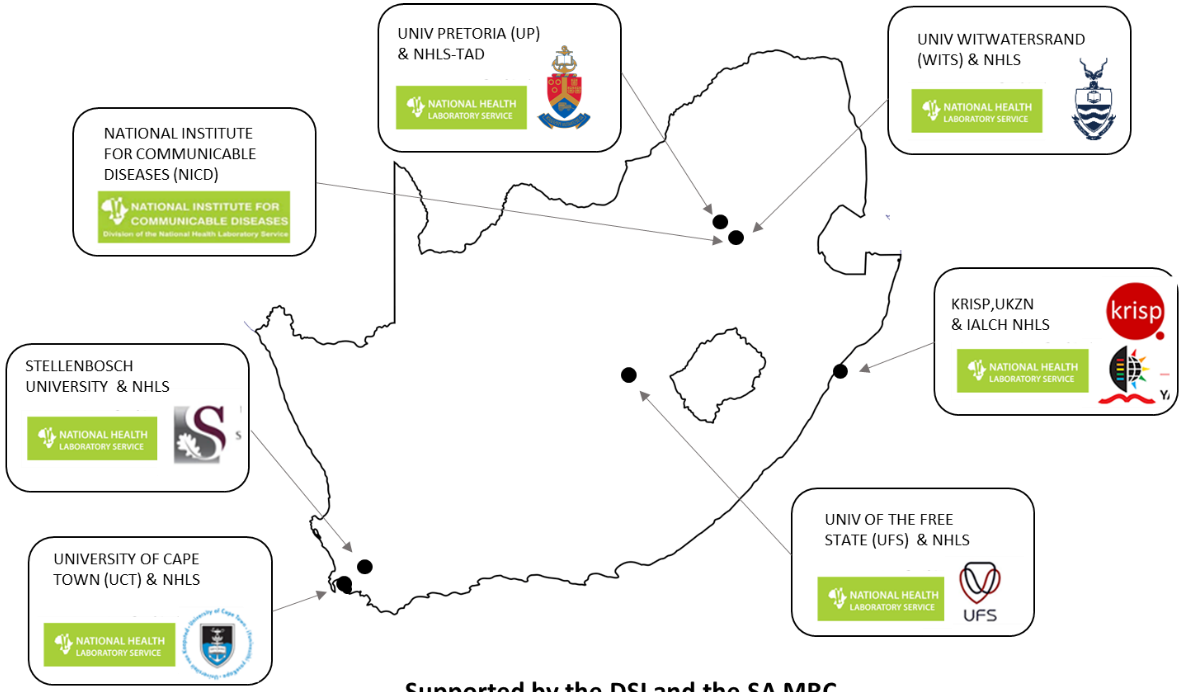
Network for Genomic Surveillance in South Africa (NGS-SA)

SARS-CoV-2 Sequencing Update

12 August 2022



NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES (NICD)

UNIV PRETORIA (UP) & NHLS-TAD

UNIV WITWATERSRAND (WITS) & NHLS

KRISP,UKZN & IALCH NHLS

STELLENBOSCH UNIVERSITY & NHLS

UNIVERSITY OF CAPE TOWN (UCT) & NHLS

UNIV OF THE FREE STATE (UFS) & NHLS

Supported by the DSI and the SA MRC

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

Prepared by the National Institute for Communicable Diseases (NICD) of the National Health Laboratory (NHLS) on behalf of the Network for Genomics Surveillance in South Africa (NGS-SA)

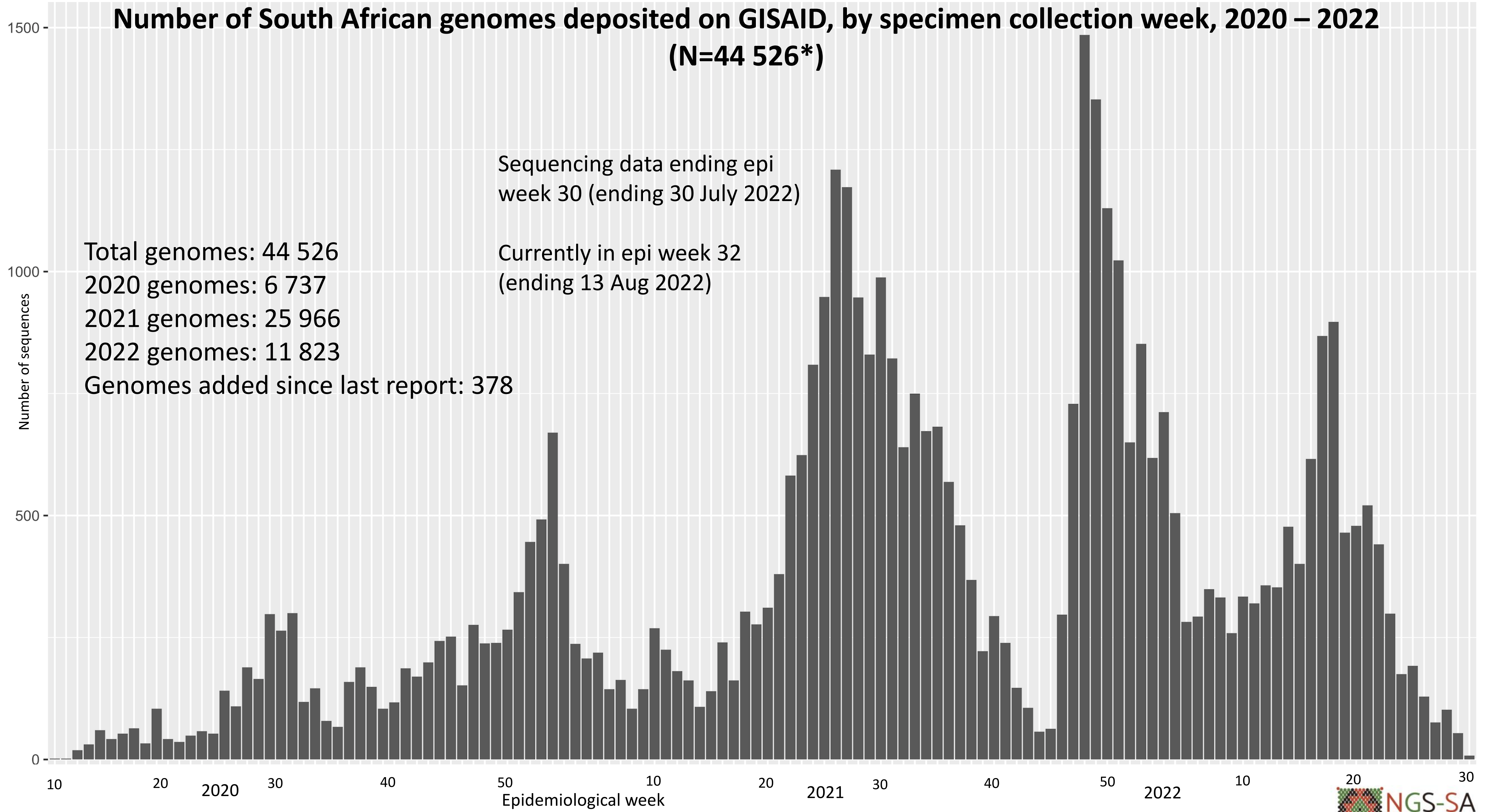
The genomic data presented here are based on South African SARS-CoV-2 sequence data downloaded from GISAID (www.gisaid.org) on 12 August 2022 at 14h18

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

Number of South African genomes deposited on GISAID, by specimen collection week, 2020 – 2022 (N=44 526*)



Sequencing data ending epi week 30 (ending 30 July 2022)

Currently in epi week 32 (ending 13 Aug 2022)

Total genomes: 44 526
2020 genomes: 6 737
2021 genomes: 25 966
2022 genomes: 11 823
Genomes added since last report: 378

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

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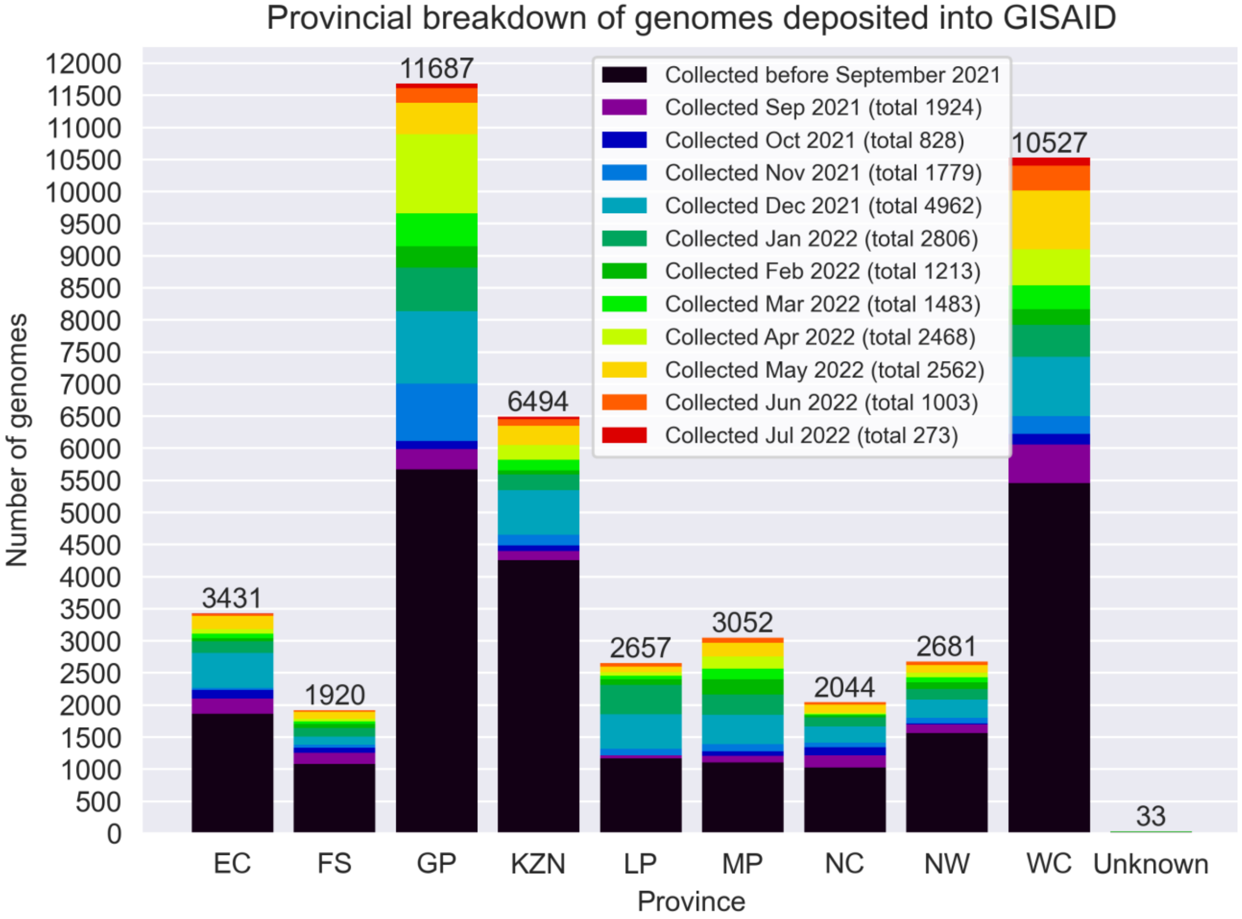
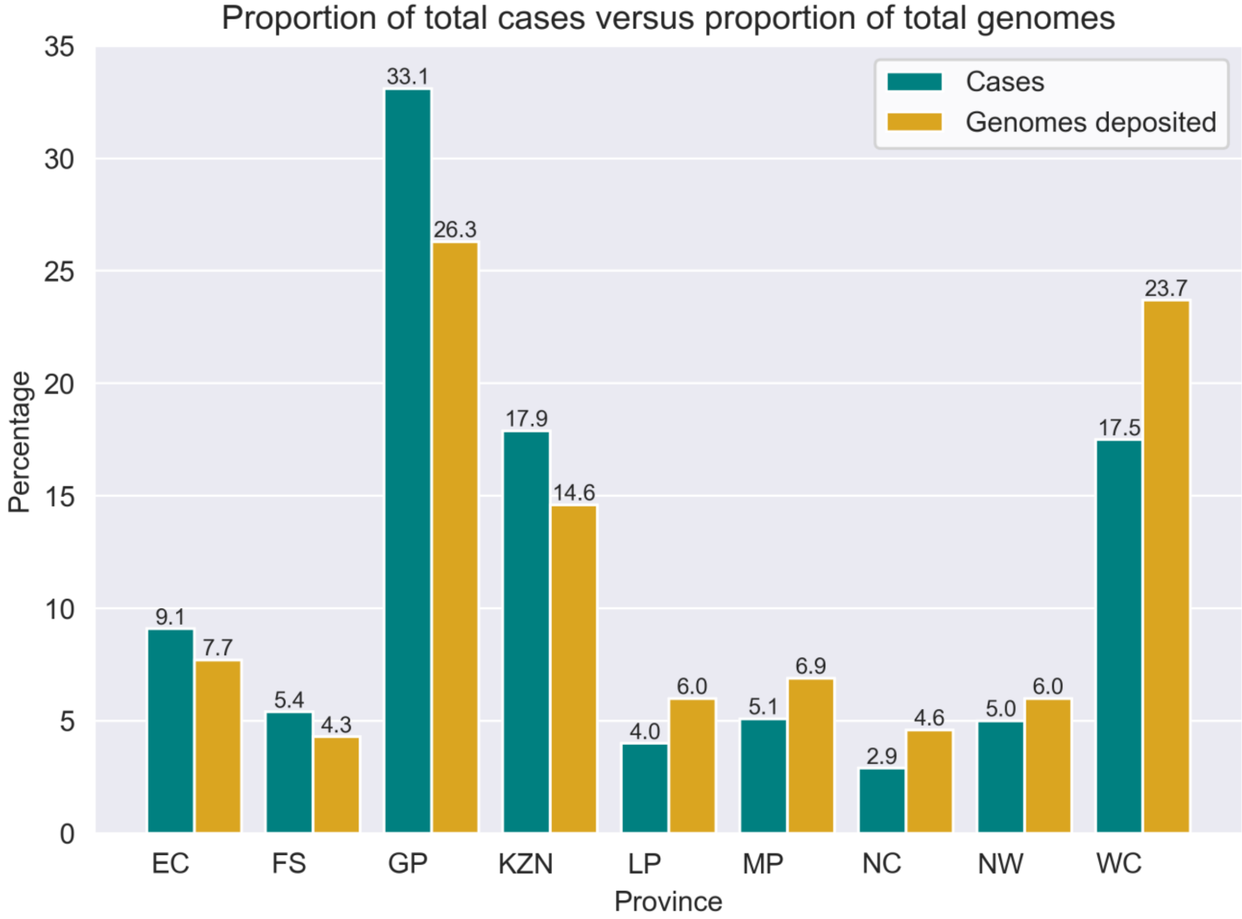
GISAID genomes vs total cases, 2020 – 2022 (N=44 526)


