Can Sugar Taxes Prevent Diabetes in Latin America?

Instructor's Note

2018

Purpose

The purpose of this teaching pack is to teach students about the global burden of noncommunicable diseases (NCDs) and an increasingly popular prevention strategy being utilized around the globe: the implementation of national sugar taxes.

What are NCDs and why are they important?

Noncommunicable diseases (NCDs) such as heart disease, stroke, cancer, and diabetes are chronic conditions that cannot be transmitted from person to person, but are rather driven by shared risk factors, including smoking, physical inactivity, and poor diets. NCDs are defined by their slow progression and long duration. Although they are the leading cause of premature death, they also impair people's quality of life, and therefore contribute substantially to global trends in both mortality and morbidity. Although NCDs are commonly discussed in the context of high-income settings, low- and middle-income countries account for over three-quarters of total NCD deaths, highlighting the importance of adopting a global lens when studying trends.

Why are sugar taxes considered a health policy intervention to address NCDs?

As countries around the world continue to confront the rising tide of diabetes, obesity, and other related noncommunicable diseases, governments have started to use tax policy as a means of promoting healthy behaviors. These efforts are largely informed by the success of tobacco taxes, which have been found to substantially reduce smoking rates worldwide.[1] Governments are increasingly trying to apply lessons from tobacco control to curb sugar intake at the population level, and research suggests these efforts have been largely successful.[2] For example, in the two years after an excise tax was levied on sugar-sweetened beverages in Mexico in 2013, purchases of sugary beverages declined by nearly eight percent.[3]

Lesson Summaries

This teaching pack is composed of this Instructor's Note, as well as three lessons, student handouts, and additional resources that can be used by instructors to supplement teaching materials. Although the three

[1] Marr C, Huang C-C. Higher Tobacco Taxes Can Improve Health and Raise Revenue. Center on Budget and Policy Priorities 2014; Mar 19. https://www.cbpp.org/research/higher-tobacco-taxes-can-improve-health-and-raise-revenue.

[2] Wright A et al. Policy Lessons From Health Taxes: A Systematic Review of Empirical Studies. BMC Public Health 2017; 17: 583. DOI: http://doi.org/10.1186/s12889-017-4497-z.

[3] Colchero MA et al. In Mexico, Evidence of Sustained Consumer Response Two Years After Implementing a Sugar-Sweetened Beverage Tax. Health Affairs 2017; 36(3): 564-571. https://www.healthaffairs.org/doi/abs/10.1377/hlthaff.2016.1231.

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lessons are designed to be a unit with each building upon the prior, they can also be used as individual stand-alone modules.

In Lesson One, **Noncommunicable Diseases 101**, students will learn what NCDs are and use data to quantify the impact they have on populations globally. First, students will learn key metrics used to study trends in disease in order to provide a common language with which to discuss global health topics. Using this new terminology, they will then analyze the extent to which NCDs impact population health by interpreting graphical depictions of the global burden of NCDs.

The goal of Lesson Two, **Understanding Diabetes in Latin America**, is to teach students about trends in a specific NCD: diabetes. Through a series of classroom exercises, students will study the spread of diabetes globally and examine factors that may be contributing to its rise. First, students will use comparative global data to identify regions where diabetes control should be a priority. Then, focusing specifically on the region of Latin America, students will work in small groups to define local trends and describe relevant driving factors.

Finally, in Lesson Three, **Sugar Tax: Public Health or Personal Choice?** students will read about the implementation of sugar taxes in Latin America and discuss the ways such a tax could impact key stakeholders on the ground. More specifically, students will learn about Mexico's successful attempt at passing a national tax on sugar-sweetened beverages and discuss its implications for health and society. Taking these factors into account, students will then participate in a role-play activity in which they consider the advantages and disadvantages of sugar taxes from the perspective of various key stakeholders in Colombia, where advocates are trying to pass a similar tax to reduce sugar consumption.

Upon the completion of all three lessons, students should have a basic understanding of global trends in NCDs, risk factors that contribute to their development, and the health benefits and social costs of tax changes designed to address them at the population level.

Teaching Materials

- Lesson Plan: Noncommunicable Diseases 101 (and graphic handout)
- Lesson Plan: Understanding Diabetes in Latin America (and graphic handout)
- Lesson Plan: Sugar Tax: Public Health or Personal Choice?

Additional Resources

- Annotated Bibliography: Can Sugar Taxes Prevent Diabetes in Latin America?
- Glossary: Can Sugar Taxes Prevent Diabetes in Latin America?

Learner Level

- Undergraduate

Learning Objectives

This lesson will enable students to:

1. Describe the burden of noncommunicable diseases both globally and in Latin America.
2. Identify factors at the individual, social, and policy level that may contribute to regional trends.
3. Understand both the health benefits and social costs of using sugar taxes as a national strategy to reduce population levels of diabetes.

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Noncommunicable Diseases 101

Lesson Plan 1

2018

Purpose

The purpose of this lesson is to provide undergraduate learners with a broad introduction to what noncommunicable diseases (NCDs) are and how their impact can be quantified. Students will learn about important features that distinguish NCDs from communicable (or infectious) diseases like tuberculosis and malaria and will practice analyzing graphically depicted data on cardiovascular disease to understand the toll of NCDs on populations around the globe.

Learner Level

- Undergraduate

Time

One 90-minute session

Required Pre-Reading

- Goldie SJ. Chronic Disease. Global Health Education and Learning Incubator at Harvard University 2015. https://vimeo.com/130263116.

Learning Goals

1. Understand the differences between communicable and noncommunicable diseases.
2. Define key health metrics used to compare the burden of diseases globally.
3. Interpret visual data to compare the impact of communicable and noncommunicable diseases across different regions.

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Procedure

Part 1: Required Pre-Work
(15 Minutes)

The first part of this lesson will be completed by students prior to class. Students will view the following video (approximately 15 minutes long) that describes the key features of noncommunicable diseases, their magnitude on a global scale, and the leading risk factors underlying their spread:

- Chronic Disease. Global Health Education and Learning Incubator at Harvard University 2015. https://vimeo.com/130263116.

After viewing the video, students should prepare brief written responses to the following questions:

1. What are noncommunicable diseases (NCDs)?
2. In what ways are NCDs different than communicable diseases, like malaria, tuberculosis, or HIV/AIDS?
3. Why are NCDs important?

Part 2: The ABCs of NCDs
(45 Minutes)

At the start of class, the instructor will begin by introducing the following key concepts that are foundational to understanding population health:

- **Prevalence** – The percentage of people in the population who have a health condition, measured at a particular point in time. This gives you a sense of *how common* a disease or condition is.
- **Mortality** – Another word for "death." When studying the burden of a health issue, it is often measured by the number of deaths that are attributable to it in a defined population. This tells you about the *impact* of a disease or condition with respect to premature deaths.
- **Morbidity** – Disability due to the presence of a health issue or its symptoms. This also tells you about the *impact* of a disease or condition, but over the duration of someone's life.
- **Disability Adjusted Life Year (DALY)** – A measure of both premature mortality due to a health issue and morbidity due to the years of disability caused by it. More specifically, it tells you how many years of life are estimated to be lost due to a health condition in a defined population. This gives a broader sense of a health issue's *impact* by combining information on both mortality and morbidity.
- **Risk Factors** – Characteristics and behaviors of individuals, as well as conditions of their environments, that may predispose them to a given health condition. This tells you about the *causes* or *determinants* of a health issue.

These terms are important because they provide students with the language and tools they need to study trends in health, which ultimately helps identify where to focus health improvement efforts. Instructors should introduce these terms on a PowerPoint slide at the start of class so that students can relate them back to the topic of noncommunicable diseases, and also to demonstrate how they can be used to identify global health priorities. It is not necessary for students to be able to calculate health measures in this activity, but rather they should aim to understand them in a broad conceptual sense.

In the first exercise for this lesson, students will be divided into groups of three to discuss their answers to the questions they responded to before class. After sharing their responses with each other, each group will complete the following tasks:

1. Use at least one of the terms defined at the start of class to revise your one-sentence responses to the homework questions.

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2. For each condition listed below, identify whether you think it contributes more to deaths, disability, or both and explain why:
    - Cancer
    - Tuberculosis
    - Flu
3. Identify a region of the world that you think is most impacted by **noncommunicable diseases** and explain why.
4. Identify a region of the world that you think is most impacted by **communicable diseases** and explain why.

Note: If instructors are teaching in a 60-minute block, consider not breaking the class into small groups, and only reviewing Question 1.

After discussing amongst themselves for about 20 minutes, students will share their group's one-sentence answers, as well as their responses to Questions 2 through 4. Model answers are provided in the gray box below to help instructors assess their students' understanding.

Answer Key:

These questions are meant to test students' understanding of NCDs on a conceptual level, and students are not required to cite statistics to complete them. The responses provided below are examples of model answers, but they are not the only correct answers to these questions. Other thoughtful responses to the questions may also be acceptable.

(1) One-Sentence Reponses:

1. **What are noncommunicable diseases (NCD)?**

Also called chronic diseases, NCDs are diseases caused by common *risk factors* that cause multiple diseases, rather than the transmission of an infectious agent. NCDs are health conditions (such as cancer) that cause *morbidity* over long periods of time, as opposed to infectious diseases (such as malaria) which may arise and cause *mortality* much more quickly.

2. **How are NCDs different that communicable diseases (CDs), like malaria, tuberculosis, or HIV/AIDS?**

Whereas CDs are "contagious" or "infectious," NCDs are not transmitted from person to person and instead are caused by *risk factors* relating to personal health behaviors and environmental conditions. Those afflicted with NCDs experience long-term *morbidity*, as opposed to many CDs which are either cured or cause *mortality* more rapidly.

3. **Why are NCDs important?**

NCDs are important because they cause burdensome *morbidity* and mortality, much of which can be prevented by minimizing *risk factors*. Additionally, their *prevalence* is increasing in a number of populations worldwide.

(2a) Cancer

- **Deaths:** Cancer contributes more to deaths than disability because many forms of cancer kill people quickly (less than a year or two).
- **Disability:** Cancer contributes more to disability than death because many types of cancer need to be managed and treated for long periods of time. During this management and treatment period, those with cancer experience a range of mild to severe disability.

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- **Both:** Cancer causes disability starting from the time when symptoms are experienced. It then often causes death as well, after disability has been experienced for multiple months or years.

(2b) Tuberculosis (TB)

- **Disability:** With the exception of certain drug-resistant forms, TB is a disease that the sufferer can live with for many years, with only minimal episodes of disability. The majority of the people in the world who suffer from TB are able to access treatment. Therefore, TB contributes more to disability than deaths.
- **Deaths:** TB is an infectious disease that can only be managed by medications. Without these medications, many sufferers of TB would die quite quickly. Given that there are populations in the world in which TB diagnosis and treatment are not readily available, TB contributes more to deaths than disability.
- **Both:** TB contributes heavily to the burdens of both disability and deaths worldwide. It contributes to disability because so many people are living with the disease for many years and they experience the ill effects of it on a regular basis. It contributes to deaths because those who are not able to seek treatment or who have a drug-resistant form of the disease do die in many cases.

(2c) Flu

- **Deaths:** Since those afflicted with flu either recover quickly (relative to the recovery period from an NCD) or die, flu-caused disability is much smaller than the burden of flu-caused death.

(3) Noncommunicable diseases – I think the United States of America (USA) and Canada make up a region of the world most impacted by NCDs. This is because infectious diseases (such as measles, hepatitis, and TB) do not pose significant health risks to these populations. Since they are not afflicted by these infectious diseases, these regions are then most susceptible to the other major category of diseases: NCDs. Another reason for the heavy impact of NCDs in the USA and Canada is that their populations are susceptible to many of the risk factors for NCDs including sedentary lifestyles, poor diet, and lack of access to healthy food.

(4) Communicable diseases – I believe that the Caribbean region is largely impacted by communicable diseases (CDs) because many countries in the region lack the infrastructure and capacity to limit the spread of CDs. These shortcomings have been exacerbated by recent natural disasters, causing additional problems related to water availability and cleanliness, human waste sanitation, and access to medical treatment. These conditions for health allow infectious diseases to spread from person to person and allow disease vectors such as mosquitoes to thrive.

Part 3: Using Data To Compare the Global Burden of Diseases
(45 Minutes)

Comparing Communicable and Non-Communicable Disease Burdens

Next, the instructor will present data from the Global Burden of Disease studies to identify the regions of the world most impacted by noncommunicable diseases compared to those most impacted by communicable diseases. The **Global Burden of Disease** studies make up a long-running research project managed by the Institute for Health Metrics and Evaluation (IHME) that combines data from 195 countries to describe global trends in premature death and disability for more than 300 diseases and injuries.

The following diagrams were created using data from the IHME's Data Visualization tools to illustrate differences across regions. Instructors can use the map examples provided in this activity (also available as full-page handouts; see the Appendix) or may wish to construct different maps more catered to their unique interests. Prompting questions for class discussion are provided in **bold** and can be presented on a

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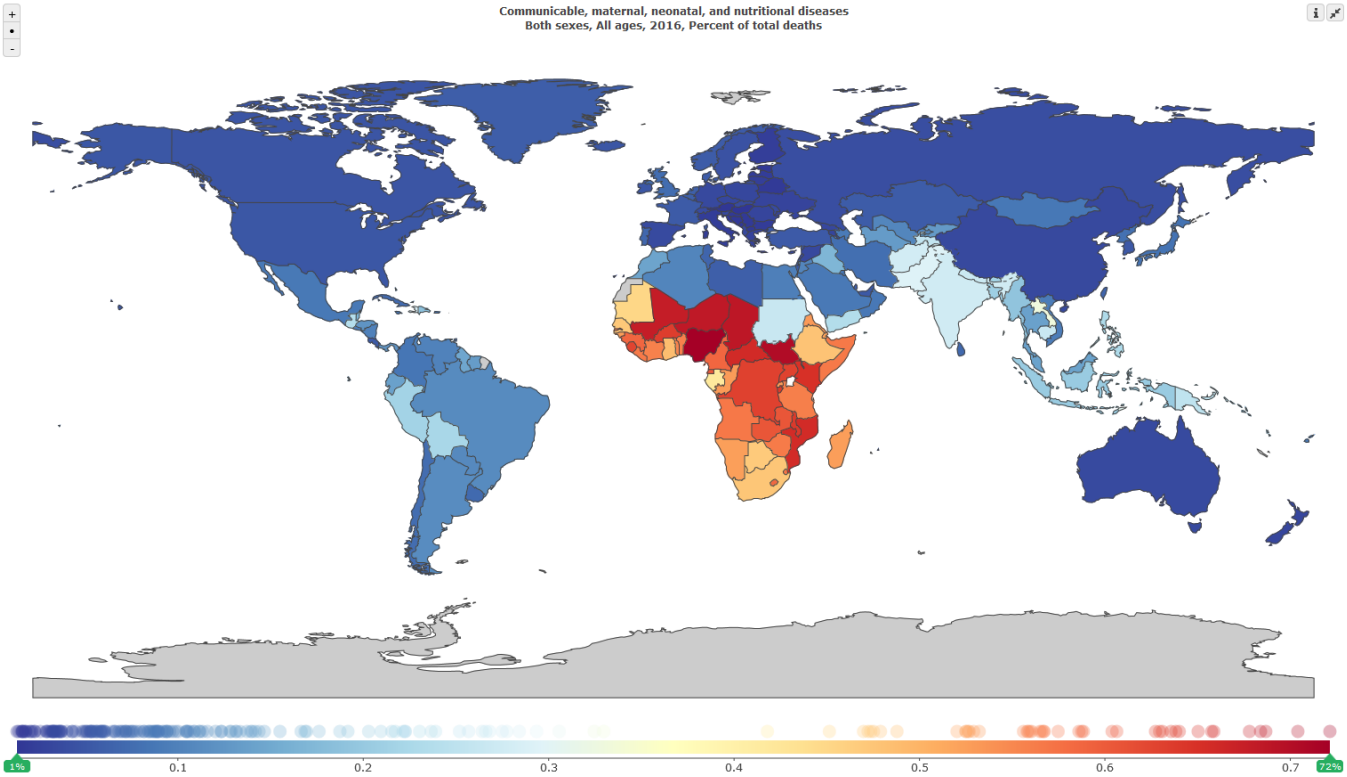
PowerPoint slide or converted into a handout so students can record the answers the class brainstorms together. Model answers are again provided in the gray boxes below each question.

Figure 1: Percentage of Deaths Attributable to Communicable Diseases, Maternal, Neonatal, and Nutritional Diseases Globally in 2016



Source: Percentage of Deaths Attributable to Communicable Diseases Globally in 2016. GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://ihmeuw.org/68a9.

The first map the class will interpret together (Figure 1) includes data on communicable diseases, maternal and child mortality, and undernutrition. Before posing the following discussion questions with the class, the instructor should take a moment to briefly connect what is depicted to the content they viewed before class. In the assigned video on NCDs, communicable diseases are described as **"the unfinished agenda."** This is a catch-all phrase used to broadly refer to diseases that are driven largely by poverty. Communicable diseases are just one part of "the unfinished agenda," which also includes maternal mortality, child mortality, and undernutrition. The map presented above includes data on all three causes, but for the purposes of the exercise, the class will consider it illustrative of the burden of communicable diseases, and also the conditions of poverty that predispose it.

Discussion Questions for Figure 1

1. In simple terms, what is this map depicting?
2. Now that we understand what is being displayed, what trends do you notice in communicable disease?
3. What factors do you think might explain the differences we see around the world?

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Answer Key:

Graphical Literacy

- **What:** Communicable, maternal, neonatal, and nutritional diseases
- **Metric:** Percentage of total deaths (mortality) depicted in a color spectrum from blue to red
- **Who:** All people (both sexes, all ages)
- **Where:** Globally
- **When:** 2016
- **Key:** Dark blue indicates less than 10 percent of deaths, light blue between ~20 percent and ~35 percent of deaths, yellow between ~35 percent and ~45 percent of deaths, light orange between ~45 percent and ~55 percent of deaths, dark orange between ~55 percent and ~65 percent of deaths, and red over ~65 percent of deaths.

Global Trends in Communicable Diseases

- The countries where the majority of deaths are attributable to communicable diseases are in **sub-Saharan Africa**, while Europe, North America, and Australia appear to have the lowest proportion of deaths due to communicable diseases. In Asia, Russia and China also have a low percentage of deaths attributable to communicable disease, although the overall trend appears to be more heterogeneous in that region.
- In the other regions of the world, communicable diseases appear to still be a challenge for Southeast Asia (with many countries above 25 percent), but they are less of a concern in South America (where most of the countries are below 20 percent).
- The countries where communicable diseases account for the highest proportion of deaths are **Nigeria** (72 percent) and **South Sudan** (70 percent).
- The countries where communicable diseases account for the lowest proportion of deaths are **Hungary** (1.3 percent) and **Austria** (1.4 percent).

Potential Explanations

- Health care quality and access differs across regions and countries, which means individuals with treatable conditions are unable to receive the care they need. This influences maternal mortality in particular, where health care solutions prevent or manage most complications in pregnancy or childbirth.
- Socioeconomic conditions, which shape maternal and neonatal health as well as nutrition, vary across the world. Countries with poor socioeconomic conditions are likely to have poorer health outcomes.
- Hygiene and vaccination practices, among other preventive behaviors that reduce burden of communicable diseases, differ across countries.

