

SARS-CoV-2 Sequencing Update 03 June 2022



Supported by the DSI and the SA MRC

Msomi N, Mlisana K, et al. Lancet Microbe 2020

The genomic data presented here are based on South African SARS-CoV-2 sequence data downloaded from GISAID (www.gisaid.org) on 3 June 2022 at 10h01



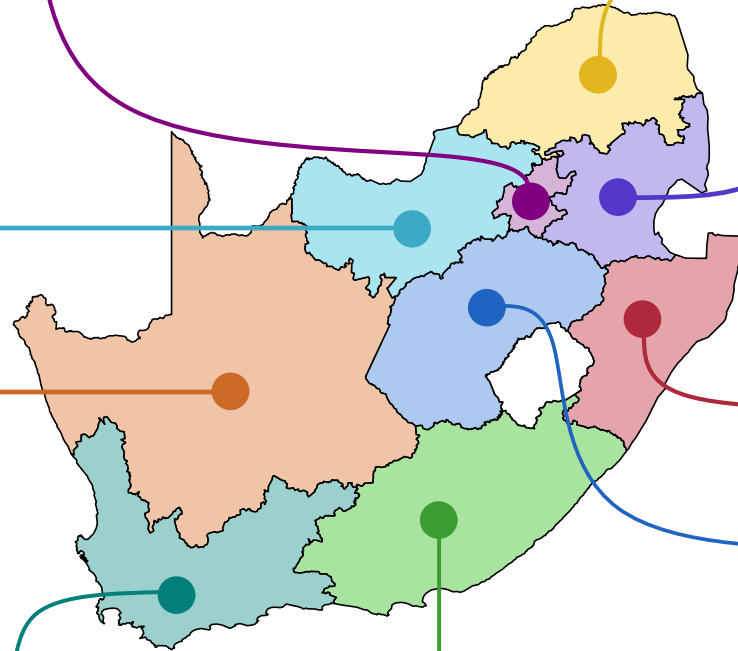
Data license: <https://www.gisaid.org/registration/terms-of-use/>

Elbe, S., and Buckland-Merrett, G. (2017) Data, disease and diplomacy: GISAID's innovative contribution to global health. *Global Challenges*, 1:33-46. DOI: 10.1002/gch2.1018 PMCID: 31565258

Shu, Y., McCauley, J. (2017) GISAID: Global initiative on sharing all influenza data – from vision to reality. *EuroSurveillance*, 22(13) DOI: 10.2807/1560-7917.ES.2017.22.13.30494 PMCID: PMC5388101

SARS-CoV-2

GENOMIC SURVEILLANCE epiweeks 39 (2021) - 21 (2022)



Gauteng

↓ PTP: 13.9%

Genomes Cases
5 153 (31.1%) 382 891 (37.0%)

Genomes deposited in the last week

10 2 1 114 38 2 3 4 5 3 1

North West

↓ PTP: 14.6%

Genomes Cases
810 (4.9%) 48 037 (4.6%)

Genomes deposited in the last week

1 11 6

Northern Cape

↓ PTP: 24.4%

Genomes Cases
730 (4.4%) 23 324 (2.3%)

Genomes deposited in the last week

27 3

Western Cape

↓ PTP: 29.2%

Genomes Cases
3 519 (21.2%) 179 548 (17.3%)

Genomes deposited in the last week

1 1

Eastern Cape

↓ PTP: 20.1%

Genomes Cases
1 187 (7.2%) 69 910 (6.8%)

Genomes deposited in the last week

1 9 1 78 13 5 3

Limpopo

- PTP: 10.9%

Genomes Cases
1 291 (7.8%) 35 258 (3.4%)

Genomes deposited in the last week

7

Mpumalanga

↓ PTP: 13.2%

Genomes Cases
1 513 (9.1%) 47 975 (4.6%)

Genomes deposited in the last week

1 11 6

KwaZulu-Natal

↓ PTP: 13.1%

Genomes Cases
1 812 (10.9%) 197 195 (19.0%)

Genomes deposited in the last week

4 1 8 28 1

Free State

↓ PTP: 17.3%

Genomes Cases
557 (3.4%) 51 401 (5.0%)

Genomes deposited in the last week

2 1



391 genomes added since the previous report

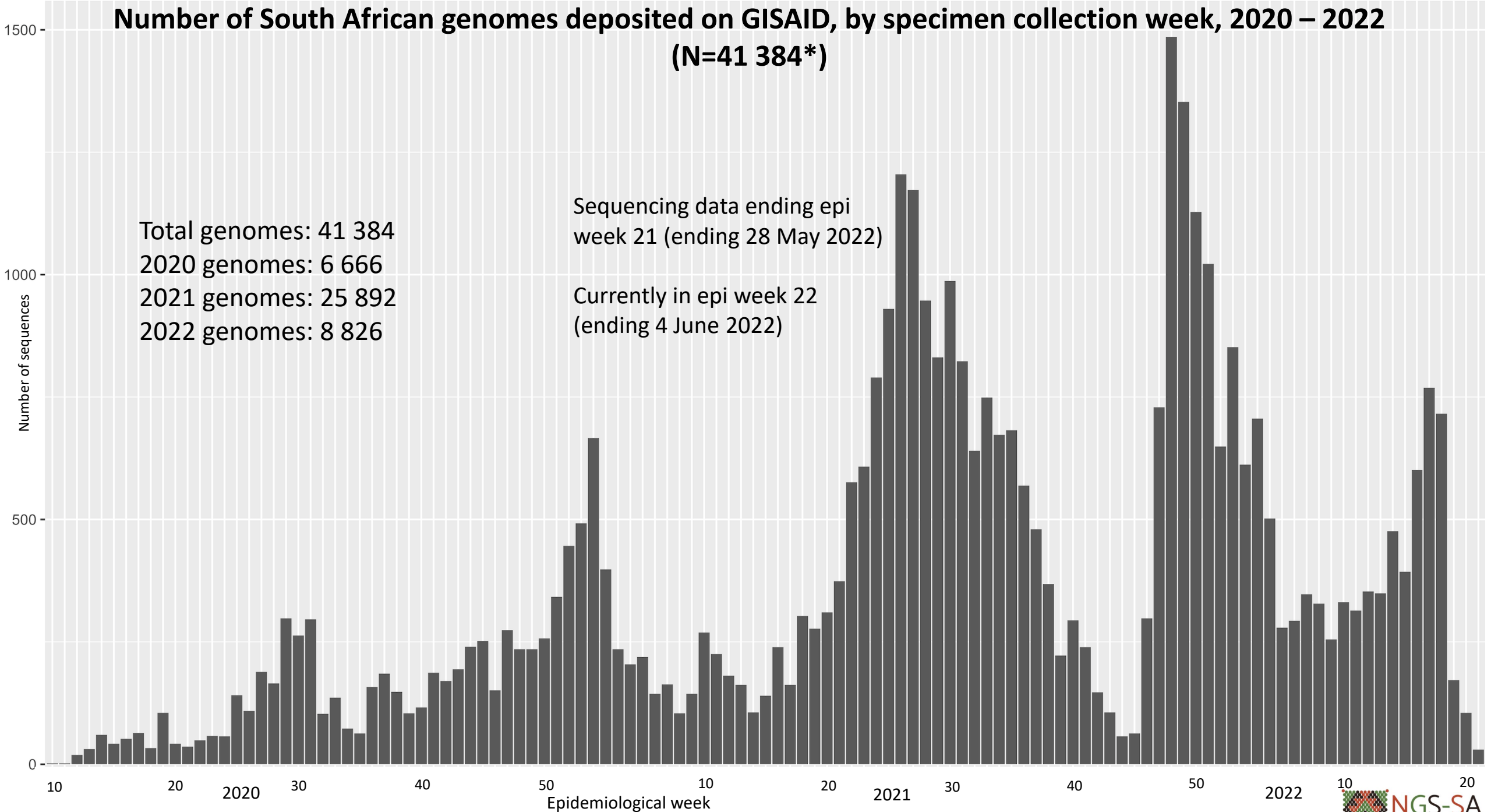


Bar graphs represent genomes sequenced per epiweek, with lines representing cases by collection date (weeks 39 [2021] – 21 [2022])

Genomes and cases presented as provincial total (percentage of national total) for epiweeks 39 (2021) – 21 (2022)

PTP: percentage testing positive in week 21 (22 May 2022 – 28 May 2022); arrow indicates direction of change since previous week (15 May 2022 – 21 May 2022) if change was significant ($P < 0.05$)

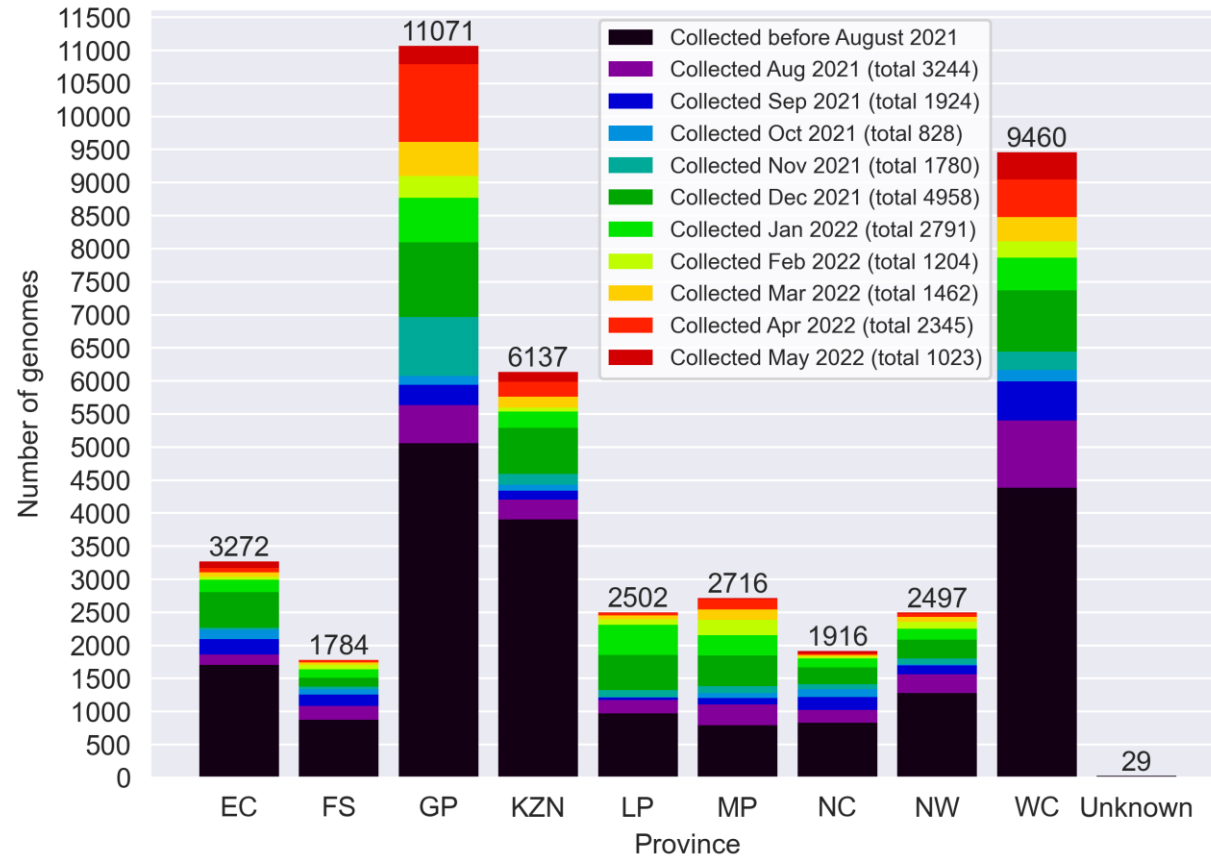
Number of South African genomes deposited on GISAID, by specimen collection week, 2020 – 2022 (N=41 384*)