Provincial breakdown of genomes deposited into GISAID


Proportion of total cases versus proportion of total genomes

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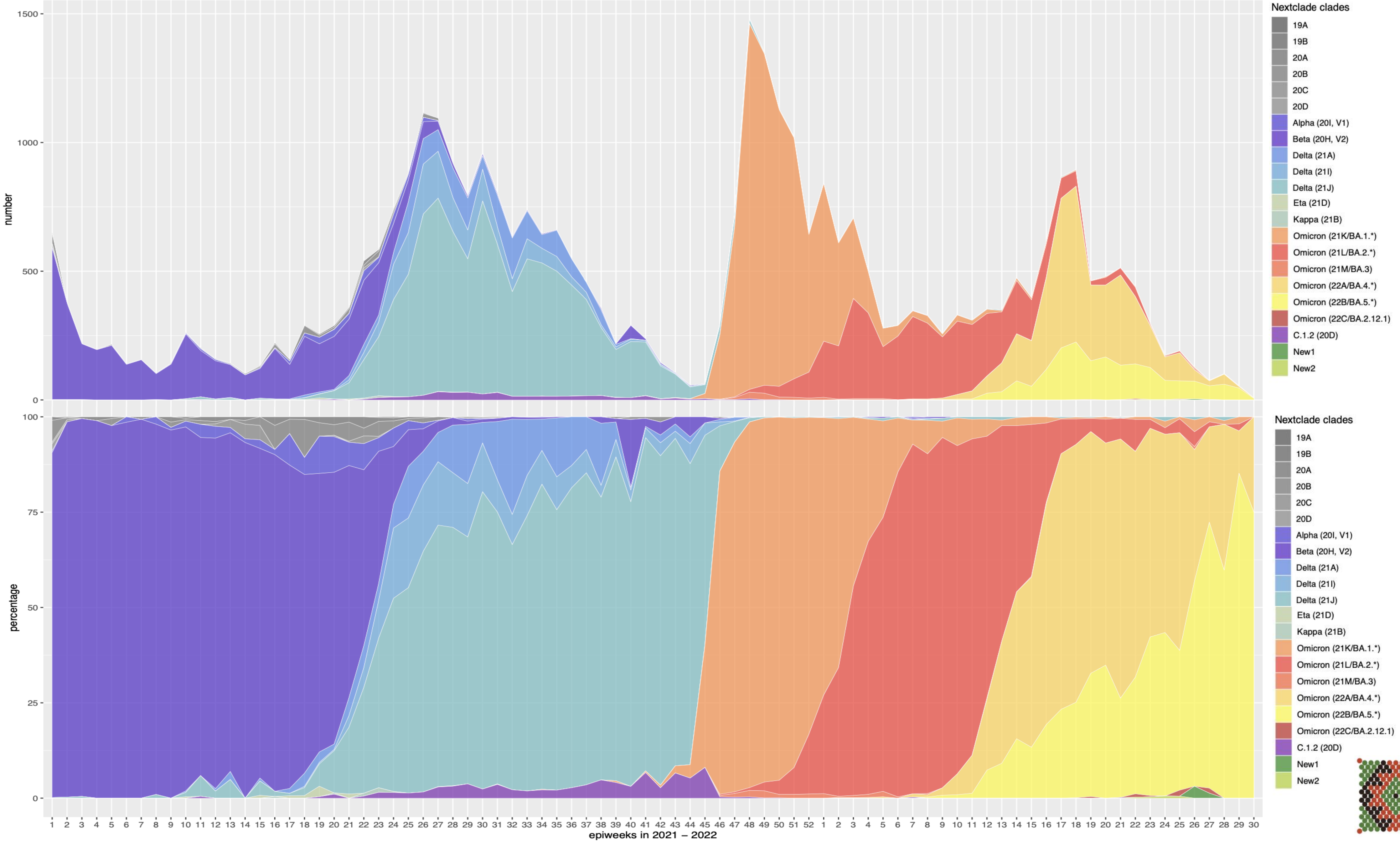
Number and percentage of clades by epiweek in South Africa, 2021 – 2022 (37 702*)



Sequencing data ending epi week 30 (ending 30 July 2022)

Currently in epi week 32 (ending 13 Aug 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.

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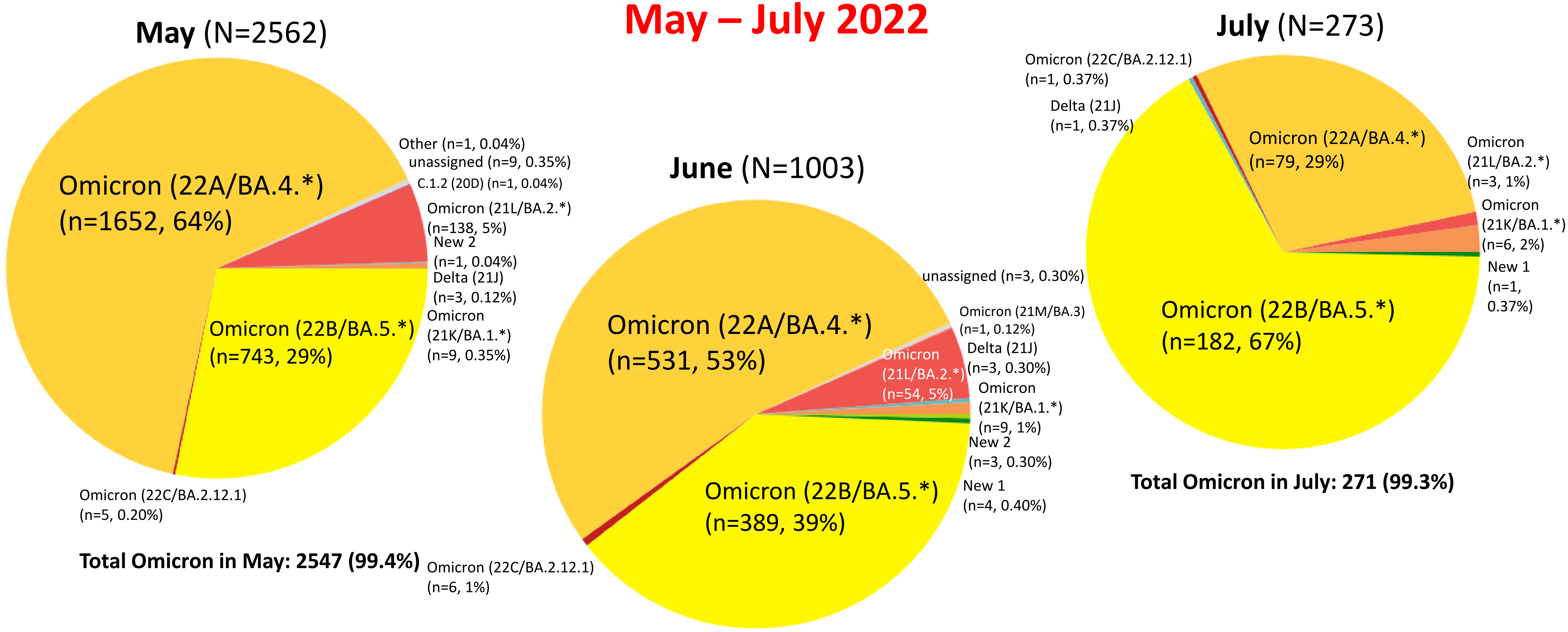
Prevalence of Variants of Concern (VOC) and Variants of Interest (VOI) in May – July 2022



Total Omicron in May: 2547 (99.4%)

Total Omicron in June: 990 (98.7%)

Total Omicron in July: 271 (99.3%)

Clade key (bar graph)

- 🟩 New1
- 🟩 New2
- 🟧 Omicron (21K/BA.1.*)
- 🟥 Omicron (21L/BA.2.*)
- 🟥 Omicron (22C/BA.2.12.1)
- 🟧 Omicron (21M/BA.3)
- 🟨 Omicron (22A/BA.4.*)
- 🟨 Omicron (22B/BA.5.*)
- 🟪 C.1.2 (20D)
- 🟪 Beta (20H, V2)
- 🟦 Alpha (20I, V1)
- 🟦 Delta (21A)
- 🟦 Delta (21I)
- 🟦 Delta (21J)
- 🟩 Kappa (21B)
- 🟩 Eta (21D)
- ⬛ 20D
- — Cases
- ⬛ 20C
- ⬛ 20B
- ⬛ 20A
- ⬜ 19B
- ⬜ 19A
- ⬜ unassigned

