

Variants and Vaccines: The Current State of COVID

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DISCLOSURES

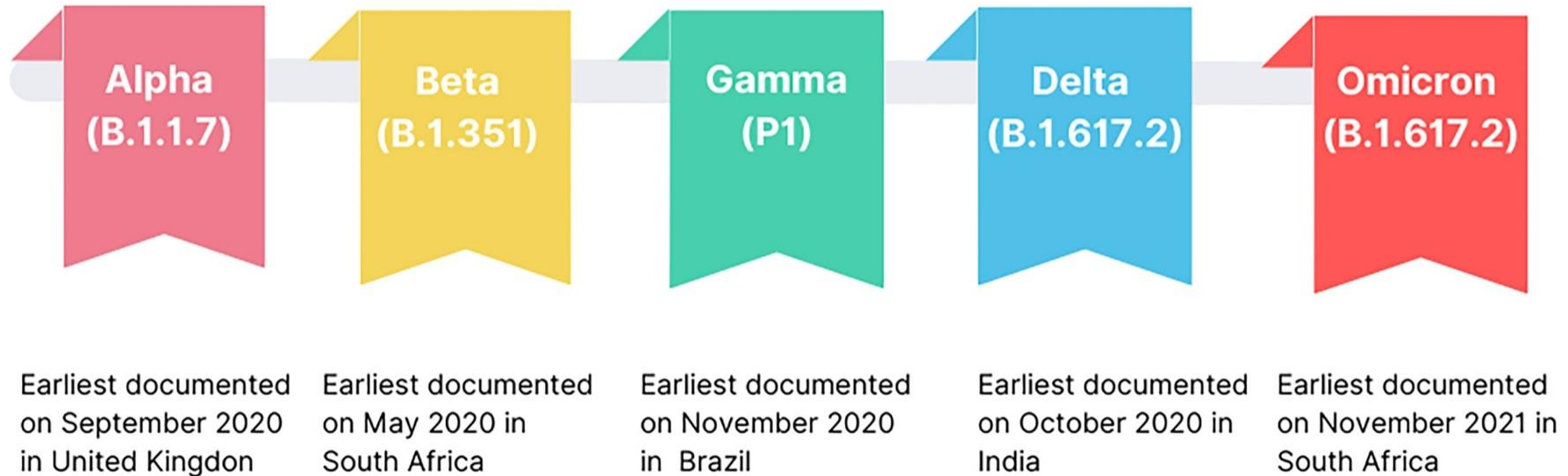
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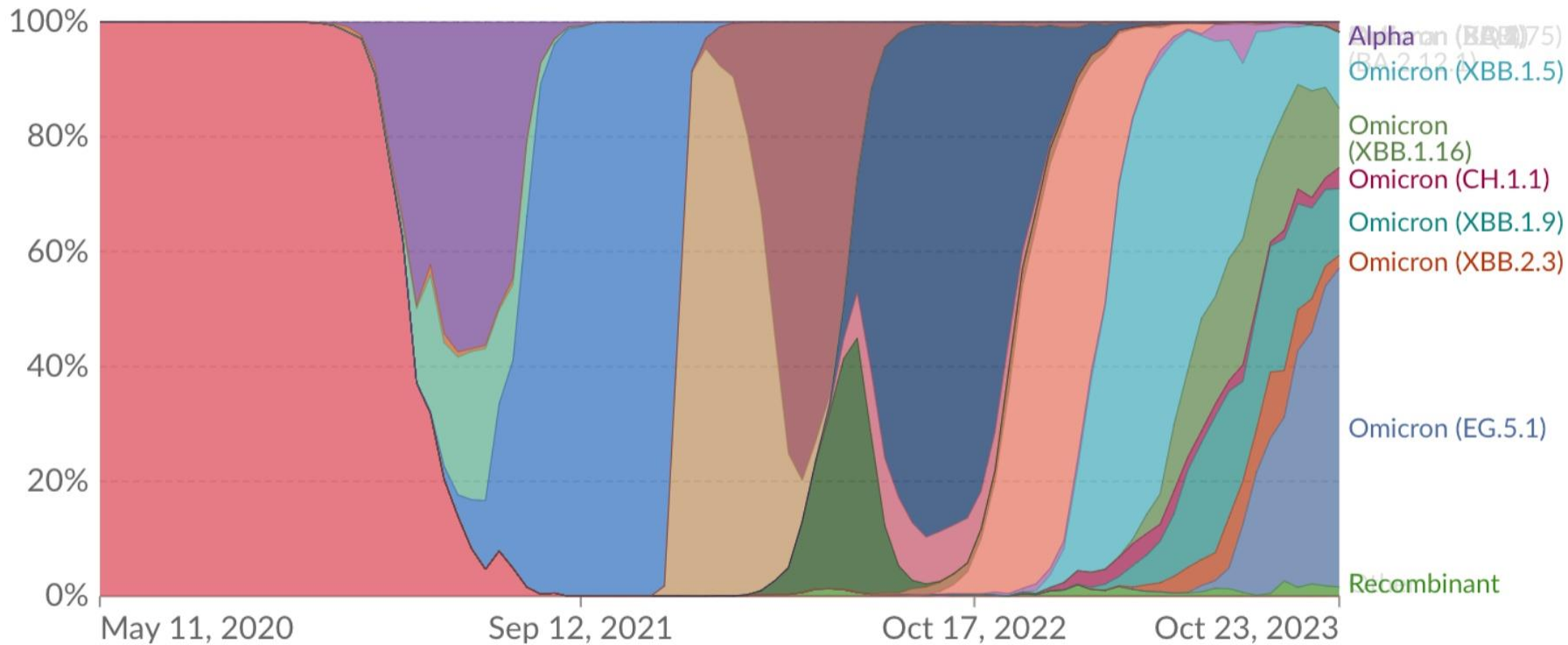
OBJECTIVES

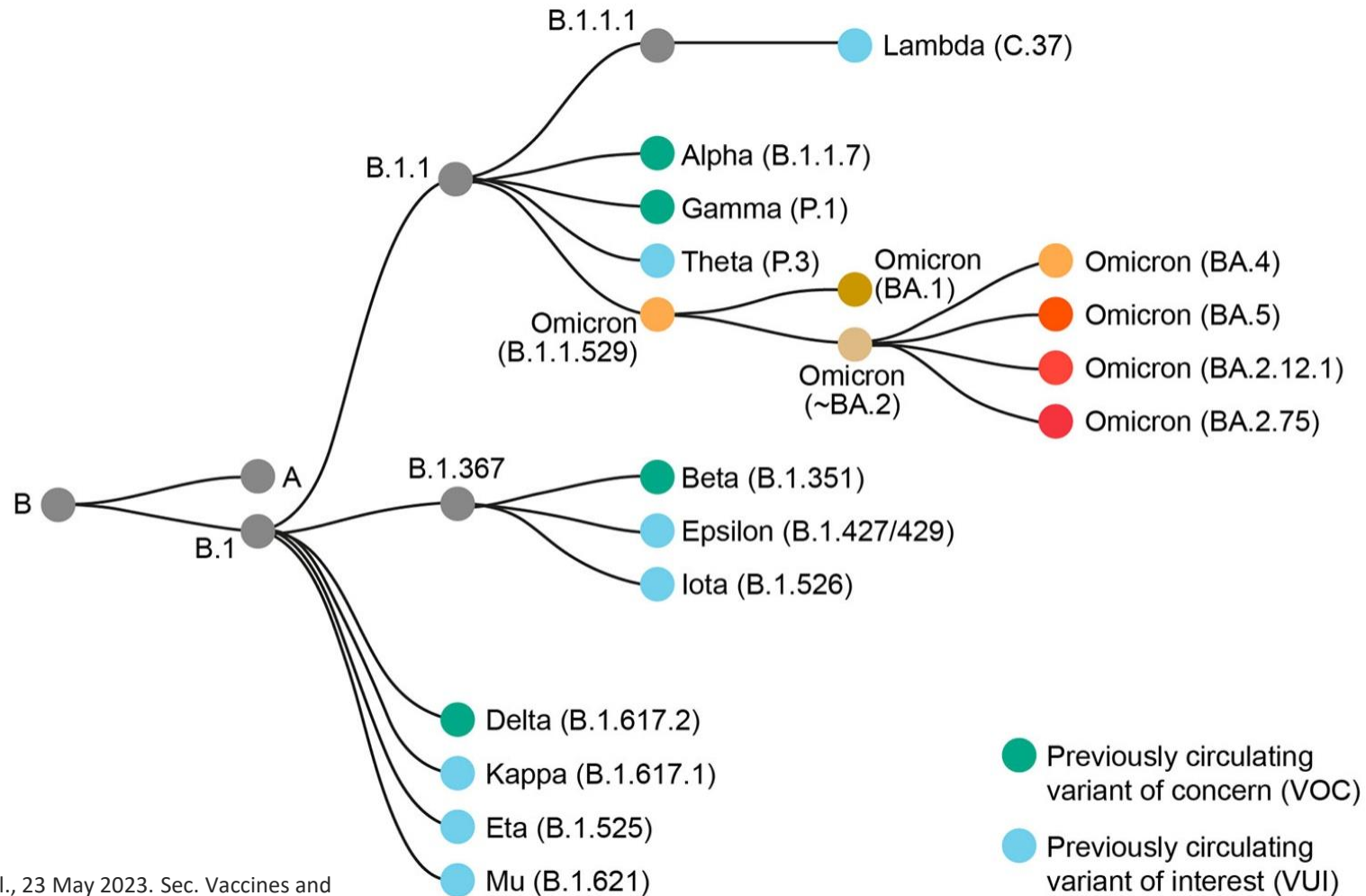
1 Provide an update on the current circulating variants and available vaccines.

