NIH National Institute of Environmental Health Sciences

Educational Materials
Impact of Social and Environmental Determinants of Health on COVID-19 Pandemic in the United States

Using the Pandemic Vulnerability Index Model to Examine the Risk Factors Associated with COVID-9

Lesson 2

Subject: Multiple

Lesson Title: Social Determinants of Health and COVID-19. Part I: Social Determinants

Alignment to the NGSS:

- Analyze and interpret data.

- Construct explanations (for science) and design solutions (for engineering).

- Obtain, evaluate, and communicate information.

NC Essential Standards Applied to This Curriculum

- NC Essential Standards, **Health Education**, High School
  9.PCH.1.1—Recognize that individuals have some control over risks for communicable and chronic diseases.
  https://files.nc.gov/dpi/documents/curriculum/healthfulliving/new-standards/healthful-living/9-12.pdf

  NC Essential Standards, **American History 2**
  AH2.H.8.3—Evaluate the extent to which a variety of groups and individuals have had opportunity to attain their perception of the "American Dream" since Reconstruction. The student will understand the ideal of opportunity may not always be attainable or equitable for everyone.
  https://files.nc.gov/dpi/documents/files/american-history-2-unpacking-document.pdf

- NC **English Language Arts**, Grades 11-12, Reading Standards for Informational Text
  RI.11-12.7—Integrate and evaluate multiple sources of information presented in different media or formats, including visually and quantitatively, as well as in words in order to address a question or solve a problem.
  https://files.nc.gov/dpi/documents/curriculum/languagearts/parents/standards-11-12.pdf

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Common Core Standards Aligned with This Curriculum

English Language Arts and Literacy Standards

- CCSS.ELA-Literacy.RI.11-12.3—Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.
  http://www.corestandards.org/ELA-Literacy/RI/11-12/

- CCSS.ELA-Literacy.W11-12.1—Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
  http://www.corestandards.org/ELA-Literacy/W/11-12/

- CCSS.ELA-Literacy.W.11-12.5—Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
  http://www.corestandards.org/ELA-Literacy/W/11-12/

- CCSS.ELA-Literacy.W11-12.6— Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information
  http://www.corestandards.org/ELA-Literacy/W/11-12/

- CCSS.ELA-Literacy.W11-12.7—Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
  http://www.corestandards.org/ELA-Literacy/W/11-12/

Student Learning Objectives

- Describe social determinants of health and provide some examples.
- Explain the role that social determinants play in the risk of COVID-19 infection and the severity of COVID-19 outcome.
- Explain why the term "social determinants" has been changed to "social influencers."
- Explain why education matters to health and why it's so important to finish high school.

Lesson Summary

The COVID-19 Pandemic Vulnerability Index (PVI) model examines the vulnerability of each county in the U.S. to COVID-19 from multiple perspectives, including infection rate, intervention measures such as social distancing and testing, and social determinants of health (https://www.niehs.nih.gov/research/programs/coronavirus/covid19pvi/details/index.cfm). The social determinants of health (SDOH*) reflect the social factors and physical conditions of the environment in which people are born, live, learn, play, work, and age (World Health Organization, https://www.who.int/social_determinants/en/). Together these social determinants and physical/environmental determinants affect a wide range of health risks and disease outcomes, as in the case of COVID-19.

This lesson plan will be divided into two parts: part one examines the social determinants* in the PVI model, including population demographics (race/ethnicity), co-morbidities (diabetes), and health disparities (associated with poverty and unemployment). Part two studies the environmental factors in the PVI model, such as residential density and air pollution. Students will gather relevant information from multiple sources, analyze and integrate the information, and write a concluding paragraph for this lesson to demonstrate their understanding and practice their science communication skills.

*Examples of social determinants and physical/environmental determinants, according to Healthy People 2020:

https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health

Social Determinants:

- Access to educational, economic, and job opportunities.

- Access to health care services.

- Socioeconomic conditions (e.g., concentrated poverty and the stressful conditions that accompany it).

Physical and Environment Determinants:

- Natural environment, such as green space (e.g., trees and grass) or climate change.

- Housing and community design.

- Exposure to toxic substances and other physical hazards.

Materials and Equipment
Computers and internet connection

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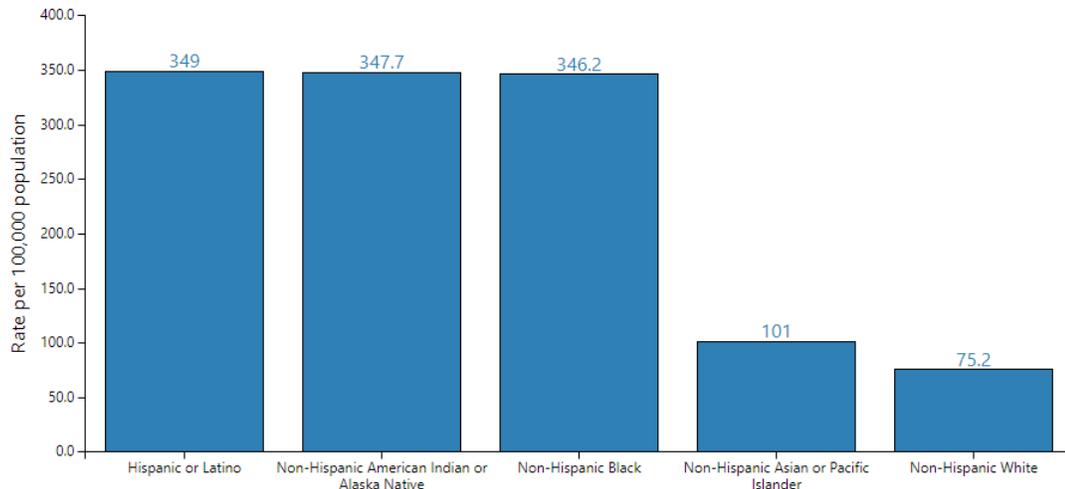Health on COVID-19 Pandemic in the United States*

Procedure

Engagement (20-25 minutes)

Teacher provides students with an overview of the COVID-19 Pandemic Vulnerability Index (PVI) model (https://covid19pvi.niehs.nih.gov/; https://www.niehs.nih.gov/research/programs/coronavirus/covid19pvi/details/index.cfm).

