioral, and environmental risk factors for type 2 diabetes and make recommendations for lifestyle changes.

Learning Outcomes

- Students will be able to assess a person's family health history and identify risk factors for a specific disease.
- Students will be able to make recommendations for reducing a person's risk of developing type 2 diabetes.
- Students will be able to create a model demonstrating the interaction of modifiable and non-modifiable risk factors.

Materials

1. "My Family Health Portrait" program accessible from the internet.
2. Computers with Internet access (one for each student and teacher)
3. LCD projector
4. Whiteboard and pens

Total Duration

One hour, 20 minutes

Note to teachers: This lesson plan discusses family history and its relationship to diabetes. Please note that family history can be a sensitive topic. Some students might not know or have access to their family health history. Other students might not wish to share their family history with others. It is important to be sensitive to individual student needs when discussing this topic. Because of these considerations, this lesson plan uses a fictional case study for family history discussions. An optional extension activity that allows students to analyze their own family history is included and can be used at the teacher's discretion.

Procedures

Step One
Teacher Preparation
The teacher should access the "My Family Health Portrait" program on each computer and print copies of the "Diabetes Case Study" (Step 3) and the "Risk Factors and Recommendation" worksheets (Step 4) that will be used with this tool. For background knowledge about family history and its importance in public health, review the "Family History and Type 2 Diabetes" presentation in Step 2. Make sure that the PowerPoint presentation is ready to be shown, that the LCD projector has been warmed up, and that one copy of the "Family History Skeleton Notes" has been made for each student for the direct instruction portion of the lesson. For the Introduction, the teacher should write the

three essential questions on the board that will be used in the "Think-Pair-Share" activity. Finally, copies of the extension activity should be printed, if necessary.

Web Resources
Title: HHS- U.S. Surgeon General's Family Health Initiative
URL: http://www.hhs.gov/familyhistory/
Description: This Web site from the U.S. Department of Health and Human Services provides links to the "My Family Health Portrait" program or a paper version of the program.

Title: CDC's Family History Website for the Public
URL: http://www.cdc.gov/genomics/public/famhistMain.htm
Description: This Web site from the Centers for Disease Control and Prevention has materials about family history for the general public. There is a fact sheet in English and Spanish that might be particularly useful for this lesson plan.

Title: National Diabetes Education Program: School Personnel
URL: http://ndep.nih.gov/resources/school.htm
Description: This Web site from the National Institutes of Health has materials about preventing and dealing with diabetes designed especially for school personnel. There is a tip sheet available at this site entitled "Tips For Kids: Lower Your Risk For Type 2 Diabetes" that would be particularly useful for this lesson plan.

Introduction   **Duration: 10 minutes**
Students share their ideas regarding three essential questions through a "Think-Pair-Share" activity. First, students think about and write down answers to the following three questions:
- Think about your family and friends. What does it mean when someone says that they have type 2 diabetes and it runs in their family?
- If type 2 diabetes runs in a person's family, does that mean they will definitely get it?
- What other factors should be considered?

After three minutes of thinking and recording, students discuss their responses with the student sitting next to them for two minutes. Once students finish discussing, they share their ideas with the whole class during a 3-5 minute discussion. To ensure equitable participation, the teacher calls on a random selection of students. This activity will smooth the transition into content knowledge, and allows the teacher to informally assess pre-existing student knowledge about family history and type 2 diabetes.

Step 2   **Duration: 15 minutes**
Once students have shared their views on the essential questions, they will view a brief PowerPoint presentation and take notes. The teacher can use the "Skeleton Notes" worksheet provided if a more structured format for note-taking is desired. Also, the presentation will describe the prevalence of diabetes, the risk factors for developing type 2 diabetes, and the effects of type 2 diabetes so that students can describe risk factors and health recommendations for this lesson's case study. The presentation will discuss family history in relation to type 2 diabetes and discuss the interaction of genetic, environmental, and behavioral risk factors for developing a disease.

Supplemental Documents
<u>Title:</u> Family History and Type 2 Diabetes
<u>Description:</u> This PowerPoint presentation provides student-centered information about diabetes, its treatment and prevention, and the relationship of family history and type 2 diabetes.

