Asking Questions About Vaccines

Introduction

This guide was made to encourage and assist DataJam teams interested in exploring vaccinations. Each Vaccine topic will be accompanied by:

A Definition and Overview

B Potential Research Questions

C Resources to Datasets Exploring the Issue

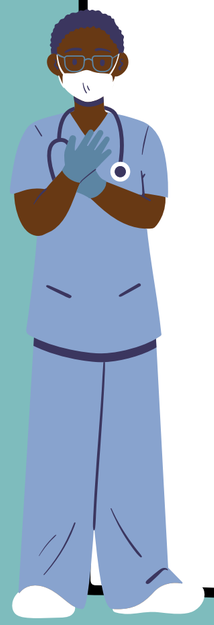
Vaccine History

- The first vaccine was for smallpox
- Created in 1796 by Dr. Edward Jenner
- Developed when he observed people with cowpox were immune to small pox

Myth About Vaccines Causing Autism

- Former doctor, Andrew Wakefield, was paid to publish a fake report that vaccines cause autism
- The report was discredited and deemed fraudulent by the British General Medical Council
- Many researchers have published studies disproving Wakefield's claim and there is no real, credible evidence associating vaccines and autism
- Despite the medical community acknowledging that this article was fake, unfortunately many people still wrongly believe vaccines cause autism

6 Key Types of Vaccines



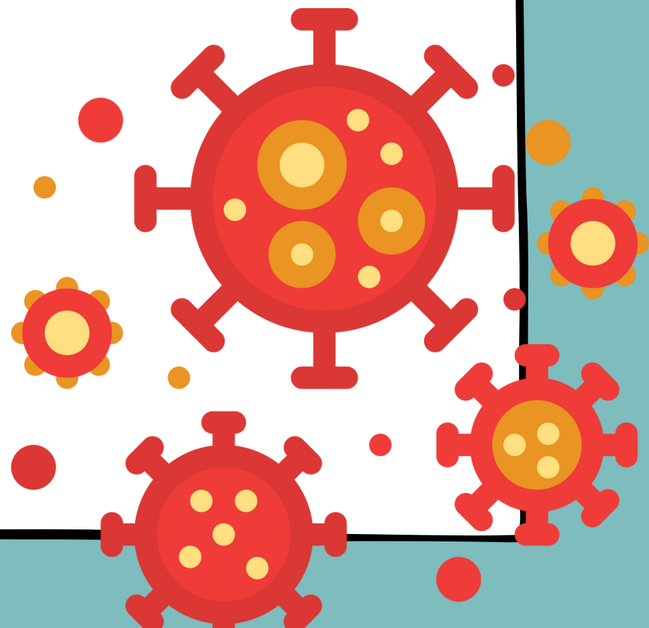
1. Inactivated
2. Live-attenuated
3. mRNA
4. Subunit, Recombinant, Polysaccharide, and Conjugate
5. Toxoid
6. Viral Vector

Inactivated Vaccines

- Use the inactivated version of a virus to create an immune response
- Not as strong as “live-virus” types
- Usually require boosters to increase immunity

Examples

- **Flu Shot**
  - recommended annually based on new flu virus strains
- **Hepatitis A** (causes liver inflammation):
  - recommended for babies within the first 2 years of life
- **Polio** (causes paralysis):
  - 4 doses recommended throughout childhood



Example Research Question:

How do national trends in Flu Vaccinations compare between rural and urban settings?

Useful Dataset:

CDC WEEKLY FLU VACCINATION DASHBOARD
Exploratory Data Product

How to Use:

1. Explore these data tabs (seen to the right) to discover weekly updating data on flu vaccination
2. Data is shown compared with averages from previous years
3. Data can be stratified by race, ethnicity, age
4. Certain tabs have different ways to display the data, including bar graph, line graph, and prevalence maps
5. In each tab, find and click the “View and Download Data” tab like the example below to export information