Students are divided into groups and discuss the following:

- What are social determinants of health?

  Social determinants of health are the conditions in which people are born, grow, live, work and age. They include factors like socioeconomic status, education, neighborhood and physical environment, employment, and social support networks, as well as access to health care.

- Examine the figure below. Are there disparities in whether or not people are hospitalized due to COVID-19 based on their race/ethnicity?

Age-adjusted COVID-19-associated Hospitalization Rates by Race and Ethnicity — COVID-NET, March 1 – September 12, 2020

https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covidview/index.html#hospitalizations

- Each group of students suggest one social determinant that might contribute to the phenomenon illustrated by this figure.

  Some social determinants that might put racial and ethnic minority groups at increased risk for COVID-19-associated hospitalization are: Work in industries (grocery stores, service industry, etc.) that require contact with the public, less likely to have access to adequate health care, do not have paid sick leave and therefore do not take time off when disease is not severe, more likely to have other health issues that put them at risk, language barrier for getting disease prevention information and education.

- If time allows, let students examine the following graph.

U.S. Poverty Rates by Race and Hispanic or Latino Origin: 2007-2011
(For information on confidentiality protection, sampling error, nonsampling error, and definitions, see www.census.gov/acs/www)
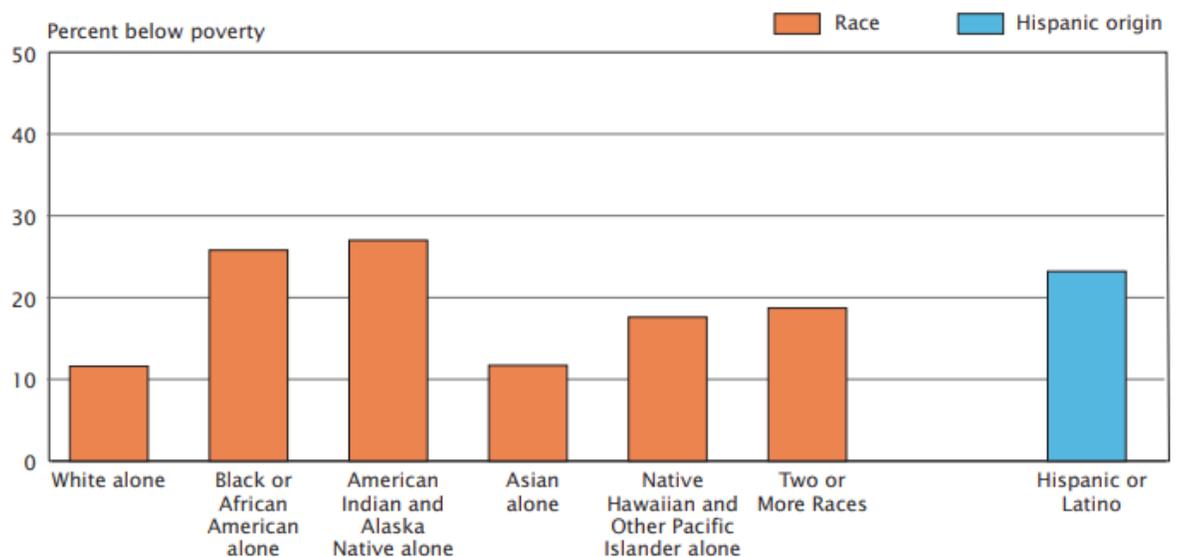
Note: Persons who report only one race among the six defined categories are referred to as the race-alone population, while persons who report more than one race category are referred to as the Two or More Races population. This figure shows data using the race-alone approach. Use of the single-race population does not imply that it is the preferred method of presenting or analyzing data. The Census Bureau uses a variety of approaches. Because Hispanics may be of any race, data in this figure for Hispanics overlap with data for race groups.

Source: U.S. Census Bureau. 2007–2011 American Community Survey.

https://www2.census.gov/library/publications/2013/acs/acsbr11-17.pdf

- Ask students if they note that the three groups with a higher rate of poverty (American Indian and Alaska Native, African American, Hispanic or Latino) are also the groups with higher COVID-19- associated hospitalization rates.

- Ask students to discuss whether people who live in poverty shoulder a higher burden of more severe COVID-19 outcomes (for example, hospitalization). If the answer is "yes", ask them to suggest some plausible explanations (for example, lack of health insurance coverage and less likely to have access to adequate health care, more likely to have underlying medical conditions that put them at risk, more likely to reside in crowded living arrangement).

Exploration and Explanation (40-45 minutes)

Divide students into the following 5 groups and they have between 15 and 20 minutes to finish assigned work. Each group will report its findings and conclusions to the rest of class (5 x 5 minutes = 25 minutes).

1. Labor force characteristics by race and ethnicity
   https://www.bls.gov/opub/reports/race-and-ethnicity/2018/home.htm

2. Educational attainment, unemployment rate, and earnings
   https://nces.ed.gov/programs/coe/indicator_cba.asp

3. Educational attainment by race/ethnicity
   https://nces.ed.gov/programs/raceindicators/indicator_RFA.asp

4. Diabetes by race/ethnicity and educational attainment
   https://www.cdc.gov/diabetes/disparities.html

5. Health insurance coverage by race/ethnicity
   https://www.census.gov/content/dam/Census/library/publications/2018/demo/p60-264.pdf, p.17

