

Lesson 5

Evaluating Solutions

Time: 50 min

[Video overview of lesson](#) (1:37)

[Student Roadmap](#)-
Hyperlinked Google
Doc for Lesson 5

Lesson Objectives:

Students will be able to learn:

- How are solutions to the growth of t2d driven by individuals and/or society?
- What is my solution to help decrease the occurrence of t2d?
- What is one benefit and one cost for my solution to this problem?

Overview

In this lesson, students evaluate solutions to the complex problem of type 2 diabetes in our communities by evaluating and communicating information about different prevention and treatment options for people with, or at risk for, type 2 diabetes. Using evidence gathered throughout the unit, students engage in argumentation to support their position on the best treatments and preventative measures that address this complex condition.

Enduring Understandings

- Type 2 diabetes is a complex condition that is heavily influenced by environmental factors such as access to resources, personal choice, product marketing, public policy, socio-economic status, and stress.
- Students can make a meaningful contribution to the prevention of type 2 diabetes.

Essential Question

What can I/we do to decrease the occurrence of type 2 diabetes?

Lesson Summary with Timings

Entrance Activity	5 min
Looking at Options	20 min
Your Solution	20 min
Closure	5 min

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Materials

Materials	Quantity
Computer and projector	1 per class
Slide set for unit (Slides 86 - 89 for Lesson 5)	1 per class
Options Packet (also included at end of lesson) Option 1: Medications Option 2: Food Labeling and Marketing Option 3: Surgery Option 4: Lifestyle changes Option 5: Soda Ban	1 per group or student, depending on strategy
Student Sheet 5.1: Options Organizer	1 per student
Student Sheet 5.2: Evaluating Solutions (can be printed two-sided with Student Sheet 5.1)	1 per student
Lesson Summary Guide from Lesson One (two-sided)	1 per student

Procedure


Part I (Engage)

Entrance Activity

(5 min)

1. Entrance activity: Students can respond to the questions posed on the entrance slide in several ways, as directed by the teacher. Suggested strategies include using a think-pair-share activity, a brief class discussion, or an individual writing exercise. Students should focus on the main question, and then choose one or more of the *think about...* options as time allows.

Slide 86



Biology, Homeostasis, and Type 2 Diabetes
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Entrance Activity

If current trends continue, 1 in 3 U.S. adults will have diabetes by 2050.

How would you distribute money and resources towards **prevention** and/or **treatment** of diabetes?

To think about....

- How old will you be in 2050?
- Will you be at risk for type 2 diabetes?
- How and when should your future self take steps to prevent you from developing type 2 diabetes?

Note: Teachers could give students a hypothetical \$1 million to combat the trends for type 2 diabetes and ask students what percentage of the money they would spend on prevention, what percentage on treatment, and how the money would be used.

2. Use the next slide to show students the financial burden that diabetes places on individuals, families, communities, and health care systems.

Slide 87



Part II (Explore/Explain)

Looking at The Options

(20 min)

- Tell students that they will read about options that address the growing diabetes problem proposed by different groups, and then recommend their own solutions. The next slide shows students the options they will be presented with. For each option, students will read a description of the option and be asked to think about a few factors. Make sure students understand the types of questions asked, but don't answer the question at this point.

Prevention or Treatment? Is the goal of this option prevention (keeping people from becoming diabetic) or treatment (providing interventions for people already living with type 2 diabetes)? Or both?

Individual or Social? Is the option driven by the choices and decision-making of individuals, or at a societal policy level in which people need to work together to create change? Are there ways social policies and group behaviors contribute to health in this option?

Who benefits? What is the cost? Who is harmed? What kinds of harms and benefits might come from different options? Costs associated are not only monetary but could be harm to some groups or people.

