COVID-19 Update
Moderna COVID-19 Vaccine

COVID-19 ECHO Presentation
December 16, 2020

Alexander Wu, ScD, MPH
Past CDC Epidemic Intelligence Service Officer assigned to NPAIHB, 2018–2020

Global, U.S. Situation

What works

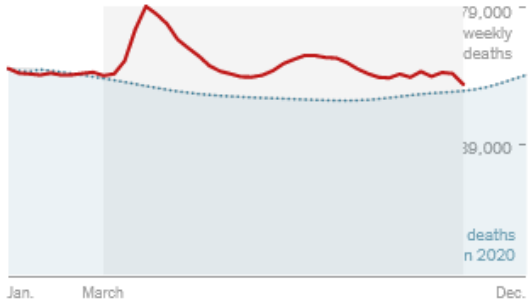
Moderna COVID-19 Vaccine, mRNA-1273

Global, U.S. Situation

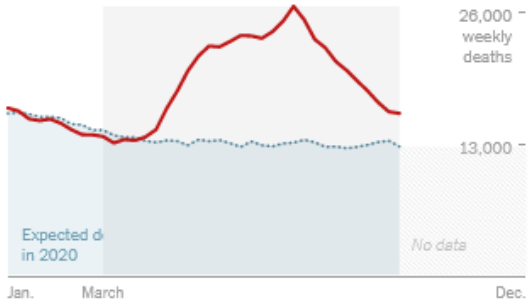
What works

Moderna COVID-19 Vaccine, mRNA-1273

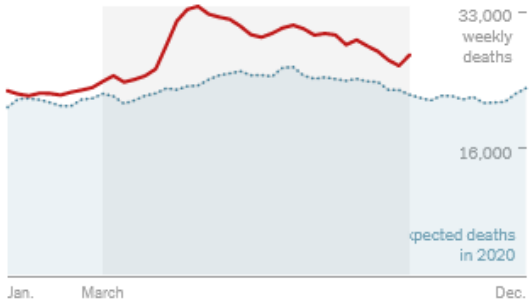
U.S.
329,300+ excess deaths from March 1 to Nov. 7



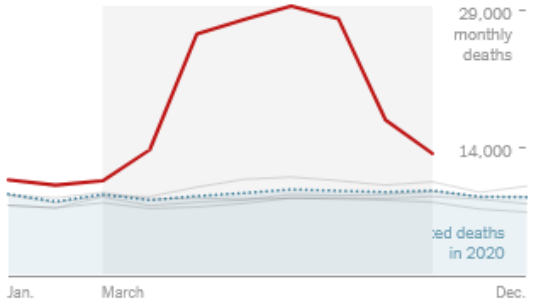
Mexico
189,200+ excess deaths from March 2 to Sept. 27



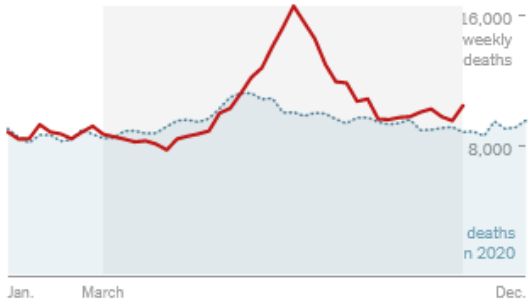
Brazil
154,500+ excess deaths from March 2 to Oct. 4



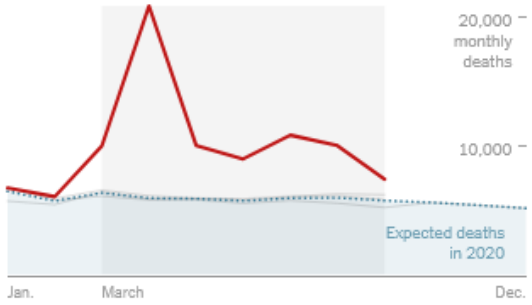
Peru
94,200+ excess deaths from March to October



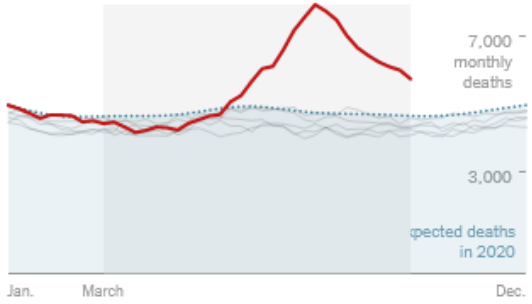
South Africa
36,600+ excess deaths from March 4 to Nov. 10



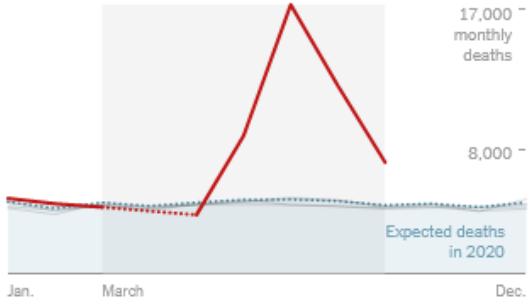
Ecuador
36,200+ excess deaths from March to September



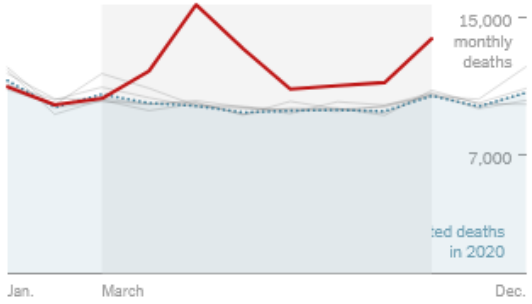
Colombia
27,000+ excess deaths from March 2 to Oct. 4