<u>Title:</u> Skeleton Notes
<u>Description:</u> This Word document allows students to fill in notes from the PowerPoint presentation as they listen to it. The skeleton notes can be used as a modification for students who need assistance with note-taking, or as a tool to keep the whole class on task.

Step 3   **Duration: 20 minutes**
Next, students will examine one family's risk for diabetes by using a case study. First, have students read the "Diabetes Case Study" for Tina Santiago, a woman with a family history of diabetes. Next, direct students to enter Tina's family history information from the case study into "My Family Health Portrait", an Internet public health tool. This tool will create Tina's primary and secondary family pedigree. If necessary, the teacher can demonstrate the use of "My Family Health Portrait", before students begin.

Web Resources
<u>Title:</u> HHS- U.S. Surgeon General's Family History Initiative
<u>URL:</u> http://www.hhs.gov/familyhistory/
<u>Description:</u> This Web site from the U.S. Department of Health and Human Services includes information about the Surgeon General's Family History Initiative and provides links to the "My Family Health Portrait" program or a paper version of the program.

<u>Title:</u> Diabetes Case Study
<u>URL:</u> http://www.hhs.gov/familyhistory/docs/DiabetesCaseStudy.pdf
<u>Description:</u> This online case study from the U.S. Surgeon General's Family History Initiative includes information about Tina Santiago, a woman with a family history of type 2 diabetes. The case study includes a family health history and pedigree, and recommendations to help lower Tina's risk of developing type 2 diabetes.

Step 4   **Duration: 20 minutes**
Using the diabetes case study, the "Additional Information about Tina" handout, the PowerPoint presentation, and provided Web sites, ask students to determine what risk factors for type 2 diabetes Tina possesses and make recommendations for her to lower her risk. Have students use the American Diabetes Association's "Diabetes Risk Test" (a link to the test is provided in the Web Resources section for this step. Her risk factors will include genetic, environmental, and behavioral components, but recommendations should only address the modifiable components – the environmental and behavioral factors.

Web Resources
<u>Title:</u> Diabetes Risk Test
<u>URL:</u> http://www.diabetes.org/risk-test.jsp
<u>Description:</u> This Web site from the American Diabetes Association features a test that can be used to assess a person's risk of developing type 2 diabetes.

Students will visit this Web site and use information from the case study in order to complete the "Risk Factors and Recommendations" worksheet.

Title: Diabetes, Family History, and Genetics
URL: http://www.diabetes.org/genetics.jsp
Description: This Web site provides information about genetic and environmental risk factors associated with type 1 and type 2 diabetes. Students will visit this Web site in order to complete the "Risk Factors and Recommendations" worksheet.

Title: Risk Factors for Type 2 Diabetes
URL: http://diabetes.niddk.nih.gov/dm/pubs/riskfortype2/index.htm#7
Description: This Web site provides information about risk factors, prevention, and treatment of type 2 Diabetes. Students will visit this Web site in order to complete the "Risk Factors and Recommendations" worksheet.

Title: Tips for Controlling Diabetes
URL: http://www.ndep.nih.gov/diabetes/pubs/TipsFeel_Eng.pdf
Description: This Web site provides information about monitoring and controlling the "ABC's" of diabetes through realistic lifestyle changes. Students will visit this Web site in order to complete the "Risk Factors and Recommendations" worksheet.

Supplemental Documents
Title: Additional Information about Tina
Description: This Word document provides additional information about Tina's behavioral and environmental risk factors to enable students to assess her modifiable risk factors.

Title: Risk Factors and Recommendations Worksheet
Description: This Word document allows students to synthesize Tina's risk factors for developing type 2 diabetes and to make justified recommendations for treatment and prevention.

Title: Risk Factors and Recommendations Answer Key
Description: This Word document serves as a tool for the teacher to assess student progress on the Risk Factors and Recommendations Worksheet.