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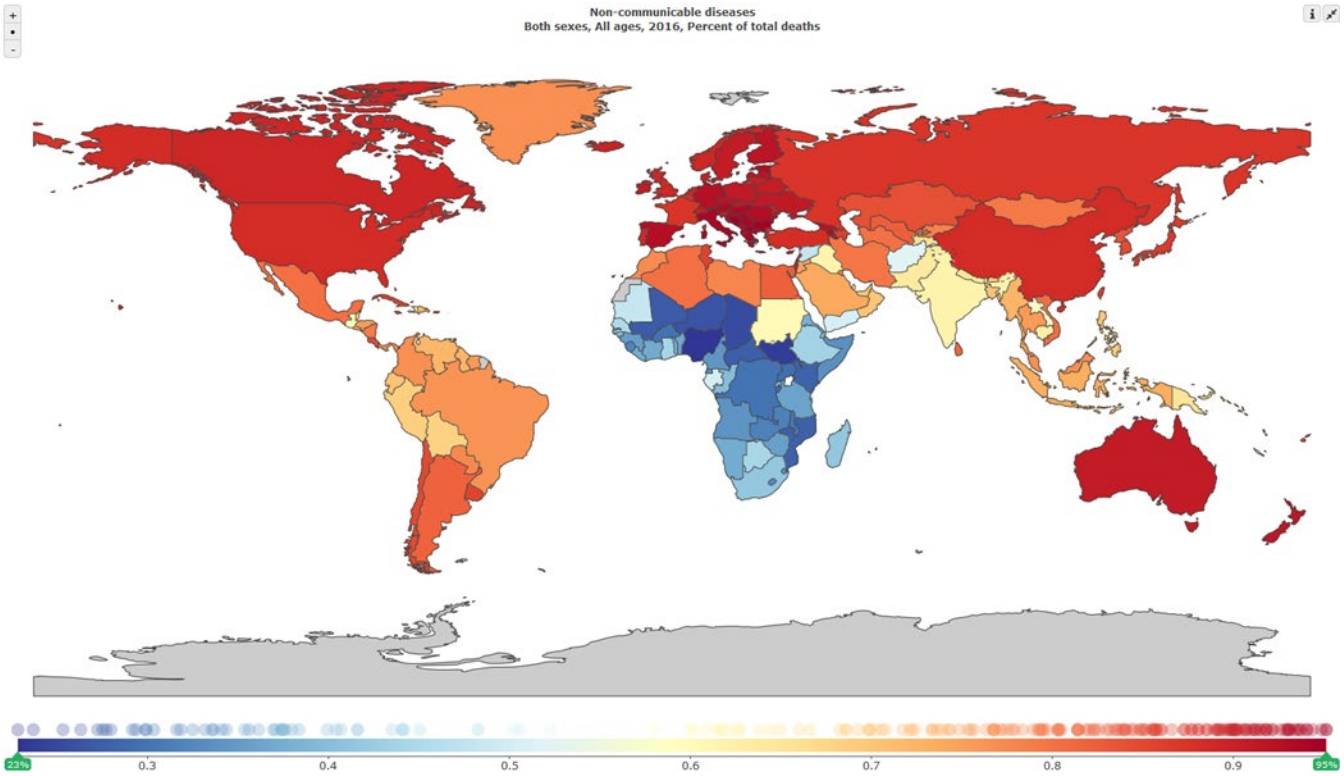
Figure 2: Percentage of Deaths Attributable to Noncommunicable Diseases Globally in 2016



Source: Percentage of Deaths Attributable to Noncommunicable Diseases Globally in 2016. GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://ihmeuw.org/68al.

Discussion Questions for Figure 2

1. What differences do you notice in what is depicted on this map? (Hint: Focus on the key.)
2. How are trends in mortality due to NCDs different than what was observed previously for communicable diseases?
3. What factors do you think might explain the differences between communicable disease and NCD trends?

Answer Key:

Graphical Literacy

- **What:** Noncommunicable diseases
- **Metric:** Same as prior graph (percentage of total deaths, i.e., mortality)
- **Who:** Same as prior graph (all people)
- **Where:** Same as prior graph (globally)
- **When:** Same as prior graph (2016)
- **Key:** Dark blue indicates less than 35 percent of deaths, blue between ~35 percent and ~45 percent, light blue between ~45 percent and ~55 percent of deaths, yellow between ~55 percent and ~65 percent of deaths, light orange between ~65 percent and ~75 percent of deaths, dark orange between ~75 percent and ~85 percent of deaths, and red over ~85 percent of deaths.
- **The change in scale between the graph for NCDs and the prior graph of communicable diseases is fairly stark.** The low end of the scale for communicable diseases was <10 percent, compared to <35 percent for

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NCDs, while the high end of the scale for communicable diseases was >65 percent while it is>85 percent for NCDs.

Global Trends in NCDs

- The trends we saw previously appear to be reversed when we look at the percentage of deaths attributable to noncommunicable diseases. The region with the highest levels of NCD deaths are **Europe, North America, and Australia**, while sub-Saharan Africa has the lowest levels.
- In Latin America, it appears that all countries are above 65 percent, while in Southeast Asian countries, NCDs make up approximately 60 percent of deaths or more.
- The countries where NCDs account for the highest proportion of deaths are **Bosnia and Herzegovina** (95 percent) and **Macedonia** (95 percent).
- The countries where communicable diseases account for the lowest proportion of deaths are **Nigeria** (23 percent) and **South Sudan** (24 percent).

Potential Explanations

- Fewer individuals in sub-Saharan Africa are surviving to the age where they could develop NCDs relative to areas outside of the region.
- The globalization of NCD risk factors, amplified by rapid urbanization and growing middle classes.
- Responses to NCDs are typically focused on changing behavior (e.g., physical activity, diet, substance use). Because these behaviors often depend on the individual and can be challenging to sustain, it might explain why there's a change in scale between the two graphs.

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Comparing Data on Mortality and Morbidity

Next, the class will investigate the difference in mortality and morbidity associated with communicable diseases compared to NCDs. The instructor should start by asking students what they think the top five leading causes of death are globally (think *mortality*) and what the top five causes of death and disability are globally (think *mortality and morbidity*). The instructor should record both lists on the board before revealing the following graphs, side by side:

Chart 1: Top Causes of Death Globally, 2016

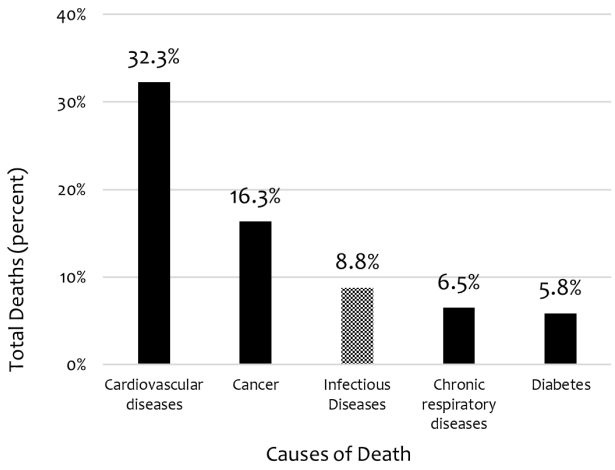
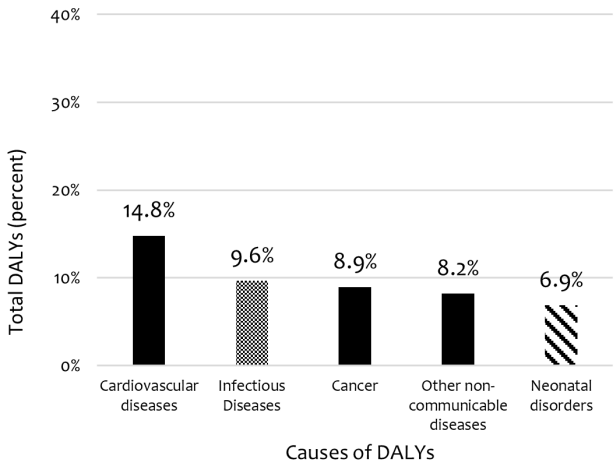


Chart 2: Top Causes of DALYs Globally, 2016



Source: GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://vizhub.healthdata.org/gbd-compare.

Note: In the bar charts above, solid indicates NCDs, gray indicates infectious disease, and patterned indicates maternal and child health issues. All bar charts in this Lesson are derived from GBD data at http://vizhub.healthdata.org/gbd-compare.

Discussion Questions for Bar Charts 1 and 2

Did anything surprise you about either of these lists?

- What similarities do you observe between the top five causes of death and the top five causes of death and disability (e.g., DALYs)?
- What differences do you observe?
- What are the reasons for these differences?

Answer Key:

Similarities

- The top cause for both death and DALYs is cardiovascular disease.
- Cardiovascular disease, cancer, and infectious diseases are among the top five causes for both death and DALYs.

Differences & Potential Explanations

- **While top causes of deaths are from infectious diseases and NCDs, a top cause of DALYs includes neonatal disorders (a maternal and child health issue).** Neonatal disorders are not necessarily a cause of

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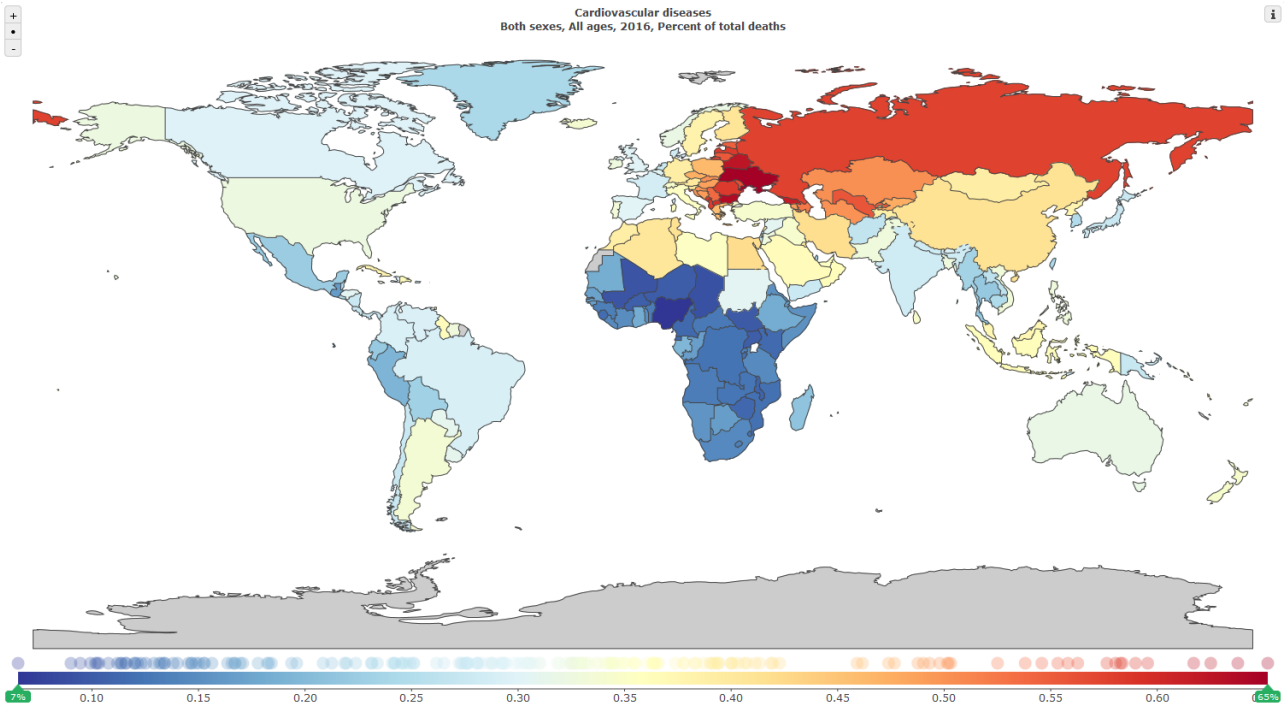
premature death, but rather morbidity over the life course. As a result, they likely contribute less to mortality and more to DALYs.

- **Top causes of death include chronic respiratory diseases and diabetes which are not included in the top causes of DALYs.** This difference may be somewhat counterintuitive to students, as these are both chronic diseases and therefore may be expected to contribute more to DALYs than mortality. However, both conditions–if left untreated and diagnosed late–can result in substantial premature death.
- **Top causes of DALYs include other NCDs and neonatal disorders, which are not included in the top five causes of mortality.** Both NCDs and neonatal disorders can result in chronic conditions that individuals manage for much of their life but are not necessarily causes of premature death. This would contribute to more morbidity in the population, but not necessarily mortality.
- **The impact of cardiovascular disease is more than double the amount of total death (in percentage) compared to DALYs.** Although cardiovascular disease is the leading cause of both death and disability around the world, it accounts for a greater proportion of death than DALYs. This may be due to the fact that people typically develop cardiovascular disease later in life. For diseases that develop in older age, they contribute less years of life lost to DALYs that diseases that impact individuals earlier in the life course.

Examining Regional Differences in NCD Mortality

Now that students have a sense of the disease burden associated with different conditions, the class will dive deeper into regional differences in the leading cause of both overall deaths and NCD deaths: cardiovascular disease. The instructor should display the following map and bar chart to the class and ask students if anything surprises them about the order of regions most impacted by cardiovascular disease.

Figure 3: Percentage of Deaths Attributable to Cardiovascular Disease Globally in 2016



Source: Percentage of Deaths Attributable to Cardiovascular Diseases Globally in 2016. GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://ihmeuw.org/68ff.

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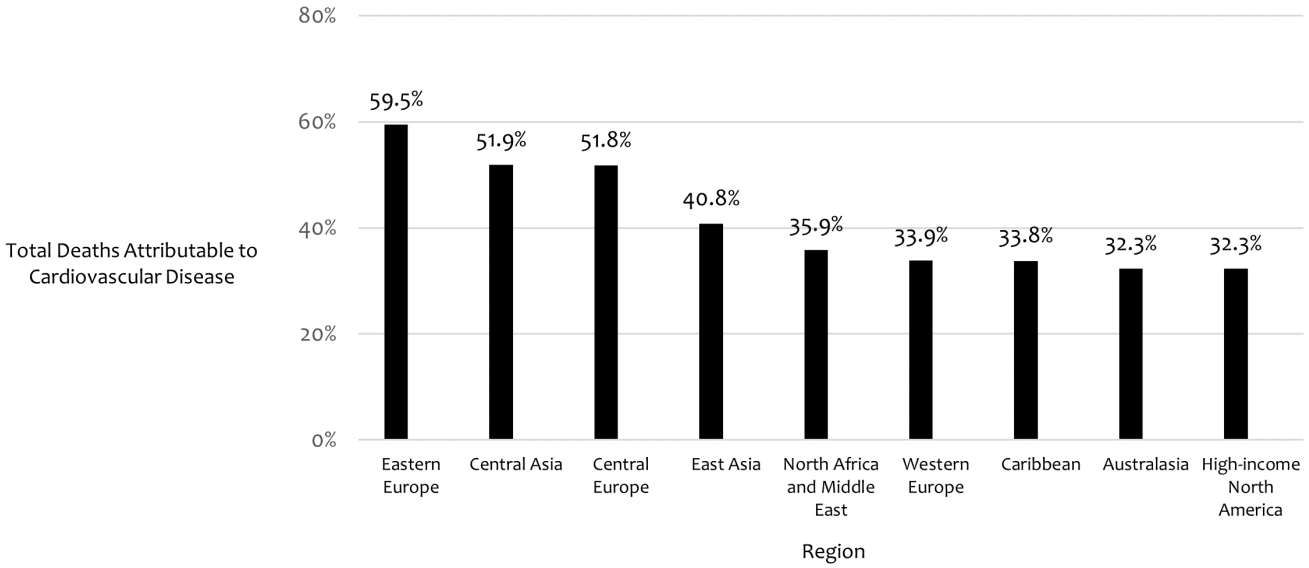
Chart 3: Top Regions Impacted by Cardiovascular Disease, 2016



Source: GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://vizhub.healthdata.org/gbd-compare.

Points to Highlight:

- The region with the most deaths due to cardiovascular disease is **Eastern Europe** (Ukraine had the highest proportion of CVD deaths at 65 percent), while the region with the lowest burden out of the ten listed is **high-income North America** (USA and Canada).
- There is a dramatic difference between the **Eastern Europe** region and other regions where the proportion of deaths hovers around one-third.
- Instructors should also ask students what **risk factors** they think may be particularly relevant to explaining this difference. While students can come up with a number of different explanations, it is worthwhile to mention differences in climate that may contribute to lower **physical activity levels**, as well as potential **dietary differences**. Physical activity and diet are two of the most important risk factors for cardiovascular disease, and understanding regional differences may help shed light on this trend.
- Thinking more specifically about **diet**, students may also notice that the **North Africa and Middle East** region has about 35 percent of deaths attributable to CVD despite cultural preferences for a "heart healthy" Mediterranean diet (i.e., a diet high in fruits, vegetables, whole grains, and olive oil). When brainstorming reasons to explain this trend, students may consider the impact of **globalization** and the spread of multinational food corporations (e.g., fast food chains and soda companies) on dietary habits around the world.

Next, the instructor will share global data on cancer to illustrate how different NCDs may have different regional trends. Again, after displaying the following map and bar chart, the instructor can ask students if anything surprised them about either the order of regions most impacted by cancer, or how the map differs from the cardiovascular disease map above.

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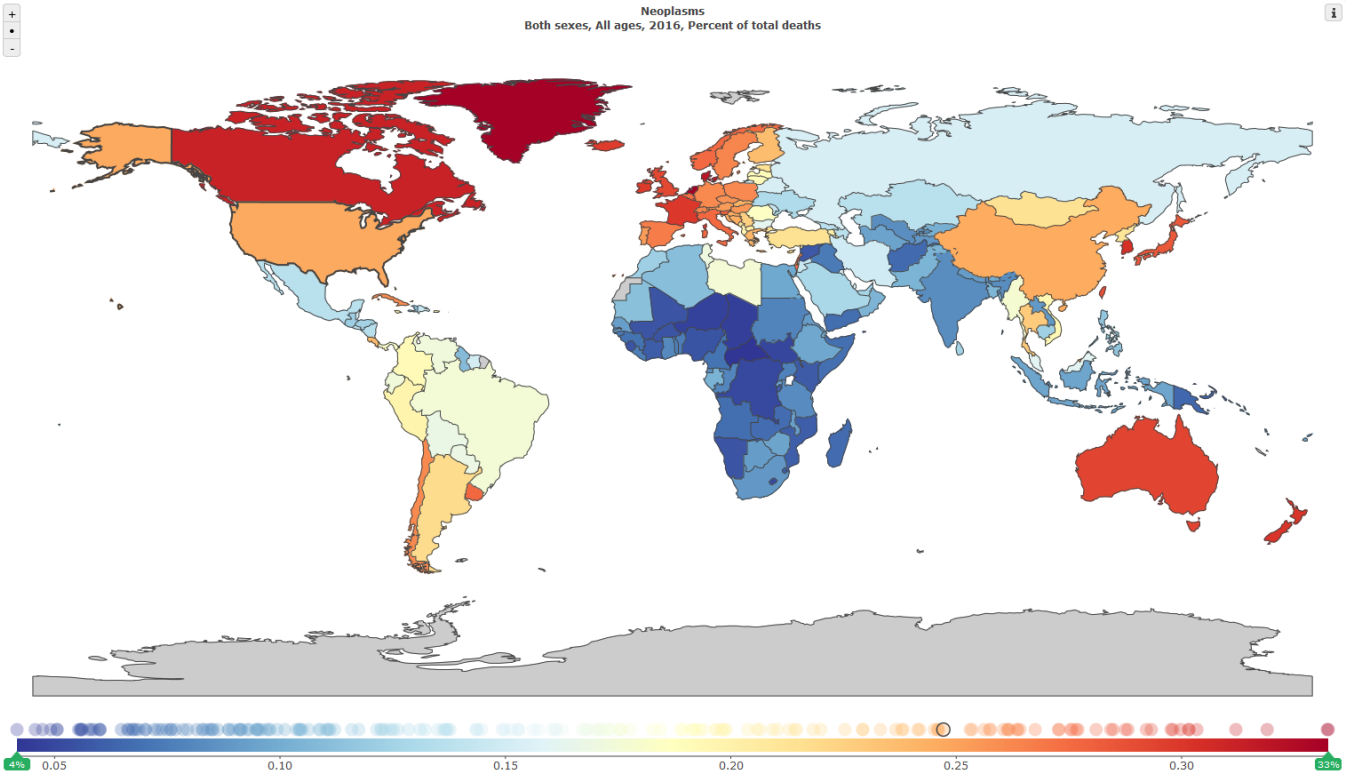
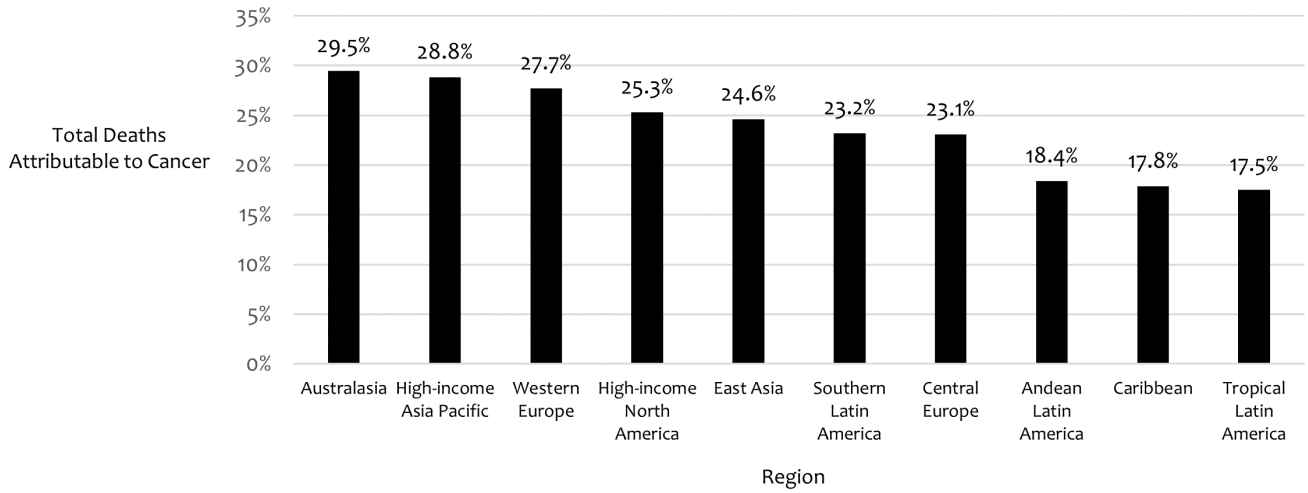
Figure 4: Percentage of Deaths Attributable to Cancer Globally in 2016



Source: Percentage of Deaths Attributable to Cancer Globally in 2016. GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://ihmeuw.org/69py.