Bolivia
25,600+ excess deaths from March to September

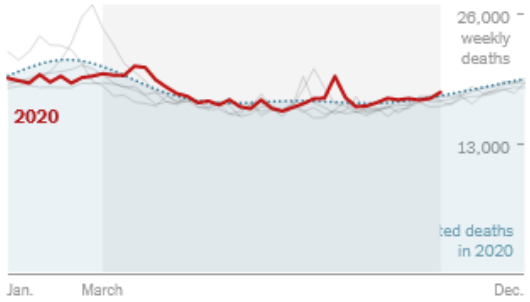


Moscow, Russia
18,900+ excess deaths from March to October



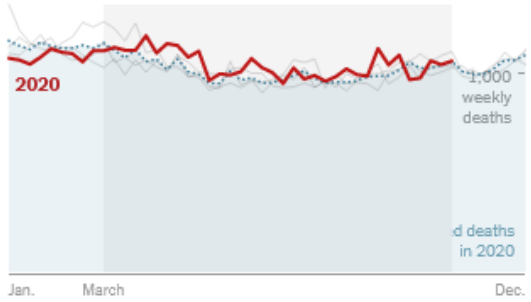
Germany

3,600+ excess deaths from March 2 to Oct. 25



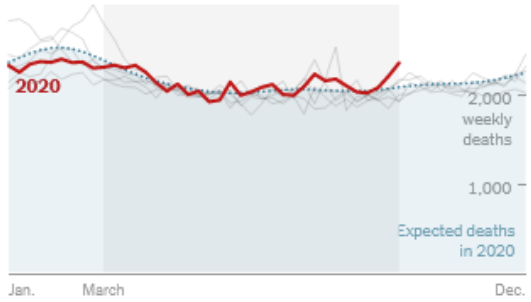
Finland

1,100+ excess deaths from March 2 to Nov. 1



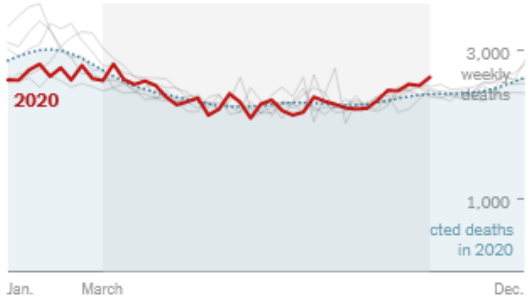
Czech Republic

600+ excess deaths from March 2 to Sept. 27



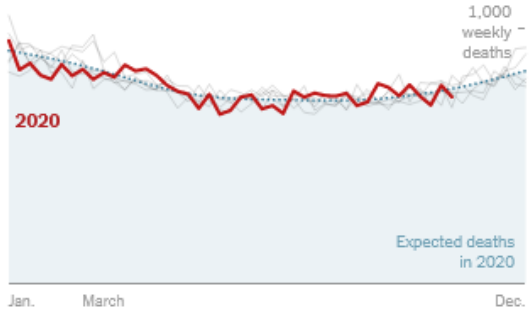
Hungary

200+ excess deaths from March 2 to Oct.18



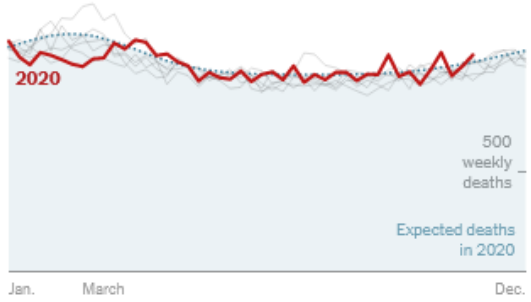
Norway

Fewer than 100 excess deaths from March 2 to Nov. 1



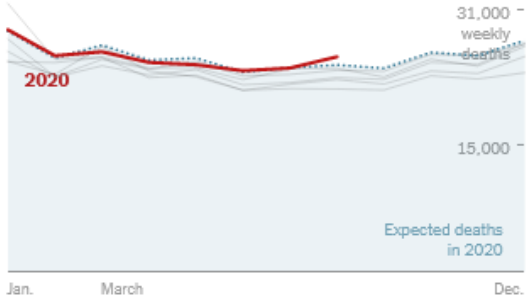
Denmark

No excess deaths



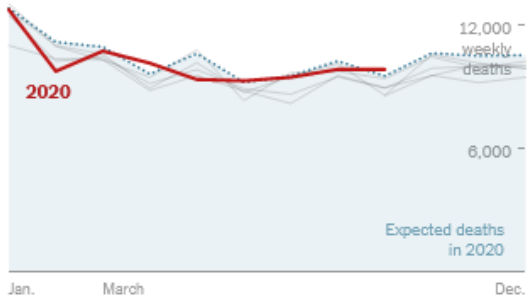
South Korea

No excess deaths



Tokyo, Japan

No excess deaths



Notes: Data from weeks 1, 52 and 53 are excluded, as they may represent partial weeks.

COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

Global Cases
73,773,321

Cases by Country/Region /Sovereignty

- 16,769,765 US
- 9,932,547 India
- 6,970,034 Brazil
- 2,708,940 Russia
- 2,447,458 France
- 1,928,165 Turkey
- 1,893,568 United Kingdom
- 1,888,144 Italy
- 1,762,212 Spain
- 1,510,203 Argentina

Admin0 | Admin1 | Admin2

Last Updated at (M/D/YYYY)
12/16/2020, 9:28 AM

Cumulative Cases | Active Cases | Incidence Rate | Case-Fatality Ratio | Testing Rate

191
countries/regions

Lancet Inf Dis Article: Here. Mobile Version: Here. Data sources: Full list. Downloadable database: GitHub, Feature Layer.
Lead by JHU CSSE. Technical Support: Esri Living Atlas team and JHU APL. Financial Support:

Global Deaths
1,641,578

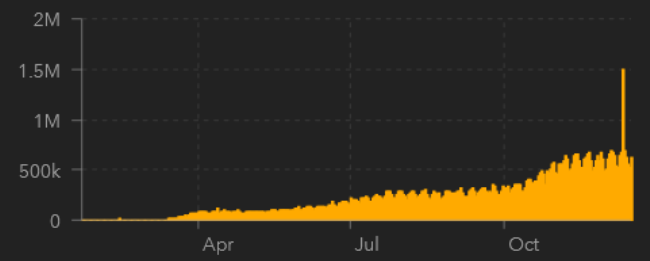
- 304,841 deaths US
- 182,799 deaths Brazil
- 144,096 deaths India
- 115,099 deaths Mexico
- 66,537 deaths Italy

Global Deaths

US State Level
Deaths, Recovered

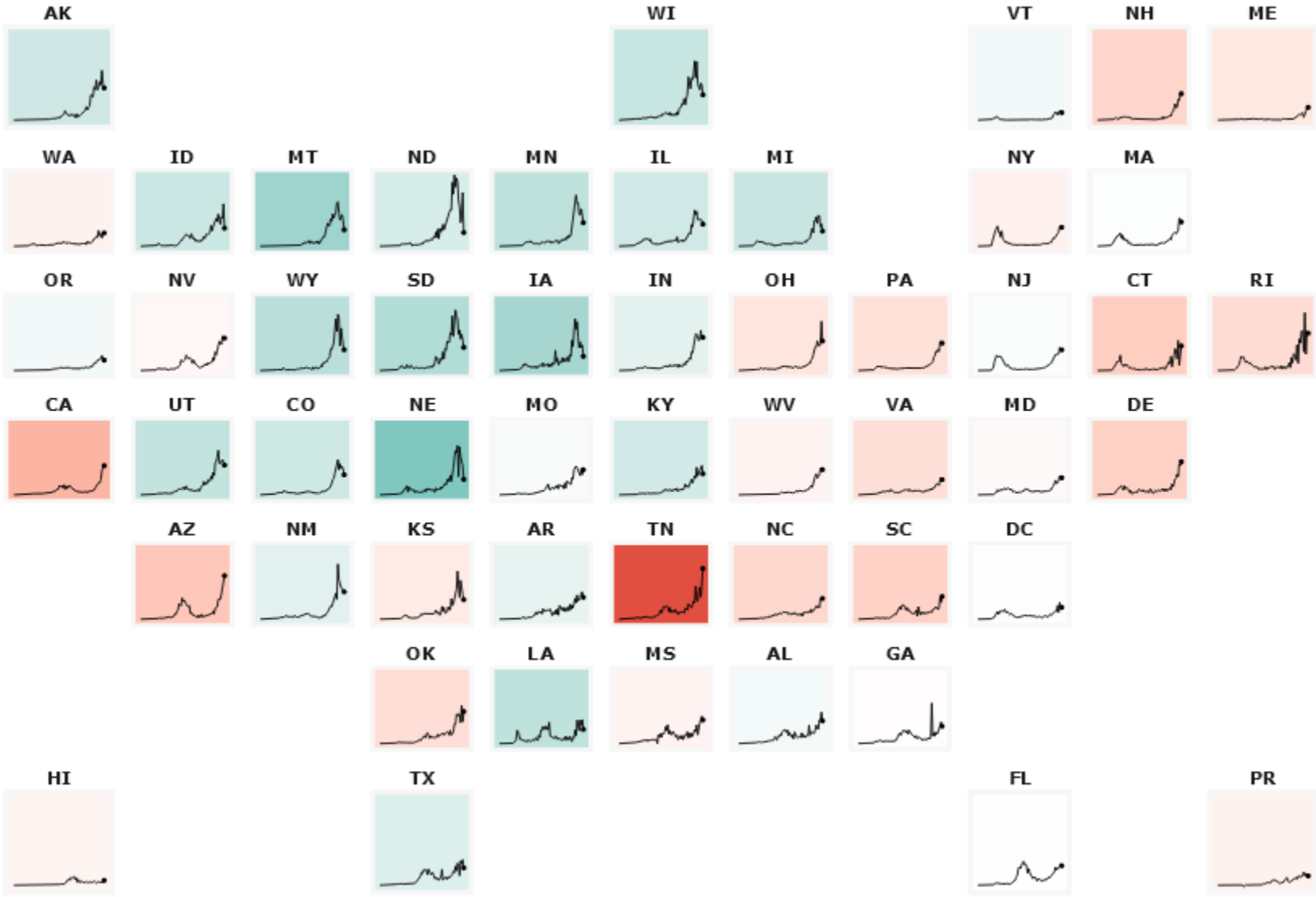
- 35,831 deaths, 92,136 recovered New York US
- 24,648 deaths, 1,203,398 recovered Texas US
- 21,501 deaths, recovered California US
- 20,082 deaths, recovered Florida US