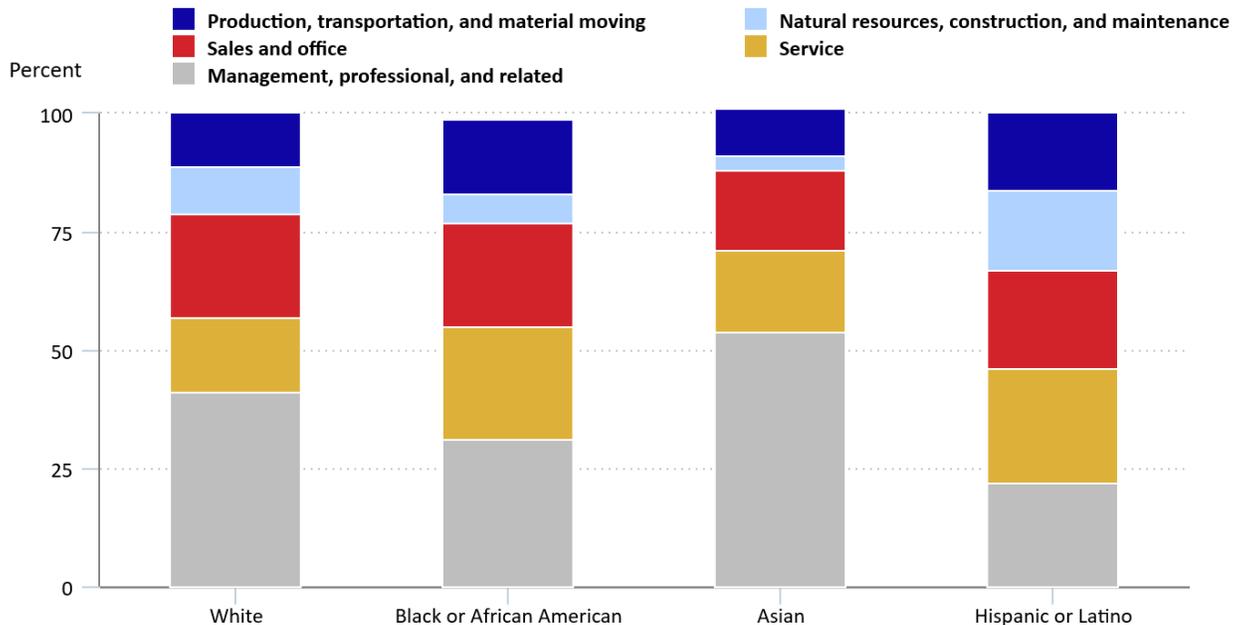**Educational Materials**
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1. **Labor force characteristics by race and ethnicity**

**Employed People by Occupation, Race and Hispanic or Latino Ethnicity,
2018 Annual Averages**

Click legend items to change data display. Hover over chart to view data.
Note: People whose ethnicity is identified as Hispanic or Latino may be of any race.
Data may not sum to 100 percent because of rounding.
Source: U.S. Bureau of Labor Statistics, Current Population Survey (CPS).

(https://www.bls.gov/opub/reports/race-and-ethnicity/2018/home.htm)

Ask students to do the following:

    a. Based on the data provided in the above figure, list the two dominant professions (in terms of % of population in the profession) for each racial/ethnic group.

    b. Discuss the differences in likelihood of exposure to SARS-CoV-2 (the coronavirus that causes COVID-19) for people in the different professions that are listed in Chart 3. Consider factors such as exposure to the public, practicality of social distancing in the working environment, and feasibility of teleworking, etc. For example, service industry workers are required to have contact with the public and are less likely to work from home.
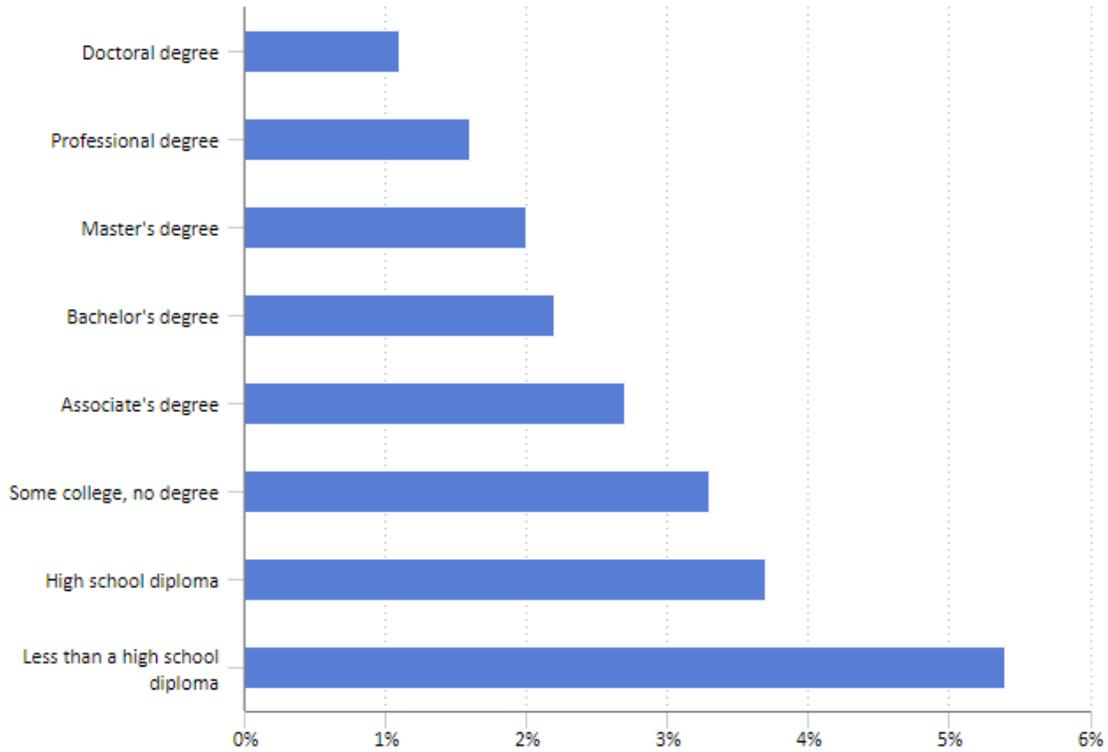
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2. Educational attainment, employment rate, and earnings