2 Current evidence on the impact of vaccination on post-infection COVID syndromes

Timeline of the COVID-19 variants of concern





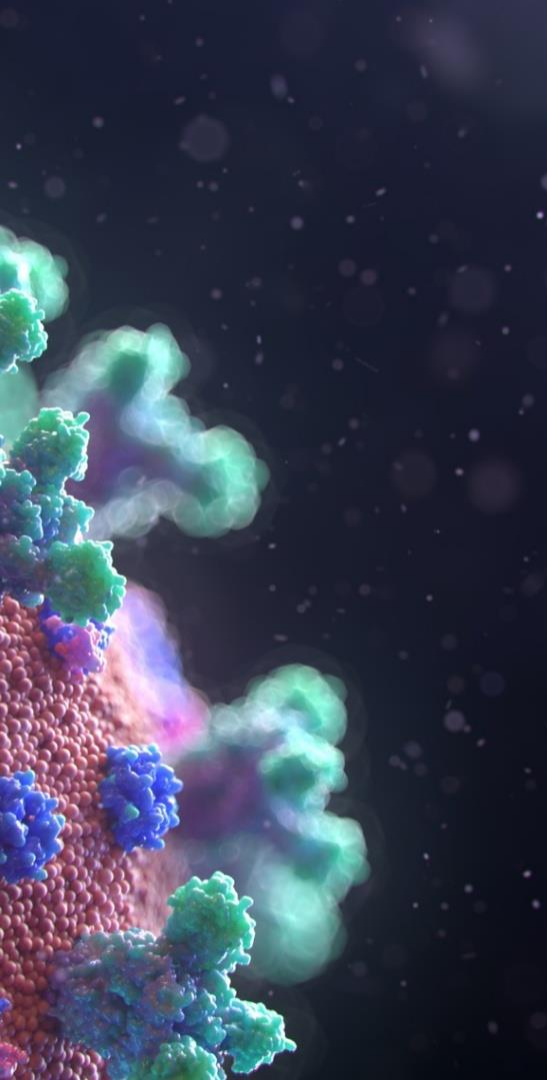


OMICRON CHANGED EVERYTHING

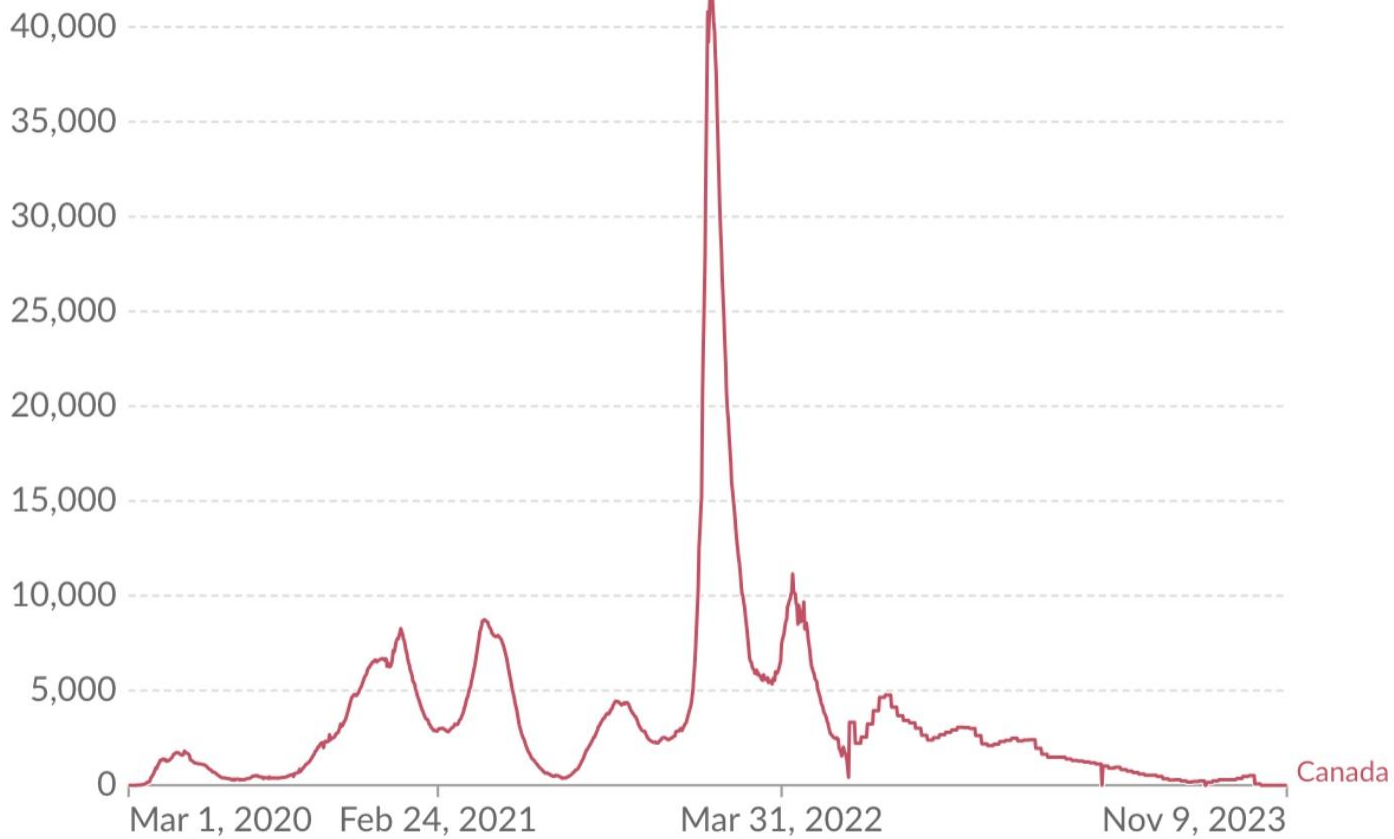
1 Highly transmissible

2 Unprecedented case numbers

3 Lower mortality





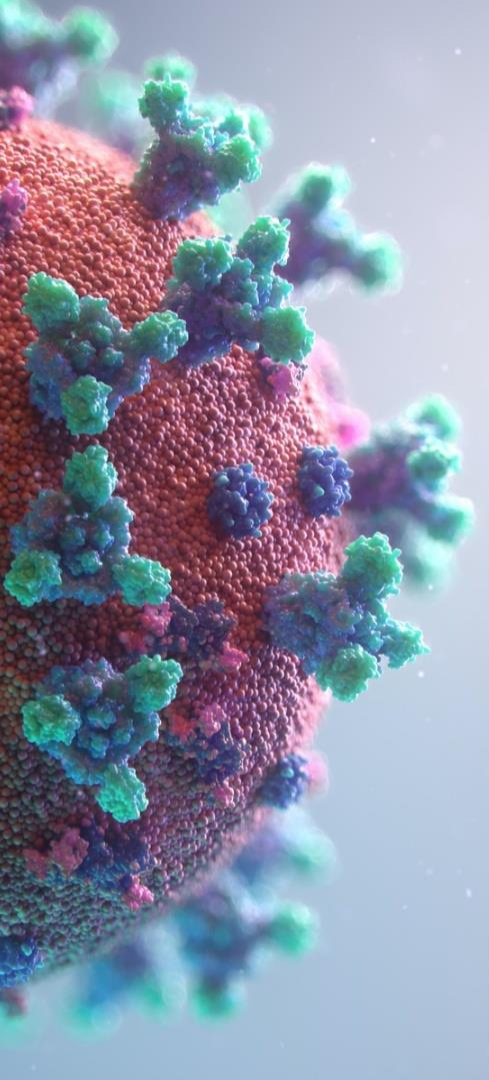


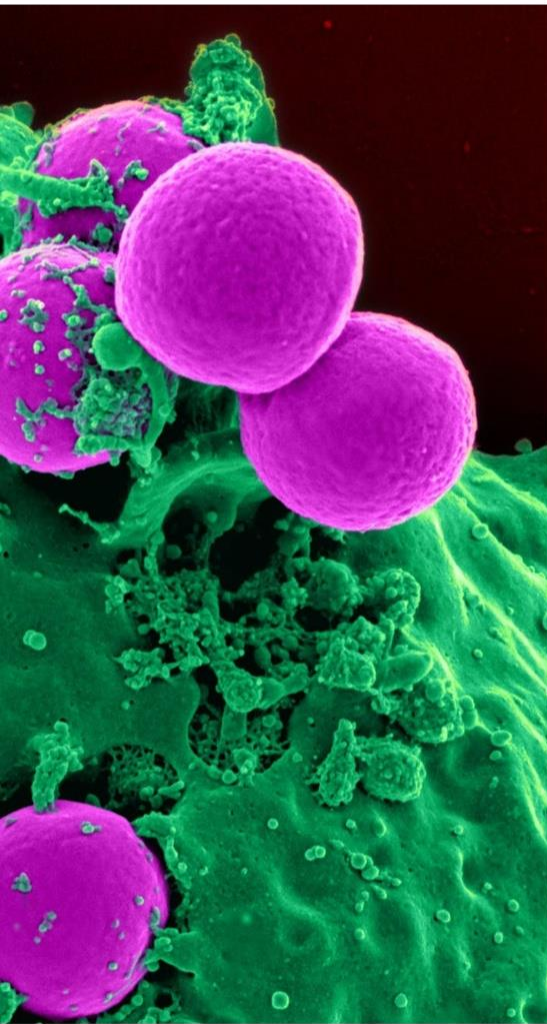
Canada

"BETWEEN APRIL AND AUGUST
2022, **98%** OF CANADIANS HAD
ANTIBODIES AGAINST COVID-19
54% HAD ANTIBODIES FROM
A PREVIOUS INFECTION"

