

# COVID-19 UPDATE: OMICRON UPDATE, PART 1

**David J. Weber, MD, MPH, FIDSA, FSHEA, FRSM (London)**  
**Sanders Distinguished Professor of Medicine, Pediatrics and Epidemiology**  
**Associate Chief Medical Officer**  
**Medical Director, Hospital Epidemiology**



**UNC**  
SCHOOL OF MEDICINE

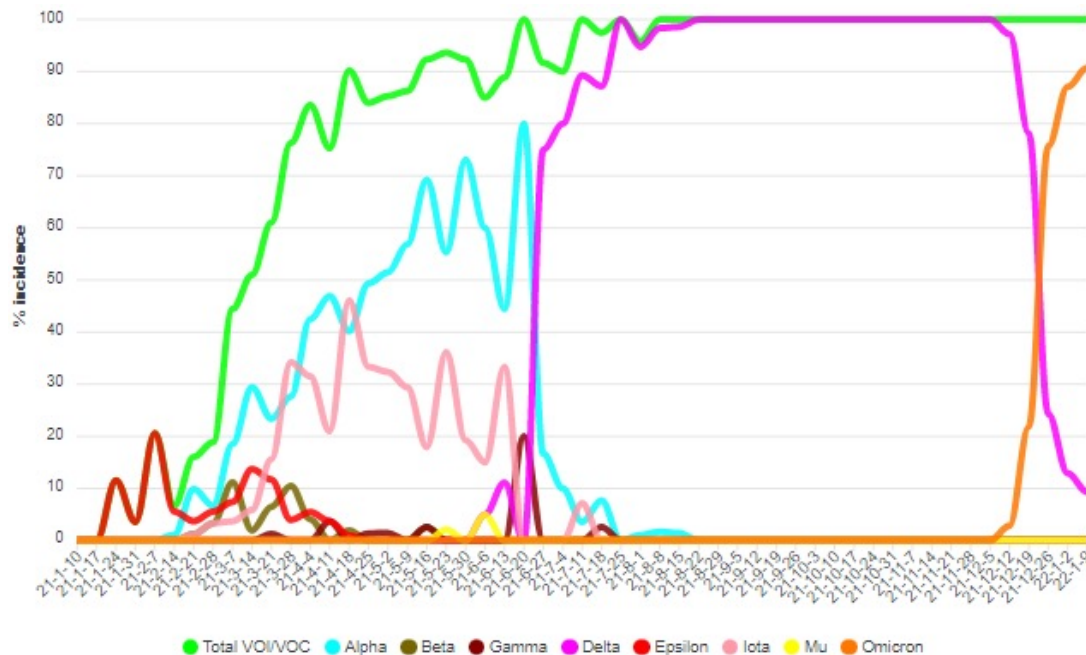
Disclosures: Consultancy; Pfizer, Merck, Sanofi, PDI, Germitec, UVinnovators  
All drugs/vaccines issues discussed consistent with FDA approvals or authorizations

# COVID-19: RECENT SUMMARY

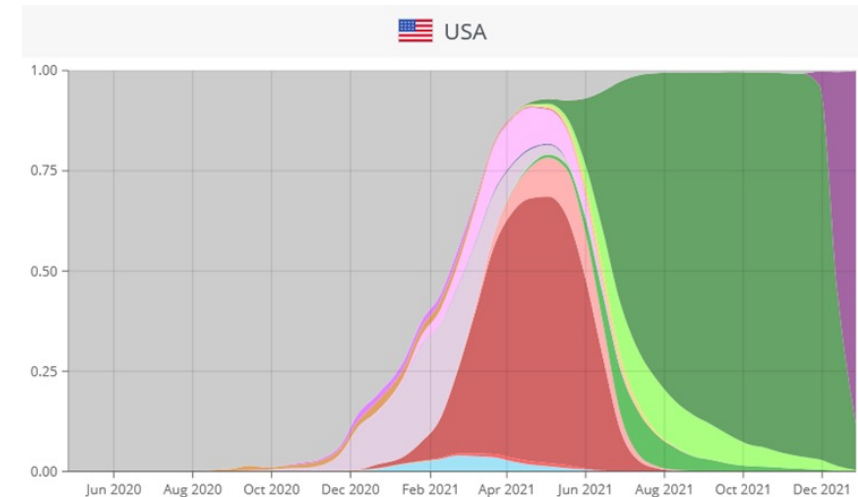
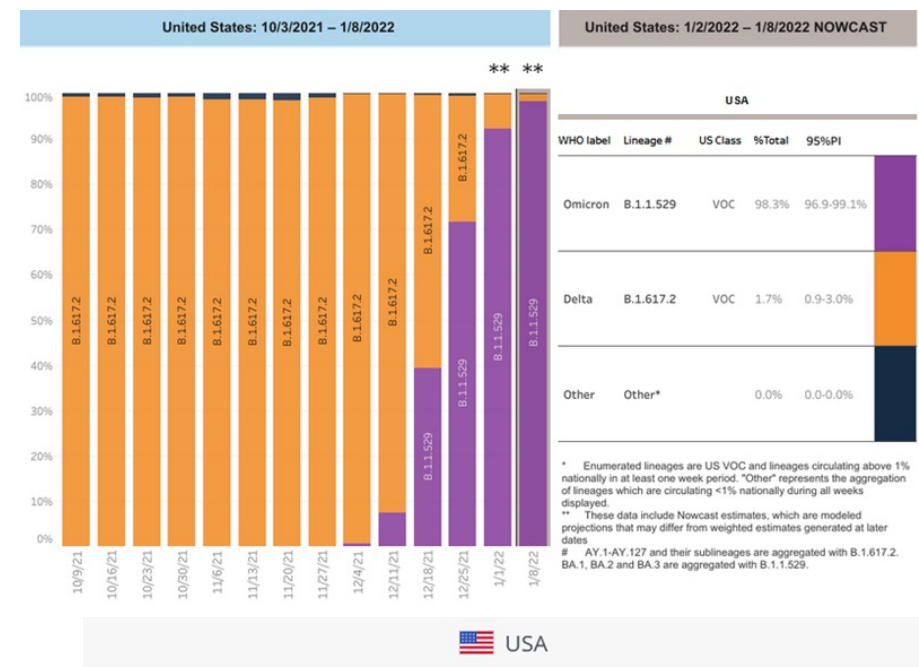
- Increasing cases and hospitalizations due to Omicron
  - Hospitalizations largely limited to unvaccinated and immunocompromised
- Omicron
  - Dominant variant; highly transmissible; escape from most monoclonal antibody therapy; escape for “natural immunity” and vaccine (“fully vaccinated”) but good effectiveness if “up to date” on vaccines (i.e., boosted)
  - Less virulent (i.e., lower frequency of serious illness, hospitalizations, and deaths)
  - Incubation period, median = 3 days (range, 1-4 days) – makes it impossible to perform contact tracing
- Advances in therapy – active against Omicron (therapy for mild-moderate illness) - limited supply for all but remdesivir
  - Paxlovid: FDA authorized, substantial drug interactions, CYP3A4 inhibitor; ~88% effective to prevent hospitalizations, oral
  - Sotrovimab: FDA authorized, IV infusion
  - Remdesivir: FDA approved but “off label”, IV infusion each day for 3 days
  - Molnupiravir: FDA authorized, limited effectiveness (~30% to prevent hospitalization), oral
- Advances in preventive therapy (IM)
  - Evusheld (tixagevimab co-packaged with cilgavimab and administered together)
- Prevention = 1) vaccine; primary series plus booster; 2) universal pandemic precautions in healthcare facilities; masking in community; 3) avoid presenteeism (i.e., stay home and contact occupational health if ill)

# OMICRON, UNC-MC & US

3,661 genomes through Jan. 8, 2022

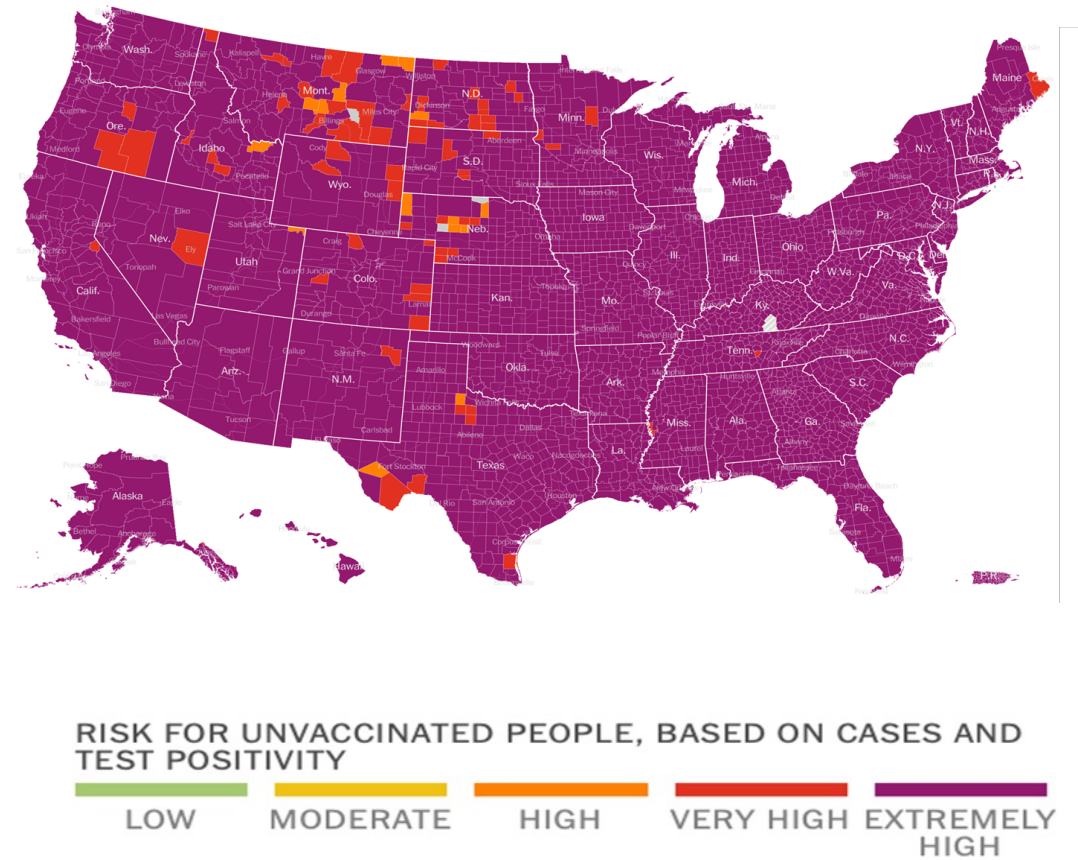
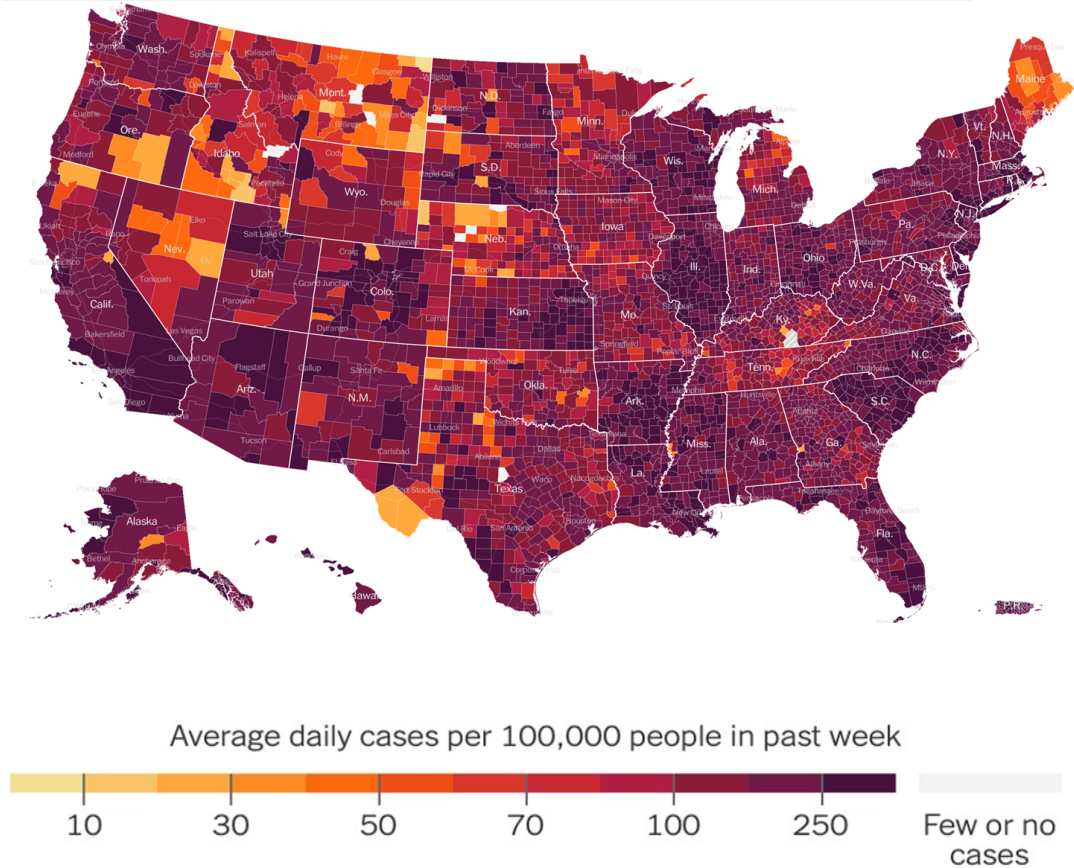


