Variants of SARS-CoV-2

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What we know:

• Viruses mutate during genome replication
  – Mutations = changes in genome over time
    • SARS-CoV-2 acquires ~1-2 new mutations every month
  – Variant = has mutations that differentiate it from predominant strain circulating in the population
  – Lineage = group of variants with similar genetic changes and common ancestor

What we know:

- SIGVariant classification scheme

- Variants of High Consequence
  - None identified in US to date

- Variants of Concern
  - Delta & Omicron

- Variants of Interest
  - None currently designated

- Variants Being Monitored
  - Alpha, Beta, Gamma, Epsilon, Eta, Iota, Kappa, Mu, Zeta, B.1.617.3
Genomic epidemiology of SARS-CoV-2

https://nextstrain.org/ncov/global
B.1.167.2 & AY Lineages (Delta)

- 13 mutations
  - 9 in spike protein
- Increase in severity of illness
  - More likely to be hospitalized
- 2X more contagious
- AY.1 and AY.2 lineages are not susceptible to some monoclonal antibody treatments, but most other delta lineages are to those with EUA
- Reduction in neutralization by post-vaccination sera
B.1.1.529 (Omicron)

- About 50 mutations not seen in combination before
  - 30+ mutations in spike protein, 15 of which are in RBD
- Unknown impact on severity of illness, vaccine-induced immunity, or immunity from previous infection
- *May* have increased transmissibility
  - Predominate variant in South Africa, replacing Delta
- Deletion of H69, V70 reduces S-gene target sensitivity of TaqPath COVID-19 Combo kit
  - SGTF for specimen may be omicron, but must be confirmed by sequencing
## Summary of current variants

<table>
<thead>
<tr>
<th>Name</th>
<th>Earliest Sample Date</th>
<th>Cases in US</th>
<th># of countries reporting cases</th>
<th>Key Mutations</th>
<th>Transmissibility Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.1.1.7 Alpha</td>
<td>09/20</td>
<td>Yes</td>
<td>175</td>
<td>ΔH69-V70, N501Y, D614G, P681H</td>
<td>50% greater</td>
</tr>
<tr>
<td>B.1.351 Beta</td>
<td>09/20</td>
<td>Yes</td>
<td>114</td>
<td>K417N, E484K, N501Y, D614G,</td>
<td>50% greater</td>
</tr>
<tr>
<td>P.1 Gamma</td>
<td>10/20</td>
<td>Yes</td>
<td>74</td>
<td>K417T, E484K, N501Y, D614G</td>
<td>Higher viral load &amp; greater transmissibility</td>
</tr>
<tr>
<td>B.1.617.2 Delta</td>
<td>03/21</td>
<td>Yes</td>
<td>148</td>
<td>T19R, ΔE156-F157, L452R, L478K, D614G, P681R</td>
<td>2X greater than original</td>
</tr>
</tbody>
</table>

PANGO Lineages (https://cov-lineages.org/index.html#global_reports), CDC MMWR (https://www.cdc.gov/mmwr/volumes/70/wr/mm7003e2.htm), Global Virus Network (https://gvn.org/covid-19/omicron-b-1-1-529/#)
More than 91% of current cases are caused by B.1.617.2 Delta Variant

Omicron ~3% of current cases

Other Delta AY Lineages account for remaining cases
What are we doing about it?

Sequencing!

- National SARS-CoV-2 Strain Surveillance (NS3) system
  - CDC contracts with large commercial labs (LabCorp, Quest, Path Group)
  - CDC funds 29 universities to conduct genomic surveillance research
  - SPHERES, a national consortium of laboratories sequencing SARS-CoV-2
    - n = 250 institutions, including academic centers, industry, non-governmental organizations, & public health agencies
    - led by CDC’s Advanced Molecular Detection (AMD) program
  - TN PHL submits SARS-CoV-2 positive specimens weekly (avg. 5-15) after WGS is completed on site
    - most patient samples are now tested by reference labs & universities throughout the state
CDC NS3 Enhanced Surveillance efforts

- **B.1.1.529 (Omicron)**
  - Some samples present SGTF, but not all (Samples sent to CDC should not solely focus on SGTF)

- **Additional new variants**
  - CDC requires approval for sample submission

- **Vaccine breakthroughs**
  - Defined as positive SARS-CoV-2 RNA or Ag test detected from a respiratory specimen collected ≥14d after completing full vaccine series
  - Can send up to 20 samples weekly to CDC

- **All other previous variants are no longer requested by CDC**

How to stop SARS-CoV-2 variant emergence

Transmission → Infection → Viral Replication → Mutation

- Vaccination
- Handwashing
- Mask-wearing
- Social distancing (6ft)
Questions?

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