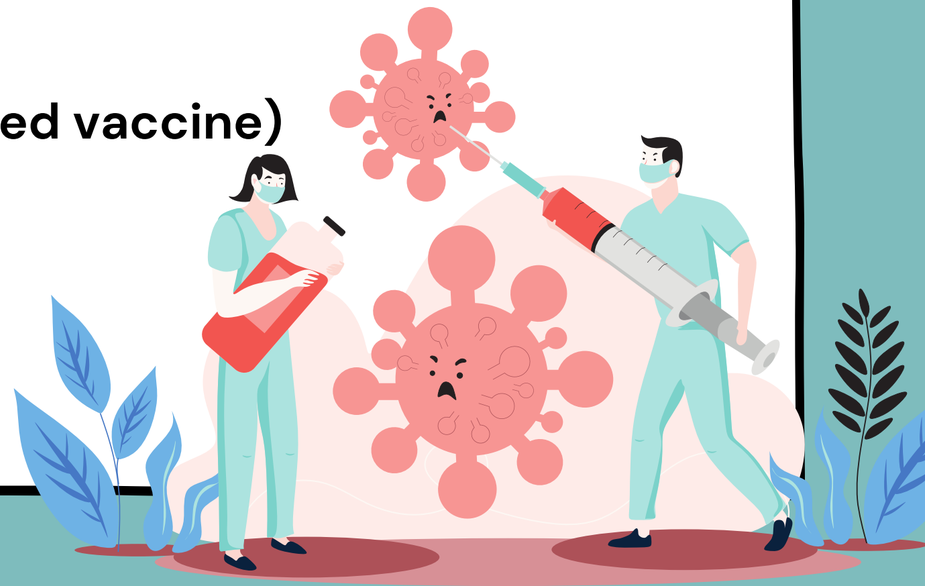
View and Download Data

Live-Attenuated Vaccines

- Created from a weakened version of the virus
- Create strong, lasting immune response

Examples

- **Chickenpox**
  - **2 doses throughout childhood**
- **Measles, Mumps, Rubella (MMR combined vaccine)**
  - 2 doses throughout childhood
- **Rotavirus**
  - recommended during 1st year of life

