

Omikron

Prof. Dr. med. Andri Rauch, Universitätsklinik für Infektiologie, Inselspital BERN

Town Hall 10.12.2021



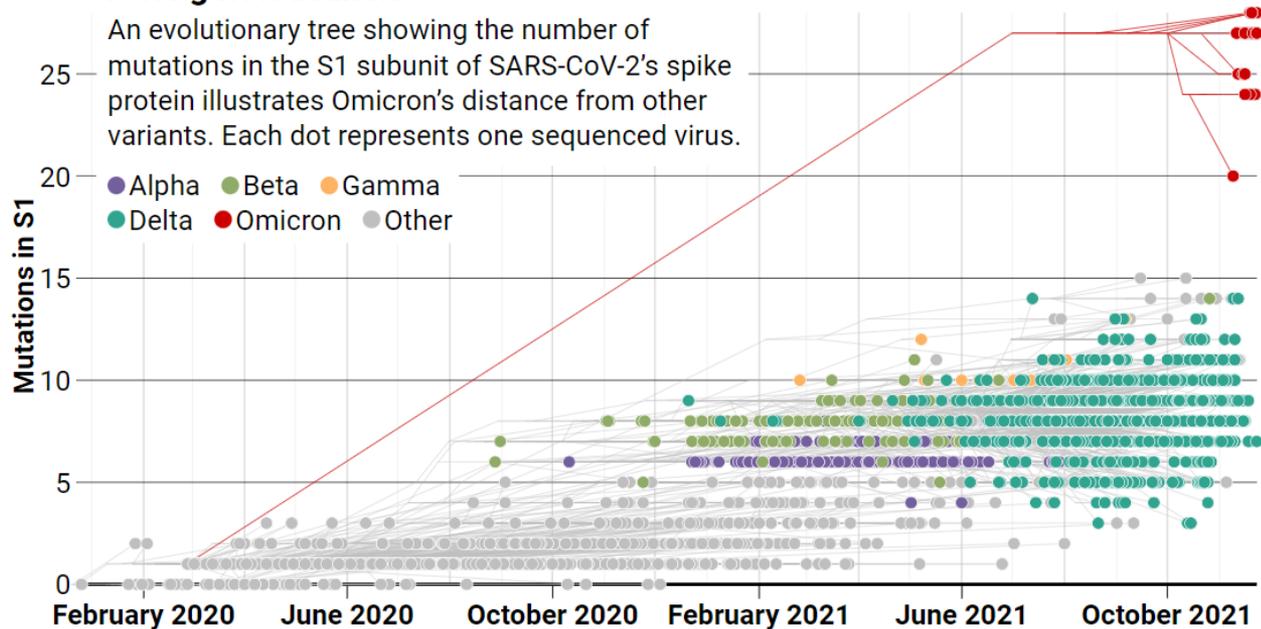
Omikron

- 1) Was ist besonders an Omikron?
- 2) Wird Omikron Delta verdrängen?
- 3) Beeinträchtigt Omikron den Impfschutz und die Antikörpertherapie?
- 4) Wird Omikron den Schweregrad von COVID-19 verändern?

Omikron als «outlier»