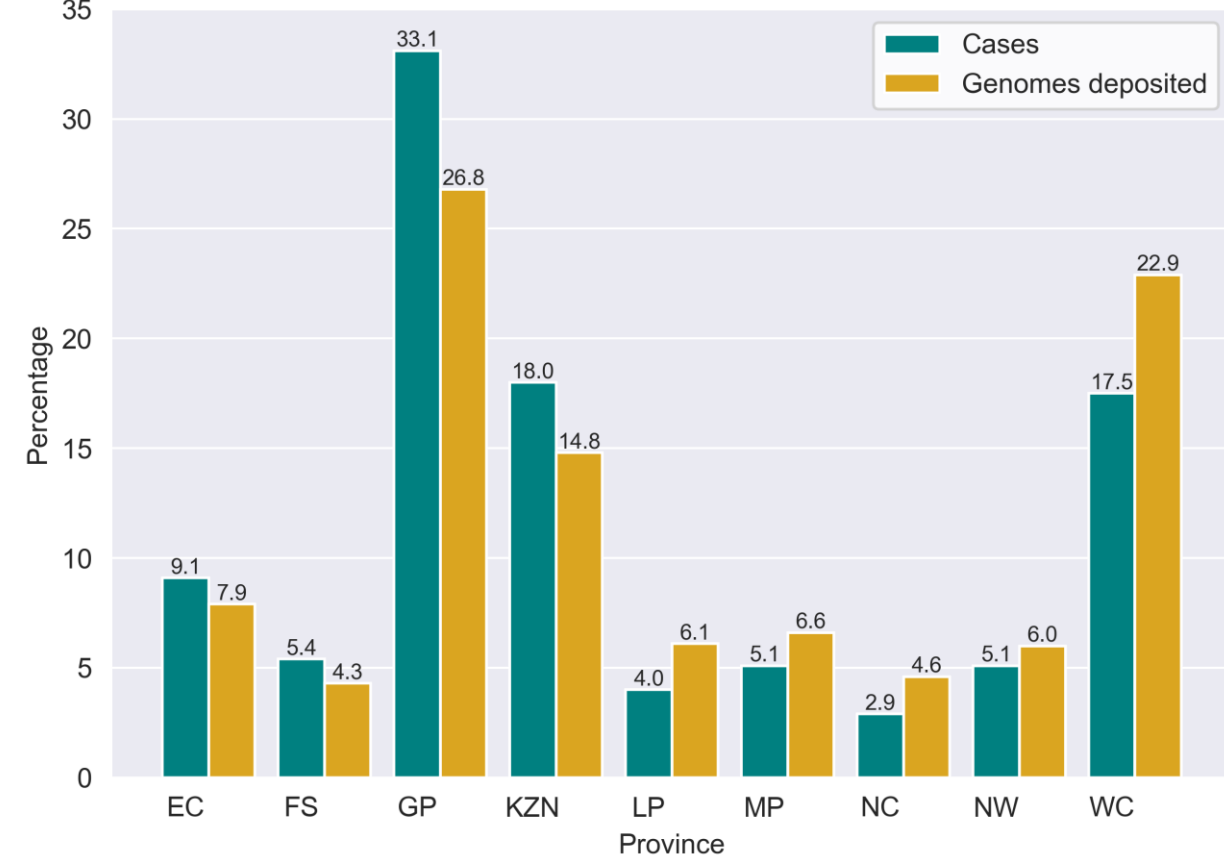
*This represents the cleaned, de-duplicated dataset of unique **National and Pneumonia Surveillance** sequences. This dataset will be used for all further figures.

GISAID genomes vs total cases, 2020 – 2022 (N=41 384)

Provincial breakdown of genomes deposited into GISAID



Proportion of total cases versus proportion of total genomes



All provinces, apart from GP, KZN and WC, have comparable percentages of overall cases and sequenced genomes. All provinces have contributed sequences for April and May.

Number and percentage of clades by epiweek in South Africa, 2021 – 2022 (34 631*)

Distribution of Nextclade Clades in South Africa

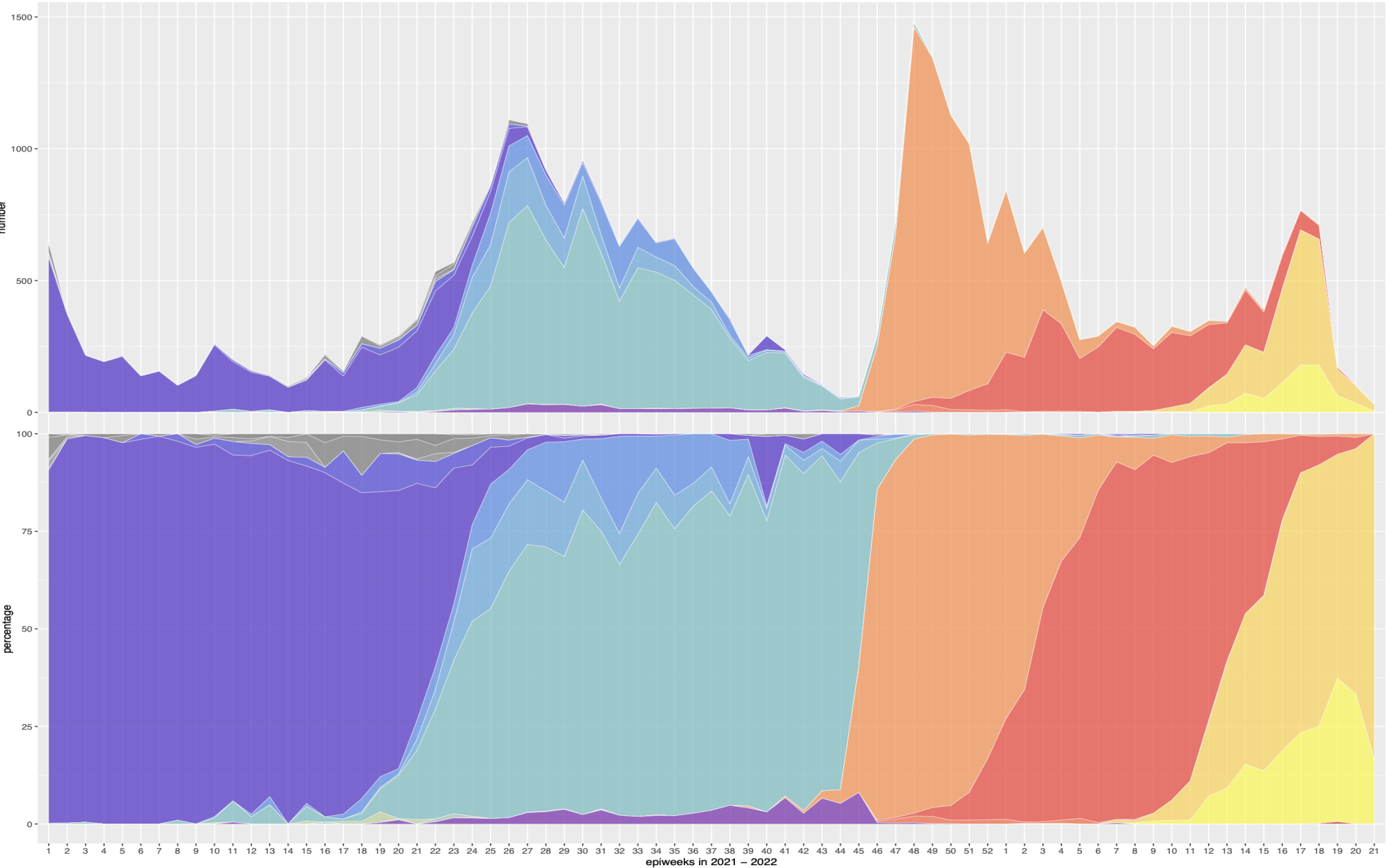
Nextclade clades

- 19A
 - 19B
 - 20A
 - 20B
 - 20C
 - 20D
 - Alpha (20I, V1)
 - Beta (20H, V2)
 - Delta (21A)
 - Delta (21I)
 - Delta (21J)
 - Eta (21D)
 - Kappa (21B)
 - Omicron (21K/BA.1.*)
 - Omicron (21L/BA.2.*)
 - Omicron (21M/BA.3)
 - Omicron (22A/BA.4)
 - Omicron (22B/BA.5)
 - Omicron (22C/BA.2.12.1)
 - C.1.2 (20D)
- Nextclade clades
- 19A
 - 19B
 - 20A
 - 20B
 - 20C
 - 20D
 - Alpha (20I, V1)
 - Beta (20H, V2)
 - Delta (21A)
 - Delta (21I)
 - Delta (21J)
 - Eta (21D)
 - Kappa (21B)
 - Omicron (21K/BA.1.*)
 - Omicron (21L/BA.2.*)
 - Omicron (21M/BA.3)
 - Omicron (22A/BA.4)
 - Omicron (22B/BA.5)
 - Omicron (22C/BA.2.12.1)
 - C.1.2 (20D)

Sequencing data
ending epi week 21
(ending 28 May
2022)

Currently in epi
week 22 (ending 4
June 2022)

*Excludes sequences
missing collection dates,
as well as those collected
January 1st and 2nd 2021
as they are part of
epiweek 53 of 2020.

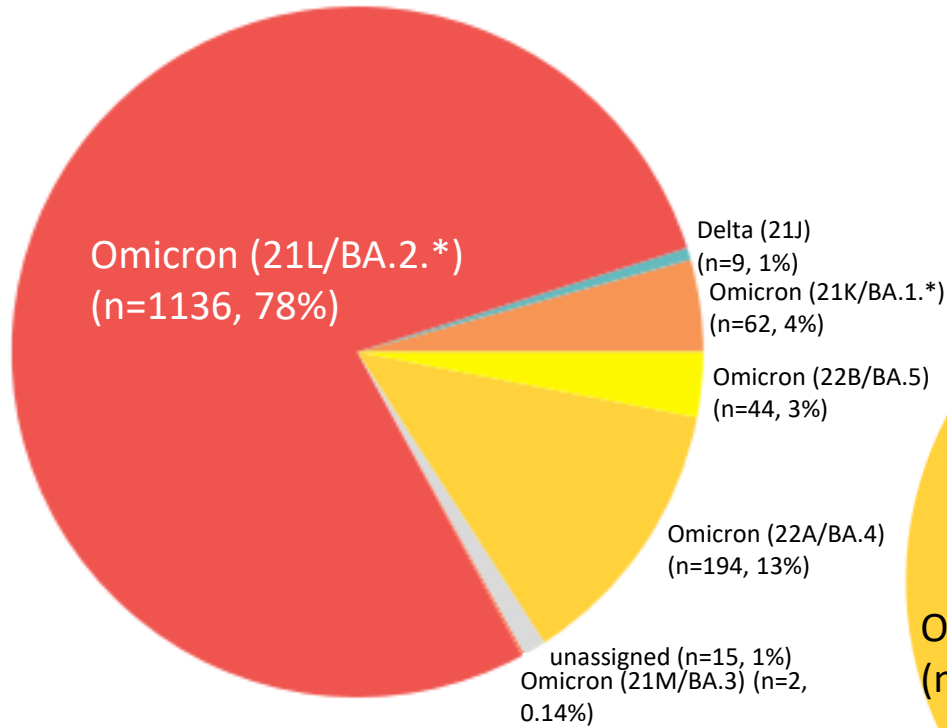


Delta dominated in South Africa until October at >80%. Omicron has dominated from November onwards.