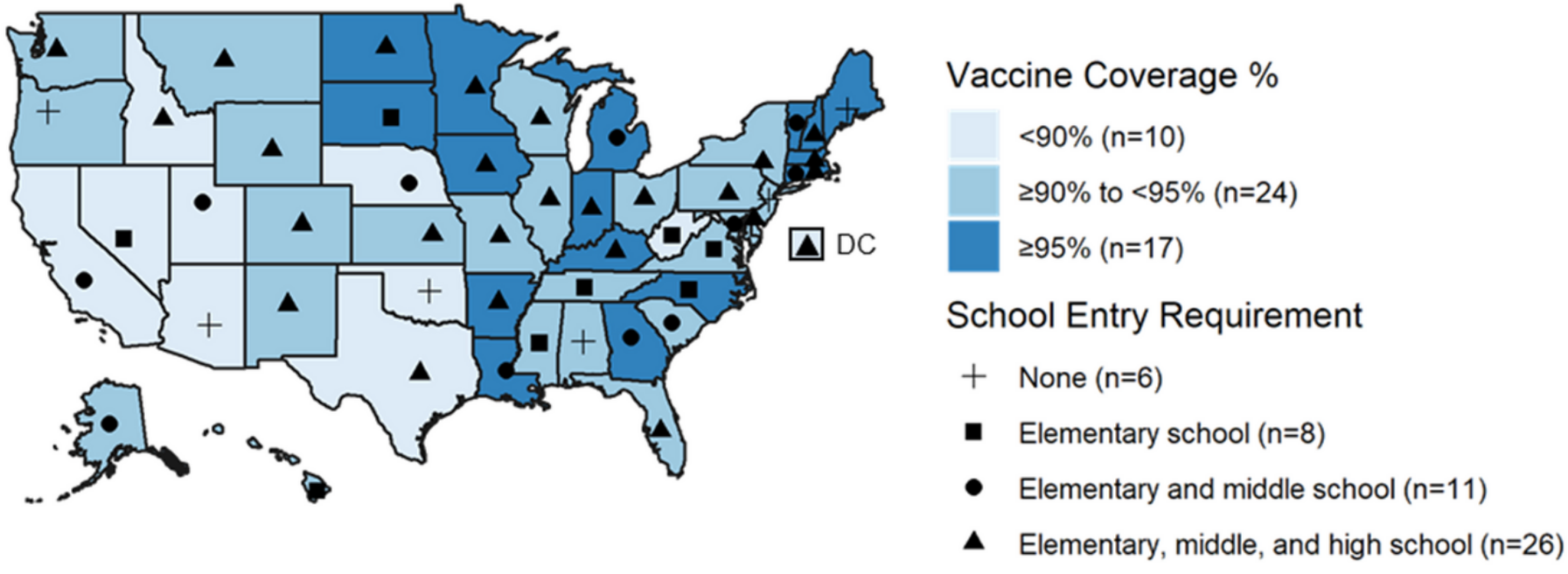


Example Research Question:

Are vaccine-related school entry requirements related to chicken pox vaccine coverage in youths across the United States?

The Journal of Infectious Diseases

Supplementary Figure 2. Estimated Vaccination Coverage with ≥2 Doses of Varicella Vaccine by School 2-Dose Vaccination Requirement Among Adolescents Aged 13-17 Years, United States – National Immunization Survey-Teen, 2020.



How to Use:

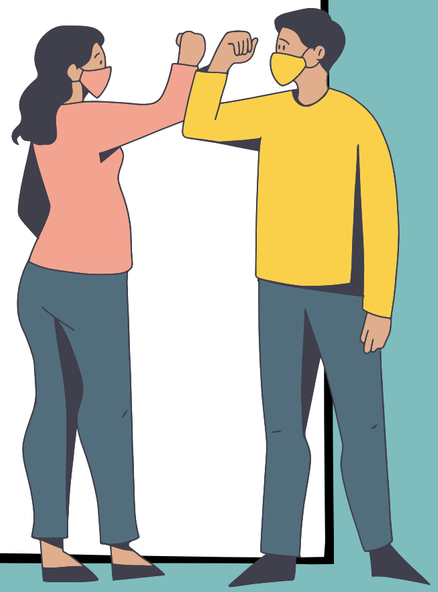