A long new branch

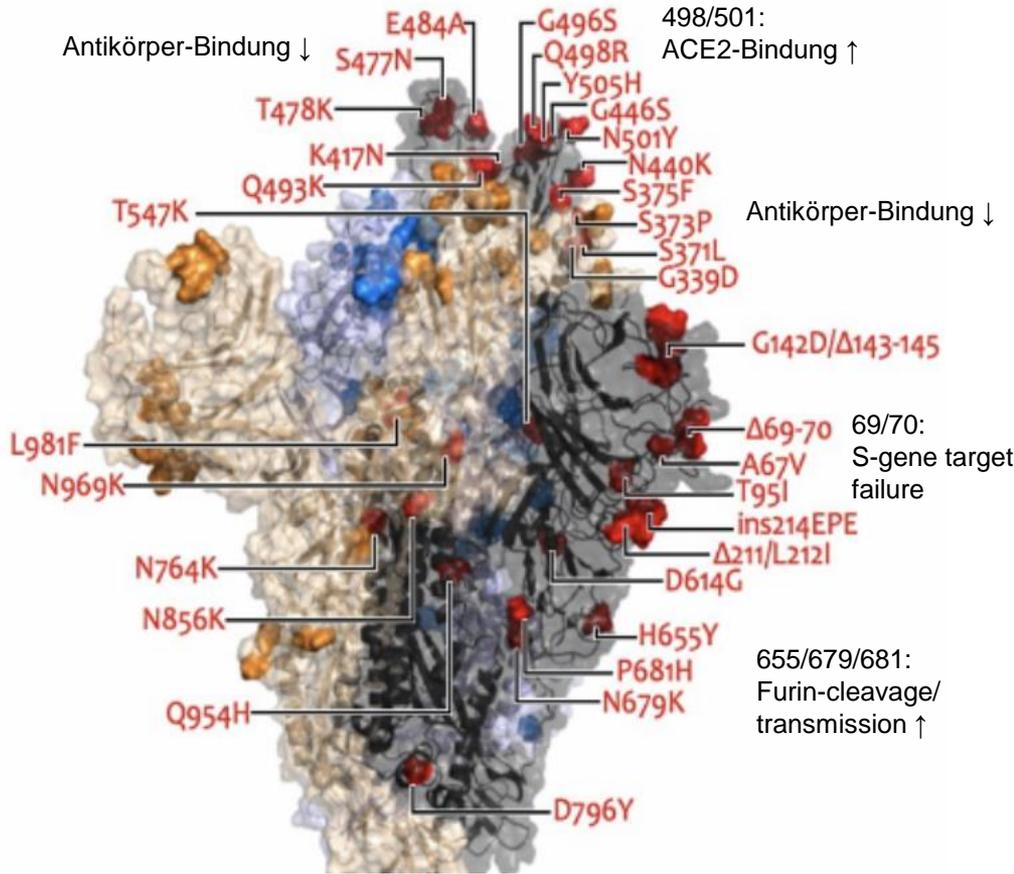
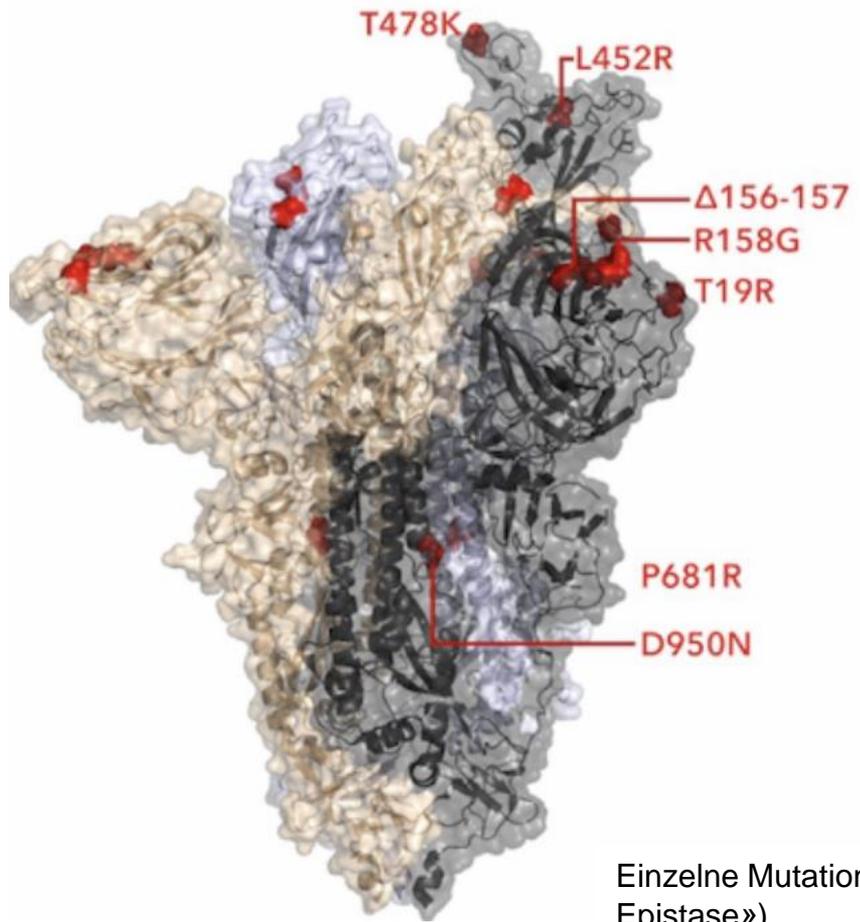
An evolutionary tree showing the number of mutations in the S1 subunit of SARS-CoV-2's spike protein illustrates Omicron's distance from other variants. Each dot represents one sequenced virus.