<https://covid.cdc.gov/covid-data-tracker/#variant-proportions>;  
<https://covariants.org/per-country>



- ✓ 20I (Alpha, V1)
- ✓ 20H (Beta, V2)
- ✓ 20J (Gamma, V3)
- ✓ 21A (Delta)
- ✓ 21I (Delta)
- ✓ 21J (Delta)
- ✓ 21K (Omicron)

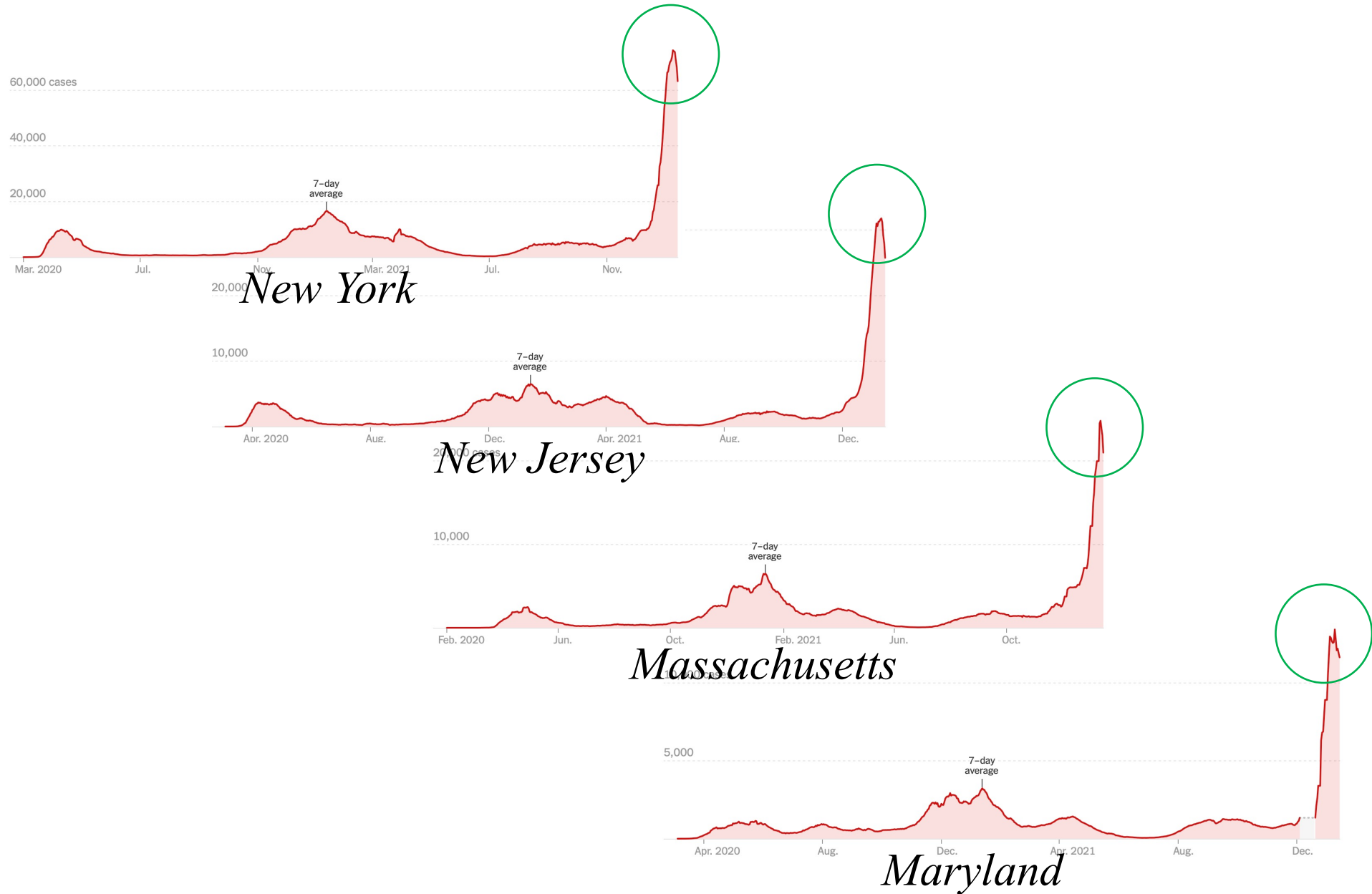
# COVID-19 HOTSPOTS AND RISK LEVELS, US



Source, NY Times 16 Jan 2022



# COVID-19 CASE ACCRUAL IN FOUR STATES

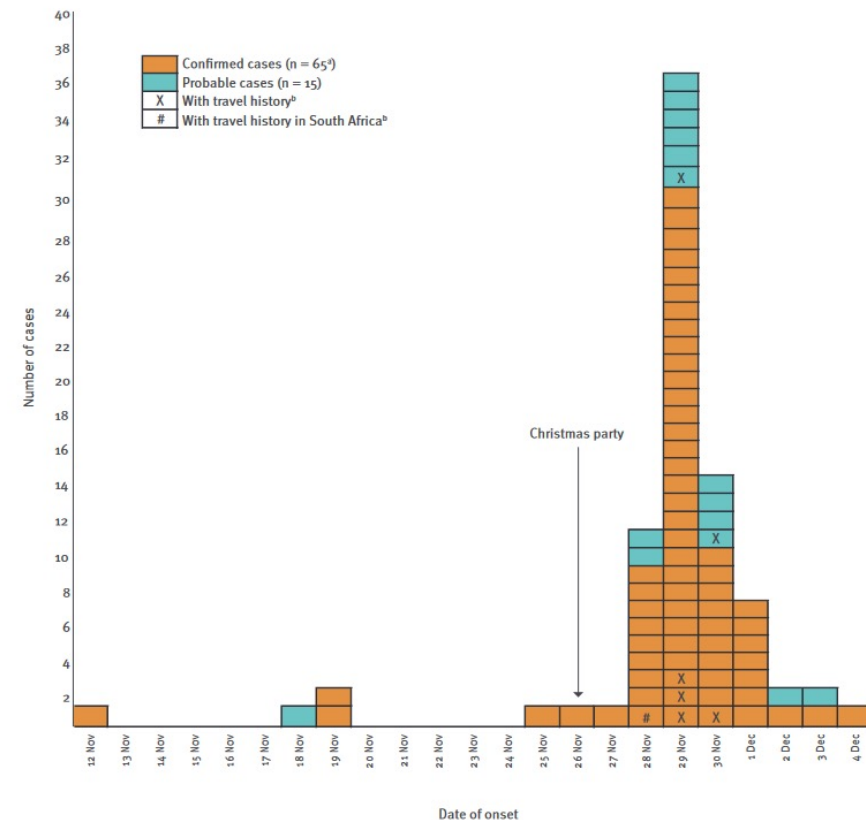


Source: New York Times 1-16-2022

# Outbreak caused by the SARS-CoV-2 Omicron variant in Norway, November to December 2021

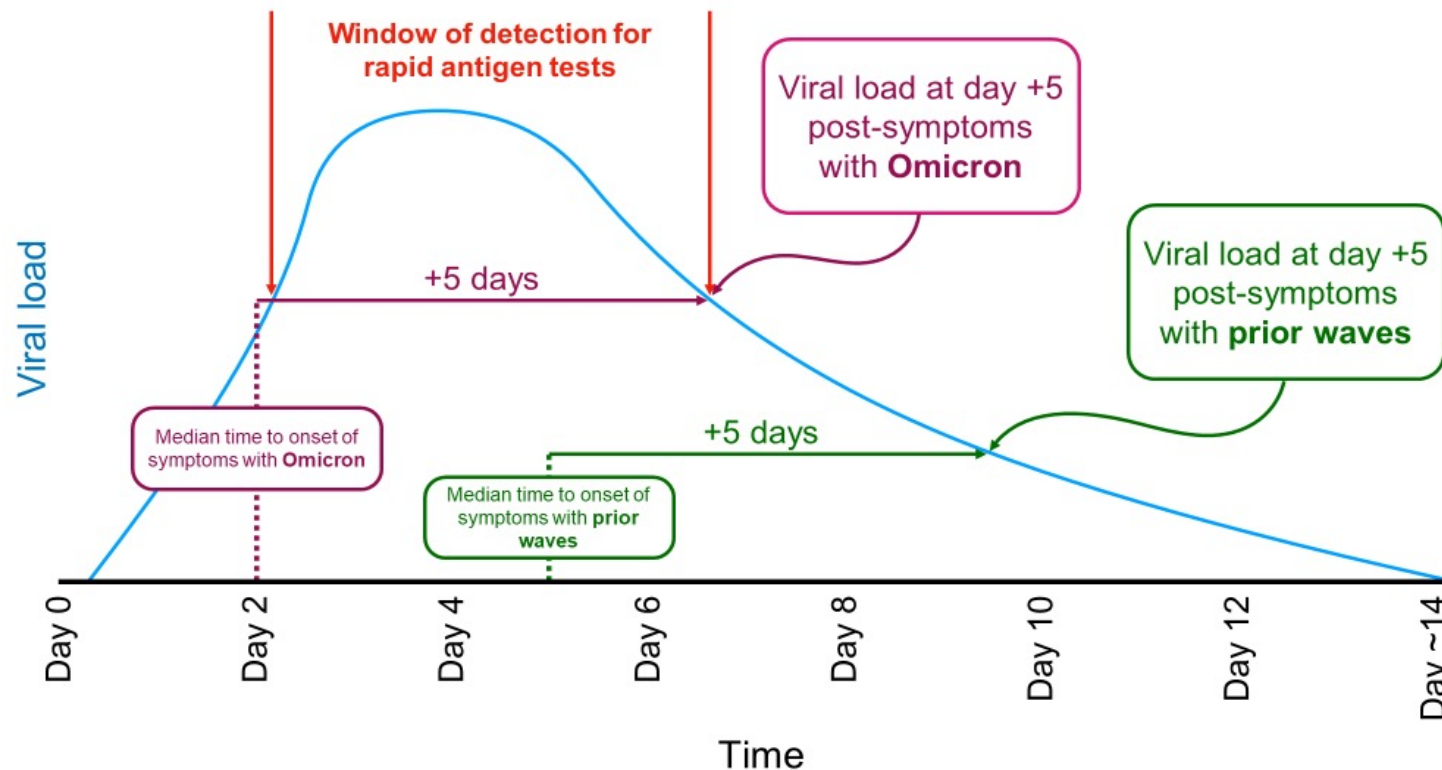
- In late November 2021, an outbreak of Omicron SARS-CoV-2 following a Christmas party with 117 attendees was detected in Oslo, Norway. The observed Omicron **attack rate was 74%** and **most cases developed symptoms**.
- As of 13 December, none have been hospitalized. Most participants were 30–50 years old. **96% were fully vaccinated (none boosted)**. All were to be test negative prior to event.
- **Assuming exposure at the event, the incubation period for symptomatic cases had a median of 3 days (IQ range, 3-4).**
- Party was a closed event held in a separate room of a restaurant.
- These findings corroborate reports that the Omicron variant may be more transmissible, and that vaccination may be less effective in preventing infection compared with Delta.