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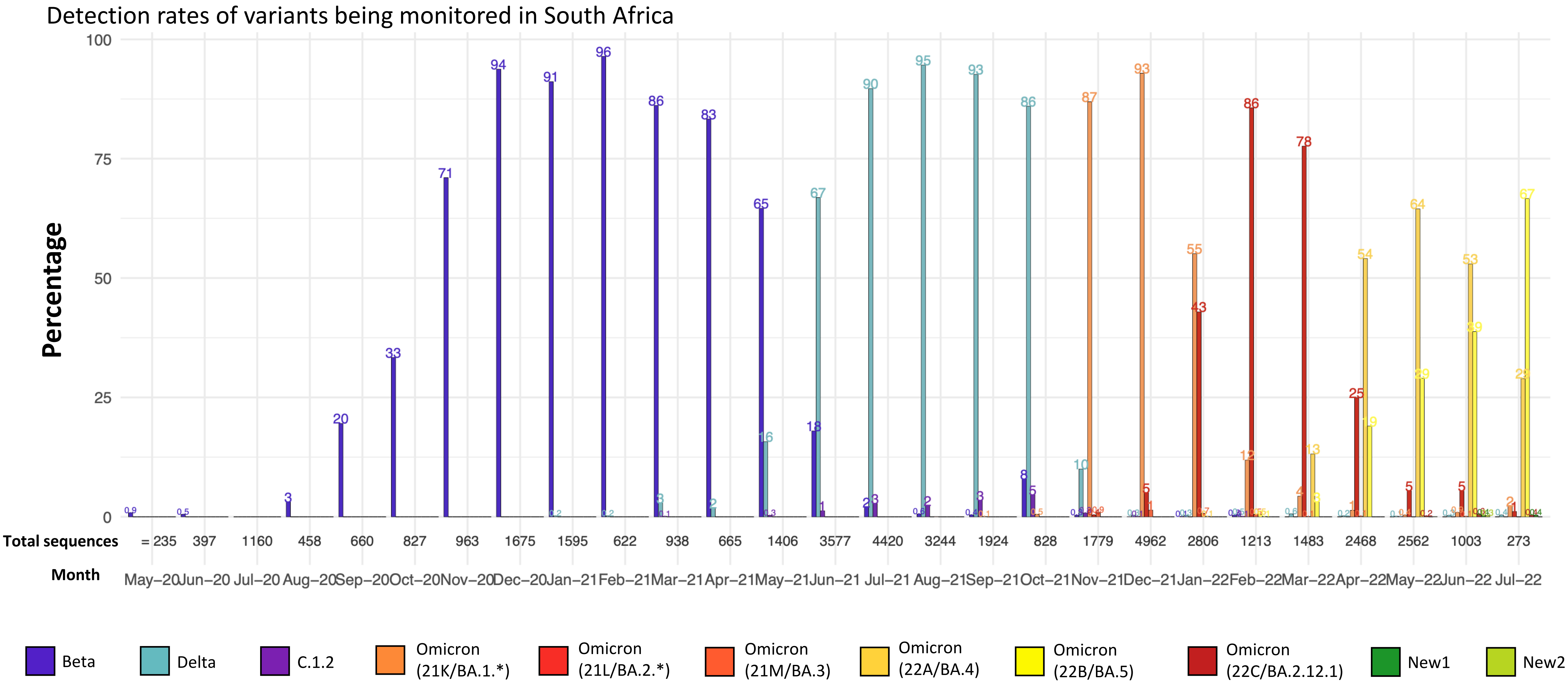
Detection Rates: Beta, Delta, C.1.2 and Omicron



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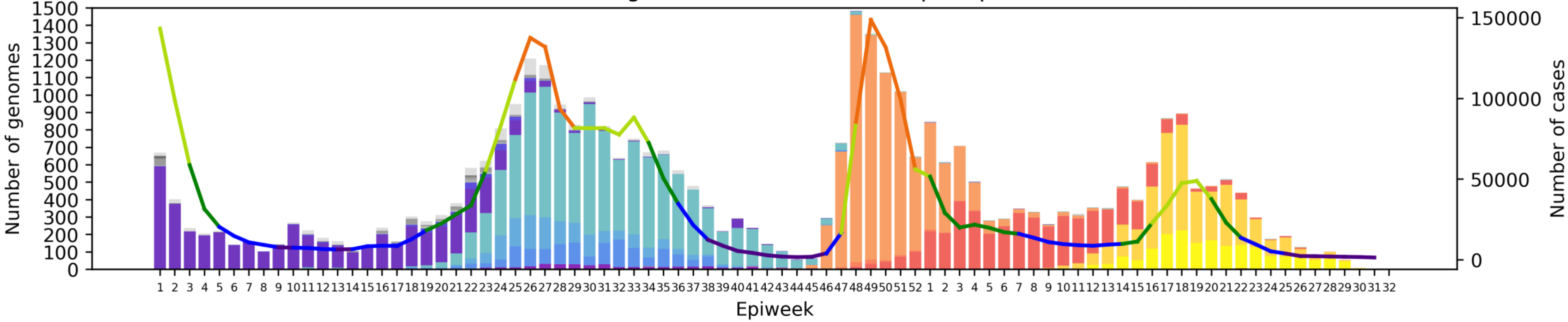
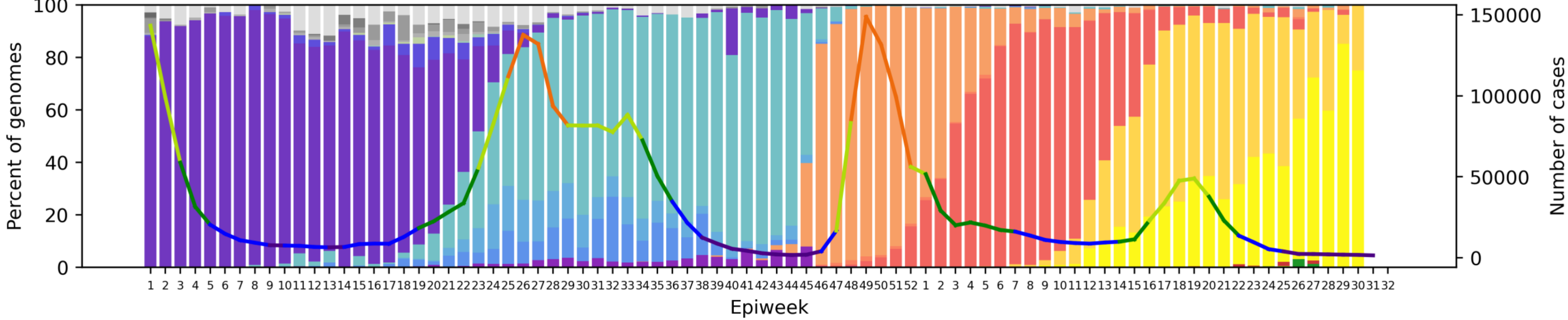
*Bars represent percentage prevalence of variant for the month; total number sequences collected for the month are given below the bar

South Africa, 2021-2022, n = 37 702*

South Africa number of genomes, cases, and PTP per epiweek (N=37702)



South Africa percentage of genomes, number of cases, and PTP per epiweek (N=37702)



Clade key (bar graph)

- 🟩 New1
- 🟩 New2
- 🟧 Omicron (21K/BA.1.*)
- 🟥 Omicron (21L/BA.2.*)
- 🟥 Omicron (22C/BA.2.12.1)
- 🟧 Omicron (21M/BA.3)
- 🟨 Omicron (22A/BA.4.*)
- 🟨 Omicron (22B/BA.5.*)
- 🟪 C.1.2 (20D)
- 🟪 Beta (20H, V2)
- 🟦 Alpha (20I, V1)
- 🟦 Delta (21A)
- 🟦 Delta (21I)
- 🟦 Delta (21J)
- 🟩 Kappa (21B)
- 🟩 Eta (21D)
- ⬛ 20D
- — Cases
- ⬛ 20C
- ⬛ 20B
- ⬛ 20A
- ⬜ 19B
- ⬜ 19A
- ⬜ unassigned

Weekly percentage testing positive key (line graph)

- — ≤ 5
- — 6 - 10
- — 11 - 20
- — 21 - 30
- — 31 - 40
- — 41 - 50
- — 51 - 55

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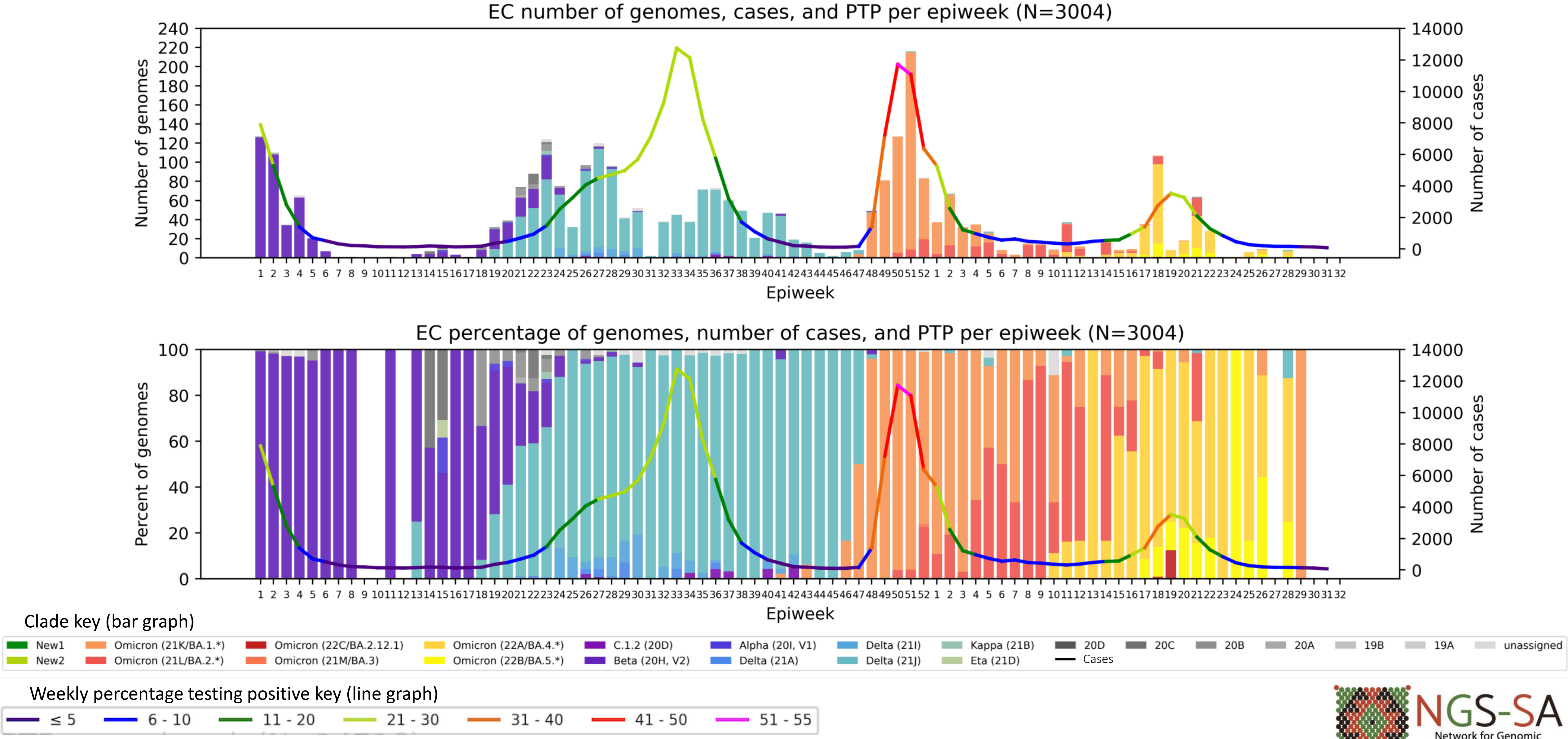
*Excludes sequences missing collection dates, as well as those collected January 1st and 2nd 2021 as they are part of epiweek 53 of 2020.

Eastern Cape Province, 2021-2022, n = 3004

Genomes added since last report: 48*



*May include genomes from 2020 which are not pictured here and are not included in the slide total.