Delta

MUTATIONEN

Omicron

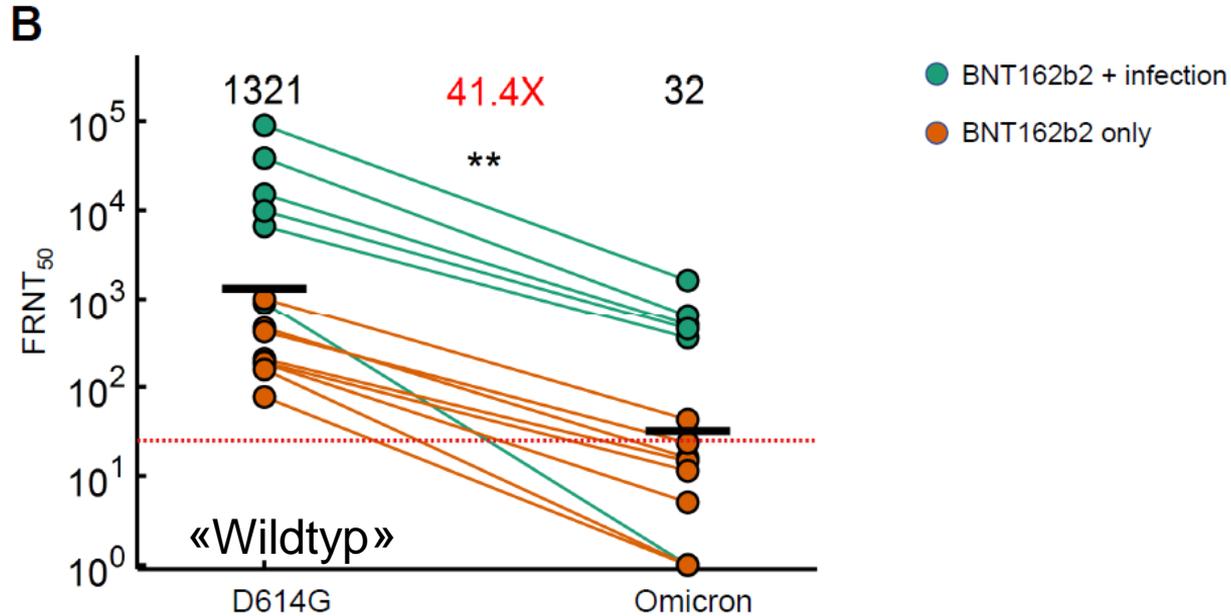


Einzelne Mutationen reduzieren «Fitness», in Kombination aber Fitness ↑ («positive Epistase»)