Slide 88



- Distribute the [reading packets](#) and [Student Handout 5.1:Options Organizer](#) to students. Suggested reading and discussion strategies include:

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- a) **Jigsaw:** Each group gets one of the options to read, discuss and record on the Options Organizer. Students then are re-rearranged so that new groups are mixed to have a person familiar with each option. The members of the new group each share his or her option with the rest of the new group to record.
- b) **Round Robin:** Each student group is given one option to read and discuss. After an appropriate amount of time, the option is rotated to the next group until each group has read each option.
- c) **Homework:** The readings and Student Sheet 5.1 can be given out as individual homework before class starts.
- d) **Student Presentations:** Groups of students can learn deeply about one option and then present this option to the rest of the class. Students may wish to go into more depth by finding or using additional resources listed at the end of this section.
- e) **Whole Class Discussion:** Each option can be read through and discussed as a class.

Part III (Elaborate):

Your Solution

(20 minutes)

5. After students are familiar with the different options presented in the packet, ask them to present their own solution to the problem by answering the driving question they have been working with throughout the unit:

What can I/we do to decrease the occurrence of type 2 diabetes?

6. Encourage students to address *specific* concerns that they believe contribute to type 2 diabetes in targeted solutions. Encourage students to pick and choose elements from any of the options they have just read about, or to create their own targeted solution based on what they have learned throughout the unit. While global solutions (i.e. “more education”) are needed and helpful, targeted solutions will be more feasible to analyze. Examples of targeted solutions could include the following:
 - a. Promoting healthy food choices in school cafeterias
 - b. Distributing a cookbook of quick and healthy snacks for students
 - c. Building bike and walking paths in the community
 - d. Proposing a tax on sugar-sweetened beverages or highly processed foods
 - e. Providing people with lifestyle coaches that support healthy choices
 - f. Offering healthy cooking lessons to a community
 - g. Banning sugar-sweetened drinks from schools
 - h. Mandating time for physical activity as part of the school day through recess and/or PE
 - i. Promoting school fun runs, races, or other physical event

Additional ideas can be found in the *Call to Action* projects section of this lesson.

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7. Pass out [Student Sheet 5.2: Evaluating Solutions](#). Individually or in groups, students can work through the sheet with their own solution.
8. Students can revisit the last column of their [Lesson Summary Guide](#) and build off ideas they have recorded after each lesson.

Part IV (Evaluate): Sharing Solutions and Closure (5 minutes)

9. Encourage students to share their solutions with the group. If time permits, allow students to decide which solution(s) are most likely to succeed.
10. Lastly, students should return to the *Lesson Summary Guide* before class is over and complete the “end of unit” questions on the back page. The next slide can be used as an informal check-in to see if student ideas have changed from the beginning of the unit to the end, by asking students to hold up their fingers to show where they stood at the beginning and end of the unit for each question.

Slide 89

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Back to the Beginning

I think that solutions to the growth of type 2 diabetes lie mostly with:

1 2 3 4 5 6 7 8 9 10
Individuals Society

I think developing type 2 diabetes is mostly due to:

1 2 3 4 5 6 7 8 9 10
Genes Environment

Extension

Students could present and defend their solutions to their classmates. Competing student design solutions could be respectfully evaluated by their peers and, if a school-based solution exists, that solution could be enacted by the class. Student solutions may also lend themselves to Call to Action Projects (see below).

Looking Forward: Call to Action Projects

Type 2 diabetes is a complex condition that brings together issues of health care, scientific research, environmental influences, personal choice, access to resources, diet and exercise, social justice, public policy, and more. The nature of this complex topic lends itself well to extended learning through student projects. If students have a leadership/project component to their education, they could be encouraged to create a type 2 diabetes-themed Call to Action project, in which they synthesize and apply their learning throughout the unit by creating a product that demonstrates their understanding of type 2 diabetes, addresses a specific diabetes-related problem, and contributes to a solution. Successful Call to Action projects implement direct, meaningful, and relevant actions to make a contribution towards combating diabetes within the students' communities.