Prevalence of Variants of Concern (VOC) and Variants of Interest (VOI) in

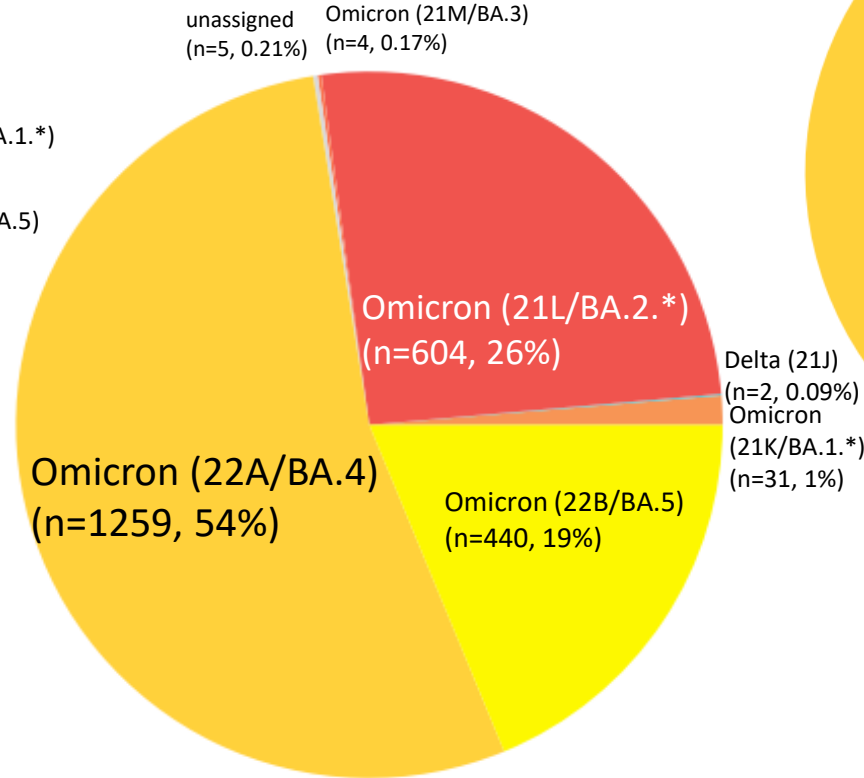
March – May 2022

March (N=1462)



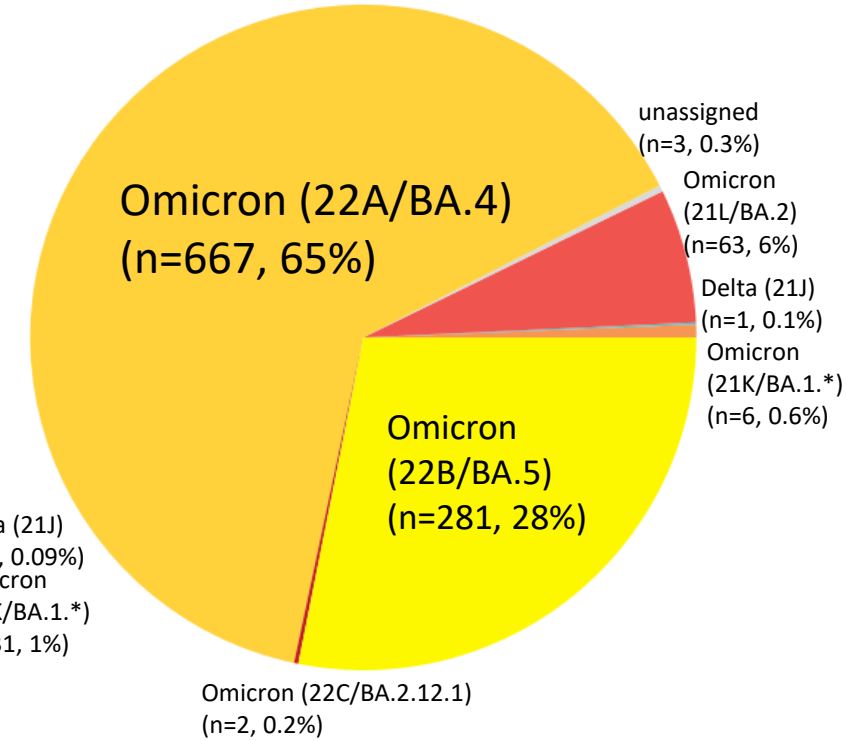
Total Omicron in Mar: 1438 (98.4%)

April (N=2345)



Total Omicron in Apr: 2338 (99.7%)

May (N=1023)



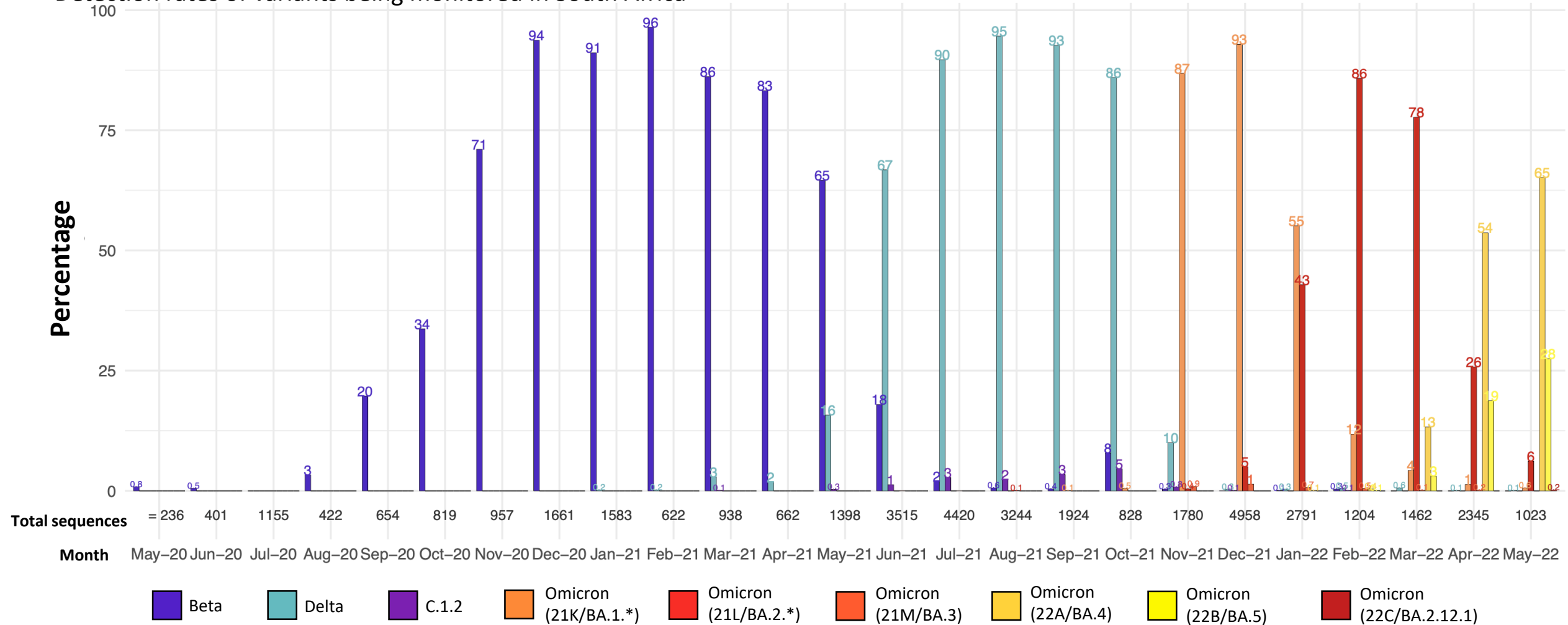
Total Omicron in May: 1019 (99.6%)

Omicron (21K/BA.1.*)
Omicron (21M/BA.3)
Omicron (22B/BA.5)
Delta (21I)
C.1.2 (20D)
Beta (20H, V2)
Kappa (21B)
Eta (21D)
Other
unassigned

Omicron dominated in March (98.4%, 1438/1462), April (99.7%, 2338/2345) and May (99.6%, 1019/1023). BA.2 was dominant in March. BA.4 and BA.5 together were dominant in April and are dominant in May. BA.2.12.1 has been detected at low levels in May (0.2%).

Detection Rates: Beta, Delta, C.1.2 and Omicron

Detection rates of variants being monitored in South Africa

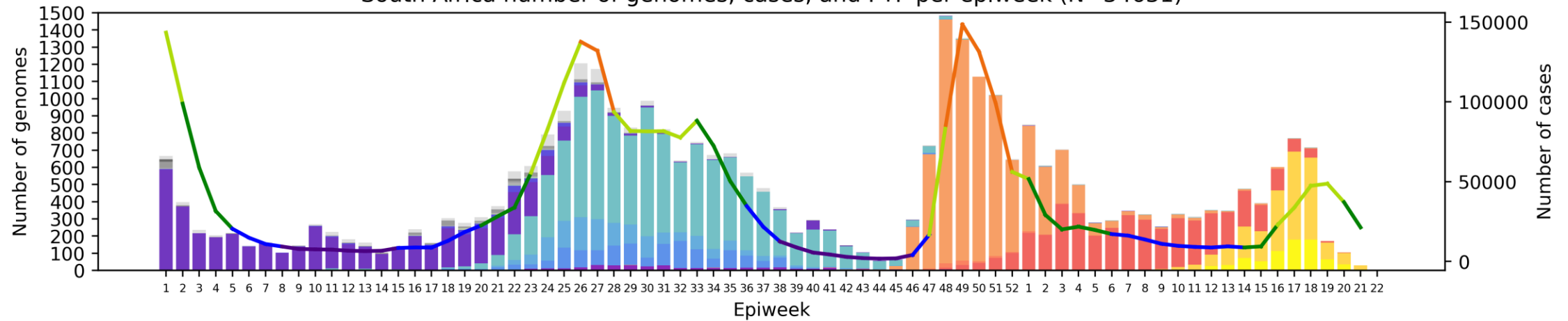


*Bars represent percentage prevalence of variant for the month; total number sequences collected for the month are given below the bar

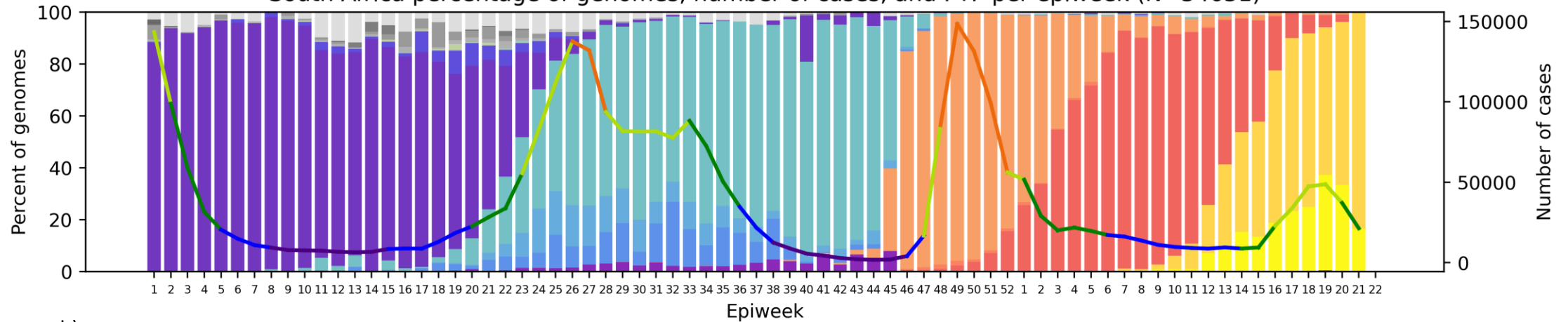
Omicron has been dominant since November (>85% in November, >98% in December – May).
BA.2 made up 43% of genomes in January, 86% in February, 78% in March and 26% in April. BA.4 and BA.5 together dominated in April at 72%, and in May at 93%.