OMICRON CHANGED EVERYTHING

- 1 Immuno-evasive
- 2 Higher risk of re-infection

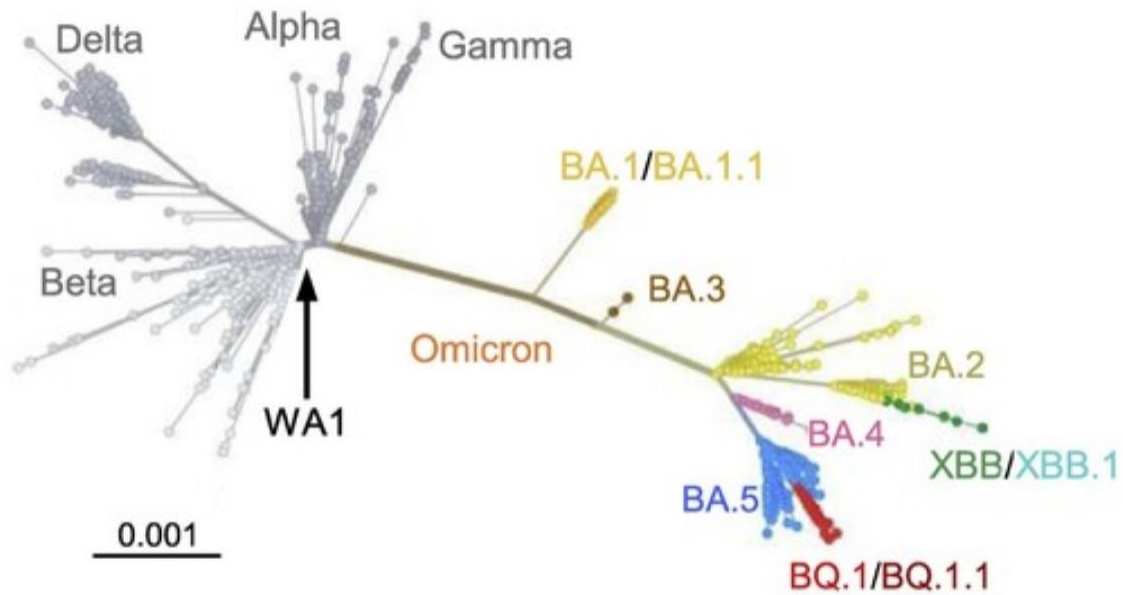


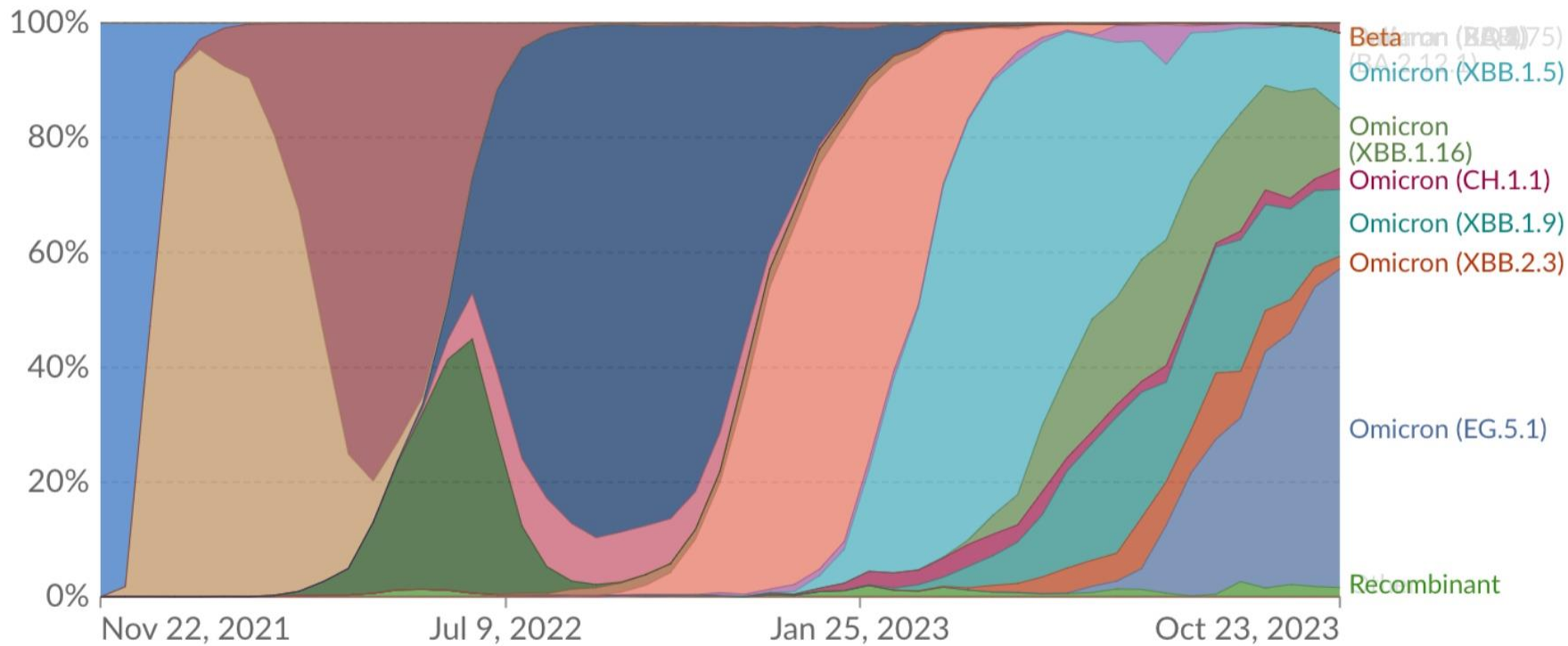


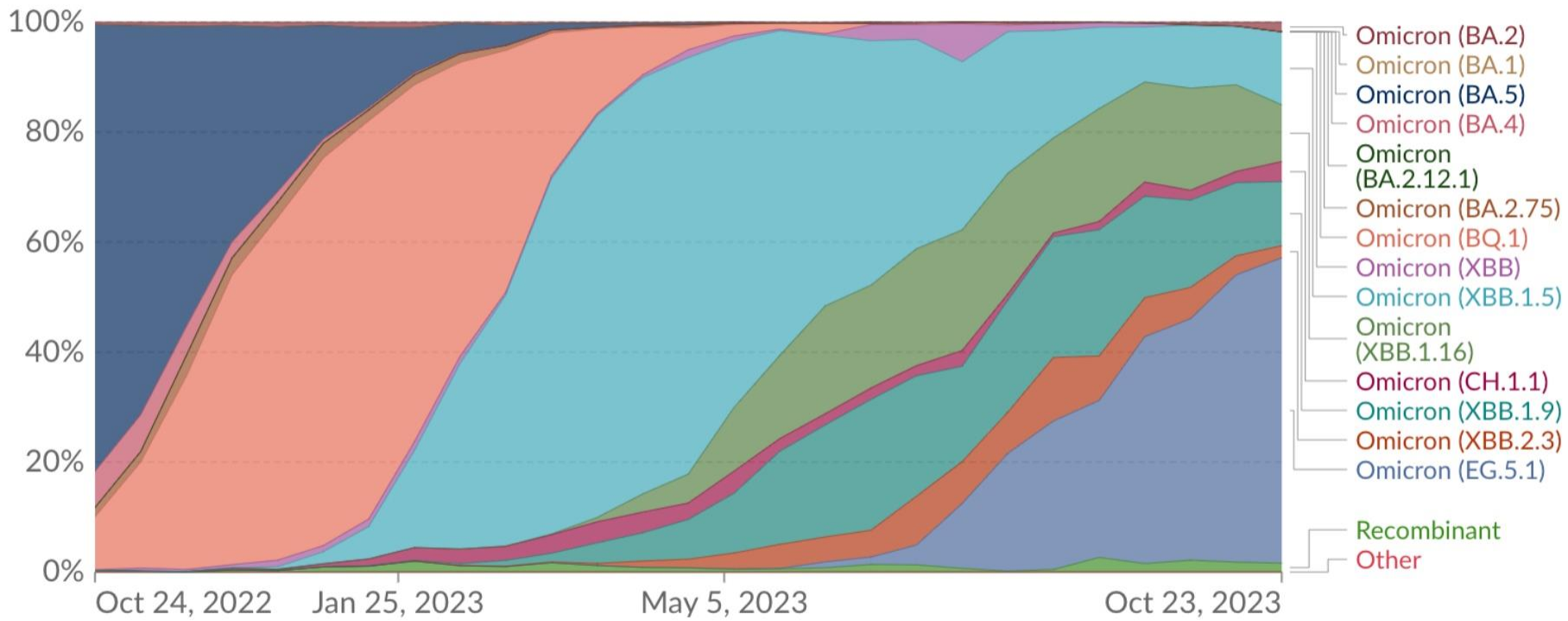
OMICRON CHANGED EVERYTHING

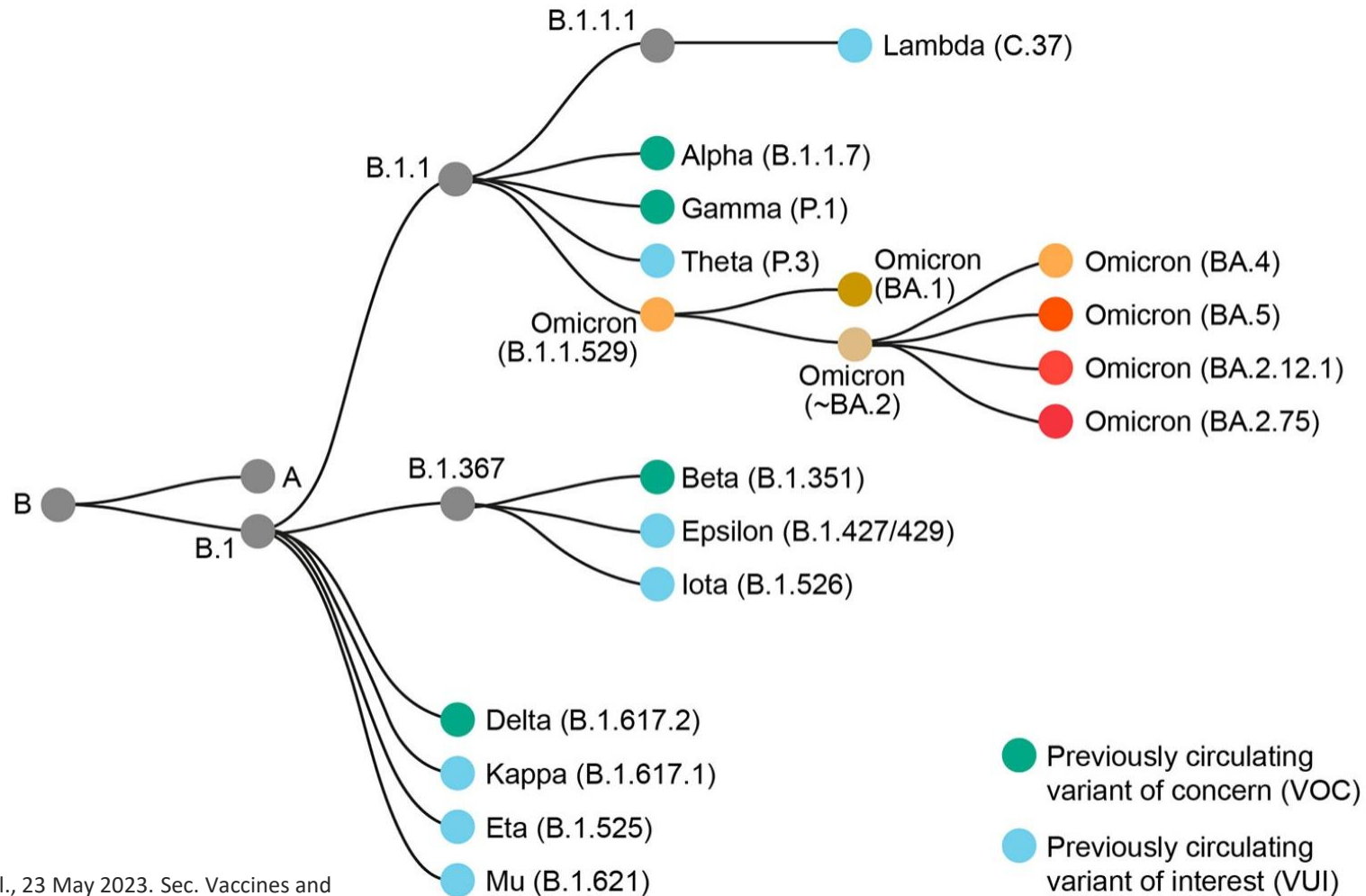
