COVID-19: *Updates*

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University of Chicago
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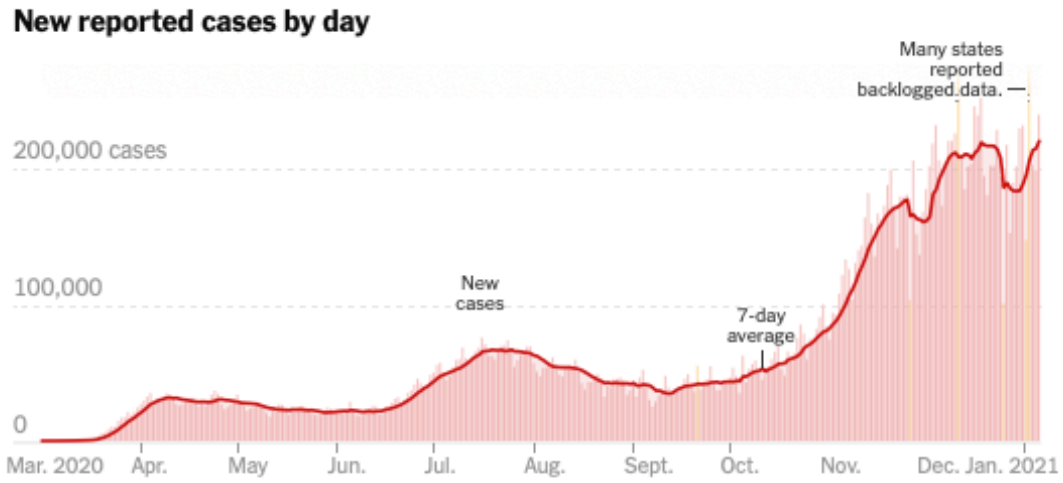
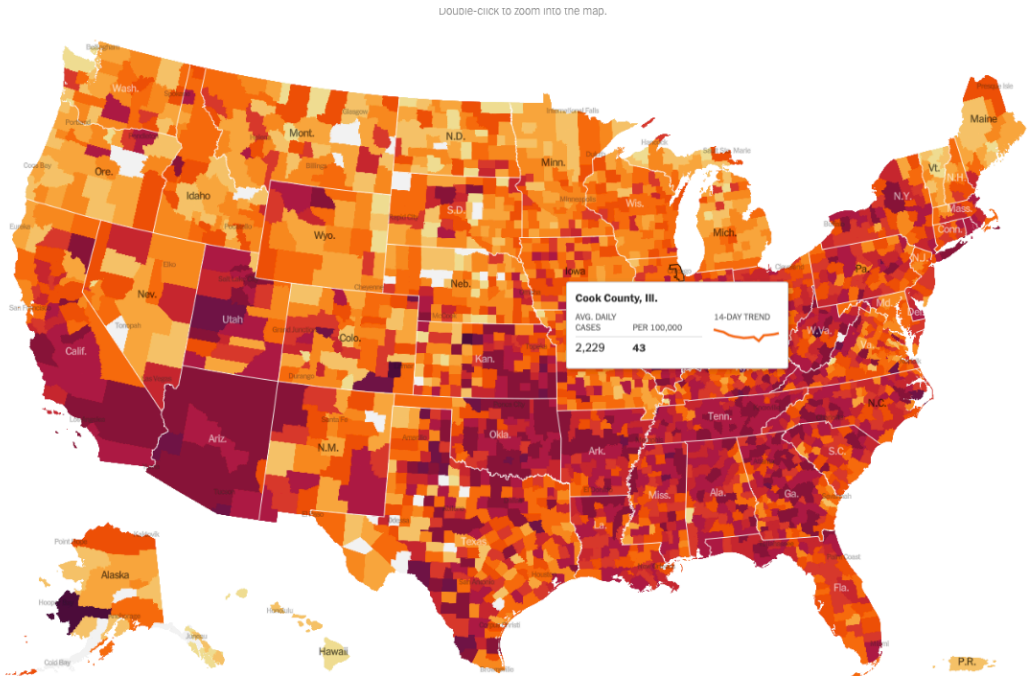
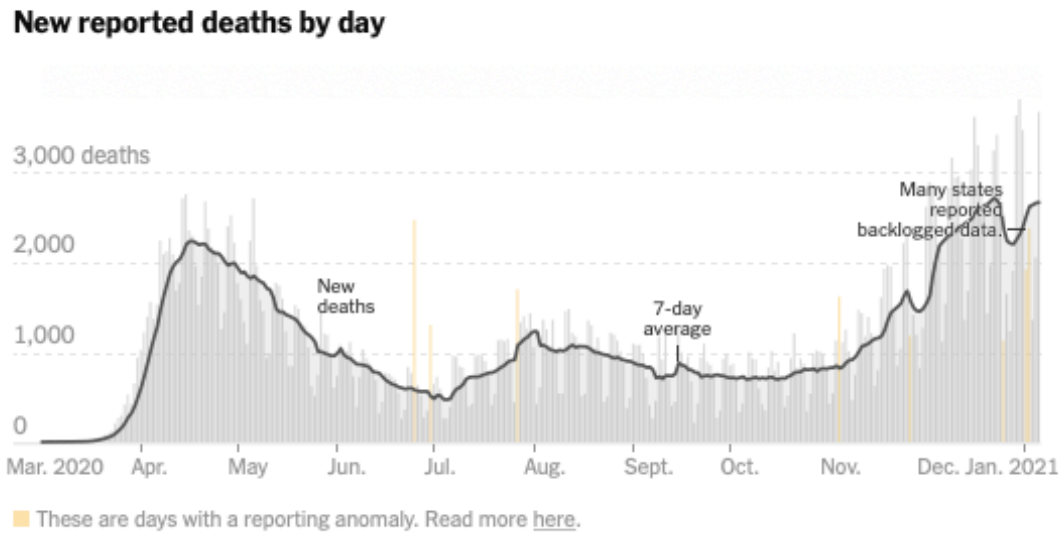
Disclosures

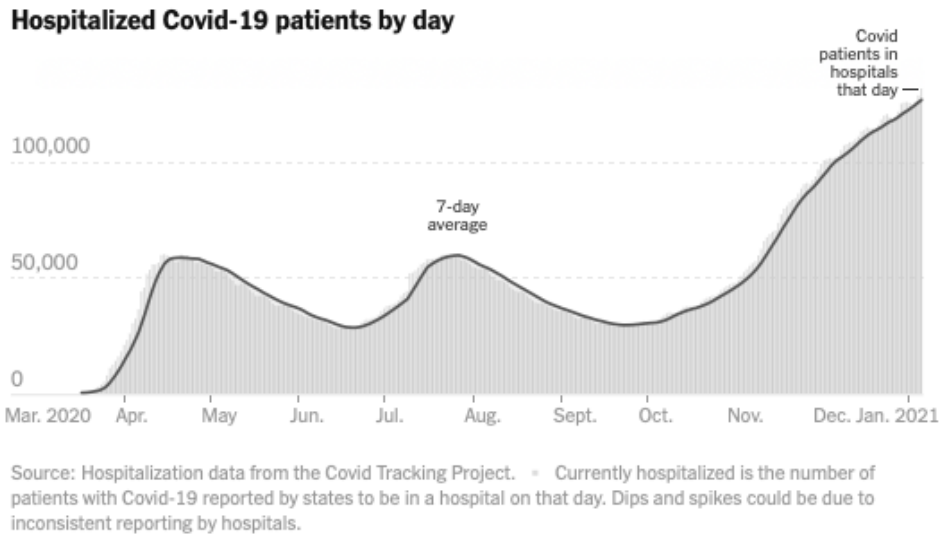
- We have no relevant financial interests to disclose.