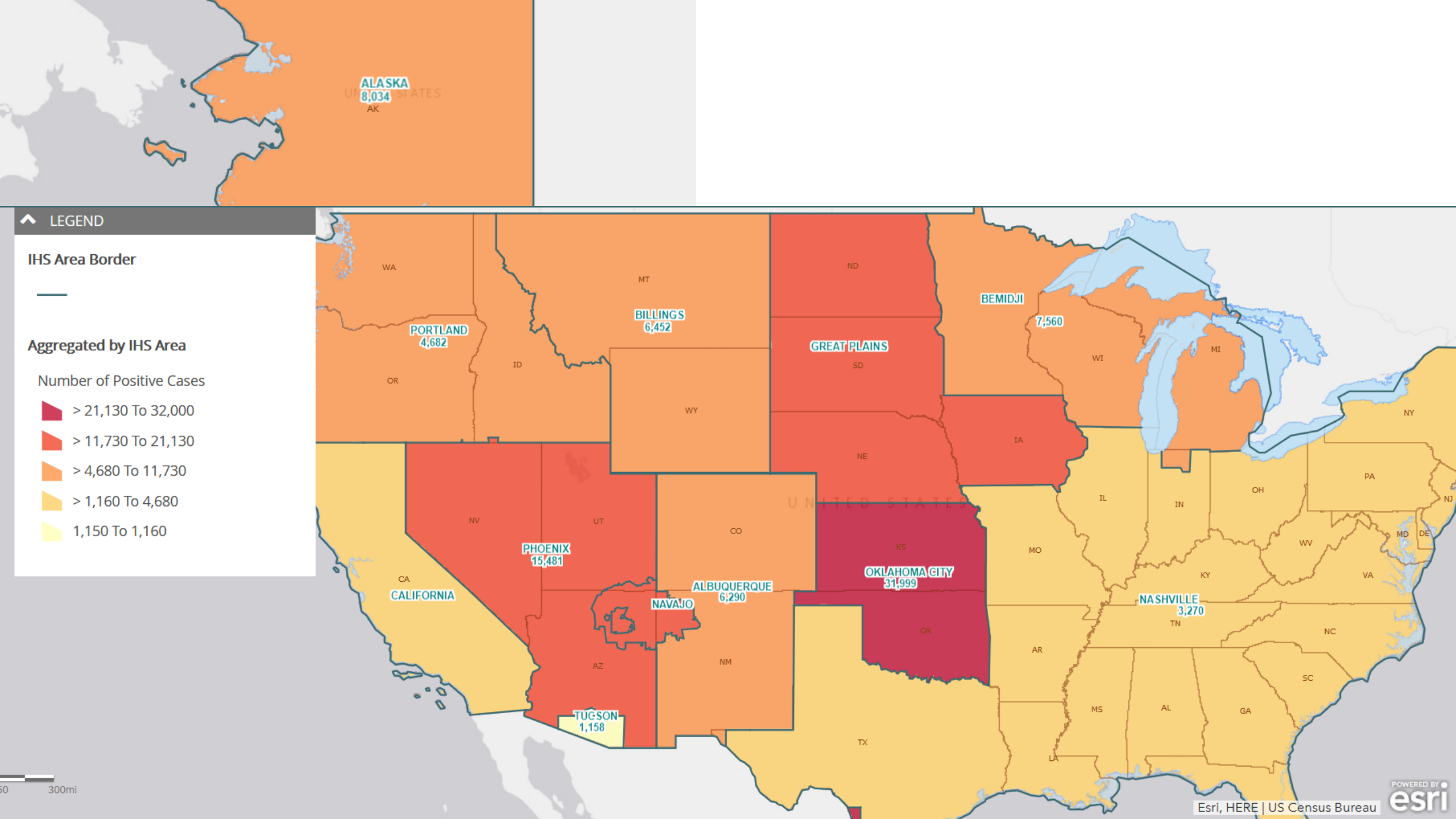
US Deaths, Recov...



Daily Cases

Daily New Cases per 100k people. Data shown from **1/22/20 to 12/14/20**.




ALASKA
8,034
AK
LEGEND
IHS Area Border
Aggregated by IHS Area
Number of Positive Cases
> 21,130 To 32,000
> 11,730 To 21,130
> 4,680 To 11,730
> 1,160 To 4,680
1,150 To 1,160
WA
PORTLAND
4,682
OR
ID
MT
BILLINGS
6,452
WY
ND
GREAT PLAINS
SD
NE
BEMIDJI
7,560
MN
WI
MI
IA
NY
PA
OH
IL
IN
WV
MD
DE
NJ
MO
KY
VA
TN
NC
SC
AR
MS
AL
GA
LA
TX
OK
KS
OKLAHOMA CITY
31,999
NASHVILLE
3,270
NV
UT
CO
PHOENIX
15,481
ALBUQUERQUE
6,290
NAVAJO
NM
AZ
TUCSON
1,158
CA
CALIFORNIA
300mi
Esri, HERE | US Census Bureau
POWERED BY esri

Global, U.S. Situation

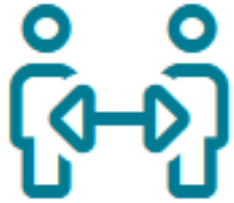
What works

Moderna COVID-19 Vaccine, mRNA-1273

3 W's

Wash hands

Wear a mask



Watch distance

1

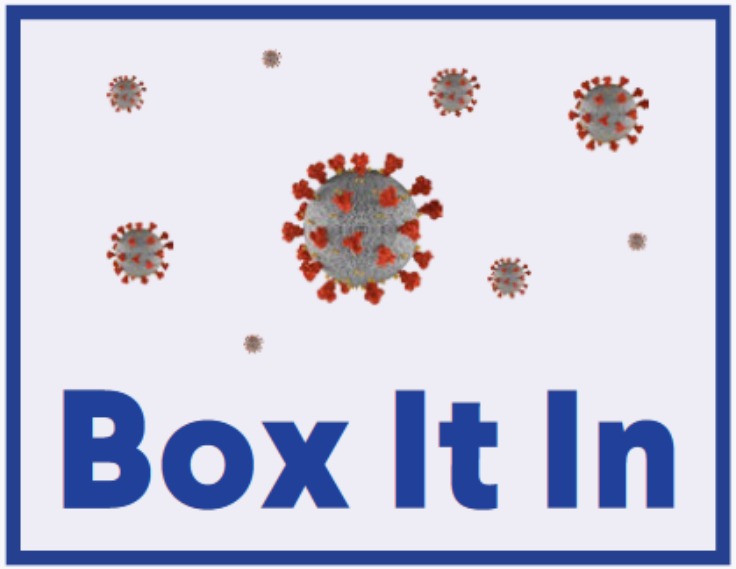
Test

Widely

2

Isolate

All infected people



Box It In

To get us all working again

3

Find

Everyone who has been in contact with infected people

4

Quarantine

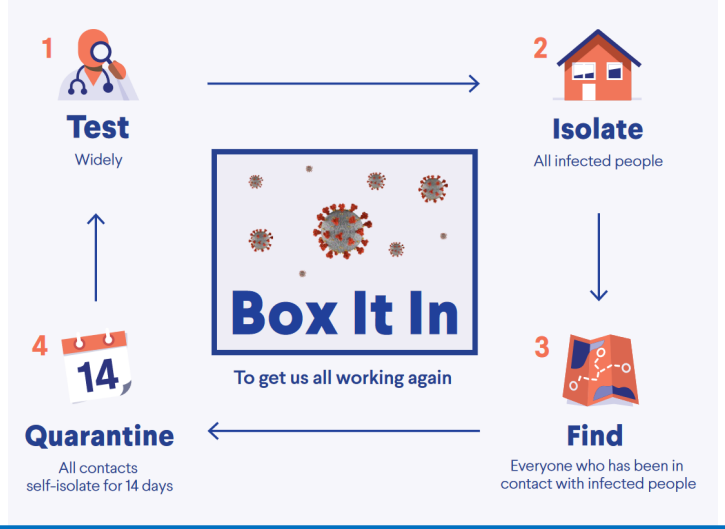
All contacts self-isolate for 14 days

3 W's

Wash hands

Wear a mask

Watch distance



Pre-Vaccination

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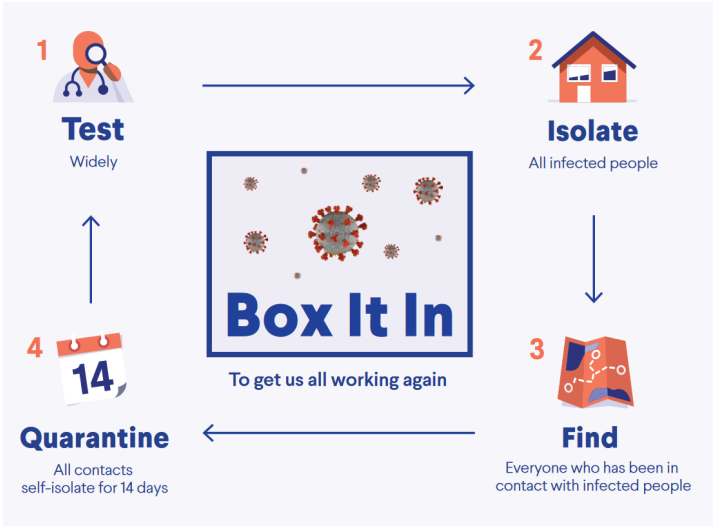

