What You Need to Know About Variants: Omicron and Beyond

Tara Kerin, PhD
UCLA
David Geffen School of Medicine
Department of Infectious Diseases
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Does this ever end?
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Current State of COVID-19
Worldwide

- **Current daily average number of cases:** 2,883,443
  - Previous high was ~827K new cases a day in April 2021
  - Total cases: 331 million

- **Current daily average number of deaths:** ~7,000
  - Previous peak was ~14,500 a day in January 2021
  - Total number of worldwide deaths: 5.5 Million (1.68%)

- **Total number of vaccinations**
  - At least one dose: 4.6 Billion (59.5%)
  - Fully Vaccinated*: 3.9 Billion (50.3%)
  - Boosted: 554.6 Million (7.0%)
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<th><strong>In the US</strong></th>
<th><strong>In California</strong></th>
<th><strong>In LA county</strong></th>
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*Data complied from the New York Times, the CA dept of PH, and the LA county PH*
Omicron

- Reported to WHO from SA on Nov 24
- Nov 26 - 9.2% positivity rate
- Dec 3 - 24.3% positivity rate

- First Case in US on Dec 1
- By Jan 11th - 99% of cases
- LA - increased 10 fold - one month

- ~50 mutations
- 36 on the spike protein
Omicron in Kids

1. Children make up ~18% of cases
   a. Possibly due to older being vaccinated
   b. More in person interactions

2. Hospitalizations are increasing
   a. Increases across the spectrum
   b. Still the lowest rate
      i. 1.13 new admissions per 100,000 children
Omicron- In with a bang, out with a whimper?

The Bang

• More contagious
  -replicated 70 times higher than the Delta variant and the original virus in the bronchial tissue

• Quick wave?
  -cases peaked in 3 weeks in SA
  -hospital rates lower than before

The Whimper

• Less severe?
  -replicated less efficiently (10 times lower) in lung tissue than the original strain

• Slow roll?
  -still not below pre omicron levels
  -hospitalizations/deaths still going up

Chan Chi-wai, et al, Dec 2021; JHSPH and JHWSE data
Vaccines, Testing, and Masks
Do Vaccines Work Against Omicron?

van der Straten et al, 2022, preprint
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From December 13, 2021 to December 19, 2021, unvaccinated people were **20.8 times more likely** to die from COVID-19 than fully vaccinated people.
T-Cells aren’t recognizing the spike protein. They still recognize Omicron, and provide a strong response.

**B Cells**
- Make the antibodies to bind to spike protein

**NK Cells**
- Part of the innate immune system - ready to kill any foreign cells

**T Cells**
- Both inform the B cells to make antibodies and release cytokines to kill the virus

Keeton et al, 2022
**Booster Data**

Garcia-Beltran et al, *CELL*, Dec 2021

**TAKE AWAY**-
- 56% less likely to become infected compared to vaccinated people who had not received a booster and less likely to pass it on (Lyngse et al, 2021, preprint)

- Boosters provide needed protection from Omicron infection by increasing antibodies.
- T-cells will prevent hospitalization / death
Vaccines Work

Even against Omicron for severe disease and death.

Boosters can further protect against infection
Two types of diagnostic test

Antigen (or flow or rapid)
- High Specificity (few false positives)
- Ok Sensitivity (~1/3 of true positives will give a false negative)
- Positive during infectious period

PCR (or NAT)
- High Sensitivity and Specificity
- Positive before and after infectious period
SARS-CoV-2 viral load

- Viral load
- Low analytic sensitivity (lateral flow test)
- High analytic sensitivity (PCR)

- Exposure
- Incubation
- Infectious
- Post infectious

Symptoms

Early infection detectable by PCR only (potentially pre-infectious)

Infectious

Late phase detectable by PCR only (potentially post-infectious)

PCR test continues to be positive in throat swabs
Average 17 days (maximum 83 days)
WHO TO TEST
1. Anyone showing symptoms
2. Anyone with a known exposure
3. Anyone attending a high risk event or visiting a vulnerable person

WHEN TO TEST
1. Immediately by PCR or 12-24 hrs. after symptoms by rapid
2. 3-5 days after exposure by PCR, 4-6 by rapid test
3. Within 48 hrs. by PCR and 24 hrs. by rapid test
Exposed?
1. Vaccinated and Boosted- watch for symptoms (no need to quarantine)
2. Not vaccinated or more than 6 months out since last vaccine shot? Wait 5 days. Watch for symptoms.