Continuing Rise across the US









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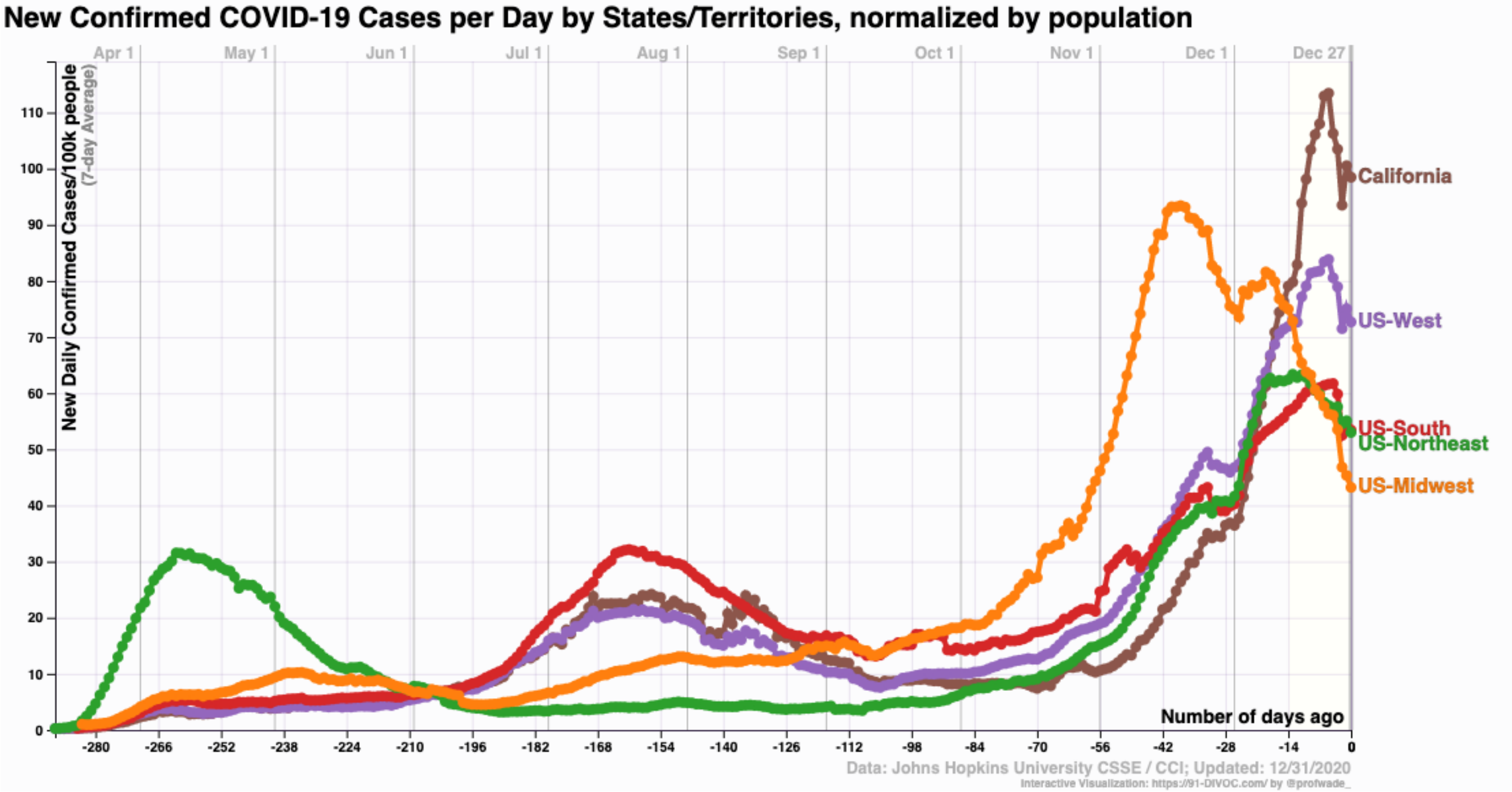
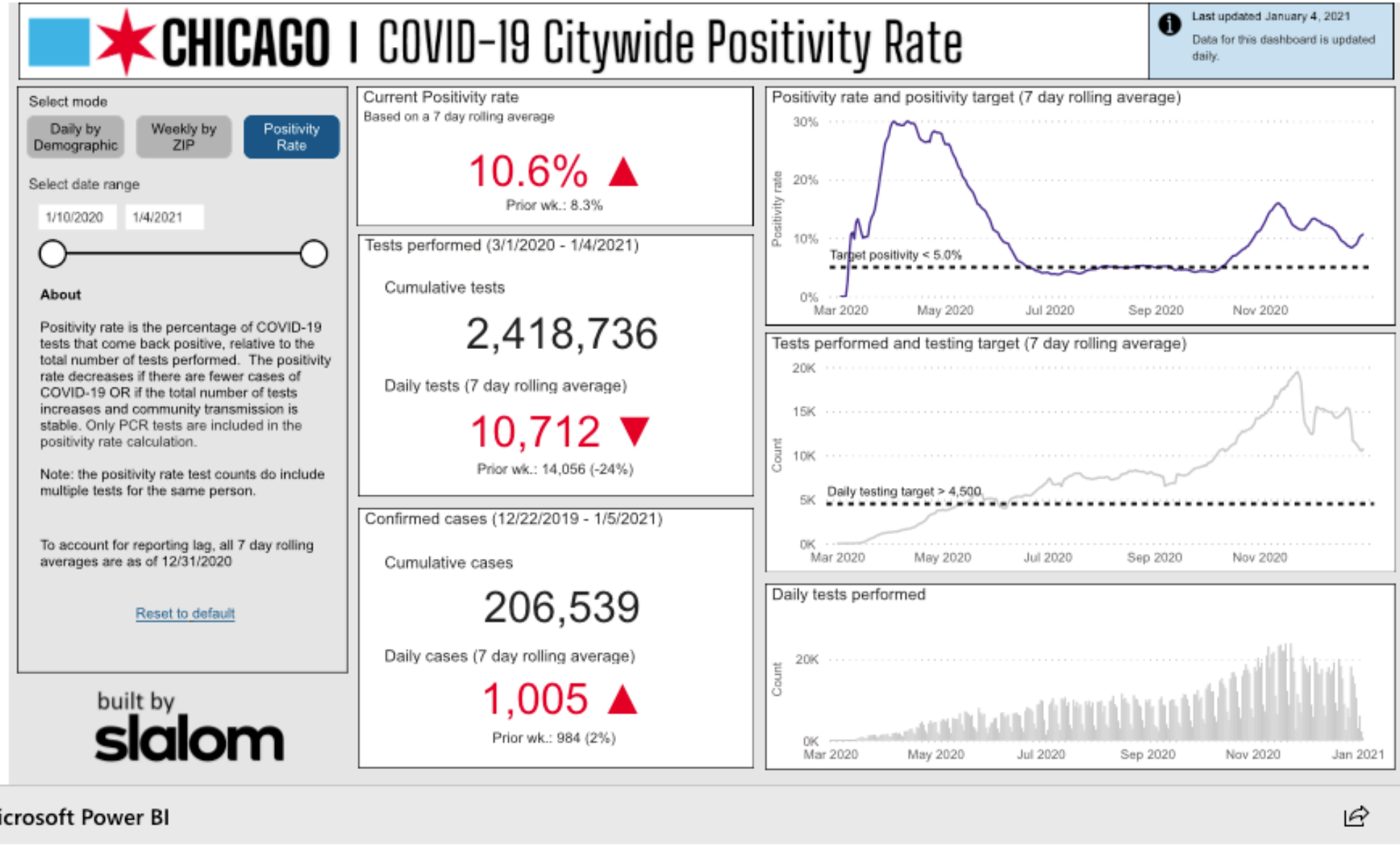
Data as of 12/31/20

1. https://www.nytimes.com/interactive/2020/us/coronavirus-us-cases.html


New Confirmed COVID-19 Cases per Day by States/Territories, normalized by population
Apr 1
May 1
Jun 1
Jul 1
Aug 1
Sep 1
Oct 1
Nov 1
Dec 1
Dec 27
New Daily Confirmed Cases/100k people
(7-day Average)
110
100
90
80
70
60
50
40
30
20
10
0
-280
-266
-252
-238
-224
-210
-196
-182
-168
-154
-140
-126
-112
-98
-84
-70
-56
-42
-28
-14
0
Number of days ago
California
US-West
US-South
US-Northeast
US-Midwest
Data: Johns Hopkins University CSSE / CCI; Updated: 12/31/2020
Interactive Visualization: https://91-DIVOC.com/ by @profwade_

COVID Dashboard



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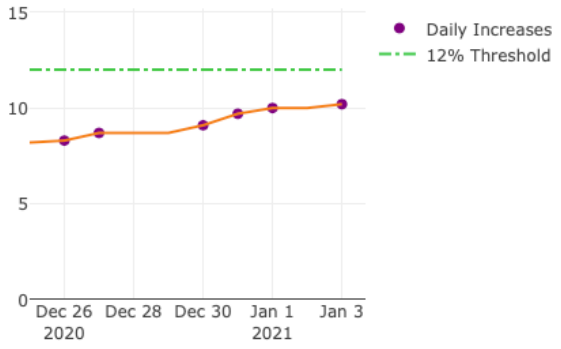
https://www.chicago.gov/city/en/sites/covid-19/home/covid-dashboard.html

Region 11 (Chicago)

Test Positivity 7-Day Rolling Average

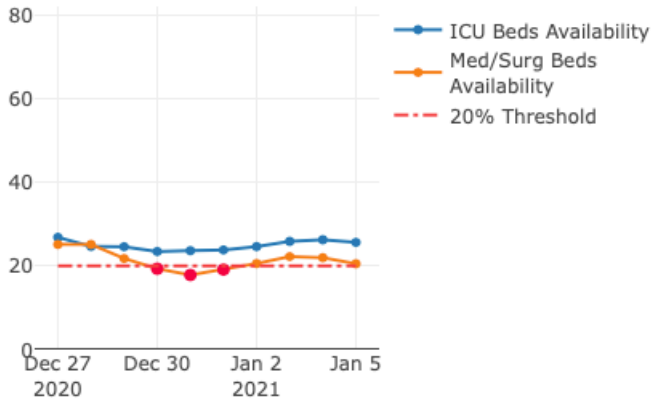
11 Consecutive Days under 12% threshold



Hospital Bed Availability 3-Day Rolling Average

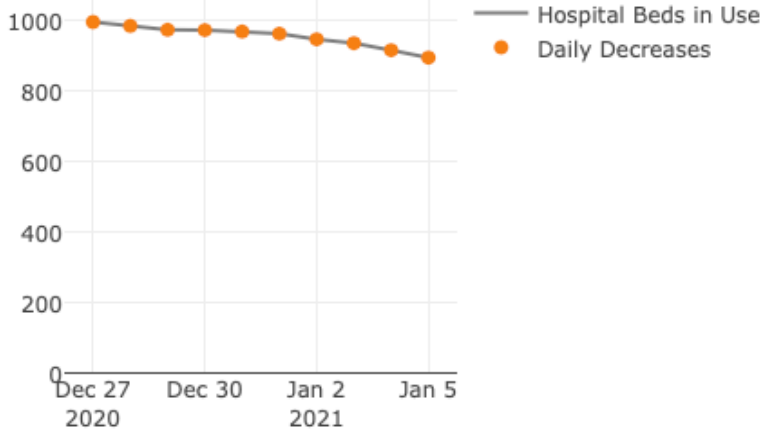
ICU Beds:11 Consecutive Days Over 20% Threshold

