Details of the emerging variants analysis can be found in “BV-BRC SARS-CoV-2 Emerging Variant Report – 20220823.xlsx” based on sequence data from GISAID.

Keep in mind that the information provided reflects sequence counts and sequence proportions and, as such, is impacted by sampling bias in the sequence databases and should not be interpreted as the prevalence of disease caused by these variants.

In addition, due to sequence anomalies (e.g., ambiguous nucleotides in many sequence records) and other issues, the absolute counts of Variants of Concern sequences are likely to be underestimates of the true sequence prevalence.

This report includes preliminary/incomplete stats for the month of August in order to identify early signs of novel variants emerging.

The key findings are summarized below.

USA – VOC

OMICRON

- In the US, virtually all sequences reported to date in June, July, and August are Omicron, with BA.2.12.1 displaced by BA.5 and BA.4 and their sub-lineages.
  - The CDC Nowcast for the week ending 08/13/22 estimates that BA.5 proportions are now dominating in the United States at 88.9% (95% PI: 87.6-90.0%).
  - The CDC Nowcast has split BA.4 and BA.4.6; estimates for BA.4 proportions are now at 4.3% (95% PI: 4.0-4.7%); estimates for BA.4.6 proportions are now at 6.3% (95% PI: 5.2-7.6%).
  - The US CDC Nowcast estimates that BA.2.12.1 proportions are now at 0.5% (95% PI: 0.4-0.5%).
- Lineages with sequence prevalence >0.5% in August so far are (ranked in order of sequence prevalence):
  - BA.5.2.1 - 29%, 1.2 fold growth
  - BA.5.1 - 13%, 1.2 fold growth
  - BA.5.2 – 12.1%, 1.4 fold growth
  - BA.5.5 – 8.2%, 0.8 fold growth
  - BA.5.6 – 6%, 1 fold growth
  - BA.4.6 – 5%, 1.8 fold growth
  - BA.5 – 5%, 1.3 fold growth
  - BA.4.1 – 4.3%, 0.7 fold growth
  - BA.4 – 2.4%, 0.67 fold growth
  - BA.2.12.1 – 2.2%, 0.23 fold growth
  - BA.5.1.1 – 2.2%, 1.1 fold growth
  - BE.1 – 1.8%, 1.0 fold growth
  - BE.3 – 1.8%, 1.1 fold growth
BF.5 – 1.3%, 1.2 fold growth (7.5 fold growth in Nebraska)
BE.1.1 – 1.2%, 1.6 fold growth

- In aggregate, BA.5.x sequences constitute 74% in July and 84.1% in August so far in the US
- In aggregate, BA.4.x sequences constitute 13% in July and 12.1% in August so far in the US

- Notable substitutions present within the top ten BA.5 sub-lineages in August so far in the US:
  - One BA.5 sub-lineage carries the R346T and N658S substitutions (BF.3)
  - One BA.5 sub-lineage carries the A1020S substitution only (BA.5.1)
  - One BA.5 sub-lineage carries the Y144- substitution only (BA.5.2)
  - One BA.5 sub-lineage carries the V289I substitution only (BA.5.2.1)
  - One BA.5 sub-lineage carries the R346S substitutions (BA.5.2.1)

- Notable substitutions present within the top ten BA.4 sub-lineages in August so far in the US:
  - One BA.4 sub-lineage carries the R346T and N658S substitutions
  - Two BA.4 sub-lineages carry the V3G substitution only
  - One BA.4 sub-lineage carries the N658S substitution only
  - One BA.4 sub-lineage carries the V3G and I670V substitutions
  - One BA.4 sub-lineage carries the V3G and R346T substitutions
  - One BA.4 sub-lineage carries the V3G and R346I substitutions

- Several Omicron sub-lineages appear to carry a recurring mutation at position 346 in the S proteins (S:R346T in BA.2.74, BA.2.76, BA.4, BA.4.1, BA.4.6, BA.4.7, BA.4.5, BA.5.1, BA.2.12.1, BA.2, S:R346S in BA.5.2.1or S:R346I in BA.4.1)

- Several Omicron sub-lineages appear to carry a recurring mutation at position 444 in the S proteins (K444R in BA.5.2.1 with 5 fold growth rate, K444N in BA.5.2.1 with 4 fold growth rate, and K444T in BA.5.6 with 4 fold growth rate in July)

DELTA (B.1.617.2 and AY sub-lineages) (no significant change since previous report)
- No Delta sequences in the US in August so far.