Project Ideas

Ideas for projects may include:

- Educate peers and others on sugar content of common drinks
- Survey and analyze foods typically given at food banks
- Create a media literacy lesson for peers using food and drink marketing
- Develop a cookbook for a person who is prediabetic or living with diabetes
- Enroll a team/create an educational table for a *Tour de Cure* or other event
- “Do This, Not That” (in parallel to book “Eat This, Not That”)
- Develop a script for a “living room focus group”
- Propose public policy at local or state level to improve health
- Develop a monthly healthy menu plan for a family of four given a budget
- Assess the nutritional quality of school lunch programs
- Use a personal tracking device or health app to analyze one’s own practices

Resources for Options Packet:

Medications:

References

American Diabetes Association: What Are My Options?

<http://www.diabetes.org/living-with-diabetes/treatment-and-care/medication/oral-medications/what-are-my-options.html>

Diabetes.co.uk: The Global Diabetes Community

<https://www.diabetes.co.uk/treatment-for-type2-diabetes.html>

Joslin Diabetes Center: Oral Diabetes Medications Summary Chart

http://www.joslin.org/info/oral_diabetes_medications_summary_chart.html

List of Medications Available for Diabetes

Last reviewed Mon 27 June 2016

By Markus MacGill

Reviewed by [Alan Carter, PharmD](#)

<https://www.medicalnewstoday.com/articles/311300.php>

Background on the DPP

<https://www.niddk.nih.gov/about-niddk/research-areas/diabetes/diabetes-prevention-program-dpp>

Food Labeling and Marketing Resources

Morbid obesity in a developing country: the Chilean experience

Claudia Bambs, Jaime Cerda, Alex Escalona

Bulletin of the World Health Organization

<http://www.who.int/bulletin/volumes/86/10/07-048785/en/>

Nutrition Reviews Special Article

Lesson 5

June 2001: 170-176

Nutrition Transition in Latin America: The Case of Chile

Cecilia Albala, M.D., M.P.H., Fernando Vio, M.D., M.P.H., Juliana Kain, M.P.H., and Ricardo Uauy, M.D., Ph.D.

In sweeping war on obesity, Chile slays Tony the Tiger

By Andrew Jacobs, Feb 7, 2018

<https://www.nytimes.com/2018/02/07/health/obesity-chile-sugar-regulations.html>

Surgery Resources

Abbasi, J. (2017). Unveiling the “Magic” of Diabetes Remission After Weight-Loss Surgery. *JAMA*. 317 (6), 571-574.

<https://jamanetwork.com/journals/jama/fullarticle/2601499>

Galchen, R. (2016) Bariatric Surgery: The Solution to Obesity? The New Yorker [September 26, 2016 Issue](#).

<https://www.newyorker.com/magazine/2016/09/26/bariatric-surgery-the-solution-to-obesity>

Keider, A., (2011). Bariatric Surgery for Type 2 Diabetes Reversal: The Risks. *Diabetes Care* 34 Supplement 2, S361-S366. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3632208/>

Obesity Coverage Staff (2013). Weight Loss Surgery Coverage and Costs. In *Insurance and Costs, Pre-approval Process*.

<https://www.obesitycoverage.com/weight-loss-surgery-insurance-coverage-and-costs/>

Yska, J. P., van Roon, E. N., de Boer, A., Leufkens, H. G. M., Wilffert, B., de Heide, L. J. M., de Vries, F. and Lalmohamed, A. (2015). Remission of Type 2 Diabetes Mellitus in Patients After Different Types of Bariatric Surgery: A Population-Based Cohort Study in the United Kingdom. *JAMA Surg*. 150 (12) 1126-1133.

<https://jamanetwork.com/journals/jamasurgery/fullarticle/2446843>

Other Surgery Resources

American Diabetes Association. Bariatric Surgery.

<http://www.diabetes.org/living-with-diabetes/treatment-and-care/bariatric-surgery.html>

Kolata, G. (2016). After Weight-Loss Surgery, A Year of Joys and Disappointments. New York Times December 27, 2016 issue.

<https://www.nytimes.com/2016/12/27/health/bariatric-surgery.html>

National Institute of Diabetes and Digestive and Kidney Diseases. Bariatric Surgery.