1 Subvariants emerge every ~**3 months**

2 Subvariants within subvariants









Percentage of samples sequenced

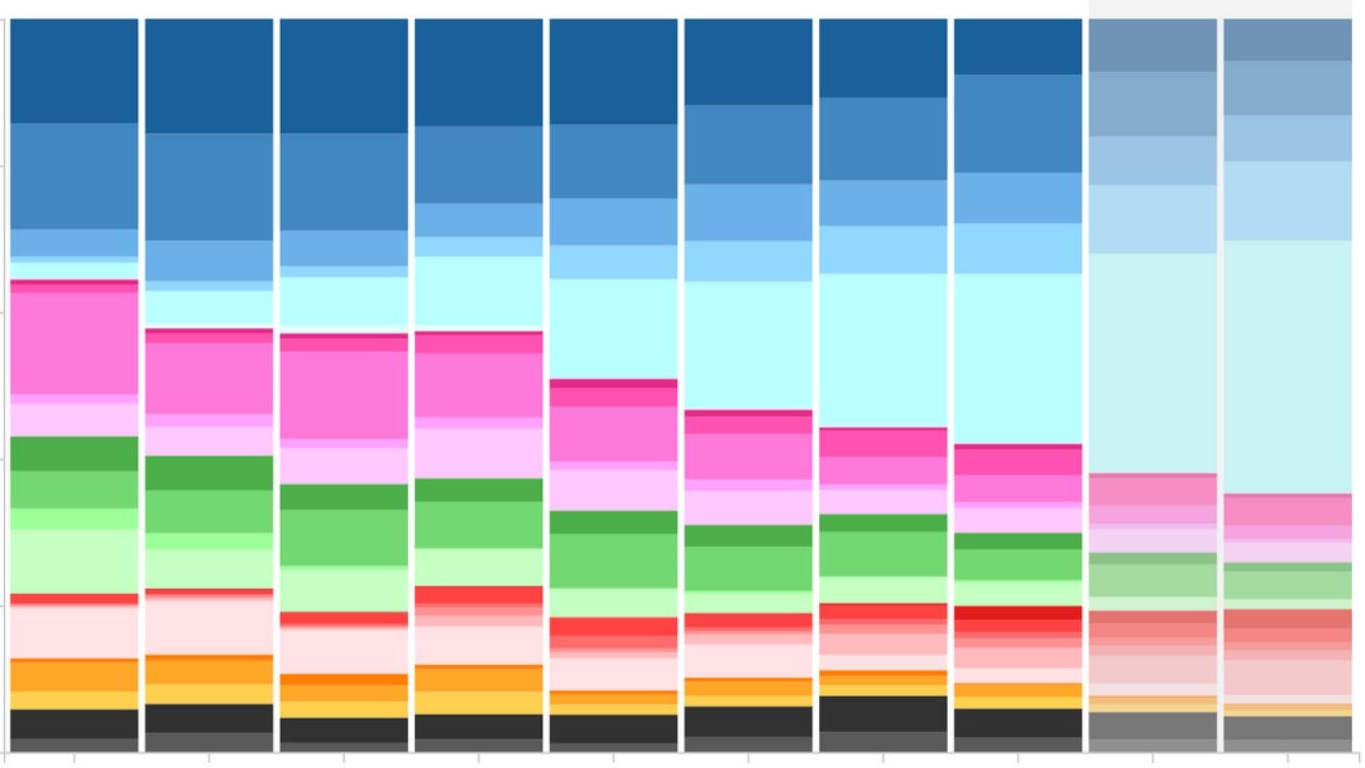
100%
80%
60%
40%
20%
0%

Aug 27, 2023
Sep 03, 2023
Sep 10, 2023
Sep 17, 2023
Sep 24, 2023
Oct 01, 2023
Oct 08, 2023
Oct 15, 2023
Oct 22, 2023
Oct 29, 2023