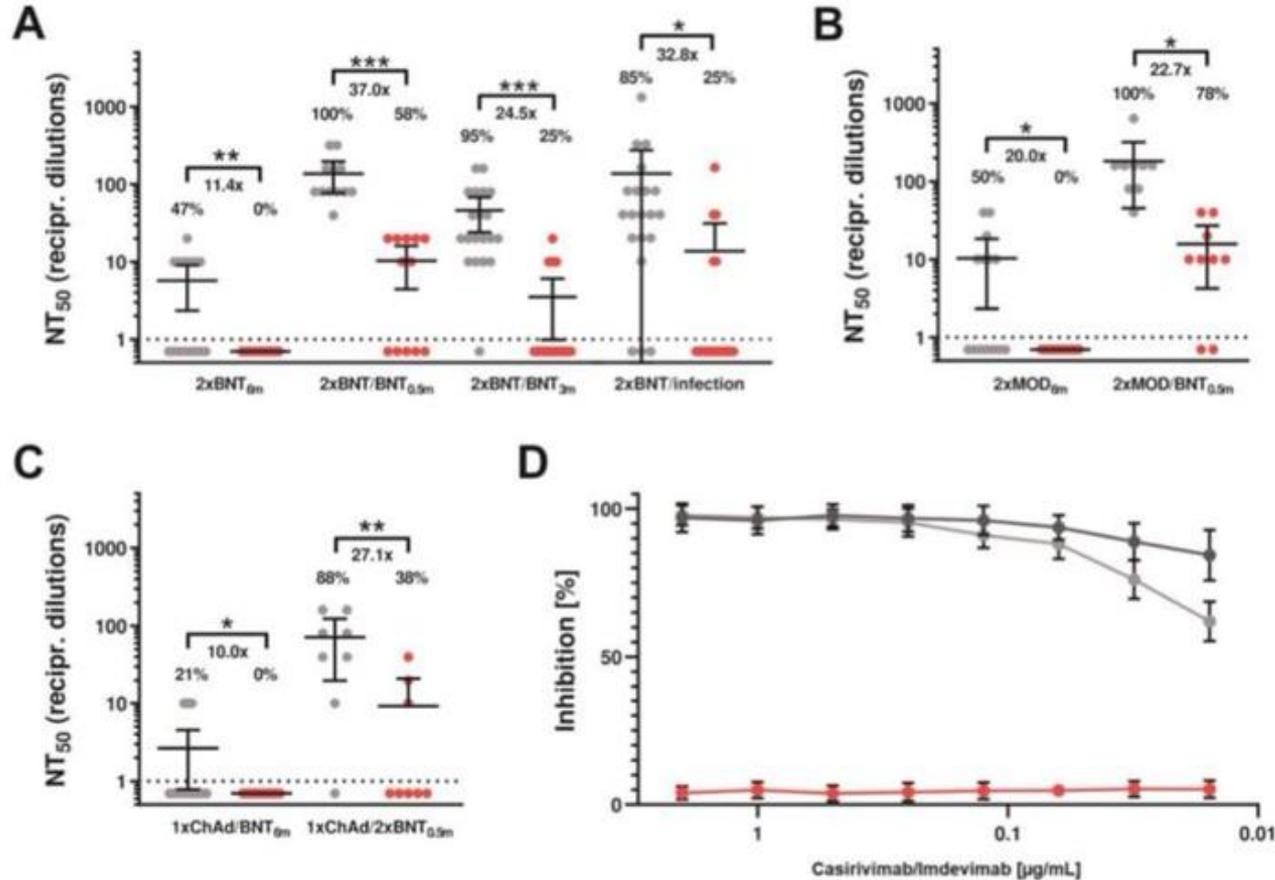
Mögliche Ursachen für Akkumulation von so vielen Mutationen:

- Unerkannte Transmission über längere Zeit in Gebieten mit wenig Surveillance
- Evolution / Adaptation bei PatientIn mit «chronischer» Infektion
- Reverse Zoonose