Unemployment Rate by Education Attainment, 2019

Click legend items to change data display. Hover over chart to view data.
Note: Data are for persons age 25 and over. Earnings are for full-time wage and salary workers.
Source: Current Population Survey, U.S. Department of Labor, U.S. Bureau of Labor Statistics.
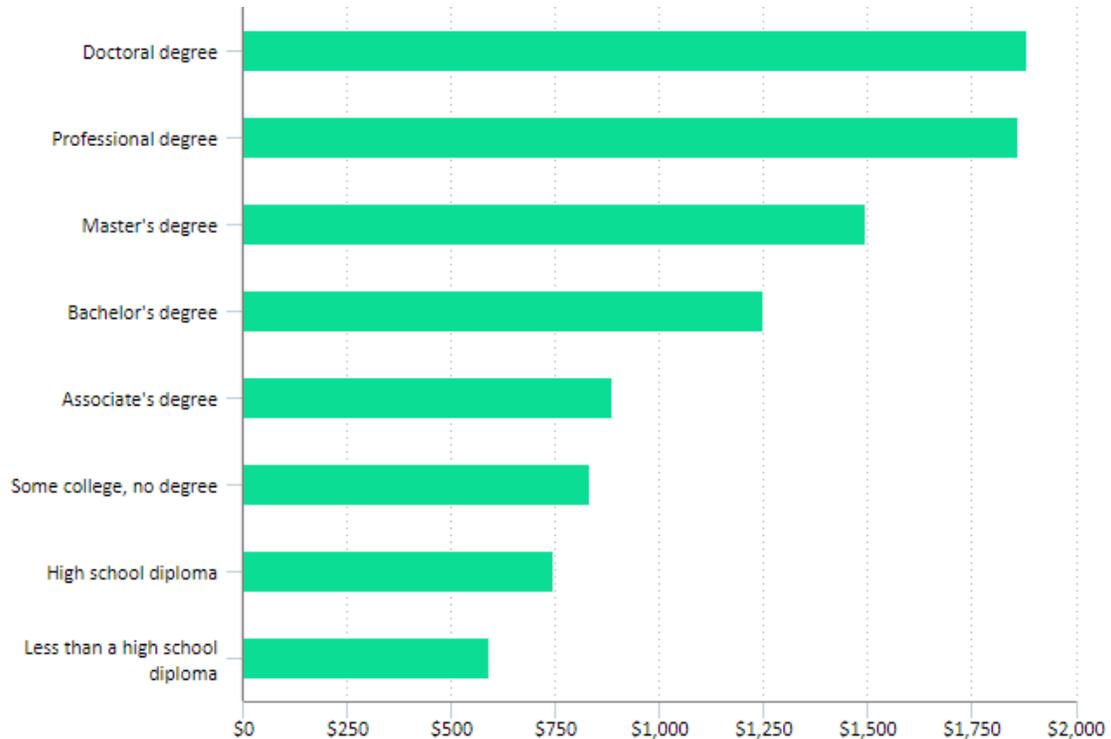
Median Weekly Earning by Education Attainment, 2019

Click legend items to change data display. Hover over chart to view data.
Note: Data are for persons age 25 and over. Earnings are for full-time wage and salary workers.
Source: Current Population Survey, U.S. Department of Labor, U.S. Bureau of Labor Statistics.

https://www.bls.gov/careeroutlook/2020/data-on-display/education-pays.htm

Ask students to do the following:

    a. Discuss the association between educational attainment and unemployment rate.

    b. Discuss the association between educational attainment and annual earnings.

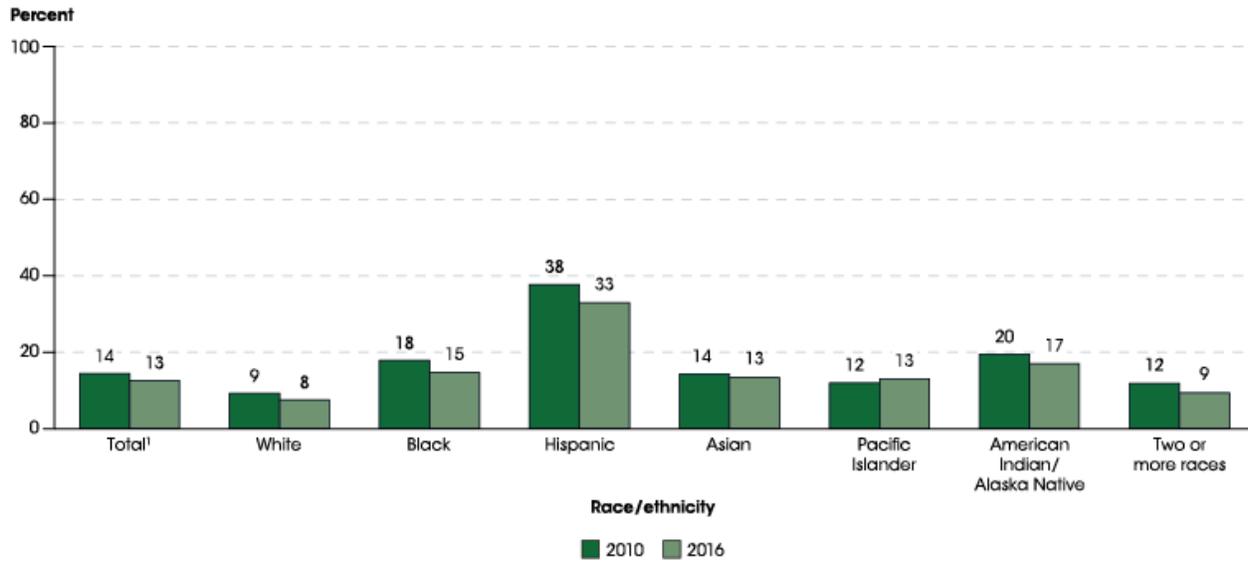   c. Discuss whether people's employment status and earnings affect their health status. Explain.
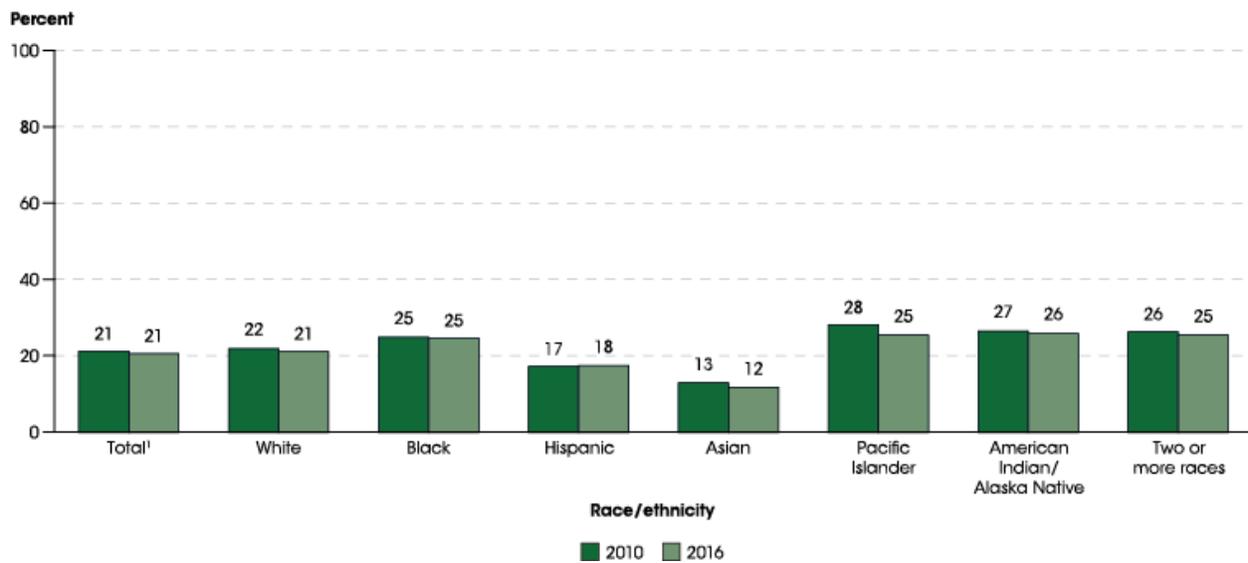
3. Educational attainment by race/ethnicity