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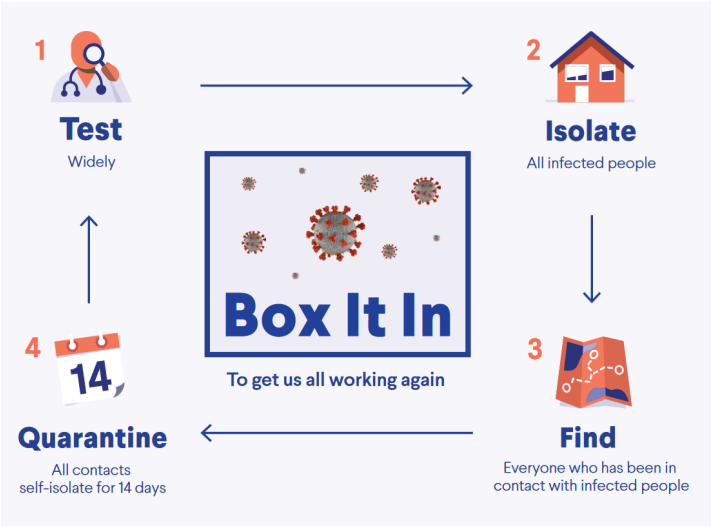
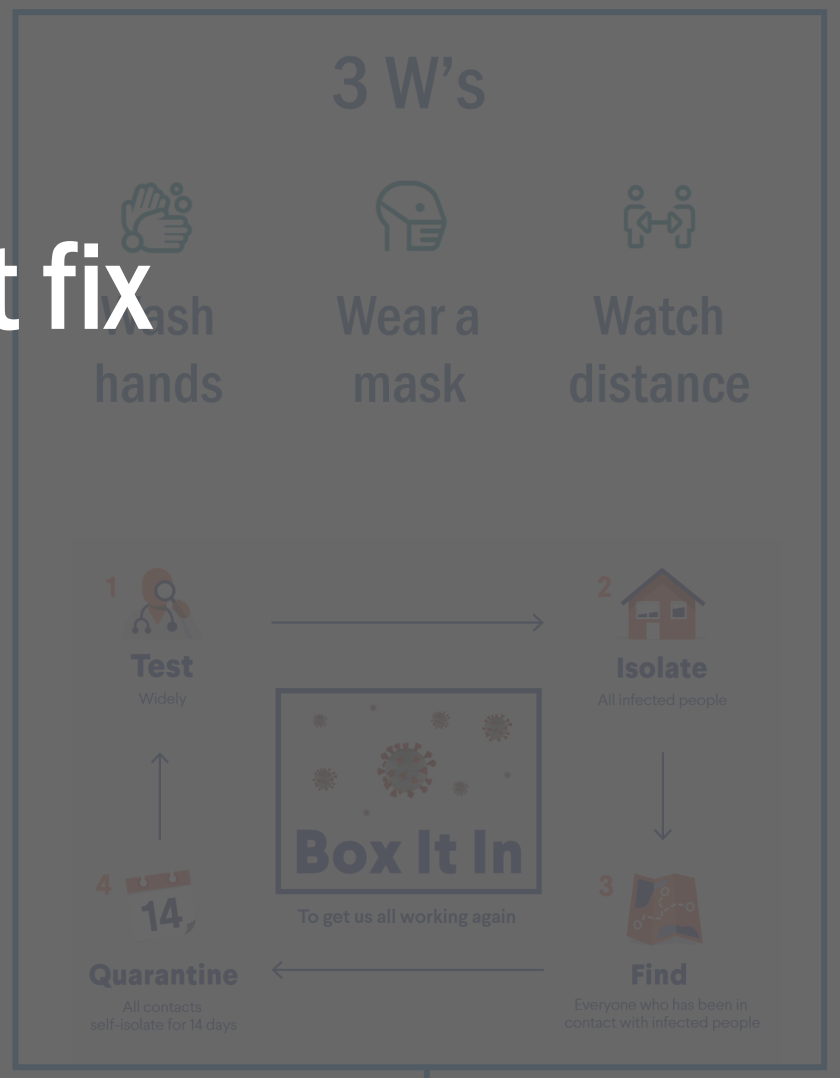


Pre-Vaccination

Post-Vaccination

Why?

- Vaccine is not a perfect fix

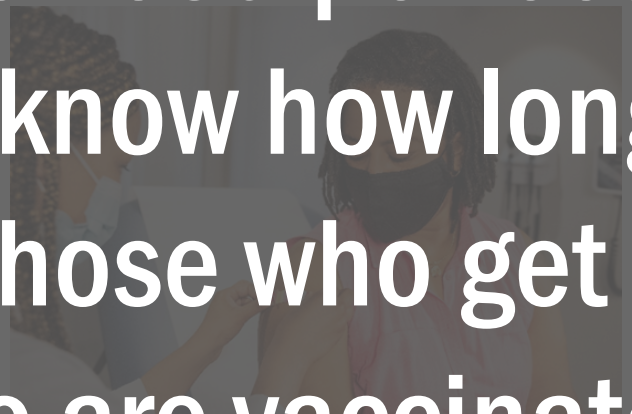


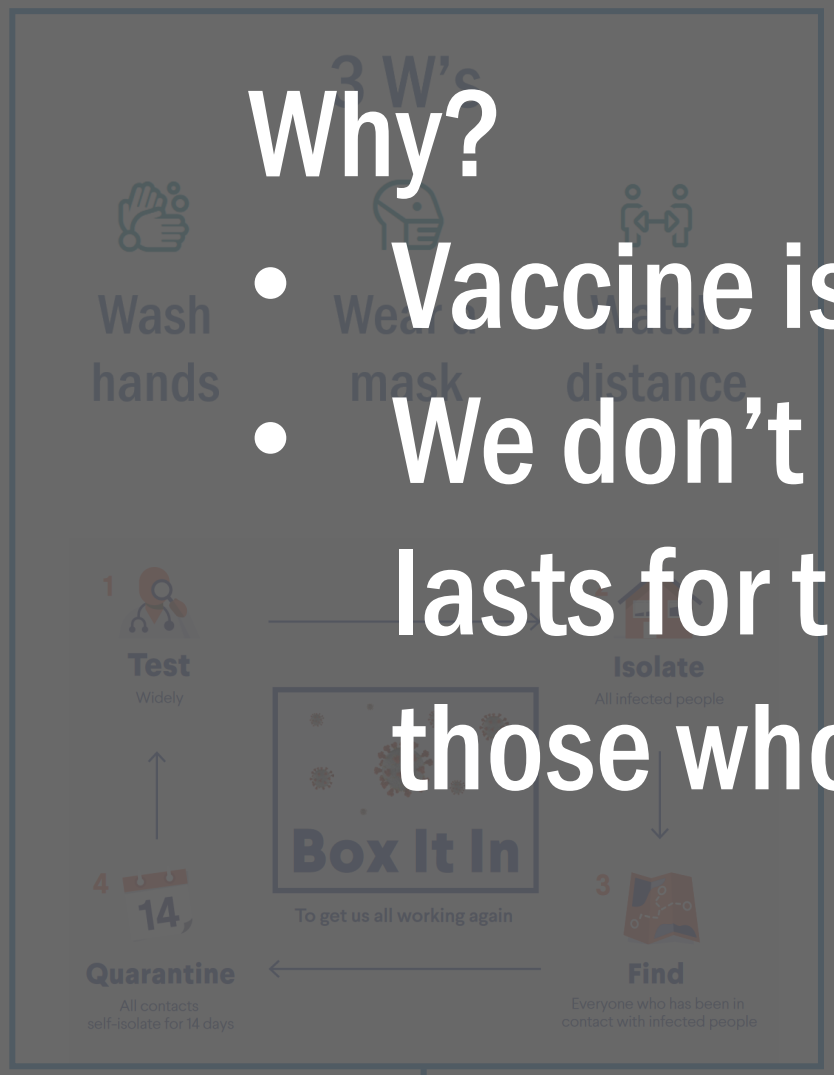
Pre-Vaccination

Post-Vaccination

Why?

- Vaccine is not a perfect fix
- We don’t know how long protection lasts for those who get infected or those who are vaccinated





Pre-Vaccination

Post-Vaccination

Why?