<https://www.niddk.nih.gov/health-information/weight-management/bariatric-surgery>

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Lifestyle Changes Resources

Updated Genetic Score Based on 34 Confirmed Type 2 Diabetes Loci Is Associated With Diabetes Incidence and Regression to Normoglycemia in the Diabetes Prevention Program

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3064108/>

The Diabetes Prevention Program (DPP): Description of lifestyle intervention

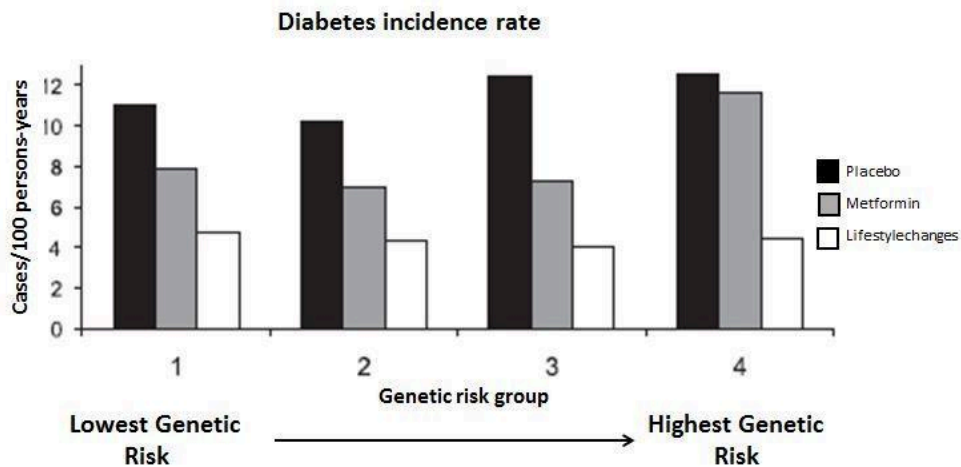
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1282458/>

Option 1: Medications

A person who is diagnosed with type 2 diabetes may be prescribed one or more drugs to control their condition. There are many classes of oral drugs that use different tactics to control blood glucose levels, including those that help the body to respond better to insulin, those that stimulate insulin release from the pancreas, and those that slow down digestion. In addition, people with type 2 diabetes are sometimes given medication to help them lose weight.

The most commonly prescribed oral medication (and generally first to be prescribed) is called Metformin. It helps the body respond better to insulin, mainly by decreasing the release of glucose by the liver.

The graph below shows results from a long-term research study involving over 3000 people who were pre-diabetic at the start of the study. People in the study were randomly divided into three treatment groups. The Lifestyle changes group received extensive coaching on diet and exercise. The Metformin group was prescribed Metformin twice a day for the duration of the study. The placebo (control) group did not get the drug or Lifestyle coaching. All participants in this study had their DNA analyzed to measure their genetic risk for developing type 2 diabetes based on their alleles for 34 risk genes. The graph below compares the rate of progression to type 2 diabetes for people in the study. How effective do you think Metformin is compared to the other groups? Does it have a similar effect for all genetic risk groups?



Hivert, M-F et al., 2011; *Diabetes* 60:1340-1348

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Overall, participants who took metformin lowered their chances of developing type 2 diabetes by 31 percent compared with participants who took a placebo. Metformin was most effective for younger people, people with a body mass index over 35, and women with a history of diabetes during pregnancy.

Like all drugs, Metformin has side effects. These include loss of appetite, upset stomach, bloating, gas, and diarrhea. If it does not work well enough at reducing a person's blood glucose, then sometimes an additional drug is given.

Insulin may be prescribed if a person's beta cells in the pancreas are not functioning well enough and oral medications and lifestyle interventions are not lowering blood glucose sufficiently. Although insulin is very effective at lowering blood glucose, it needs to be administered carefully so that a person's blood glucose does not get too high or too low. According to the American Diabetes Association, the cost of insulin has tripled in the past ten years, which is cause for concern for insulin-dependent diabetics.