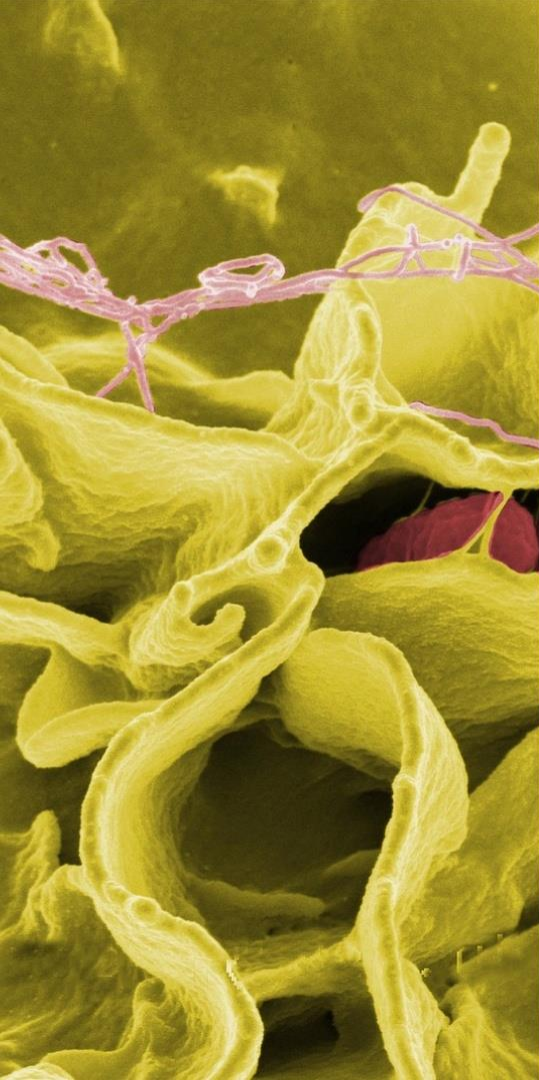
Nowcasted estimates

COVID-19 variants

- EG.5
- EG.5.1.1*
- EG.5.1*
- EG.5.1.3*
- HK.3*
- HV.1*
- EG.5*
- XBB.1.16
- XBB.1.9
- XBB.1.5
- XBB.2.3
- Other



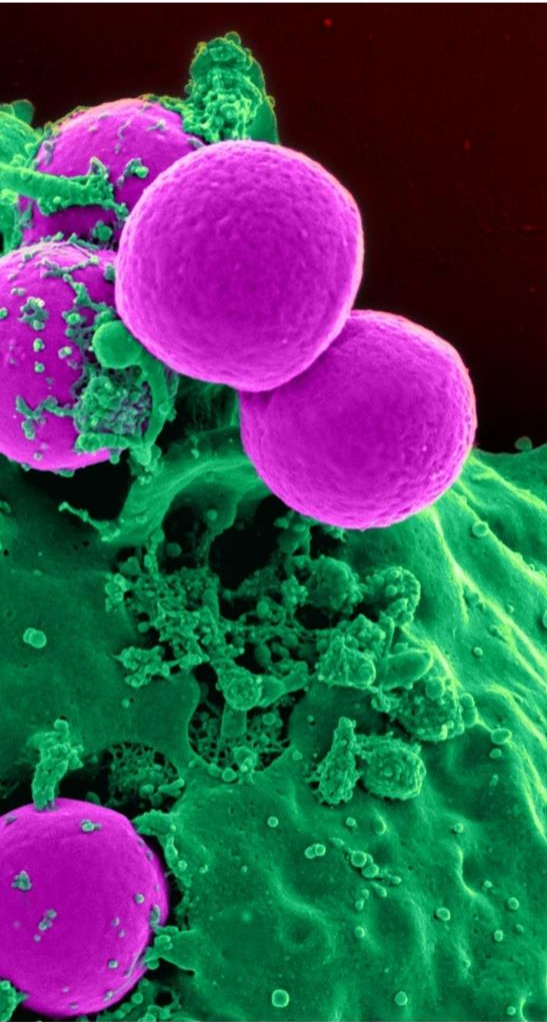
EG.5: WHAT'S THE DEAL?