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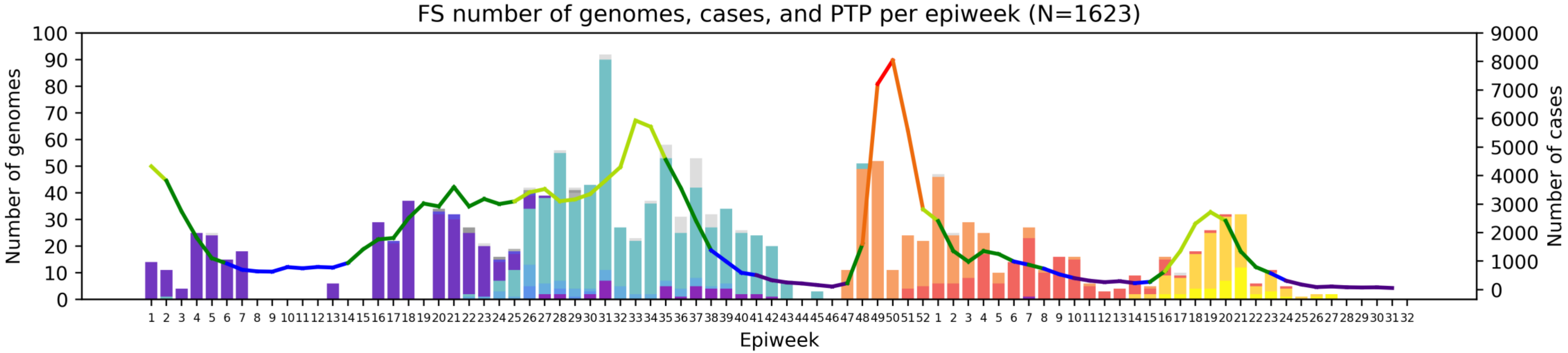
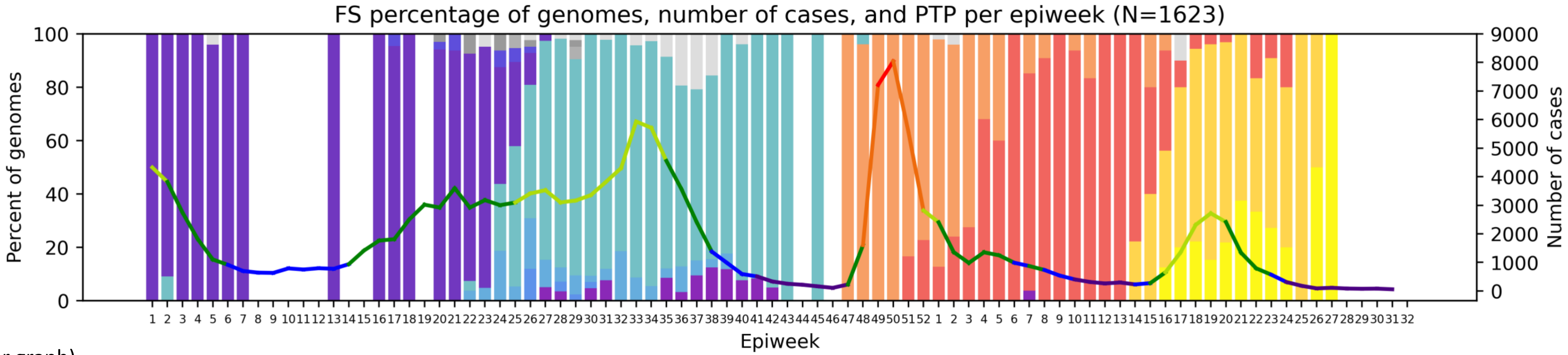
Free State Province, 2021-2022, n = 1623

Genomes added since last report: 41*


FS number of genomes, cases, and PTP per epiweek (N=1623)


FS percentage of genomes, number of cases, and PTP per epiweek (N=1623)

Clade key (bar graph)

- 🟩 New1
- 🟩 New2
- 🟧 Omicron (21K/BA.1.*)
- 🟥 Omicron (21L/BA.2.*)
- 🟥 Omicron (22C/BA.2.12.1)
- 🟧 Omicron (21M/BA.3)
- 🟨 Omicron (22A/BA.4.*)
- 🟨 Omicron (22B/BA.5.*)
- 🟪 C.1.2 (20D)
- 🟪 Beta (20H, V2)
- 🟦 Alpha (20I, V1)
- 🟦 Delta (21A)
- 🟦 Delta (21I)
- 🟦 Delta (21J)
- 🟩 Kappa (21B)
- 🟩 Eta (21D)
- ⬛ 20D
- — Cases
- ⬛ 20C
- ⬛ 20B
- ⬛ 20A
- ⬜ 19B
- ⬜ 19A
- ⬜ unassigned

Weekly percentage testing positive key (line graph)

- — ≤ 5
- — 6 - 10
- — 11 - 20
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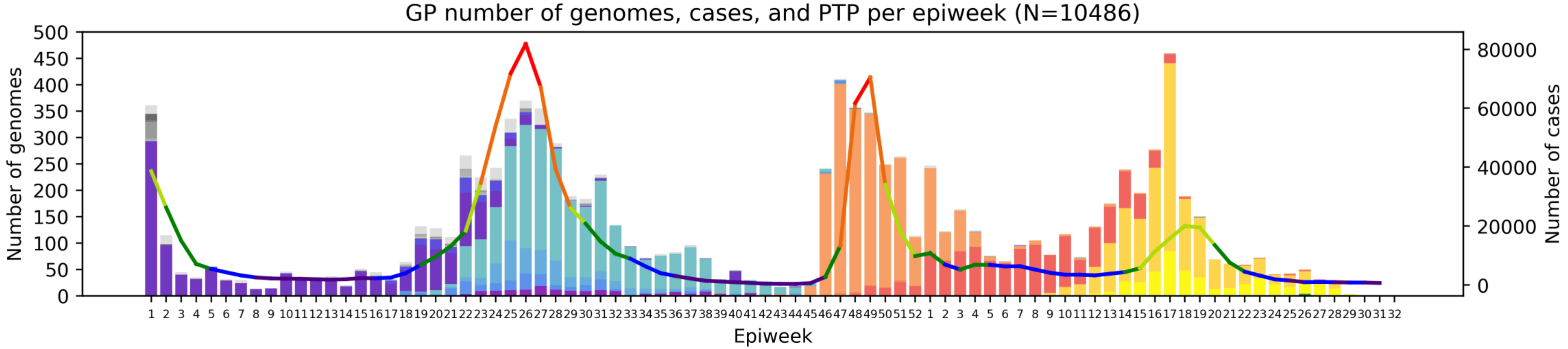
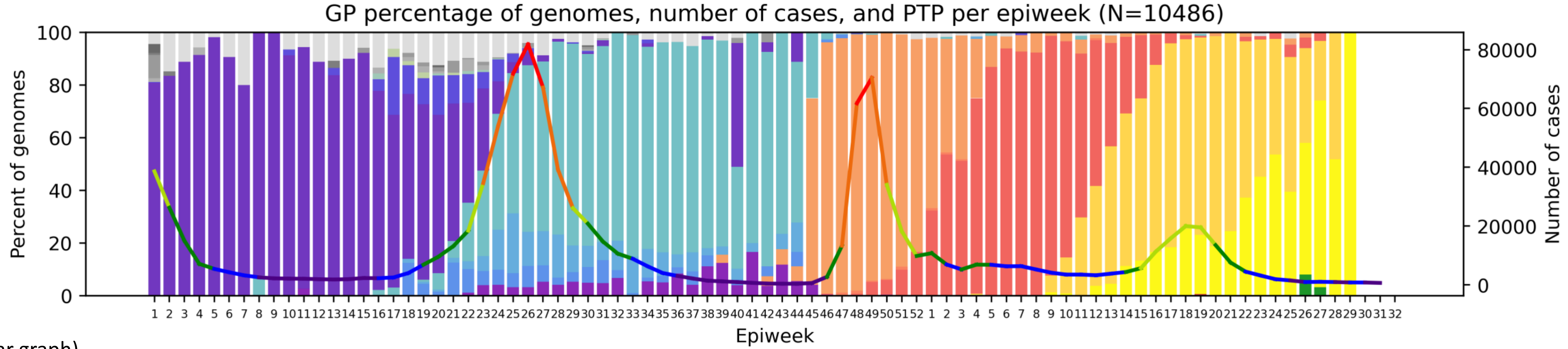
*May include genomes from 2020 which are not pictured here and are not included in the slide total.

Gauteng Province, 2021-2022, n = 10 486

Genomes added since last report: 69*





Clade key (bar graph)

- 🟩 New1
- 🟩 New2
- 🟧 Omicron (21K/BA.1.*)
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- 🟥 Omicron (22C/BA.2.12.1)
- 🟧 Omicron (21M/BA.3)
- 🟨 Omicron (22A/BA.4.*)
- 🟨 Omicron (22B/BA.5.*)
- 🟪 C.1.2 (20D)
- 🟪 Beta (20H, V2)
- 🟦 Alpha (20I, V1)
- 🟦 Delta (21A)
- 🟦 Delta (21I)
- 🟦 Delta (21J)
- 🟩 Kappa (21B)
- 🟩 Eta (21D)
- ⬛ 20D
- — Cases
- ⬛ 20C
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- ⬛ 20A
- ⬜ 19B
- ⬜ 19A
- ⬜ unassigned

Weekly percentage testing positive key (line graph)

- — ≤ 5
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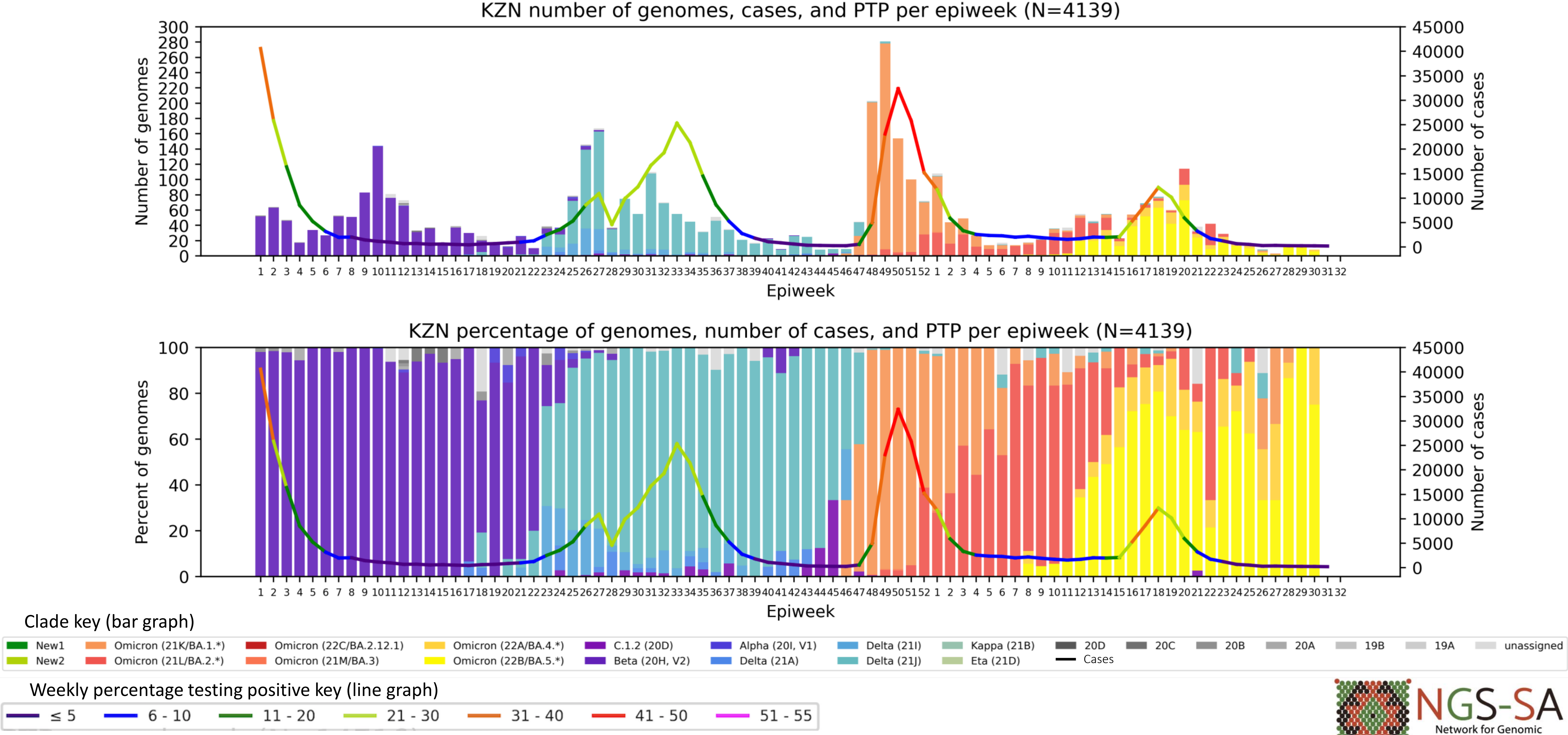
*May include genomes from 2020 which are not pictured here and are not included in the slide total.