South Africa, 2021-2022, n = 34 631*

South Africa number of genomes, cases, and PTP per epiweek (N=34631)



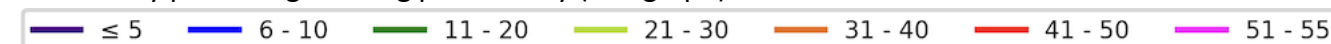
South Africa percentage of genomes, number of cases, and PTP per epiweek (N=34631)



Clade key (bar graph)

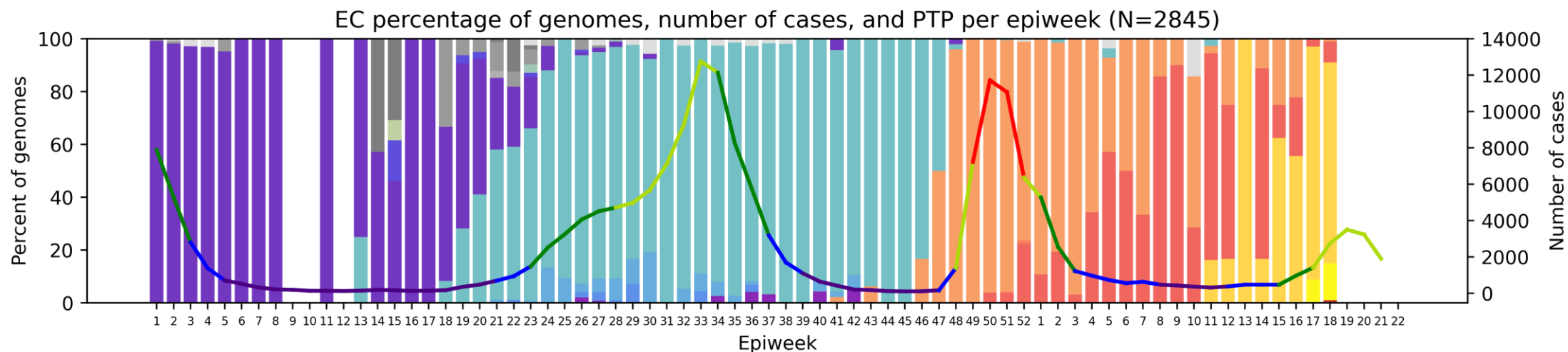
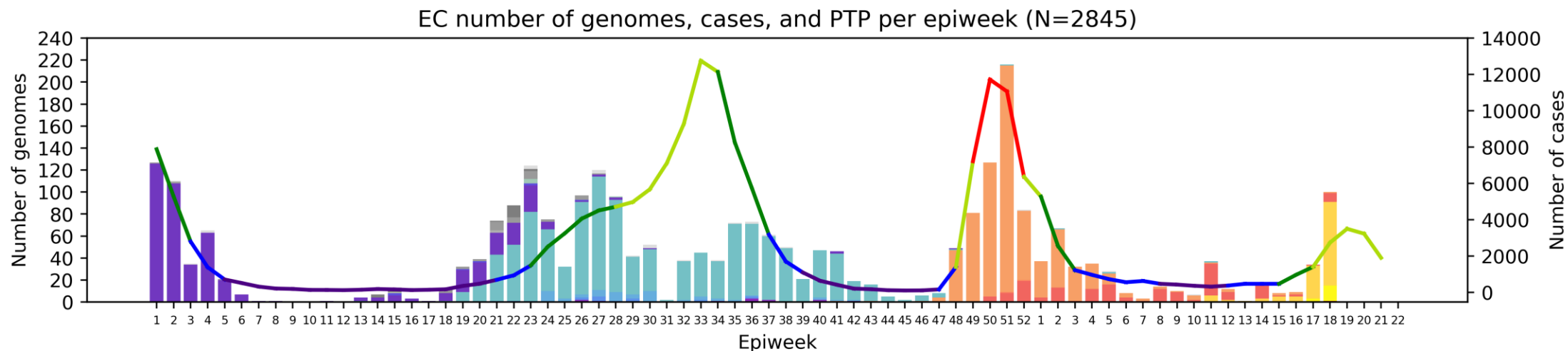


Weekly percentage testing positive key (line graph)



*Excludes sequences missing collection dates, as well as those collected January 1st and 2nd 2021 as they are part of epiweek 53 of 2020.

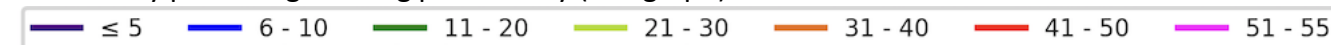
Eastern Cape Province, 2021-2022, n = 2845



Clade key (bar graph)

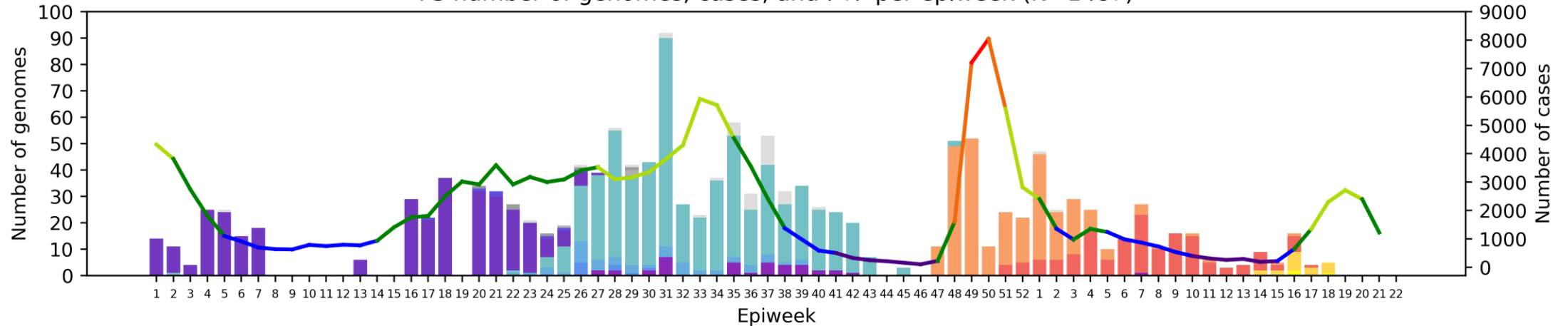


Weekly percentage testing positive key (line graph)

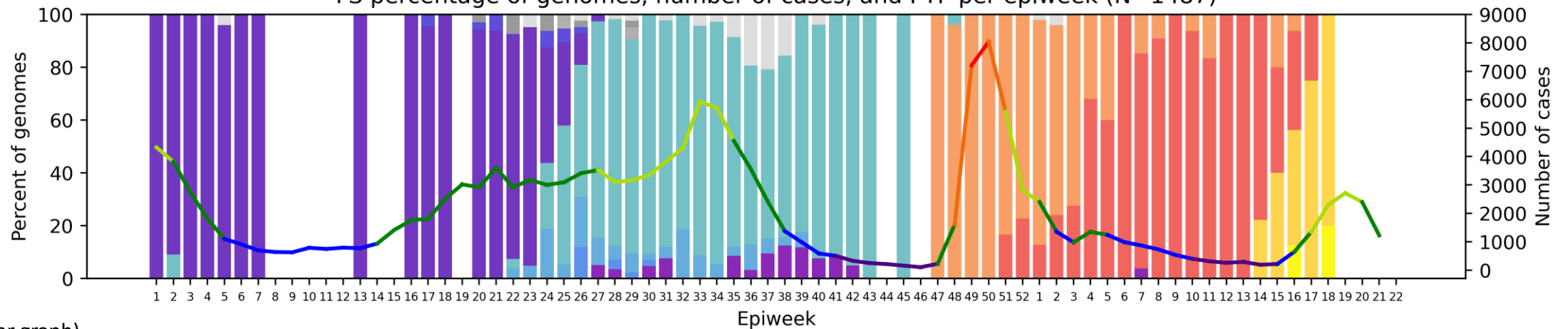


Free State Province, 2021-2022, n = 1487

FS number of genomes, cases, and PTP per epiweek (N=1487)



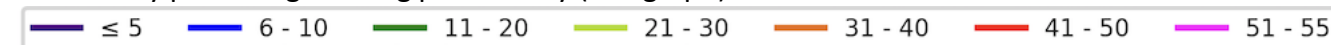
FS percentage of genomes, number of cases, and PTP per epiweek (N=1487)



Clade key (bar graph)

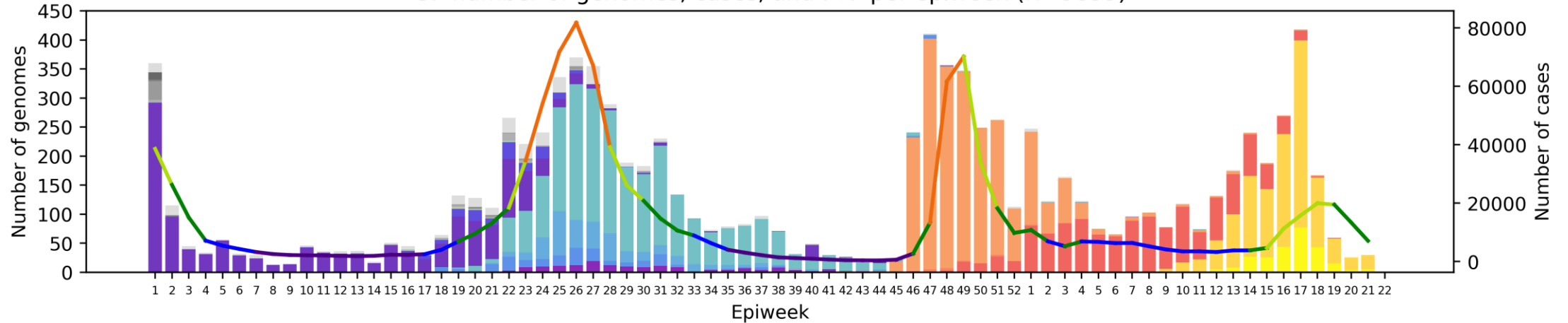


Weekly percentage testing positive key (line graph)

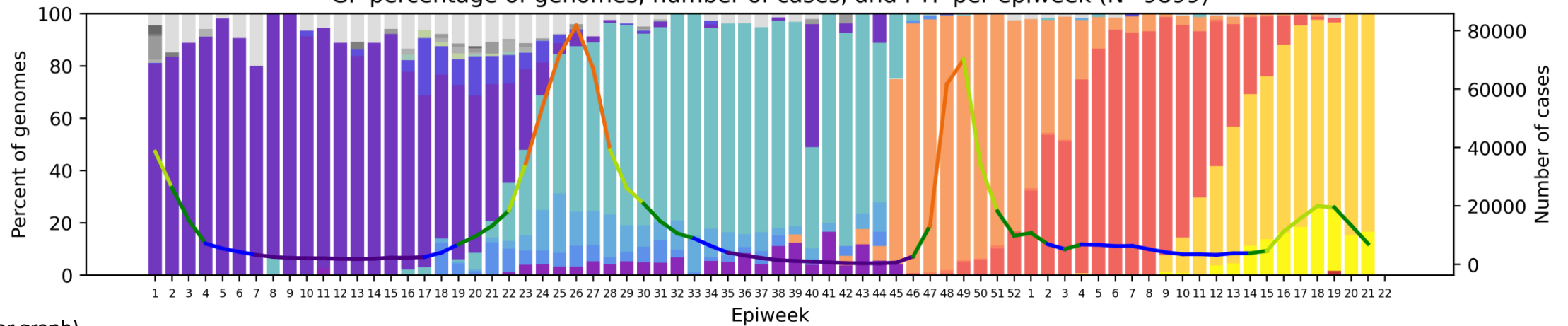


Gauteng Province, 2021-2022, n = 9899

GP number of genomes, cases, and PTP per epiweek (N=9899)