Conclusion   **Duration: 15 minutes**
Students assist the teacher in creating a type 2 diabetes risk triangle for Tina using the information provided about her genetic, behavioral, and environmental risk factors. Draw a triangle on the board and fill in student responses at each appropriate point. To avoid repetition, use a "Scattergories" format in which students may only add new information to the model and may not repeat each other. Call on a random assortment of students to add information to the triangle until all risk factors are included. For each risk factor mentioned, elicit verbal student recommendations to reverse the effects of the factor. Through class creation of this family history model, the teacher can informally assess student understanding of the interplay of risk factors, as well as effective changes for modifiable factors. The teacher can access a sample of the model by opening the "Sample Model of Tina's Type 2 Diabetes Risk" document.

Supplemental Document
Title: Sample Model of Tina's Type 2 Diabetes Risk
Description: This PowerPoint slide provides a sample model for the teacher to use when explaining the model assignment to students.

Assessment

Students are assessed in two steps of this lesson. First, students complete and are graded on the "Risk Factors and Recommendations" worksheet for Tina. This worksheet is graded using the "Risk Factors and Recommendations Answer Key" (Step 4). Then, student understanding is informally assessed using the risk triangle model they create during the conclusion.

Modifications

Extension
Students could use their knowledge of family history and risk factors to analyze their own risk for type 2 diabetes or another disease or condition. Specifically, students could create a personal pedigree using "My Family Health Portrait" software, analyze their risk for the chosen disease, and make a commitment to combat one risk factor through a lifestyle change. Students could fill out the 'Personal Family History Worksheet' and turn it in as an extension activity. Please note that parents might need to sign a waiver before students participate in this activity. Additionally, please note that family history can be a sensitive topic. Some students might not know or have access to their family health history. Other students might not wish to share their family history with others.   It is important to be sensitive to individual student needs when discussing this topic, and to keep any information that is collected private.

Web Resources
Title: Diabetes Risk Test
URL: http://www.diabetes.org/risk-test.jsp
Description: This Web site from the American Diabetes Association features a test that can be used to assess a person's risk of developing type 2 diabetes. Students can use this Web site to complete their "Personal Family History Worksheet."

Title: HHS- U.S. Surgeon General's Family Health Initiative
URL: http://www.hhs.gov/familyhistory/
Description: This Web site from the U.S. Department of Health and Human Services includes information about the Surgeon General's Family Health Initiative and provides links to download the "My Family Health Portrait" program or a paper version of the program.

Title: Risk Factors for Type 2 Diabetes
URL: http://diabetes.niddk.nih.gov/dm/pubs/riskfortype2/index.htm#7
Description: This Web site provides information about risk factors, prevention, and treatment of type 2 diabetes. Students can use this Web site to complete their "Personal Family History Worksheet."

Title: Tips for Controlling Diabetes
URL: http://www.ndep.nih.gov/diabetes/pubs/TipsFeel_Eng.pdf
Description: This Web site provides information about monitoring and controlling the "ABC's" of type 2 diabetes through realistic lifestyle changes. Students can use this Web site to complete their "Personal Family History Worksheet."

Supplemental Documents
Title: Personal Family History Worksheet
File Name: Personal Health Portrait.doc
Description: Students will complete this worksheet to assess their own risk for diabetes or another disease or condition. This activity is completed as an extension of other assignments completed during the lesson. Please note that no answer key is provided for this worksheet, as answers are highly individual. The family health portrait and risk analysis created for Tina in this lesson plan can serve as an example. Point values are included on the worksheet.

Other Modifications
Skeleton notes are provided for students who struggle with note-taking, or have difficulty staying on task.

Title: Skeleton Notes
File Name: Family History Skeleton Notes.doc
Description: This Word document allows students to fill in notes from the PowerPoint presentation as they listen to it. The skeleton notes can be used as a modification for students who need assistance with note-taking, or as a tool to keep the whole class on task.