Percentage of Adults Age 25 and Older Who Had Not Completed High School, by Race/Ethnicity: 2010 and 2016

Percent

Race/ethnicity	2010	2016
Total[1]	14	13
White	9	8
Black	18	15
Hispanic	38	33
Asian	14	13
Pacific Islander	12	13
American Indian/Alaska Native	20	17
Two or more races	12	9

Percentage of Adults Age 25 and Older Who Had Completed Some College but Had Not Earned a Degree, by Race/Ethnicity: 2010 and 2016
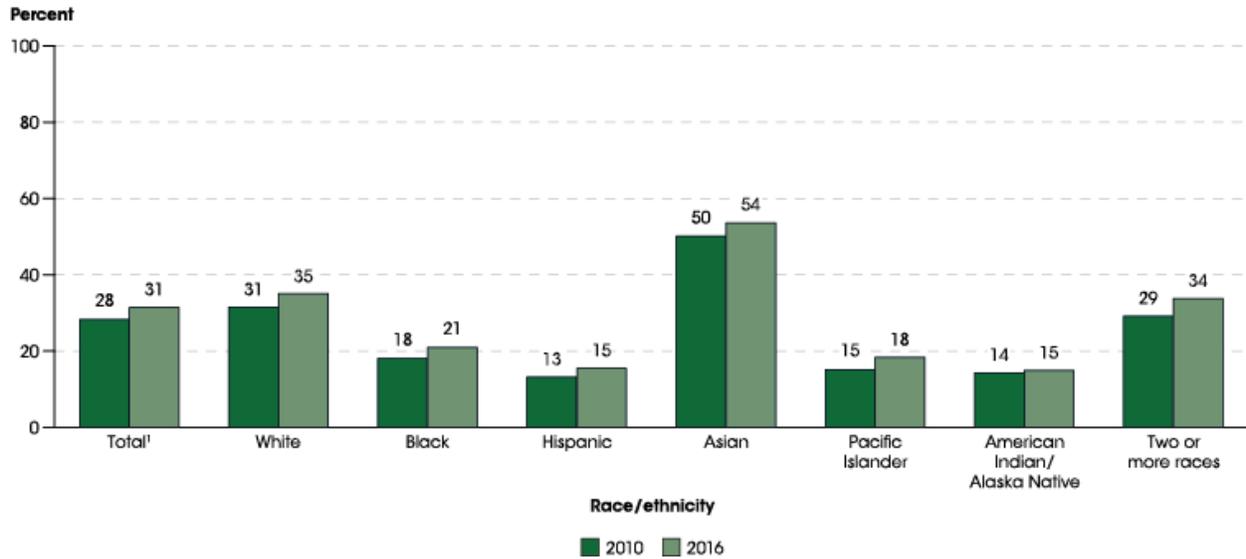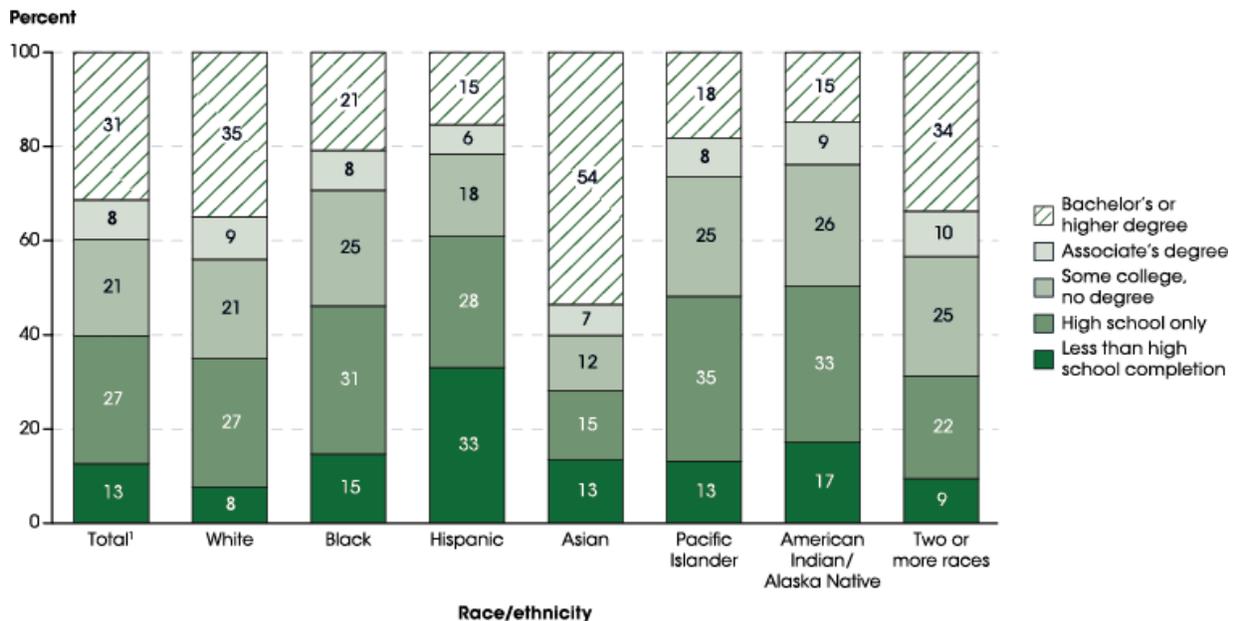
Percent