Med/Surg Beds:4 Consecutive Days Over 20% Threshold



COVID-19 Patients in the Hospital 7-Day Rolling Average

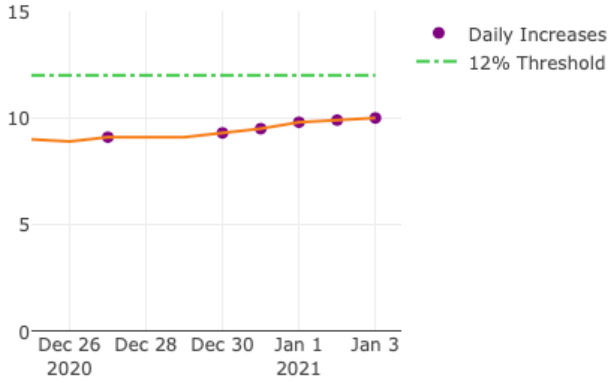
10 Days of COVID-19 Patient Decreases



Region 10 (near suburbs)

Test Positivity 7-Day Rolling Average

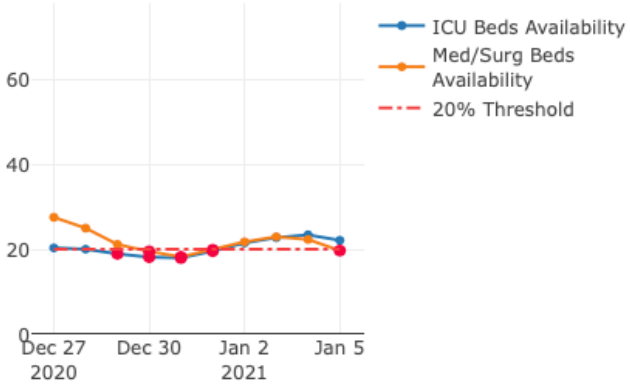
11 Consecutive Days under 12% threshold



Hospital Bed Availability 3-Day Rolling Average

ICU Beds:5 Consecutive Days Over 20% Threshold

Med/Surg Beds:5 Consecutive Days Over 20% Threshold



COVID-19 Patients in the Hospital 7-Day Rolling Average

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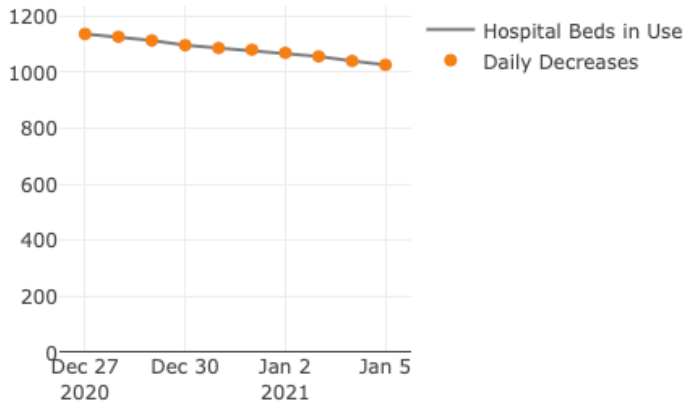


https://www.dph.illinois.gov/regionmetrics?regionID=10 data as of 1/6/20

Morbidity and Mortality Weekly Report

Performance of an Antigen-Based Test for Asymptomatic and Symptomatic SARS-CoV-2 Testing at Two University Campuses — Wisconsin, September–October 2020

Ian W. Pray, PhD[1,2,3,*]; Laura Ford, PhD[1,2,*]; Devlin Cole, MD[3,4]; Christine Lee, PhD[1,5], John Paul Bigouette, PhD[1,2]; Glen R. Abedi, MPH[1]; Dena Bushman, MSN, MPH[1,2]; Miranda J. Delahoy, PhD[1,2]; Dustin Currie, PhD[1,2]; Blake Cherney, MS[1]; Marie Kirby, PhD[1]; Geroncio Fajardo, MD[1]; Motria Caudill, PhD[1,6]; Kimberly Langolf, MS[7]; Juliana Kahrs, MS[7]; Patrick Kelly, MD[4,8]; Collin Pitts, MD[4,8]; Ailam Lim, PhD[9]; Nicole Aulik, PhD[9]; Azaibi Tamin, PhD[1]; Jennifer L. Harcourt, PhD[1]; Krista Queen, PhD[1]; Jing Zhang, PhD[1]; Brett Whitaker, PhD[1]; Hannah Browne[1]; Magdalena Medrzycki, PhD[1]; Patricia Shewmaker, PhD[1]; Jennifer Folster, PhD[1]; Bettina Bankamp, PhD[1]; Michael D. Bowen, PhD[1]; Natalie J. Thornburg, PhD[1]; Kimberly Goffard, MBA[10]; Brandi Limbago, PhD[1]; Allen Bateman, PhD[7,11]; Jacqueline E. Tate, PhD[1]; Douglas Gieryn[1]; Hannah L. Kirking, MD[1]; Ryan Westergaard, MD, PhD[3,4]; Marie Killerby, VetMB[1]; CDC COVID-19 Surge Laboratory Group

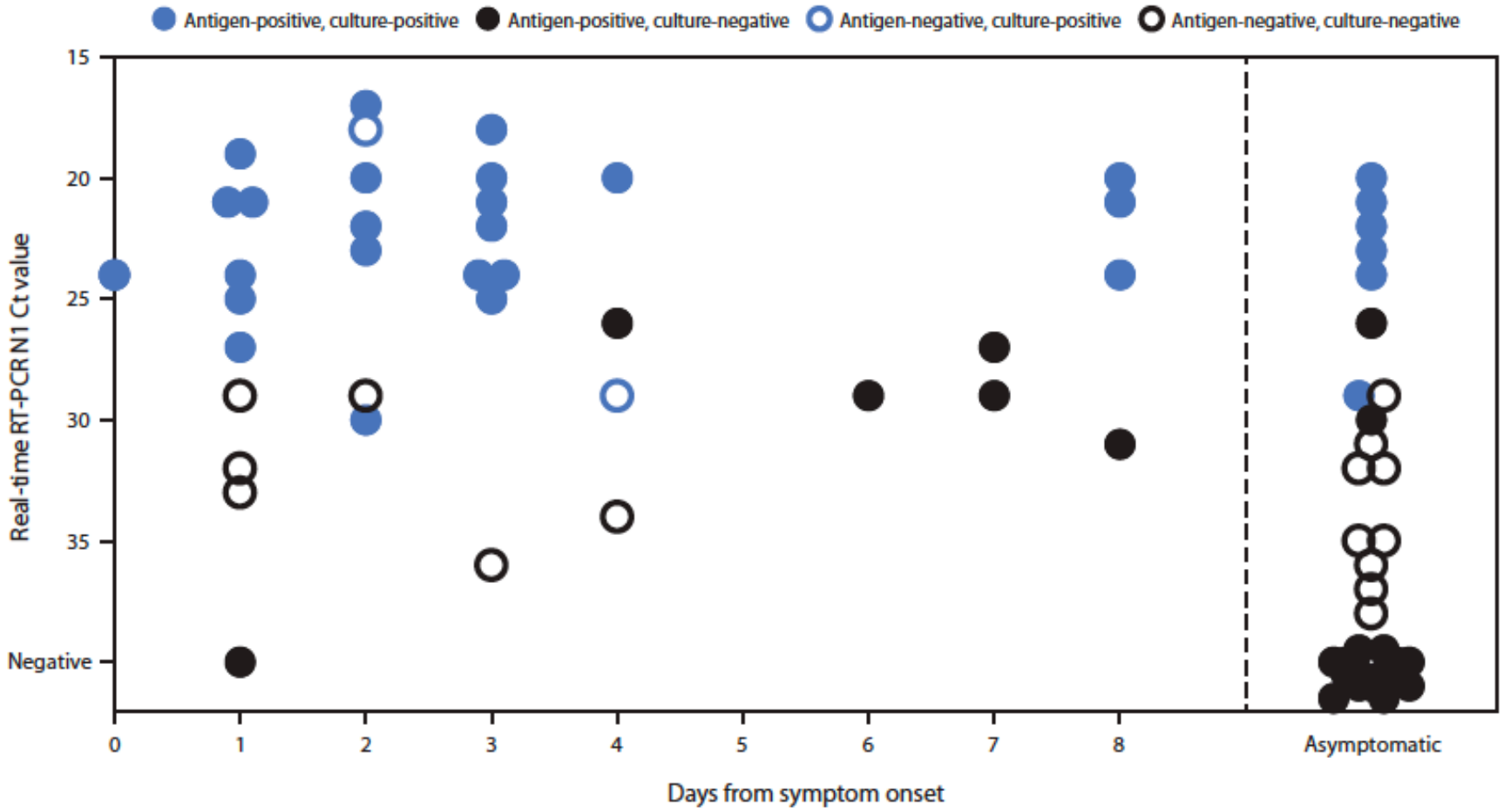
- Evaluation of Sofia SARS Antigen Fluorescent Immunoassay (FIA) compared with RT-PCR for SARS-CoV-2 detection among asymptomatic and symptomatic persons at 2 universities in WI
- Sept 28-Oct 9, 1098 paired nasal swab samples samples
- Viral culture was attempted on all antigen positive or RT-PCR positive samples

TABLE 2. Sensitivity, specificity, positive predictive value, and negative predictive value of Sofia SARS Antigen Fluorescent Immunoassay compared with real-time reverse transcription–polymerase chain reaction (RT-PCR) among asymptomatic and symptomatic persons — two universities, Wisconsin, September–October 2020

Antigen test result	RT-PCR result, no.					
	Asymptomatic (N = 871)			Symptomatic* (N = 227)		
	Positive	Negative	Total	Positive	Negative	Total
Positive	7	14	**21**	32	2	**34**
Negative	10	840	**850**	8	185	**193**
Total	17	854	871	40	187	227
Test evaluation, % (95% CI)						
Sensitivity	41.2 (18.4–67.1)			80.0 (64.4–90.9)		
Specificity	98.4 (97.3–99.1)			98.9 (96.2–99.9)		
Positive predictive value	33.3 (14.6–57.0)			94.1 (80.3–99.3)		
Negative predictive value	98.8 (97.8–99.4)			95.9 (92.0–98.2)		

Abbreviation: CI = confidence interval.
* One or more symptoms reported.