Education Standards

National Science Education Standards

SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES, CONTENT STANDARD F:
As a result of activities in grades 5-8, all students should develop understanding of

- **Personal health**
- **Populations, resources, and environments**
- Natural hazards
- **Risks and benefits**
- Science and technology in society

LIFE SCIENCE, CONTENT STANDARD C:
As a result of their activities in grades 5-8, all students should develop understanding of

- **Structure and function in living systems**
- **Reproduction and heredity**
- **Regulation and behavior**
- Populations and ecosystems
- Diversity and adaptations of organisms

State Standards

EALR 1.2.8: Analyze how the human organ systems regulate growth, development, and life functions.

EALR 2.1.4: Analyze how physical, conceptual, and mathematical models represent and are used to investigate objects, events, systems, and processes

EALR 3.1.1: Analyze local, regional, national, or global problems or challenges in which scientific design can be or has been used to design a solution.

<u>**Skeleton Notes for Type 2 Diabetes and Family History PowerPoint**</u>

Diabetes in the Family: A Case Study
Tyrell Hardtke, CDC's 2005 Science Ambassador Program

Slide 1: Title Slide

Slide 2: Today's Question [no notes]

Slide 3: Overview [no notes]

Slide 4: What is Diabetes?
Diabetes is a disease in which a person's _____ are too _____.
Type 1 =
Type 2 =

Label the process shown on the overhead:

If your brother (shown above) has type 1 diabetes, what part of the picture would change?
Answer:
How about if she has type 2?
Answer:

Slide 5: Who Has Diabetes?
About _____ percent of the U.S. population had diabetes in 2005. That's _____ people!
About _____ percent of people with diabetes have type 1 diabetes, and about _____ percent have type 2.

Slide 6: What are the risk factors for type 2 diabetes?
List 5 risk factors:

Slide 7: **How Bad is Type 2 Diabetes, Really?**
It increases your risk of _____about two times.
Other complications are _____, _____, _____, _____ and _____.

Slide 8: How Can We Treat and Prevent Diabetes?
Diabetes can be treated with _____ and _____ changes.
One medication that must be used for type 1 diabetes is _____. Why is that medication used? Answer: _____
For type 2 diabetes, medications that _____ or _____ can help.
To see if we are at high risk for type 2 diabetes, we can see if it is part of our _____. If it is, we can get frequent _____ check-ups and make smart _____ and _____ choices.

Slide 9: What Do You Mean "It Runs In the Family?"
If a _____ runs in your family, it is part of your _____.
Your risk of developing a disease is a combination of _____, _____, and _____.
Some combinations put you _____ for developing certain diseases.

Slide 10: The Risk Triangle
You can think of your risk of developing a disease as a triangle, with your _____, _____, and _____ all influencing your risk.
Some examples of how your behavior might influence your risk of developing a disease are _____ and _____.
Some examples of how your environment might influence your risk of developing a disease are _____ and _____.

Slide 11: Using Family History for Prevention
Environment and behavior are _____ risk factors.
Genetics is a _____ risk factor.
You can prevent disease by changing _____ risk factors.
Example: You are at high risk for lung cancer. What kind of modifiable risk factor could you change to lower your risk of getting it? How could you do that Answer:

Slide 12: Summary [no notes]

<u>**Additional Information about Tina**</u>

Diabetes in the Family: A Case Study
Tyrell Hardtke, CDC's 2005 Science Ambassador Program

Pretend you are Tina's doctor. After discussing her family history with her in your office, you know that to assess her risk of developing type 2 diabetes you need to find out what Tina's behavioral and environmental risk factors are. What sorts of things would you like to know about Tina?

You talk with Tina and she tells you that she knows her diet could be healthier. She says she hasn't been eating very many fruits and vegetables lately, and she also tells you that she doesn't get a lot of physical activity in a normal day. She would like to go out for a walk each day after dinner, but she lives in a neighborhood that is a high-traffic area and doesn't have any sidewalks. You weigh Tina and measure her height. She weighs 120 pounds and is 5'1" tall.

Tina asks you what her risk of developing type 2 diabetes is and wants to know how she can reduce her risk.