1 Descendent of
Omicron
XBB1.9.2

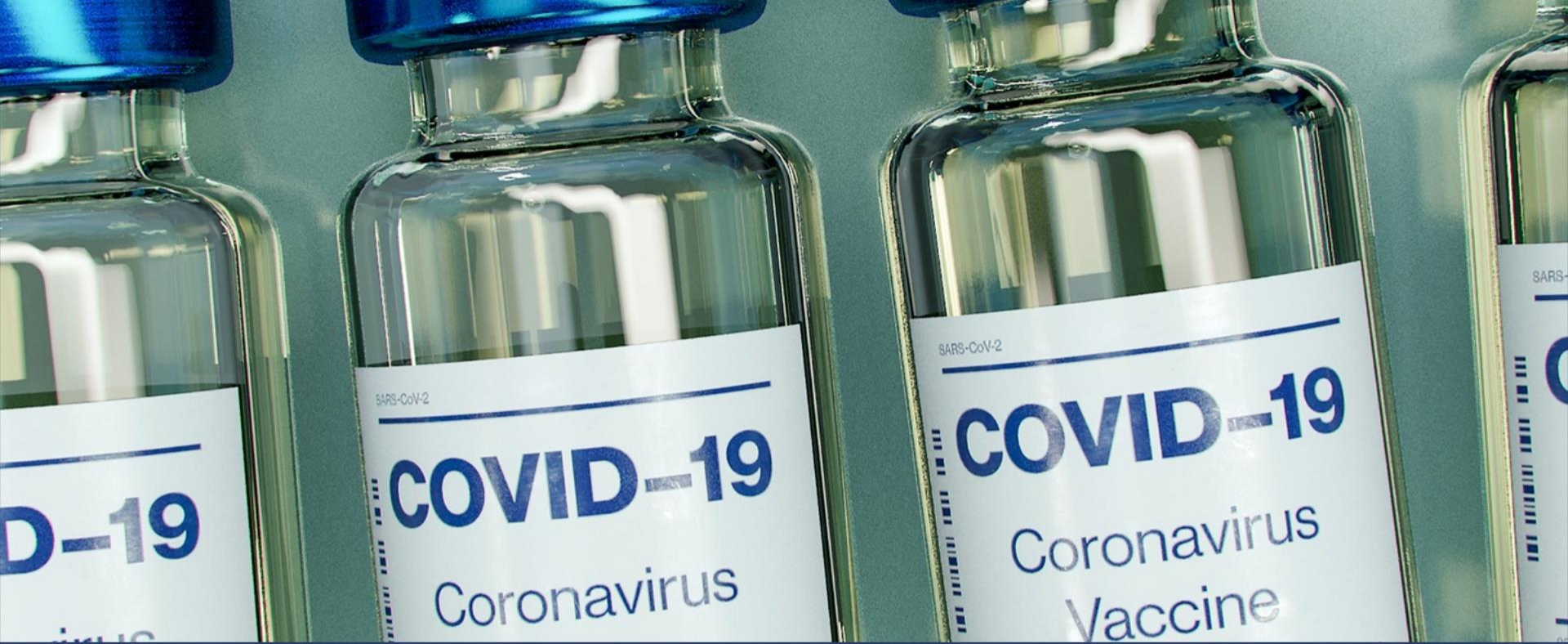
2 Presumably
vaccine
responsive

VARIANTS: CONCLUSIONS

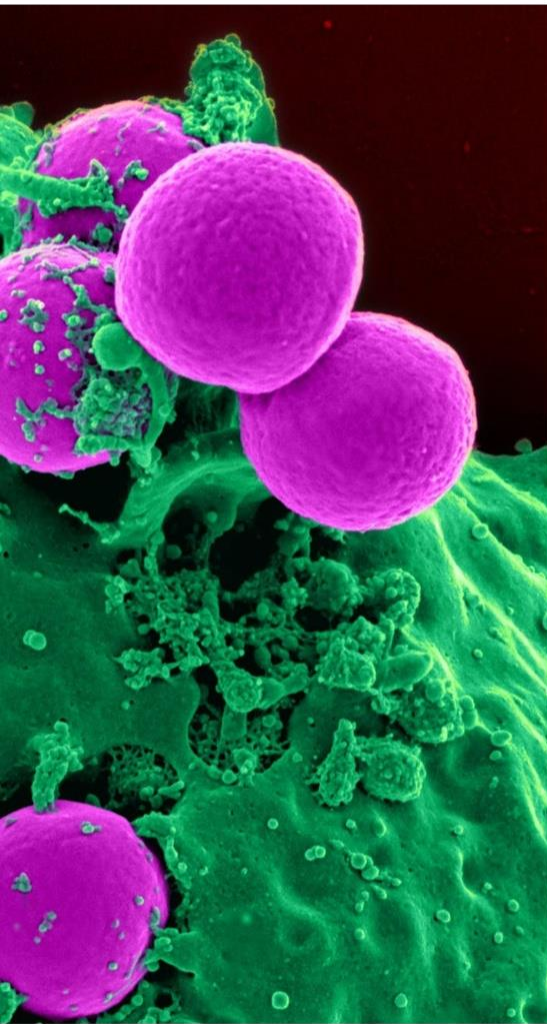


1 Omicron variants are inevitable

2 Progressive decline in mortality



VACCINES



OMICRON CHANGED EVERYTHING

1 Vaccines less effective, still responsive

2 Novel vaccines have therefore been created

R346K	Only found in a subset of sequences (2)	Resistance to neutralizing antibodies (12)
S371L	BA.1	Resistance to RBD neutralizing antibodies (all classes) (12)
N440K	BA.1, BA.2, BA.4, BA.5, BA.2.1.12	Resistance to neutralizing antibodies (12), increased fusogenicity (13)
G446S	BA.1	Resistance to neutralizing antibodies (12)
L452R	BA.4, BA.5	Increased binding to ACE2 (14)
L452Q	BA.2.12.1	
F486V	BA.4, BA.5	Broadly neutralizing antibody evasion (15)
E484A	BA.1, BA.2, BA.4, BA.5, BA.2.12.1	Neutralizing antibody evasion (16)
Q493R	BA.1, BA.2, BA.2.12.1 (Reverted to R493Q in BA.4 and BA.5)	Increased binding to ACE2 (17), neutralizing antibody evasion (12)
N501Y	BA.1, BA.2, BA.4, BA.5, BA.2.12.1	Increased binding to ACE2 (18)
H655Y	BA.1, BA.2, BA.4, BA.5, BA.2.12.1	Increased binding to ACE2/transmissibility (19); enhancement of endosomal entry (20, 21)
P681H	BA.1, BA.2, BA.4, BA.5, BA.2.12.1	Transmissibility (22); enhancement of endosomal entry (21)
N969K	BA.1, BA.2, BA.4, BA.5, BA.2.12.1	Reduced fusogenicity to S2 domain (23)
ORF1a/NSP6		
del3674–3676	BA.1	Protein stability (24)
del3675–3677	BA.2, BA.4, BA.5, BA.2.12.1	

MODERNA SPIKEVAX

MRNA

PFIZER-BIONTECH COMIRNATY

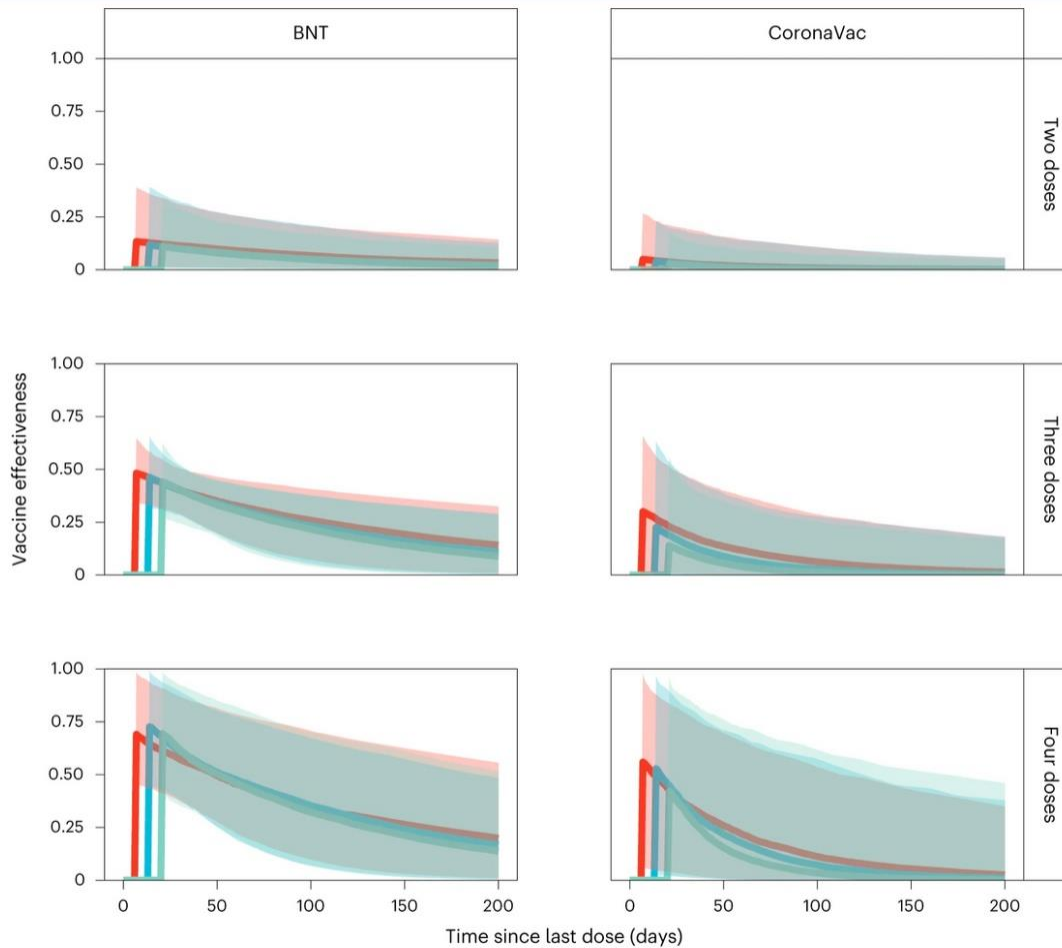
MRNA

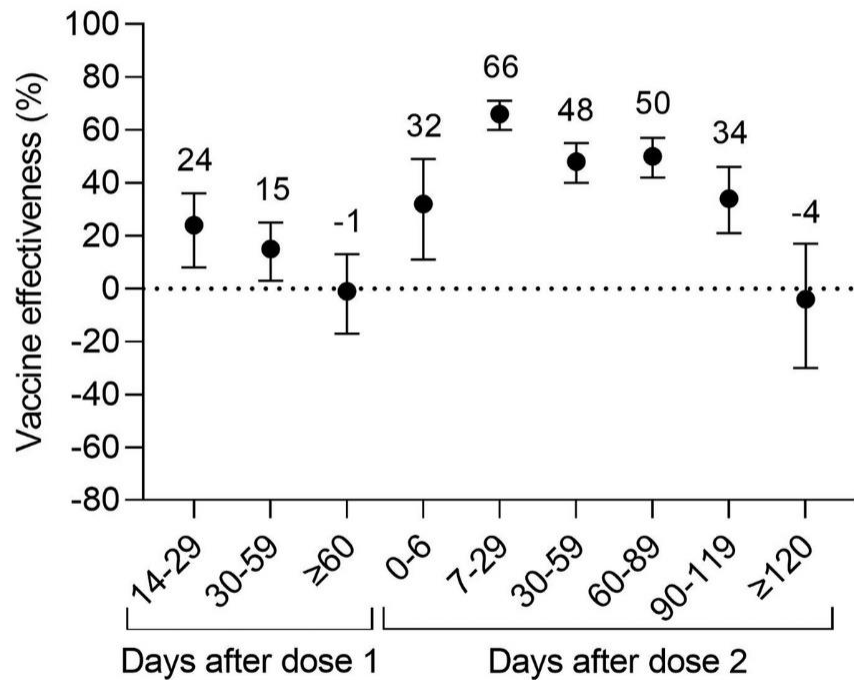
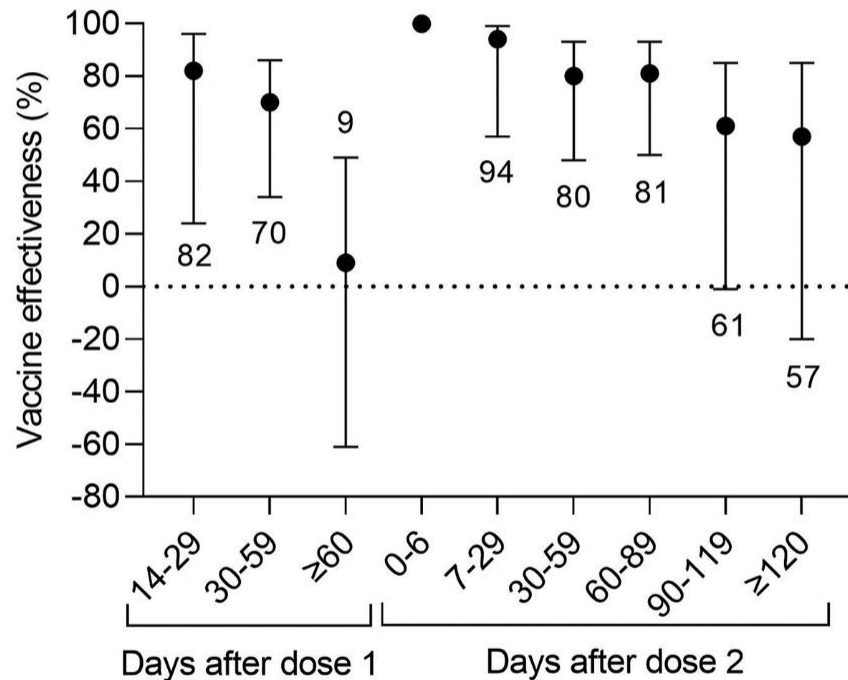
ASTRAZENECA VAXZEVRIA COVID-19 VACCINE