Option 2: Food Labeling and Marketing

Reversing the obesity trend in Chile through a national nutritional labeling law

In the three decades between the late 1960s to the late 1990s, Chile, like many other Latin American countries, made great improvements in socio-economic status, literacy, infant mortality, life expectancy, and gross national product. However, as malnutrition and undernutrition decreased during this period, Chile saw a significant increase in obesity and the chronic diseases associated with obesity (see Figure 1). This

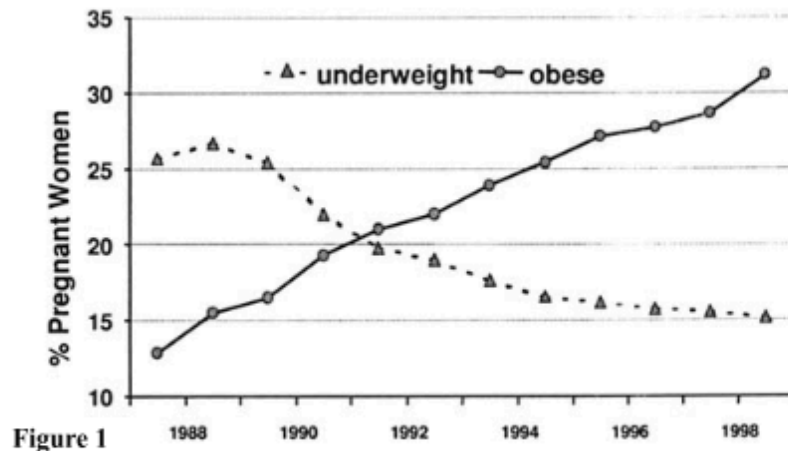


Figure 1

increase in obesity is associated with increased intake of foods high in saturated fats, a decrease in consumption of cereals and legumes, and a more sedentary lifestyle.

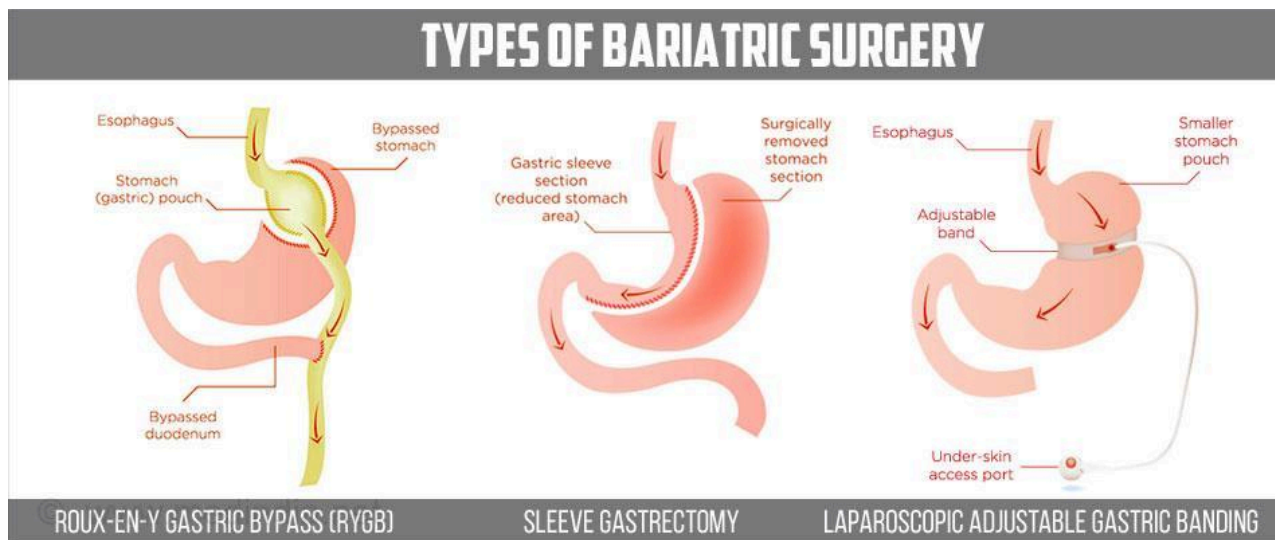
In 2016, the Chilean government adopted a sweeping nation-wide war on obesity through policies directed at unhealthy food, including changes in how foods are labeled, a ban on junk foods in and around schools, and prohibition of advertising for junk food on TV programs and websites viewed by children. Foods that are high in salt, sugar, fats, or calories are required to show a black stop sign label for each—and based on their ingredients, some foods are required to show all four. In addition, manufacturers are no longer allowed to use cute mascots or symbols that appeal to children, like Tony the Tiger or Chester Cheetah.