FIGURE. Viral culture results among participants with positive Sofia SARS Antigen Fluorescent Immunoassay or positive SARS-CoV-2 real-time reverse transcription–polymerase chain reaction (RT-PCR) results (n = 69),* by cycle threshold (Ct) value† and the interval between specimen collection and reported symptom onset or asymptomatic status — university A, Wisconsin, September–October 2020



* n = 30 antigen- and culture-positive; n = 22 antigen-positive and culture-negative; n = 15 antigen- and culture-negative; n = two antigen-negative and culture-positive.

† Ct values represent cycle thresholds for the N1 target probe during SARS-CoV-2 real-time RT-PCR; Ct values are represented on the y-axis in descending order to indicate that lower Ct values represent higher levels of RNA in the specimen.

- Concern for FALSE POSITIVES in asymptomatic people even at a HIGH rate of community prevalence
- To account for reduced antigen test accuracy, **confirmatory testing with a nucleic acid amplification test (e.g., RT-PCR) should be considered after negative antigen test results in symptomatic persons and positive antigen test results in asymptomatic persons.**

UK variant B.1.1.7

Covid-19: What have we learnt about the new variant in the UK?

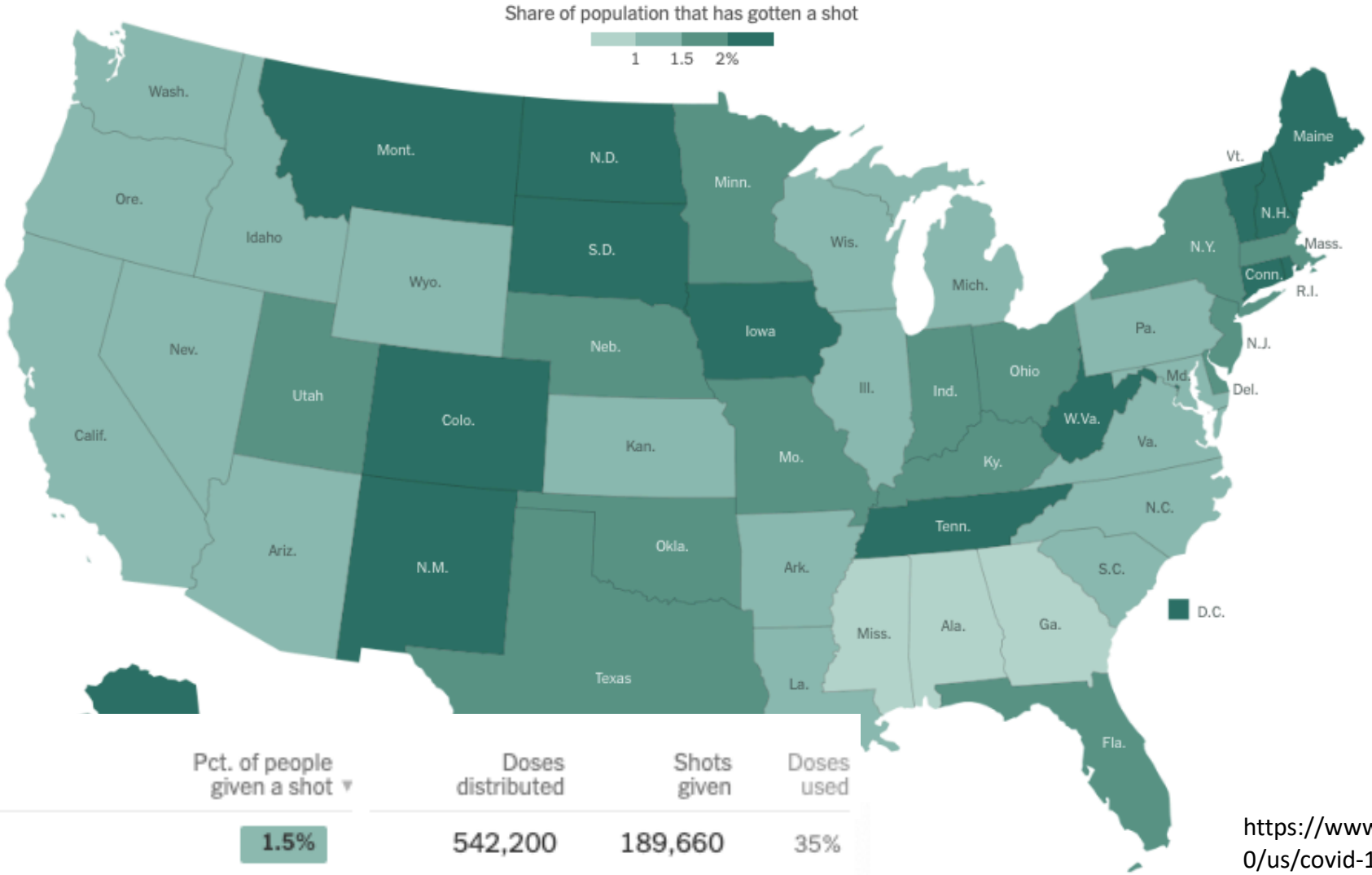
BMJ 2020 ; 371 doi: https://doi.org/10.1136/bmj.m4944 (Published 23 December 2020)
Cite this as: *BMJ* 2020;371:m4944

- Viruses constantly change through mutation, this is expected. Multiple new variants have already been documented
  - The B1.1.7 variant is defined by 17 mutations
  - One of most significant mutations is an N501Y mutation in the spike protein
- In the UK, a new variant has emerged with a large number of mutations
- What do we know about this variant?
  - May be more easily transmissible (early estimates rate of transmission ~50-71% higher than other variants)
- What are we still learning?
  - Currently there is no evidence that this will change the effectiveness of COVID-19 vaccines. Most experts believe the vaccines will still be effective because of the nature of the immune response to the virus
  - Currently there is no evidence that it causes more severe disease
- Current testing and PPE remain effective

https://www.cdc.gov/coronavirus/2019-ncov/transmission/variant.html

About 5.3 Million People in the U.S. Have Gotten a Covid-19 Vaccine

By The New York Times Updated Jan. 6, 2021



Name	Pct. of people given a shot	Doses distributed	Shots given	Doses used
Illinois	1.5%	542,200	189,660	35%

Source: Centers for Disease Control and Prevention

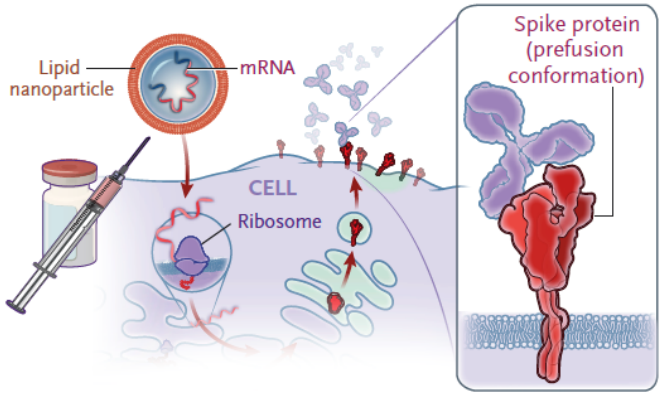
https://www.nytimes.com/interactive/2020/us/covid-19-vaccine-doses.html

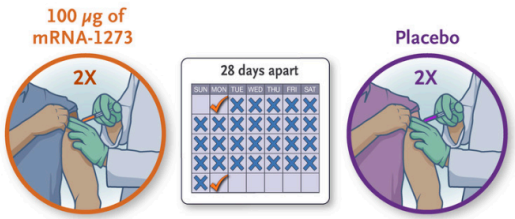
Vaccines Development

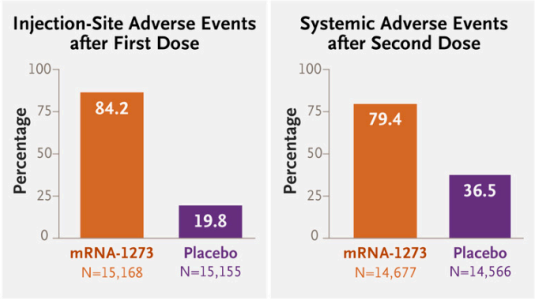
Company	Type	Trial phase/Place	US Federal Funds?
moderna NIH National Institutes of Health Turning Discovery Into Health	mRNA (2 doses)	3 – US sites **EUA 12/18/20**	Yes
BIONTECH Pfizer FOSUN PHARMA	mRNA (2 doses, cold storage)	2/3 – US, Argentina, Brazil, Germany **EUA 12/11/20**	Yes
AstraZeneca UNIVERSITY OF OXFORD	Adenoviral Vectored (2 doses, less expensive, easy to store)	2/3 – England, India, Brazil, S. Africa **EUA in UK, India, Argentina, Mexico**	Yes
Johnson & Johnson Beth Israel Lahey Health Beth Israel Deaconess Medical Center	Adenoviral Vectored (1 dose)	Phase 3 **EUA application expected late Jan 2021**	Yes
NOVAVAX Creating Tomorrow's Vaccines Today	Subunit Protein (2 doses)	Phase 3 started 12/28/20	Yes
sinovac	"Inactivated" (2 doses , 91% effective in Turkish)	3 – Brazil **EUA Indonesia, China**	No