KwaZulu-Natal Province, 2021-2022, n = 4139

Genomes added since last report: 23*



KZN number of genomes, cases, and PTP per epiweek (N=4139)

KZN percentage of genomes, number of cases, and PTP per epiweek (N=4139)

*May include genomes from 2020 which are not pictured here and are not included in the slide total.

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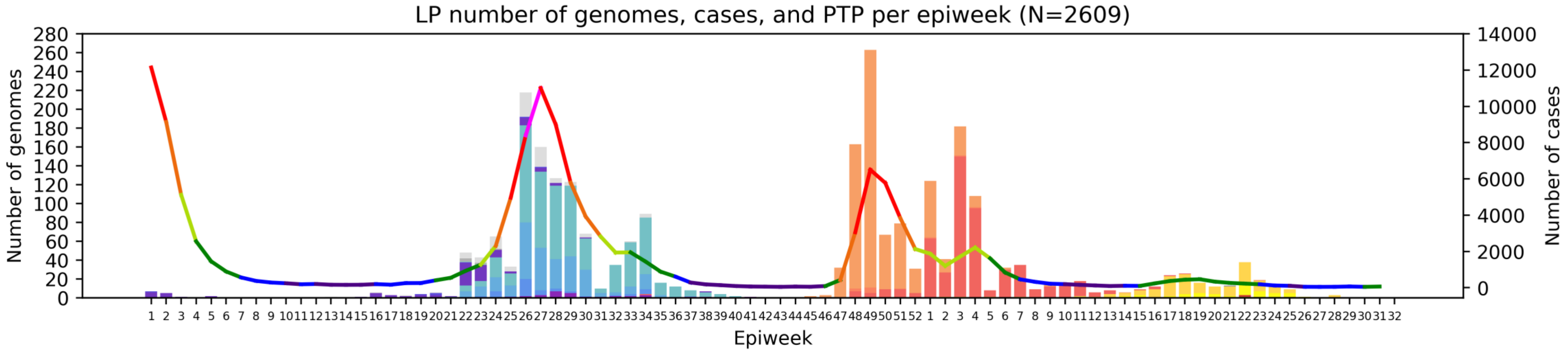
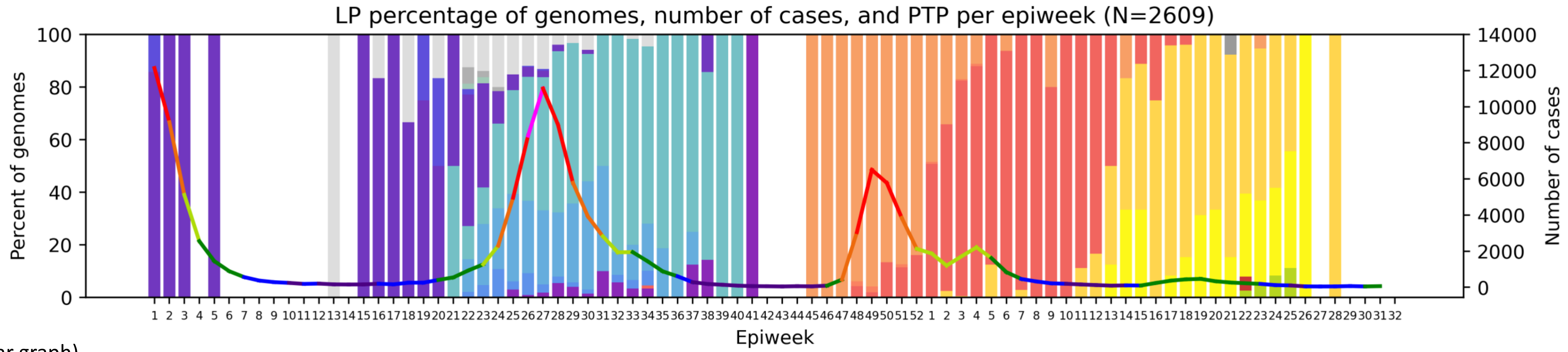
Limpopo Province, 2021-2022, n = 2609

Genomes added since last report: 10*





Clade key (bar graph)

- New1
- New2
- Omicron (21K/BA.1.*)
- Omicron (21L/BA.2.*)
- Omicron (22C/BA.2.12.1)
- Omicron (21M/BA.3)
- Omicron (22A/BA.4.*)
- Omicron (22B/BA.5.*)
- C.1.2 (20D)
- Beta (20H, V2)
- Alpha (20I, V1)
- Delta (21A)
- Delta (21I)
- Delta (21J)
- Kappa (21B)
- Eta (21D)
- 20D
- Cases
- 20C
- 20B
- 20A
- 19B
- 19A
- unassigned

Weekly percentage testing positive key (line graph)

- ≤ 5
- 6 - 10
- 11 - 20
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- 31 - 40
- 41 - 50
- 51 - 55

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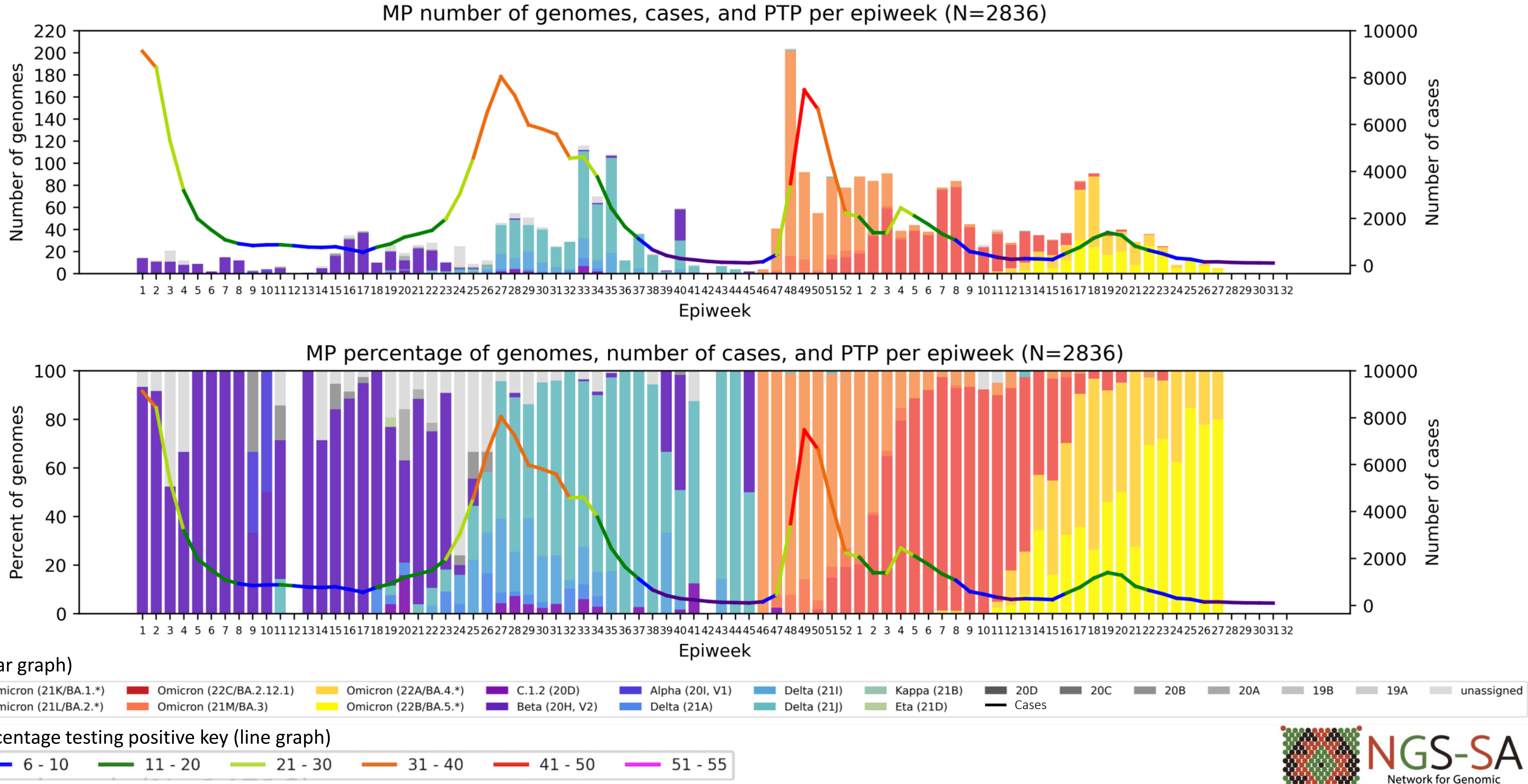
*May include genomes from 2020 which are not pictured here and are not included in the slide total.

Mpumalanga Province, 2021-2022, n = 2836

Genomes added since last report: 22*



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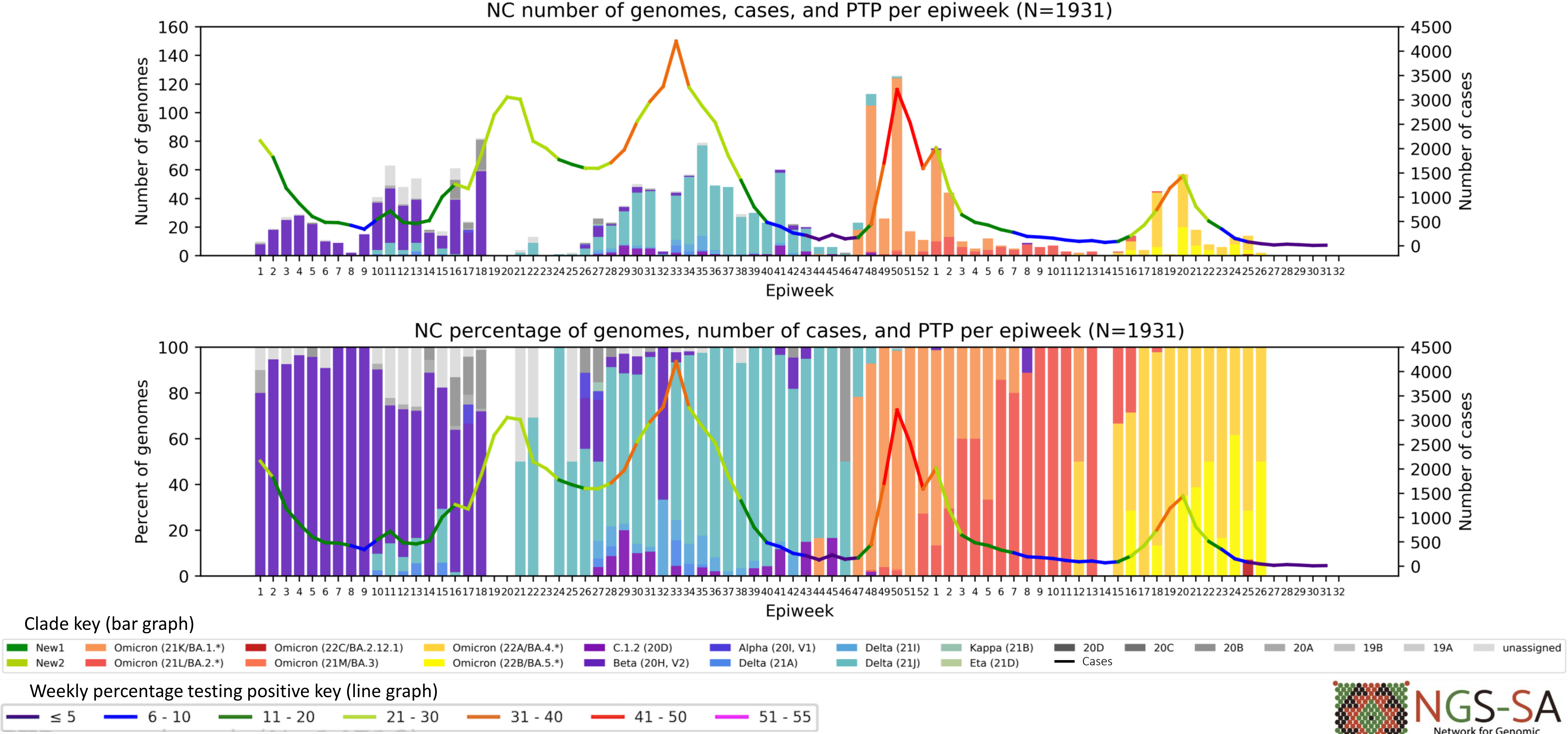
*May include genomes from 2020 which are not pictured here and are not included in the slide total.