Chart 4: Top Ten Regions Impacted by Cancer, 2016



Source: GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://vizhub.healthdata.org/gbd-compare.

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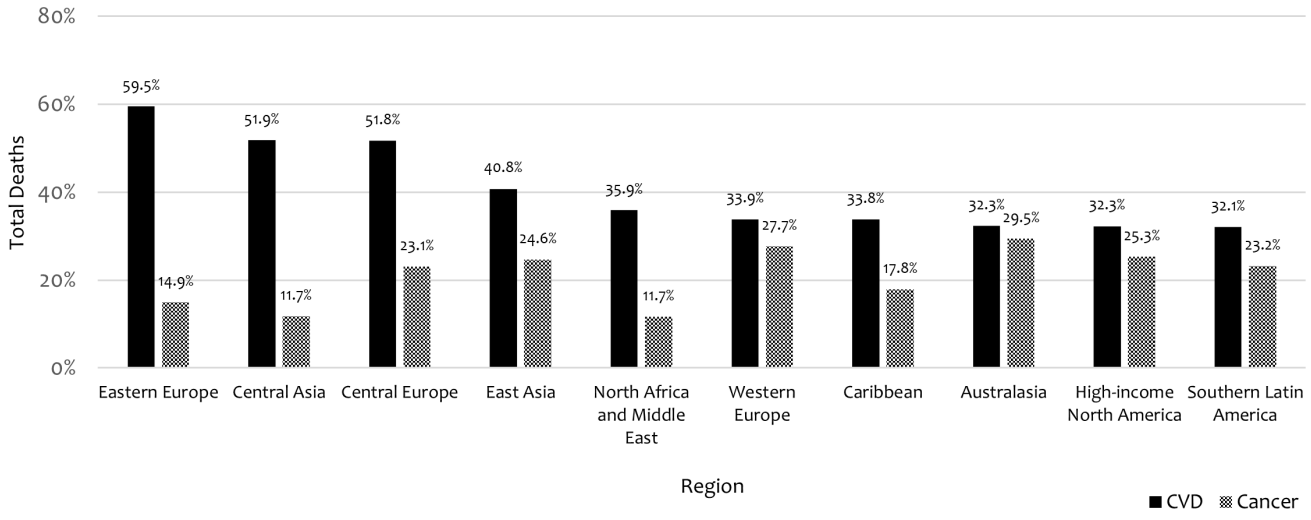
The data in this graph shows that the order of regions impacted by cancer is quite different from the comparable bar chart for cardiovascular disease deaths. Here, the regions with the greatest burden of cancer are Australasia (29.5 percent) and the Asia Pacific (28.8 percent), while Eastern Europe (the region most impacted by cardiovascular disease) is not even present. Additionally, while Latin America was not represented in the prior graph of regions most impacted by cardiovascular disease, it is substantially impacted by cancer. When comparing across NCDs, students may be surprised by the magnitude of the burden of cardiovascular disease, which is nearly double that of cancer in the regions most impacted.

To further illustrate that point, the instructor can share the following bar chart, which overlays cancer data for the top ten regions most impacted by cardiovascular disease.

Chart 5: Percentage of Total Deaths Attributable to Cardiovascular Disease and Cancer in the Ten Regions Most Impacted by Cardiovascular Disease, 2016



Source: GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://vizhub.healthdata.org/gbd-compare.

Students will notice that for some regions the burden of cancer and cardiovascular disease is very comparable (e.g., Australasia and Western Europe). For other regions where cardiovascular disease is a substantial challenge, cancer is less burdensome (e.g., Eastern Europe and Central Asia). These differences may have important impacts on national health priorities as some regions have to divide their resources and response efforts between two very different conditions, while others have more freedom to focus their efforts predominantly on cardiovascular disease.

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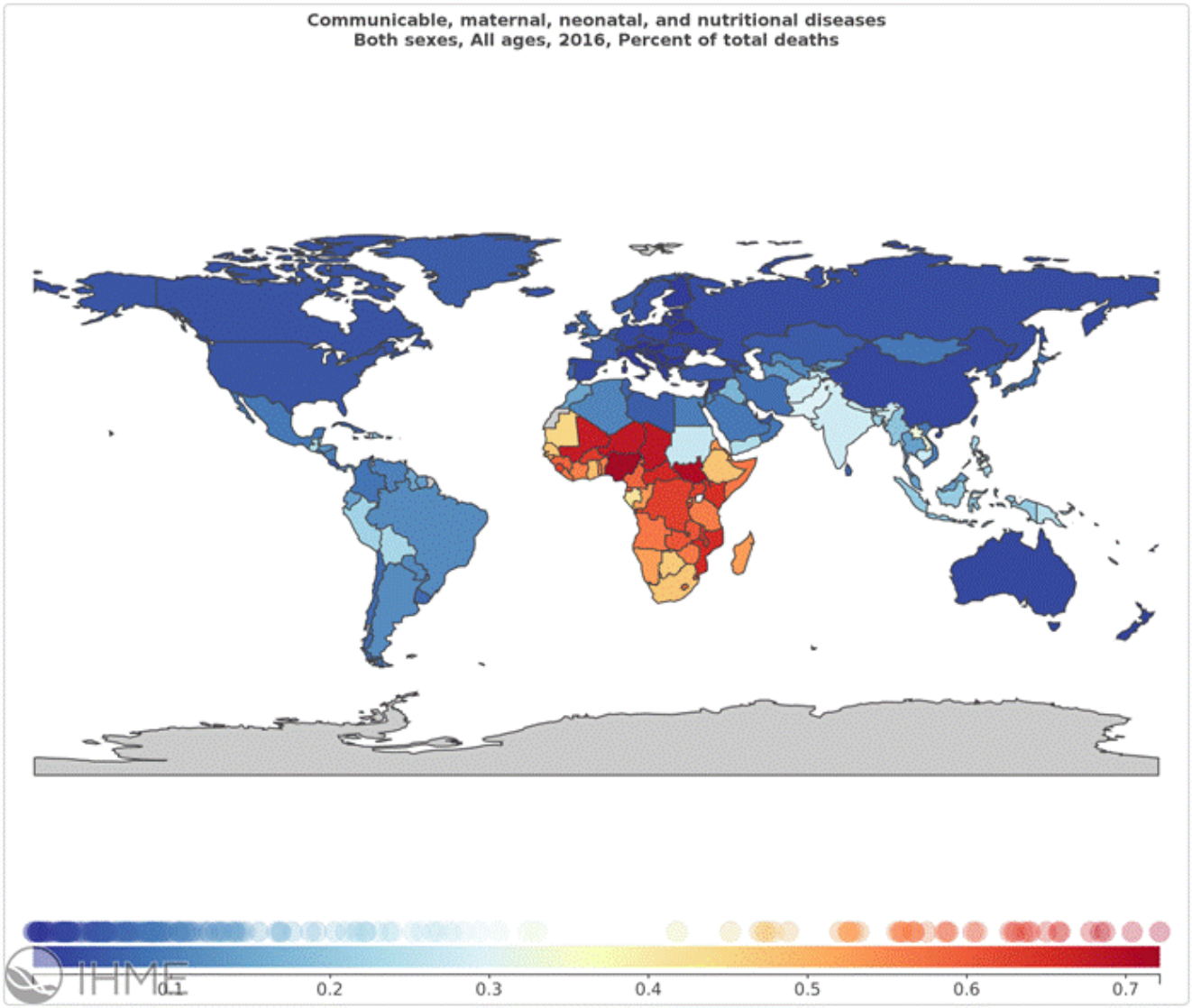
Appendix: Student Handouts

Figure 1: Percentage of Deaths Attributable to Communicable Diseases, Maternal, Neonatal, and Nutritional Diseases Globally in 2016



Source: Percentage of Deaths Attributable to Communicable Diseases Globally in 2016. GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://ihmeuw.org/68a9.

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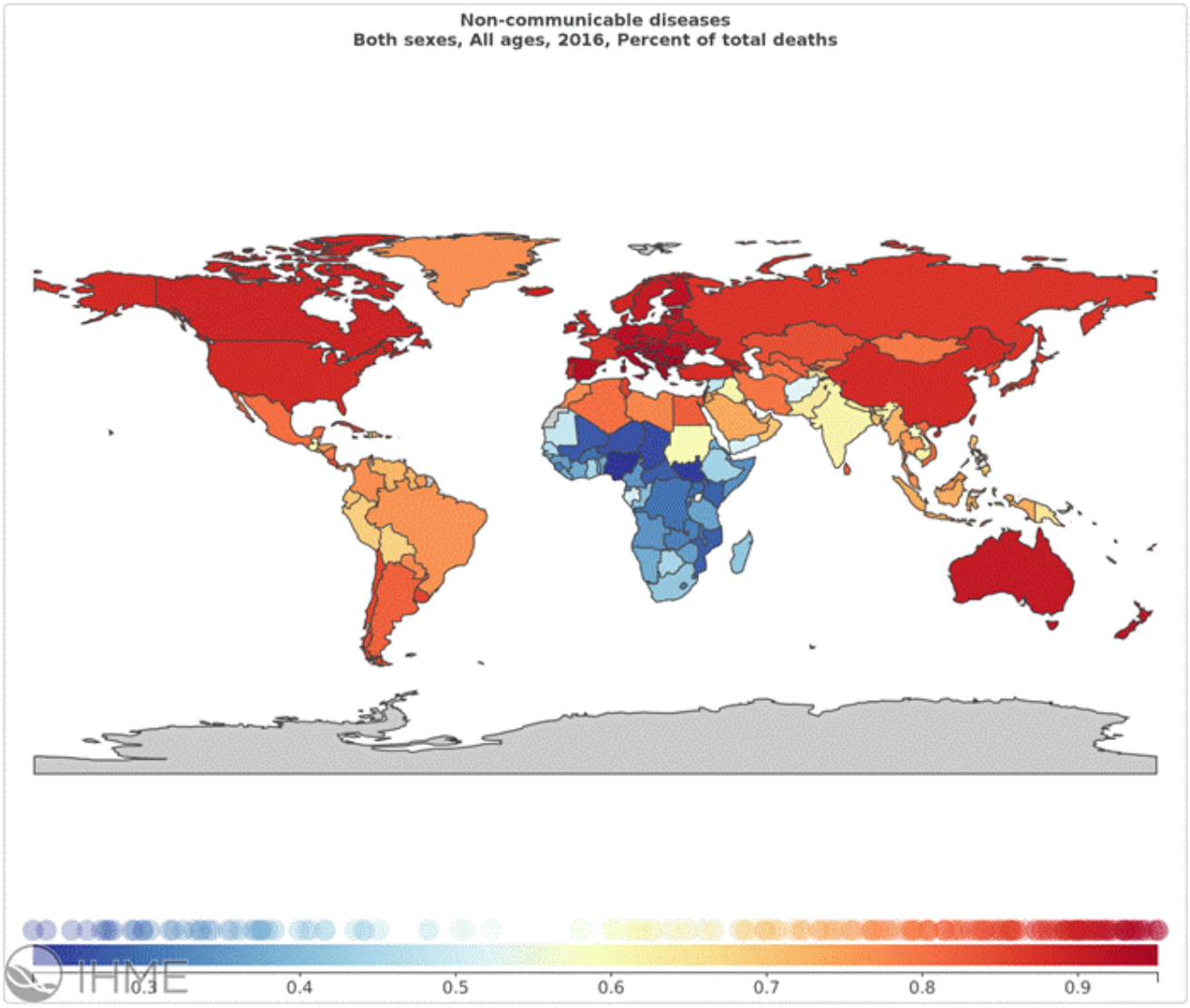
Figure 2: Percentage of Deaths Attributable to Noncommunicable Diseases Globally in 2016



Source: Percentage of Deaths Attributable to Noncommunicable Diseases Globally in 2016. GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://ihmeuw.org/68al.

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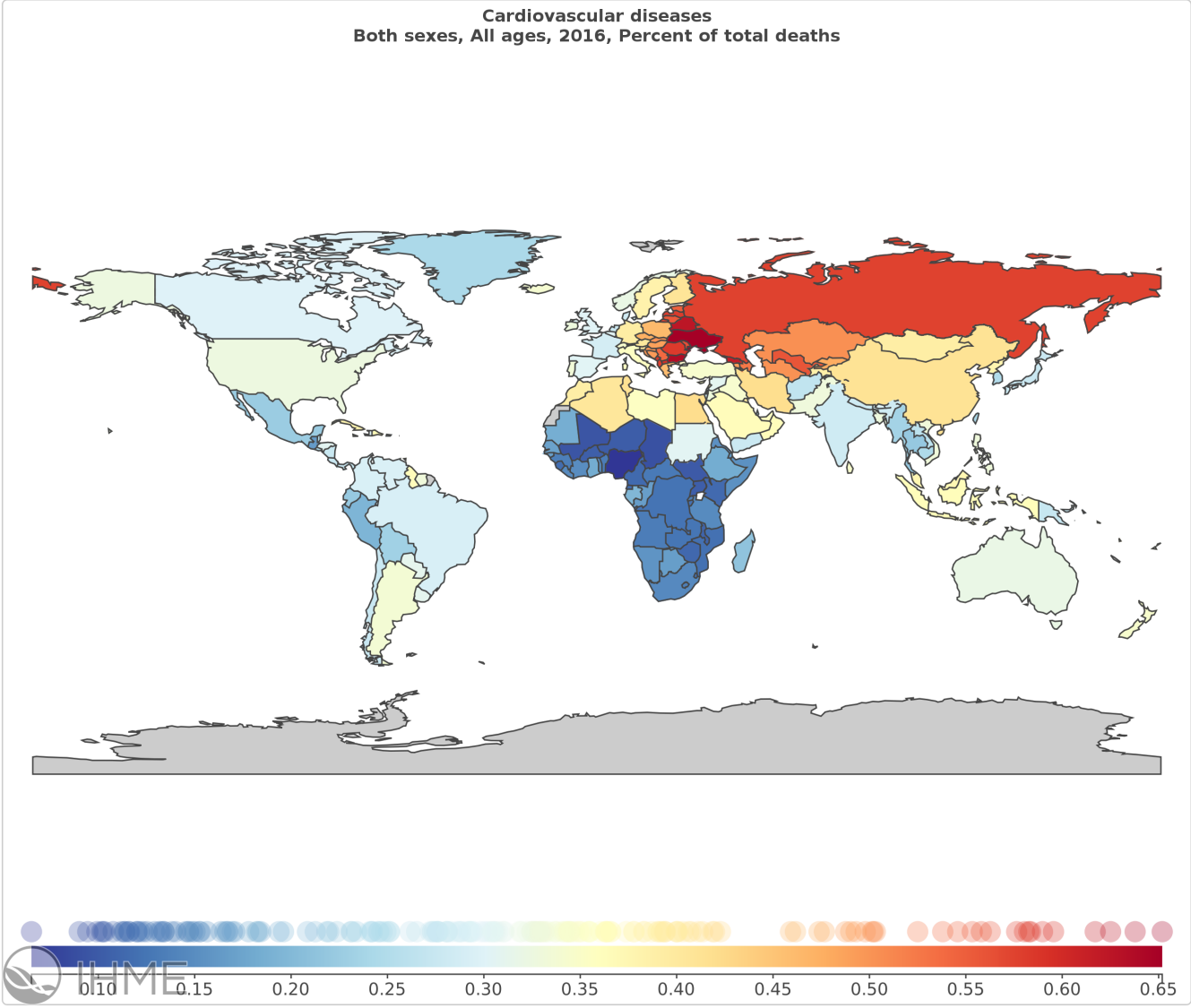
Figure 3: Percentage of Deaths Attributable to Cardiovascular Disease Globally in 2016



Source: Percentage of Deaths Attributable to Cardiovascular Diseases Globally in 2016. GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://ihmeuw.org/68ff.

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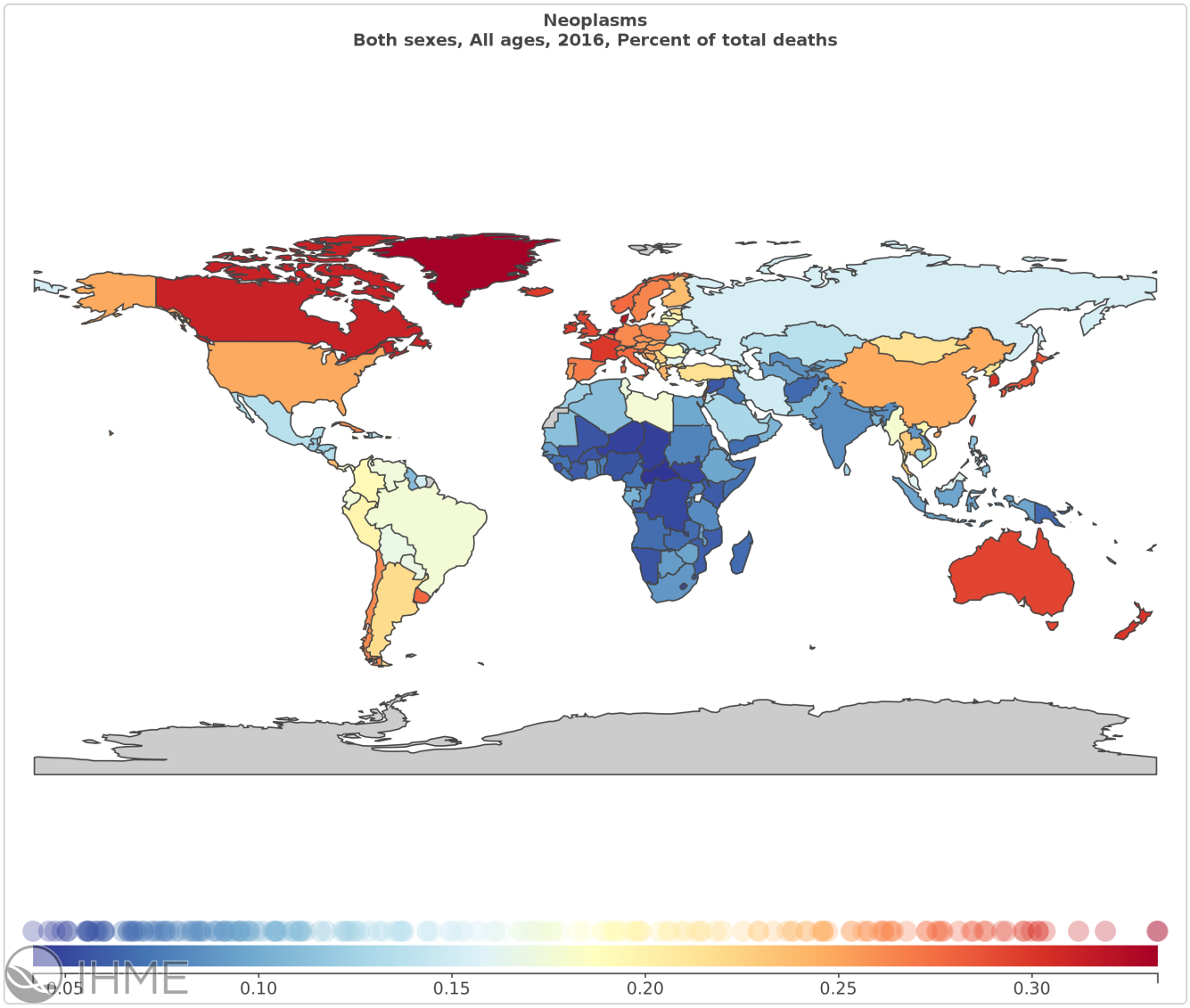
Figure 4: Percentage of Deaths Attributable to Cancer Globally in 2016



Source: Percentage of Deaths Attributable to Cancer Globally in 2016. GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://ihmeuw.org/69py.