- Vaccine is not a perfect fix
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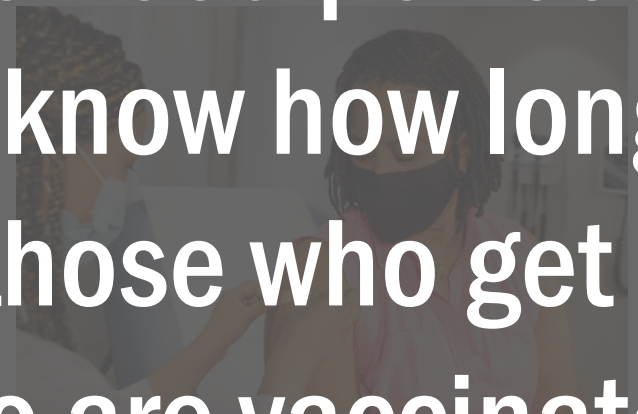
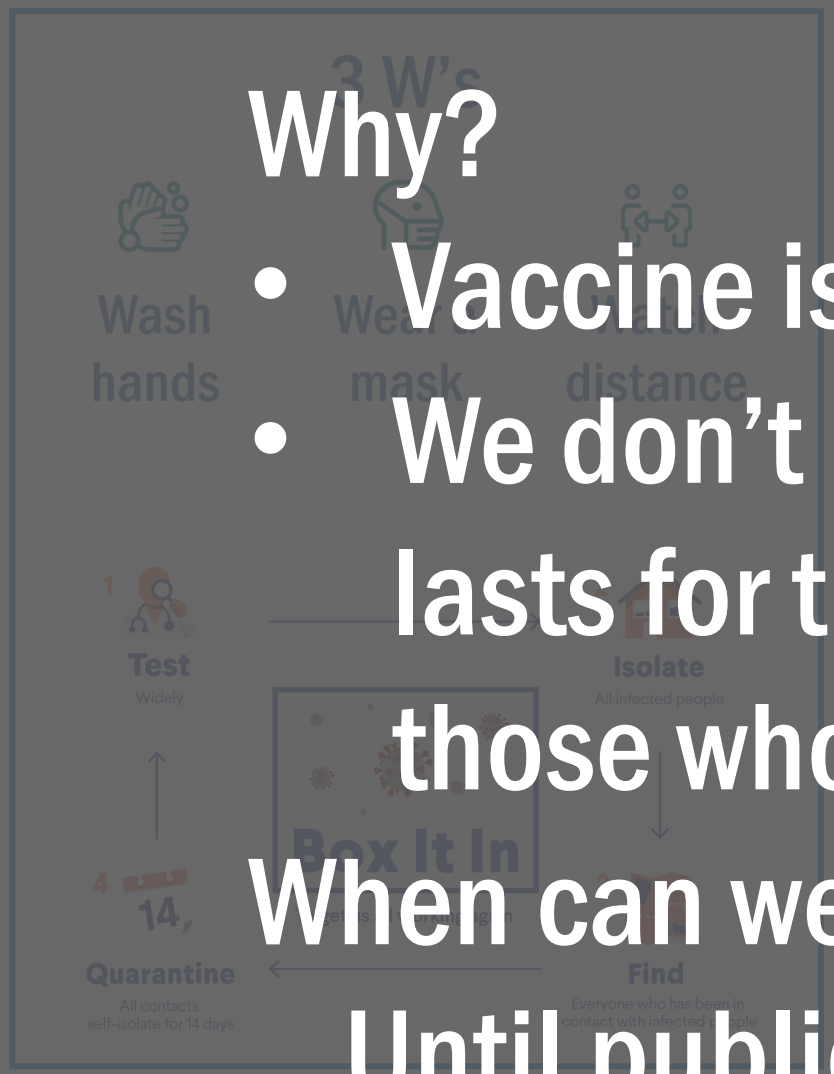
When can we stop?