Risk Factors and Recommendations

Diabetes in the Family: A Case Study
Tyrell Hardtke, CDC's 2005 Science Ambassador Program

Directions: Pretend you are Tina's doctor. After discussing her family and personal health history with her in your office, you decide to further examine Tina's prognosis. To do so, answer the following questions:

1. What are Tina's risk factors for developing type 2 diabetes?

    Genetics:

    Behaviors:

    Environment:

2. Based on the above risk factors, is Tina at higher risk for developing type 2 diabetes? Explain your answer.

3. Make three recommendations for lowering Tina's risk of developing type 2 diabetes:

4. As Tina's doctor, what things can you do to help Tina monitor her health more closely?

1. What are Tina's risk factors for developing type 2 diabetes? (____/5 points)
Genetics:
-Tina's brother developed type 2 diabetes at age 38. Her uncle developed type 2 diabetes in his 40s, and her grandmother developed type 2 diabetes in her 50s. Tina is 36 years old, so she is getting closer to the ages at which her relatives developed diabetes.

Behaviors:
-Tina doesn't get very much physical activity on most days.
-Tina's diet does not include very many servings of fruits and vegetables.

Environment:
-Tina lives in an area with a lot of traffic and no sidewalks. It is difficult for her to be physically active in her neighborhood.

2. Based on the above risk factors, is Tina at higher risk for developing type 2 diabetes? Explain your answer. (____/5 points)
Yes. Tina has a family history of type 2 diabetes, with a brother, an uncle, and a grandparent developing the disease. Therefore, she could be genetically predisposed to developing type 2 diabetes. Also, Tina is physically inactive and her diet is not as healthy as it could be. It is difficult for her to be physically active in her neighborhood. All of these risk factors combined put Tina at a higher risk for developing type 2 diabetes.

3. Make five recommendations to lower Tina's risk for developing type 2diabetes. (____/5 points)
Maintain a healthy weight
Eat at least 5 servings of fruits and vegetables a day
Limit intake of saturated fats, particularly fats from animal products
Be moderately active for at least 30 minutes on 5 or more days a week, or vigorously active for at least 20 minutes on 3 or more days a week
Do not smoke
Limit to one alcoholic drink per day

4.   As Tina's doctor, what things can you do to help Tina monitor her health more closely? (____/5 points)
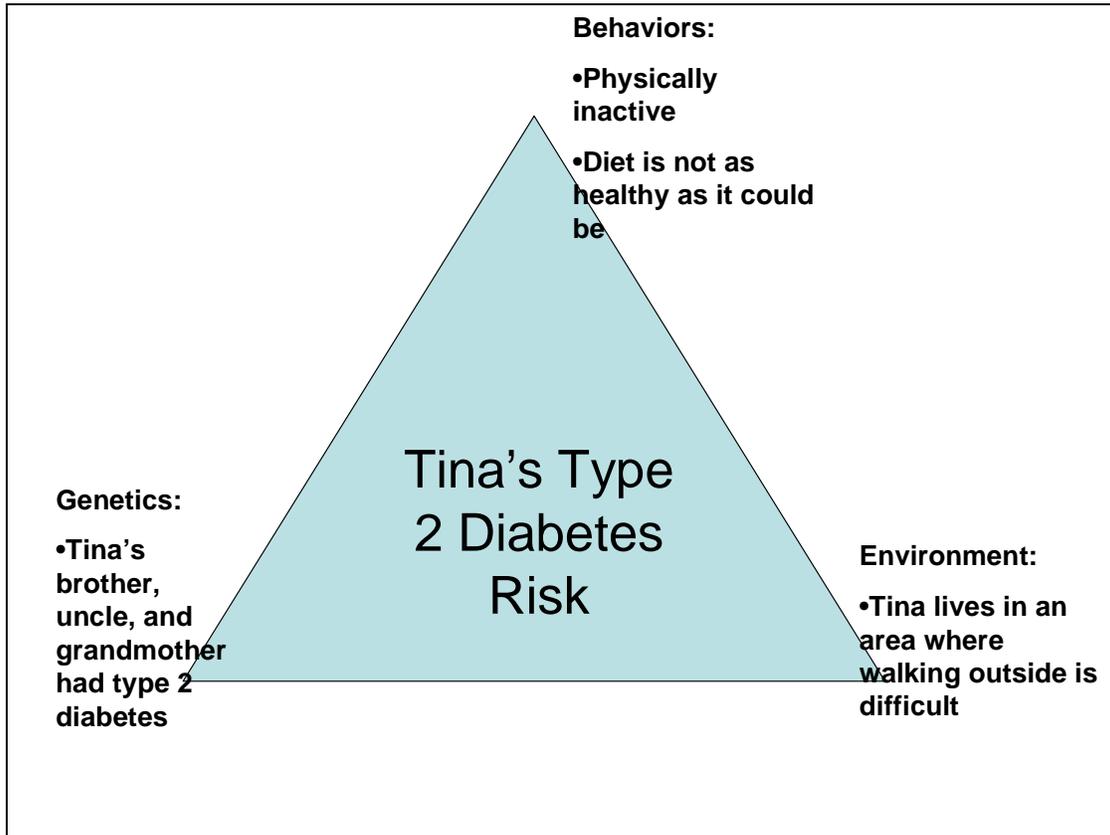Tina's doctor can encourage her to get a:
*   Cholesterol test every 5 years
*   Blood glucose (sugar) test regularly (typically recommended every 3 years—doctors may recommend more frequent screenings for individuals at increased risk for diabetes)
*   Blood pressure check every year
Tina's doctor can also encourage her to record and update her family health history so that she can be aware of her risks for developing other diseases and conditions.