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Understanding Diabetes in Latin America

Lesson Plan 2

2018

Purpose

Diabetes is a noncommunicable disease where the body does not produce enough insulin (type 1 diabetes) or cannot effectively use insulin (type 2 diabetes). Because insulin is a hormone that controls blood sugar, uncontrolled diabetes often leads to high blood sugar levels; over time, this can have severe effects on physical health. Complications associated with diabetes include heart disease, stroke, kidney failure, blindness, and lower limb amputation. Recent data suggests that diabetes is increasing dramatically in low- and middle-income countries, making it a growing global priority. Maintaining a healthy diet and engaging in regular physical activity are some ways to prevent diabetes, and countries around the world are considering new ways to encourage these behaviors to reduce its burden on the population.

The purpose of this lesson is to teach undergraduate learners about global trends in diabetes, focusing particularly on the Latin American region. First, students will practice interpreting graphically depicted data to identify regions and countries where diabetes control should be a priority. Then, students will home in on the Latin American region and use current data to identify which country faces the greatest burden. Finally, working in small groups, students will focus on a specific high-risk country—Mexico—and brainstorm ways in which social factors that may contribute to current trends.

Learner Level

- Undergraduate

Time

One 90-minute session

Required Pre-Reading

- WHO Fact Sheet: Diabetes. World Health Organization 2023. https://www.who.int/news-room/fact-sheets/detail/diabetes.

Learning Goals

1. Describe how the prevalence of diabetes in Latin America compares to the rest of the world.
2. Identify countries within the Latin American region that face the highest burden of diabetes.
3. Use country-level data to identify key conditions for health driving local trends in diabetes.

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Procedure

Part 1: Required Pre-Work

At the start of this lesson, the instructor will begin by providing the class with a broad overview of diabetes. As required pre-work, students should have read a fact sheet produced by the World Health Organization (WHO) that covers key facts and figures:

- WHO Fact Sheet: Diabetes. World Health Organization 2023. https://www.who.int/news-room/fact-sheets/detail/diabetes.

As a brief warm-up activity, the instructor can pose the following questions to the class in a traditional call and response fashion. Alternatively, if the instructor would like to formally assess students' ability to recall the information from the reading, they could consider having a brief pop quiz with the following questions, and have students provide 1-2 sentence answers.

1. What is diabetes?
2. What long term health outcomes are associated with diabetes?
3. How common is diabetes?
4. What populations face a particularly high risk of diabetes?

Answer Key

Key points highlighted in these answers are taken directly from the WHO fact sheet assigned as pre-reading for this session.

1. **Defining diabetes**–Diabetes is a chronic condition defined by an inadequate production of insulin (type 1 diabetes, i.e., "childhood-onset" diabetes) or a physiologic dysfunction in which the body cannot use the insulin that is present (type 2 diabetes, i.e., "non-insulin dependent" diabetes). Since insulin regulates blood sugar levels, diabetes can result in hyperglycemia (i.e., high blood sugar) over time, which can damage bodily systems.
2. **Consequences of diabetes**–Diabetes is linked with an increased likelihood of having a heart attack, stroke, lower limb amputation, blindness, and kidney failure.
3. **Diabetes prevalence**–Roughly 1.6 million deaths were attributable to diabetes in 2015. Among adults, the prevalence of diabetes worldwide has grown from 4.7% in 1980 to 8.5% in 2014. By 2030, the WHO estimates that it will be the seventh leading cause of death globally.
4. **Risk factors**–People who are overweight and obese, physically inactive, have an unhealthy diet (i.e., high in sugar or saturated fats), and smokers are more likely to experience diabetes. Avoiding these behaviors has been shown to effectively delay the onset of diabetes or prevent it altogether.

Part 2: Comparative Data Interpretation
(30 Minutes)

Note: If instructors are teaching in a 60-minute block, consider skipping ahead to Part 3.

Next, students will learn about global trends in diabetes by working in pairs to interpret a graph comparing the prevalence of diabetes across different regions in the world.

1. After breaking off into pairs, the instructor will distribute the following diagram (Figure 1, also available as a full-page handout) to each group and also project it on the board. Be sure to point out to students that the data presented here does not distinguish between type 1 and type 2 diabetes. In the article this came from, the authors note that it is difficult to tell the two forms of diabetes apart

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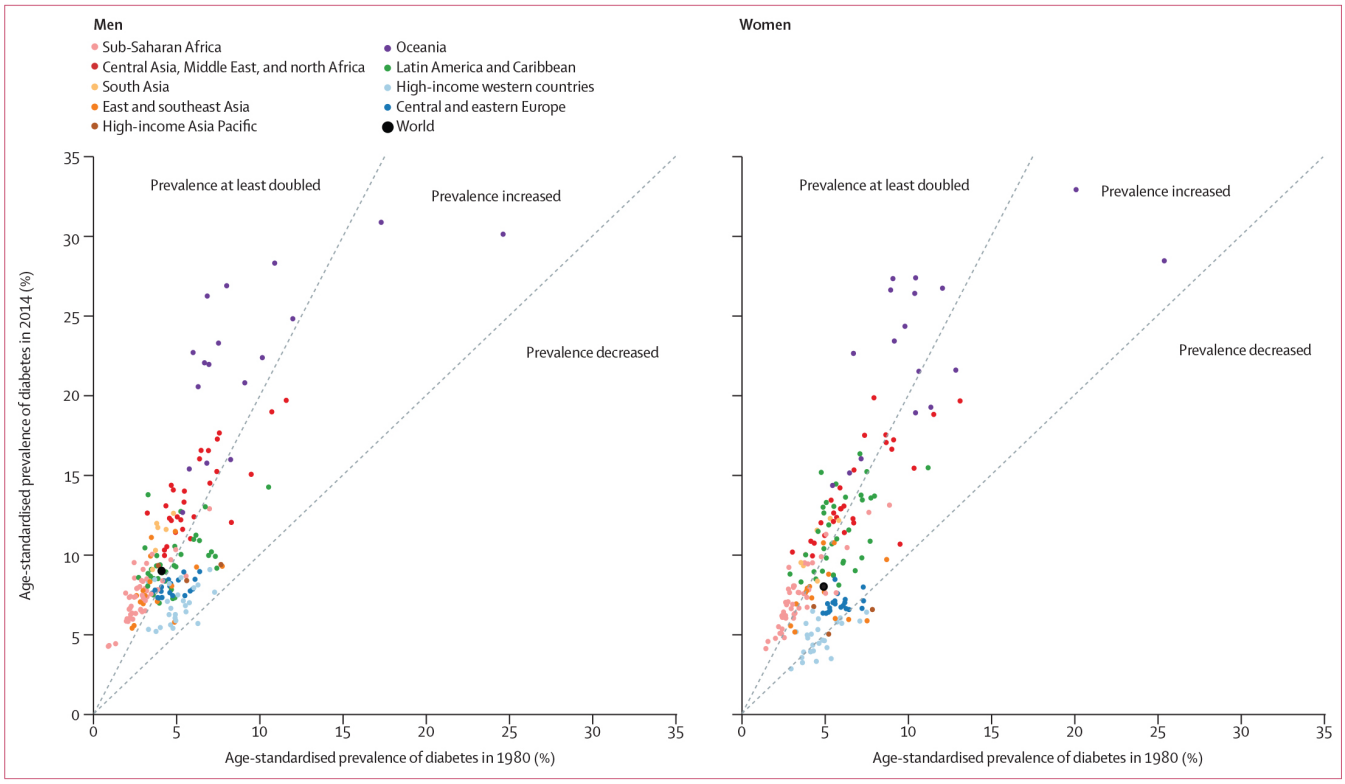
in adults. It is also noted that between 85 percent and 95 percent of cases of diabetes among adults are due to type 2 diabetes, so type 2 diabetes is likely driving observed trends.

Figure 1: Comparison of Age-Standardized Prevalence of Diabetes in Adults in 1980 and 2014



Source: Worldwide Trends in Diabetes Since 1980: A Pooled Analysis of 751 Population-Based Studies with 4·4 Million Participants. The Lancet 2016; 387: 1513-30. DOI: http://dx.doi.org/10.1016/S0140-6736(16)00618-8.

2. After giving students a few moments to examine this graph, the instructor should ask if groups have any questions about what is depicted. This is a good opportunity for students to ask about the meanings of any terms they do not recognize. As a reminder, **prevalence** refers to the percentage of people in the population who have diabetes in a specific time period. Data on diabetes prevalence will give you a sense of how common it is in a given region. By providing an **age-standardized** prevalence in this graph, the authors are simply stating that they used statistical methods to account for age, and therefore trends are not due to the age distribution of the population. This is important to be aware of because, as populations age, the prevalence of chronic diseases like diabetes tends to increase. When we consider an age-standardized prevalence, we can rule out the possibility that increases in prevalence are due to an aging population.
3. Once students are clear on their terms, they will break into their groups and spend 15 minutes answering the questions listed below:

    - What exactly is this figure describing? (Be sure to describe the title, each axis, the legend, and the three regions highlighted.)
    - What does this figure tell us about diabetes globally?
    - In what regions has diabetes prevalence doubled? Of those regions, which have the highest prevalence of diabetes?

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- Focusing specifically on Latin America, what do you notice? How would you compare the risk of developing diabetes in Latin America compared with the other regions depicted?

4. After recording their responses, the groups will come back together with the larger class and report their answers. The instructor should write key points that are raised on the board so students can note important observations. Instructors should be sure to refer to the answer key below to ensure that all major themes are brought to light in the class discussion.

Answer Key

Describing the figure

- The two graphs in this figure provide a comparison of the age-standardized prevalence of diabetes among adults in 1980 compared to 2014. The fact that they are **age-standardized** means that they have accounted for age in the estimates and therefore the trends we see are not due to aging populations, but due to true increases in the prevalence of diabetes within each age category.
- In each graph, countries' change in prevalence is illustrated by plotting their prevalence of diabetes in **1980 on the x-axis** and their prevalence in **2014 on the y-axis**. The **dotted lines** demarcate the area in the graph representing where prevalence at least doubled, increased, or decreased. Within each graph, the colored dots represent the prevalence in different regions (e.g., salmon=Sub-Saharan Africa, green=Latin America and Caribbean), while the large black dot represents the worldwide prevalence. Lastly, the graph on the **left depicts trends for men**, while the graph on the **right depicts trends for women** to highlight potential differences by gender.
- The data portrayed in the figures came from a pooled analysis of 751 population-based studies that included a total of 4.4 million participants.

Summarizing key findings

- **Global trends:** For both men and women, the prevalence of diabetes worldwide increased from 1980 to 2014 (see black dot). However, the increase was more pronounced for men, for whom the prevalence of diabetes doubled. When considering differences by region, the prevalence of diabetes increased for all countries except one high-income western country. For women, the prevalence of diabetes increased in most countries; however, there were perhaps 10-20 countries where the prevalence decreased.
- **Gender differences:** For men, the prevalence of diabetes at least doubled, most notably in Sub-Saharan Africa (salmon), Central Asia/the Middle East/north Africa (red), and Oceania (purple), as well as some south Asian countries (yellow) and some countries in Latin America and the Caribbean (green). For women, there appears to be a larger clustering of Latin American/Caribbean countries in which the prevalence of diabetes at least doubled.
- **Regional trends:** Among the countries in which diabetes at least doubled among both men and women, the highest prevalence of diabetes in 2014 was observed in Oceania.
- **Latin American trends:** Focusing particularly on Latin America and the Caribbean, the region seems to be experiencing trends similar to what has been observed in other regions in the world. However, while other regions are facing increases across the population, trends may be gendered in Latin America and the Caribbean. Based on the data, it appears that the prevalence of diabetes has at least doubled in more Latin American and Caribbean countries for women than it has for men. Additionally, the prevalence among women appears to be higher.

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Part 3: Diabetes in Latin America: A Deeper Dive
(15 Minutes)

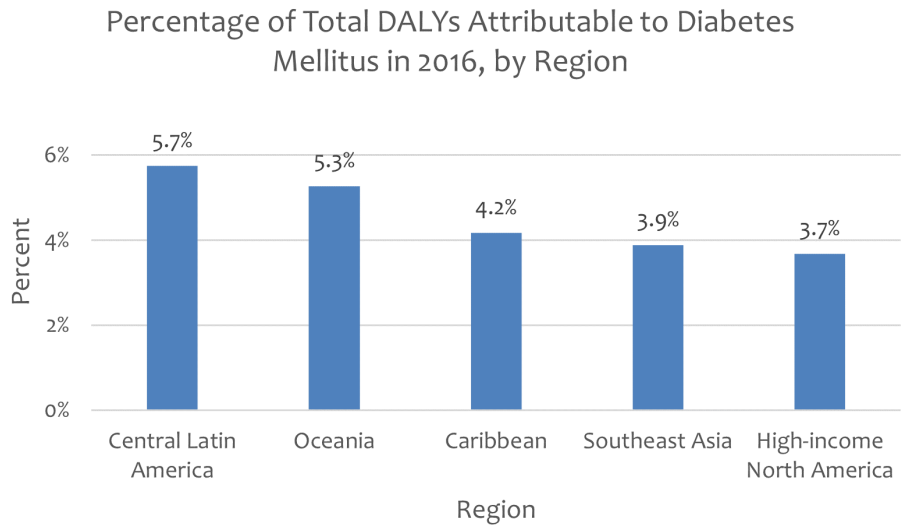
Now that the students have gained some insight into global trends in diabetes, the instructor will take a deeper dive into diabetes in the Latin American region using data from the Global Burden of Disease. The **Global Burden of Disease** (GBD) is a research project managed by the Institute for Health Metrics and Evaluation that combines data from 195 countries to describe global trends in premature death and disability for over 300 diseases and injuries.

This portion of the lesson will give students the opportunity to revisit the global health metrics they learned in Noncommunicable Diseases 101. To ensure that all students are on the same page and remember the content presented in the previous lesson, instructors should begin this part of class by asking for a volunteer to: **(1) describe what a DALY is**; and **(2) explain why they are useful in describing noncommunicable diseases like diabetes**.

As a reminder, **DALYs (or disability-adjusted life years)** are a measure of both premature mortality due to a health issue, and the years of life it impacts through disability. More specifically, DALYs tell us how many estimated years of life are "lost" due to a given health condition in a specific region. Although diabetes is among the leading causes of death globally, it is a condition that typically does not trigger mortality immediately, but rather develops over time. DALYs can be helpful to quantify the burden of diseases like diabetes because they are able to capture both morbidity that can accrue over the life course as well as the extent to which it contributes to death.

After reviewing these key concepts, the instructor will present a series of bar graphs (Figures 2, 3, and 4, all derived from GBD data) to the class to help students better understand the issue of diabetes in Latin America. Below each graph, an explanation of key points is provided in italics as a guide for instructors.

Figure 2: Five Regions Facing the Greatest Burden of Diabetes Globally, 2016



Source: GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://vizhub.healthdata.org/gbd-compare.

In the previous data interpretation activity, Oceania (i.e., Australia) was identified as the region with the highest prevalence of diabetes. However, looking at GBD data, we see that Central Latin America actually

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exceeds Oceania in the percentage of total DALYs attributable to diabetes in 2016. This means that based on our most recent global data, Central Latin America is the region that faces the greatest burden of diabetes.

Instructors can consider asking the students the following questions to unpack this data further:

Why do you think this trend is different than what was presented in the "Comparison of Age-Standardized Prevalence of Diabetes" graph we discussed earlier?

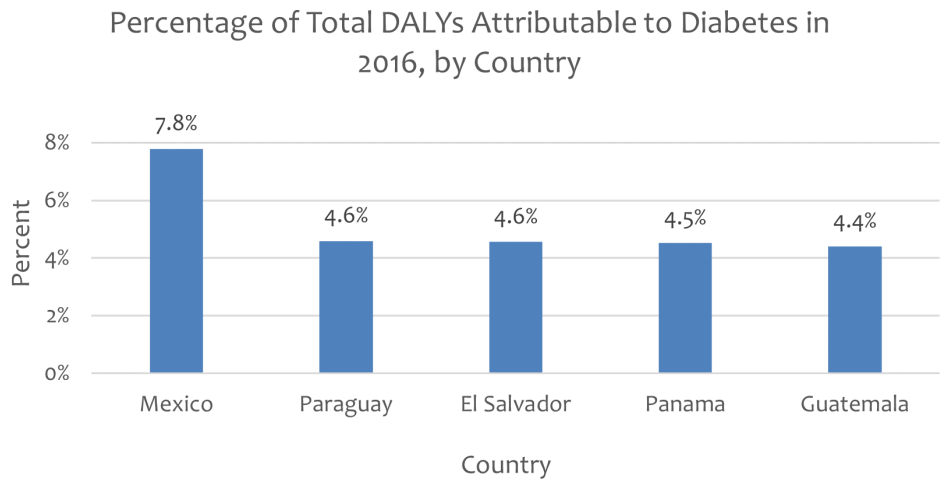
Students should note a few points:

1. **Differences in the definition of geographic regions:** The ways in which global regions are defined varies between these two graphs. In the previously discussed Lancet article, all of Latin America and the Caribbean are grouped into a single category. GBD, on the other hand, breaks global data down into smaller regions.
2. **Differences in the metrics used:** The previous graph describes trends in the prevalence of diabetes (i.e., the percentage of people in the population who have it), while this graph depicts the extent to which diabetes burdens countries and regions based on an estimation of the number of healthy years of life are "lost" in the population due to it.
3. **Differences in the reference point for each measure** The previous graph focuses on prevalence, which is an **absolute**, point-in-time estimate of the total percentage of people in a given region with diabetes. On the other hand, this graph presents data on the percentage of total DALYs attributable to diabetes **relative** to other diseases.

Is there anything that surprises you about the regions in this top five list?

Students may be surprised to see that the burden of diabetes in Southeast Asia is comparable to that of high-income North America. Instructors can encourage students to have an open discussion about what they think is driving this trend. While there is no right or wrong answer to this question, instructors should encourage students to think about potential social factors that may contribute to rising trends as countries become more developed, such as a greater availability of unhealthy, low-cost fast food.

Figure 3: Five Countries in Latin America Facing the Greatest Burden of Diabetes, 2016.



Source: GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://vizhub.healthdata.org/gbd-compare.

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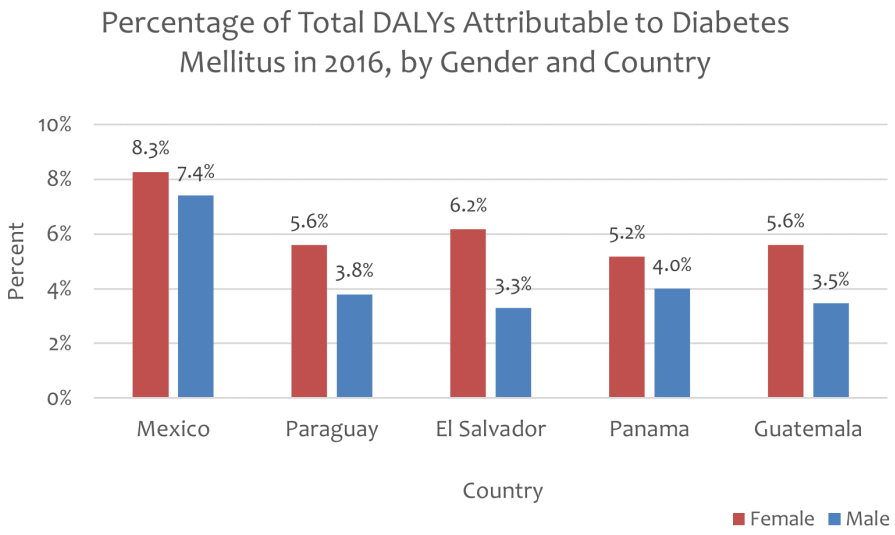
When we take a deeper dive into the Central Latin America region, we see that one country in particular stands out as facing a notably high burden of diabetes: Mexico. Nearly 8 percent of total DALYs in Mexico are attributable to diabetes, compared to ~4.5 percent in the following five countries.