Race/ethnicity	2010	2016
Total[1]	21	21
White	22	21
Black	25	25
Hispanic	17	18
Asian	13	12
Pacific Islander	28	25
American Indian/Alaska Native	27	26
Two or more races	26	25

Percentage of Adults Age 25 and Older Who Had Completed a Bachelor's or Higher Degree, by Race/Ethnicity: 2010 and 2016

Percent

Race/ethnicity

■ 2010   ■ 2016

Percentage Distribution of Educational Attainment of Adults Age 25 and Older, by Race/Ethnicity: 2016

Percent

Race/ethnicity

Legend:
- Bachelor's or higher degree
- Associate's degree
- Some college, no degree
- High school only
- Less than high school completion

https://nces.ed.gov/programs/raceindicators/indicator_RFA.asp
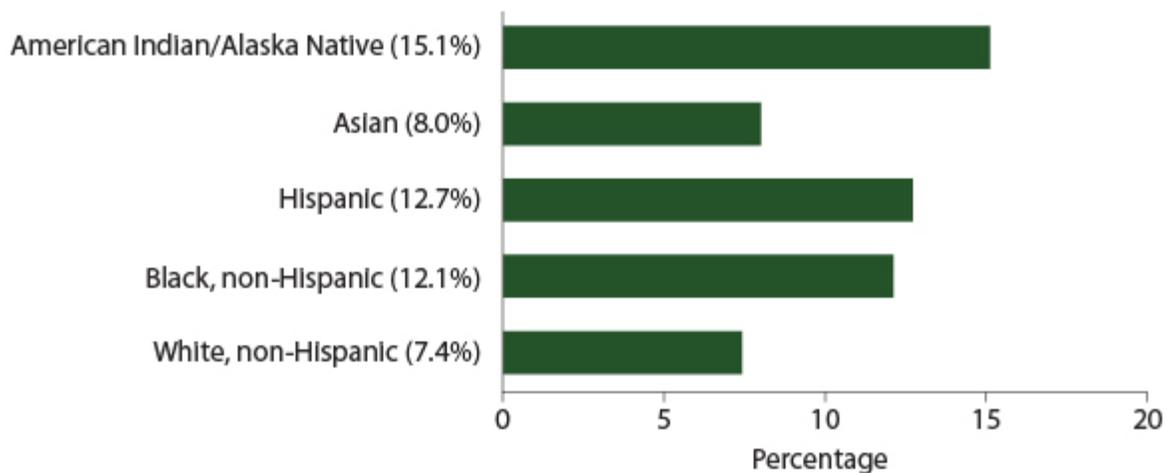
Ask students to do the following:

a. Analyze data from the figure "Percentage Distribution of Educational Attainment of Adults Age 25 and Older, by Race/Ethnicity: 2016" and compare educational attainment among different racial/ethnic groups. Focus on "less than high school", "high school only", and "bachelor's or higher degree".

b. Discuss the potential impact of education attainment on health

4. **Diabetes by race/ethnicity and educational attainment**

Type 2 diabetes is listed by CDC as an "underlying medical condition" that increases risk for severe illness from COVID-19 (https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html).

The following charts show the percentage of diagnosed diabetes in five ethnic groups. Estimates in the charts do not differentiate between type 1 and type 2 diabetes. However, because type 2 diabetes accounts for 90% to 95% of all diabetes cases, the data presented are likely to be more characteristic of type 2 diabetes (https://www.cdc.gov/diabetes/disparities.html).