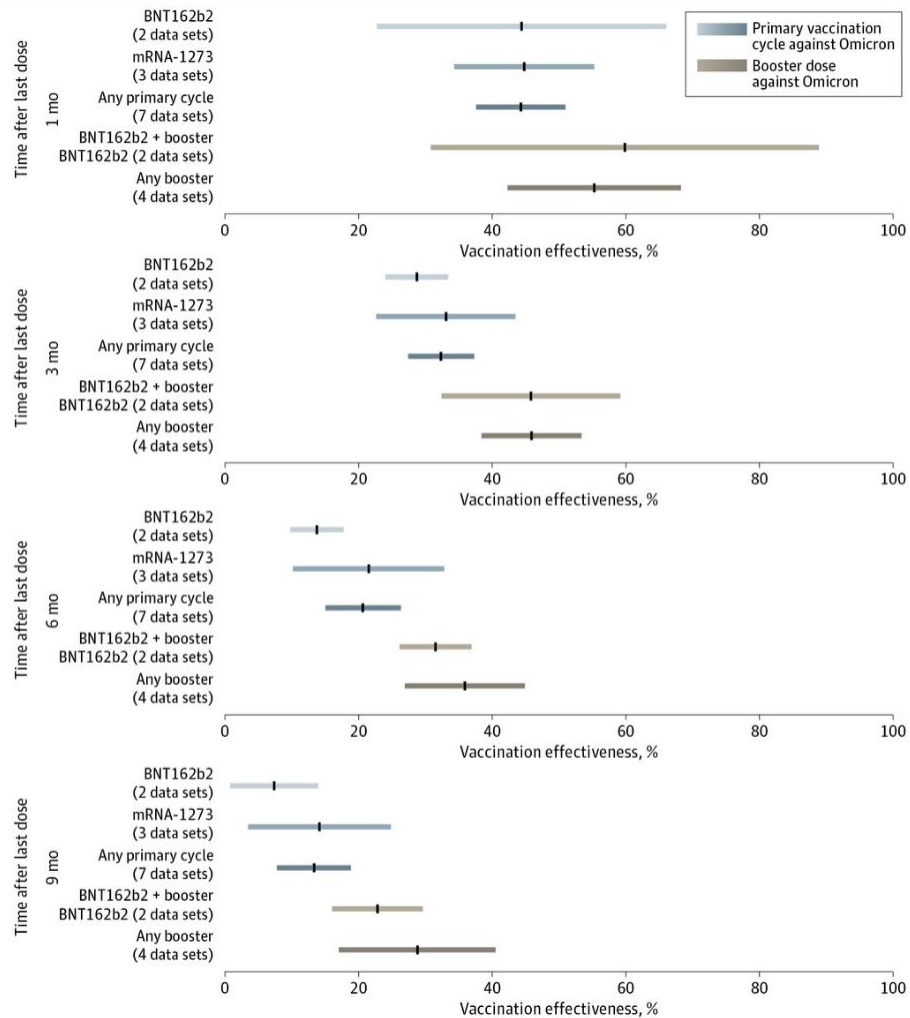
VIRAL VECTOR

NOVAVAX NUVAXOVID

PROTEIN



A**B**












VACCINE EFFICACY

- 1 Waning impact on infection
- 2 Decreased impact on reducing hospitalization
- 3 Post-COVID syndrome?

Original Article

The effectiveness of COVID-19 vaccine in the prevention of post-COVID conditions: a systematic literature review and meta-analysis of the latest research

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Maria Celidonio Gutfreund², Mariana Kim Hsieh² , Vivian Lin MD² , Mohammed Alsuhaibani MBBS⁴,
Shinya Hasegawa MD¹ , Joseph Tholany MD¹ , Eli N. Perencevich MD, MS^{1,3}, Jorge L. Salinas MD⁵,
Michael B. Edmond MD, MPH, MPA⁶ and Luiz Vicente Rizzo MD²



SYSTEMATIC REVIEW

- 32 studies included
- 8 in the Omicron era
- PCC definition not standardized
- Variety of observational designs included

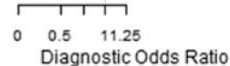


KEY FINDINGS

- 32 studies included
- 8 in the Omicron era
- No benefit after infection

COVID-19 vaccine before or after COVID-19

Ayoubkhani 2022	0.61 (0.53, 0.72)
Azzolini 2022	0.29 (0.13, 0.64)
Ballouz 2022	0.41 (0.27, 0.62)
El Otomani 2022	1.16 (0.56, 2.40)
Emecen 2023	0.14 (0.05, 0.39)
Hajjaji 2022	0.60 (0.21, 1.73)
Hernandez-Aceituno 2023	1.56 (0.91, 2.70)
Ioannou 2022	0.92 (0.81, 1.05)
Jassat 2023	0.59 (0.48, 0.73)
Kahlert 2023	0.87 (0.67, 1.15)
Kuodi 2023	0.61 (0.44, 0.84)
Marra 2023	0.70 (0.60, 0.83)
Meza-Torres 2022	2.06 (1.92, 2.21)
Mohr 2023	0.41 (0.26, 0.63)
Nehme 2022	0.60 (0.44, 0.82)
Perlis 2022	0.82 (0.71, 0.94)
Pinato 2022	0.34 (0.12, 0.96)
Richard 2023	0.62 (0.39, 0.98)
Senjain 2022	0.66 (0.45, 0.97)
Tannous 2022	0.75 (0.67, 0.85)
Taquet 2022	0.97 (0.90, 1.04)
Thawetai 2023	0.51 (0.29, 0.90)
Van der Maaden 2023	0.90 (0.75, 1.08)
Zisis 2022	0.42 (0.39, 0.44)
Pooled DOR	0.68 (0.52, 0.89)



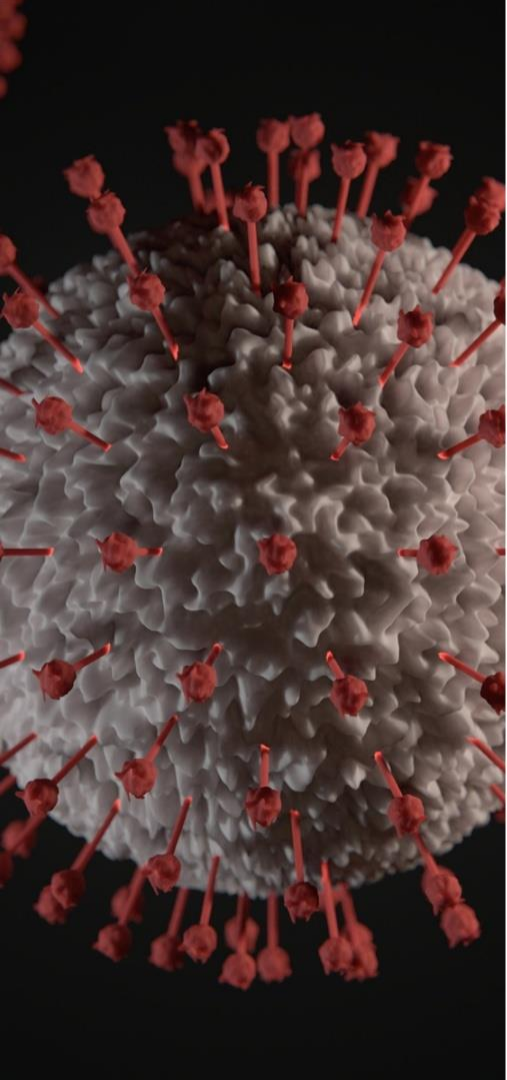
Vaccinated individuals	COVID-19 vaccine before/after COVID-19 infection**	Studies included (n)	Participants [vaccinated + unvaccinated] (n)	Pooled Diagnostic Odds Ratio [DOR] (95% CI)	I ² test for heterogeneity	Vaccine effectiveness* (95% CI)
Fully vaccinated	Before/After	24	620,221	0.680 (0.523, 0.885)	0%	32.0% (11.5%, 47.7%)
Fully vaccinated	Before	21	618,841	0.631 (0.518, 0.769)	0%	36.9% (23.1%, 48.2%)
Fully vaccinated	After***	5	396,101	1.303 (0.890, 1.907)	19.9%	–
Fully vaccinated	Before (Omicron era)	7	25,414	0.684 (0.542, 0.862)	50.1%	31.6% (13.8%, 45.8%)
Booster dose (1 st)	Before	3	5,948	0.313 (0.278, 0.353)	0%	68.7% (64.7%, 72.2%)