In-vitro reduzierte Neutralisation nach Impfung



In-vitro reduzierte Neutralisation durch aktive und passive Immunisierung



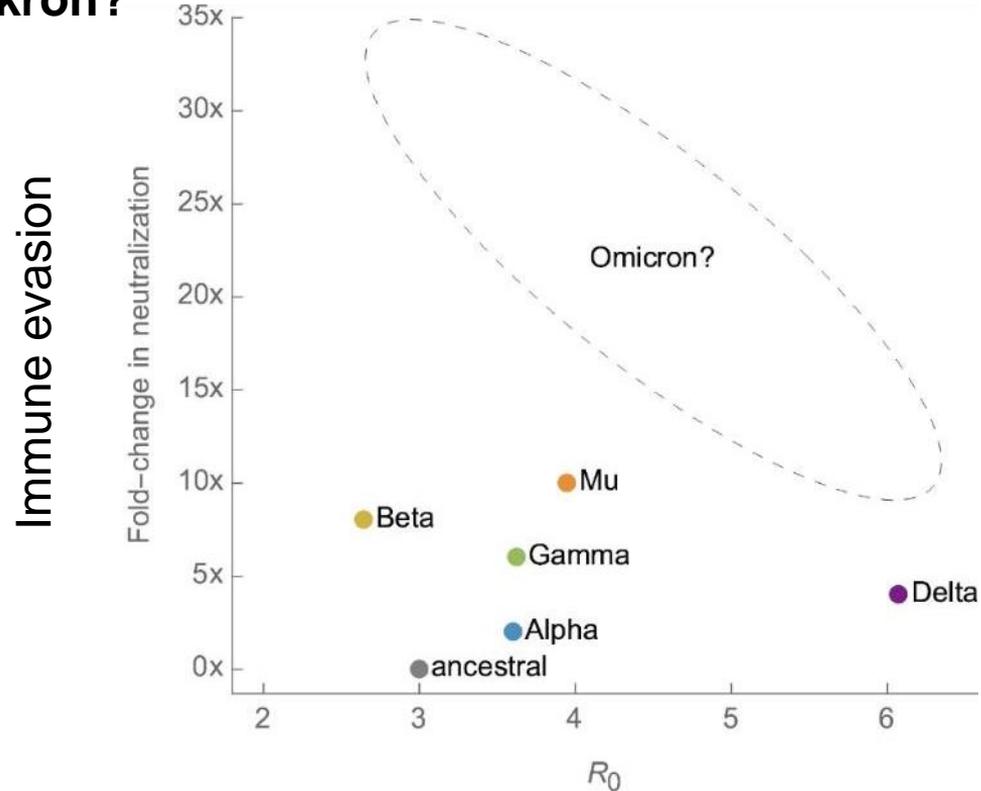
Wilhelm / Ciesek et al, preprint

Überdurchschnittlich viele Mutationen in T-cell epitopen → Relevanz bezüglich Immunantwort unsicher!

	Omicron	Beta	Gamma	Delta
# Changes on Spike	37	10	12	9
# T cell Epitopes	348	125	159	108
% T cell Epitopes	27.29%	9.80%	12.47%	8.47%
# B cell Epitopes	550	231	273	198
% B cell Epitopes	30.91%	12.98%	15.34%	11.12%

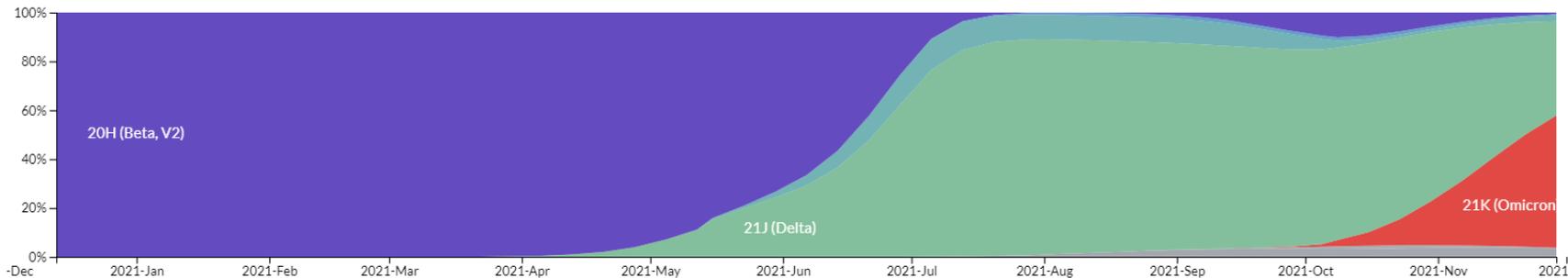
www.virological.org/

Neutralisation durch Antikörper und Transmissionsrate: Wo liegt Omikron?