Distribution of COVID-19 cases infected with the SARS-CoV-2 Omicron variant by date of symptom onset and case classification, after attending Christmas party, Oslo, Norway, November–December 2021 (n = 81)



# Is my rapid antigen test a false negative?

## Hypothesis for why rapid tests can be falsely negative with omicron



### Hypothesis

- Symptoms arise earlier in infection by Omicron due to pre-existing immunity

### Consequences

- Higher risk that antigen tests could be falsely negative with Omicron because viral loads are lower at median time to onset of symptoms (day 2)
- Viral loads at day +5 from symptoms may be higher in Omicron

### Assumptions

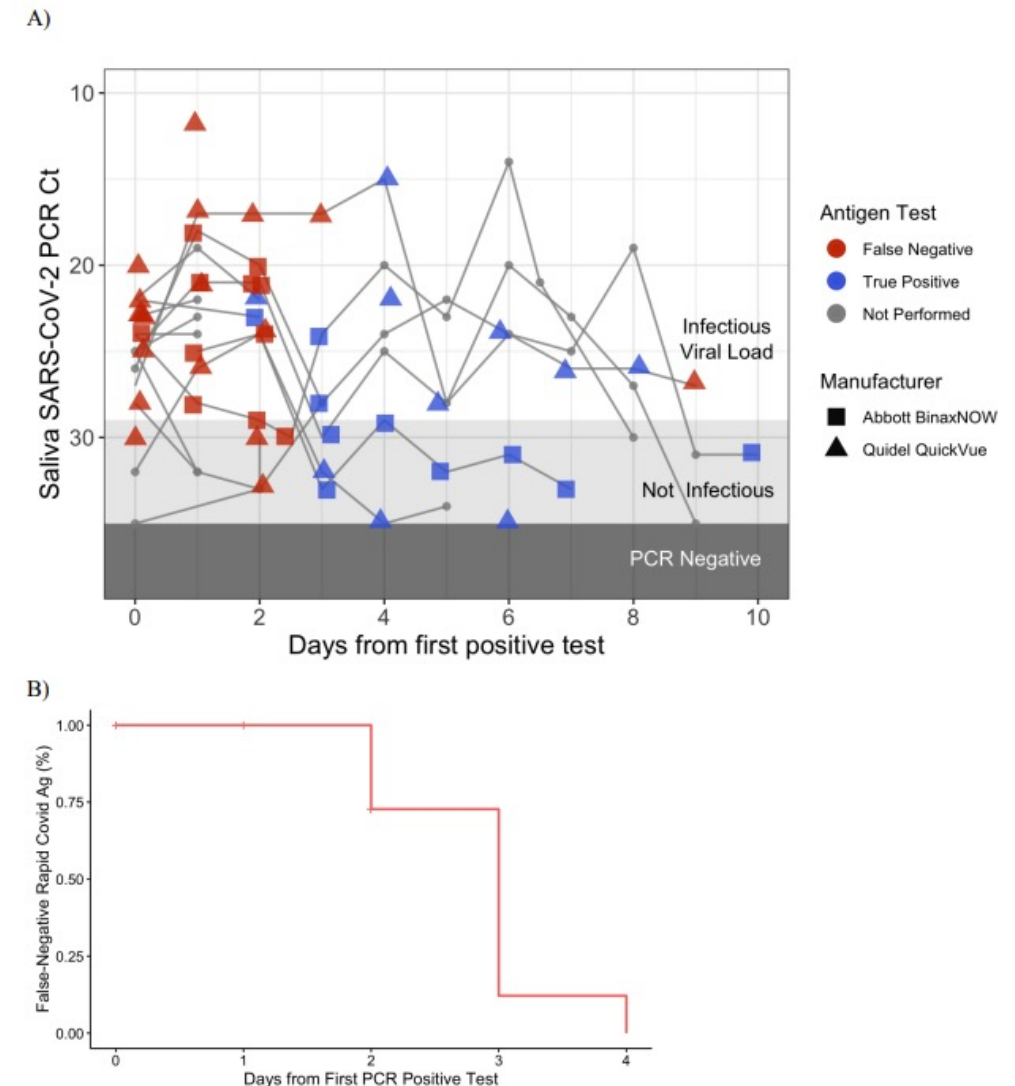
- Viral load kinetics with omicron unchanged from prior waves
- No differences in viral loads between symptomatic and asymptomatic people

# Discordant SARS-CoV-2 PCR and Rapid Antigen Test Results When Infectious: A December 2021 Occupational Case Series

- Retrospective cohort study, 1-31 Dec 2021, NYC, LA, SF
- We identified 30 individuals with 62 matched pairs of rapid antigen and positive PCR results from specimens collected at the same time. The S-gene dropout associated with Omicron was observed in 29 of 30 cases. Viral dynamics and discordance in test results are shown in Figure 1. Four cases were confirmed to have transmitted the virus between false-negative antigen tests, with saliva PCR cycle threshold (Ct) values between 23-28 for the N gene. **On Days 0 and 1, all rapid antigen tests produced false-negative results, despite 28 of 30 pairs having infectious viral load within the range of confirmed Omicron transmissions in the cohort (Ct <29). The median time from first positive PCR to first detectable antigen positive was 3 days (95% CI: 2-NA).** After infection was detected, a subgroup (n=5) who received daily saliva PCR, nasal swab PCR, and nasal swab rapid Ag testing showed viral load peaked in saliva 1-2 days before nasal tests. All individuals in the cohort developed symptoms within two days of the first PCR positive test

Adamson B, et al. <https://doi.org/10.1101/2022.01.04.22268770>

Shown are Cycle Threshold (Ct) counts and rapid antigen test results from paired samples of infected patients (Panel A). Also shown is the Kaplan Meier analysis of time from positive PCR to positive rapid antigen test (Panel B).





# High Rate of Asymptomatic Carriage Associated with Variant Strain Omicron

- In early December 2021, the Ubuntu clinical trial, designed to evaluate efficacy of the mRNA-1273 vaccine (Moderna) among persons living with HIV (PLWH), began enrolling participants.
- Nasal swabs are routinely obtained at the initial vaccination visit, which requires participants to be clinically well to receive their initial jab. **Of the initial 230 participants enrolled between 12/2-12/17/21, 71 (31%) were PCR+ for SARS-CoV-2: all of whom were subsequently confirmed by S gene dropout to be Omicron; 48% of the tested samples had cycle threshold (CT) values <25 and 18% less than 20, indicative of high titers of asymptomatic shedding.** Asymptomatic carriage rates were similar in SARS-CoV-2 seropositive and seronegative persons (27% respectively).
- We also evaluated asymptomatic carriage in a sub study of the Sisonke vaccine trial conducted in South African HCP, which indicated 2.6% asymptomatic carriage during the Beta and Delta outbreaks and subsequently rose to 16% in both PLWH and PHLWH during the Omicron period.

**Table 1b . Prevalence of asymptomatic SARS-CoV-2 infection upon entry in vaccine studies.**

Trial	Vaccine (developer)	Location	Dates	Predominant variant	Total participants	SARS-CoV-2 PCR+ <sup>†</sup>	Prevalence
COVE (CoVPN 3001; NCT04470427)	mRNA-1273 (Moderna)	US	Aug-Oct 2020	Ancestral	30,022	182	0.6%
Teen COVE (NCT04649151)	mRNA-1273 (Moderna)	US	Dec 2020-Feb 2021	Ancestral	3,469	22	0.6%
Ensemble (CoVPN 3003; NCT04505722.)	Ad26.COV2.S (Janssen)	US South Africa S. America	Sept 2021-Jan 2020	USA: ancestral South Africa: Beta S. America: Gamma, ancestral, P.2	Overall: 41,273 PLWH <sup>§</sup> : 1,227	Overall: 227 PLWH <sup>§</sup> : 7	Overall: 0.55% PLWH <sup>§</sup> : 0.58%
Sisonke sub study (NCT04838795)	Ad26.COV2.S (Janssen)	South Africa	June-Aug 2021	Delta	1,604	39	2.4%
Ubuntu (PACTR202105817814362)	mRNA-1273 (Moderna)	South Africa	Dec 2021-ongoing	Omicron	230*	71*	31%

<sup>†</sup>At time of vaccination visit

<sup>§</sup>Most enrollment of people living with HIV (PLWH) occurred in South Africa

\*Participants with baseline data as of Dec. 17, 2021

Garrett N, et al.  
<https://doi.org/10.1101/2021.12.20.21268130>

## Data suggest higher household transmissibility of Omicron compared with Delta among vaccinated persons (Denmark, 2021)

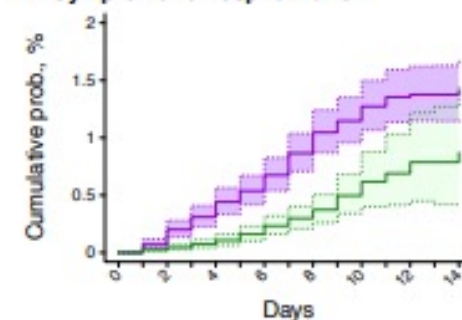
	Omicron households (N=2225)		Delta households (N=9712)	
Vaccine Status	2° attack rate for Omicron (# 2° cases)	Odds ratio for Omicron transmissibility (95% CI)	2° attack rate for Delta (# 2° cases)	Odds ratio for Delta transmissibility (95% CI)
Unvaccinated	29% (340)	1.04 (0.87-1.24)	28% (2044)	2.31 (2.09-2.55)
Fully vaccinated	32% (1057)	ref	19% (2714)	ref
Booster-vaccinated	25% (77)	0.54 (0.40-0.71)	11% (165)	0.38 (0.32-0.46)

SARS-CoV-2 Omicron VOC Transmission in Danish Households: <https://www.medrxiv.org/content/10.1101/2021.12.27.21268278v1.full.pdf>

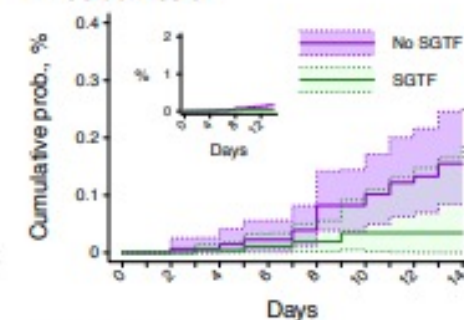
# Clinical outcomes in patients infected with Omicron in CA

- Methods: Assessed ~53,000 with S gene target failure (SGTF, surrogate for Omicron) and ~17,000 with non-SGTG (surrogate for Delta)
- Results: Hospital admissions occurred among 235 (0.5%) and 222 (1.3%) of cases with Omicron and Delta variant infections, respectively. Among cases first tested in outpatient settings, the aHR for any subsequent hospital admission and symptomatic hospital admission associated with Omicron variant infection were 0.48 (0.36-0.64) and 0.47 (0.35-0.62), respectively. Rates of ICU admission and mortality after an outpatient positive test were 0.26 (0.10-0.73) and 0.09 (0.01-0.75) fold as high among cases with Omicron compared to cases with Delta. Median duration of hospital stay was 3.4 (2.8-4.1) days shorter for hospitalized cases with Omicron.