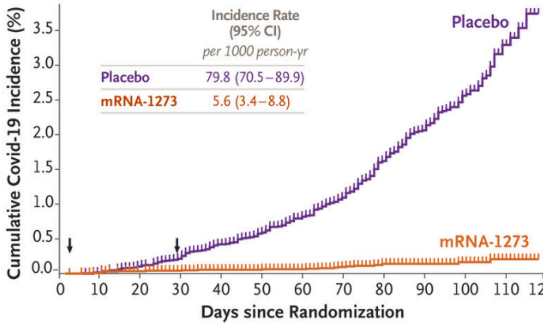
mRNA vaccines

- mRNA is a code that is used to make pieces of the spike protein that is unique to SARS-CoV2.
- It is coated in a special protective coating so it is not broken down before it reaches the cells.
- The mRNA never goes into the cell's nucleus or affects the genetic material inside the cell
- The spike proteins are displayed on the cell surface and causes the immune system to produce antibodies and activate T cells in the same way a natural infection would.
- These antibodies are specific to the SARS-CoV-2 virus and stay primed to fight it if you ever come into contact with it.









	mRNA-1273 Vaccine N=14,550	Placebo N=14,598
Symptomatic Covid-19	11	185
Severe Covid-19	0	30

Vaccine efficacy of 94.1% (95% CI, 89.3–96.8%; P<0.001)

CONCLUSIONS

Two doses of a SARS-CoV-2 mRNA-based vaccine were safe and provided 94% efficacy against symptomatic Covid-19 in persons 18 or older.

https://www.cdc.gov/vaccines/covid-19/hcp/mrna-vaccine-basics.html

JAMA. 2020;324(12):1125-1127. doi:10.1001/jama.2020.16866

Polack FP, NEJM,2020

Approach to post-vaccine signs and symptoms

KEY POINTS:

- Cough, runny nose, loss of taste/smell, shortness of breath --> NOT consistent with post-vaccine symptoms, could be due to COVID-19 itself or another virus/non-infectious cause
- Fever, chills, fatigue muscle aches, joint pains → MAY BE vaccine-related
- CDC guidance is available (next slides – for review)

Evaluating and managing systemic new onset-post vaccination signs and symptoms for HCW:

HCP Signs and Symptoms	Suggested approach	Additional notes
Signs and symptoms *unlikely* to be from COVID-19 vaccination: Presence of ANY systemic signs and symptoms consistent with SARS-CoV-2 infection (e.g., cough, shortness of breath, rhinorrhea, sore throat, loss of taste or smell) or another infectious etiology (e.g., influenza) that are not typical for post-vaccination signs and symptoms.	Exclude from work pending evaluation for possible etiologies, including SARS-CoV-2 infection, as appropriate. Criteria for return to work depends on the suspected or confirmed diagnosis. Information on return to work for HCP with SARS-CoV-2 infection is available here.	If performed, a negative SARS-CoV-2 antigen test in HCP who have signs and symptoms that are not typical for post-vaccination signs and symptoms should be confirmed by SARS-CoV-2 nucleic acid amplification test (NAAT). Further information on testing is available here: https://www.cdc.gov/coronavirus/2019-nCoV/lab/index.html

https://www.cdc.gov/coronavirus/2019-ncov/hcp/post-vaccine-considerations-healthcare-personnel.html

Evaluating and managing systemic new onset-post vaccination signs and symptoms for HCW

Signs and Symptoms	Suggested approach	Additional notes
Signs and symptoms *that may be* from either COVID-19 vaccination, SARS-CoV-2 infection, or another infection: Presence of ANY systemic signs and symptoms (e.g., fever, fatigue, headache, chills, myalgia, arthralgia) that are consistent with post-vaccination signs and symptoms, SARS-CoV-2 infection or another infectious etiology (e.g., influenza). **Fever in healthcare settings is defined as a measured temperature of 100.0°F (37.8°C) or higher.**	Evaluate the HCP. HCP who meet the following criteria may be considered for return to work without viral testing for SARS-CoV-2: Feel well enough and are willing to work and Are afebrile* and Systemic signs and symptoms are limited only to those observed following COVID-19 vaccination (i.e., do **not** have other signs and symptoms of COVID-19 including cough, shortness of breath, sore throat, or change in smell or taste). If symptomatic HCP return to work, they should be advised to contact occupational health services (or another designated individual) if symptoms are not improving or persist for more than 2 days. Pending further evaluation, they should be excluded from work and viral testing should be considered. If feasible, viral testing could be considered for symptomatic HCP earlier to increase confidence in the cause of their symptoms. *HCP with fever should, ideally, be excluded from work pending further evaluation, including consideration for SARS-CoV-2 testing. If an infectious etiology is not suspected or confirmed as the source of their fever, they may	If performed, a negative SARS-CoV-2 antigen test in HCP who have symptoms that are limited only to those observed following COVID-19 vaccination (i.e., do not have cough, shortness of breath, sore throat, or change in smell or taste) may not require confirmatory SARS-CoV-2 NAAT testing. Additional information is available here: https://www.cdc.gov/coronavirus/2019-ncov/lab/resources/antigen-tests-guidelines.html

https://www.cdc.gov/coronavirus/2019-ncov/hcp/post-vaccine-considerations-healthcare-personnel.html

Anaphylaxis and COVID-19 vaccination

- Has been reported, although remains rare (MMWR 1/6/21, Vol70)
  - 21 cases reported to VAERS Dec 14-23; 11.1 cases/million doses
    - 71% occurred within 15 minutes of vaccination
    - 81% had history of allergic reactions or anaphylaxis
- Possibly due to PEG (polyethylene glycol; a lipid)
  - PEG allergy is rare, but has been implicated in those with reactions to injectable medications
- A history of anaphylaxis to one of the vaccine's components is a contraindication to receiving the vaccine
  - CDC added history of immediate allergic reaction of any severity to PEG or polysorbate (potential cross-reactivity with PEG) contraindication to vaccination (12/30/20)
- A history of anaphylaxis to *any* vaccine or injectable medication requires 30 minutes of monitoring post-dose
- Others need only to be monitored for 15 minutes
- <u>Burden of anaphylactic reactions remains very low compared to the burden of disease from COVID-19</u>

https://www.cdc.gov/vaccines/covid-19/info-by-product/clinical-considerations.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fvaccines%2Fcovid-19%2Finfo-by-product%2Fpfizer%2Fclinical-considerations.html

Reminders/review:

- **None** of the COVID-19 vaccines in use or under development use the live virus that causes COVID-19.
- People can experience normal side effects, such as fever, after vaccination. These side effects are signs that the body is building immunity.
- It takes a few weeks for the body to build immunity after vaccination. A person could be infected with the virus that causes COVID-19 just before or just after vaccination and get sick. This is because the vaccine has not had enough time to provide protection.
- COVID-19 mRNA vaccines will not cause you to test positive on COVID-19 viral tests.
- People who have gotten sick with SARS-CoV-2 may still benefit from vaccination.