Until public health officials say otherwise





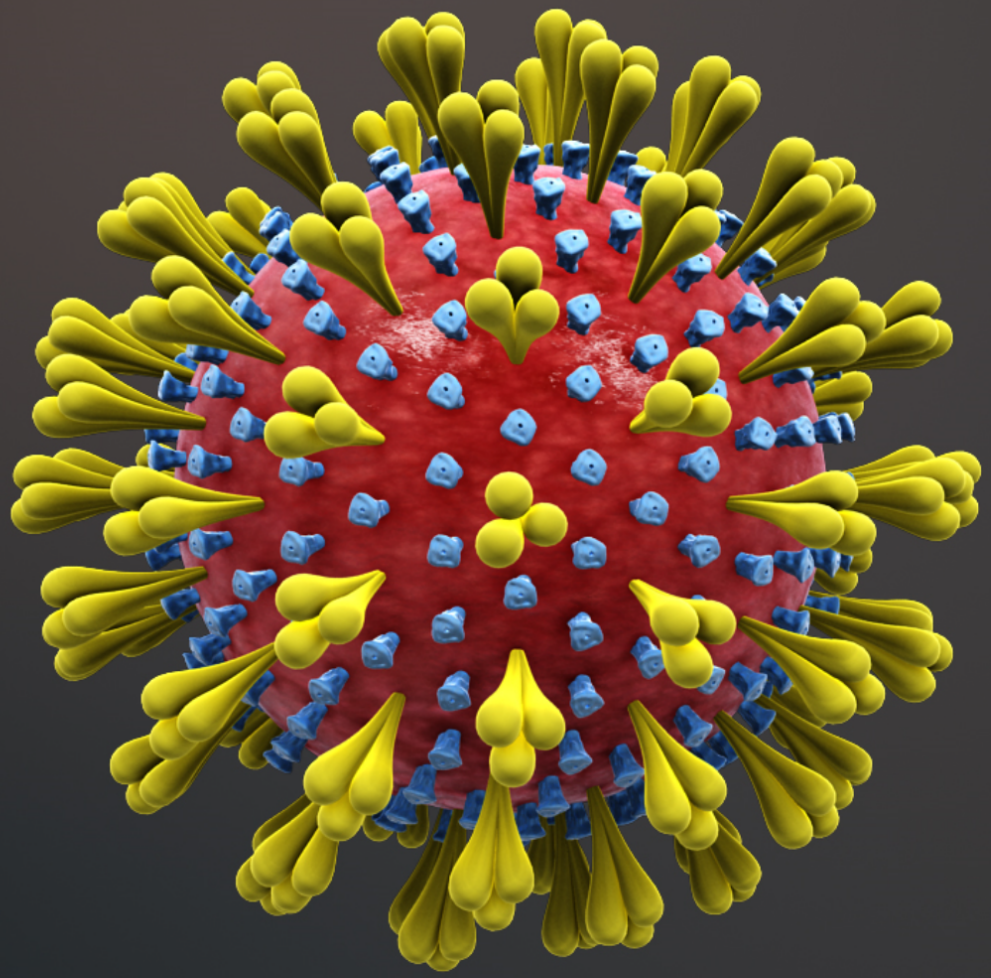
Pre-Vaccination

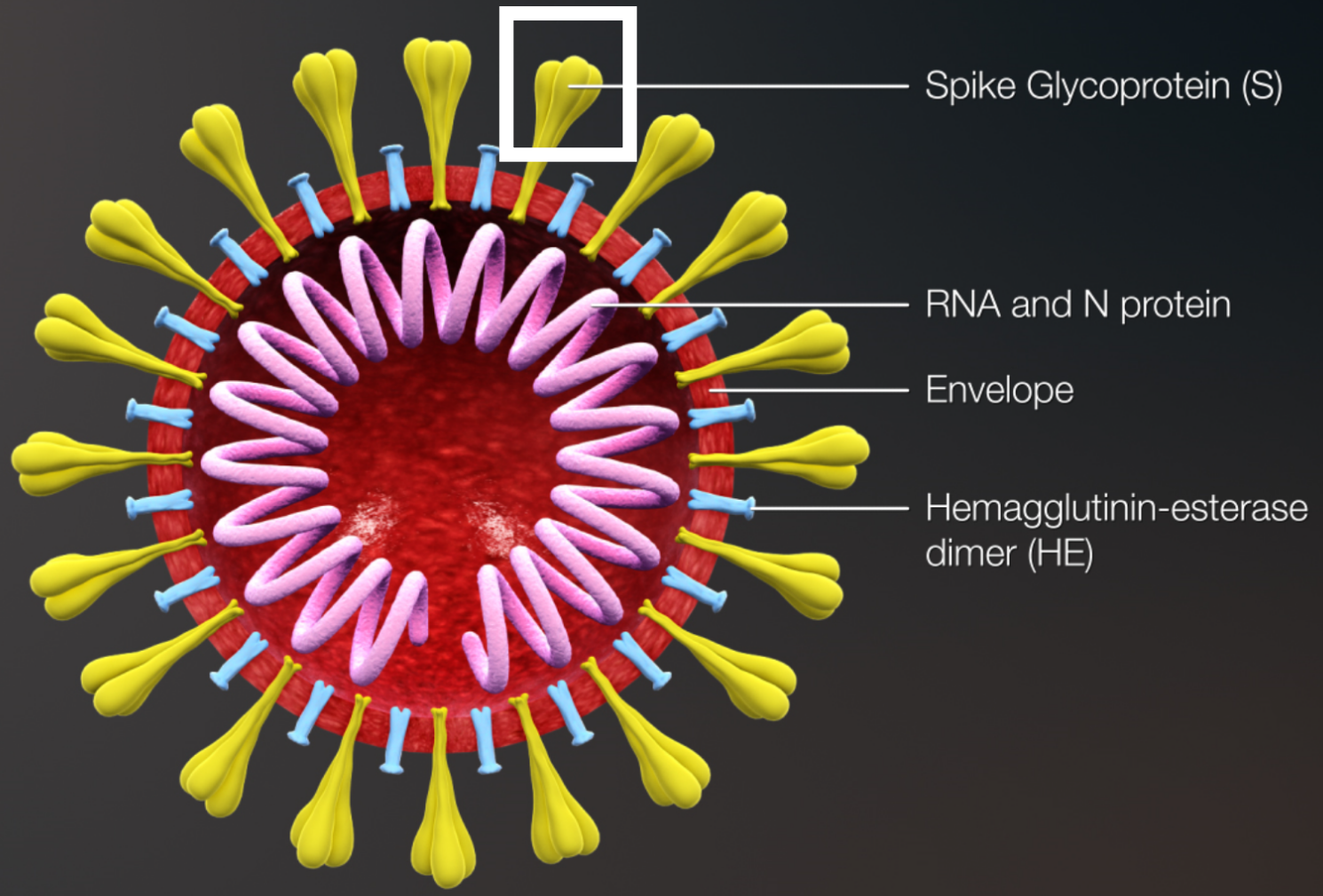
Post-Vaccination

Global, U.S. Situation

What works

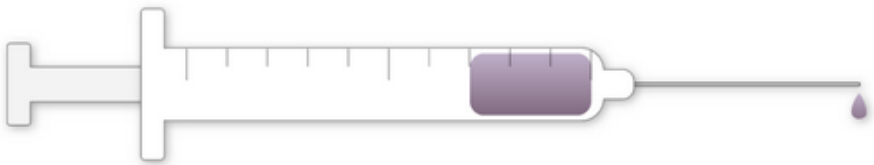
Moderna COVID-19 Vaccine, mRNA-1273




Spike Glycoprotein (S)
RNA and N protein
Envelope
Hemagglutinin-esterase dimer (HE)

How the Pfizer-BioNTech Vaccine Works

By Jonathan Corum and Carl Zimmer Updated Dec. 14, 2020



The German company BioNTech partnered with Pfizer to develop and test a coronavirus vaccine known as **BNT162b2**. A clinical trial demonstrated that the vaccine has an efficacy rate of 95 percent in preventing Covid-19.

Moderna Vaccine

- Cambridge, Massachusetts (2010)
- mRNA-1273 delivered in a lipid nanoparticle “bubble”
- mRNA does not enter cell nucleus or interact with genome

Moderna Vaccine

- Cambridge, Massachusetts (2010)
- mRNA-1273 delivered in a lipid nanoparticle “bubble”
- mRNA does not enter cell nucleus or interact with genome
- Phase 1: consistent immune response and lasted >=3 months
- Phase 2: produced antibodies to SARS-CoV-2 spike protein
  - 2 doses of 100ug vaccine had similar levels of neutralizing antibody titers in 250ug dose
  - Decided on 2 doses of 100ug

Moderna Vaccine, Phase 3

- 30,351 participants randomized to two groups
  - 15,181 people received mRNA-1273 vaccine
  - 15,170 received placebo
  - Received two doses total: Day 1 and Day 29

Moderna Vaccine, Phase 3

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  - 15,181 people received mRNA-1273 vaccine
  - 15,170 received placebo
  - Received two doses total: Day 1 and Day 29
- 99 vaccine study sites in the U.S.
- 36.5% of participants representing communities of color
- 230 AI/AN people, 0.8% of participants

Moderna Vaccine, Phase 3

- Primary efficacy endpoint: Vaccine efficacy in preventing COVID-19 occurring at least 14 days after dose 2
- 196 cases of Covid-19: 185 in placebo group 11 in vaccine group
  - Efficacy = 94.1% (89.3%, 96.8%)

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- Efficacy lowest for severely obese (BMI>40 kg/m^2): 91.2% (32.0%, 98.9%)
- Efficacy in > 64 year-old group = 86.4% (61.4%, 95.5%)
- Zero severe COVID-19 cases in vaccine group; 30 in placebo group

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- Zero severe COVID-19 cases in vaccine group; 30 in placebo group
- EUA application submitted to FDA November 30, 2020
- Efficacy of one dose: 80.2% (55.2%, 92.5%); ? beyond 28 days

Moderna Vaccine, Phase 3

- No anaphylactic or severe hypersensitivity reactions
- Common solicited adverse reactions

Injection site pain	91.6%		Muscle pain	59.6%
Fatigue	68.5%		Joint pain	44.8%
Headache	63.0%		Chills	43.4%

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Fatigue	68.5%		Joint pain	44.8%
Headache	63.0%		Chills	43.4%

- 0.2% to 9.7% (fatigue) reported as severe (more frequent after dose 2 and less frequent in participants aged ≥65 years)
- 4 cases of Bell's palsy: 3 in vaccine group, 1 in the placebo (frequency not above that expected in general population)

Characteristic	Moderna
Vaccine name	mRNA-1273
Vaccine type	Messenger RNA (mRNA)
Trial registration #	NCT04470427
Target enrollment	30,000 (39% ages 45-64; 25% ages 65+)
US diverse enrollment	37% (20% - Hispanic; 10% - African American/Black; 4% - Asian; 3% - All others)
Ages eligible for trial	18+
Part of OWS	Did accept Operation Warp Speed funding for vaccine development as well as advance agreement for purchase of at least 100M doses
Number of doses	2 doses (28 days apart)
Diluent required	No
Vial volume & dosage	5mL multidose (10 doses/vial)
Cold storage	Conventional freezer (-20°C)
Storage duration	- up to 6 months in -20°C freezer (Pfizer 6 months at -80 to -60 C) - up to 30 days in 2°C–8°C fridge (Pfizer 5 days refrigerated at 2 to 8 C) - up to 12 hours (unopened vial, 6 hours after first draw) at room temp (Pfizer 6 hours diluted with sterile saline)

Characteristic	Moderna
Vaccine name	mRNA-1273
Vaccine type	Messenger RNA (mRNA)
Demonstrated efficacy	- 94.1% at final results 196 cases, measured starting from 14 days post second dose, (185 placebo/11 vaccine) - 100% against severe disease - Efficacy consistent across age, race and ethnicity
Adverse events	- No significant safety concerns at this time; longer term safety unknown - Prominent events included: fatigue (9.7%) and myalgia (8.9%)
Doses available	- Up to 15M for US by end 2020 - Up to 1B doses by end 2021
Shipping details	- Sent from manufacturer through central distributor (i.e., McKesson); most likely arriving via UPS or FedEx

Global, U.S. Situation

What works

Moderna COVID-19 Vaccine, mRNA-1273

Resources

Vaccines and Immunizations Home

For Parents

For Adults

For Pregnant Women

For Healthcare Professionals

COVID-19 Vaccination

For Healthcare Professionals

Preparing to Provide COVID-19 Vaccines

Answering Patients' Questions

Some patients won't have questions about coronavirus disease 2019 (COVID-19) vaccination when you give your strong recommendation and use language that assumes patients will get vaccinated when doses are widely available. If a patient questions your recommendation about COVID-19 vaccination, this does not necessarily mean they will not accept a COVID-19 vaccine. This is a new vaccine, and some questions are to be expected. Your patients consider you their most trusted source of information when it comes to vaccines, and sometimes they simply want *your* answers to their questions.

This page outlines some topics patients ask about most vaccines and tips for how to answer their questions.

Questions about Vaccine Safety and the Speed of Vaccine Development

The federal government, under the umbrella of Operation Warp Speed, has been working since the start of the pandemic to make a COVID-19 vaccine available as soon as possible. This accelerated timeline is unprecedented and has raised concerns for some people that safety may be sacrificed in favor of speed. However, as with all vaccines, safety is a top priority.

For Specific Groups of People
Basics and Common Questions +
Vaccines and Preventable Diseases +
News and Media Resources +

Questions about Whether It Is Better to Get Natural Immunity Rather than Immunity from Vaccines

Because some people with COVID-19 can have very mild symptoms, some may see natural infection as preferable to receiving a new vaccine. Others may be concerned that getting a COVID-19 vaccine could make a later illness worse. Help your patients understand the risks and benefits so they can be confident choosing to get vaccinated.

Patients may ask: Is the vaccine that helpful? I heard getting COVID-19 gives you better and longer immunity than the protection a vaccine can give. Can it actually make my illness worse if I do end up getting COVID-19?
To respond, you can:

- Explain the potential serious risk COVID-19 infection poses to them and their loved ones if they get the illness or spread it to others. Remind them of the potential for long-term health issues after recovery from COVID-19 disease.
- Explain that scientists are still learning more about the virus that causes COVID-19. And it is not known whether getting COVID-19 disease will protect everyone against getting it again, or, if it does, how long that protection might last.
- Describe how the vaccine was tested in large clinical trials and what is currently known about its safety and effectiveness.

Be transparent that the vaccine is not a perfect fix. Patients will still need to practice other precautions like wearing a mask, social distancing, handwashing and other hygiene measures until public health officials say otherwise.