Northern Cape Province, 2021-2022, n = 1931

Genomes added since last report: 88*



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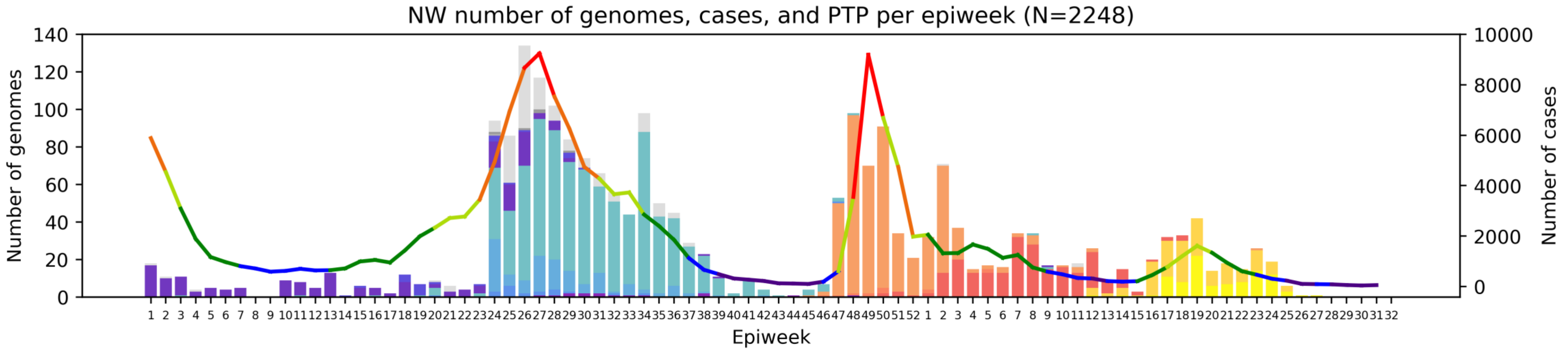
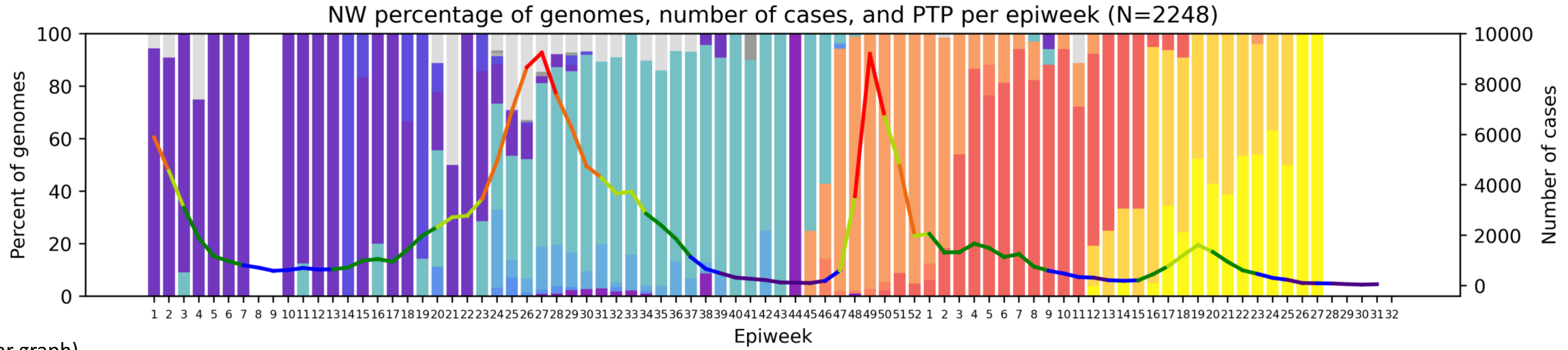
*May include genomes from 2020 which are not pictured here and are not included in the slide total.

North West Province, 2021-2022, n = 2248

Genomes added since last report: 31*


NW number of genomes, cases, and PTP per epiweek (N=2248)


NW percentage of genomes, number of cases, and PTP per epiweek (N=2248)

Clade key (bar graph)

- ■ New1
- ■ New2
- ■ Omicron (21K/BA.1.*)
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- ■ Kappa (21B)
- ■ Eta (21D)
- ■ 20D
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- ■ 20C
- ■ 20B
- ■ 20A
- ■ 19B
- ■ 19A
- ■ unassigned

Weekly percentage testing positive key (line graph)

- — ≤ 5
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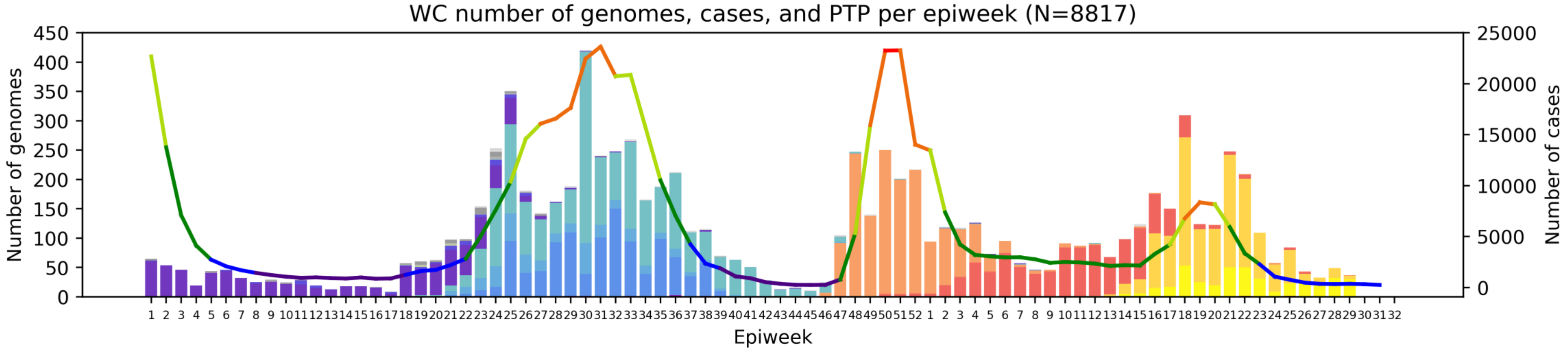
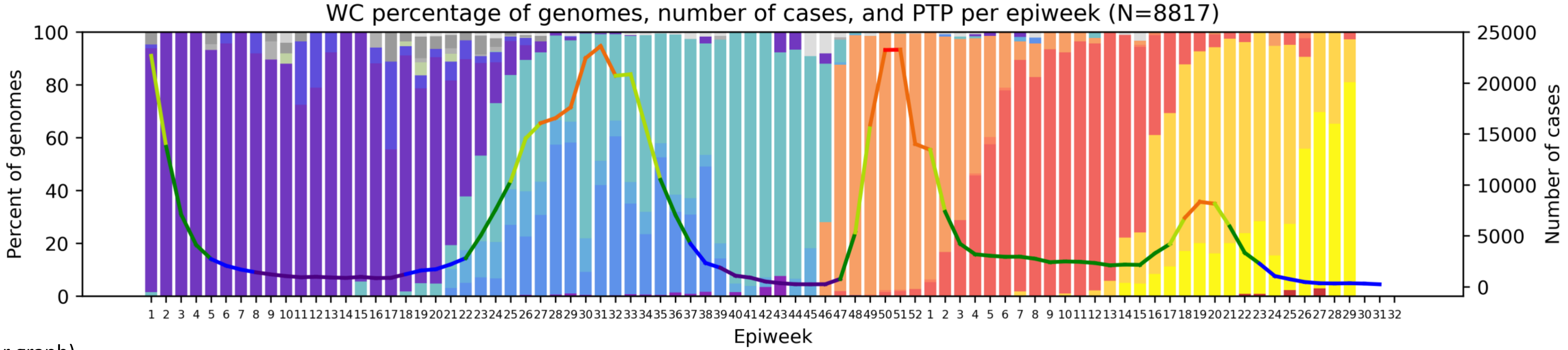
*May include genomes from 2020 which are not pictured here and are not included in the slide total.

Western Cape Province, 2021-2022, n = 8817

Genomes added since last report: 46*





Clade key (bar graph)

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Summary

- **Sequencing update**
  - All provinces have contributed sequences for April, May, and June. July sequences are from all provinces except LP and NC.
  - Omicron dominated in May (99.4%), June (98.7%) and July (99.3%). BA.4 and BA.5 together were dominant in May, June and July.
- **N=9 sequences with novel mutational profile**
  - No recent sequences have been detected but NGS-SA teams are closely monitoring the data
- **Variant of Concern Omicron in South Africa**
  - Dominates 2022 sequencing data at >98% of genomes.
  - While BA.1 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%), May (93%), June (92%) and July (95%).
  - BA.2.12.1 was detected in South Africa at low prevalence in May, June and July (<1%)
- Low frequency of previously circulating variants such as Delta still detected in recent data.