There has not been sufficient time in the last two years to see changes in the obesity rates. However, the new laws are having effects on products being sold, which in many cases have been re-formulated to get rid of one or more of their black labels. Furthermore, children are advising their parents about which products not to buy because of their labels. Two other South American countries, Ecuador and Brazil, are now considering adopting similar rules.



Bariatric surgery: A Magic Bullet to cure type 2 diabetes?

'Bariatric' means 'weight treatment,' and bariatric surgeries are designed to help very obese people to lose weight. There are three common types, all of which either bypass or constrict the stomach. In the most effective type of surgery (RYGB, below) the bypassed portion of the stomach is sealed surgically, and the bypassed duodenum is attached to the lower part of the small intestine so digestive juices from the stomach can enter the small intestine.



As well as losing weight, people with type 2 diabetes who have bariatric surgery are much more likely to have their diabetes go into remission than matched controls who do not get surgery. In one study in the United Kingdom, people having bariatric surgery were 43 times (for gastric bypass), 17 times (for sleeve gastrectomy), and 7 times (for gastric banding) more likely to have their t2d in remission within 6 months of treatment, as compare to controls.

There are risks associated with bariatric surgery, including a small risk of death within 30 days of the operation (a rate similar to other surgeries), the need for subsequent surgery to repair the initial surgery or treat other GI conditions, increased depression, increased use of drugs and alcohol, and nutritional deficiencies. In addition, diabetes remission can reverse over time. For example, in one study conducted in Sweden, the rates of remission decreased from 72% after two years to 30% after 15 years.

Who qualifies for bariatric surgery? The criteria were set in the 1991 National Institutes of Health Consensus Conference Guidelines and are as follows: patients must have a body mass index (BMI) of 40 or greater, or a BMI greater than 35 and a condition such as type 2 diabetes, hypertension, or heart disease. Additional criteria might be set by the hospital offering the surgery, such as length of time being obese, whether the patient has tried other methods to lose weight, psychological factors, and willingness to eat a healthy diet.

Who typically gets bariatric surgery, and how much does it cost? Typically, patients able to get surgery are middle to upper class. The costs vary depending on type of surgery, from \$23,000 for gastric bypass surgery to about \$15,000 for gastric sleeve and gastric banding surgery. Some, but not all health insurance policies will cover some or most of the cost, but it depends on the patient's insurance policy. Gastric bypass surgery is covered by Medicaid in 48 states.

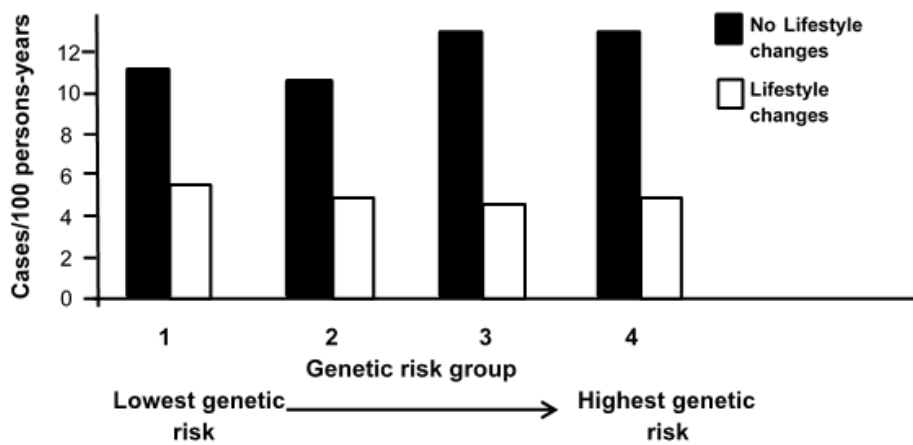
Option 4: Lifestyle Changes

The Diabetes Prevention Program (DPP) was a long-term research study involving over 3000 people in the United States. At the beginning of the DPP, participants were all overweight and had prediabetes, but not diabetes. The participant group was composed of 45% racial and ethnic minorities.