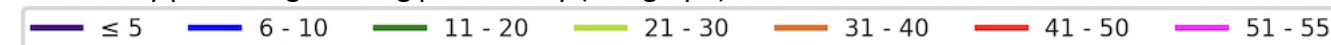
GP percentage of genomes, number of cases, and PTP per epiweek (N=9899)



Clade key (bar graph)

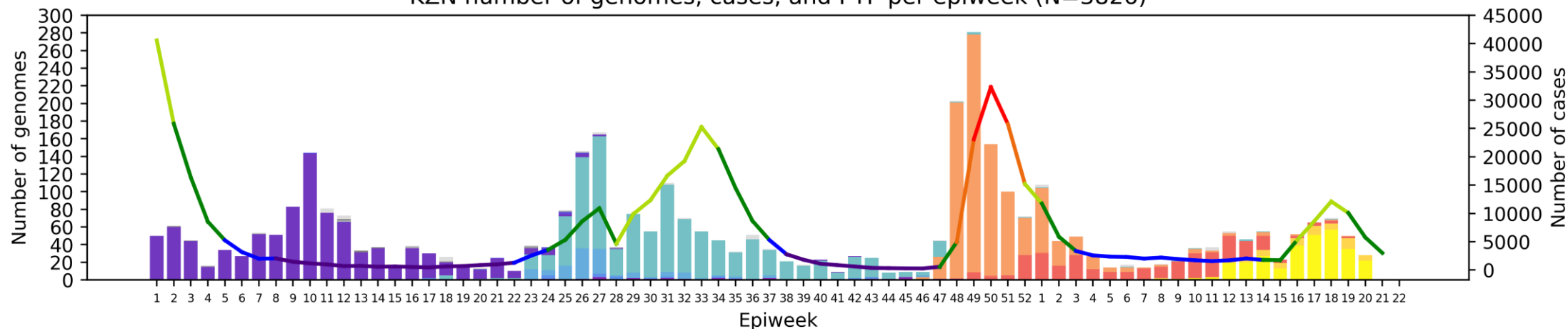


Weekly percentage testing positive key (line graph)

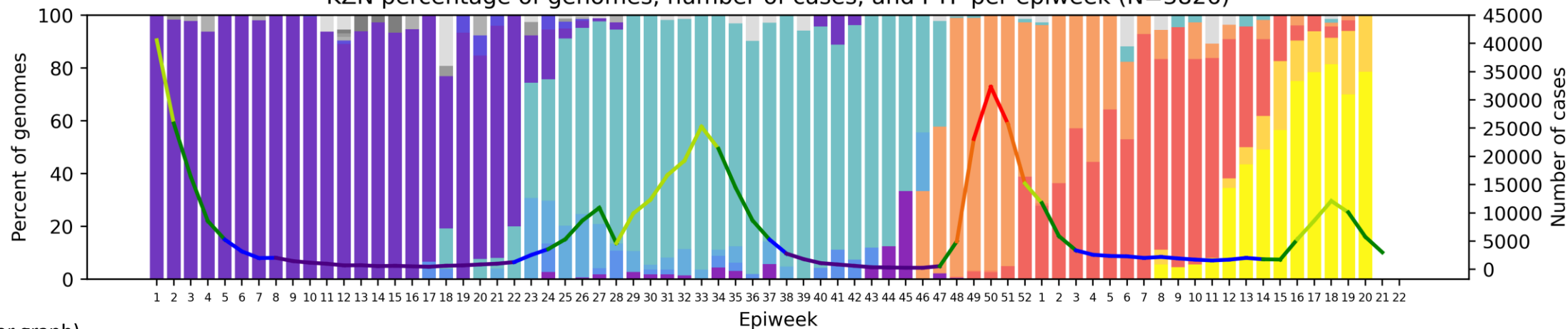


KwaZulu-Natal Province, 2021-2022, n = 3826

KZN number of genomes, cases, and PTP per epiweek (N=3826)



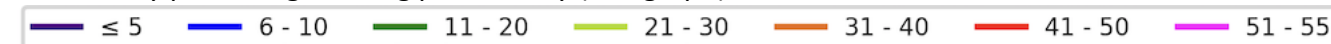
KZN percentage of genomes, number of cases, and PTP per epiweek (N=3826)



Clade key (bar graph)

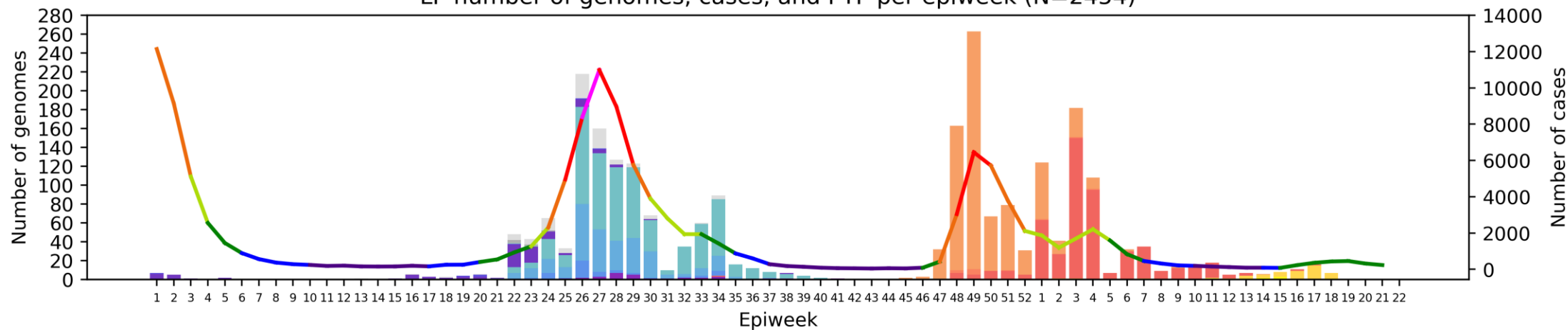


Weekly percentage testing positive key (line graph)

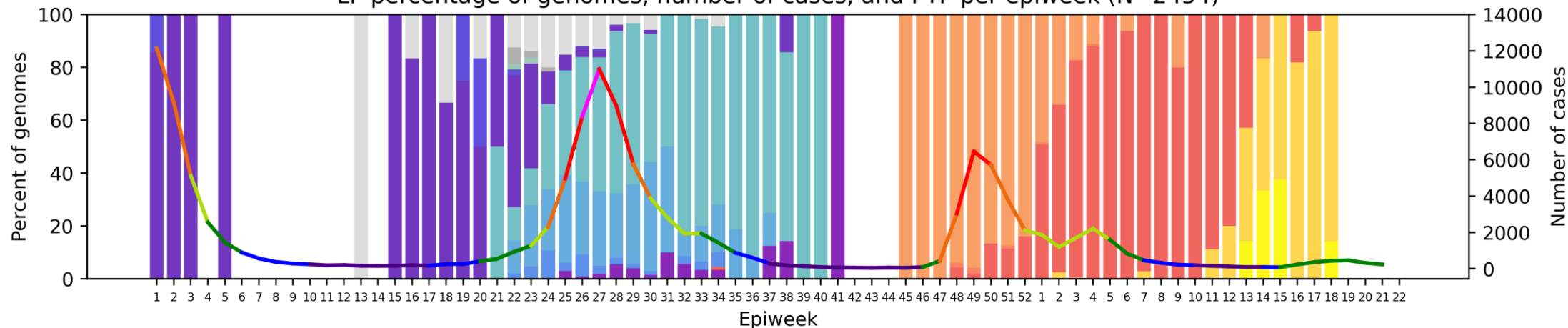


Limpopo Province, 2021-2022, n = 2454

LP number of genomes, cases, and PTP per epiweek (N=2454)



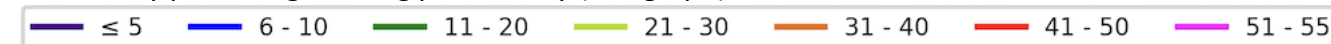
LP percentage of genomes, number of cases, and PTP per epiweek (N=2454)



Clade key (bar graph)

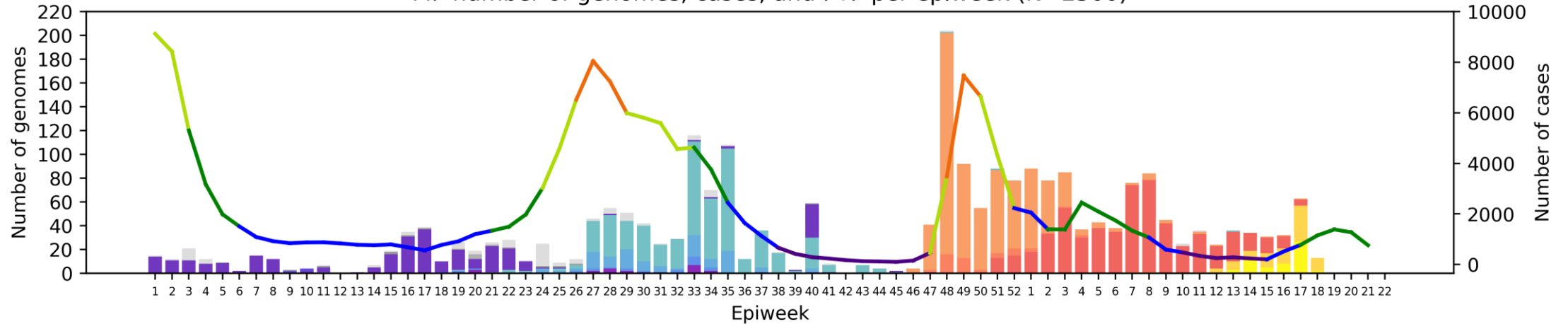


Weekly percentage testing positive key (line graph)

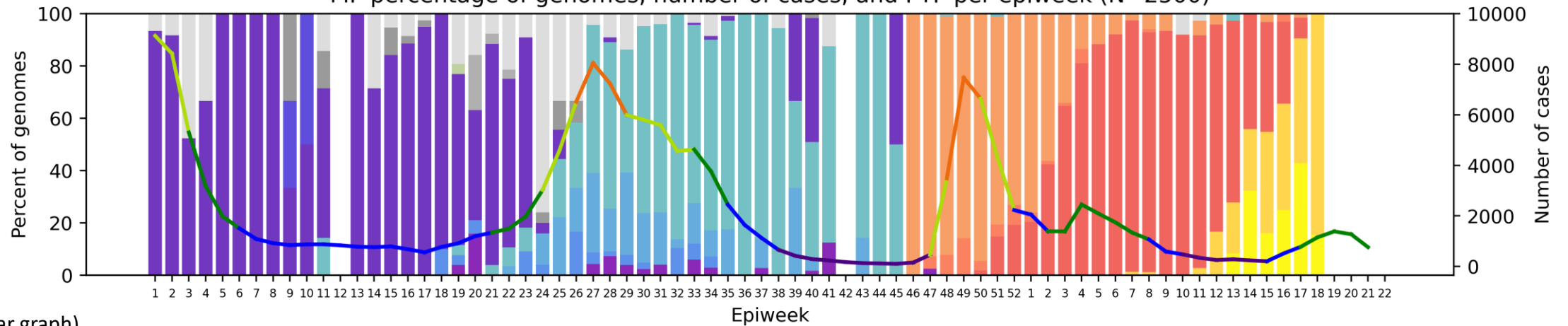


Mpumalanga Province, 2021-2022, n = 2500

MP number of genomes, cases, and PTP per epiweek (N=2500)