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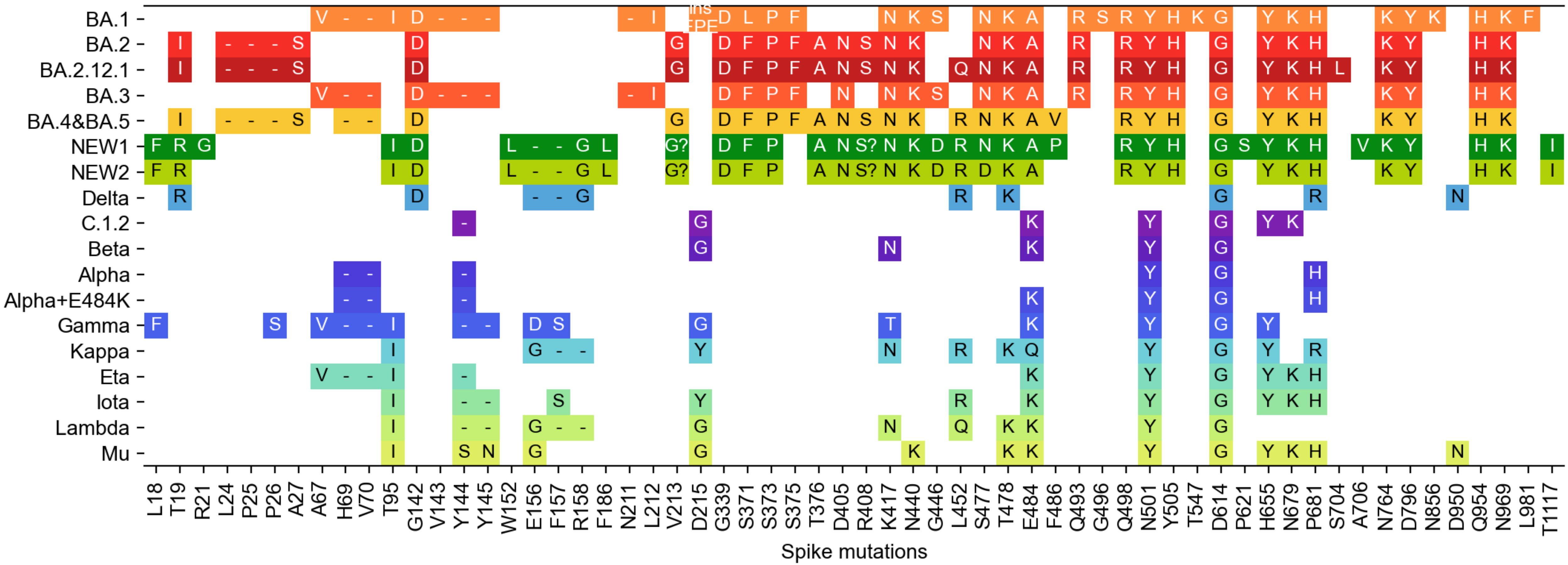
[1] https://github.com/cov-lineages/pango-designation/releases/tag/v1.3

Spike protein mutation* profile of Variants of Interest and Concern



- 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 mutations present in Omicron, Delta, or the new SGTP sequences are pictured

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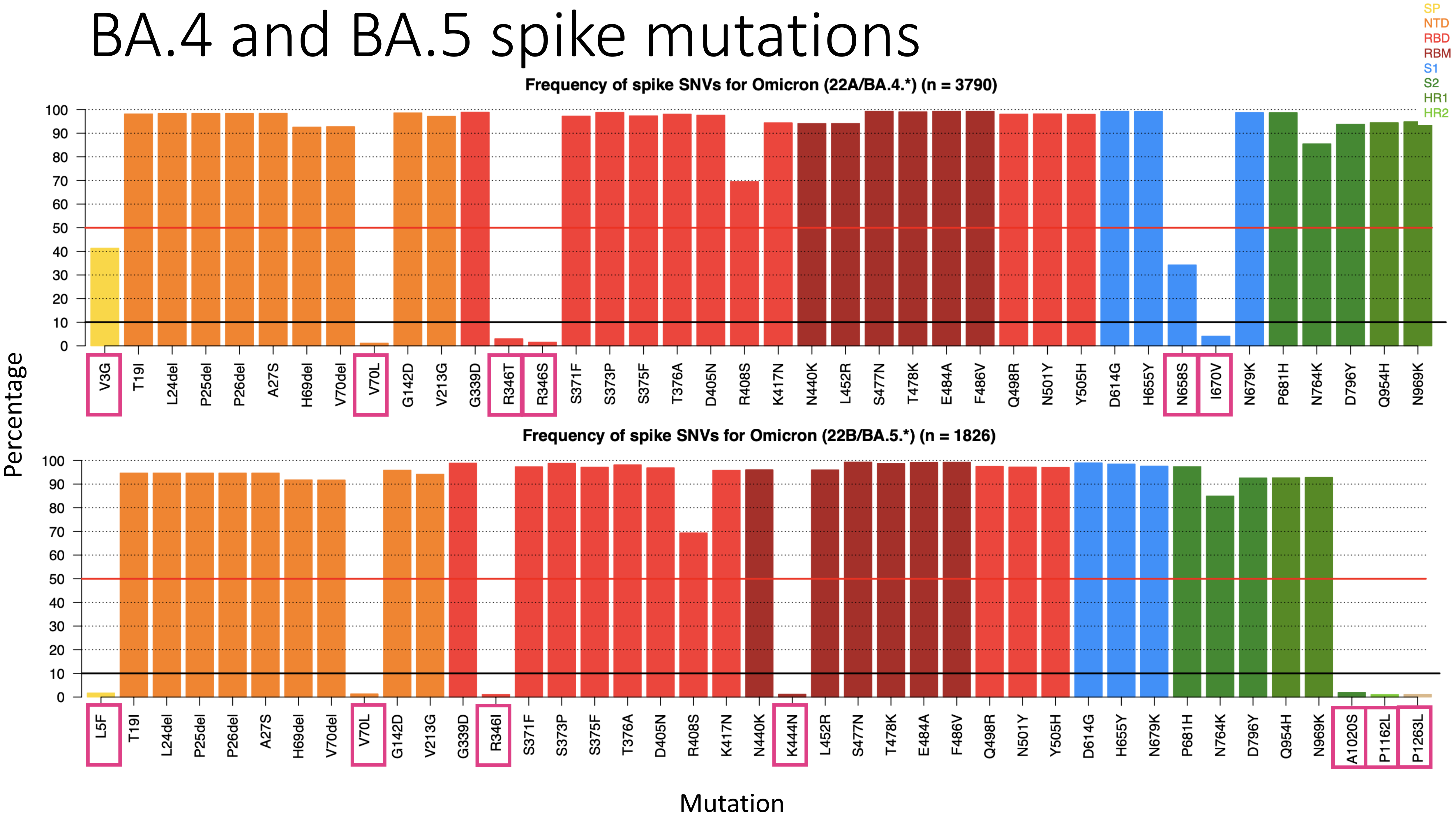
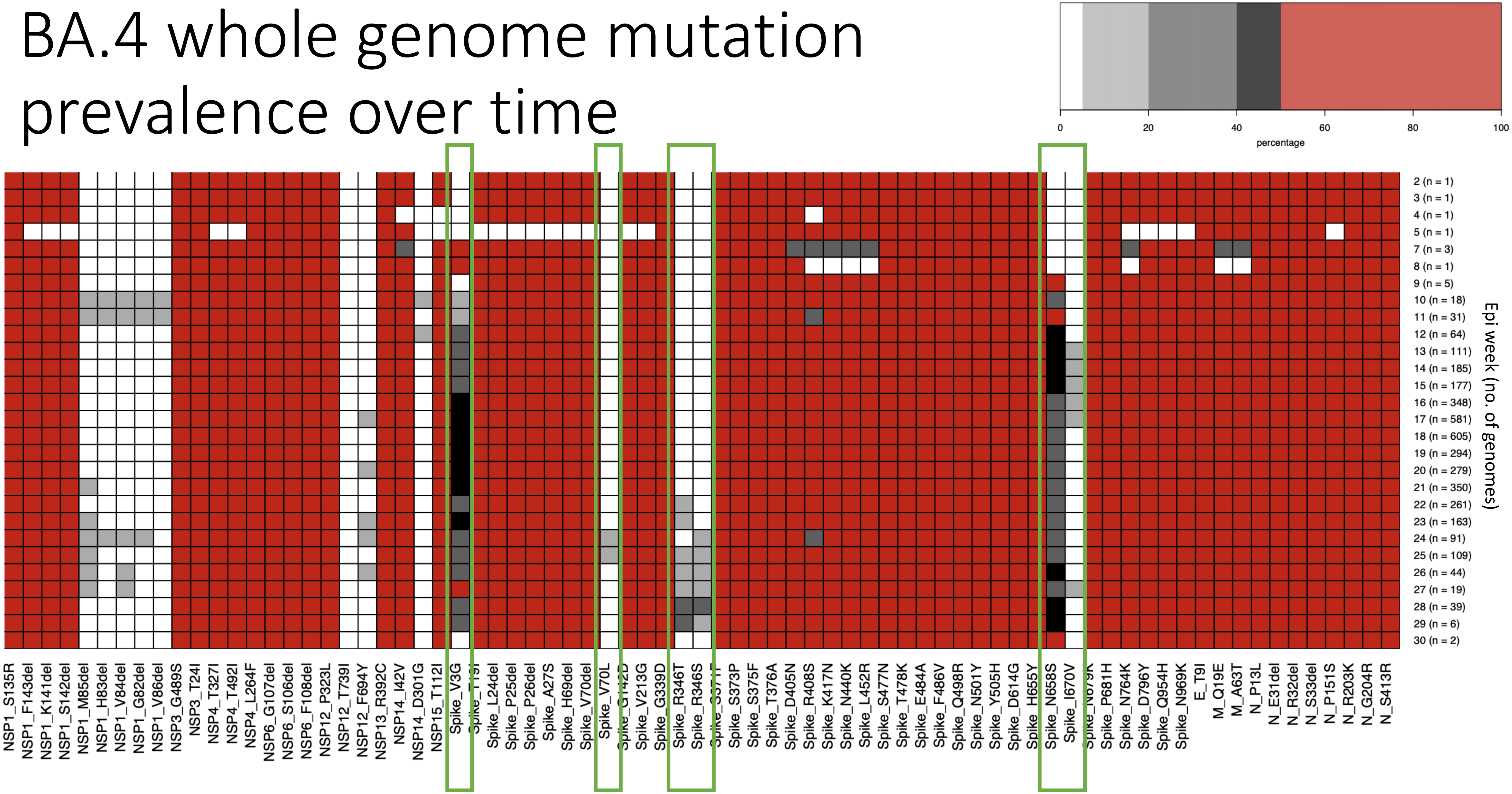
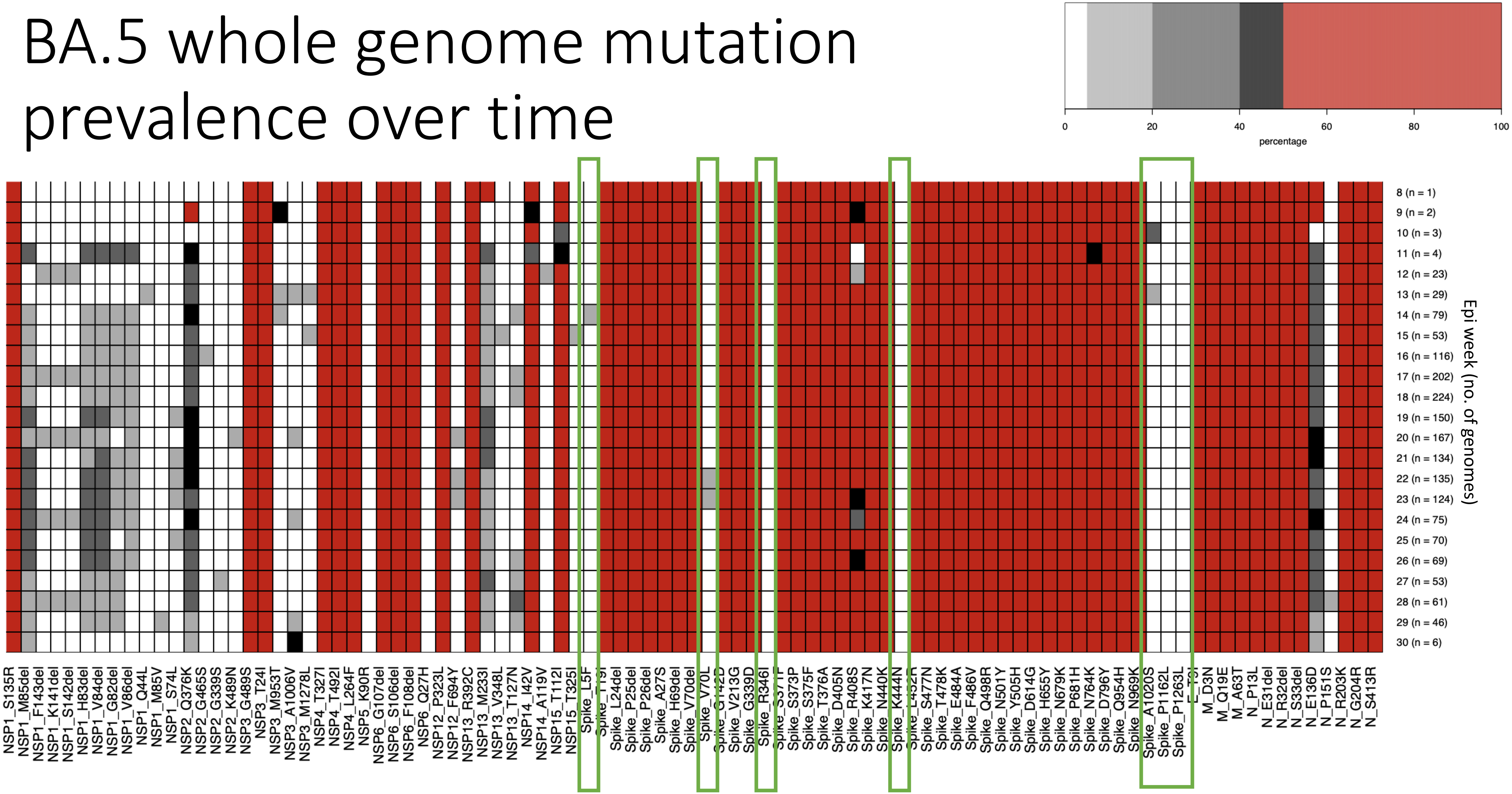
BA.4 and BA.5 spike mutations