Instructors may want to note that this graph illustrates disease burden in relation to other causes of DALYs, but if we examine country-level differences in prevalence (as was done in Part 2 of this lesson), the differences between countries are less pronounced. Nevertheless, Mexico has a greater burden of disease in relation to prevalence, proportion of disease burden, as well as the absolute number of people with diabetes in the population.[1]

Figure 4: Five Countries in Latin America Facing the Greatest Burden of Diabetes, 2016



Source: GBD Compare Data Visualization. Institute for Health Metrics and Evaluation 2016. http://vizhub.healthdata.org/gbd-compare.

Finally, in our last graph, we examine differences by gender. In our previous data interpretation activity, we saw that differences in Latin America appeared to be gendered, with women facing a greater burden than men. Here, we see that is indeed the case as women have a higher proportion of DALYs attributable to diabetes in all five Latin American countries compared to men. Interestingly, in Mexico (the country facing the greatest burden of diabetes in the region), this gender disparity is less pronounced than the other countries. For example, in Ecuador, the percent of total DALYs attributable to diabetes among women is nearly twice that of men.

Now that the class has identified Mexico as a country where diabetes control should be a health priority, students will spend the rest of class working in small groups to identify country-specific factors that may be contributing to current trends.

[1] Diabetes Country Profiles 2016. World Health Organization 2016. https://www.who.int/teams/noncommunicable-diseases/surveillance/data/diabetes-profiles.

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Part 4: Examining Country-Specific Conditions for Health
(30 Minutes)

Next, the class will adopt a more country-specific lens to think about diabetes and its contributing factors. Students will work in groups to examining fact sheets describing country-specific trends in diabetes and related nutritional factors in **Mexico**. Instructors may also consider including a second country (for instance, one in Southeast Asia, which also faces a high burden of diabetes) so students can compare across different settings.

Divide the class into groups of two or three students, and distribute copies of the following country profiles to each group:

- Mexico Diabetes Country Profile. World Health Organization 2016. https://www.who.int/publications/m/item/diabetes-mex-country-profile-mexico-2016.
- Mexico Nutrition Country Profile. International Food Policy Research Institute 2022. https://globalnutritionreport.org/resources/nutrition-profiles/latin-america-and-caribbean/central-america/mexico.

Assign each group to answer **one** of the questions below using the provided country profiles. Groups will discuss their answers amongst themselves for 15 minutes, and then will reconvene with the rest of the class to share out their responses. Instructors should be sure to highlight the key points listed in the answer key below as groups share their answers.

Analyze the prevalence of diabetes in Mexico in 2016. Consider the following points when crafting your answer:

- Are there differences by gender?
- How does the current prevalence compare to the prevalence in 2006? 1996? 1986?
- What are the main national strategies to address diabetes in the population?

1. **Make a list of potential factors (supported by statistics) influencing diabetes in Mexico.** Support your answer with data from either of the country profiles provided.
2. **Identify factors you think may be potentially relevant but are not included in either of the country profiles you received.** Why do you think these factors are important to take into consideration?

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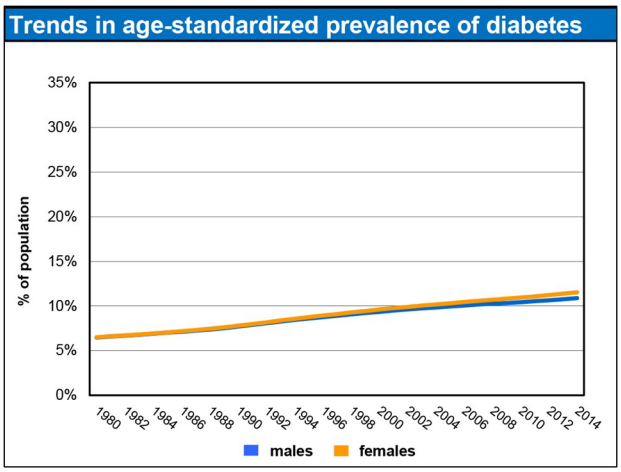
Answer Key

Describing the prevalence of diabetes in Mexico

1. In the diabetes country profile, the following graph of age-standardized prevalence is provided:



Interpreting the data depicted, we see that:

The prevalence of diabetes is 10.4 percent in Mexico, with a higher proportion of women having the condition than men (11.0 vs. 9.7 percent).

Diabetes accounts for 14 percent of total deaths among all age groups in Mexico.

In terms of raw numbers of deaths, more younger men (ages 30-69) are dying from diabetes compared to older men (ages 70+). Roughly comparable numbers of older and younger women are dying from diabetes.

The age-standardized prevalence of diabetes has been rising in Mexico from 1980 to 2014, and there is evidence of a widening of gender disparities. Using the graph above, we can estimate the prevalence at each year as follows:

Table 1 – Estimate of age-standardized prevalence of diabetes in Mexico

Year	Prevalence of Diabetes in Men (percent)	Prevalence of Diabetes in Women (percent)
2014	10.5	11.0
2006	~10.0	~10.2
1996	~8.9	~9.0
1986	~7.0	~7.0

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To clarify potential misunderstandings, it is important to note to students that the data presented in this graph are **age-standardized prevalence,** while the data presented in the table pictured below are **overall prevalence.**

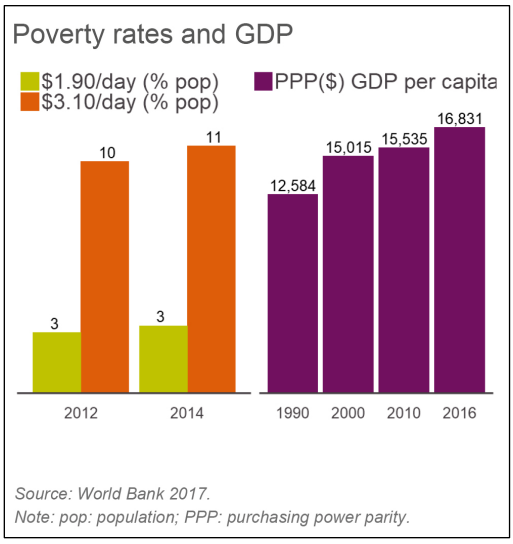
Table 2 - Prevalence of Diabetes and Related Risk Factors

Condition or Risk Factor	Males	Females	Total
Diabetes	9.7%	11.0%	10.4%
Overweight	61.6%	65.0%	63.4%
Obesity	22.1%	32.7%	27.6%
Physical inactivity	18.9%	31.2%	25.4%

Factors influencing diabetes in Mexico

2. In the Nutrition Country Profile, the following conditions for health influencing trends in diabetes are described:

Poverty



In 2014, 3 percent of the population was living on $1.90/day, while 10 percent was living on $3.10/day. With nearly 15 percent of the population living in poverty, it is reasonable to presume that inexpensive junk foods likely are an important source of food for vulnerable populations.

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Urbanization

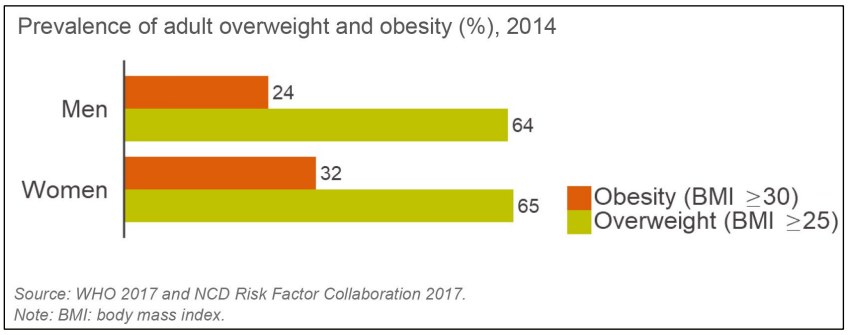
Table 3 - 2017 urbanization statistics for Mexico

Urbanization statistic	2017
Population (thousands)	129,163
Under-5 population (thousands)	11,547
Urban (%)	80
>65 years (%)	7

Source: 2017 projections from UN Population Division 2017

80 percent of the population of Mexico was living in an urban area in 2017. Although no data is provided to illustrate differences in dietary choices and food availability between rural and urban areas, fresh produce and healthy food options are often less readily available (or affordable) in the latter.

Overweight and Obesity



Very high proportions of people are overweight, defined as having a Body Mass Index (BMI) greater than or equal to 25 (65 percent of women, 64 percent of men). Being overweight or obese is a risk factor for diabetes, meaning people who have these conditions are more likely to develop diabetes over time. Often, individuals are both overweight and have diabetes (i.e., it is a co-morbid condition).

3. Relevant factors not included on either country profile

While the country profiles provide relevant descriptive statistics related to nutrition and some structural factors impacting it in Mexico, they provide very little information on social determinants of health that are likely important drivers of diabetes. At the individual level, diabetes is impacted directly by an individual's food and beverage consumption as well as their physical activity. Both of these factors are shaped in various ways by the multiple contexts or environments in which people live, including their family/home, peer group, school, workplace, and neighborhood, and broader national environment (e.g., government policies, industry practices, agriculture, media, and social norms/values). For example, an individual's ability to engage in physical activity is impacted by factors at the community level, including neighborhood safety and urban planning (i.e. walkable cities, green spaces, etc.), as well as factors at the sociocultural level (e.g. culture-specific gender norms that may encourage boys but not girls to participate in organized sports). On the next page, you will find one example of a simplified, graphical depiction of these various environments.

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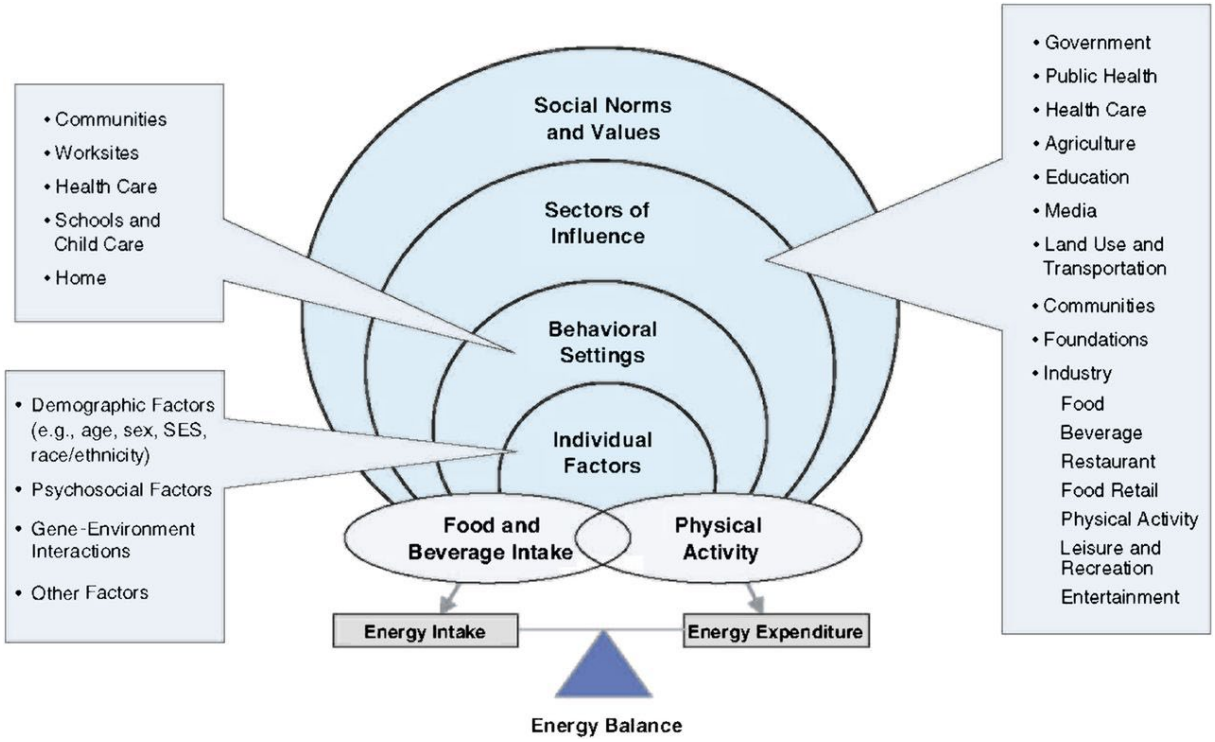
Figure 5: Levels and Sectors of Influence on Obesity and Diabetes Risk



Source: Hill JO et al. Scientific Statement: Socioecological Determinants of Prediabetes and Type 2 Diabetes. Diabetes Care 2013; 36(8): 2431. http://care.diabetesjournals.org/content/36/8/2430.

In the above diagram, the circles represent the social contexts individuals operate within. The circles are nested within each other to represent the multilevel nature of social environments and the fact that they together shape individuals' nutrition and physical activity in ways that tip the energy balance in the direction of intake (i.e., weight gain) or energy expenditure (i.e., weight loss).

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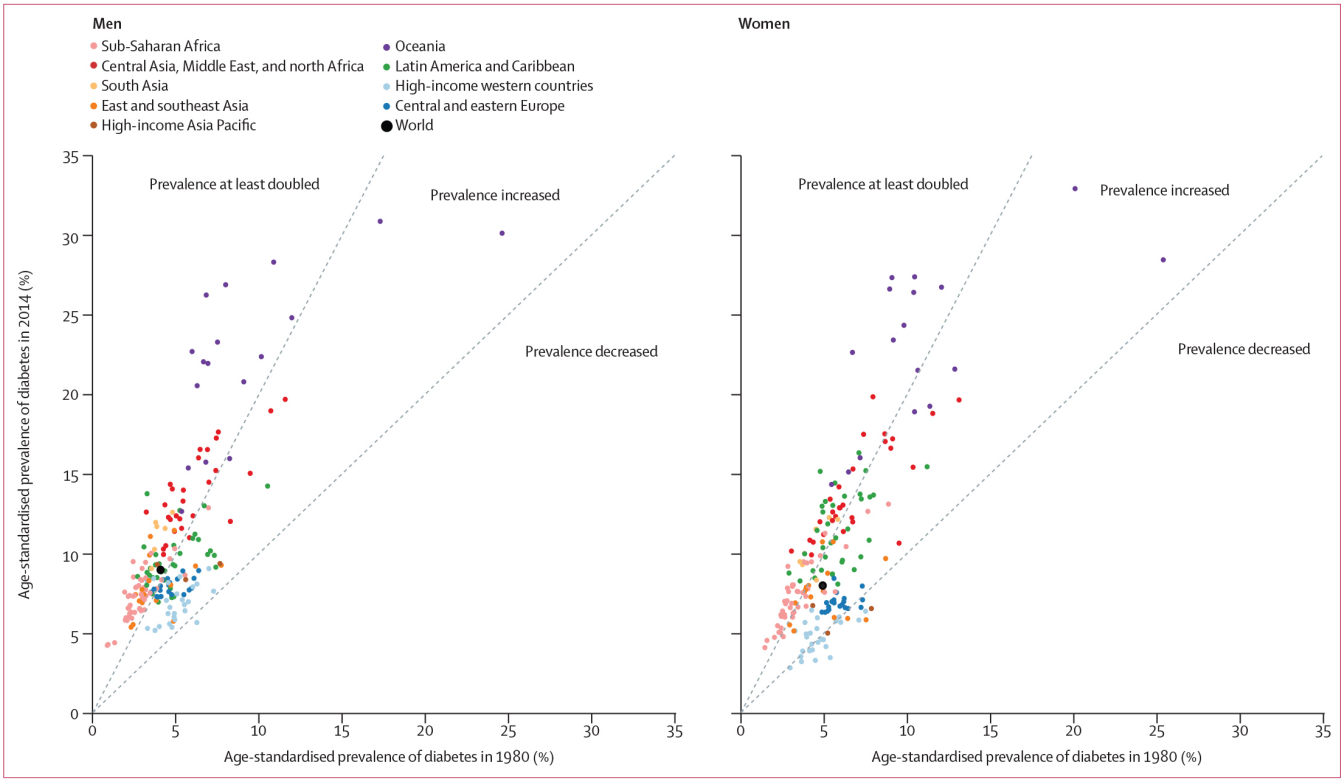
Appendix: Student Handout

Figure 1: Comparison of Age-Standardized Prevalence of Diabetes in Adults in 1980 and 2014



Source: Worldwide Trends in Diabetes Since 1980: A Pooled Analysis of 751 Population-Based Studies with 4·4 Million Participants. The Lancet 2016; 387: 1513-30. DOI: http://dx.doi.org/10.1016/S0140-6736(16)00618-8.

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Sugar Tax: Public Health or Personal Choice

Lesson Plan 3

2018

Purpose

The purpose of this lesson is to teach undergraduate students about the rationale behind using taxation as a strategy to improve public health. First, students will learn about Mexico's experience implementing a national sugar tax and the health benefits that it has accrued over the years. Then, students will participate in a role play activity in which they consider the advantages and disadvantages of this approach to combating diabetes from the perspective of various key stakeholders in Colombia, a Latin American country where advocates are currently trying to pass a similar tax on sugar-sweetened beverages.

Learner Level

- Undergraduate

Time

One 90-minute session

Required Pre-Reading

- Donaldson E. Advocating for Sugar-Sweetened Beverage Taxation: A Case Study of Mexico. Johns Hopkins Bloomberg School of Public Health 2016. https://ncdalliance.org/news-events/news/advocating-for-sugar-sweetened-beverage-taxation-a-case-study-of-mexico.
- She Took on Colombia's Soda Industry: Then She was Silenced. The New York Times 2017; Nov 13. https://nyti.ms/2hyr8ZM.

Learning Goals

1. Understand how a national sugar tax is hypothesized to reduce population trends in diabetes.
2. Determine the ways sugar taxes might impact key stakeholders at the individual, community, business, and policy levels.
3. Analyze the health benefits associated with a sugar tax in light of its potential ethical and social costs.

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Procedure

Part 1: Taxation as a Public Health Intervention
(30 Minutes)

Note: If instructors are teaching in a 60-minute block, consider skipping ahead to Part 2.

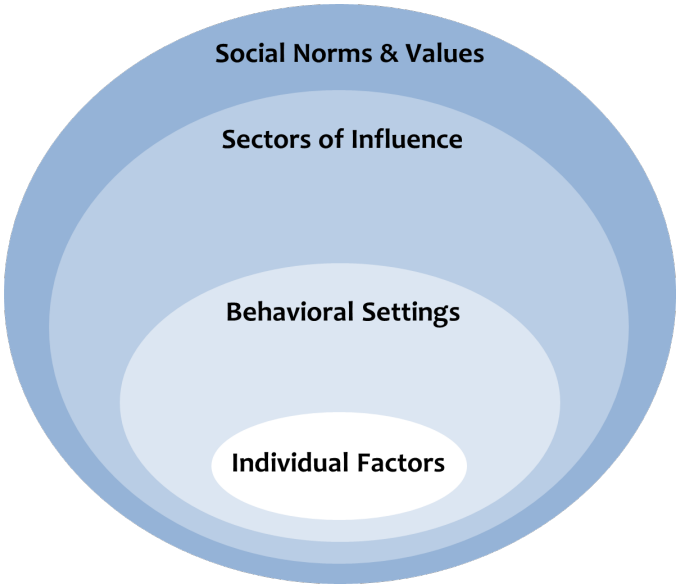
In the previous lesson of this teaching pack, "Understanding Diabetes in Latin America," students identified Mexico as the country facing the greatest burden of diabetes in Latin America. In this lesson, students will learn about a national policy initiative recently implemented as a public health response in Mexico. As required pre-work, students should have read a case study produced by Johns Hopkins Bloomberg School of Public Health that describes the implementation of a tax on sugar-sweetened beverages in Mexico, and subsequent health improvements that were observed at the population level:

- Donaldson E. Advocating for Sugar-Sweetened Beverage Taxation: A Case Study of Mexico. Johns Hopkins Bloomberg School of Public Health 2016. https://ncdalliance.org/news-events/news/advocating-for-sugar-sweetened-beverage-taxation-a-case-study-of-mexico.