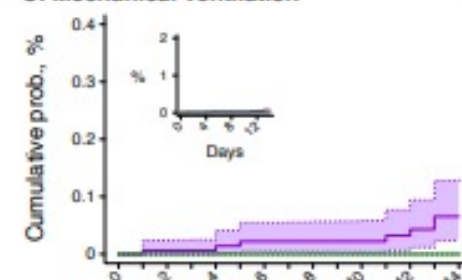
A: Symptomatic hospitalization



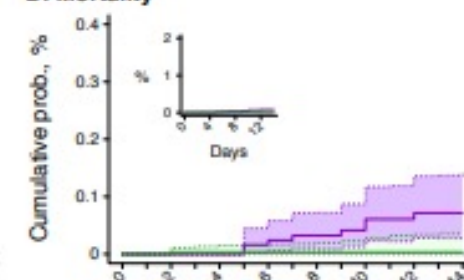
B: ICU admission



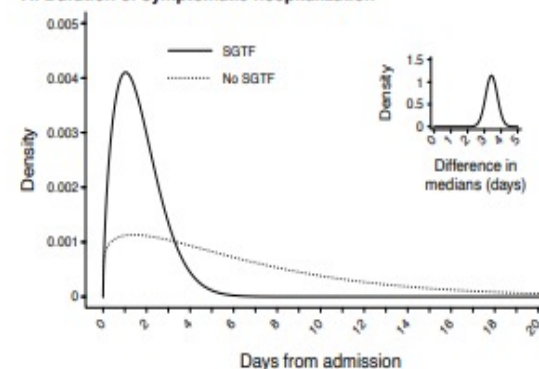
C: Mechanical ventilation



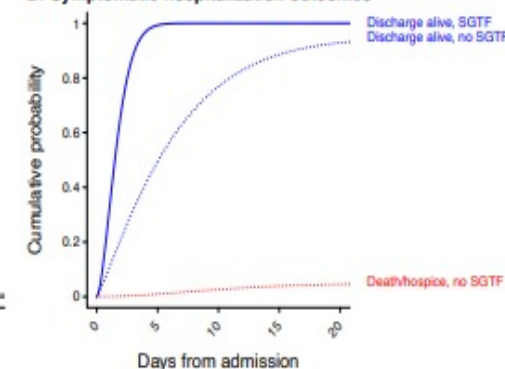
D: Mortality



A: Duration of symptomatic hospitalization

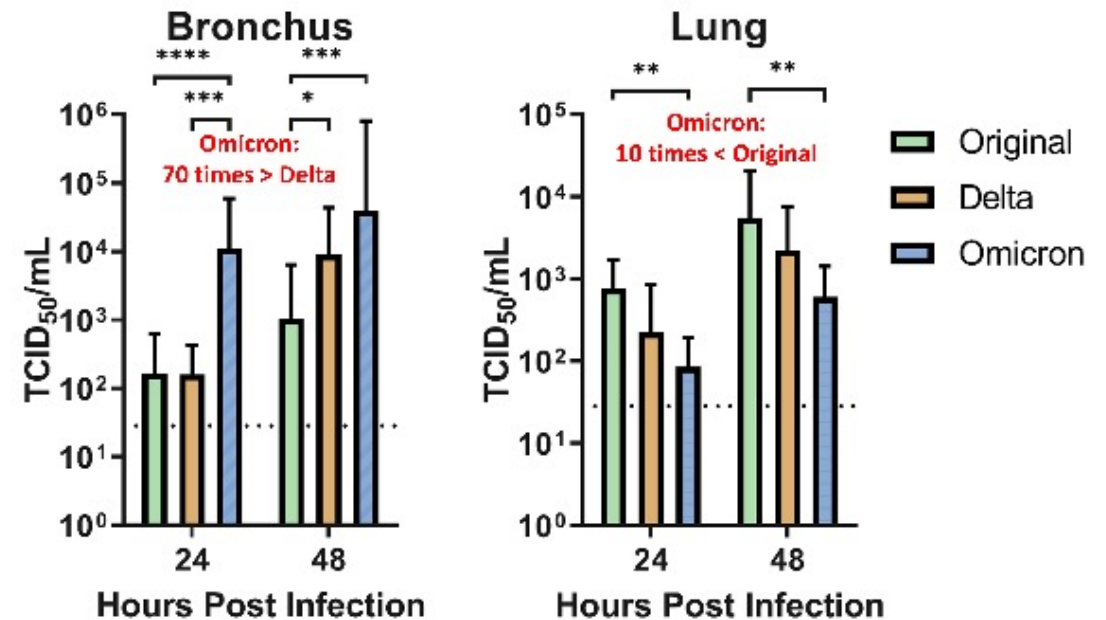


B: Symptomatic hospitalization outcomes

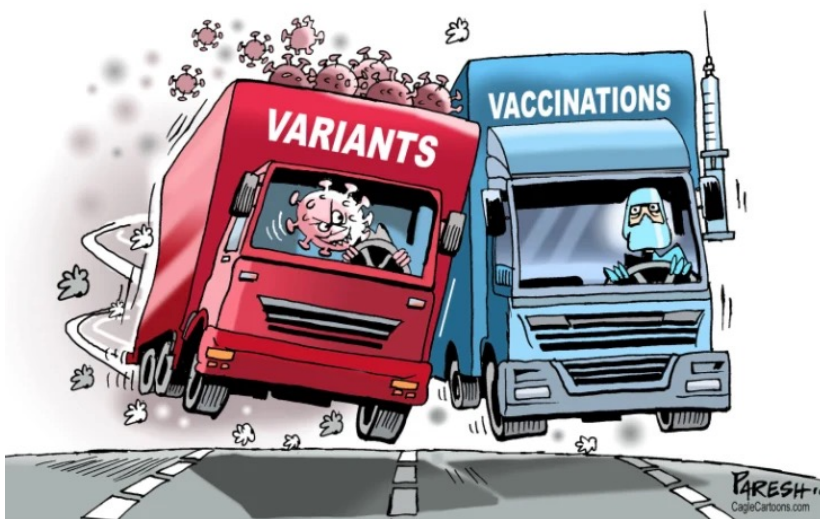
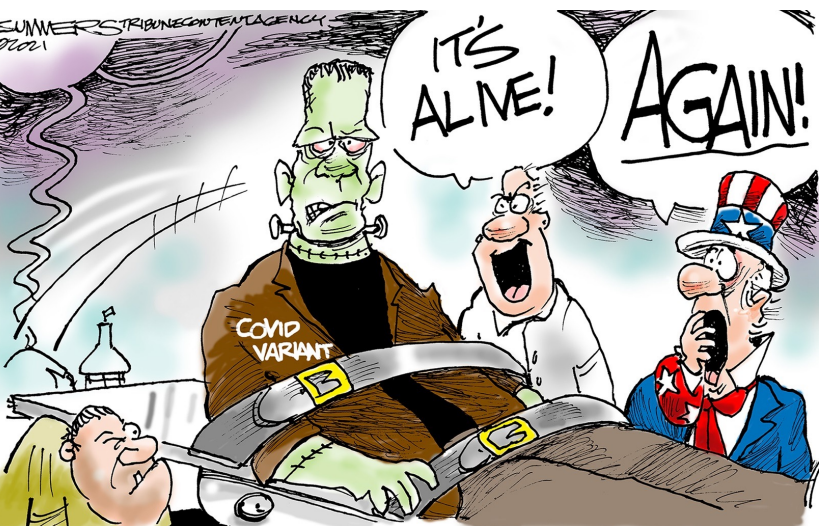
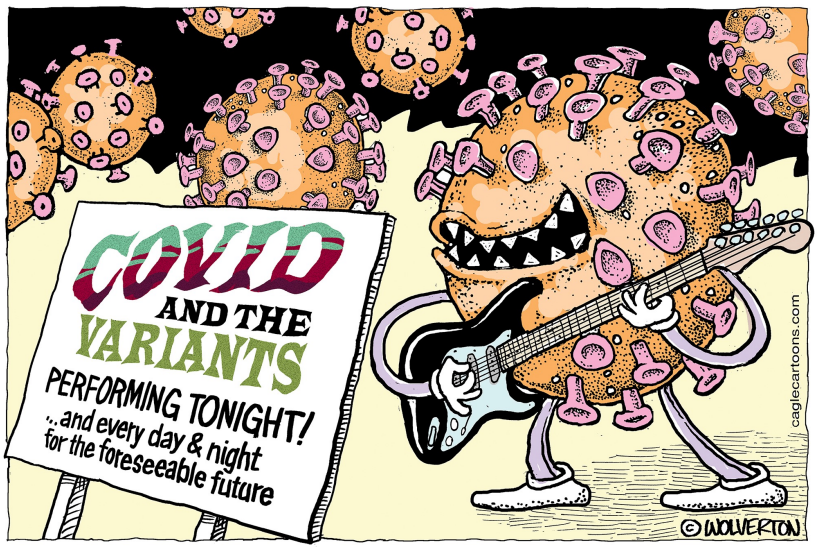
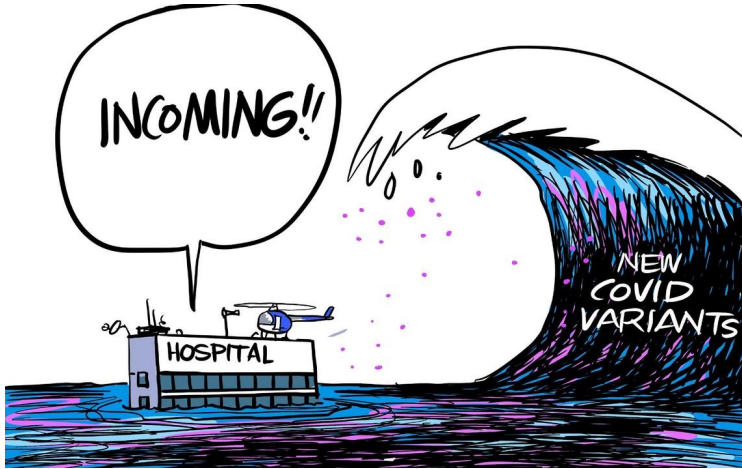


# OMICRON INFECTIVITY FOR BRONCHIAL AND LUNG TISSUES

A study led by researchers from the LKS Faculty of Medicine at The University of Hong Kong (HKUMed) provides the first information on how the novel Variant of Concern (VOC) of SARS-CoV-2, the Omicron SARS-CoV-2 infect human respiratory tract. The researchers found that Omicron SARS-CoV-2 infects and multiplies 70 times faster than the Delta variant and original SARS-CoV-2 in human bronchus, which may explain why Omicron may transmit faster between humans than previous variants. Their study also showed that the Omicron infection in the lung is significantly lower than the original SARS-CoV-2, which may be an indicator of lower disease severity. This research is currently under peer review for publication.











*Questions?*

# COVID-19 UPDATE: OMICRON UPDATE, PART 2

**David J. Weber, MD, MPH, FIDSA, FSHEA, FRSM (London)**  
**Sanders Distinguished Professor of Medicine, Pediatrics and Epidemiology**  
**Associate Chief Medical Officer**  
**Medical Director, Hospital Epidemiology**



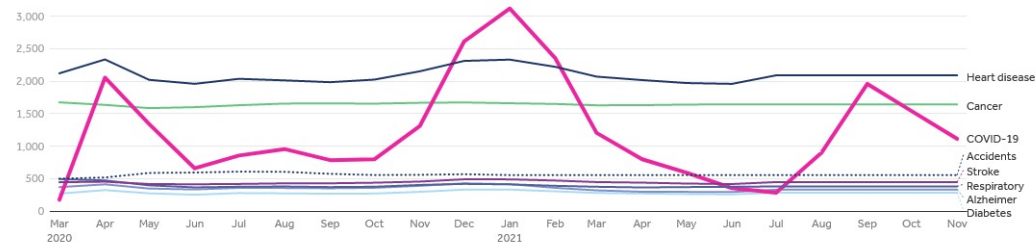
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Disclosures: Consultancy; Pfizer, Merck, Sanofi, PDI, Germitec, UVinnovators  
All drugs/vaccines issues discussed consistent with FDA approvals or authorizations

# IMPACT OF COVID-19 ON DEATHS BY AGE GROUP, US

COVID-19 rank fell to number 7 among leading causes of death in July but is back up to number 3 in November 2021

Average daily deaths in the United States, by cause (March 2020 - November 2021)



Notes: For accidents in 2021, the 2020 daily average is plotted. For all other leading causes, July through November data is the average from January - June 2021. Respiratory disease represents chronic lower respiratory disease.