USA – (other VOCs and VOIs) (no significant change since previous report)
- None in July or August.

USA – Recombinants
- XE – 0 sequences in the US in July, none in August so far
- XM – 1 sequence in the US in July, none in August so far
- XY – 1 sequence in the US in August so far
- XAA – 1 sequence in the US in July, none in August so far
- XAC – 1 sequence in the US in July, none in August so far
- XAF - 1 sequence in the US in July, none in August so far
- See a summary of recombinant lineages at the end of this report.

World – VOC

OMICRON

- Omicron remains dominant globally, with the following lineages showing the highest sequence prevalence (> 0.5%) or growth rate (>3 fold) in August so far:
  - BA.5.2.1 – 21.4%, 1.2 fold growth
  - BA.5.1 – 18.6%, 1 fold growth
  - BA.5.2 - 17%, 1.3 fold growth
  - BA.5 – 4%, 1.6 fold growth
  - BE.1.1 – 3.8%, 1.1 fold growth
  - BA.5.5 – 3.3%, 0.79 fold growth
  - BF.5 – 3%, 1 fold growth
  - BA.4.6 – 3%, 1.8 fold growth
  - BA.4.1 – 2.9%, 0.64 fold growth
  - BA.5.6 – 2.7%, 1 fold growth
  - BA.2 – 2.3%, 0.7 fold growth
  - BA.4 – 2%, 0.6 fold growth
  - BE.1 – 1.9%, 0.9 fold growth
  - BA.2.12.1 - 1%, 0.23 fold growth
  - BA.5.1.1 - 0.93%, 1 fold growth
  - BA.5.2.3 – 0.68%, 1.36 fold growth
  - BE.3 - 0.68%, 1 fold growth
  - BA.5.1.3 - 0.65%, 1 fold growth
  - BA.2.75 - 0.57%, 1.1 fold growth
  - BA.5.3.1 - 0.56%, 0.93 fold growth
  - BF.1 - 0.52%, 0.7 fold growth
  - BA.5.1.2 - 0.51%, 0.5 fold growth

- BA.2.75: sometimes nicknamed “Centaurus”, this sublineage shows a high growth rate in India (94 fold in June, 4.2 fold in July, and 1.3 fold in August so far) and comprises 27% of sequences in India in August so far. It is also present in 32 other countries, including the United States (22 states). Preliminary signs of increasing growth rates for July and August in Australia, Austria, Denmark, USA, Israel, Japan, Nepal, Germany, New Zealand, Canada, Thailand, Russia, Singapore, South Korea, UK and Indonesia

- BA.2.76: this sublineage showed a high growth rate globally in June (11 fold) but has slowed down in July (0.9 fold). Notable spike substitutions in this variant include Y248N and R346T, both of which occur in antigenically important sites.

- Similar issues with variable ancestral reversion that are likely due to sequencing artifacts, as described above for US sequences

- Notable substitutions present within the top ten BA.5 sub-lineages globally in August so far:
  - One BA.5 sub-lineage carries the T76I substitution
  - One BA.5 sub-lineage carries the R346T substitution
One BA.5 sub-lineage carries the A1020S substitution

Notable substitutions present within the top ten BA.4 sub-lineages globally in August so far:
- One BA.4 sub-lineage (most prevalent) carries the R346T and N658S substitutions (BA.4.6)
- Three BA.4 sub-lineages carry the V3G substitution only
- One BA.4 sub-lineage carries the N658S substitution only
- One BA.4 sub-lineage carries the R346S and N658S substitutions
- One BA.4 sub-lineage carries the V3G and lacks the N440K and G142D substitutions
- One BA.4 sub-lineage carries the V3G and lacks the N440K substitution
- One BA.4 sub-lineage carries the V3G and I670V substitutions
- One BA.4 sub-lineage carries the R346T and N658S substitutions