1. Data table shows estimated vaccine coverage for youths aged 13-17 across the US
2. The symbols show in the legend correspond to the state-wide school vaccination requirements
3. The darker the color, the higher chicken pox vaccine coverage is

Messenger RNA (mRNA) Vaccines

- Makes proteins that cause an immune response
- Quick and easily producible
- Newer technology

Examples

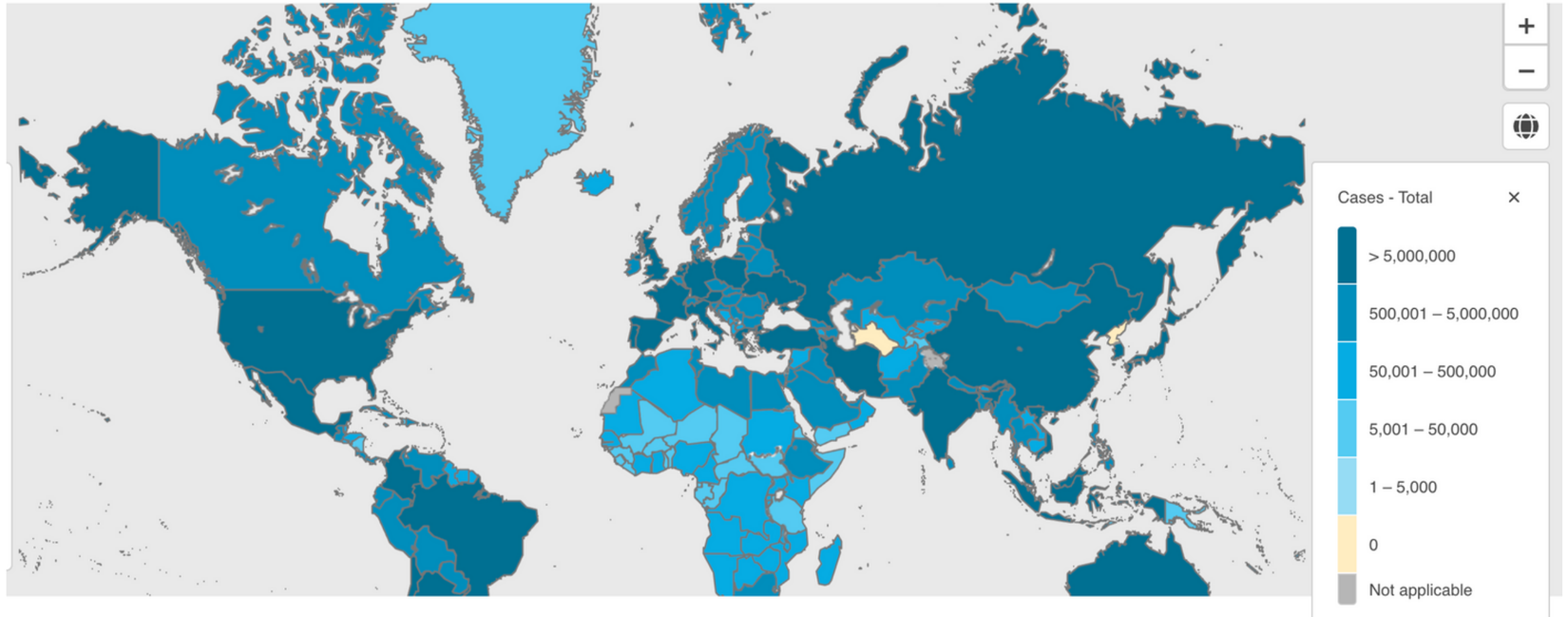
- COVID-19 Vaccine (Moderna & Pfizer versions)
  - Multiple doses recommended for increased immunity