KEY FINDINGS

- Overall estimated **VE = 38%**
- 2 doses = 32% (before infection)
- 3 doses = 69% (before infection)
- No benefit after infection

ANTI-VIRAL IMPACT ON PCC

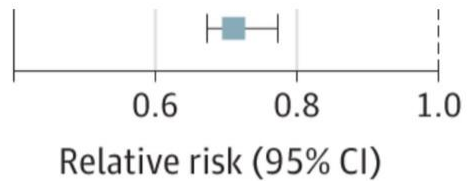


1 Observational studies only

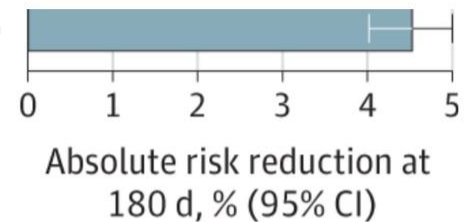
2 Molnupiravir, Paxlovid studied

PCC

0.74 (0.72 to 0.77)

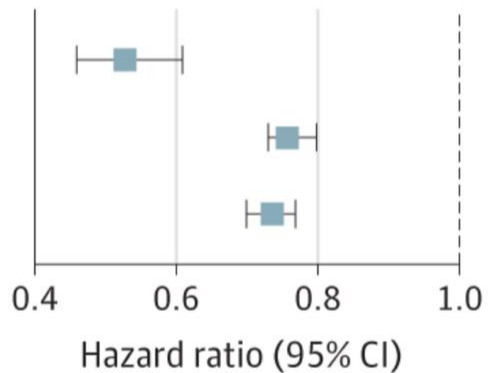


4.51 (4.01 to 4.99)

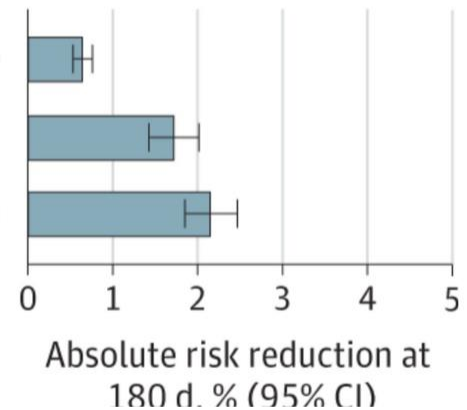


Death

0.53 (0.46 to 0.61)

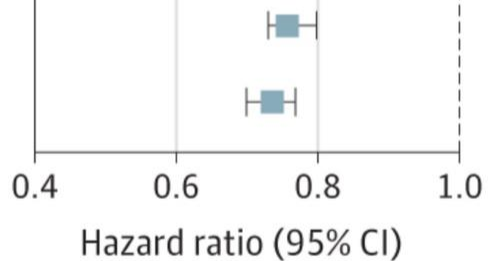


0.65 (0.54 to 0.77)

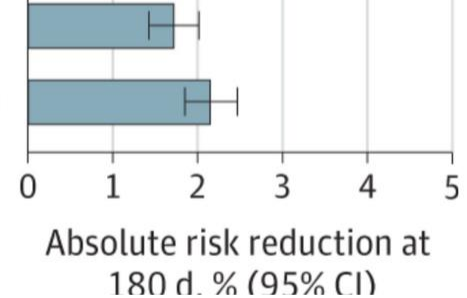


Hospitalization

0.76 (0.73 to 0.80)

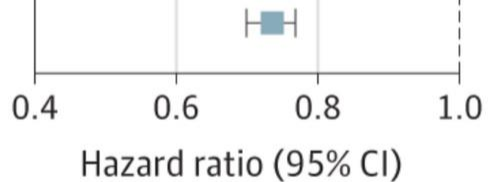


1.72 (1.42 to 2.01)

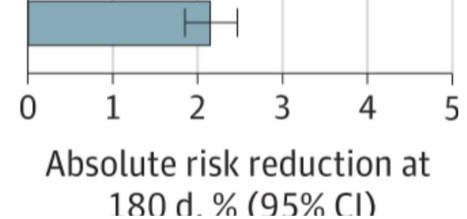


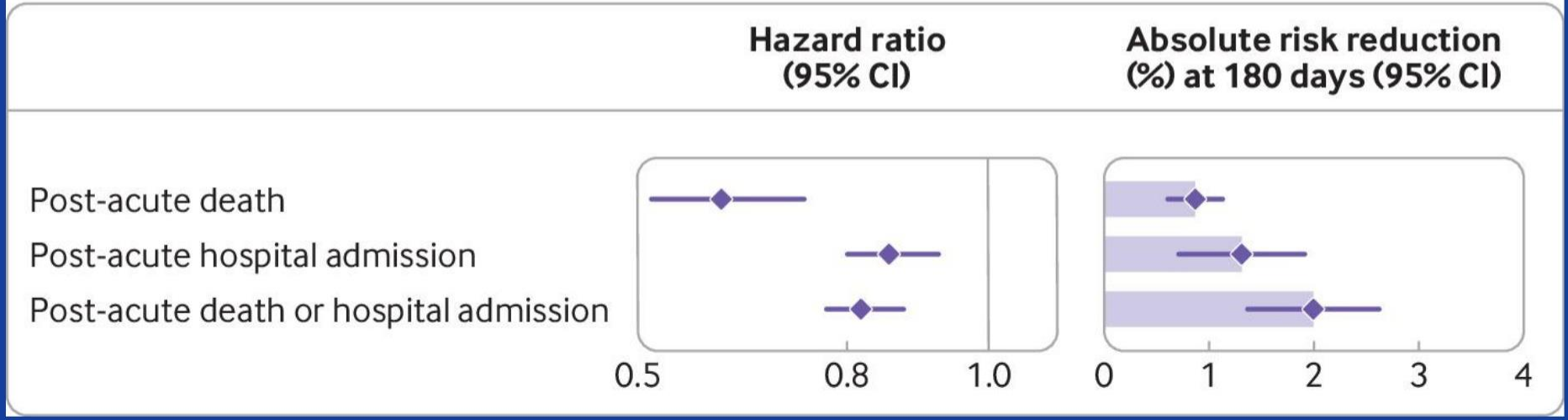
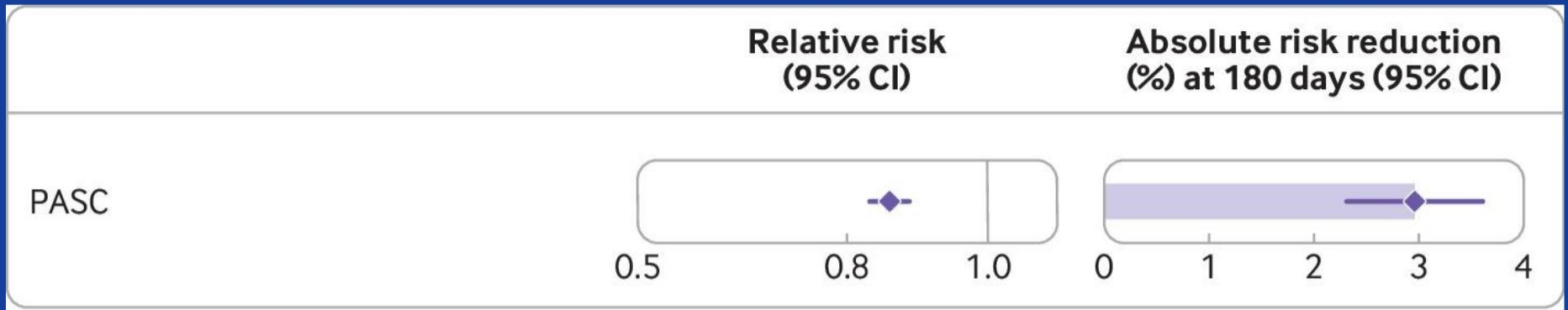
Death or hospitalization

0.74 (0.70 to 0.77)



2.15 (1.85 to 2.46)





CONCLUSIONS

- 1 Omicron is highly transmissible, infection is highly probable
- 2 New variants are inevitable



CONCLUSIONS

- 1 Vaccines are partially effective
- 2 Vaccines and antivirals are protective against post-COVID syndromes