Total: _____/20 pts.

Sample Model of Tina's Risk for Developing Type 2 Diabetes

Behaviors:

•**Physically inactive**

•**Diet is not as healthy as it could be**

Tina's Type 2 Diabetes Risk

Genetics:

•**Tina's brother, uncle, and grandmother had type 2 diabetes**

Environment:

•**Tina lives in an area where walking outside is difficult**

Extension: Personal Family History

Diabetes in the Family: A Case Study
Tyrell Hardtke, CDC's 2005 Science Ambassador Program

1. **Create a family pedigree based on your family history to analyze your risk of type 2 diabetes or another disease or condition. Please staple your completed pedigree to the back of this worksheet. (_____3pts.)**

2. **After analyzing your pedigree and looking at the provided Web sites, list your risk factors for your chosen disease. (_____3pts.)**
   Genetic:

   Behavioral:

   Environmental:

3. **Use the table at the end of this worksheet to determine if your *genetic* risk of disease is high, moderate, or low. (Note that your overall risk of disease depends on your family history and also on your behavioral and environmental risk factors.) (_____2 pts.)**

4. **How can you lower your risk for this disease? (_____2 pts.)**

5. **Choose one behavioral or environmental change that you can make to lower your risk. Can you fully commit to this change? If so, what is your plan to stick with the change? (_____2 pts.)**

Total: _____/12 pts.

High Risk

1. Premature disease in a 1st degree relative

2. Premature disease in a 2nd degree relative

3. Two affected 1st degree relatives

4. One 1st degree relative with late or unknown disease onset and an affected 2nd degree relative with premature disease from the same lineage

5. Two 2nd degree maternal or paternal relatives with at least one having premature onset of disease

6. Three or more affected maternal or paternal relatives

Moderate Risk

1. One1st degree relative with late or unknown onset of disease

2. Two 2nd degree relatives from the same lineage with late or unknown disease onset

Low Risk

1. No affected relatives

2. Only one affected 2nd degree relative from one or both sides of the pedigree

3. No known family history

4. Adopted person with unknown family history

Table adapted from Scheuner MT, Wang SJ, Raffel LJ, et al. Family history: a comprehensive genetic risk assessment method for the chronic conditions of adulthood, Am J Med Genet 1997;7:315-24.

Web Resources:
1. Family history: http://www.hhs.gov/familyhistory/
2. Diabetes: http://www.ndep.nih.gov/diabetes/pubs/TipsFeel_Eng.pdf
3. Diabetes: http://diabetes.niddk.nih.gov/dm/pubs/riskfortype2/index.htm#7