BA.4 whole genome mutation prevalence over time



BA.5 whole genome mutation prevalence over time



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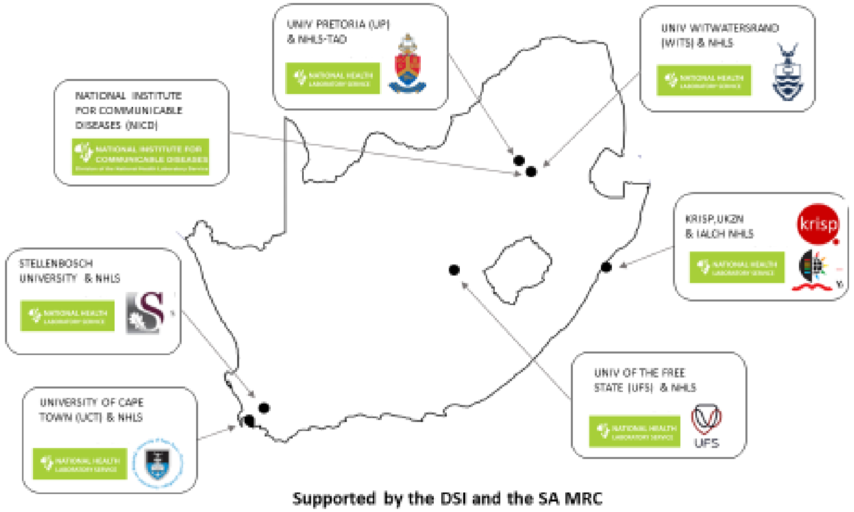

Supported by the DSI and the SA MRC

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Science and Innovation
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Division of the National Health Laboratory Service

EDCTP

This project (RIA2020EF-3030) is part of the EDCTP2 programme supported by the European Union”

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Mr Kubendran Reddy
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University of KwaZulu-Natal & Africa Health Research Institute

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Richard Lessels
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Jennifer Giandhari
Sureshnee Pillay
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NHLS Greenpoint
Annabel Enoch

This project has received funding from the European Union's Horizon Europe Research and Innovation Actions under grant No. 101046041

UCT, IDM and CIDRI-Africa
Deelan Doolabh
Arash Iranzadeh
Lynn Tyers
Innocent Mudau
Nokuzola Mbhele
Fezokuhle Khumalo
Thabang Serakge
Bruna Galvão
Arghavan Alisoltani (U. California)

Robert Wilkinson
Darren Martin
Nicola Mulder
Wendy Burgers
Ntobeko Ntusi
Rageema Joseph
Sean Wasserman
Linda Boloko

Zoonotic arbo and respiratory virus program Centre for Viral Zoonoses Department Medical Virology/ NHLS Tshwane Academic division University of Pretoria

ZARV research program/UP
Marietjie Venter (Head: ZARV)
Adriano Mendes (Postdoc)
Amy Strydom (Postdoc)
Michaela Davis (MSc, intern medical scientist)
Carien van Niekerk

NHLS Tshwane
Prof Simnikiwe Mayaphi (HOD)

Funders:
GIZ/BMBF: African Network for Improved diagnostics and epidemiology of common and emerging infectious agents (ANDEMIA)
G7 Global Health fund, Robert Koch Institute, Dr Fabian Leendertz

National Institute for Communicable Diseases

Centre for Respiratory Diseases & Meningitis
Anne von Gottberg
Thabo Mohale
Daniel Amoako
Josie Everatt
Boitshoko Mahlangu
Noxolo Ntuli
Anele Mnguni
Amelia Buys
Cardia Fourie
Noluthando Duma
Linda de Gouveia
Jackie Kleynhans
Nicole Wolter
Sibongile Walaza
Mignon du Plessis
Stefano Tempia
Mvuyo Makhasi
Cheryl Cohen

Centre for HIV and STIs
Jinal Bhiman
Cathrine Scheepers
Constantinos Kurt Wibmer
Thandeka Moyo
Tandile Hermanus
Frances Ayres
Zanele Molaudzi
Bronwen Lambson
Tandile Hermanus
Mashudu Madzivhandila
Prudence Kgagudi
Brent Oosthuysen
Penny Moore
Lynn Morris

NICD Groups
NICD COVID-19 response team
NICD SARS-CoV-2 Sequencing Group

Sequencing Core Facility
Zamantungwa Khumalo
Annie Chan
Morne du Plessis
Stanford Kwenda
Phillip Senzo Mtshali
Mushal Allam
Florah Mnyameni
Arshad Ismail

University of the Free State

UFS
Dominique Goedhals
Armand Bester
Martin Myaga
Peter Mwangi
Emmanuel Ogunbayo
Milton Mogotsi
Makgotso Maotoana
Lutfiyya Mohamed

NHLS Division of Virology
Sabeehah Vawda
Felicity Burt
Thokozani Mkhize
Diagnostic laboratory staff

Additional support and collaborators

NHLS
Koeleka Mlisana
Zinhle Makatini
Eugene Elliot
Florette K. Treurnicht
Kathleen Subramoney
Oluwakemi Laguda-Akingba
Shareef Abrahams
Greta Hoyland
Gloria Selabe
Elias Bereda
Jeannette Wadula

Hyrax Biosciences
Simon Travers

Cape Town HVTN Laboratory
Erica Anderson-Nissen
Anneta Naidoo

Ndlovu Research
Hugo Tempelman
CJ Umunnakwe

Lancet
Allison J. Glass
Raquel Viana

Ampath
Terry Marshall
Cindy van Deventer
Eddie Silberbauer

Pathcare Vermaak
Andries Dreyer
Howard Newman
Riaan Writes
Marianne Wolfaardt
Warren Lowman

Bridge-the-Gap
Raymond Rott

Cytespace Africa Laboratories
Christa Viljoen

ARC-OVI
Lia Rotherham

CAPRISA
Salim Abdool Karim
Nigel Garret

UKZN - Big Data
Francesco Pettruccione
Ilya Sinayskiy

University of Oxford
José Lourenço

FioCruz, Brazil
Vagner Fonseca
Marta Giovanetti
Luiz Carlos Junior Alcantara

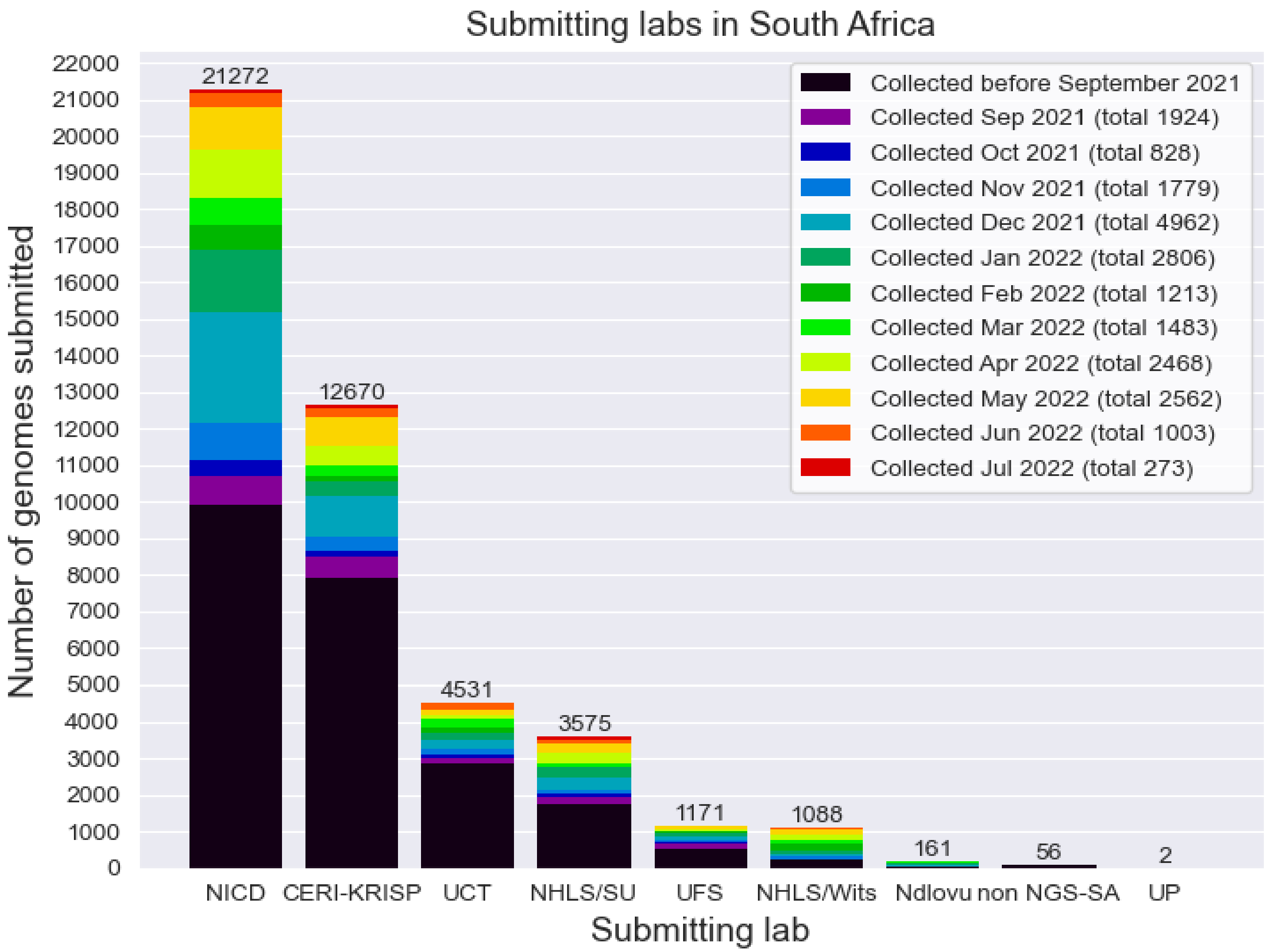
Africa CDC
John Nkengasong
Sofonias Tessema

Netcare:
Richard Friedland
Craig Murphy
Caroline Maslo
Liza Sitharam

DSI
Glaudina Loots

SA MRC
Glenda Gray

South African genomes submitted per submitting lab, 2020 - 2022 (N=44 526)



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.

NGS-SA
Network for Genomic Surveillance in South Africa

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
Omicron*	B.1.1.529	GR/484A	21K, 21L, 21M, 22A, 22B, 22C, 22D	+S:R346K +S:L452X +S:F486V	Multiple countries, Nov-2021	VUM: 24-Nov-2021 VOC: 26-Nov-2021

* Includes BA.1, BA.2, BA.3, BA.4, BA.5 and descendent lineages. It also includes BA.1/BA.2 circulating recombinant forms such as XE. WHO emphasizes that these descendant lineages should be monitored as distinct lineages by public health authorities and comparative assessments of their virus characteristics should be undertaken.

° Only found in a subset of sequences

https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/ accessed 12 August 2022

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
Delta	B.1.617.2	G/478K.V1	21A, 21I, 21J	India, Oct-2020	VOI: 4-Apr-2021 VOC: 11-May-2021 Previous VOC: 7-Jun-2022

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

https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/ accessed 12 August 2022

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.)