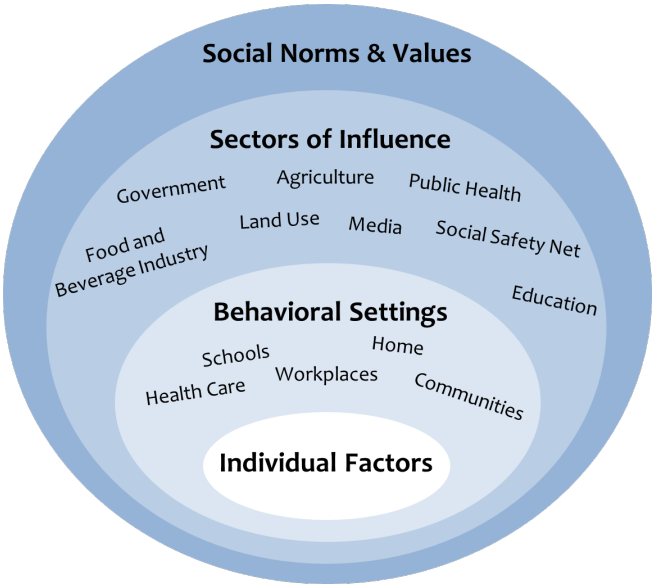
In the first part of class, students will discuss this case study, thinking particularly about the factors that were identified as important drivers of diabetes at the end of the previous lesson.

To refresh students on what was identified in the last lesson, instructors should begin the class by drawing (or projecting) the following diagram on the board and ask students to call out factors that they think may be impacting trends in diabetes at each level. This activity is meant to be a brief warm-up and review and should not take more than 5-10 minutes.

Empty Diagram (Left):



Sample Completed Diagram (Right):



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Sample Answers:

The factors listed below are a sampling of what the class may brainstorm as a group. Other factors that are not listed here may also be valid answers, and instructors should assess the quality of responses based on their relevance and plausibility.

Social Norms & Values

- Gender norms around physical activity
- Food norms (e.g., Fast food vs. healthy food options)

Sectors of Influence

Public Health

- Public health infrastructure
- Health and nutrition education

Government

- Zoning regulations (e.g., Fast food restaurants near schools)
- Development (e.g., Green grocers in poor neighborhoods)
- Pro-poor policies (e.g., Food stamps)
- Taxes
- Calorie labelling requirements

Food and Beverage Industry

- Food pricing
- Advertising
- Lobbying

Behavioral Settings

Home

- Healthy food options at home
- Parental or family food preferences
- Family leisure activities
- Cultural dietary preferences
- Poverty

School

- Healthy food options at school
- PE classes
- Nutrition education

Community/Neighborhood

- Availability of healthy food outlets (e.g., Green grocers)
- Community gardens
- Safety
- Parks and greenspace
- Walkability

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- Urban or rural residence
- Neighborhood disadvantage

Individual Factors

- Dietary choices and preferences
- Sedentary behavior
- Physical activity
- Gender

Next, the instructor will lead an informal conversation with the class around the assigned reading. Below are a series of questions to help guide the discussion. Model answers are included in *italics* following each question.

1. **What factor listed in the diagram we just brainstormed does a sugar-sweetened beverage (SSB) tax address? Do you think it is sufficient to tackle diabetes in Mexico? Why or why not?**

   SSB taxes are designed to change individuals' dietary choices through government intervention on beverage pricing. While there is no right or wrong answer to the question of whether students think such taxation would be effective or not, instructors should encourage the class to take a step back and think about the big picture with respect to diabetes and specifically the factors they think are more or less important. For instance, students could cite individual dietary preferences as the primary driver but recognize that those preferences are shaped by both industry pricing for all citizens, but also by experiences of poverty for low-income populations. Students could also highlight physical activity at the individual level as a primary driver, but also acknowledge that the extent to which an individual can engage in physical activity may depend on factors at various other levels as well. Ultimately, through discussion of this question, students should gain an appreciation of the complexity of diabetes and the challenges around imposing an intervention that only targets one (or two) of its contributing factors.

2. **Both proponents and opponents of Mexico's SSB tax argue that the issue affects low-income Mexicans. Are they both right? Why or why not?**

   Opponents

   - *Individuals need a minimum of calories, and SSBs are a core part of Mexican working-class diet.*
   - *Mexicans would lose jobs if SSB companies lost revenue.*
   - *SSBs are a critical source of income for small sugar cane producers or corner stores.*
   - *A SSB tax disproportionately affects the poor (i.e., it is a regressive tax).*

   Proponents

   - *Obesity and diabetes disproportionately affect the poor.*
   - *70 percent of Mexicans support SSB, which includes low-income Mexicans, too.*
   - *SSB industry doesn't support sugar cane producers since most beverage use high-fructose corn-syrup, not cane sugar. Corner stores could be incentivized to sell healthier non-SSB beverages.*

3. **Why do you think the Mexico's political context was favorable to the SSB tax?**

   - *The Mexican government was looking for revenue sources.*
   - *President Nieto ran on a platform of fiscal reforms in the form of taxes.*
   - *The election of the new legislature and president in 2013 created a good window to act on a tax since the legislature and president had a set amount of time to outline a new government budget.*

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4. **To what extent was the passing of a SSB tax in Mexico a transparent and democratic process?**

   There is no single right answer to this question. Rather, its purpose is to motivate students to think about the realities of how many policy decisions are made. The case study states that "seven out of every 10 Mexicans" were in support of some form of the tax, suggesting that popular vote would have led to this reform passing. Nevertheless, lobbying tactics and negotiations carried out by both proponents and opponents of the tax are ultimately what led to it going into law.

   The Process Was Democratic

   - *Legislators are elected to represent the views of the people, and in this case, they did since the will of the majority was upheld.*
   - *Lobbying efforts from both sides are a legitimate method of influencing public opinion and helping both ordinary citizens and governments understand all sides of an issue before forming an opinion.*

   The Process Was <u>Not</u> Democratic

   - *Even though the will of the majority was consistent with the eventual outcome, the vast majority of Mexicans were detached from the policy-making process, which ultimately boiled down to each side's ability to swing the favor of a small group of powerful legislators.*
   - *To sway opinion in their favor, opponents of the tax propagated false information through "consumer front groups" that misrepresented the views of the public.*
   - *Proponents of the tax directly targeted legislators rather than members of the public.*
   - *Other actions detailed in Table 1 of the case study illustrate that policy-making is not always about the opinion of the majority, but rather can be determined by a few powerful actors.*

Part 2: Small Group Discussion
(20 Minutes)

Now that students have a basic understanding of sugar taxes as a public health intervention, they will break up into small groups to participate in an activity in which they brainstorm advantages and disadvantages of sugar taxes as a public health intervention from the perspective of various stakeholders on the ground. As required pre-work, students should have read a *New York Times* article describing efforts to pass a 20 percent tax on sugar-sweetened beverages in Colombia:

- She Took on Colombia's Soda Industry: Then She was Silenced. The New York Times 2017; Nov 13. https://nyti.ms/2hyr8ZM.

In both the United States and abroad, the soda industry has perceived such taxes as a major threat and put millions of dollars into opposing them. Recently, opposition efforts have intensified in the Global South, which the industry sees as an emerging market to make up for losses due to reductions in soda consumption in wealthier countries. In places like Colombia, companies have used "bare-knuckled" strategies to stop taxes, including heavy lobbying efforts to sway government officials and lawmakers, wire-tapping advocates' phones, and various bullying tactics. The article on soda taxing in Colombia describes intense industry efforts to halt the tax proposed in 2016, despite widespread support from both the president and 70 percent of the public.

With this article in mind, student groups will be assigned to consider the benefits and/or costs of implementing a sugar tax from one of the following "stakeholder" perspectives:

1. An upper-middle-class family
2. A low-income single mom with three children

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3. A soda industry executive
4. A public health worker
5. An elected official representing a city or region suffering from low employment, underfunded schools, high-levels of violence, and poor infrastructure
6. A 45-year-old man with diabetes
7. An urban small business owner of a "corner store"/bodega

Students should be encouraged to make links between the points that arise in their conversations about their assigned stakeholders' views with the situation in Colombia they read about for class.

Each group should designate one group member to be a note-taker who will summarize up to five key points from their discussion and share them with the class.

Part 3: Class Discussion
(40 Minutes)

When the class has reconvened, note-takers will report their group's key points and the instructor will facilitate a class discussion based on the groups' responses. Key points that should emerge from the conversation are listed below in bold, with accompanying explanations and prompting questions to spark further discussion.

As students share their thoughts, the instructor should note important themes using key words or phrases on the board, using the guide below to ensure all relevant points are discussed. While there are no correct or incorrect answers in this exercise, instructors should be mindful of the key points that should emerge from the conversation, and steer students towards points that do not emerge from the discussion organically.

- **Regressive taxation** (*Especially relevant to stakeholders 2, 4, 5, and 7*): Regressive taxes are those that disproportionately burden the poor (as opposed to a progressive tax, in which those with more income bear more financial responsibility). While taxes on unhealthy products (such as cigarettes and alcohol) have been found to disincentivize consumption and change social norms around unhealthy behaviors, the financial burden of a sugar tax may not be felt equally across socioeconomic groups. Although applied to all sugar-sweetened beverages, it would be inequitably experienced by low-income populations who tend to purchase disproportionately more soda than higher-income populations due to accessibility. These populations are also those who bear a greater burden of chronic disease. Wealthier people, on the other hand, tend to have more access to diverse alternate beverage options, and greater means to pursue them.
    - **Open-Ended Reflection Prompt:** This argument was central to Postobón's opposition to a sugar tax in Colombia. Do you think it was a fair one? How would you rebut this argument?
- **The use of the tax revenue** (*Especially relevant to stakeholders 2, 4, and 5*): The equity of a policy intervention like a sugar tax also depends on how the tax revenue will be used. If the funds are used to improve the social safety net, support schools, bolster failing infrastructure, or provide other sources of support to disadvantaged people disproportionately bearing the financial burden, the benefits of the proposed tax could not only be more equitable than suggested above, but also help reduce disparities by targeting broader social determinants of health.
    - **Open-Ended Reflection Prompt:** Do you think it is possible for the financial costs and health gains of a sugar tax to be equitably experienced in the population? Do you find this approach to be fair in the Colombian context?
- **Advancing population health vs. individual health** (*Especially relevant to stakeholders 3, 4, and 6*): Taxes are frequently designed to yield substantial population health impacts in the long-term with

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less immediate impacts on individual-level health outcomes. While a sugar tax may not singlehandedly prevent an individual from developing diabetes, it would likely result in lower population prevalence of diabetes over time. Therefore, it is an investment in the future with the goal of preventing the development or exacerbation of chronic health issues in the population.
    - **Open-Ended Reflection Prompt:** Considering public health resources are limited, what do you think is a more worthwhile investment: individual-level health interventions (e.g., those aimed at screening and treating diabetes in the population), or population-level interventions (e.g., those aimed at preventing future disease)?

- **Personal choice vs. public health** (*Relevant to all stakeholders*): A common point raised in industry opposition efforts relates to the issue of personal choice. What if I know that sugar-sweetened beverages are bad for my health, but I want to drink them anyway because I like them? In a free society, people have the right to make whatever choices they see fit, even if it is to engage in health-compromising behaviors, and companies have the right to sell things that are bad for people.
    - **Open-Ended Reflection Prompt:** Do you think it is fair for public health professionals to obstruct people's freedom to engage in the behaviors they desire in service of "the greater good"?

- **Food access** (*Especially relevant to stakeholders 4, 5, and 7*): "Food deserts" are common to many urban neighborhoods where local small convenience stores are the primary food source, but those stores often carry highly processed foods (such as sugared sodas, candy, salted snacks, and pre-packaged foods that have a long shelf life). Such business owners need to be incentivized to stock more fresh foods (milk, fruits, and vegetables) and price them profitably to make healthy consumer choices an affordable option. The teacher may combine this discussion with water access, not only the price of bottled water (and recycling options for plastics) but the fact that these may also be neighborhoods without reliable access to clean water.
    - **Open-Ended Reflection Prompt:** How do higher priced sugared beverages due to taxation change the overall access that consumers (especially low-income consumers in urban neighborhoods) have to healthy food options? Can you think of alternative ways to increase healthy food access?

- **The disproportionate influence of industry** (*Especially relevant to stakeholders 3 and 4*): The argument that individuals may understand the health consequences of their actions and still choose to engage in unhealthy behaviors often presumes that individuals' choices are inherent and not shaped by a broader constellation of social factors. While choice may operate at the individual level, large-scale industries like the soda industry and food manufacturers play a large role in shaping individual preferences and choices through various means, including marketing campaigns, concerted efforts targeting governmental lobbying efforts, and even philanthropic endeavors (for example, Postobón's nutrition campaign described at the end of the article).
    - **Open-Ended Reflection Prompt:** In what ways do you think industry shapes the personal preferences of people in Colombia? How has globalization influenced industry efforts to both promote their goods and oppose regulation efforts?

- **Regulation vs. collaboration** (*Especially relevant to stakeholders 3 and 4*): Historically, industry has stood in stark opposition to public health agendas. One need not look further than public health efforts to regulate tobacco and industry efforts to mislead the public about its health hazards for proof. However, many argue that adopting a strict stance within public health in opposition to industry eliminates the possibility to work across sectors to address the major challenges impacting

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population health. While the health sector often faces the challenges of insufficient funding, many major corporations have philanthropic arms aimed at social good.

- **Open-Ended Reflection Prompt:** What are ways you think public health and industry may work together to stem the tide of chronic disease? Do you think it is ethical for public health to partner with the industries who profit from promoting unhealthy behavior in the population?

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global health education and learning
INCUBATOR
at Harvard University

Annotated Bibliography

Can Sugar Taxes Prevent Diabetes in Latin America?

2018

Overview

This bibliography is a selective sampling of educational resources that introduce students to the topic of public health taxes, and specifically taxes on sugar-sweetened beverages. The multidisciplinary materials may be suitable for students at the high school, undergraduate college, and public health graduate school levels. Learning objectives and supporting materials will vary depending on how the material is used in a course. Brief annotations provide a cursory summary and indicate where certain materials may be particularly relevant. Within each section, dated publications are listed in chronological order.

This selective bibliography accompanies a Teaching Pack on noncommunicable diseases and sugar taxes. The materials listed here represent a diversity of viewpoints and opinions and do not necessarily reflect the viewpoints and opinions of the Incubator.

This annotated bibliography includes:

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Selected Resources

*indicates resource listed in GHELI's online Repository

BASIC READS

*** Resource Pack. Global Noncommunicable Diseases**
Resource Pack: Global Noncommunicable Disease. Global Health Education and Learning Incubator 2023. https://repository.gheli.harvard.edu/repository/collection/resource-pack-noncommunicable-disease.

*** Fact Sheet. Diabetes**
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Article. Scientific Statement: Socioecological Determinants of Prediabetes and Type 2 Diabetes
Hill JO et al. Scientific Statement: Socioecological Determinants of Prediabetes and Type 2 Diabetes. Diabetes Care 2013; 36(8): 2430-2439. http://care.diabetesjournals.org/content/36/8/2430.

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Should Sugary Drinks Be Taxed Like Cigarettes? PBS NewsHour 2012; Jun 7. https://youtu.be/3QzzG-7q5CU.

TEACHING MATERIALS

*** Teaching Case. Soda Tax Debates: A Case Study of Berkeley vs. Big Soda's Social Media Campaign**
Soda Tax Debates: A Case Study of Berkeley vs. Big Soda's Social Media Campaign. Berkeley Media Studies Group, Public Health Institute 2016. http://www.bmsg.org/resources/publications/soda-tax-debates-a-case-study-of-berkeley-vs-big-sodas-social-media-campaign.

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GHELI repository link: https://repository.gheli.harvard.edu/repository/collection/resource-pack-noncommunicable-disease
Noncommunicable diseases (NCDs) now outnumber infectious disease as the top killers globally. This resource pack supports teaching and learning about NCDs, relevant risk factors, social determinants, and responses from within and outside the health sector to mitigate their impact. This pack deliberatively focuses on cardiovascular disease and stroke, chronic lung disease, diabetes and cancers, which are responsible for approximately 75% of NCD's, as well as their often shared risk factors such as tobacco, alcohol, poor diet, physical inactivity and overweight and obesity. Resources include global reports, review articles, country profiles, fact sheets and data, some of which focus on the general category of NCD's and some of which focus on one particular disease area or risk factor. Irrespective of focus, they collectively illuminate the impact of social determinants on disparities and inequities across socioeconomic position, race and ethnicity, educational status, and gender. The most recent data reveals that the global community is not on track to meet the Sustainable Development Goals, despite their being evidence-based interventions and policies that would be effective if implemented. While several of the global reports provide an overview of global and regional progress, country profiles, case studies and data interactives allow learners to explore how individual countries are doing.

Fact Sheet. Diabetes
Diabetes. Fact Sheet. World Health Organization 2023. https://www.who.int/news-room/fact-sheets/detail/diabetes.
GHELI repository link: https://repository.gheli.harvard.edu/repository/11858
This fact sheet from the World Health Organization (WHO) focuses on the global burden of diabetes, the clinical manifestations and health outcomes, and the available interventions. Although the fact sheet differentiates the types of diabetes (e.g., type I, type II and gestational), the emphasis is on the consequences of disease (blindness, kidney failure, heart attacks, stroke, and lower limb amputation), age-specific patterns of mortality, projected trends, and prevention, and the diagnosis and treatment options.

Fact Sheet. Diabetes in Hispanic/Latino Communities Advocacy Fact Sheet
Diabetes in Hispanic/Latino Communities Advocacy Fact Sheet. American Diabetes Association 2014. http://main.diabetes.org/dorg/PDFs/Advocacy/fact-sheet-advocacy-hispanic.pdf.
This fact sheet from the American Diabetes Association describes the extent to which diabetes impacts Hispanic/Latino populations in the United States and advocacy efforts designed to improve outcomes at the population level. Compared to non-Hispanic whites, Hispanics have a 66 percent greater likelihood of being diagnosed with diabetes, and also experience higher rates of insurance, which contributes to ethnic disparities. Although this fact sheet focuses on the American context, presenting more local data may help make the topic more accessible and understandable to novice students.

Fact Sheet. What is Diabetes?
What is Diabetes? National Heart, Lung, and Blood Institute 2013. https://www.nhlbi.nih.gov/health/educational/healthdisp/pdf/tipsheets/What-Is-Diabetes.pdf.
This fact sheet from the National Heart, Lung, and Blood Institute provides basic background information on Diabetes for students who are unfamiliar with the disease. In addition to describing the difference between Type 1 diabetes (which results when the body stops making insulin) and Type 2 diabetes (which develops when the body continues to make insulin but does not use it efficiently), the fact sheet also lists symptoms, diagnostic criteria, and risk factors in an easy-to-understand format with accompanying graphics.

Article. Scientific Statement: Socioecological Determinants of Prediabetes and Type 2 Diabetes
Hill JO et al. Scientific Statement: Socioecological Determinants of Prediabetes and Type 2 Diabetes. Diabetes Care 2013; 36(8): 2430-2439. http://care.diabetesjournals.org/content/36/8/2430.
This article in the American Diabetes Association's journal, Diabetes Care, provides a general overview of how social, environmental, and biological factors impact diabetes trends at the population level. In addition to presenting epidemiologic data describing increases in the prevalence of diabetes in the U.S. over time, the authors discuss how factors at the home or family level, at workplaces, in schools and communities, and at the public policy level together influence individuals' food consumption and physical activity patterns.

REPORTS

Report. Noncommunicable Diseases Progress Monitor
Noncommunicable Diseases Progress Monitor 2022. World Health Organization 2022.
https://www.who.int/publications/i/item/9789240047761.
GHELI repository link: http://repository.gheli.harvard.edu/repository/12146
This report from the World Health Organization (WHO) provides an overview of noncommunicable diseases (NCDs) worldwide. The four main noncommunicable diseases - cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases - account for 74% of global deaths. This report provides data on ten indicators for NCD progress monitoring, including reducing NCD deaths, tobacco demand reduction measures, measures to reduce harmful alcohol use, and strengthening health systems through primary health care and universal health coverage (UHC).