Percentage of US Adults Aged 18 or Older with Diagnosed Diabetes, by Racial and Ethnic Group, 2013-2015 (2017 Diabetes Report Card)
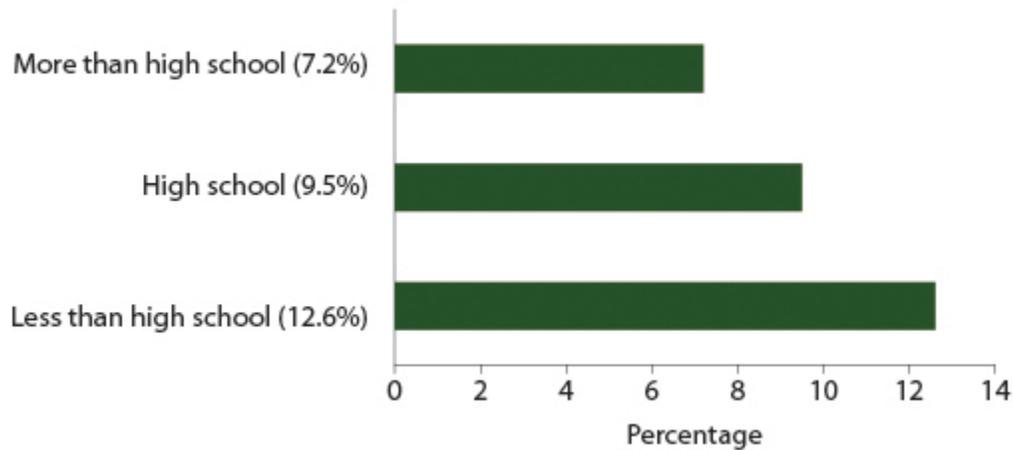
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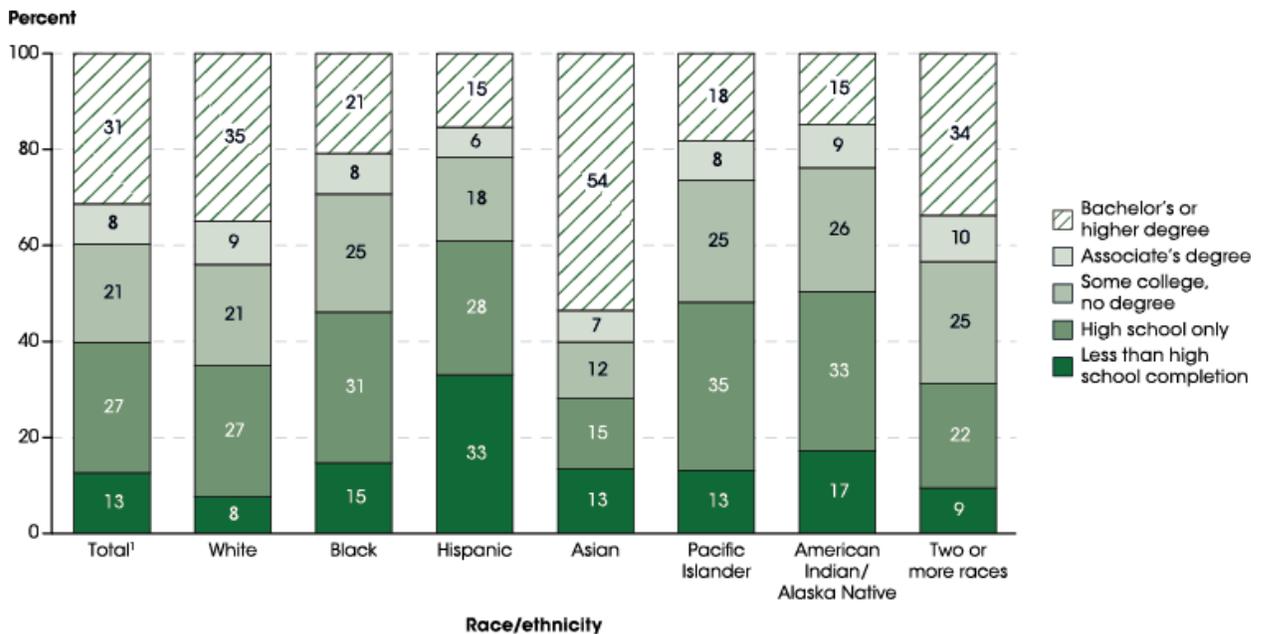Health on COVID-19 Pandemic in the United States*

Percentage of US Adults Aged 18 or Older with Diagnosed Diabetes, by Education Level, 2013-2015 (2017 Diabetes Report Card)

https://www.cdc.gov/diabetes/disparities.html

Percentage Distribution of Educational Attainment of Adults Age 25 and Older, by Race/Ethnicity: 2016

https://nces.ed.gov/programs/raceindicators/indicator_RFA.asp

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Ask students to do the following:

a. Analyze data from the three figures above and describe the association between diabetes prevalence, race/ethnicity, and educational attainment.
b. Discuss type 2 diabetes listing as a co-morbidity of COVID-19; are specific racial/ethnic groups more vulnerable to COVID-19 because their higher prevalence of diabetes?

5. **Health insurance coverage by race/ethnicity**

Percentage of Children Under the Age of 19 and Adults Aged 19 to 64 Without Health Insurance Coverage by Selected Characteristics: 2017

(Population as of March of the following year)
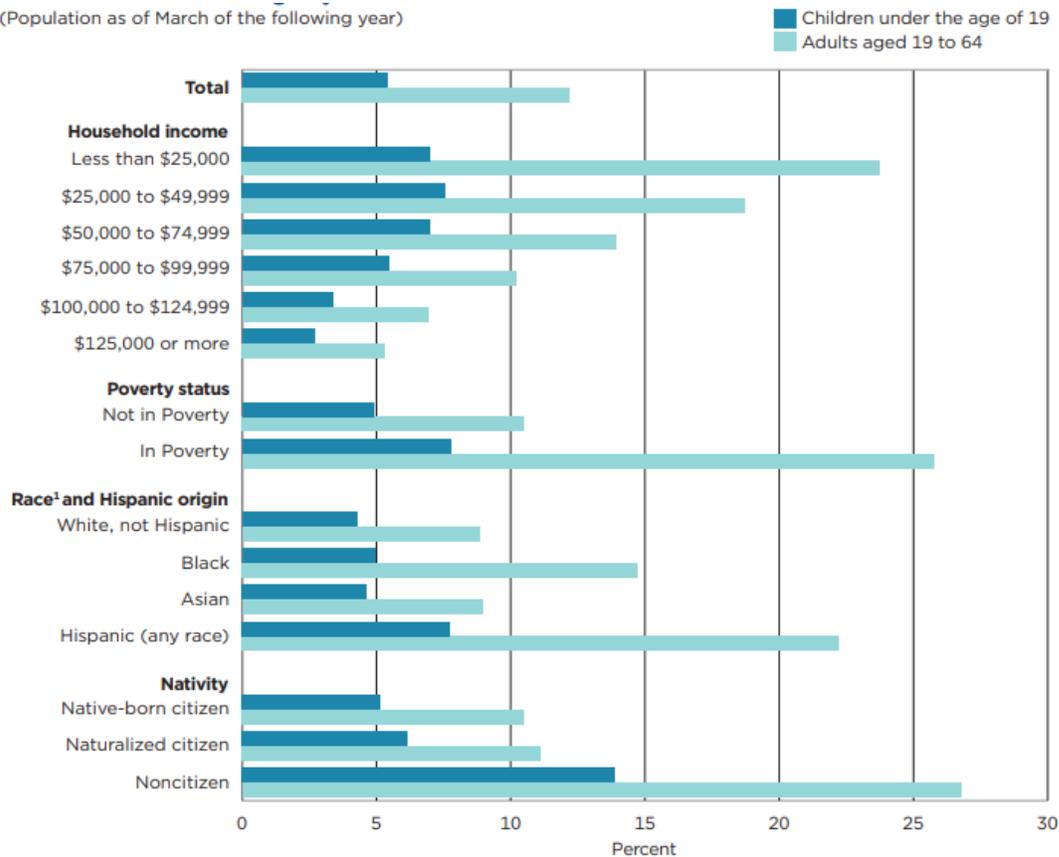
[1] Federal surveys give respondents the option of reporting more than one race. This figure shows data using the race-alone concept. For example, Asian refers to people who reported Asian and no other race.