Source: KFF analysis of CDC mortality and KFF COVID-19 tracker • [Get the data](#) • [PNG](#)

Peterson-KFF  
Health System Tracker

COVID-19 was the number 1 leading cause of death for people ages 45-54 years in October 2021

Age-specific rank of COVID-19 deaths among leading causes of death in the U.S., 2021

Ages	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	All Ages
January	7	6	4	2	2	1	1	1	1	1	1
February	13	7	5	4	4	2	2	2	1	2	1
March	15	8	6	6	5	4	3	3	3	5	3
April	7	7	6	6	5	4	3	3	3	5	3
May	11	8	5	6	5	4	3	3	5	6	3
June	13	11	7	6	5	4	4	6	7	8	6
July	13	8	5	6	5	4	3	4	6	7	7
August	7	6	4	2	1	1	1	2	3	3	3
September	7	5	4	2	1	1	1	1	3	2	2
October	7	6	4	2	2	1	2	3	3	3	3

Note: Monthly deaths due to COVID-19 for each month in 2021 (as of December 8, 2021 data) were compared to age-specific death counts due to other rankable leading causes.

Source: KFF analysis of CDC Provisional data, CDC Wonder data, and KFF COVID-19 Tracker data • [Get the data](#) • [PNG](#)

Peterson-KFF  
Health System Tracker

<https://www.healthsystemtracker.org/brief/covid19-and-other-leading-causes-of-death-in-the-us/>



# FREQUENCY AND SYMPTOMS OF LONG-COVID-19

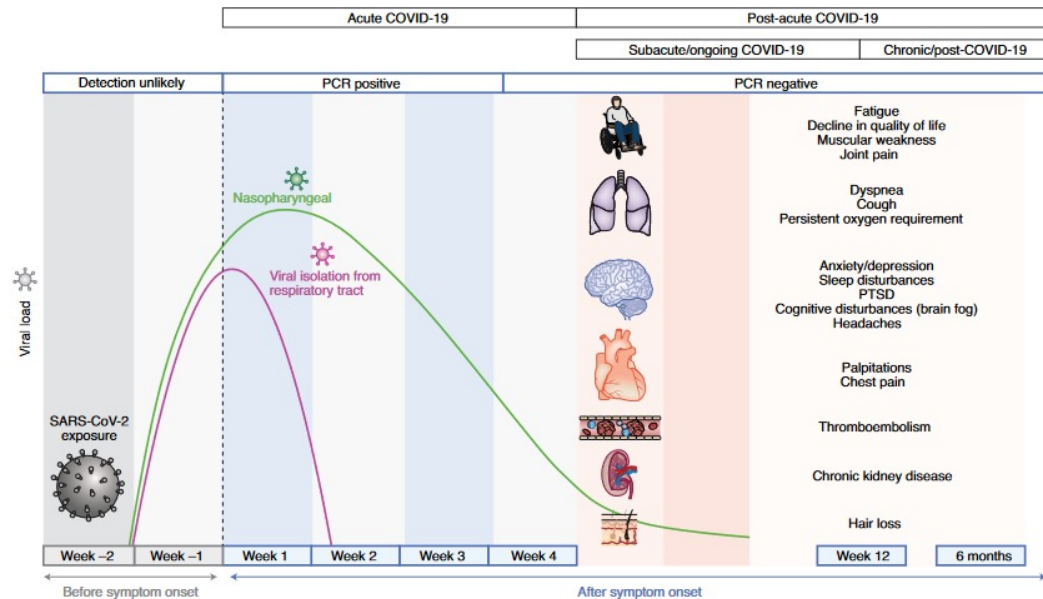
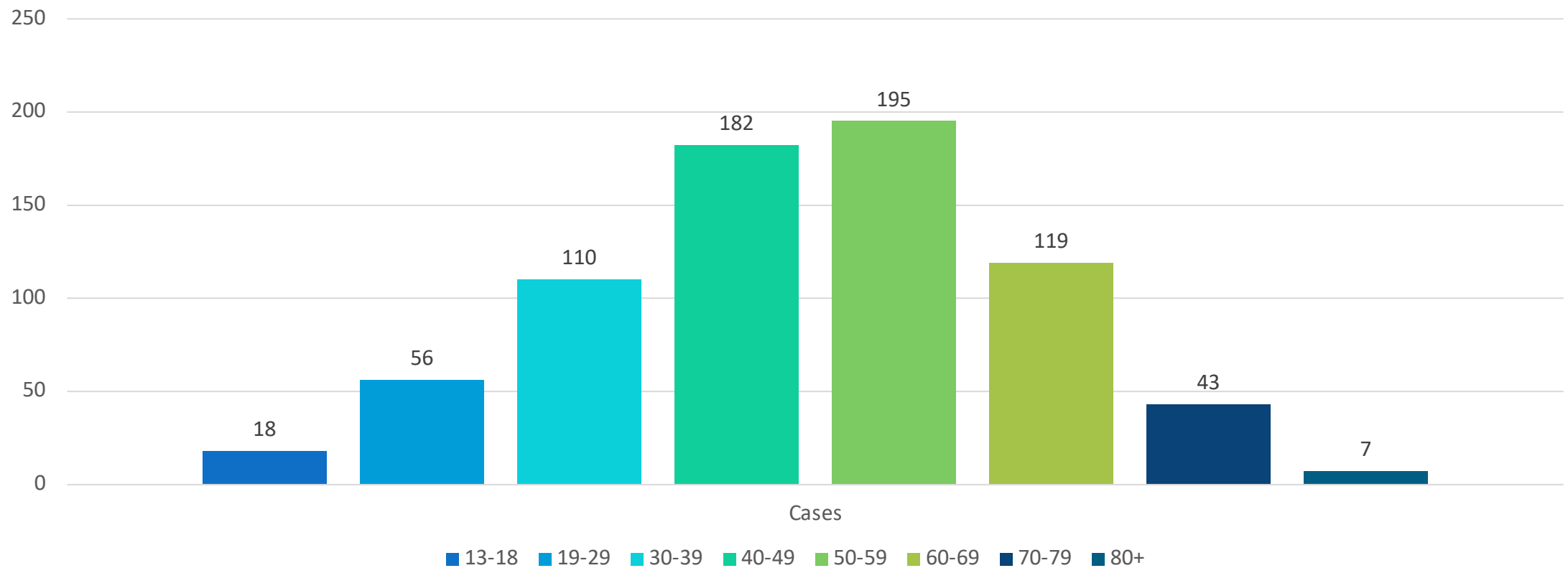


Fig. 1 | **Timeline of long-COVID.** Nalbandian et al. define long-COVID as persistent symptoms and/or delayed or long-term complications beyond four weeks from the onset of symptoms. Credit: Adapted with permission from A. Nalbandian et al. *Nat. Med.* 27, 601–615 (2021), Springer Nature

- Goal: Assess long-COVID-19 in large EMR database
- Methods: Retrospective cohort study using EMR data from 81 million patients, 273,618 COVID-19 survivors; incidence within 6 months and 3-6 months after diagnosis
- Results: Among COVID-19 survivors (mean [SD] age: 46.3 [19.8], 55.6% female), 57.00% had one or more long-COVID feature recorded during the whole 6-month period (i.e., including the acute phase), and 36.55% between 3 and 6 months.
  - 1 in 3 patients had one or more features of long-COVID recorded between 3 and 6 months after a diagnosis of COVID-19. This was significantly higher than after influenza.
  - 2 in 5 of the patients who had long-COVID features in the 3- to 6-month period, had no record of any such feature in the previous 3 months.
  - The risk of long-COVID features was higher in patients who had more severe COVID-19 illness, and slightly higher among females and young adults. White and non-white patients were equally affected.

# UNC-CH LONG COVID-19 CLINIC

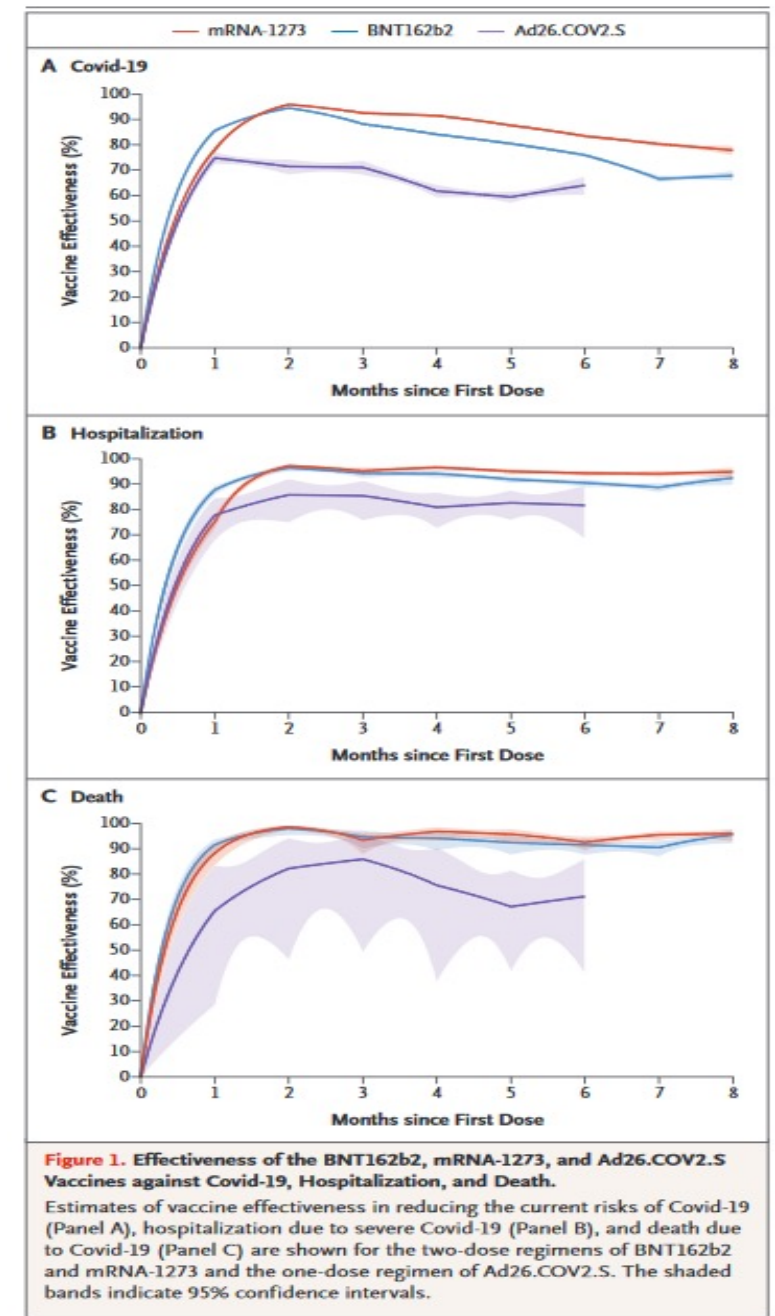
Frequency COVID-19 Cases Seen in Long COVID-19 Clinics, UNC-MC, by Age



Data supplied by Dr. Jonh Baratta

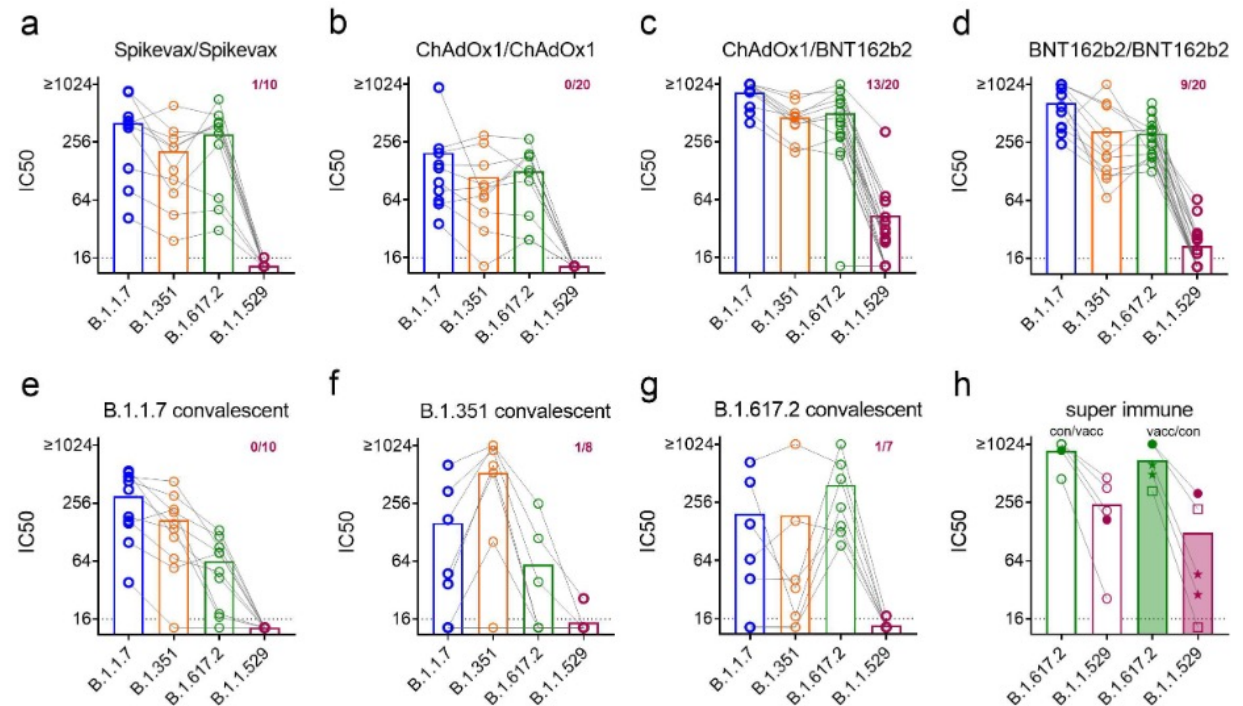
# Effectiveness of Covid-19 Vaccines over a 9-Month Period in NC