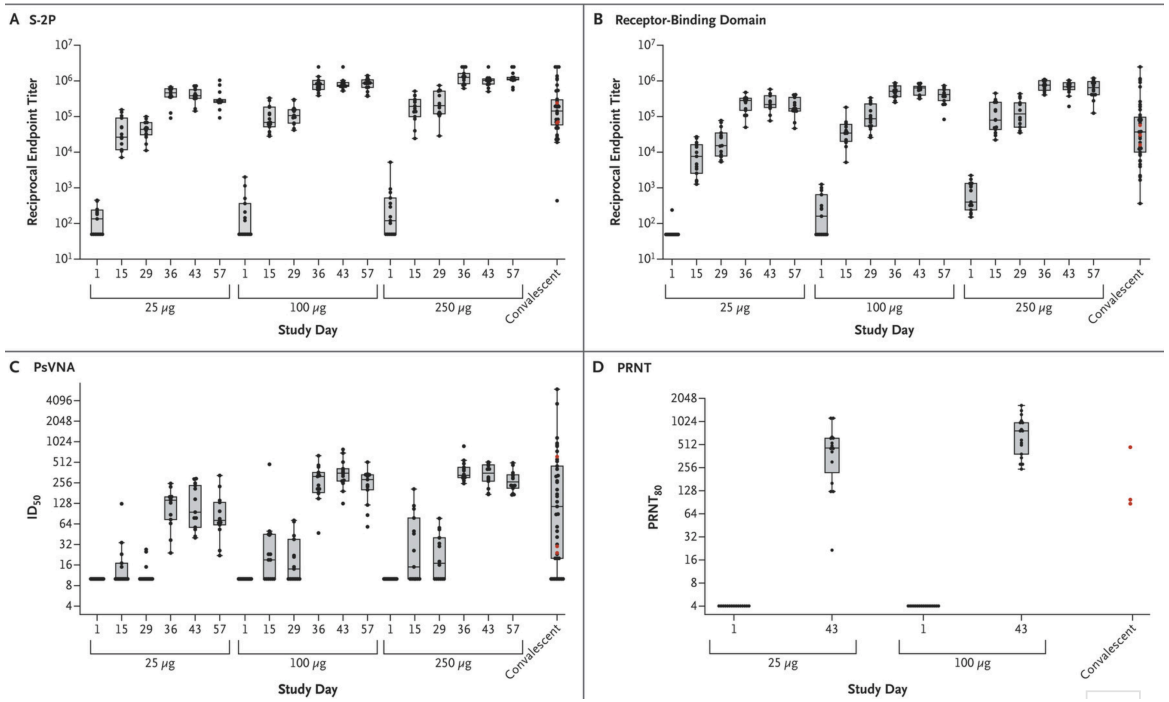
12.31.2020

Critical Populations for Vaccine Allocation

	Limited supply of vaccine		Increased Supply of vaccine	
	Healthcare Workers & Long Term Care Facility Residents & Staff.	**Persons aged 75 years and older & Frontline Essential Workers.**	**Persons 16 to 59 (comorbid conditions), persons 65 to 75 & other essential workers.**	**The rest of the population.**
	Phase 1a	Phase 1b	Phase 1c	Phase 2
	Healthcare Personnel: Defined by the CDC as paid and unpaid workers in healthcare settings who have the potential for direct or indirect exposure to patients or infectious materials. E.g. Nurses & Nursing Assistants, Physicians (MD, NP, PA), Respiratory Technicians, Pharmacists, Emergency Medical Services (EMS), etc. Other workers such as Reception Staff, Environmental Services Staff, X-Ray Technician's, Phlebotomists, Infectious Waste Workers, Dietary staff, Laundry staff, security staff, etc. **Long Term Care Facility Residents:** Defined by the CDC as adults who reside in facilities that provide a range of services, including medical and personal care, to persons who are unable to live independently.	**Further updates to be released for Phase 1b for the context of Illinois;** **Frontline Essential workers:** Includes those workers who are essential for the functioning of society, such as firefighters (including volunteer), Law Enforcement Officers, Corrections Officers, Food and Agriculture Workers, Postal Service Workers, Manufacturing Workers, Grocery Store Workers, Public Transit Workers, Daycare Workers and the Education sector, including teachers and Support Staff.	**Further updates to be released for Phase 1b for the context of Illinois;** **Persons aged 16 to 59:** With conditions that increase the risk for severe COVID-19. Such as obesity, diabetes, pulmonary disease, heart conditions including hypertension, kidney disease, cancer, immuncompromised, sickle cell and pregnancy. **Persons aged 65 to 74 years old.** **Other Essential Workers:** Workers in transportation & logistics, water & wastewater, food service, shelter and housing (e.g., construction), finance (e.g., bank tellers), information technology & communications, energy, legal, media, and public safety (e.g., engineers), and public health workers.	**Phase 2 is pending ACIP recommendations, possible groups could include;** **The rest of the population aged 16 & up.**
Est. Pop.	**850,000**	**3,800,000**	**3,500,000**	**1,700,000**

Changes in Dosing? Combinations?

- UK recently publicized plans for increasing the time between doses to increase the number of people getting at least one dose.
  - This was not intently studied, but some evidence of a 52.4% efficacy after 1 dose in Pfizer trial
  - Some modeling evidence that it could avert 23-29% more cases*
- Can you get one type vaccine followed by another?
  - Not studied – do not recommend at present. Though per the UK guidance this may be acceptable
- Reducing the Moderna vaccine dose is being considered
  - 50mcg nearly as effective as 100mcg, but not studied
  - FDA considering studying this, but not recommending currently