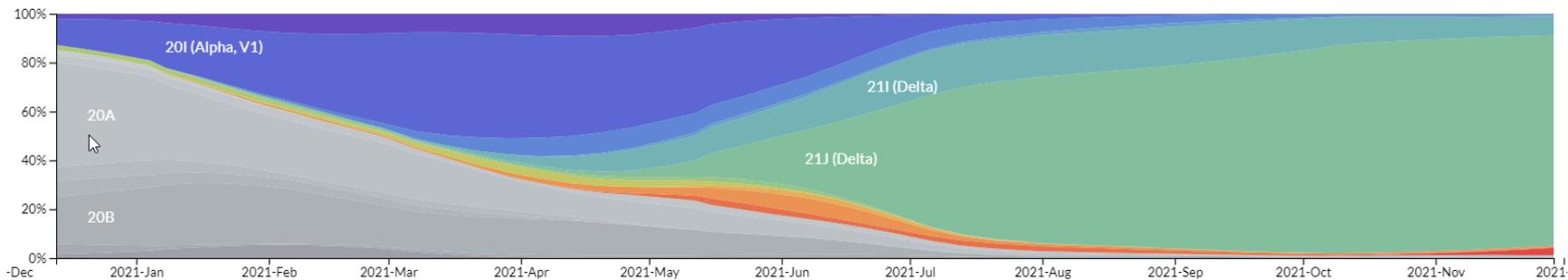
Südafrika

Frequencies (colored by Clade and normalized to 100% at each time point for 302 out of a total of 3546 tips)



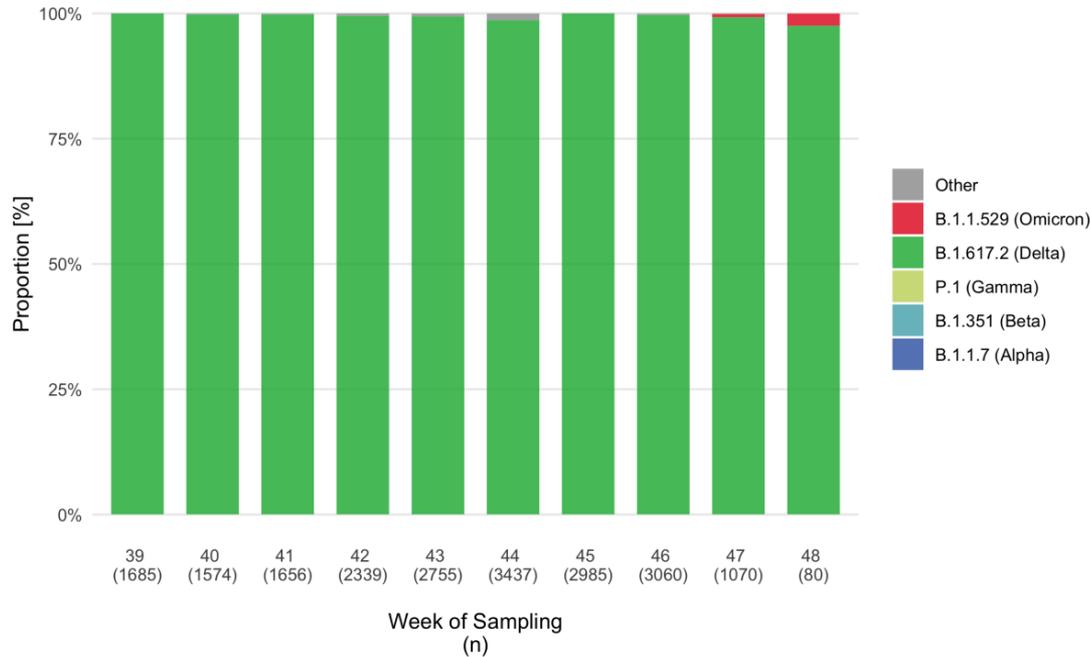
Global

Frequencies (colored by Clade)