- Methods: We extracted data regarding Covid-19–related vaccination and outcomes during a 9-month period (11/12/20-8/9/21) for ~10.6 million NC residents
- Results: For the two-dose regimens of mRNA vaccines BNT162b2 (30µg/dose) and mRNA-1273 (100µg/dose), vaccine effectiveness against Covid-19 was **94.5%** (95% CI, 94.1 to 94.9) and **95.9%** (95% CI, 95.5 to 96.2), respectively, at **2 months** after the first dose and decreased to **66.6%** (95% CI, 65.2 to 67.8) and **80.3%** (95% CI, 79.3 to 81.2), respectively, at 7 months. Among early recipients of BNT162b2 and mRNA-1273, effectiveness decreased by approximately 15 and 10 percentage points, respectively, from mid-June to mid-July, when the delta variant became dominant. For the one-dose regimen of Ad26.COV2.S (5×10<sup>10</sup> viral particles), effectiveness against Covid-19 was **74.8%** (95% CI, 72.5 to 76.9) at 1 month and decreased to **59.4%** (95% CI, 57.2 to 61.5) at 5 months. **All three vaccines maintained better effectiveness in preventing hospitalization and death than in preventing infection over time, although the two mRNA vaccines provided higher levels of protection than Ad26.COV2.S.**



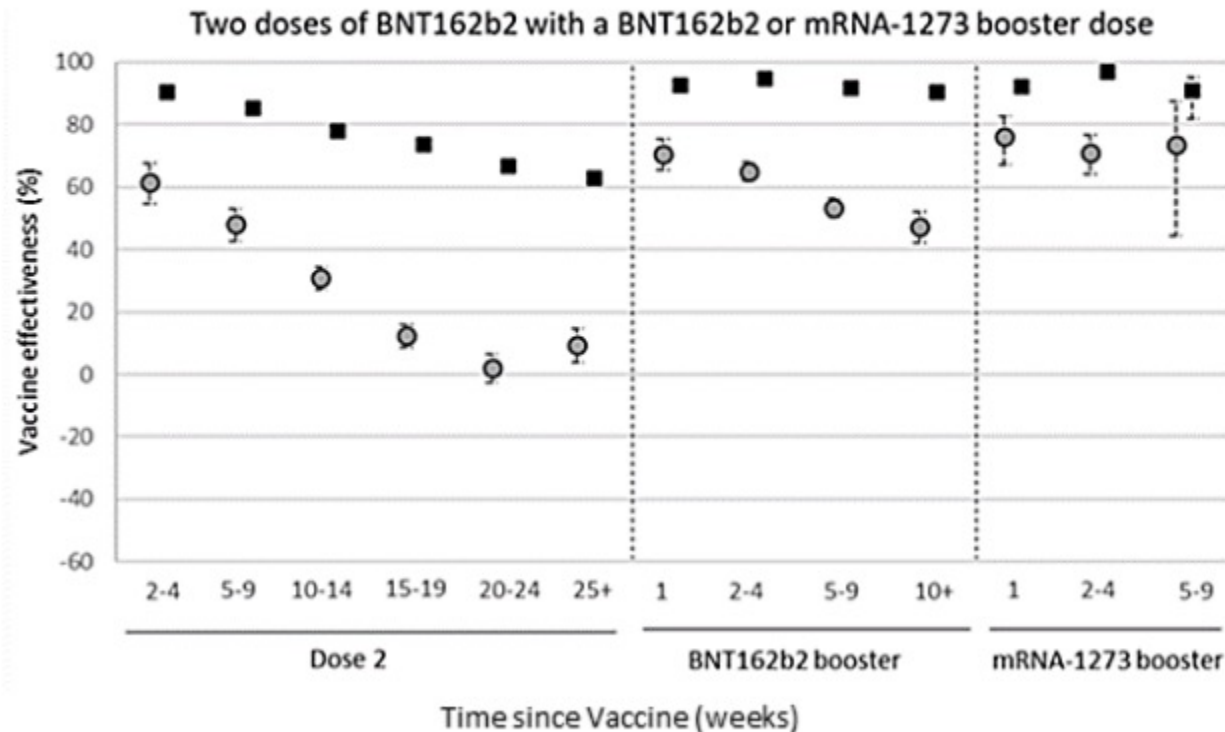
# Omicron Evades Neutralization by Sera from Vaccinated and Convalescent Individuals

- In vitro study of sera from infected or vaccinated persons
- Results: Figure 1 shows that **sera from vaccinated individuals neutralized the B.1.1.529 variant to a much lesser extent than any other variant analyzed (B.1.1.7, B.1.351, B.1.617.2)**. We found some B.1.1.529 cross-neutralization in individuals vaccinated with either the homologous BNT162b2 or the heterologous ChAdOx1 prime/BNT162b2 boost regimen but not after homologous ChAdOx1 vaccination. Furthermore, the sera from convalescent individuals largely failed to neutralize B.1.1.529 although cross-neutralization was observed against other variants. **All sera from super immune individuals that had been infected and vaccinated once or twice with BNT162b2 or that had been vaccinated and subsequently were infected were able to neutralize B.1.1.529, although to a lesser degree than B.1.617.2.**





## Pfizer mRNA vaccine effectiveness (VE) is lower for symptomatic infection due to Omicron compared to Delta



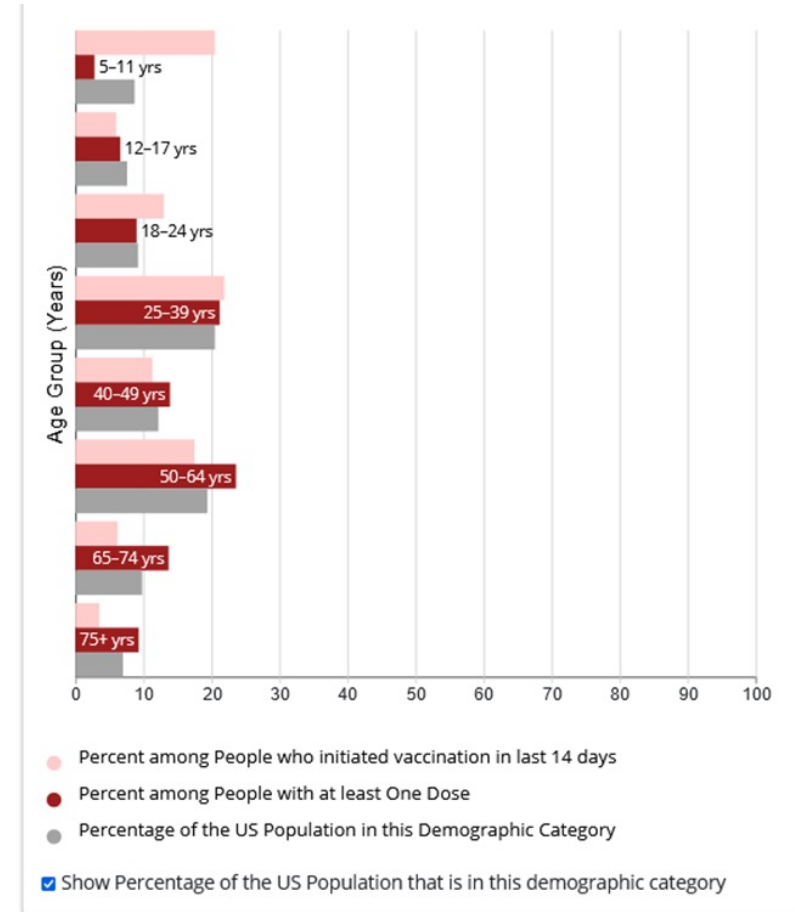
- Post 2-dose: increased waning immunity for Omicron (~15%) vs. Delta (~60%) at 25+ weeks post 2<sup>nd</sup> dose
- Booster: ~65% VE against Omicron 2 weeks; decreases to 45% at 10+ weeks

[SARS-CoV-2 variants of concern and variants under investigation:  
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1043807/technical-briefing-33.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1043807/technical-briefing-33.pdf)

# COVID-19 VACCINE COVERAGE BY “UP TO DATE” AND AGE, US, CDC

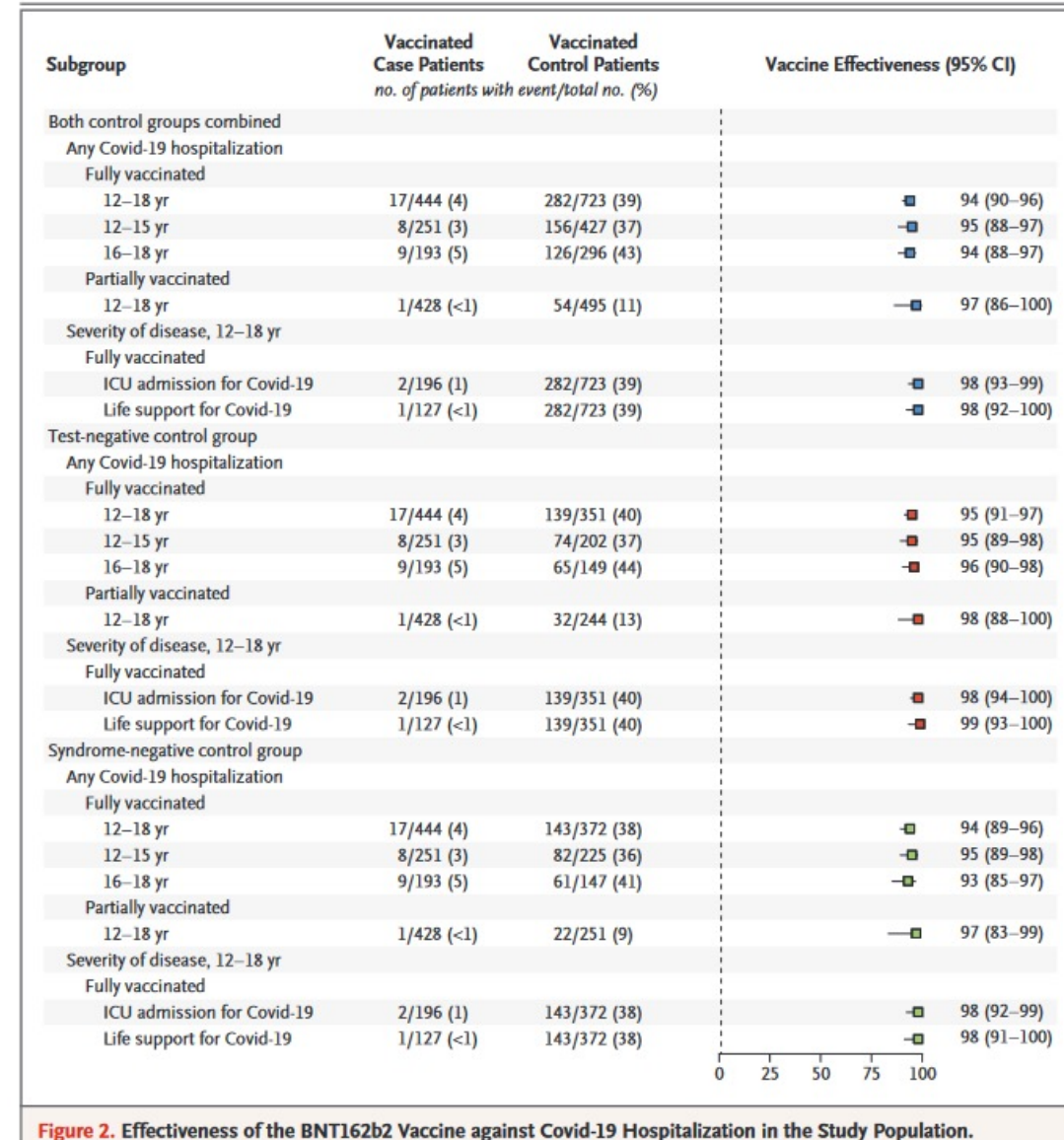
<b>Total Vaccine Doses</b> Delivered 632,575,655 Administered 515,162,867 <a href="#">Learn more about the distribution of vaccines.</a>	At Least One Dose	Fully Vaccinated	Booster Doses***
	Fully Vaccinated* People	Count	Percent of US Population
	Total	207,016,514	62.4%
	Population ≥ 5 Years of Age	207,006,442	66.3%
	Population ≥ 12 Years of Age	202,375,514	71.4%
	Population ≥ 18 Years of Age	188,777,814	73.1%
	Population ≥ 65 Years of Age	48,079,504	87.7%
207.0M People fully vaccinated			
73.0M People received a booster dose**			