Example Research Question:

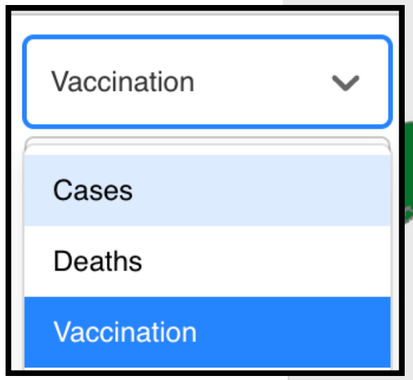
Are vaccination rates related to confirmed cases of COVID-19 globally?

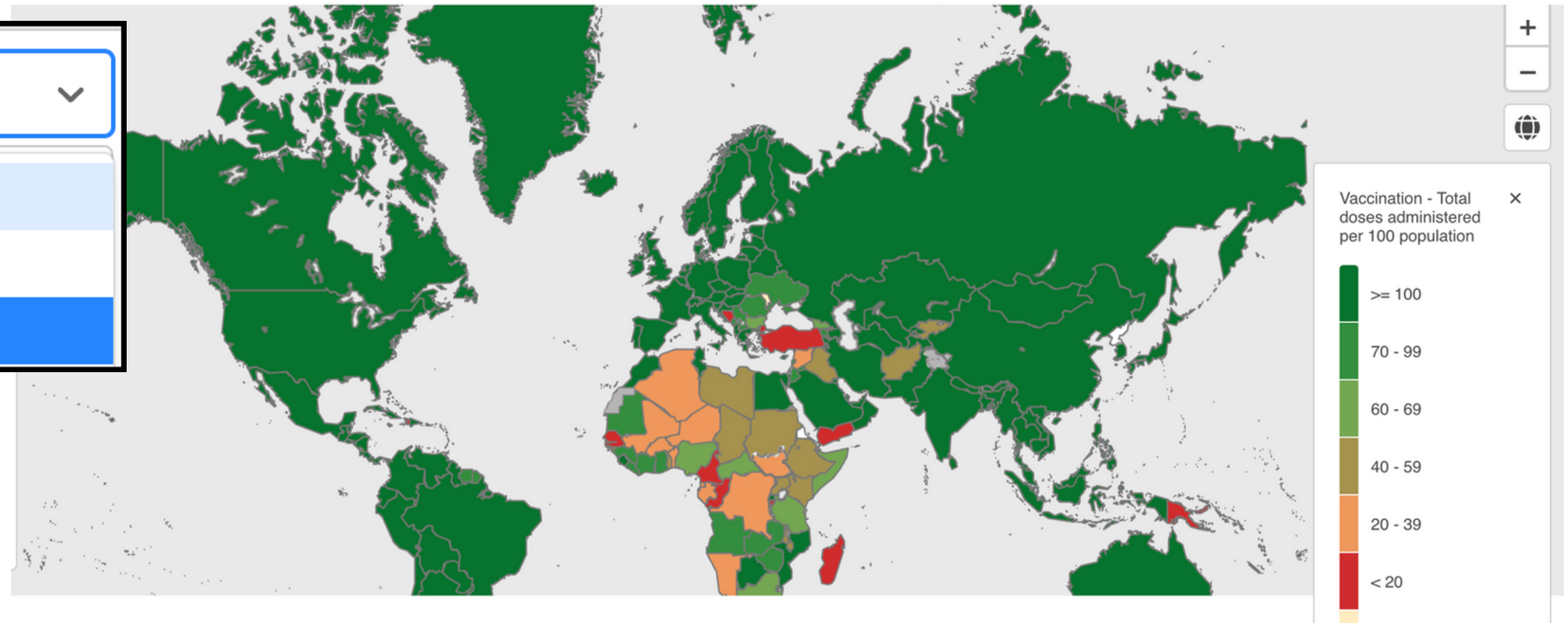
World Health Organization



How to Use:

1. To explore the dataset, use the drop down bar (seen in the box to the right) to toggle between cases, deaths, and vaccinations
2. The figure legend on the side of each map is color coded to help you decipher the data





3. To export, click the “Data” tab to be directed to an export link

Subunit, Recombinant, Polysaccharide, and Conjugate Vaccines

- Uses a small part of the germ/virus/bacteria to trigger immune response
- Very strong
- Require boosters for increased immunity

Examples

- Human Papillomavirus (HPV)
  - 2 or 4 doses for people ages 9-25 years old
- Hepatitis B (causes liver damage)
  - 3 doses recommended throughout childhood
- Pneumococcal
  - 4 doses recommended throughout childhood

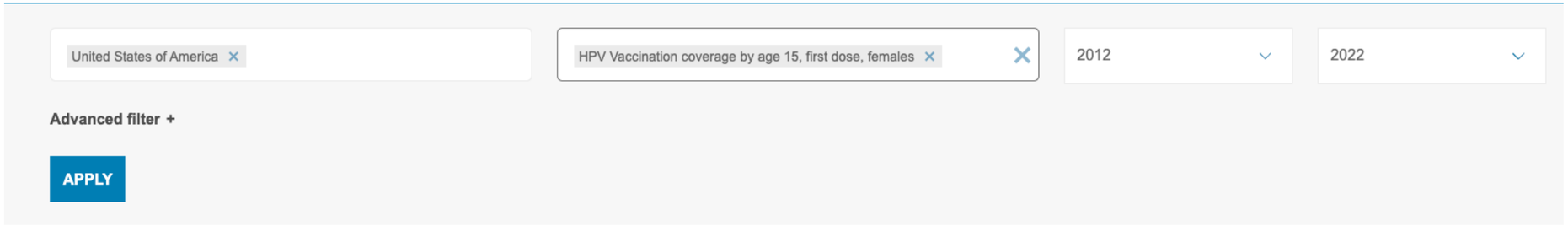
Example Research Question:

How has Human Papillomavirus (HPV) vaccination coverage improved for adolescent females in the US over the last 10 years?

World Health Organization

How to Use:

1. To use this dataset, click on each of the drop down categories (see example below) to filter for the relevant location, age/sex group, and timespan
2. You can also search for other countries, other age groups, males, and different time periods
3. The data can be displayed in tables, maps, charts, or compared with other vaccines/conditions