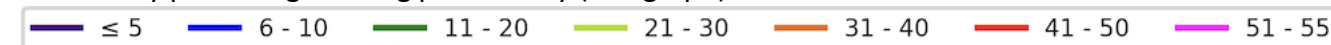
MP percentage of genomes, number of cases, and PTP per epiweek (N=2500)



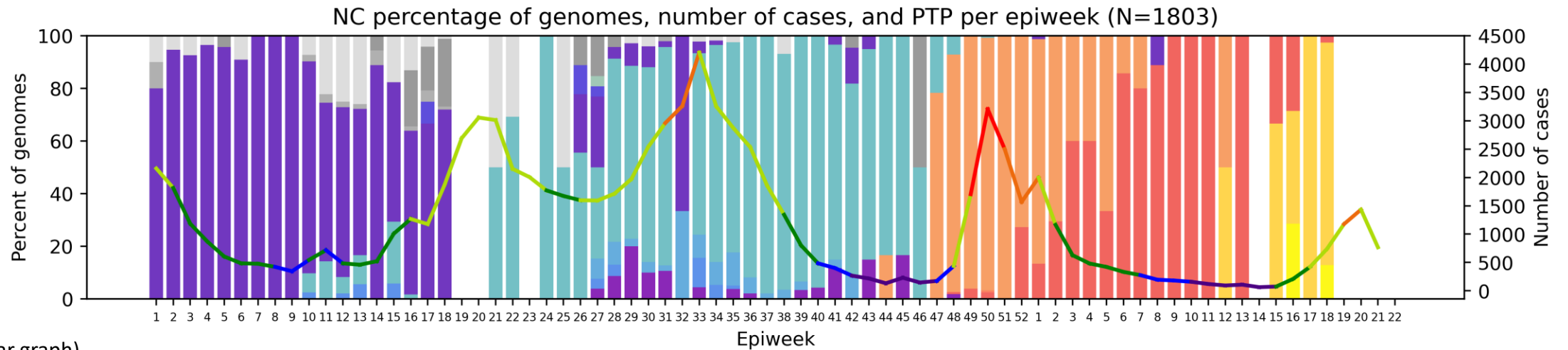
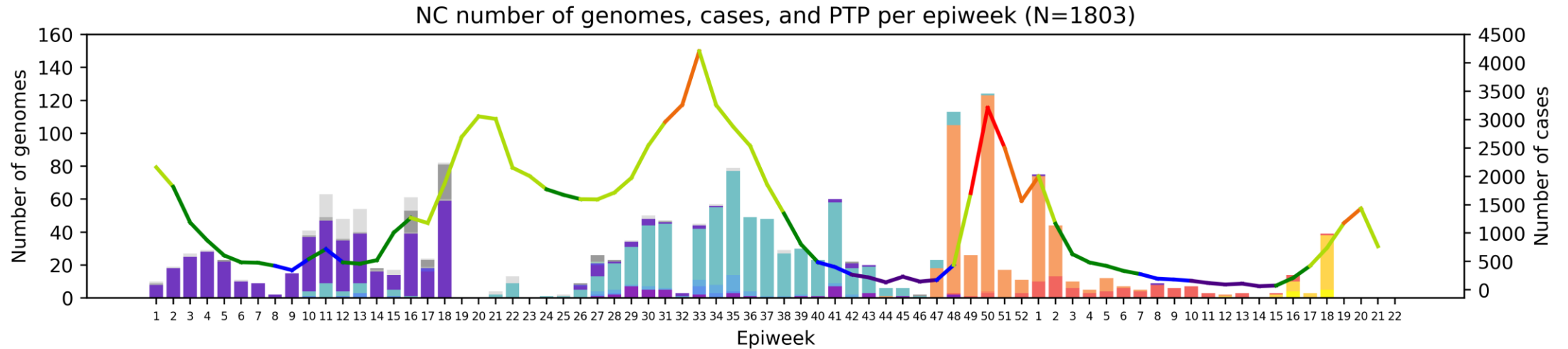
Clade key (bar graph)



Weekly percentage testing positive key (line graph)



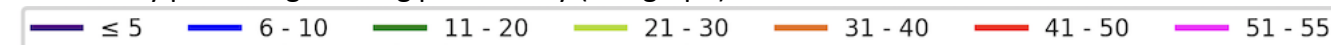
Northern Cape Province, 2021-2022, n = 1803



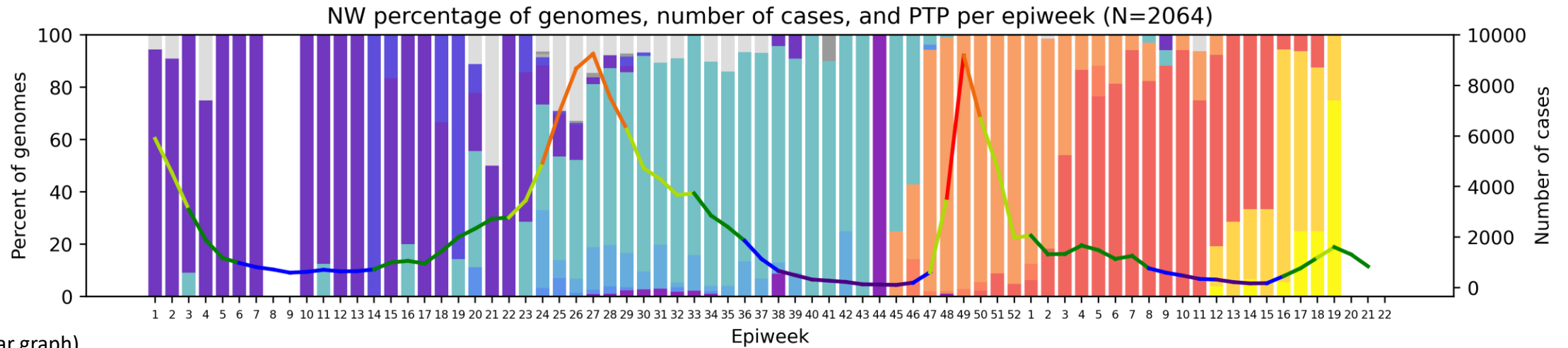
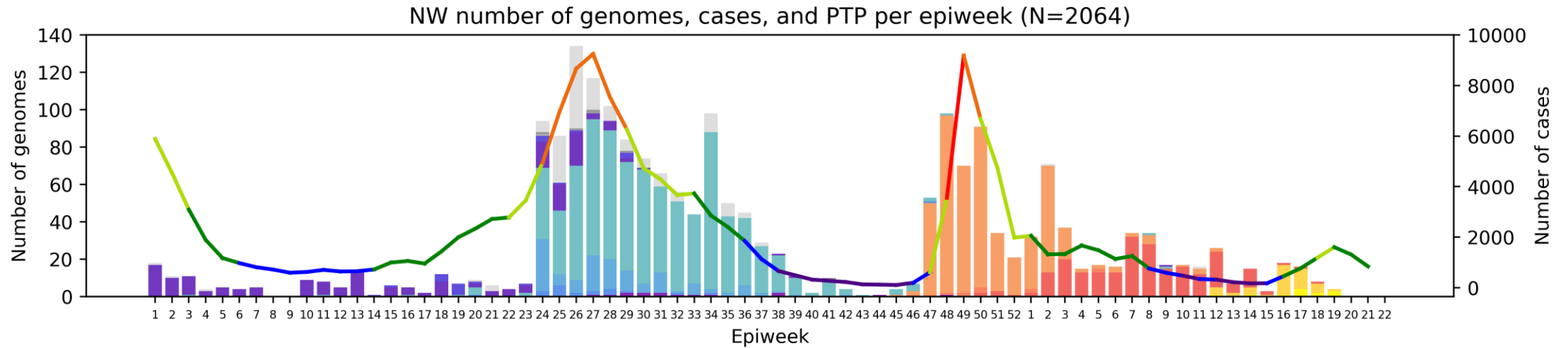
Clade key (bar graph)



Weekly percentage testing positive key (line graph)



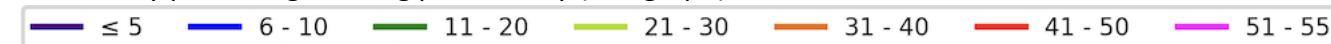
North West Province, 2021-2022, n = 2064



Clade key (bar graph)

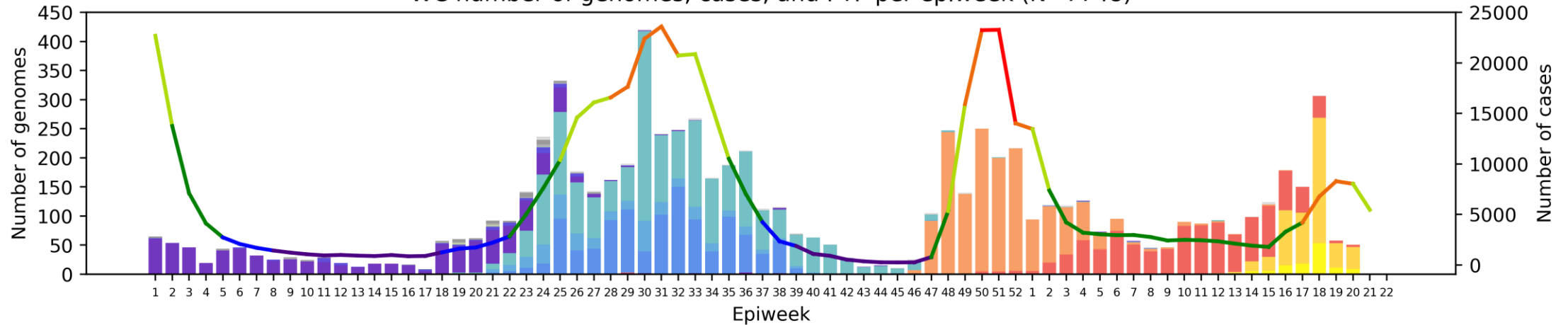


Weekly percentage testing positive key (line graph)

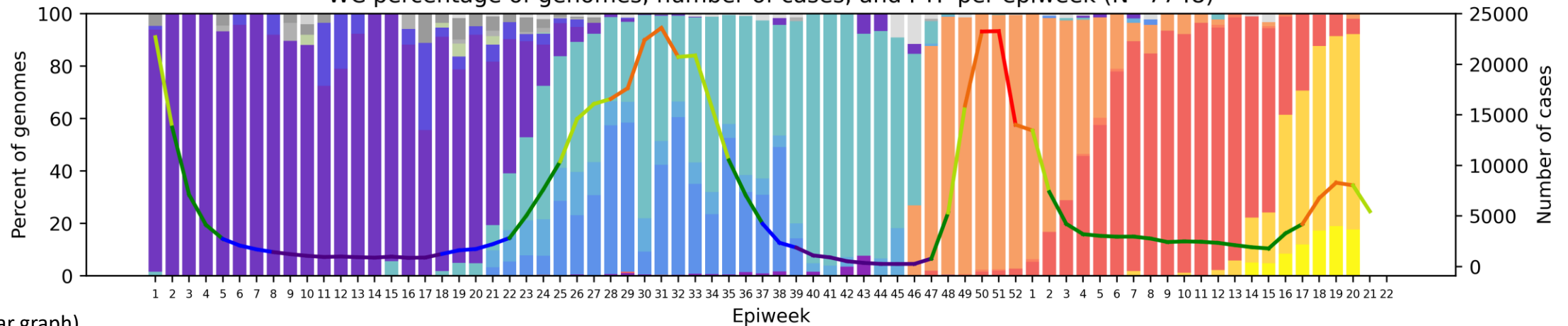


Western Cape Province, 2021-2022, n = 7748

WC number of genomes, cases, and PTP per epiweek (N=7748)