<b>Total Vaccine Doses</b> Delivered 632,575,655 Administered 515,162,867 <a href="#">Learn more about the distribution of vaccines.</a>	At Least One Dose	Fully Vaccinated	Booster Doses***
	Fully Vaccinated* People with a Booster Dose**	Count	Percent of Fully Vaccinated*
	Total	72,991,028	35.3%
	Population ≥ 18 Years of Age	72,344,151	38.3%
	Population ≥ 50 Years of Age	49,191,993	50.1%
	Population ≥ 65 Years of Age	28,668,993	59.6%
207.0M People fully vaccinated			
73.0M People received a booster dose**			



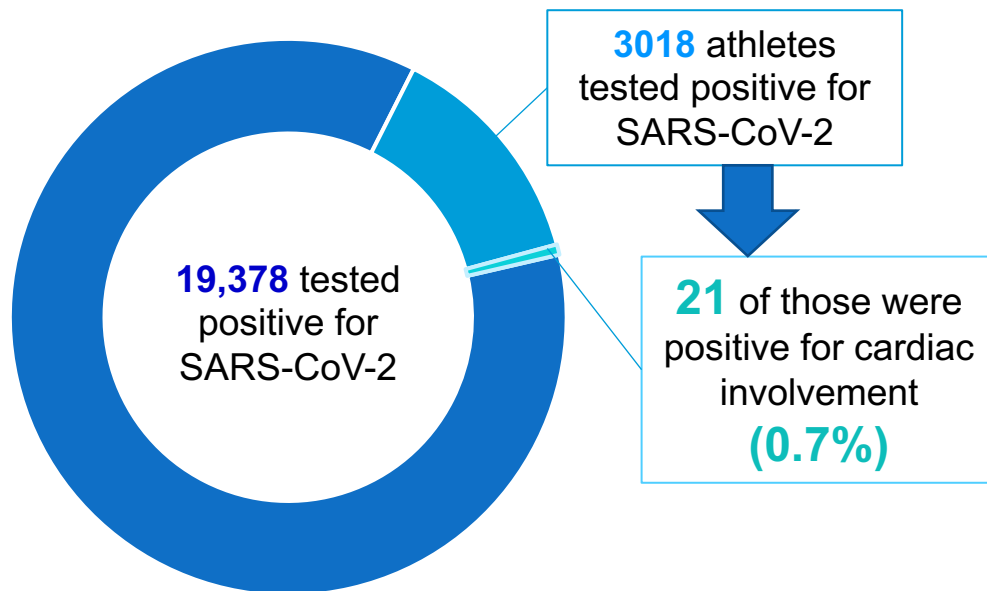
# Effectiveness of BNT162b2 Vaccine against Critical Covid-19 in Adolescents

- Methods: Study used a case–control, test-negative design to assess vaccine effectiveness against Covid-19 resulting in hospitalization, admission to an ICU, use of life-supporting interventions (mechanical ventilation, vasopressors, and extracorporeal membrane oxygenation), or death, 7/1/20-10/25/21
- Results: 445 cases and 777 controls enrolled. Overall, 17 cases (4%) and 282 controls (36%) had been fully vaccinated. Of the case patients, 180 (40%) were admitted to the ICU, and 127 (29%) required life support; only 2 patients in the ICU had been fully vaccinated. The overall effectiveness of the BNT162b2 vaccine against hospitalization for Covid-19 was **94%** (95% CI, 90 to 96); the effectiveness was **95%** (95% CI, 91 to 97) among test-negative controls and **94%** (95% CI, 89 to 96) among syndrome-negative controls. The effectiveness was **98% against ICU admission and 98% against Covid-19 resulting in the receipt of life support. All 7 deaths occurred in patients who were unvaccinated.**



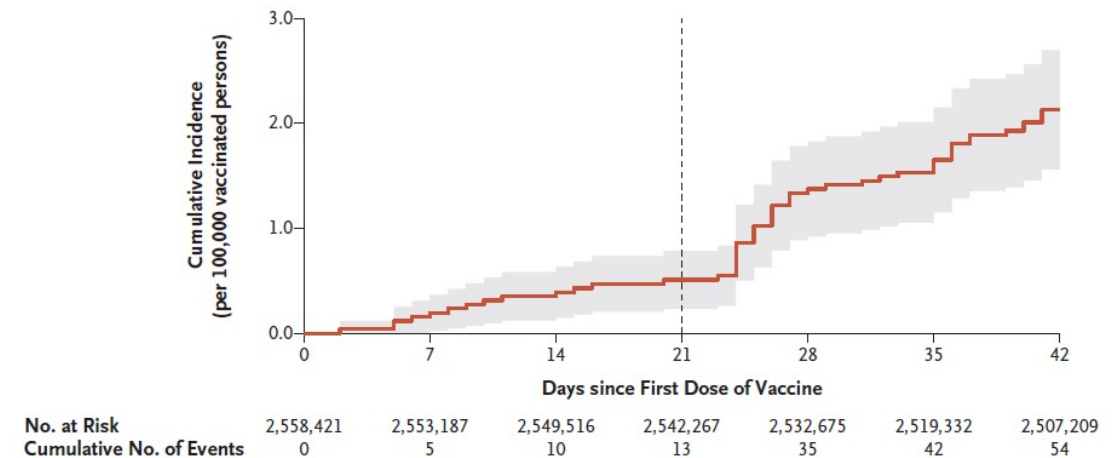
# Risk of Myocarditis Post-COVID-19 Infection or mRNA Vaccination

Young (20 years of age) competitive athletes across 42 colleges and universities in the US were prospectively followed and tested over a 4-month time period<sup>1</sup>



Retrospective analysis of healthcare records of 2.5 million vaccinated individuals (>16 years) in Israel<sup>2</sup>

## Kaplan–Meier Estimates of Myocarditis at 42 Days<sup>2</sup>



Overall estimated IR: 2.13 cases per 100,000 (95% CI: 1.56–2.70)<sup>2</sup>

Highest incidence rate: 10.69 cases per 100,000 (95% CI: 6.93–14.46) among males aged 16–29 yrs<sup>2</sup>

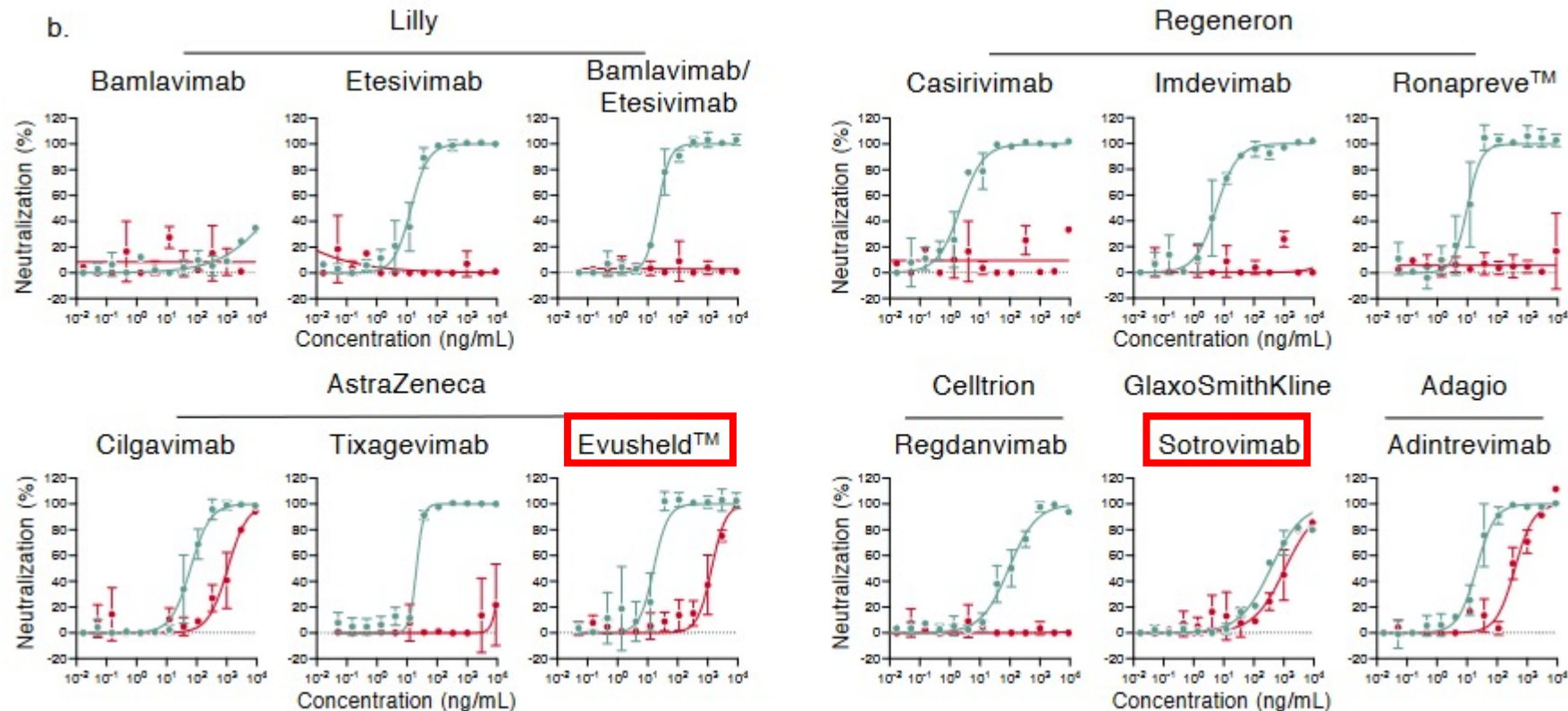
Cases of myocarditis after COVID-19 or vaccine both were relatively rare and tended to be mild or moderate in severity<sup>1,2</sup>

CI, confidence interval.