For information on confidentiality protection, sampling error, nonsampling error, and definitions in the Current Population Survey, see <www2.census.gov/programs-surveys/cps/techdocs/cpsmar18.pdf>.

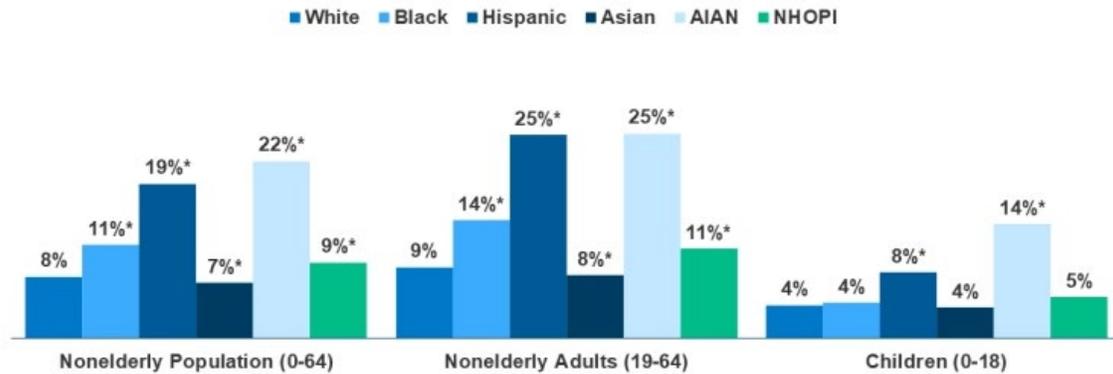Source: U.S. Census Bureau, Current Population Survey, 2018 Annual Social and Economic Supplement.

https://www.census.gov/content/dam/Census/library/publications/2018/demo/p60-264.pdf, p.17

Uninsured Rates Among Nonelderly Individuals by Race/Ethnicity, 2018

Note: * Indicates statistically significant difference from Whites at the p<0.05 level. Persons of Hispanic origin may be of any race but are categorized as Hispanic for this analysis; other groups are non-Hispanic. Includes nonelderly individuals 0-64 years of age. NHOPI refers to Native Hawaiians and Other Pacific Islanders. AIAN refers to American Indians and Alaska Natives.
Source: KFF analysis of 2018 American Community Survey, 1-Year Estimates.

https://www.kff.org/disparities-policy/issue-brief/changes-in-health-coverage-by-race-and-ethnicity-since-the-aca-2010-2018/

AIAN: American Indians and Alaska Natives

NHOPI: Native Hawaiians and Other Pacific Islanders

Ask students to do the following:

a. Analyze data in the two figures above and discuss disparity of health insurance among people of different race/ethnicity. Lack of health insurance is considered a risk factor in the COVID-19 PVI model.

b. Suggest a plausible explanation for the disparity identified in (a).

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Elaboration (15-20 minutes)

Students examine several social determinants of health in this lesson: race/ethnicity, socioeconomic status (educational attainment, unemployment rate, income level), co-morbidity, and lack of health insurance coverage. These conditions have an impact on the clinical outcomes of COVID-19 patients and therefore are considered risk factors for the COVID-19 PVI model. After sharing what they learn from this lesson, students will synthesize their learning and elaborate the interrelationship among all the social determinants examined in this lesson (a relationship diagram might be helpful).

Another emphasis of this lesson plan is to help students to understand that most of the social determinants of health are **correlated** with one's health but they are not necessarily **causal**. In fact, **all SDOHs (except race) can change throughout an individual's life** and for that reason, **"social influencers"** is a more correct term than **"social determinants."** Ask students to discuss what they can do to alleviate the impact of those influencers. Data included in this lesson plan demonstrate that education is a powerful tool to counteract the social influencers' impact on one's life and health. For example, there is measurable difference in diabetes incidence, unemployment rate, and earning between people with or without high school diploma.

> ### Why change the term from "determinants" to "influencers"?
>
> "…while the factors and conditions considered here are referred to as 'social determinants,' they may be more aptly discussed as 'influencers' or 'predictors' rather than direct determinants of an individual's or community's health status. **Most of these conditions are highly correlated with one's health but not necessarily causal; further, all SDOH (except race) can change throughout one's life."**
>
> https://www.americanactionforum.org/research/understanding-the-social-determinants-of-health/

Evaluation

- Have students practice examining the impact of certain social influencers to health problems of students' choosing—a health problem that interests them, or a problem facing their own community (for example, lack of access to healthful food like fruits and vegetables and obesity).

- Have students conduct group discussion and individually draft a response in reply to these questions:

  o Considering the data in the charts, what do you observe about the relationship between two or more of social influencers? Include at least two specific pieces of evidence from the graphs to support your claim.

  o Extension: Which social influencers can we control? Give reasons to support your answer.