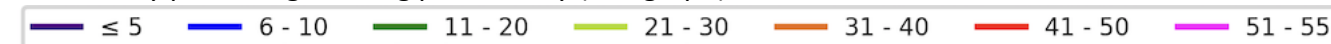
WC percentage of genomes, number of cases, and PTP per epiweek (N=7748)



Clade key (bar graph)



Weekly percentage testing positive key (line graph)

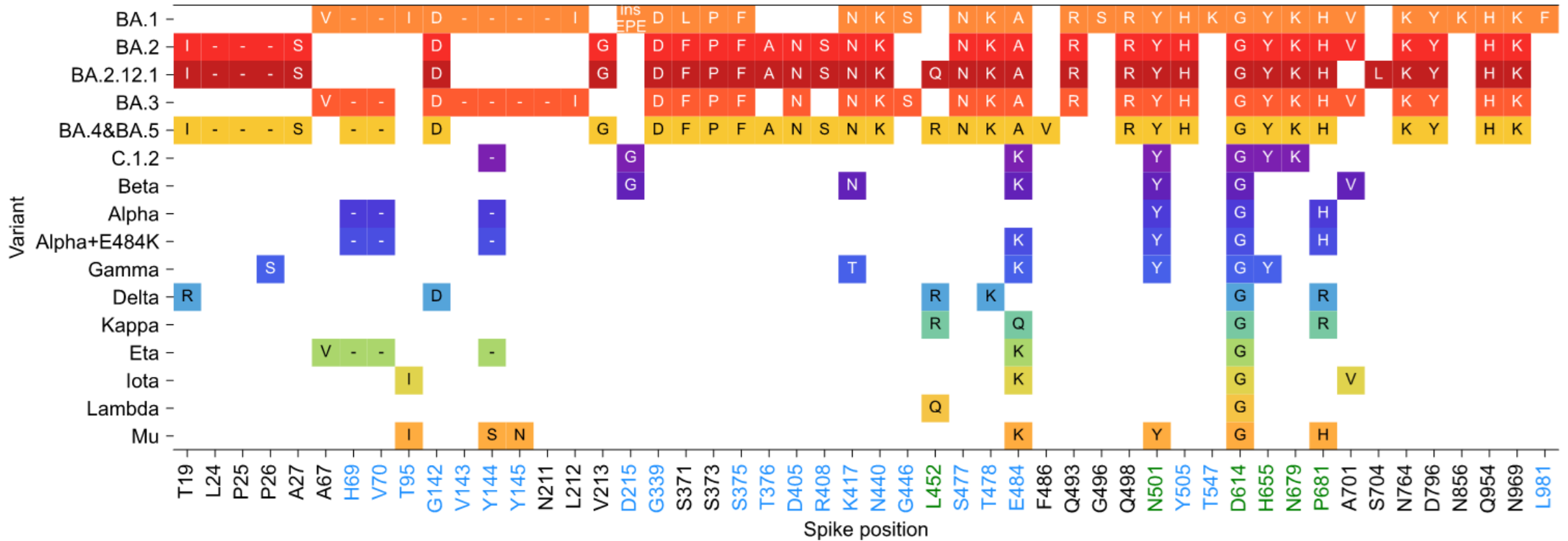


Summary

- **Variant of Concern Omicron in South Africa**
 - Dominates 2022 sequencing data at >98% of genomes.
 - While BA.1 (and sub-lineages) was the predominant lineage in January (55%), BA.2 dominated in February (86%) and March (78%).
 - Omicron lineages BA.4 and BA.5 increased in prevalence in March (16%), and together are dominant in April (73%) and May (93%).
 - BA.2.12.1 has been detected in South Africa at low prevalence in May (0.2%)
 - This is the first time BA.2.12.1 has been detected in South Africa
- Low frequency of previously circulating variants such as Delta still detected in recent data.

¹<https://github.com/cov-lineages/pango-designation/releases/tag/v1.3>

Omicron spike mutations compared to other VOC/VOIs



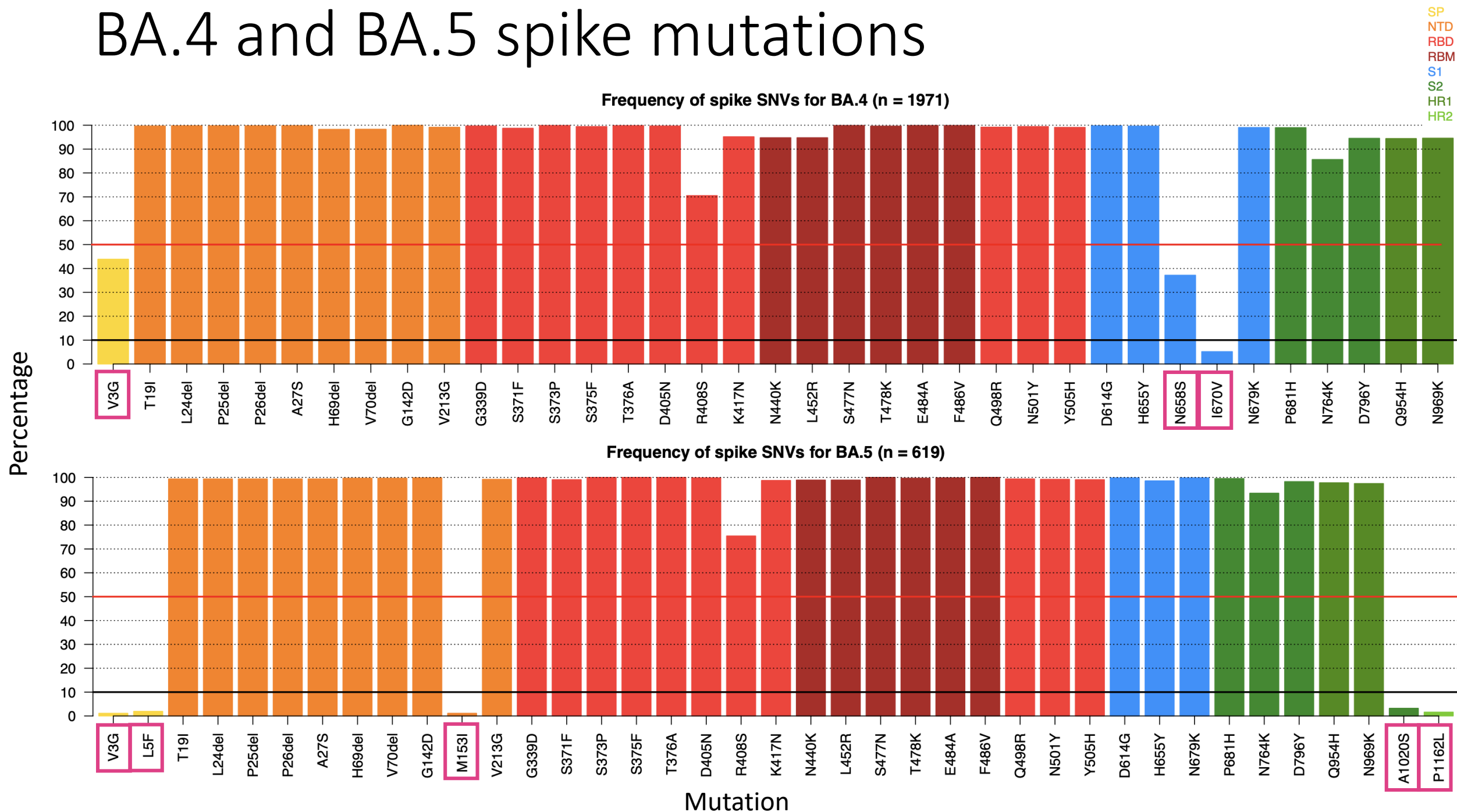
Mutation impact key

Unknown/unconfirmed impact Known/predicted immune escape Enhanced infectivity

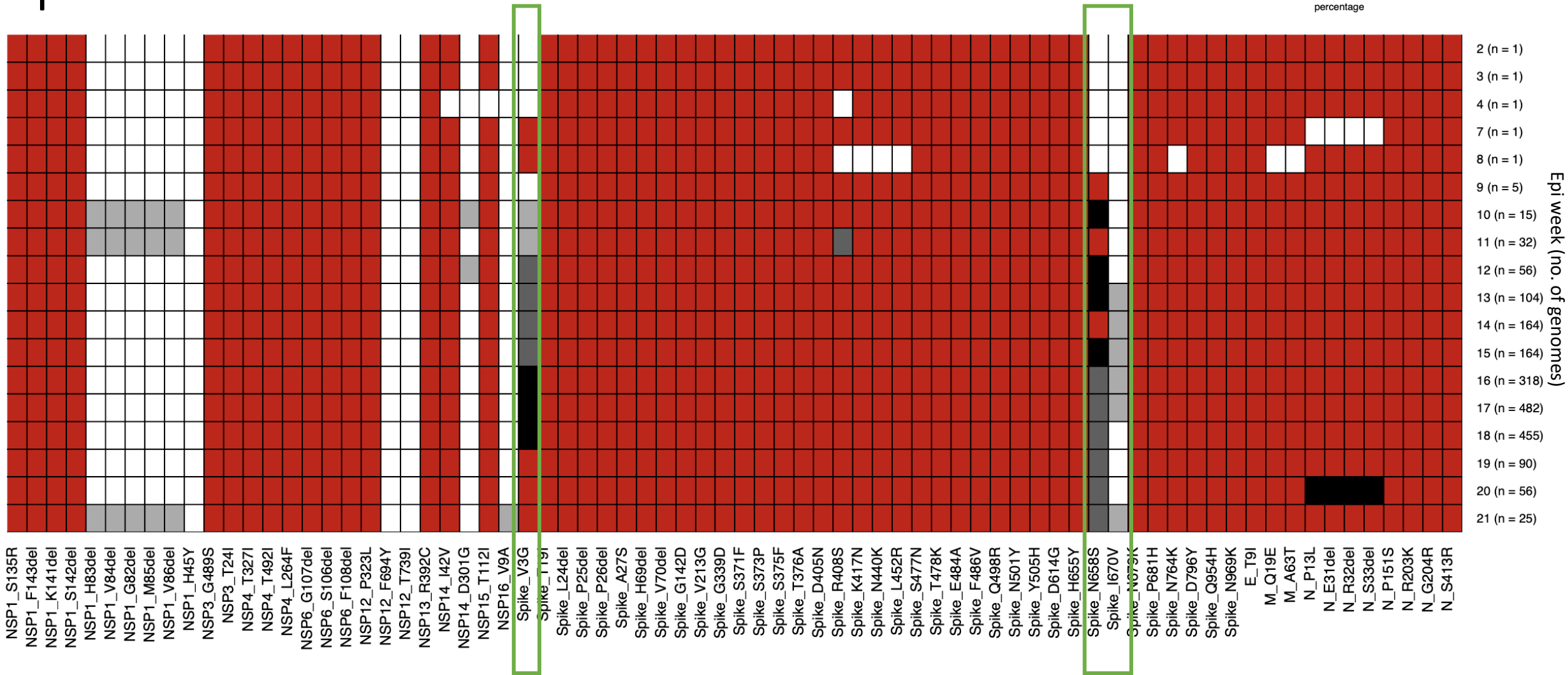
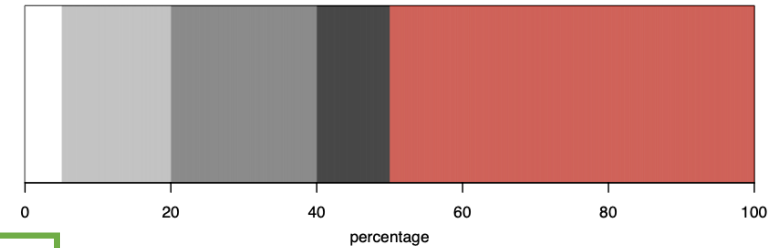
- Multiple changes within the two immunogenic regions in S1 (NTD and RBD)
 - Including a three amino acid insertion
- Accumulation of mutations surrounding the furin cleavage site
 - Including combination of N679K and P681H
- Effect of most spike S2 subunit changes have not been defined, but may be linked to immune escape

Only lineage-defining mutations are pictured.