1. Moulson N, et al. *Circulation*. 2021;144:256-266. 2. Witberg G, et al. *N Engl J Med*. 2021. Oct 6. DOI: 10.1056/NEJMoa2110737

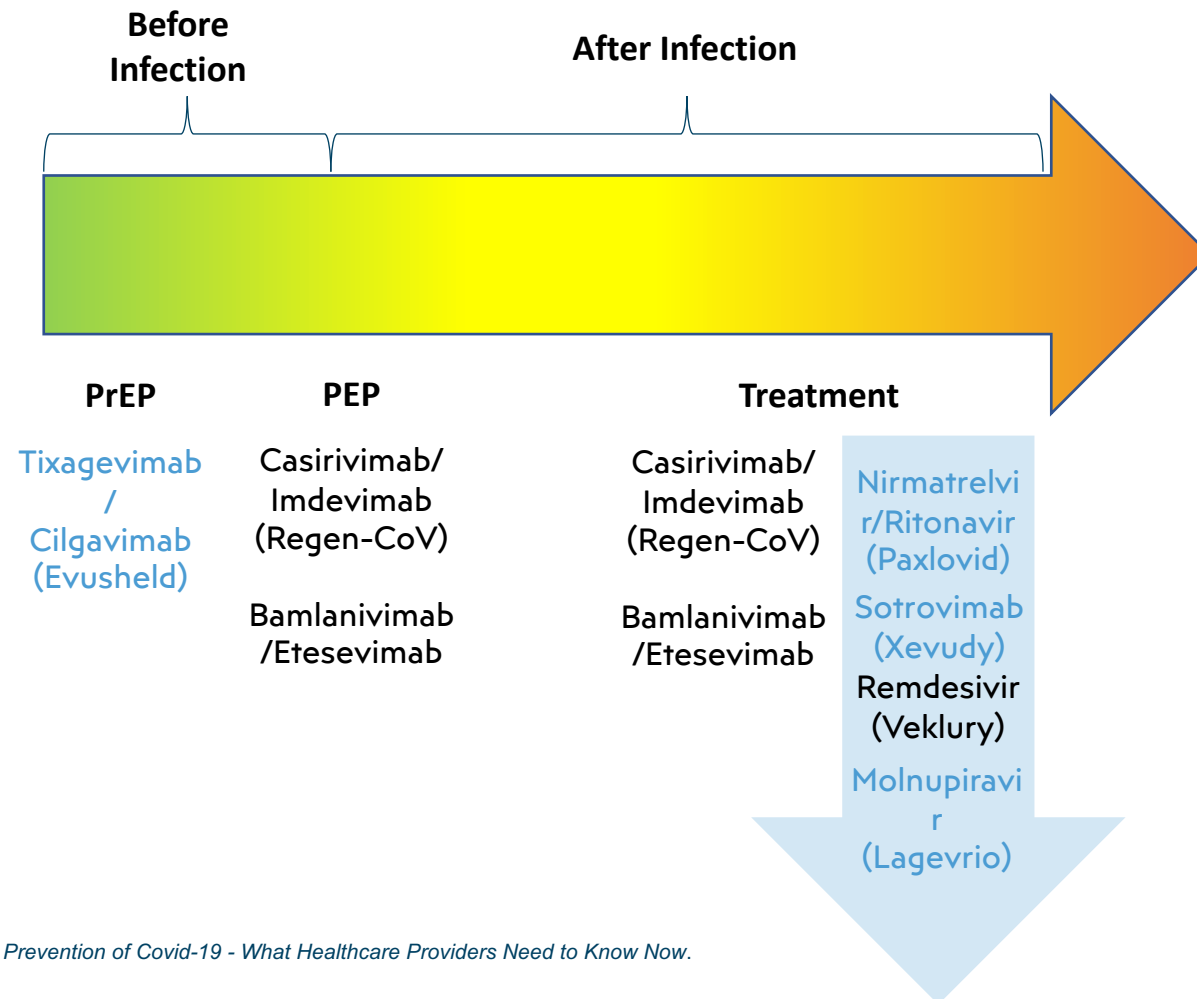


# Considerable Escape of SARS-CoV-2 Variant Omicron to Antibody Neutralization



BR11 (Chinese drug) combination maintains activity with reduced  $IC_{50}$

# COVID Therapeutics Overview



Wohl, D. (2021, December). *Treatment and Prevention of Covid-19 - What Healthcare Providers Need to Know Now.*

# NEW CDC MASK GUIDANCE, 14 JANUARY, 2022

A respirator has better filtration, and if worn properly the whole time it is in use, can provide a higher level of protection than a cloth or procedural mask. A mask or respirator will be less effective if it fits poorly or if you wear it improperly or take it off frequently. A respirator may be considered in certain situations and by certain people when greater protection is needed or desired: 1) **When caring for someone who is sick with COVID-19**; 2) **If you are at increased risk for severe illness, for example, people who are immunocompromised, older adults, and people with certain underlying medical conditions**; 3) **When working at a job where you interact with large numbers of the public, especially when not everyone is consistently wearing a mask**. For example, bus drivers and grocery store workers; 4) When riding on planes, buses, trains, or other forms of public transportation\*, especially if it is for a long period of time on crowded conveyances; 5) **When physical distancing is not possible or when you are in crowded indoor or outdoor public settings**; 6) **If you are not up to date on COVID-19 vaccinations**.

Concerns with new CDC guidance: 1) 60% of K95s (per CDC) are counterfeit; 2) K95s not standardized; may be less effective than a medical mask; 3) Potential shortages of N95s for HCP in high risk situations (e.g., COVID-19 patients, AGPs); 4) Failure to wear proper size of K95/N95 may reduce effectiveness; 5) Persons wearing a K95 or N95 may periodically remove due to claustrophobia or perceived difficulty breathing; 6) Since SARS-CoV-2 is endemic, sets a new standard for routine use of N95s in the hospital for all patient contacts/activities for the future. 7) No epidemiologic studies demonstrate that K95/N95 better at preventing COVID-19 for the public.

<https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/types-of-masks.html>

## Wear a mask with the best fit, protection, and comfort for you.

 <b>N95 Respirator</b> NIOSH-approved	 <b>KN95 Respirator</b>	 <b>Disposable Mask</b> Sometimes referred to as "surgical masks" or "medical procedure masks"	 <b>Cloth Mask</b> Non-medical, made of fabric
When worn correctly, respirators offer the highest level of protection and filter 95% of particles.	Filtration varies depending on standard. When worn correctly, KN95s provide more protection than disposable masks.	Disposable masks offer more protection than cloth masks.	Layered finely woven cloth masks offer more protection. Loosely woven cloth masks provide the least protection.



Masks and respirators should not be worn by children younger than 2 years old.

[cdc.gov/coronavirus](https://cdc.gov/coronavirus)



Table 1. Face Mask Fitted Filtration Efficiency (FFE) Against Submicron Particle Penetration

Face mask	Condition	Approved	% FFE (SD) <sup>a</sup>	No. of masks tested on male test individual
<b>Commonly used</b>				
MAXAIR Controlled Air Purifying Respirator system <sup>b</sup>	New	NA	99.6 (0.1)	1
3M 8210 N95 <sup>b</sup>	New	Yes <sup>c</sup>	97.9 (0.5)	2
3M 8210 N95 <sup>b</sup>	Expired in 2011	NA	98.5 (0.4)	3
3M 1860 N95 <sup>b</sup>	New	Yes <sup>c</sup>	98.5 (0.4)	1
3M 1860 N95 <sup>b</sup>	Expired in 2009	NA	97.0 (1.0)	3
3M 1860 N95 <sup>b</sup>	EtO sterilized	NA	98.1 (0.5)	3
3M 1860 N95 <sup>b</sup>	H <sub>2</sub> O <sub>2</sub> sterilized	NA	96.8 (0.7)	1
3M 1870+ Aura N95 <sup>b</sup>	New	Yes <sup>c</sup>	99.2 (0.3)	1
3M 1870+ Aura N95 <sup>b</sup>	Autoclaved	NA	98.0 (0.4)	3
Halyard Health 46827 N95 <sup>b</sup>	New	Yes <sup>c</sup>	99.5 (0.1)	1
<b>Surgical mask</b>				
With ties	New	NA	71.5 (5.5)	4
With ear loops	New	NA	38.1 (11.4)	3
<b>Less commonly used</b>				
Dasheng DTC-3Z with head straps <sup>b</sup>	New	Yes <sup>c</sup>	99.2 (0.3)	1
3M 8511 N95 with exhaust valve <sup>b</sup>	New	Yes <sup>c</sup>	98.0 (0.5)	1
Moldex 2200 N95 <sup>b</sup>	New	Yes <sup>c</sup>	97.8 (0.5)	1
One Sperial HC-NB295F Duckbill <sup>b</sup>	New	Yes <sup>c</sup>	97.7 (0.7)	1
3M 9010 CN N95 <sup>b</sup>	New	Yes <sup>c</sup>	97.6 (0.8)	1
Dasheng DTC-3W with head straps <sup>b</sup>	New	Yes <sup>c</sup>	95.5 (1.2)	1
Safemark Magic City 6950 Duckbill <sup>b</sup>	New	Yes <sup>c</sup>	95.2 (1.3)	1
U-Line S-9632	New	Yes <sup>c</sup>	94.2 (1.4)	1
SAS Safetycorp 8617 Duckbill	New	Not listed	93.2 (1.4)	1
Willson Saf-T Fit N1105 medium/large (Honeywell)	New	Yes <sup>c</sup>	93.0 (1.8)	1
Fangtian Duckbill FT-032 with exhaust valve	New	Not listed	86.2 (2.8)	1
Safe-Life N95 B150	New	Not listed	85.9 (2.0)	1
Jia Hu Kang KN95 mask with ear loops	New	Not listed	85.1 (2.2)	1
Dasheng DTC-3X1 with ear loops	New	Yes (CDC only) <sup>d</sup>	79.7 (4.4)	1
Zhongshan Dongfeng Huangshang GM700	New	Not listed	79.2 (6.8)	1
Dasheng DTC-3X2 with ear loops	New	Yes (CDC only) <sup>d</sup>	76.8 (5.5)	1
Guangdong Fei Fan KN95	New	Not listed	53.2 (6.8)	1

Table. Face Mask FFE Against Submicron Particle Penetration

Consumer-grade face masks	Condition	% FFE (SD) <sup>a</sup>
<b>2-Layer nylon mask with ear loops</b>		
Without aluminum nose bridge	New	44.7 (6.4)
With aluminum nose bridge	New	56.3 (6.5)
With aluminum nose bridge and 1 insert	New	74.4 (4.8)
With aluminum nose bridge, washed (no insert)	Washed 1 time	79.0 (4.3)
<b>Cotton bandana</b>		
Folded surgeon general style	New	49.9 (5.8)
Folded "bandit" style	New	49.0 (6.2)
Single-layer polyester gaiter/neck cover (balaclava bandana)	New	37.8 (5.2)
Single-layer polyester/nylon mask with ties	New	39.3 (7.2)
Polypropylene mask with fixed ear loops	New	28.6 (13.9)
3-Layer cotton mask with ear loops	New	26.5 (10.5)
<b>Medical face masks and modifications</b>		
3M 9210 NIOSH-approved N95 respirator	New	98.4 (0.5)
Surgical mask with ties	New	71.5 (5.5)
Procedure mask with ear loops	New	38.5 (11.2)
<b>Procedure mask with ear loops</b>		
Loops tied and corners tucked in	New	60.3 (11.1)
Ear guard	New	61.7 (6.5)
23-mm Claw hair clip	New	64.8 (5.1)
Fix-the-mask (3 rubber bands)	New	78.2 (3.3)
Nylon hosiery sleeve	New	80.2 (3.1)

Table. Fitted Filtration Efficiency (FFE) of Face Masks Tested in 1 Female and 2 Male Volunteers<sup>a</sup>

Face mask	FFE, mean (SD), %		
	Single mask	Double mask	Difference
<b>Procedure ear-loop masks</b>			
Medline	53 (8)	68 (16)	14 (15)
Henry	62 (11)	74 (4)	12 (7)
Shine Ya	43 (2)	55 (10)	12 (8)
Intco	61 (13)	66 (9)	4 (12)
<b>Cloth masks</b>			
Hanes cotton ear-loop mask	44 (12)	57 (14)	14 (4)
Procedure mask worn over	NA	59 (18)	16 (10)
Procedure mask worn under	NA	66 (5)	23 (12)
Cotton bandana	44 (4)	NA	NA
Procedure mask worn over	NA	55 (10)	11 (8)
Procedure mask worn under	NA	77 (10)	33 (10)
Polyester gaiter	41 (12)	NA	NA
Procedure mask worn over	NA	60 (14)	19 (7)
Procedure mask worn under	NA	81 (6)	40 (6)

Sickbert-Bennett E, et al. JAMA 2020;180:1607; Clapp P, et al. JAMA 2021;181:463; Sickbert-Bennett E, et al. JAMA Intern Med 2021;181:1126





*Questions?*