In the DPP, participants were randomly divided into different treatment groups. The first group, called the **lifestyle** intervention group, received intensive training in diet, physical activity, and behavior modification. By eating less fat and fewer calories and exercising for a total of 150 minutes a week, they aimed to lose 7 percent of their body weight within six months and maintain that loss.

Related studies identified 34 different allele combinations (gene variants) associated with type 2 diabetes. Each of the 34 risk alleles was weighted according to its effect on the development of type 2 diabetes. DPP participants were genotyped, and the weights of their risk alleles were added together to give the participant a Genetic Risk Score between 1 and 4.

The graph below compares the rate of progression to type 2 diabetes for people in all four genetic risk groups with or without lifestyle interventions. There was a 58% reduction in the incidence of type 2 diabetes in the lifestyle group compared to the control group over an average follow-up time of about 3 years. The Program was effective for all participating racial and ethnic groups and both men and women. The Program worked particularly well for participants ages 60 and older, lowering their chances of developing type 2 diabetes by 71 percent.



Modified from Hivert, M-F et al., 2011; *Diabetes* 60:1340-1348

The cost of the lifestyle intervention in the original DPP study was \$1400 per participant for the first year. The costs included an individualized goal-based approach that included weight loss and exercise goals. Each participant was assigned an individual lifestyle coach, who taught a 16-session core curriculum and follow-up sessions to help the participant achieve their goals. Although the cost of the intervention seems high, it is much lower than the average healthcare cost for one person with type 2 diabetes, which in 2009 was \$11,700.

Trimming Sugary Soda Sales Leads to Trimmer Waists, Study Finds

In recent years, hospitals and medical centers across the country have stopped selling sugar-sweetened beverages to reduce obesity and diabetes.

Now a new study carried out at the University of California, San Francisco (UCSF), has documented the health effect of a soda sales ban on its employees.

Ten months after a sales ban went into effect, UCSF workers who tended to drink a lot of sugary beverages had cut their daily intake by about half. By the end of the study period, they had, on average, reduced their waist sizes and belly fat, though they did not see any changes in their body mass index. Those who cut back on sugary beverages also tended to see improvements in insulin resistance, a risk factor for Type 2 diabetes.

The new research, published in *JAMA Internal Medicine*, is the first peer-reviewed study to examine whether a workplace sales ban on sugary drinks could lead to reduced consumption of the beverages and improve employee health.

“This was an intervention that was easy to implement,” said Elissa Epel, an author of the study and director of the Aging, Metabolism, and Emotions Center at UCSF. “It’s promising because it shows that an environmental change can help people over the long run.”

The study was funded by UCSF and several philanthropic groups, including the Robert Wood Johnson Foundation and the Laura and John Arnold Foundation, which has given money to support taxes on sugary beverages.

In recent years, the link between sugar and obesity has drawn increasing scientific attention. Health authorities say that Americans have gotten fatter because they are consuming too many calories of all kinds. But some experts have singled out the role of added sugar consumption, which increased more than 30% between 1977 and 2010.

According to the Harvard School of Public Health, sports drinks, fruit punches, sodas and other sweetened drinks are the single largest source of calories and added sugar in the American diet and “a major contributor to the obesity epidemic.” Large studies have linked them to an increased risk of Type 2 diabetes, heart disease and premature death.

According to multiple studies, sugary-drink sales bans have been somewhat less controversial than soda taxes, which have had mixed results.

Story by Anahad O’Connor of *The New York Times*
Published in *The Seattle Times*, November 12, 2019