Substitutions in spike that we are monitoring (>3 fold growth from July to August with counts >10) include the following (but note that the numbers are still relatively small for most of these):
- F486S - 0.07%, 7 fold growth
- T604N - 0.13%, 6.5 fold growth
- G252S - 0.06%, 6 fold growth
- A243 - 0.05%, 5 fold growth
- P1263S - 0.04%, 4 fold growth
- P384H - 0.24%, 4 fold growth
- P9L - 0.04%, 4 fold growth
- L244 - 0.04%, 4 fold growth
- K356T - 0.07%, 3.5 fold growth

DELTA (B.1.617.2 and AY sub-lineages)
- One Delta isolate (AY.122) globally in August so far; 28 in July.
- Countries where Delta lineages have been detected in July and August 2022: Austria, Belgium, France, India, Indonesia, Italy, Luxembourg, Philippines, Russia, South Africa, Spain, Switzerland, Ukraine, United Kingdom, USA

World (other VOIs)
- 1 Alpha genome (B.1.1.7) detected in July in the USA; none in August.
- 1 Kappa genome (B.1.617.3) detected in July in the India; none in August.

World – Recombinants
- XAG – 15 in July; 1 in August.
- XE – 8 sequences in July; none in August.
- XAF – 9 in July; none in August.
- XM – 2 in July; none in August.
- XJ – 1 in July; none in August.
- XAA – 1 in July; none in August.
- XAC – 1 in July; none in August.
- XAD – 1 in July; none in August.
- XAE – 1 in July; none in August.
- XY – 1 in August.
• See a summary of recombinant lineages at the end of this report.

Variants that have been mentioned in the media and/or social media:
• Omicron subvariants BA.4.6 and BA.2.75 are here. How concerned should California be?
• U.S. CDC recommends use of Novavax’s COVID shot for adolescents
• China Covid Cases Elevated as Virus Chief Urges More Tests
• New antibody neutralizes all known SARS-CoV-2 variants in lab tests
• ‘We cannot live with 15,000 deaths a week’: WHO warns on rise in COVID fatalities

Recombinant lineages:

One new recombinant lineages have been designated this week (XAR). A summary table of previously identified recombinant lineages can be found below. We have added the number of recombinants genomes for each lineage. XA, XB, and XC have not been detected in the past 6 months. XD-XAR are Omicron or Omicron/Delta recombinants. The majority of these recombinant lineages do not appear to have taken off and several have not been detected in recent weeks. The XE lineage appears to have the largest number of genomes.

<table>
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<tr>
<th>Name</th>
<th>Number</th>
<th>Github#</th>
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Newly designated Pango lineages:

- BA.2.75.1 from #856
- BA.2.10.4 from #898
- BJ.1 from #915
- BA.2.38.3 from #840
- BA.2.75.2 from #963: **BA.2.75 sublineage with S:R346T, S:F486S, S:D1199N**
- BA.2.75.3: BA.2.75 lineage with ORF1b:V1706I
- BA.2.76.1 from #899
- BA.2.76.2 from #939: Proposal for a Sublineage of BA.2.76 with S:N185H & ORF1a:A3730T, exclusively in Japan
- BA.2.9.6 from #671
- BA.5.1.10 from #901
- BA.5.1.11 from #908
- BA.5.1.9 from #786
- BA.5.10 from #936
- BA.5.5.1 from #873
- BA.5.6.2 from #903
- BF.13 from #883
- BE.1.2 from #923
- BF.14 from #843
- BG.6 from #836
- BH.1 from #913
- BK.1 from #901
- Recombinant lineage XAQ from #798
- Recombinant lineage XAR from #860
- BL.1: Sublineage of BA.2.75.1 with S:R346T
- BA.5.2.7: BA.5.2 sublineage with S:K444M

**Variants being monitored by various public health agencies:**

The ECDC has added the Omicron sublineage BA.2.75 to its list of “Variants of Interest” list. The latest summary table for all agencies can be found here: [https://docs.google.com/spreadsheets/d/1mAgO2wRJvEyiGtL-SBe3NgOjUk7a5zZcKm SorVkaHSU/edit#gid=0](https://docs.google.com/spreadsheets/d/1mAgO2wRJvEyiGtL-SBe3NgOjUk7a5zZcKm SorVkaHSU/edit#gid=0)