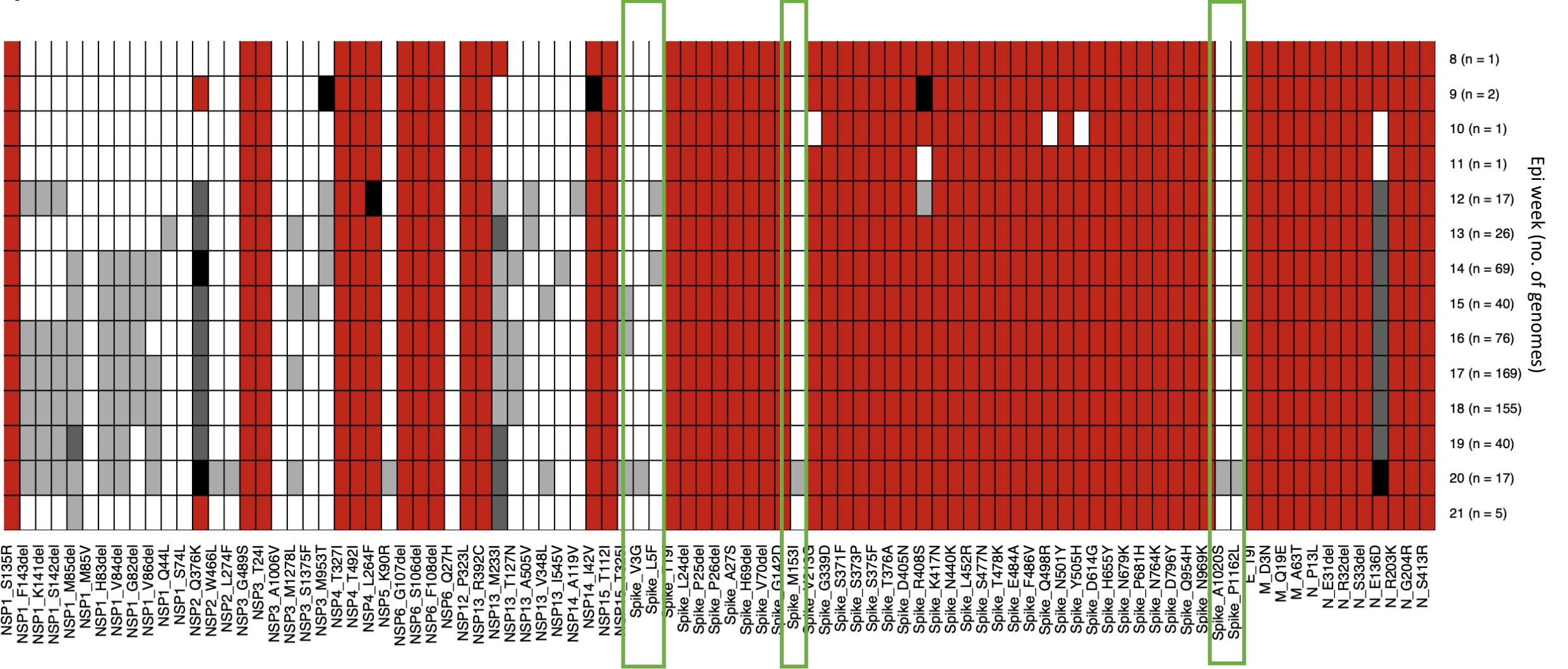
BA.4 and BA.5 spike mutations



BA.4 whole genome mutation prevalence over time



BA.5 whole genome mutation prevalence over time





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EDCTP

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National Institute for Communicable Diseases



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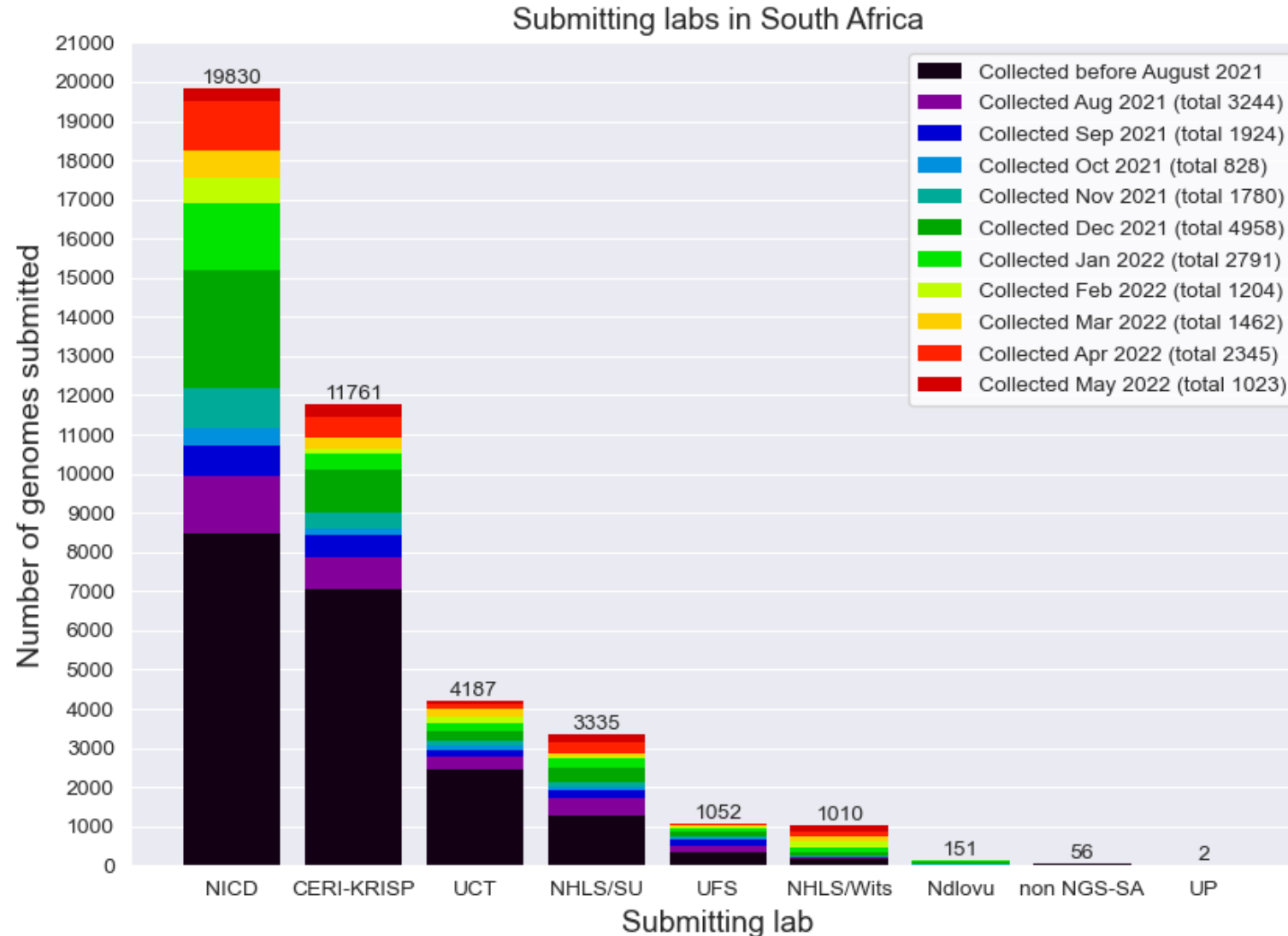
Glaudina Loots

SA MRC

Glenda Gray



South African genomes submitted per submitting lab, 2020 - 2022 (N=41 384)



NGS-SA Labs

CERI: Centre for Epidemic Response and Innovation

KRISP: KZN Research Innovation and Sequencing Platform

NDLOVU: Ndlovu Research Laboratories

NICD: National Institute for Communicable Diseases

NHLS: National Health Laboratory Service

SU: Stellenbosch University

UCT: University of Cape Town

UFS: University of the Free State

UP: University of Pretoria

Multiple labs from NGS-SA and collaborating public and private laboratories are contributing to sequencing, both as originating and as submitting (pictured here) laboratories.

Currently circulating Variants of Concern (VOC)

WHO label	Pango lineage●	GISAID clade	Nextstrain clade	Additional amino acid changes monitored°	Earliest documented samples	Date of designation
Delta	B.1.617.2	G/478K.V1	21A, 21I, 21J	+S:K417N +S:K484K	India, Oct-2020	VOI: 4-Apr-2021 VOC: 11-May-2021
Omicron*	B.1.1.529	GR/484A	21K	+S:R346K	Multiple countries, Nov-2021	VUM: 24-Nov-2021 VOC: 26-Nov-2021

<https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/> accessed 18 March 2022

●Includes all descendant lineages. See the cov-lineages.org and the Pango network websites for further details.

° Only found in a subset of sequences

Previously circulating Variants of Concern

WHO label	Pango lineage•	GISAID clade	Nextstrain clade	Earliest documented samples	Date of designation
Alpha	B.1.1.7	GRY	20I (V1)	United Kingdom, Sep-2020	VOC: 18-Dec-2020 Previous VOC: 09-Mar-2022
Beta	B.1.351	GH/501Y.V2	20H (V2)	South Africa, May-2020	VOC: 18-Dec-2020 Previous VOC: 09-Mar-2022
Gamma	P.1	GR/501Y.V3	20J (V3)	Brazil, Nov-2020	VOC: 11-Jan-2021 Previous VOC: 09-Mar-2022

<https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/> accessed 18 March 2022

- Includes all descendant lineages. See the cov-lineages.org and the Pango network websites for further details.

Submission of routine specimens for sequencing

- representative of multiple geographic regions (provinces/districts/health facilities) from individuals of
 - all ages
 - over as many time periods during the SARS-CoV-2 epidemic in South Africa
- requested that testing laboratories in both the private and public sectors, submit respiratory samples to their closest NGS-SA sequencing laboratory on a routine basis (ideally every week) as follows, depending on the capacity of the testing laboratory:
 - All positives samples should be sent every week (NGS-SA laboratory will perform random sampling as described below) **OR**
 - A weekly selection of approximately 10%-20% of randomly selected positive samples should be sent every week. Number of selected samples will depend on the size of laboratory and how many other laboratories are drained by the submitting laboratory.

Submission of special interest specimens for sequencing

In addition to routine samples mentioned above, please send specimens separately to above and clearly marked if:

- Suspected vaccine breakthrough (≥ 14 days after vaccine), especially if hospitalised and clinically severe
- Suspected re-infection (≥ 90 days after previous episode), especially if hospitalised and clinically severe
- Prolonged shedding with high SARS-CoV-2 viral loads (i.e. Ct values less than 30 for more than 1 month post-primary diagnosis) in immunocompromised individuals
- Possible animal-to-human transmission
- Suspected cases of importation from another country, especially countries known to harbour SARS-CoV-2 variants of concern or countries with little available information
- Clusters of “unusual” cases (e.g., in terms of disease presentation, patient groups affected, etc.)