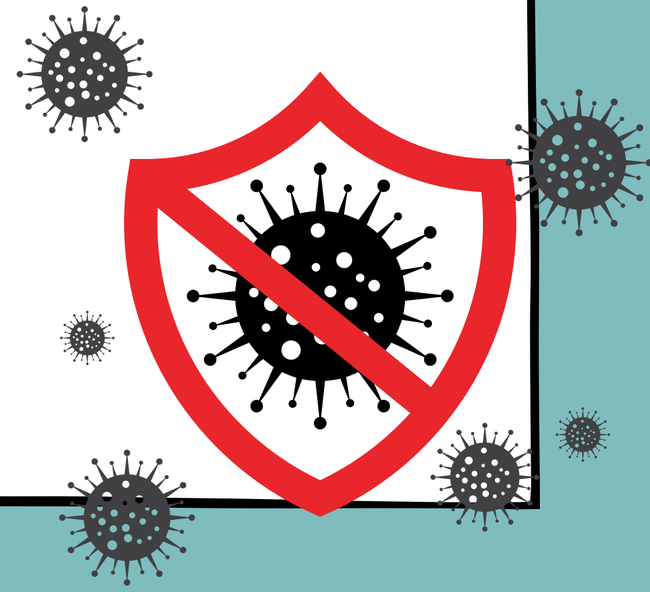
Toxoid Vaccines

- Uses toxins emitted by the germ to cause immune response
- Vaccine does not target whole germ
  - Only targets harmful toxins released by germ

Examples

- Diphtheria*
  - 5 doses recommended across childhood
- Tetanus*
  - 5 doses recommended across childhood

*These vaccines are part of the combined Tdap (Tetanus, diphtheria, pertussis) vaccine given during childhood



Example Research Question:

Is Tdap vaccination coverage in the US related to race/ethnicity?

Useful Dataset:

How to Use:

1. The link to the useful data set will redirect you to download the CDC's dataset excel sheet for Tdap vaccination coverage
2. The top. portion of the dataset will include information separated by racial/ethnic category (as seen below)
3. On this dataset, you can also compare by age group and compare with other tetanus vaccines (not necessarily Tdap)

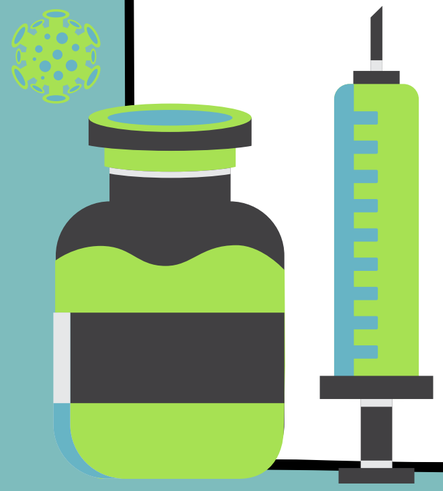
Tdap vaccination		
Overall	**23,718**	**30.1**
White	16,075	33.5
Black	2,690	21.3
Hispanic	3,085	23.1
Asian	1260	29.1
Other	608	37.6
19–64 years	**16,719**	**32.5**
≥65 years	**6,999**	**21.6**

Viral Vector Vaccines

- Uses biological engineering to modify a different, harmless virus to include parts of the harmful virus which can be recognized by the body to help trigger an immune response

Examples

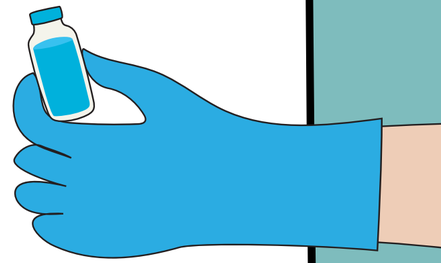
- COVID-19 (Johnson & Johnson version)
  - Single dose with mRNA vaccine booster recommended
- Ebola
  - 2 doses recommended for people in high Ebola risk areas



Example Research Question:

Is patient vulnerability to COVID-19 related to healthcare provider vaccination rates in nursing homes and in-patient facilities?

Data.CMS.gov
Centers for Medicare & Medicaid Services



How to Use:

1. Each row represents the state or national average
2. The columns represent the percentage of residents at the facility or the percentage of healthcare personnel at the facility who are up-to-date on their vaccines
3. To export the data, you can click the “Download full dataset” link (which looks like the box to the right) to export the dataset to an excel sheet

DATASET

Download full dataset

CSV • 1 KB