> Example:

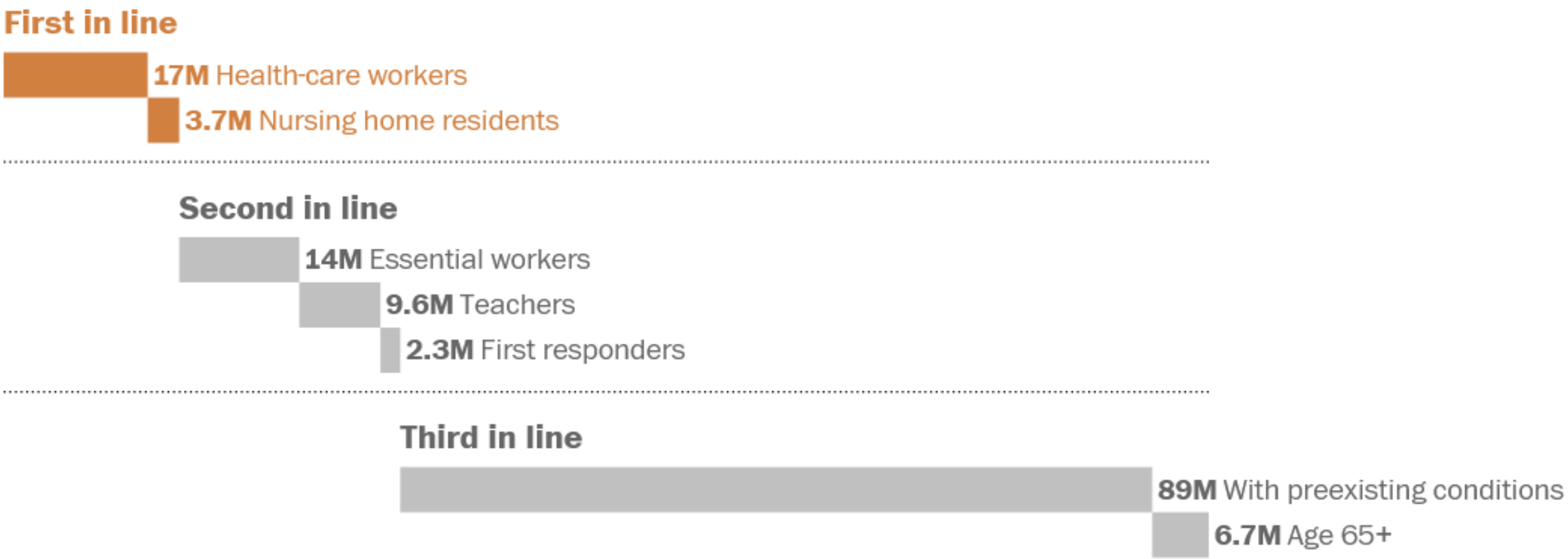
Example:

"Both this disease and the vaccine are new. We don't know how long protection lasts for those who get infected or those who are vaccinated. What we do know is that COVID-19 has caused very serious illness and death for a lot of people. If you get COVID-19, you also risk giving it to loved ones who may get very sick. Getting a COVID-19 vaccine is a safer choice."

Health

Tracking vaccine distribution, state by state

Updated Dec. 12 at 12:39 p.m.


First in line
17M Health-care workers
3.7M Nursing home residents
Second in line
14M Essential workers
9.6M Teachers
2.3M First responders
Third in line
89M With preexisting conditions
6.7M Age 65+

Alaska

Over the last week, Alaska has seen an average of **587** confirmed cases and **5** deaths per day. Alaska has the **12th** most confirmed cases per capita among states and D.C. during the same period.

Alaska is expected to get about **6,300** doses in the first set of Pfizer vaccines. If the Moderna vaccine is approved, the state could get a total of **32,000** doses before the end of the year. That is enough to vaccinate **4.4 percent** of the state population.

The New York Times

Opinion

Find Your Place in the Vaccine Line

By Stuart A. Thompson
Illustrations by Jorge Colombo

Based on your risk profile, we believe you're in line behind **268.7 million** people across the United States.

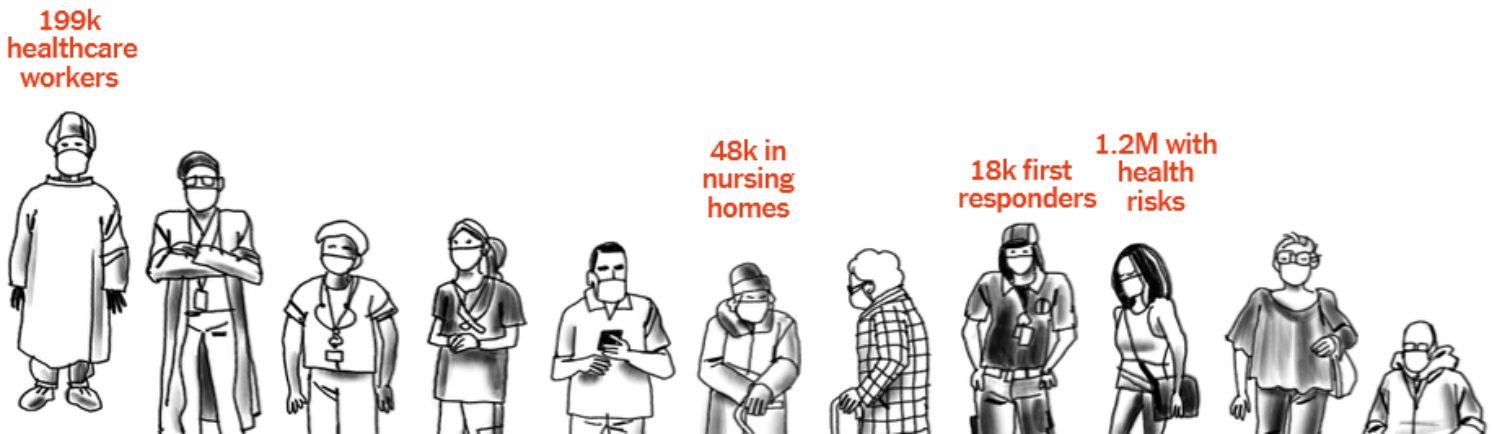
When it comes to **Oregon**, we think you're behind **3.3 million** others who are at higher risk in your state.

And in **Washington County**, you're behind **444,700** others.

These are just estimates and the line may ultimately be shorter. The order isn't yet finalized and children could be skipped entirely if the vaccine isn't approved for people under 18.

If the line in **Oregon** was represented by about 100 people, this is where you'd be standing:

The article continues below the graphic.



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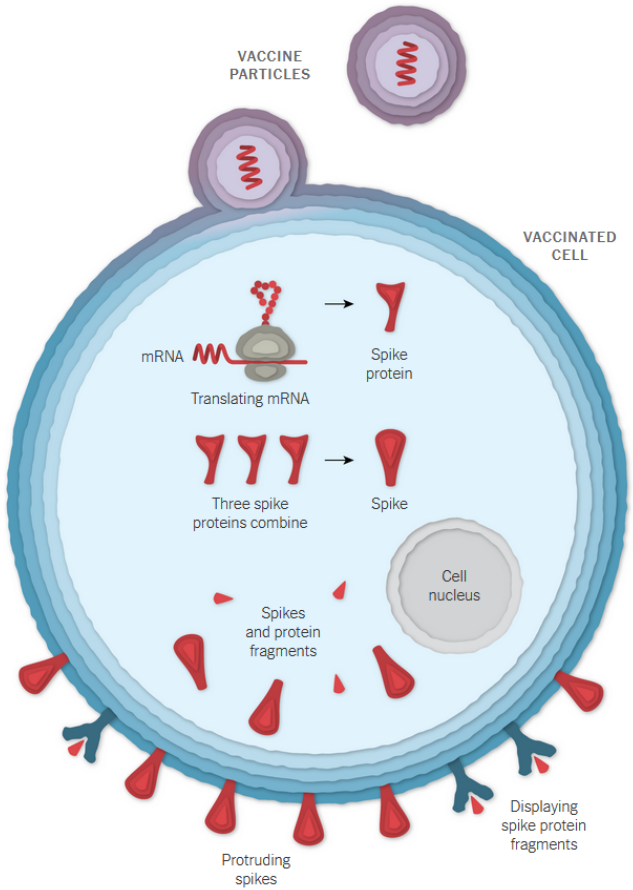
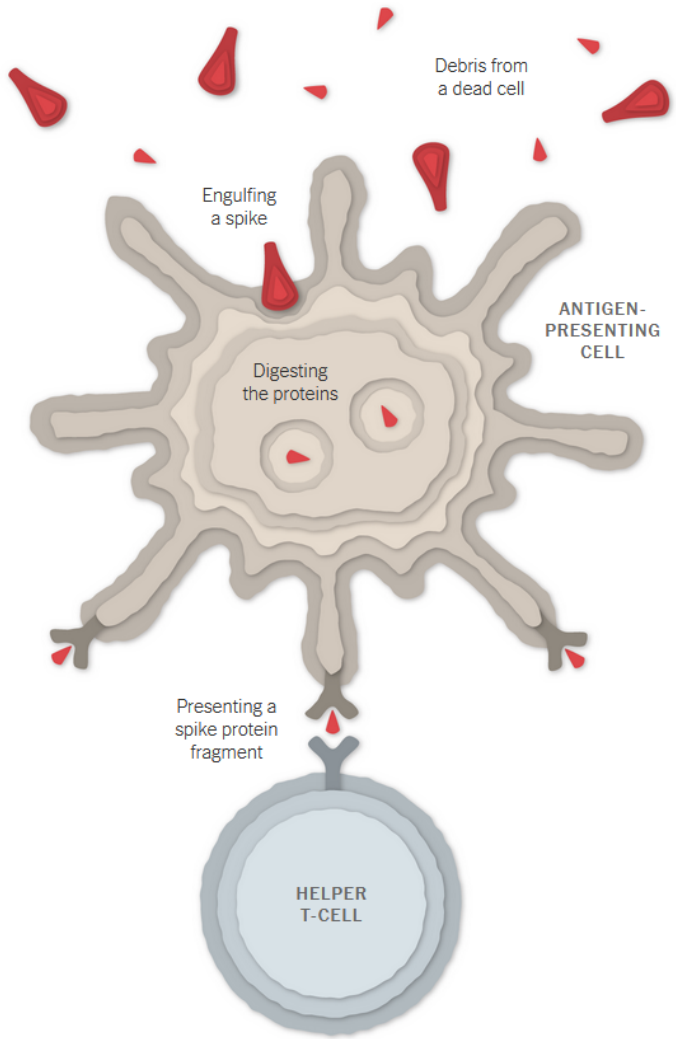
Thank You