Infected?
• Positive PCR and/or Positive Rapid- Isolate for 10 days OR until a negative rapid test. Which ever comes first
Do masks prevent COVID?

YES. But it does depend on what kind

Howard et al. 2021
- Masks can be reused!
- Depends on the time used
- Wear a cloth mask over to protect the good mask
- Toss when soiled

**Table: Source is wearing (% outward leakage)**

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- Nothing: 100% 15 min 20 min 30 min 1.25 hr 2.5 hr
- Typical cloth mask: 75% 20 min
- Typical surgical mask: 50% 30 min
- Non-fit-tested N95 FFR: 20% 1.25 hr
- Fit-tested N95 FFR: 10% 2.5 hr

*The data are for non-nanoscale transmission units, assigned for more than one mask leakage source.*

**FFR = filtering facepiece respirator; N95 = not oil-proof, 95% efficient at NIOSH filter test conditions**
Masks are effective at reducing spread—specifically N95 (KN95, KF94)
But must consider AIR FLOW, DISTANCE, and INFECTIOUSNESS.
Does this ever end?
Likelihood of more variants

1. New lineage (Omicron)
2. May continue to compete with Delta
3. More than 45% of the world is unvaccinated
4. Viruses do not evolve in a predictable fashion
Is Omicron Going to Give Us Herd Immunity?
Not Yet...

- Do not know the extent of immunity
- Takes time to travel the world
- Kids under 5 still unprotected
- Vaccine inequality around the world
- Not enough antivirals or aggressive treatments for cases
- Expect at least one more “wave”
But who cares— it’s mild right? T cells will protect us.

- Strain on Hospitals and Resources
- Lost work/ productivity
- Unknown consequences of long-term COVID-19
  - Long COVID, neurological issues, lung damage, heart damage
- Still many who can not be vaccinated
- But we may be moving to an endemic
The Endemic Future

1. COVID-19 will never go away
   a. “sterilizing immunity”- preventing all infection
      i. Holy grail of vaccines- not really achievable.
      ii. HPV to the Flu
      iii. Focus on prevention of severe disease
   b. Two lineages or more are possible

2. Protection by vaccination essential- prevents escaping variants
Vaccination and natural infection

- Less severe disease
- Less spread
- Boosters- strain specific possible

OVER TIME

Body will recognize the virus and clear it quicker
Medications

- Specific Antivirals
  - Prevent binding
  - Stop replication
  - Block exits
  - Over the counter pills (Merck/ Pfizer)

- Monoclonal Antibodies
  - Prevention for immunocompromised
The Tools

**PREVENT**
- Vaccinate
- Booster

**RESTRICT**
- Masks
- Social Distance

**IDENTIFY**
- Test
- Contact Tracing
Is Our Omicron Wave Almost Over?

- YES
  - Positivity rate down to ~16%
  - Hospitalization rates slowing
  - Cases plateauing/ dropping
  - South Africa, Europe, East Coast all appear to be declining
RECOMMENDATIONS

Don’t

1. Panic
2. Become indifferent
3. Try to get COVID

Do

1. Get vaccinated and a booster shot
2. Mask/social distance
3. Test if having symptoms, known exposure or high risk events
RESOURCES

Guidance and Information:

Masks: Aaron Collins, the mask nerd
https://www.youtube.com/channel/UC3fF_rzkmZD0ufN685YE7lg

General Epi: Dr. Katelyn Jetelina, aka “your local epidemiologist”
https://yourlocalepidemiologist.substack.com/

More Science: Dr. Jeremy Faust
https://insidemedicine.bulletin.com/

Even More Science: This week in virology blog and podcast
https://www.virology.ws/

General Virology: Dr. Trudy Rey- “Catch This”
https://www.youtube.com/channel/UCoZ7xYyx3UijG6Xus1l73Vww

GET MASKS:
https://www.projectn95.org/

GET TESTS:
https://www.covidtests.gov/

Approved tests:

- CareStart COVID-19 Antigen Home Test
- iHealth COVID-19 Antigen Rapid Test
- BD Veritor At-Home COVID-19 Test
- SCoV-2 Ag Detect Rapid Self-Test
- BinaxNOW COVID-19 Antigen Self Test
- InteliSwab COVID-19 Rapid Test
- Celltrion DiaTrust COVID-19 Ag Home Test
- QuickVue At-Home OTC COVID-19 Test
- Flowflex COVID-19 Antigen Home Test
- BinaxNOW COVID-19 Ag Card 2 Home Test
- Ellume COVID-19 Home Test
Questions?

tkerin@mednet.ucla.edu

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