Report. Tobacco Tax Reform at the Crossroads of Health and Development
Irwin A et al. Tobacco Tax Reform at the Crossroads of Health and Development. The World Bank Group 2017.
http://documents.worldbank.org/curated/en/491661505803109617/Main-report.
This report by the World Bank Group describes the impact tobacco excise taxes have on consumption, and the ways tax revenues can be used to advance poverty reduction efforts in low- and middle-income countries. Public health advocates often refer to the implementation of tobacco taxes to curb smoking when advocating for sugar taxes as a policy intervention to address obesity. The authors also discuss tobacco's impact on economies, the ways tax increases can aid in development gains and lead to reductions in cigarette consumption, and practical aspects of tobacco tax reform (e.g., tax designs, protecting vulnerable populations, political marketing and implementation issues).

Report. Effectiveness of Obesity Prevention and Control
Thavorncharoensap M. Effectiveness of Obesity Prevention and Control. Asian Development Bank Institute 2017.
https://www.adb.org/publications/effectiveness-obesity-prevention-and-control.
This report by the Asian Development Bank Institute describes the efficacy and cost-effectiveness of various strategies to address obesity in the population, including taxes on sugar-sweetened beverages, nutrition labelling, advertising bans, and school-based interventions. Sugar-sweetened beverage taxes are described as being both cost-effective and successfully contributing to obesity prevention and control, while nutrition labelling and advertising bans have limited evidence of impact on BMI and obesity. Evaluations of school-based interventions were inconclusive but are thought to be the least cost-effective strategy.

Report. The Pros and Cons of Taxing Sweetened Beverages Based on Sugar Content
Francis N et al. The Pros and Cons of Taxing Sweetened Beverages Based on Sugar Content. Urban Institute 2016.
https://www.urban.org/research/publication/pros-and-cons-taxing-sweetened-beverages-based-sugar-content.
This report from the Urban Institute describes the advantages and disadvantages of implementing a tax on sugar content in sweetened beverages, as opposed to levying taxes based on total beverage volume. Due to variation in sugar content in sweetened beverages, the authors argue that focusing on specific drinks with high levels of sugar content would be more effective in reducing sugar consumption, and also may encourage product redesign. To support this case, the ways in which content-based taxes have impacted sugar, alcohol, and tobacco consumption in the population are discussed, as well as legal and practical issues around tax implementation at the federal, state, and local levels. The Urban Institute is a Washington, D.C.-based think tank on economic and social policies.

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Report. Implications of a Sugar Tax in New Zealand: Incidence and Effectiveness
Gardiner A. Implications of a Sugar Tax in New Zealand: Incidence and Effectiveness. New Zealand Treasury Working Paper 2017. https://www.treasury.govt.nz/publications/wp/implications-sugar-tax-new-zealand-incidence-and-effectiveness-wp-16-09.
This paper from the New Zealand Treasury reviews research on the use of sugar taxes as a policy intervention to reduce population levels of obesity and examines the potential impact a sugar tax could have if implemented in New Zealand. After reviewing the literature, the authors find that the social groups at the greatest risk for obesity are those who have high price-sensitivity, and that increased taxes do not address the fact that individuals may instead choose to purchase unhealthy non-taxed products, thereby mitigating positive impacts on obesity. Finally, analyses in New Zealand find that the tax would be regressive, disproportionately burdening low-income populations.

Global Report on Diabetes 2016
Report. Global Report on Diabetes 2016. World Health Organization 2016. https://apps.who.int/iris/handle/10665/204871.
GHELI repository link: http://repository.gheli.harvard.edu/repository/11009
This report by the World Health Organization (WHO) covers the global burden, complications, economic impact, prevention, and management of diabetes. This first-ever WHO global diabetes report outlines the capacity for prevention and control of diabetes at the country level as well as access to insulin and other essential medicines. The key message of the report is the need to increase prevention and treatment of the disease through measures including expanding health-promoting environments to reduce diabetes risk factors, such as physical activity and unhealthy diets, and strengthening national capacities to help people with diabetes receive the treatment and care they need to manage their conditions. Additional resources accompanying the report include an executive summary and country profiles. A WHO fact sheet on diabetes is also available.

ARTICLES AND BRIEFS

Article. Policy Lessons from Health Taxes: A Systematic Review of Empirical Studies
Wright A et al. Policy Lessons From Health Taxes: A Systematic Review of Empirical Studies. BMC Public Health 2017; 17: 583. DOI: http://doi.org/10.1186/s12889-017-4497-z.
This article is a systematic review of 91 empirical studies and 11 related papers from the literature examining the impact of health taxes designed to increase the cost of unhealthy products. More specifically, the review focused on taxes aimed at retailers and manufacturers of unhealthy products, as well as consumer taxes on sugar-sweetened beverages. Overall, the findings illustrate that raising product prices by over 20 percent through tax increases can lead to improvements in health behaviors and outcomes by both reducing demand for sugary drinks and increasing government revenue. However, the authors also mention that the stability of the revenue earned from sugar taxes is called into question when the tax is not framed appropriately to the public, leaving it susceptible to strong industry opposition and lobbying. The authors also discuss ways to mitigate the regressive nature of such taxes, including focusing taxes on ingredients with the goal of incentivizing producers and manufacturers to change their products.

Article. In Mexico, Evidence of Sustained Consumer Response Two Years After Implementing A Sugar-Sweetened Beverage Tax
Colchero et al. In Mexico, Evidence of Sustained Consumer Response Two Years After Implementing A Sugar-Sweetened Beverage Tax. Health Affairs 2017; 36(3): 564-571.
https://www.healthaffairs.org/doi/abs/10.1377/hlthaff.2016.1231.
This study used beverage purchasing data from 6,645 households in Mexico from January 2012 to December 2015 to analyze the impact of the national sugar-sweetened beverage tax that went into effect on January 1, 2014. Results found that purchases of sugary drinks decreased by 5.5 percent in 2014 and 9.7 percent in 2015, with the largest reductions observed among low socioeconomic status households.

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Brief. Putting Taxes into the Diet Equation
Putting Taxes into the Diet Equation. Bulletin of the World Health Organization 2016; 94: 239-240. DOI: http://dx.doi.org/10.2471/BLT.16.020416.
This brief from the World Health Organization (WHO) describes the recent sugar-sweetened beverage tax implemented in Mexico and its impact on population-level consumption of sugary drinks. Potential long-term health outcomes are discussed as well as challenges to successful implementation, including food marketing. Lastly, the brief includes a summary of attempts at similar efforts taken on in other countries, including Finland, the U.K., and the U.S., and successful taxes in Hungary and France.

Article. Worldwide Trends in Diabetes Since 1980: A Pooled Analysis of 751 Population-Based Studies With 4·4 Million Participants
Worldwide Trends in Diabetes Since 1980: A Pooled Analysis of 751 Population-Based Studies With 4·4 Million Participants. The Lancet 2016; 387: 1513-30. DOI: http://dx.doi.org/10.1016/S0140-6736(16)00618-8.
This analysis estimates worldwide trends in diabetes and how changes in prevalence, together with population growth and ageing, are affecting the number of adults with diabetes. The authors pooled data from population-based studies that had collected data on diabetes through measurement of its biomarkers. They used a Bayesian hierarchical model to estimate trends in diabetes prevalence in 200 countries and territories in 21 regions, by sex and from 1980 to 2014. They also calculated the posterior probability of meeting the global diabetes target if post-2000 trends continue. Since 1980, age-standardized diabetes prevalence in adults has increased, or at best remained unchanged, in every country. Together with population growth and ageing, this rise has led to a near quadrupling of the number of adults with diabetes worldwide. For example, the number of adults with diabetes in the world increased from 108 million in 1980 to 422 million in 2014. The burden of diabetes, both in terms of prevalence and number of adults affected, has increased faster in low-income and middle-income countries than in high-income countries. While trends varied regionally, if post-2000 trends continue, the probability of meeting the global target of halting the rise in the prevalence of diabetes by 2025 at the 2010 level worldwide is lower than 1 percent for men and is 1 percent for women.

Brief. Taxes on Sugary Drinks: Why Do It?
Taxes on Sugary Drinks: Why Do It? World Health Organization 2016. http://apps.who.int/iris/handle/10665/260253.
This World Health Organization (WHO) brief describes the ways in which sugar-sweetened beverages contribute to obesity and diabetes and the potential benefits a tax on sugary beverages could have on population health through reductions in consumption, increases health care savings, and the use of tax revenue to support other public health initiatives. A summary of the impact of the Mexican sugar-sweetened beverage tax is also provided as an example of a success story.

Article. The Impact of a Tax on Sugar-Sweetened Beverages on Health and Health Care Costs: A Modelling Study
Veerman JL et al. The Impact of a Tax on Sugar-Sweetened Beverages on Health and Health Care Costs: A Modelling Study. PLOS One 2016; 11(4): e0151460. DOI: http://doi.org/10.1371/journal.pone.0151460.
This article draws on data from Australia to model the estimated impact that imposing a 20 percent tax on sugar-sweetened beverages would have on health outcomes and healthcare expenditures. Results found that small changes in BMI associated with a tax could result in gains of 112,000 health-adjusted life years for men and 56,000 for women. With respect to other health outcomes, the tax is expected to lead to 800 fewer cases of type 2 diabetes per year, 4,400 fewer cases of heart disease, and 1,100 fewer people experiencing stroke. Additionally, health care expenditures would be expected to decline by over AUD 600 million.

Article. The Relationship of Sugar to Population-Level Diabetes Prevalence: An Econometric Analysis of Repeated Cross-Sectional Data
Basu S et al. The Relationship of Sugar to Population-Level Diabetes Prevalence: An Econometric Analysis of Repeated Cross-Sectional Data. PLOS One 2013; 8(2): e57873. DOI: http://doi.org/10.1371/journal.pone.0057873.
This study used cross-sectional data from 175 countries to examine the relationship between sugar intake and diabetes prevalence. Results found that each person's 150 kilocalorie increase in sugar availability per day (roughly equal to about one can of soda) was associated with a 1.1 percent higher prevalence of diabetes, independent of sedentary

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behavior and alcohol use. The relationship between length of sugar exposure and diabetes prevalence appeared to be dose-response in nature.

Article. The Impact of Food Prices on Consumption: A Systematic Review of Research on the Price Elasticity of Demand for Food
Andreyeva et al. The Impact of Food Prices on Consumption: A Systematic Review of Research on the Price Elasticity of Demand for Food. American Journal of Public Health 2010; 100(2): 216-222. DOI: http://doi.org/10.2105/AJPH.2008.151415.
This article summarizes findings from 160 studies investigating the impact of price elasticity of demand for food, the change in product demand observed at the consumer level in response to changes in product cost. The authors found that soft drinks, juices, and meats are the most responsive to price changes. Of particular note, increases of 10 percent in the costs of soft drinks were expected to result in an 8-to-10 percent reduction in soft drink consumption.

Article. The Public Health and Economic Benefits of Taxing Sugar-Sweetened Beverages
Brownell KD et al. The Public Health and Economic Benefits of Taxing Sugar-Sweetened Beverages. The New England Journal of Medicine 2009; 361: 1599-1605. DOI: http://doi.org/10.1056/NEJMhpr0905723.
This health policy report from The New England Journal of Medicine describes the health and economic benefits of implementing a sugar-sweetened beverage tax in the United States. In addition to describing the relationship between sugar consumption and health outcomes among both children and adults, the authors also articulate the mechanisms by which sugary drinks impact health and provide information on associated economic benefits (e.g., reducing health care costs, revenue generation). Lastly, different strategies to implement the tax are discussed as well as objections and issues around public support.

Article. Ounces of Prevention: The Public Policy Case for Taxes on Sugared Beverages
Brownell KD, Frieden TR. Ounces of Prevention: The Public Policy Case for Taxes on Sugared Beverages. The New England Journal of Medicine 2009; 360: 1805-1808. DOI: http://doi.org/10.1056/NEJMp0902392.
This commentary from The New England Journal of Medicine articulates the need for a tax on sugar-sweetened beverages from the perspective of public policy. The authors discuss research linking sugary beverages with obesity and poor nutrition and highlight evidence that tobacco taxes were incredibly successful in reducing tobacco use at the population-level. Opposing views are also discussed (including the potentially regressive nature of the tax), as well as practical logistics around the implementation of a sales tax or excise tax.

DATA PUBLICATIONS, PORTALS, AND INTERACTIVES

Data Interactive. Global Health Observatory Data: Overweight/Obesity
Data Interactive. Global Health Observatory Data: Overweight/Obesity. World Health Organization 2023. https://www.who.int/data/gho/data/themes/topics/noncommunicable-diseases-risk-factors.
This World Health Organization (WHO) data interactive allows users to explore global data on overweight, obesity, and BMI from the Global Health Observatory. Global prevalence maps are provided to track weight trends since 1975 both overall and by sex. Additionally, users can identify where individual countries stand in a chart of weight category prevalences, view time series charts, and run a continuous animation of global trends over time.

Data Interactive. Data Visualization: Diabetes, Blood Pressure, BMI
Data Visualization. Diabetes, Blood Pressure, BMI. NCD Risk Factor Collaboration 2021. https://www.ncdrisc.org/data-visualisations.html.
GHELI repository link: http://repository.gheli.harvard.edu/repository/11860
NCD Risk Factor Collaboration (NCD-RisC) hosts data for diabetes, blood pressure, cholesterol, BMI, and height. The portal provides access to a wide range of data visualizations. These include maps, line plots, ranking plots, bubble plots, stacked plots, sunburst plots, and distribution plots stratified by place and gender. The web portal also provides interactive country profiles with data synthesized across risk factors by country.

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COUNTRY PROFILES

Country Profiles. Global Nutrition Report Country Profiles
Country Nutrition Profiles. 2022 Global Nutrition Report. Development Initiatives Poverty Research Ltd. 2022. https://globalnutritionreport.org/nutrition-profiles.
GHELI repository link: https://repository.gheli.harvard.edu/repository/11223
This web portal, offered by the Development Initiatives Poverty Research Ltd., provides global, regional, and country profiles that accompany the *2022 Global Nutrition Report*, which documents the status of the world's nutrition and progress made to meet global nutrition targets established by the World Health Assembly. The global fact sheet facilitates the comparison of national-level data with the global situation. Regional and country profiles include information on child, adolescent, and adult nutritional status, in addition to intervention coverage, food supply, economics, demography, and environmental impacts. *The Global Nutrition Report* is published annually and represents a multi-partner collaborative effort to consider how countries can implement interventions that are specific, measurable, and achievable. In addition to regional and country profiles, the report's web portal provides previous editions of the Global Nutrition Report, and offers access to data, infographics, blogs and case studies, and information about nutrition-related events around the world.

Country Profiles. Diabetes Country Profiles 2016
Diabetes Country Profiles 2016. World Health Organization 2016. https://www.who.int/teams/noncommunicable-diseases/surveillance/data/diabetes-profiles.
GHELI repository link: http://repository.gheli.harvard.edu/repository/11225
This web portal, offered by the World Health Organization (WHO), provides country profiles which accompany the first WHO *Global Report on Diabetes*, published in 2016, and summarize the national status of diabetes prevention and control. Each profile includes data from a variety of sources on diabetes prevalence and trends, mortality, and risk factors. Information is synthesized on the availability of diabetes country plans, monitoring and surveillance, primary prevention and treatment policies, availability of medicines, basic technologies, and procedures.

MULTIMEDIA AND NEWS

News. She Took on Columbia's Soda Industry: Then She Was Silenced
She Took on Colombia's Soda Industry: Then She was Silenced. The New York Times 2017; Nov 13. https://nyti.ms/2hyr8ZM.
This article from *The New York Times* describes advocates' efforts to implement a 20 percent tax on sugar-sweetened beverages in Colombia in 2016, and intense push-back efforts from industry to stop the tax, despite widespread support from the President of Colombia and the public majority.

News. In Sweeping War on Obesity, Chile Slays Tony the Tiger
Jacobs A. In Sweeping War on Obesity, Chile Slays Tony the Tiger. The New York Times 2018; Feb 7. https://www.nytimes.com/2018/02/07/health/obesity-chile-sugar-regulations.html.
This article from *The New York Times* describes recent marketing restrictions the Chilean government imposed on food adverting, as well as an 18 percent tax that was levied on sugar-sweetened beverages to address rising obesity rates. In addition to describing industry opposition, the article also includes side-by-side photos of food packaging before and after the legislative changes, as well as an integrated photo essay on nutrition in Chile.

News. Sugar Taxes: The Global Picture in 2017
Wan L et al. Sugar Taxes: The Global Picture in 2017. Beverage Daily 2017; Dec 20. https://www.beveragedaily.com/Article/2017/12/20/Sugar-taxes-The-global-picture-in-2017.
This article, from a pro-beverage industry website, Beverage Daily, provides a detailed country-by-country description of taxation efforts that were advanced in 2017, as well as those slated to go into effect in 2018. In 2017, sugar taxes continued to garner support in countries around the world. Since many materials related to sugar taxes are often

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produced by public health advocates, this source may provide an interesting counterpoint for classroom discussions analyzing or critiquing industry opposition.

News. How Big Business Got Brazil Hooked on Junk Food
Jacobs A, Richtel M. How Big Business Got Brazil Hooked on Junk Food. The New York Times 2017; Sep 16. https://www.nytimes.com/interactive/2017/09/16/health/brazil-obesity-nestle.html.
This article from *The New York Times* provides an in-depth description of the ways multinational food corporations like Nestlé and PepsiCo have expanded their reach in developing countries across Latin America, Africa, and Asia and contributed to rises in diabetes, heart disease, and other chronic illnesses. Integrated into the text of the article are various forms of supplementary content, including animated maps illustrating increasing rates of obesity around the world from 1985 to 2015, a short video documentary, and a photo essay illustrating the impact of poor nutrition on everyday life in Brazil. In addition to discussing the extent of the public health challenge of obesity and chronic disease and the ways the food industry has contributed to it, the article also discusses broader economic forces related to globalization that are driving current trends.

News. Governments Around the World Are Taxing Soda - And It's Forcing Coke and Pepsi to Make Major Changes
Taylor K. Governments Around the World Are Taxing Soda - And It's Forcing Coke and Pepsi to Make Major Changes. Business Insider 2016; Jun 11. http://www.businessinsider.com/governments-globally-are-taxing-soda-2016-6.
This article describes ways companies like Coca-Cola and PepsiCo have altered both their products and product design to address reduced revenue and meet changing consumer demands, even as accounts of the soda industry's position on sugar taxes tend to focus on opposition efforts.

News. World Health Officials Want Super-Size Tax on Soda and Sugary Drinks, But Are Countries Ready to Swallow That? News
Kaplan K. World Health Officials Want Super-Size Tax on Soda and Sugary Drinks, But Are Countries Ready to Swallow That? Los Angeles Times 2016; Oct 12. http://www.latimes.com/science/sciencenow/la-sci-sn-who-soda-tax-20161011-snap-story.html.
This article provides a brief overview of the World Health Organization's recommendations on sugar-sweetened beverage taxes in light of recent research on their impacts, and also provides a brief summary of observed impacts from places, such as Berkeley, California, where taxes have been implemented.

News. How the Sugar Industry Shifted Blame to Fat
O'Connor A. How the Sugar Industry Shifted Blame to Fat. The New York Times 2016; Sep 12. https://www.nytimes.com/2016/09/13/well/eat/how-the-sugar-industry-shifted-blame-to-fat.html.
This article from *The New York Times* discusses the details of the cover-up, in 1967, when the Sugar Research Foundation paid Harvard scientists to write a review on the impact of sugar on health that deliberately masked its harmful effects and its widespread impact on nutrition and health.

News. Coca-Cola Funds Scientists Who Shift Blame for Obesity Away from Bad Diets
O'Connor A. Coca-Cola Funds Scientists Who Shift Blame for Obesity Away from Bad Diets. The New York Times 2015; Aug 9. https://well.blogs.nytimes.com/2015/08/09/coca-cola-funds-scientists-who-shift-blame-for-obesity-away-from-bad-diets.
This article describes the way Coca-Cola has influenced research on obesity to convince the public that exercise has a larger impact on health than nutrition. More specifically, the work of influential researchers that have been funded by Coca-Cola is discussed and compared to misleading studies conducted by scientists paid by the tobacco industry in the 1950s and 1960s, calling attention to ethical dilemmas in public health related to industry-related financial conflicts of interest.