Omikron in der Schweiz

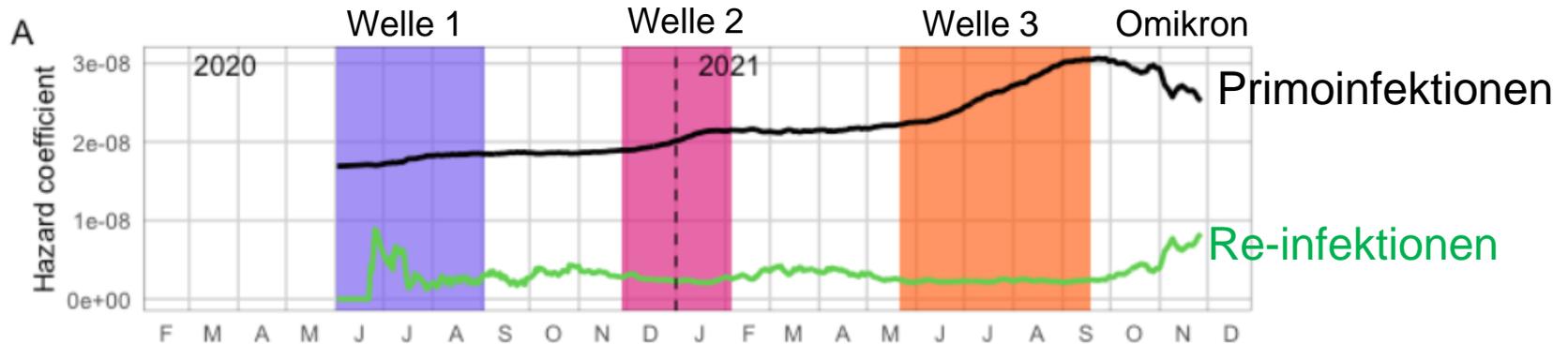
Distribution of SARS-CoV-2 Variants Swiss-wide by Week of Sampling



«Superspreader events»



Omikron (...aber nicht Delta) mit erhöhtem Risiko für Reinfektionen vgl. mit erster Welle in Südafrika



Verglichen mit Welle 1, 2.38x erhöhtes Risiko für Reinfektionen

Pulliam et al, preprint

Risiko Einschätzung UK

8 December 2021

Risk assessment for SARS-CoV-2 variant: Omicron VOC-21NOV-01 (B.1.1.529)

UK Health Security Agency

Indicator	Red, amber or green status*	Confidence level	Assessment and rationale
Growth advantage	Red	High	<p>Omicron is displaying a growth advantage over Delta This assessment is based on analysis of UK data showing increased household transmission risk, increased secondary attack rates and increased growth rates compared to Delta. Omicron is likely to outcompete Delta in the UK and predominate.</p> <p>The observed growth advantage may be due to immune evasion or transmissibility. It is most plausible that it is a combination of both. The current growth rate implies either a substantial change in one parameter or at least moderate change in both (for example if transmissibility is similar to Delta, immune evasion must be substantial).</p>
Transmissibility	Amber	Low	<p>Omicron is at least as transmissible as Delta Increased transmissibility compared to Delta is biologically plausible with the presence of furin cleavage site and nucleocapsid changes associated in vitro with advantages for replication, as well as extensive changes to the RBD. Structural modelling suggests that the mutations present may increase human ACE2 binding affinity to a much greater extent than that seen for any other variant. However, there is as yet no demonstration of transmissibility as distinct from other contributors to growth advantage.</p>
Immune evasion (including natural and vaccine derived immunity)	Red	Moderate	<p>Omicron displays a reduction in immune protection against infection (no data regarding severe disease) Based on experience with other variants, laboratory data on individual mutations, and structural modelling, the mutations present are very likely to reduce antibody binding and include changes in all 4 neutralising antibody binding sites in the RBD and also in antigenic sites in the spike N terminal domain. New published neutralisation studies are being assessed. T cell epitope data are awaited.</p> <p>Whilst there are insufficient data to quantify either vaccine effectiveness or risk of reinfection in the UK, the observed growth, case distribution and early analyses in both SA and the UK are consistent with some loss of immune protection against infection. There are insufficient data to make any assessment of protection against severe disease.</p>
Infection severity			<p>Insufficient data There are insufficient data to assess severity, which is expected in the early period of emergence of a new variant.</p>

