

Diabetes, Genetics and Genomics: Across the Lifecycle

Deb Duquette, MS, CGC¹, Jean Chickering, MSN, RN², Joan Ehrhardt, MS, CGC¹, Mary Teachout, MAT¹, Janice Bach, MS, CGC¹
 Michigan Department of Community Health
 Division of Genomics, Perinatal Health and Chronic Diseases Epidemiology¹, Section of Diabetes and Other Chronic Diseases²

Background

The Michigan Department of Community Health (MDCH) Genomics program received a 5-year cooperative agreement from the Centers for Disease Control & Prevention from 2003-2008. The goal of this cooperative agreement was to integrate genomics into state chronic disease programs.



The Michigan Diabetes and Prevention Control Program in collaboration with the Michigan Diabetes Outreach Network (MDON) creates and disseminates online self-paced independent study educational modules regarding diabetes for individuals providing health care to clients with diabetes. In 2006, MDCH Genomics requested and received approval to create a new online module regarding diabetes and genomics.

Objective

To develop and evaluate an independent study educational module regarding diabetes and genomics for individuals providing health care to clients with diabetes.

Methods

In 2007, MDCH, in partnership with MDON, developed an educational online module, entitled *Diabetes, Genetics and Genomics: Across the Lifecycle*. This module was disseminated through an existing website of diabetes educational resources at: www.diabetesinmichigan.org. This module was approved for two contact hours of continuing education credit for nurses and dietitians from 2008-2010. This is one of nine online modules available at no cost.



Methods (continued)

Diabetes, Genetics and Genomics: Across the Lifecycle provides up-to-date information on genomics related to diabetes and treatment, including key messages for each life cycle stage.

- Upon completion, participants were expected to:
- Recognize the role family health history plays in the care and prevention of diabetes
 - Define the terms *genetics* and *genomics* and identify their relationship to diabetes
 - Identify one key message for each life cycle stage: pre-pregnancy, pregnancy, childhood/adolescence and adulthood
 - Express the importance of well controlled diabetes and folic acid supplementation for women of reproductive age
 - Understand appropriate use of informed consent and genetic technology for diabetes in Michigan

The Table of Contents for the module is shown below. Throughout the module, shaded boxes were integrated to summarize information for providers (green box); highlight important messages for patients (pink box); provide case examples (blue box); and, provide information of possible interest (yellow box). Examples are shown below.

Table of Contents	
I. Introduction	7
II. Burden of Diabetes	7
III. Family health history	8
IV. Genetics, Genomics and Diabetes	13
A. Examples of Genetics and Diabetes	14
1) Mature Onset Diabetes of the Young	14
2) Monogenic Diabetes	14
B. Examples of Genomics and Diabetes	15
1) Pre-diabetes	15
2) Type 1 Diabetes	16
3) Type 2 Diabetes	16
4) Diabetes Secondary to Other Conditions	17
V. Diabetes and the Life Cycle	18
A. Diabetes and Pre-Pregnancy	18
B. Diabetes and Pregnancy	20
C. Diabetes in Children and Adolescents	23
D. Diabetes and the Adult	25
VI. Genetic Services	28
Appendix A – Genetics Terms	27
Appendix B – When to refer to genetic services	28
References	29
Post-Test	30
Diabetes Outreach Network	34

Risk factors for type 2 diabetes in children and adolescents:

- Family history of diabetes
- Overweight
- Inactive lifestyle
- Poor diet
- High blood pressure or high cholesterol
- African American, Hispanic, or Native American ancestry (but can occur in all ethnicities)
- Children over the age of 10

Important health messages for those with a family history of diabetes:

- Make healthy food choices
- Increase physical activity
- Maintain a healthy weight
- Consult health care provider and have routine check-ups
- Be smoke-free
- Manage stress
- Consider need for earlier screening
- Take a multivitamin containing 400 mcg folic acid daily (for women of childbearing age)
- Make a healthy lifestyle a family affair

An example of a family health history: Tina's Story
 Tina is 38 years old and overweight. She recently found out her 38 year old brother was diagnosed with Type 2 diabetes. After her brother's diagnosis, she was surprised to learn her uncle had been diagnosed in his 40's and her grandmother had been diagnosed in her 50's. She asked her mother about other relatives with health problems and learned her father had high cholesterol and is taking medication. Her mother also thought Tina's aunt was taking medication for high cholesterol.