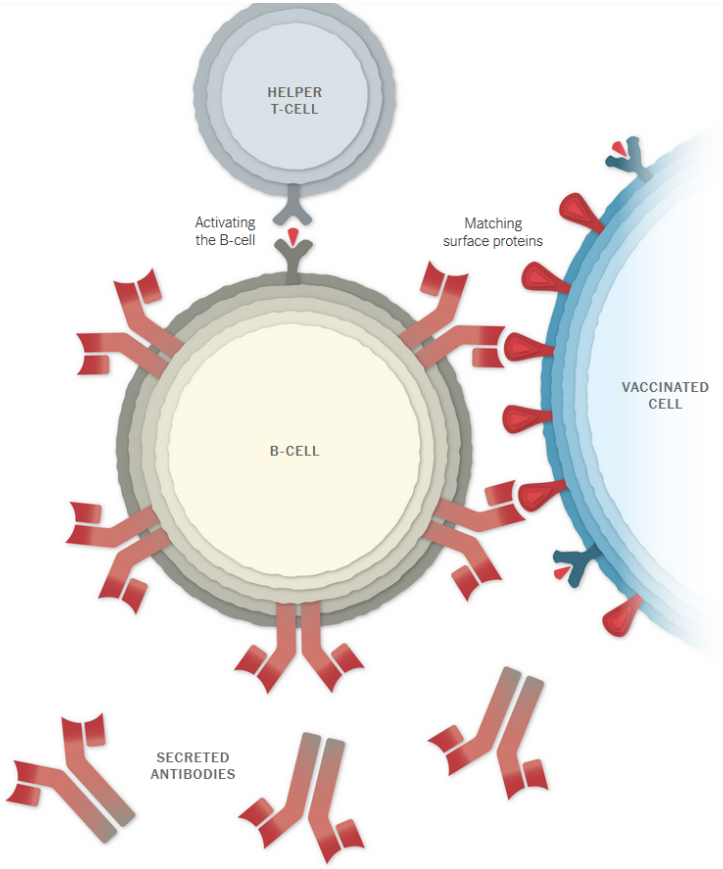
COVID-19 ECHO Presentation
December 16, 2020

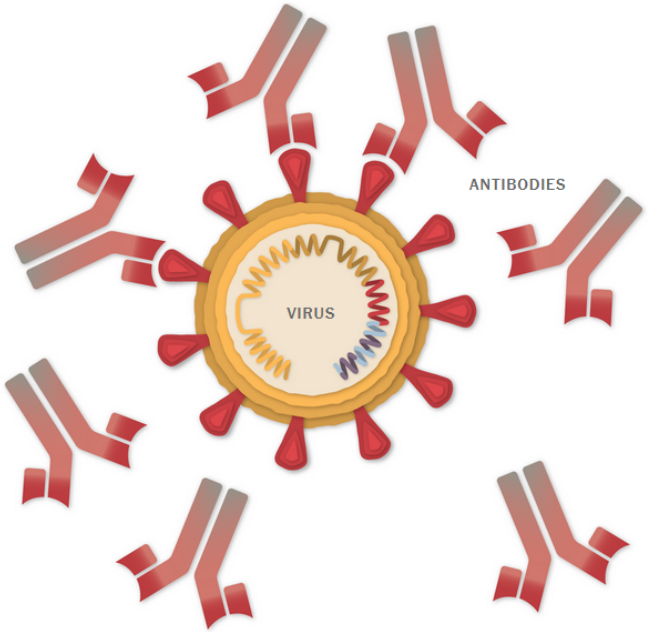
Alexander Wu, ScD, MPH

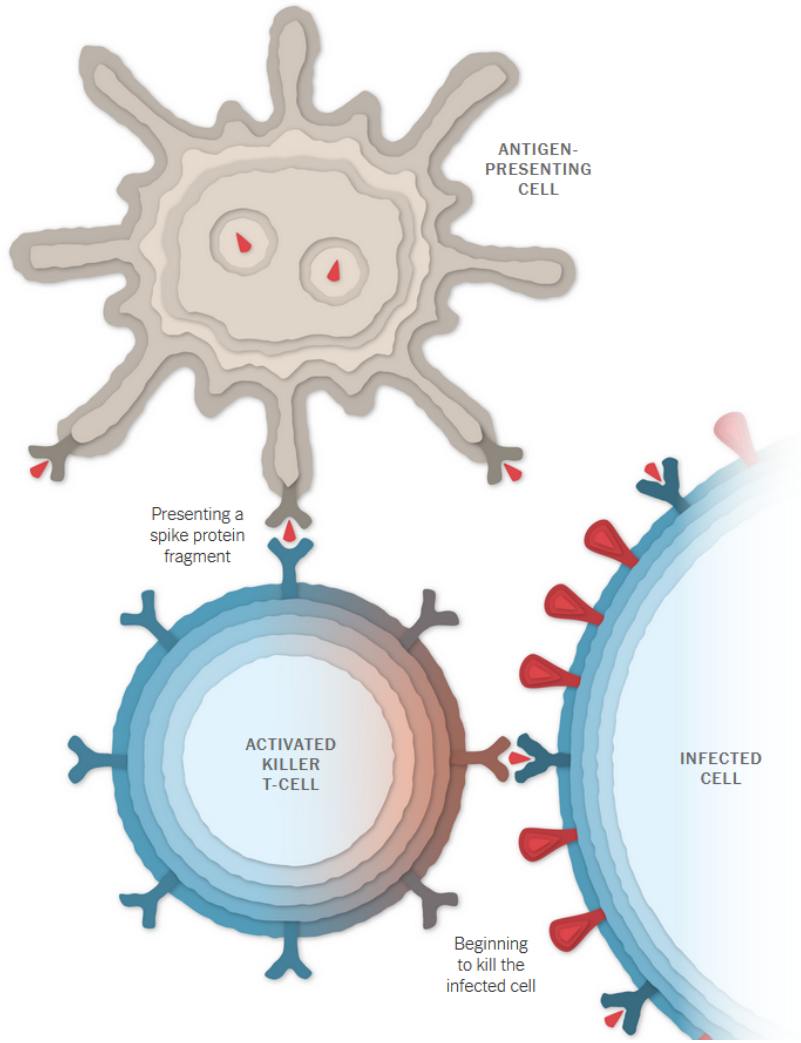
The findings and conclusions of this presentation are those of the author alone.


VACCINE PARTICLES
VACCINATED CELL
mRNA
Translating mRNA
Spike protein
Three spike proteins combine
Spike
Cell nucleus
Spikes and protein fragments
Protruding spikes
Displaying spike protein fragments


Debris from a dead cell
Engulfing a spike
ANTIGEN-PRESENTING CELL
Digesting the proteins
Presenting a spike protein fragment
HELPER T-CELL


HELPER
T-CELL
Activating
the B-cell
Matching
surface proteins
VACCINATED
CELL
B-CELL
SECRETED
ANTIBODIES


ANTIBODIES
VIRUS


ANTIGEN-
PRESENTING
CELL
Presenting a
spike protein
fragment
ACTIVATED
KILLER
T-CELL
INFECTED
CELL
Beginning
to kill the
infected cell