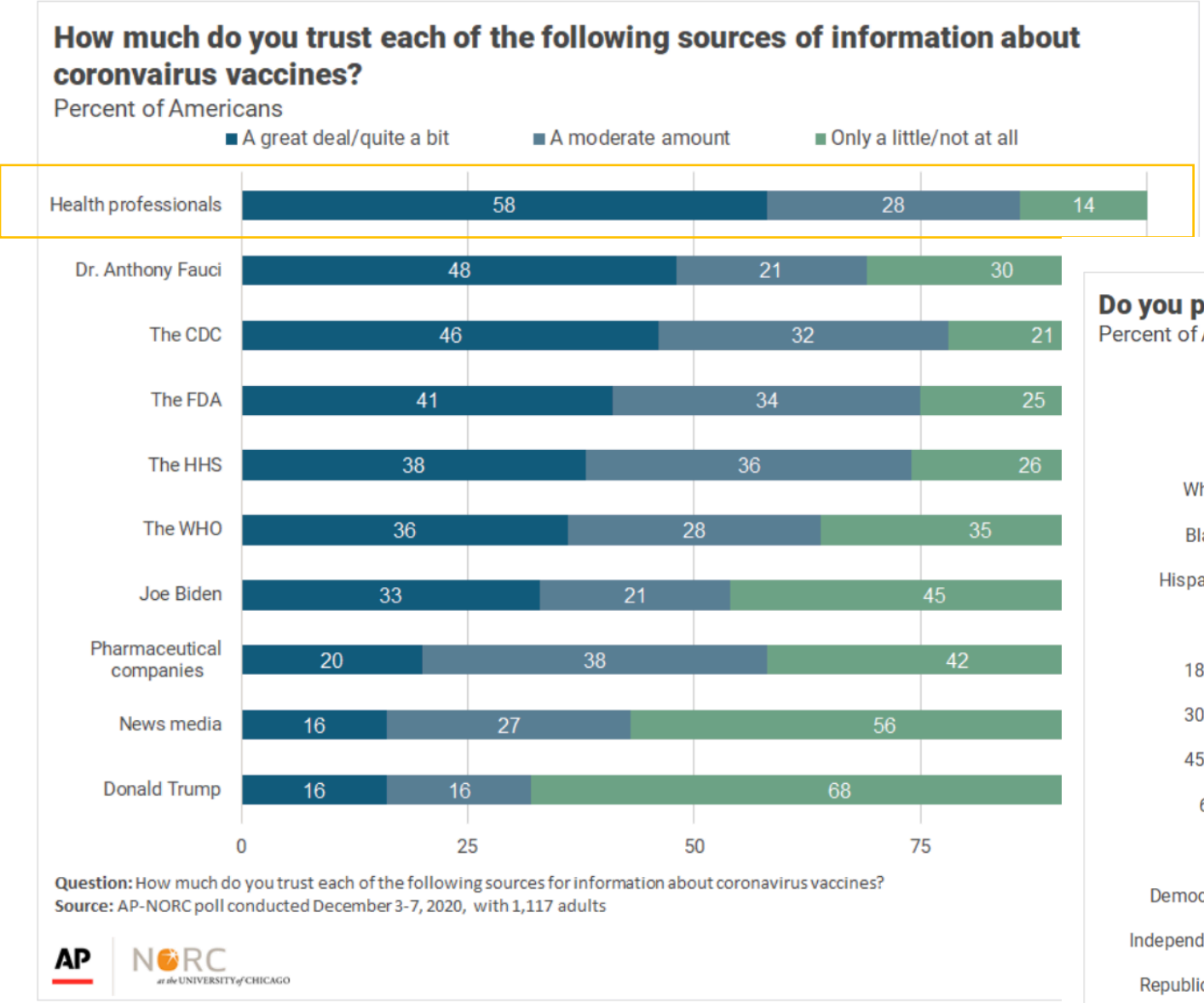
* https://doi.org/10.7326/M20-8137

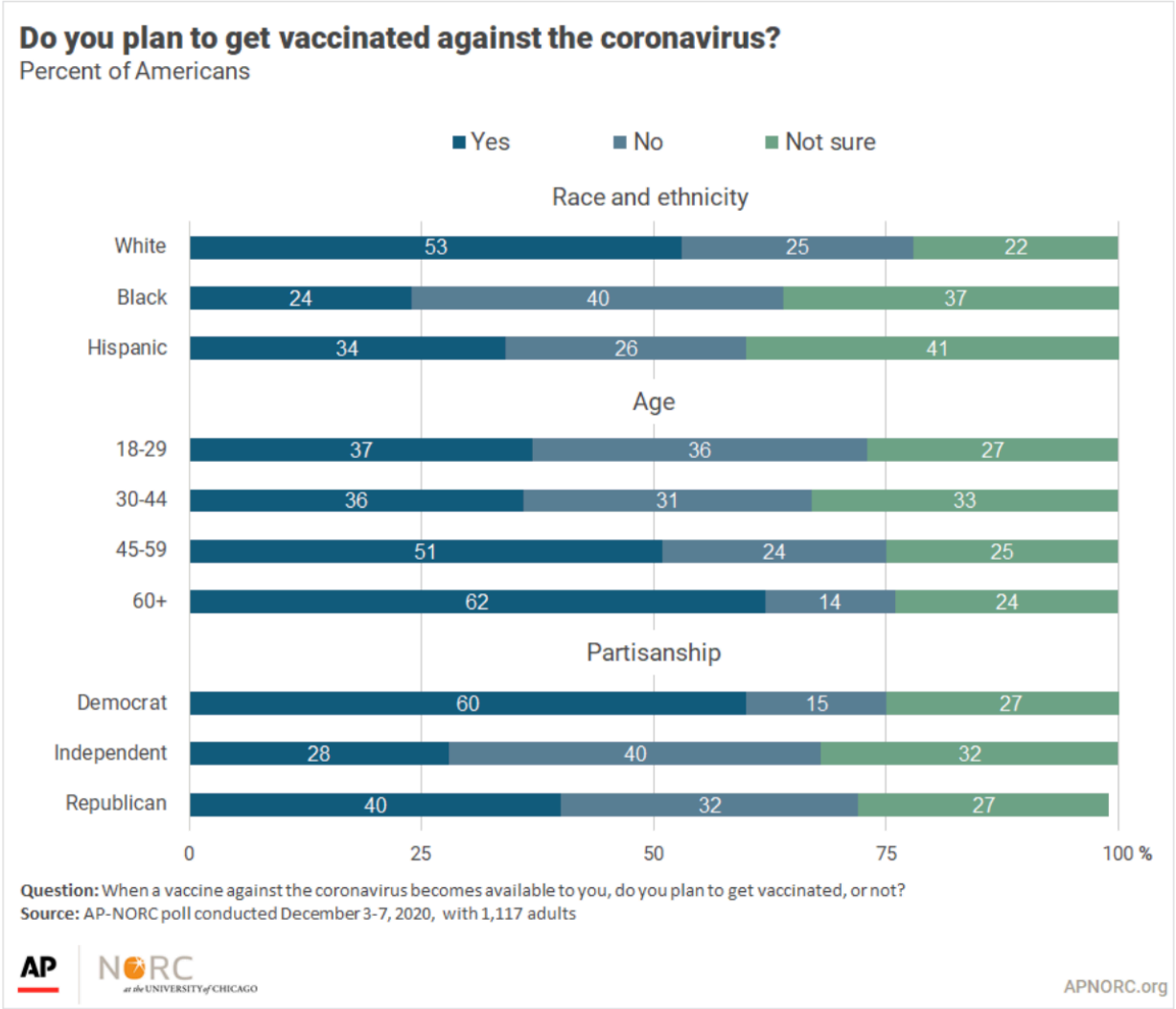
DOI: 10.1056/NEJMoa2022483

Reminder: Vaccination is one measure to help stop the pandemic.

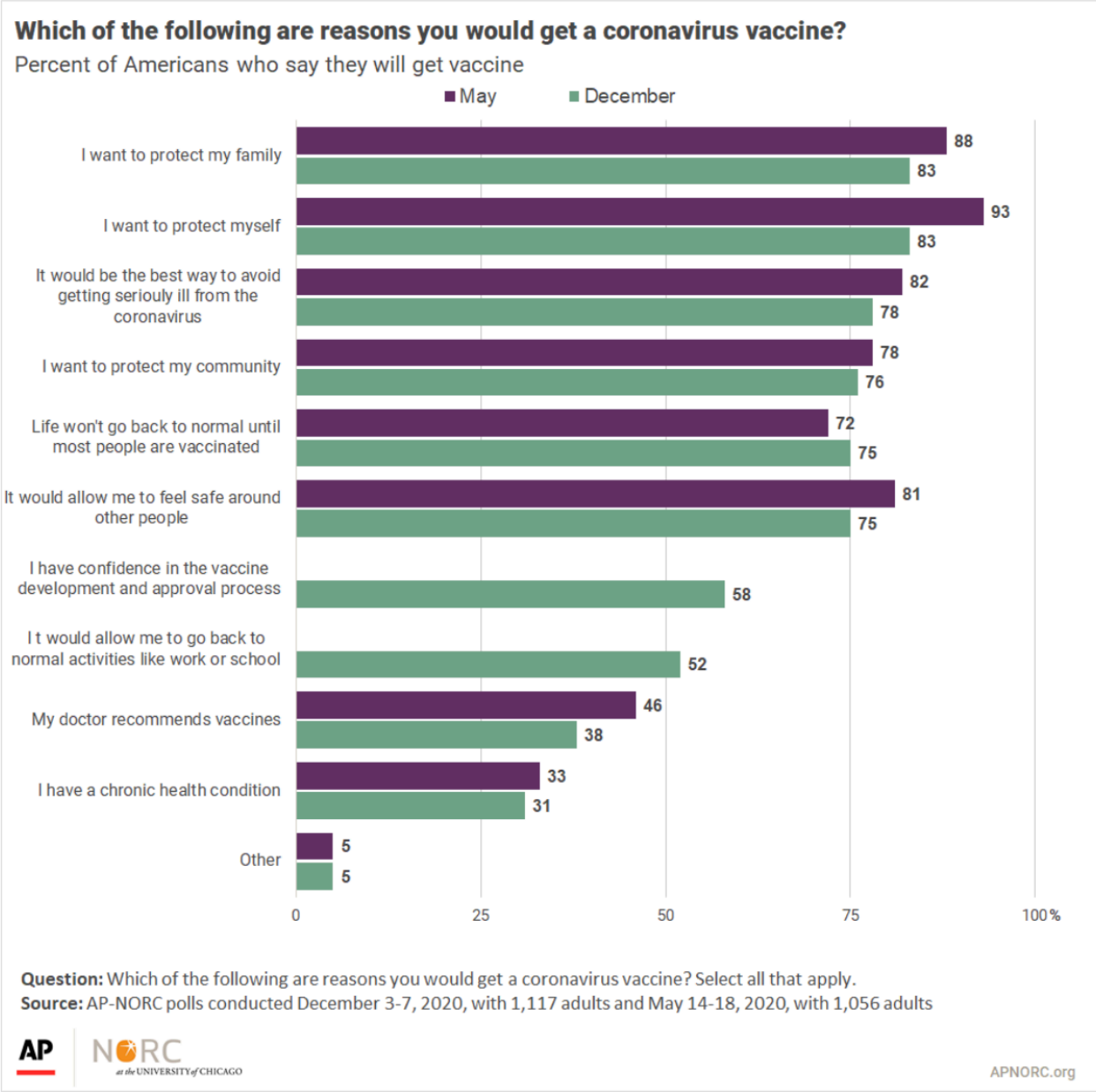
- While COVID-19 mRNA vaccines appear to be highly effective, additional preventive tools remain important to limit the spread of COVID-19.
- The combination of getting vaccinated and following CDC recommendations to protect yourself and others offers the best protection from COVID-19.
  - Cover your nose and mouth with a mask.
  - Avoid close contact. Maintain social distancing.
  - Clean and disinfect.
  - Wash your hands.

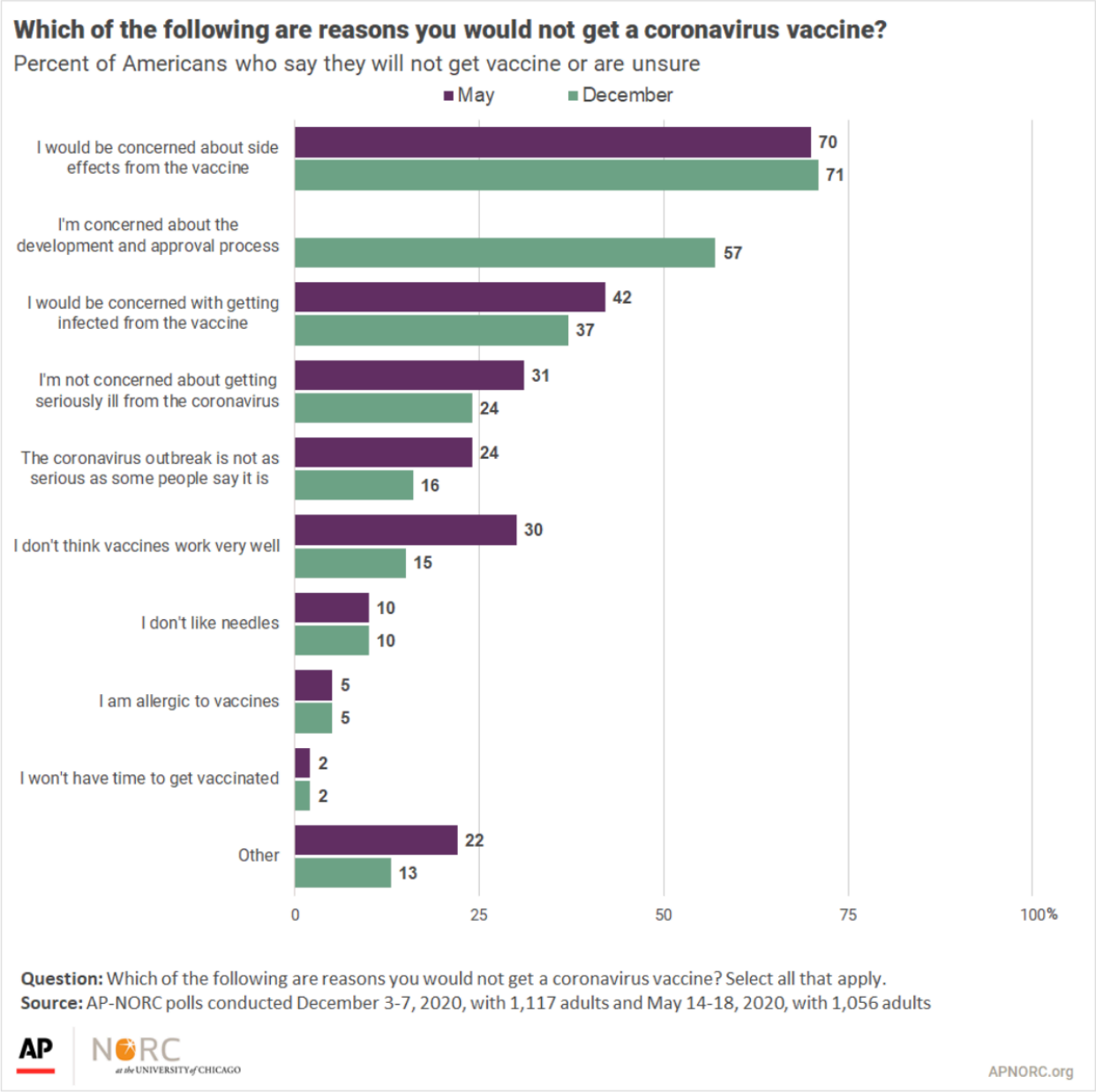
Combating vaccine hesitancy





https://apnorc.org/projects/many-remain-doubtful-about-getting-covid-19-vaccine/





AP-NORC Center for Public Affairs Research. (December, 2020).“Many remain doubtful about getting COVID-19 vaccine.” [https://apnorc.org/projects/many-remain-doubtful-about-getting-covid-19-vaccine/]