For the complete case study example, see:
www.hhs.gov/familyhistory/docs/DiabetesCaseStudy.pdf

Did you know?
 According to a recent study, women with diabetes who had low health literacy were significantly more likely to have an unplanned pregnancy and less likely to have either discussed pregnancy ahead of time with an endocrinologist or obstetrician or taken folic acid.

Results

From January 2008 to January 2010, *Diabetes, Genetics and Genomics: Across the Lifecycle* was completed by 277 health care providers. The majority of the users were Registered Nurses (N=160). Of the six MDON regions, users from TIPDON (in Michigan's Northern Lower Peninsula) were the most frequent (n=61).

The participants' evaluation of this module demonstrated strong satisfaction (summary score of 3.61 on a scale of 4.0). Examples of comments from users completing the module included:

- "I learned a lot and glad you did this module. Thanks."
- "Very interesting topic"
- "Great information. Presented in an easy to read manner."
- "Does this mean testing and genetic analysis is occurring?"
- "Thanks for the opportunity to utilize this avenue for continuing education to stay abreast on the information available on genetics and genomics with regard to diabetes. I think I've learned more reading continuing education info here rather than sitting in a class."
- "Great course! I was particularly interested in the family health history section since I am currently putting together a similar section for the national 'Diabetes Today' curriculum. It was very helpful!"
- "Thanks for this informative and interesting module addressing world, US and MI facts. I very much appreciate your efforts to increase our knowledge base about the probable costs we face if we do not restore healthy eating and lifestyle as an expectation."

Table 1: Post Test Question (Answer)	# Missed (of 249 responses)
1. Choose the term that most accurately defines genomics. (genomics is the study of interactions among multiple genes, the environment and behavior)	27
2. Choose one of the following statements that does NOT represent the importance of family health history to health care. (It is only useful to one generation)	12
3. Which of the following family history elements is (or are) important to document? (All of the above = age of onset of major medical condition, relationship to affected family member and number of family members affected with the specific medical condition)	2
4. The increase in the incidence of type 2 diabetes in children and adolescents may be due to (select all that apply) (a more sedentary lifestyle and poor diet)	13
5. Genetic testing is available for which of the following conditions? (All of the above = MODY, Cystic Fibrosis and hemochromatosis)	10
6. Which statement about type 2 diabetes is true? (a) May result from the interaction between genetic susceptibility and environmental triggers (b) Genetic testing is not currently recommended for type 2 diabetes other than as part of research studies)	34
7. When should folic acid be taken if a woman with diabetes is planning on becoming pregnant? (before conception and throughout the first trimester)	18
8. There is an increased risk of malformations in infants of mother with diabetes, especially defects in? (All of the above = cardiovascular, limb defects and central nervous system)	48
9. A modifiable risk factor of type 2 diabetes is: (a) inactive lifestyle (b) diet)	3
10. Before genetic testing for any condition is done, informed consent must be obtained)	34

As shown in Table 1, the post-test areas most often missed included: identification of malformations in infants of mothers with diabetes; recognition of the cause and availability of genetic testing for type 1 diabetes; and knowledge about the availability and informed consent process for genetic testing.

Discussion

This online educational module, the first of its kind on the topic of genomics and diabetes, is innovative and cross-cutting in its lifespan approach. The uptake, evaluation comments and post-test demonstrate that genomics can be successfully integrated into existing education opportunities for individuals providing health care to clients with diabetes. The module is currently in the process of being updated and will be submitted for approval by the Ohio Nurses Association for two contact hours of continuing education.

Acknowledgments: The authors wish to thank Diane Schmidt, MS, CGC, Rodolfo Valdez, PhD, MSC, Toni Pollin, PhD, MS, and the Diabetes Outreach Network for their input in writing this module. This project was funded in part by #U58/CCU522826, a cooperative agreement to MDCH from the Centers for Disease Control and Prevention