Video. When Grassroots Protest Rallies Have Corporate Sponsors
When Grassroots Protest Rallies Have Corporate Sponsors. ABC News 2014; Nov 4. https://youtu.be/jZ25SuSuLE8.
This ABC News story describes efforts from the soda industry to oppose a sugar tax in San Francisco in 2014. Specifically, lobbyists representing the soda industry backed "AstroTurf" campaigns, i.e., campaigns that appear to be grassroots protests from the community, but are really paid for and orchestrated by special interest groups. This

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segment provides first-hand coverage from an AstroTurf campaign and discusses how it aimed to shape the local sugar tax debate.

Video. Should Sugary Drinks Be Taxed Like Cigarettes?
Should Sugary Drinks Be Taxed Like Cigarettes? PBS NewsHour 2012; Jun 7. https://youtu.be/3QzzG-7q5CU.
This segment from a 2012 episode of PBS NewsHour discusses the advantages and disadvantages of a sugar tax in light of former New York Mayor Michael Bloomberg's attempt to implement a ban on extra-large sugary drinks. Multiple perspectives are shared, including that of small business owners, public health professionals, and community activists.

TEACHING MATERIALS

Teaching Case. Soda Tax Debates: A Case Study of Berkeley vs. Big Soda's Social Media Campaign
Soda Tax Debates: A Case Study of Berkeley vs. Big Soda's Social Media Campaign. Berkeley Media Studies Group, Public Health Institute 2016. http://www.bmsg.org/resources/publications/soda-tax-debates-a-case-study-of-berkeley-vs-big-sodas-social-media-campaign.
GHELI repository link: https://repository.gheli.harvard.edu/repository/10654
This case study includes content analysis of Berkeley's 2014 social media campaign supporting an excise tax on sugary drinks. Berkeley, California, made history in November 2014 when it passed the nation's first tax on sugary drinks, despite the beverage industry spending more than $2.4 million on an anti-tax campaign. Advocates and stakeholders in other communities can use this case study to strategize about using social media like Facebook and Twitter in their campaigns to pass sugary drink taxes, fight chronic diseases, and protect public health. This case study is based on a broader study by John Snow, Inc. (JSI) and the Public Health Institute's Berkeley Media Studies Group (PHI's BMSG) to better understand the social media, campaign materials, and news coverage of the soda tax debates in Berkeley and San Francisco.

Teaching Case. Advocating for Sugar-Sweetened Beverage Taxation: A Case Study of Mexico
Donaldson E. Advocating for Sugar-Sweetened Beverage Taxation: A Case Study of Mexico. Johns Hopkins Bloomberg School of Public Health 2016. https://ncdalliance.org/news-events/news/advocating-for-sugar-sweetened-beverage-taxation-a-case-study-of-mexico.
This case by the Johns Hopkins Bloomberg School of Public Health analyzes the issue of national taxes on sugar sweetened beverages through the lens of one of the first countries to implement an excise tax: Mexico. In 2013, an excise tax of 1 peso ($0.08) per liter of sugar-sweetened beverages was enacted thanks to advocacy efforts designed to increase awareness among both policymakers and the public through media campaigns and lobbying. This case study specifically discusses the impact of those efforts by both proponents and opponents to the tax.

Teaching Manual. How to Teach… Sugar
How to Teach… Sugar. The Guardian 2015; Sep 21. https://www.theguardian.com/teacher-network/2015/sep/21/how-to-teach-sugar.
This teaching guide from *The Guardian* is one of several "How to Teach" articles designed for in primary and secondary school students with a limited background in healthy nutrition. Various recommended activities, associated videos, and links to two lessons from the British Dental Health Foundation are provided to help instructors teach students about sugar content in foods, daily recommendations for sugar consumption, and the impact sugar has on health, including on dental caries and blood sugar levels.

Teaching Case. Demarketing Soda in New York City
Quelch JA et al. Demarketing Soda in New York City. Harvard Business School 2014. https://cb.hbsp.harvard.edu/cbmp/product/514003-PDF-ENG.
This teaching case from Harvard Business School examines the ways legislation can spark individual behavior change by influencing consumers' purchasing practices. The case describes former New York City Mayor Michael Bloomberg's failed attempt to enact a ban on large sugar-sweetened beverages and discusses it in relation to other obesity-prevention strategies implemented by the Bloomberg administration. This case study is offered for a small fee by

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Glossary

Can Sugar Taxes Prevent Diabetes in Latin America?

2018

Added Sugar
Any sugar added in preparation of foods, either at the table, in the kitchen or in the processing plant. This may include sucrose, high fructose corn syrup and others. (University of California San Francisco 2018)

Body Mass Index (BMI)
A measure of weight in kilograms (kg) relative to height in meters squared (m2). BMI is considered a reasonably reliable indicator of total body fat, which is related to the risk of disease and death. BMI status categories include underweight, healthy weight, overweight, and obese. Overweight and obese describe ranges of weight that are greater than what is considered healthy for a given height, while underweight describes a weight that is lower than what is considered healthy. Because children and adolescents are growing, their BMI is plotted on growth charts for sex and age. The percentile indicates the relative position of the child's BMI among children of the same sex and age. (United States Department of Agriculture, United States Department of Health and Human Services 2015)

Chronic Diseases
Diseases which last months or years, do not go away on their own, and are usually managed and not cured. For the first time in history diseases that are not caused by infection (noncommunicable diseases) are causing more injury and death worldwide than are those caused by infection. In the U.S. this has been true for decades but the rest of the world is catching up as our diet and lifestyle are becoming more common globally. (University of California San Francisco 2018)

Conflicts of Interest
Researchers have conflicts of interest when their work is significantly dependent on a funding source that holds a vested interest in the outcome of their research. (University of California San Francisco 2018)

Daily Reference Value
Recommendations from the Food and Drug Administration (FDA) for the amount of protein, fat, cholesterol and carbohydrates a person should eat in a day. Food labels are based on these numbers, which is shown as "DV%". (University of California San Francisco 2018)

Dental and Gum-Related Diseases
Cavities (caries) and gum inflammation (gingivitis or periodontal disease), can lead to whole body inflammatory and infectious problems. (University of California San Francisco 2018)

Diabetes Mellitus
Usually shortened to "diabetes," but sometimes called sugar diabetes. See Type 1 Diabetes and Type 2 Diabetes for more information. (University of California San Francisco 2018)

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Earmarking
The process whereby the revenues from a tax are dedicated to (or earmarked for) a specific purpose or program, defined by law. Example: SSB [sugar-sweetened beverage] taxes could be earmarked for revenue for new public health nutrition and physical activity initiatives, such as subsidies of fresh fruits and vegetables in schools, or statewide, comprehensive obesity prevention programs (Rudd Center for Food Policy and Obesity 2017)

Eating Behaviors
Individual behaviors that affect food and beverage choices and intake patterns, such as what, where, when, why, and how much people eat. (United States Department of Agriculture, United States Department of Health and Human Services 2015)

Energy Drink
A beverage that contains caffeine as an ingredient, along with other ingredients, such as taurine, herbal supplements, vitamins, and added sugars. It is usually marketed as a product that can improve perceived energy, stamina, athletic performance, or concentration. (United States Department of Agriculture, United States Department of Health and Human Services 2015)

Essential Public Health Functions
The health authority's functions with regard to: (i) monitoring, evaluation and analysis of health status; (ii) surveillance, research and control of the risks and threats to public health; (iii) health promotion; (iv) social participation in health; (v) development of policies and institutional capacity for public health planning and management; (vi) strengthening of public health regulation and enforcement capacity; (vii) evaluation and promotion of equitable access to necessary health services; (viii) human resources development and training in public health; (ix) quality assurance in personal and population-based health services; (x) research in public health; and (xi) reduction of the impact of emergencies and disasters on health. (World Health Organization 2011)

Excise Tax
A tax levied as a fixed amount per unit of measurement (e.g. ounce, gallon, case, etc.) on the producer of certain goods. The tax is often passed on to the customers in the price of the item. (Rudd Center for Food Policy and Obesity 2017)

Food Access
Ability to obtain and maintain levels of sufficient amounts of healthy, safe, and affordable food for all family members in various settings including where they live, learn, work and play. Food access is often measured by distance to a store or the number of stores in an area; individual-level resources such as family income or vehicle availability; and neighborhood-level indicators of resources, such as average income of the neighborhood and the availability of public transportation. (United States Department of Agriculture, United States Department of Health and Human Services 2015)

Food Deserts
Areas where people have limited access to a variety of healthy and affordable food. (United States Department of Agriculture 2012)

Food and Nutrition Policies
Regulations, laws, policymaking actions, or formal or informal rules established by formal organizations or government units. Food and nutrition policies are those that influence food settings and/or eating behaviors

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to improve food and/or nutrition choices, and potentially, health outcomes (e.g., body weight). (United States Department of Agriculture, United States Department of Health and Human Services 2015)

Fructose
A sugar that we eat. Also called fruit sugar. Most fructose comes in sucrose (table sugar, cane sugar, beet sugar), or from high-fructose corn syrup. (University of California San Francisco 2018)

Fruit Drinks
A drink that is not 100 percent fruit juice and may have any amount or any type of fruit juice. The food label will say how much of the drink is fruit juice. If ingredients are shown there is usually added sugar in the form of High Fructose Corn Syrup. (University of California San Francisco 2018)

Fruit Juice
A drink that is made entirely (100 percent) from the liquid which comes from squeezing or grinding up the part of the fruit we would normally eat. Sugar is not added to this drink. The drink will have the sugars that come from the food itself. The juice will likely have less fiber than the fruit. (University of California San Francisco 2018)

Glucose
Glucose is a sugar we eat. It is found in starch. It is the main fuel for our bodies. It is the sugar measured when we have a blood test to measure the blood sugar. (University of California San Francisco 2018)

Health Policy
A formal statement or procedure within institutions (notably government), which defines priorities and the parameters for action in response to health needs, available resources and other political pressures. (World Health Organization, 2015). Health policies include those specifically designed to promote health or a desired health outcome, or those not explicitly about health but acknowledged to have a health impact (e.g., education, transportation, and economic policy). (Kaiser Global Health 2013)

Health Service
Any service (i.e. not limited to medical or clinical services) aimed at contributing to improved health or to the diagnosis, treatment and rehabilitation of sick people. (World Health Organization 2011)

Health System
All the activities whose primary purpose is to promote, restore and/or maintain health; the people, institutions and resources, arranged together in accordance with established policies, to improve the health of the population they serve, while responding to people's legitimate expectations and protecting them against the cost of ill-health through a variety of activities whose primary intent is to improve health. (World Health Organization 2011)

Health Systems Strengthening
The process of identifying and implementing the changes in policy and practice in a country's health system, so that the country can respond better to its health and health system challenges; any array of initiatives and strategies that improves one or more of the functions of the health system and that leads to better health through improvements in access, coverage, quality, or efficiency. (World Health Organization 2011)

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Heart Disease
A broad term for a group of chronic diseases of the heart, these diseases include problems with blood supply to heart muscle, problems with heart valves and the electrical system of the heart. Another term you will see used to mean the same thing is cardiovascular disease. (University of California San Francisco 2018)

Hemoglobin A1C
A measure of glycated hemoglobin in the blood, commonly used to indicate an individual's average blood glucose control during the past two or three months. (Adapted from American Diabetes Association 2014)

High-Fructose Corn Syrup
A concentrated form of liquid sugar which may contain a wide range of fructose concentrations. Most commonly it contains either 42 percent or 55 percent fructose, but may contain up to 90 percent fructose. (University of California San Francisco 2018)

Indicator
A characteristic of an individual, population, or environment which is subject to measurement (directly or indirectly) and can be used to describe one or more aspects of the health of an individual or population (quality, quantity, and time). (World Health Organization 2015)

Inflammation
The human body uses special cells and chemicals to fight against injury, poisons or diseases. These cells and chemicals can be seen or measured and when they are present that is called inflammation. Too much inflammation can cause damage to the body and is a part of what happens in many diseases, like cancer and heart disease to name only two. (University of California San Francisco 2018)

Insulin
Insulin is a messenger released from the pancreas after eating, which shunts energy (glucose or triglycerides) from the blood into fat cells for storage. Insulin is given to some people with diabetes to lower the blood glucose; it leaves the blood and enters the fat cell for storage. (University of California San Francisco 2018)

Market Failure
In economics, a market failure indicates a need for government intervention because production or use of goods or services by the market is not optimal or efficient. For sugar-sweetened beverages, there are several market failures to consider: For example, people drink sugar-sweetened beverages without knowing the possible negative impact they may have on health; for short-term gratification, without considering the long-term harm of excessive consumption; and without bearing the full burden of the cost to everyone on their decisions to consume them (called "negative externalities"—see below). (Rudd Center for Food Policy and Obesity 2017)

Multi-Component Intervention
Interventions that use a combination of strategies to promote behavior change. These strategies can be employed across or within different settings or levels of influence. (United States Department of Agriculture, United States Department of Health and Human Services 2015)

Multi-Level Intervention
Interventions are those that target change at the individual level as well as additional levels, such as in the community (e.g., public health campaigns), schools (e.g., education), and food service (e.g., menu

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modification). (United States Department of Agriculture, United States Department of Health and Human Services 2015)

Negative Externalities
The negative impact of a transaction or activity on those who are not directly involved in (or are external to) it. Because of the relationship of sugar-sweetened beverage intake with negative health outcomes in both children and adults, health care costs rise. (Rudd Center for Food Policy and Obesity 2017)

Nutrient Dense
A characteristic of foods and beverages that provide vitamins, minerals, and other substances that contribute to adequate nutrient intakes or may have positive health effects, with little or no solid fats and added sugars, refined starches, and sodium. Ideally, these foods and beverages also are in forms that retain naturally occurring components, such as dietary fiber. All vegetables, fruits, whole grains, seafood, eggs, beans and peas, unsalted nuts and seeds, fat-free and low-fat dairy products, and lean meats and poultry—when prepared with little or no added solid fats, sugars, refined starches, and sodium—are nutrient-dense foods. These foods contribute to meeting food group recommendations within calorie and sodium limits. The term "nutrient dense" indicates the nutrients and other beneficial substances in a food have not been "diluted" by the addition of calories from added solid fats, sugars, or refined starches, or by the solid fats naturally present in the food. (United States Department of Agriculture, United States Department of Health and Human Services 2015)

Obesity
Obesity refers to excess body fat. Because body fat is usually not measured directly, a ratio of body weight to height is often used instead. It is defined as body mass index (BMI). An adult who has a BMI of 30 or higher is considered obese. (National Institute of Diabetes and Digestive and Kidney Diseases 2013)

Physical Activity
Any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level; generally refers to the subset of physical activity that enhances health. (United States Department of Agriculture, United States Department of Health and Human Services 2015)

Point-of-Purchase
A place where sales are made. Various intervention strategies have been proposed to affect individuals' purchasing decisions at the point of purchase, such as board or menu labeling with various amounts of nutrition information or shelf tags in grocery stores. (United States Department of Agriculture, United States Department of Health and Human Services 2015)

Population Health
The health outcomes of a group of individuals, including the distribution of such outcomes within the group. Crucial to the concept of population health is the idea that most cases in a population come from individuals with an average level of exposure (rather than high-risk groups). A small (clinically insignificant) change at a population level yields a greater impact on population health and well-being than an intervention on high-risk groups. (World Health Organization 2015)

Prevention
Reducing the risk of disease infection and transmission. In the context of HIV, prevention activities are designed to reduce the risk of becoming infected with HIV (primary prevention) and the risk of transmitting the disease to others (secondary prevention). Prevention services include voluntary counseling and testing,

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condom distribution, disease surveillance, outreach and education, and blood safety and harm reduction programs for injecting drug users. In the context of malaria, prevention activities are designed to reduce the risk of malaria transmission from mosquitoes to humans. Prevention services include mosquito control activities such as the use of insecticide-treated bed nets (ITNs), indoor residual spraying (IRS), and the use of antimalarial drugs to prevent infection, mostly in pregnant women, known as intermittent preventive treatment in pregnancy (IPT). (Kaiser Global Health 2013)

Price Elasticity
The change in the purchased quantity of a product as a result of a change in the product's price. If the percentage change in the purchased quantity is below the percentage change in price, the demand is inelastic. If the percentage change in purchased quantity is above the percentage change in price, the demand is elastic. (Rudd Center for Food Policy and Obesity 2017)

Primary Care
Often used interchangeably with first level of care. (i) the part of a health services system that assures person-focused care over time to a defined population, accessibility to facilitate receipt of care when it is first needed, comprehensiveness of care in the sense that only rare or unusual manifestations of ill health are referred elsewhere, and coordination of care such that all facets of care (wherever received) are integrated. Quality features of primary care include effectiveness, safety, people-centeredness, comprehensiveness, continuity and integration. (ii) the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing a sustained partnership with patients, and practicing in the context of family and community. (World Health Organization 2011)

Primary Health Care Reforms
Policy reforms needed to move towards health for all: moving towards universal coverage in order to contribute to health equity, social justice and the end of exclusion; shifting service delivery to people-centered primary care, to make health services more socially relevant and responsive to the changing world, while producing better outcomes; ensuring health in all policies to secure healthier communities by integrating public health actions with primary care and by pursuing healthy public policies across sectors; promoting inclusive leadership and governance, to replace disproportionate reliance on command and control or on laissez-faire disengagement of the state by participatory, negotiation based leadership. (World Health Organization 2011)

Public Health
Public health refers to all organized efforts of society to prevent disease, promote health, and prolong life among the population as a whole. Its activities aim to provide conditions in which people can be healthy and focus on entire populations, not on individual patients or diseases. (World Health Organization 2015)

Regressive Tax
One for which low-income people pay a higher percentage of their income in taxes than do high-income people. (Rudd Center for Food Policy and Obesity 2017)

Risk Factors
Potentially modifiable causes of disease and injury. (Institute for Health Metrics and Evaluation 2018)

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Sales Tax
A tax levied as a percentage of the price of an item. It is applied at the cash register, and therefore shows up on the customer's receipt after purchase. (Rudd Center for Food Policy and Obesity 2017)

Sedentary Behavior
Any waking activity predominantly done while in a sitting or reclining posture. A behavior that expends energy at or minimally above a person's resting level (between 1.0 and 1.5 metabolic equivalents) is considered sedentary behavior. (United States Department of Agriculture, United States Department of Health and Human Services 2015)

Social Determinants of Health
The circumstances in which people are born, grow up, live, work, and age, and the systems put in place to deal with illness. The World Health Organization's Commission on Social Determinants of Health (CSDH) took a holistic view of social determinants of health, arguing that "the poor health of the poor, the social gradient in health within countries, and the marked health inequities between countries are caused by the unequal distribution of power, income, goods, and services." (World Health Organization 2015)

Sugar-Sweetened Beverages (SSBs)
Beverages that are sweetened with naturally-derived caloric sweeteners such as sucrose (table sugar), high fructose corn syrup, or fruit juice concentrates. The beverages include soda, sports drinks, sweet teas and coffees, flavored waters, and energy drinks. Taxes would also apply to syrups which are used in soda dispensing machines. (Rudd Center for Food Policy and Obesity 2017)

Type 1 Diabetes
A type of diabetes mellitus in which the pancreas does not make enough insulin to keep the amount of sugar in the blood in the normal range. This means the glucose in the bloodstream is too high. Type 1 diabetes also causes many changes in the body that lead to damage to many parts of the body over time. (University of California San Francisco 2018)

Type 2 Diabetes
Type 2 diabetes mellitus, formerly called Non-Insulin Dependent Diabetes Mellitus (NIDDM) and Adult Onset Diabetes (AODM), is a disease in which our body acts as if it does not have enough insulin to keep our blood sugar levels down at normal levels. This is likely a combined effect of the body not being normally sensitive to the insulin the pancreas does make combined with the pancreas not making enough insulin for the circumstances. There is a genetic component to this disease. The body uses insulin as a signal to store glucose in liver, muscle, and fat cells. High blood glucose causes many changes in the body that lead to damage to many parts of the body over time. (University of California San Francisco 2018)

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