Vaccine Hesitancy: A Recent Anecdote

- Gave a quick review lecture on vaccines to a group of HIV case managers (social workers) – encouraging vaccination when available
- Diverse racial mix – mostly Black or Latinx
- Response:
  - ”I don’t trust it”
    - “Why are people of color being forced to do this first? Are we an experiment?”
    - “The first person who received the vaccine in Chicago was Black because they want to force us to get it!”
    - “Not enough study on vaccine! It’s being pushed too fast!”
    - “Tuskegee!!”
- **Need to Listen! And Be an Example!**

Reference slides

Included for reference: https://www.cdc.gov/vaccines/covid-19/info-by-product/clinical-considerations.html

Interim Clinical Considerations for Use of mRNA COVID-19 Vaccines Currently Authorized in the United States

Interim Considerations: Preparing for the Potential Management of Anaphylaxis at COVID-19 Vaccination Sites

Summary of recent changes (last updated December 30, 2020):

- Additional information on antibody therapies and COVID-19 vaccination
- Information on COVID-19 vaccination and outbreak management
- Additional information on vaccination of immunocompromised persons
- Updates to contraindications and precautions to vaccination
- Information on COVID-19 vaccination and tuberculin skin testing

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Appendix A: Triage of persons presenting for mRNA COVID-19 vaccination

	MAY PROCEED WITH VACCINATION	PRECAUTION TO VACCINATION	CONTRAINDICATION TO VACCINATION
CONDITIONS	**CONDITIONS** • Immunocompromising conditions • Pregnancy • Lactation **ACTIONS** • Additional information provided* • 15 minute observation period	**CONDITIONS** • Moderate/severe acute illness **ACTIONS** • Risk assessment • Potential deferral of vaccination • 15-minute observation period if vaccinated	**CONDITIONS** • None **ACTIONS** • N/A
ALLERGIES	**ALLERGIES** History of allergies that are unrelated to components of an mRNA COVID-19 vaccine†, other vaccines, injectable therapies, or polysorbate, such as: • Allergy to oral medications (including the oral equivalent of an injectable medication) • History of food, pet, insect, venom, environmental, latex, etc., allergies • Family history of allergies **ACTIONS** • 30-minute observation period: Persons with a history of anaphylaxis (due to any cause) • 15-minute observation period: All other persons	**ALLERGIES** • History of any immediate allergic reaction‡ to vaccines or injectable therapies (except those related to component of mRNA COVID-19 vaccines† or polysorbate, as these are contraindicated) **ACTIONS:** • Risk assessment • Consider deferral of vaccination and/or referral to allergist-immunologist • 30-minute observation period if vaccinated	**ALLERGIES** History of the following are contraindications to receiving either of the mRNA COVID-19 vaccines†: • Severe allergic reaction (e.g., anaphylaxis) after a previous dose of an mRNA COVID-19 vaccine or any of its components • Immediate allergic reaction‡ of any severity to a previous dose of an mRNA COVID-19 vaccine or any of its components^ (including polyethylene glycol)# • Immediate allergic reaction of any severity to polysorbate^# **ACTIONS** • Do not vaccinate# • Consider referral to allergist-immunologist

* See Special Populations section for information on patient counseling in these groups

† Refers only to mRNA COVID-19 vaccines currently authorized in the United States (i.e., Pfizer-BioNTech, Moderna COVID-19 vaccines)

‡ Immediate allergic reaction to a vaccine or medication is defined as any hypersensitivity-related signs or symptoms consistent with urticaria, angioedema, respiratory distress (e.g., wheezing, stridor), or anaphylaxis that occur within four hours following administration.

^ See Appendix B for a list of ingredients. Note: Polyethylene glycol (PEG), an ingredient in both mRNA COVID-19 vaccines, is structurally related to polysorbate and cross-reactive hypersensitivity between these compounds may occur. Information on ingredients of a vaccine or medication (including PEG, a PEG derivative, or polysorbates) can be found in the package insert.

These persons should not receive mRNA COVID-19 vaccination at this time unless they have been evaluated by an allergist-immunologist and it is determined that the person can safely receive the vaccine (e.g., under observation, in a setting with advanced medical care available)

Appendix B: Ingredients included in Pfizer-BioNTech and Moderna mRNA COVID-19 vaccines

An immediate allergic reaction to any component or previous dose of an mRNA COVID-19 vaccine is a contraindication to vaccination with both the Pfizer-BioNTech and Moderna vaccines. The following is a list of ingredients for the Pfizer-BioNTech and Moderna COVID-19 vaccines, as reported in the prescribing information for each vaccine.

Description	Pfizer-BioNTech COVID-19 vaccine	Moderna COVID-19 vaccine
mRNA	Nucleoside-modified mRNA encoding the viral spike (S) glycoprotein of SARS-CoV-2	Nucleoside-modified mRNA encoding the viral spike (S) glycoprotein of SARS-CoV-2
Lipids	2[(polyethylene glycol)-2000]-N,N-ditetradecylacetamide	PEG2000-DMG: 1,2-dimyristoyl-rac-glycerol, methoxypolyethylene glycol
	1,2-distearoyl-sn-glycero-3-phosphocholine	1,2-distearoyl-sn-glycero-3-phosphocholine
	Cholesterol	Cholesterol
	(4-hydroxybutyl)azanediyl)bis(hexane-6,1-diyl)bis(2-hexyldecanoate)	SM-102: heptadecan-9-yl 8-((2-hydroxyethyl) (6-oxo-6-(undecyloxy) hexyl) amino) octanoate
Salts, sugars, buffers	Potassium chloride	Tromethamine
	Monobasic potassium phosphate	Tromethamine hydrochloride
	Sodium chloride	Acetic acid
	Dibasic sodium phosphate dihydrate	Sodium acetate
	Sucrose	Sucrose

* Neither vaccine contain eggs, gelatin, latex, or preservatives

Note: Both the Pfizer-BioNTech and Moderna COVID-19 vaccines contain polyethylene glycol (PEG). PEG is a primary ingredient in osmotic laxatives and oral bowel preparations for colonoscopy procedures, an inactive ingredient or excipient in many medications, and is used in a process called pegylation to improve the therapeutic activity of some medications (including certain chemotherapeutics). Additionally, cross-reactive hypersensitivity between PEG and polysorbates (included as an excipient in some vaccines and other therapeutic agents) can occur.

Information on whether a medication contains PEG, a PEG derivative, or polysorbates as either active or inactive ingredients can be found in the package insert. The National Institutes of Health DailyMed database may also be used as a resource. Medications that contain PEG and/or polysorbate are also described in the supplementary materials of Stone CA, et al. "Immediate hypersensitivity to polyethylene glycols and polysorbates: more common than we have recognized." *The Journal of Allergy and Clinical Immunology: In Practice* 7.5 (2019): 1533-1540. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6706272/pdf/nihms-1019221.pdf

Appendix C: Potential characteristics of allergic reactions, vasovagal reactions, and vaccine side effects following mRNA COVID-19 vaccination

In patients who develop post-vaccination symptoms, determining the etiology (including allergic reaction, vasovagal reaction, or vaccine side effects) is important to determine whether a person can receive additional doses of mRNA COVID-19 vaccines. The following table of signs and symptoms is meant to serve as a resource but may not be exhaustive, and patients may not have all signs or symptoms. Providers should use their clinical judgement when assessing patients to determine the diagnosis and management.

Characteristic	Immediate allergic reactions (including anaphylaxis)	Vasovagal reaction	Vaccine side effects (local and systemic)
Timing after vaccination	Most occur within 15-30 minutes of vaccination	Most occur within 15 minutes	Median of 1 to 3 days after vaccination (with most occurring day after vaccination)
Signs and symptoms			
Constitutional	Feeling of impending doom	Feeling warm or cold	Fever, chills, fatigue
Cutaneous	Skin symptoms present in ~90% of people with anaphylaxis, including pruritus, urticaria, flushing, angioedema	Pallor, diaphoresis, clammy skin, sensation of facial warmth	Pain, erythema or swelling at injection site; lymphadenopathy in same arm as vaccination
Neurologic	Confusion, disorientation, dizziness, lightheadedness, weakness, loss of consciousness	Dizziness, lightheadedness, syncope (often after prodromal symptoms for a few seconds or minutes), weakness, changes in vision (such as spots of flickering lights, tunnel vision), changes in hearing	Headache
Respiratory	Shortness of breath, wheezing, bronchospasm, stridor, hypoxia	Variable; if accompanied by anxiety, may have an elevated respiratory rate	N/A
Cardiovascular	Hypotension, tachycardia	Variable; may have hypotension or bradycardia during syncopal event	N/A
Gastrointestinal	Nausea, vomiting, abdominal cramps, diarrhea	Nausea, vomiting	Vomiting or diarrhea may occur
Musculoskeletal	N/A	N/A	Myalgia, arthralgia
Vaccine recommendations			
Recommended to receive 2nd dose of mRNA COVID-19 vaccine?	No	Yes	Yes

Included for reference: https://www.cdc.gov/vaccines/covid-19/info-by-product/clinical-considerations.html