* Refer to scale and confidence grading slide.

Omikron

- 1) Was ist besonders an Omikron?
- 2) Wird Omikron Delta verdrängen?
- 3) Beeinträchtigt Omikron den Impfschutz und die Antikörpertherapie?
- 4) Wird Omikron den Schweregrad von COVID-19 verändern?

Hypothetische Szenarien

1) **Transmission** ↑↑, **Impfschutz** ↓↓, **Schweregrad der Erkrankungen** ↑↑

2) **Transmission** ↑, **Impfschutz** ↘ , **Schweregrad der Erkrankungen?**

3) **Transmission** →, **Impfschutz** → , **Schweregrad der Erkrankungen** ↓↓

Hypothetische Szenarien

1) Transmission ↑↑, Impfschutz ↓↓, Schweregrad der Erkrankungen ↑↑

2) Transmission ↑, Impfschutz ↘ , Schweregrad der Erkrankungen?

3) Transmission →, Impfschutz → , Schweregrad der Erkrankungen ↓↓

Risiken minimieren

8 December 2021

Risk assessment for SARS-CoV-2 variant: Omicron VOC-21NOV-01 (B.1.1.529)

UK Health Security Agency

Indicator	Red, amber or green status*	Confidence level	Assessment and rationale
Growth advantage	Red	High	<p>Omicron is displaying a growth advantage over Delta This assessment is based on analysis of UK data showing increased household transmission risk, increased secondary attack rates and increased growth rates compared to Delta. Omicron is likely to outcompete Delta in the UK and predominate.</p> <p>The observed growth advantage may be due to immune evasion or transmissibility. It is most plausible that it is a combination of both. The current growth rate implies either a substantial change in one parameter or at least moderate change in both (for example if transmissibility is similar to Delta, immune evasion must be substantial).</p>
Transmissibility	Amber	Low	<p>Omicron is at least as transmissible as Delta Increased transmissibility compared to Delta is biologically plausible with the presence of furin cleavage site and nucleocapsid changes associated in vitro with advantages for replication, as well as extensive changes to the RBD. Structural modelling suggests that the mutations present may increase human ACE2 binding affinity to a much greater extent than that seen for any other variant. However, there is as yet no demonstration of transmissibility as distinct from other contributors to growth advantage.</p>
Immune evasion (including natural and vaccine derived immunity)	Red	Moderate	<p>Omicron displays a reduction in immune protection against infection (no data regarding severe disease) Based on experience with other variants, laboratory data on individual mutations, and structural modelling, the mutations present are very likely to reduce antibody binding and include changes in all 4 neutralising antibody binding sites in the RBD and also in antigenic sites in the spike N terminal domain. New published neutralisation studies are being assessed. T cell epitope data are awaited.</p> <p>Whilst there are insufficient data to quantify either vaccine effectiveness or risk of reinfection in the UK, the observed growth, case distribution and early analyses in both SA and the UK are consistent with some loss of immune protection against infection. There are insufficient data to make any assessment of protection against severe disease.</p>
Infection severity			<p>Insufficient data There are insufficient data to assess severity, which is expected in the early period of emergence of a new variant.</p>

* Refer to scale and confidence grading slide.

→ Hygienemassnahmen ↑↑

→ Impfen inkl. Booster ↑↑
(Impfung anpassen?)

→ Monoklonale Ak anpassen

??