Variants and Vaccines: An Update

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Objectives

• Define variant
• Review variants of concern
• Update vaccine efficacy and effectiveness data
• Review status of COVID-19 vaccines in children
Definitions

• Mutation:
  • A permanent alteration in the genetic sequence
  • Mutations can be tracked (N501Y)

• Variant:
  • A group of coronaviruses that share the same inherited set of distinctive mutations

• Lineage:
  • A branch of viral family tree (B.1.1.7)

• Strain:
  • A lineage that has evolved differences in how the virus functions (SARS-CoV-2)
Variants:

• **Variants of concern:**
  • More infectious
  • More severe disease
  • Escape immune detection or control
  • (Interfere with diagnostics)
  • (Resistant to antiviral therapy)

• **Nomenclature:**
  • Incredibly confusing
  • Greek letters
Three spike proteins to form one spike therefore mutations appear three times
Mutations to the spike protein

- **N501Y:**
  - Increases ACE2 receptor binding affinity
- **K417N**
  - Helps the virus bind more tightly to human cells
- **E484K**
  - May help the virus evade some kinds of antibodies
Mutation Sites of the Delta Variant

Spike Protein

B.1.617

P681R

D614G

L452R

E484Q

Human Cell Receptor
Alpha, Beta, and Gamma

• Alpha:
  • More infectious

• Beta:
  • Concern that may be able to infect people previously infected with other variants
  • Vaccines seem to offer less protection
    • J and J clinical data somewhat reassuring
    • Updated Pfizer data somewhat reassuring
    • AZ failed

• Gamma
  • Concern that may be able to infect people previously infected with other variants
  • Vaccines seem to offer less protection
Delta variant
New Admissions of Patients with Confirmed COVID-19 per 100,000 Population by Age Group, United States
Aug 01, 2020 - Aug 15, 2021

Graphs showing new admissions per 100,000 population for different age groups in the United States.
Variants summary

• Variants emerge quickly
• Variants are not stable
  • Develop mutations that lead to increased infectivity or reduced susceptibility to vaccine generated immune responses or previous infection
Vaccine Development

• mRNA vaccines
  • Pfizer-BioNTech
  • Moderna
  • Novartis

• Viral vector vaccines
  • J and J
  • Oxford-AstraZeneca
  • Sputnik

• Protein
  • Norovax
  • NVD-HXP-S
mRNA vaccines
Pfizer
Moderna

Viral vector vaccines
J and J
AstraZeneca

Lipid nanoparticles containing mRNA

The NYT
Protein based vaccines (Novovax)

• Similar to HPV vaccine development
Vaccines for children: 12 and older

• Pfizer-BioNTech
  • EUA: 12 and older

• Moderna
  • Lots of data: unclear why no EUA

• J and J:
  • Data
Vaccines for children: 12 and under

• Pfizer and Moderna asked to gather additional data on safety
  • Double the number of children (to 6K)
• Pfizer likely to have different doses
  • 5-11 (10 ug); 6 month-4 years (3 ug)
• J and J have enrolled children
• “Go slow” with young children has more momentum than expected
  • Less likely to develop severe disease
Vaccine Effectiveness

• All three protect against severe disease

• Breakthrough infections:
  • Uncommon
  • More likely greater than six months after vaccination
  • Usually mild disease
  • Very, very rare death
  • Can transmit virus (high viral loads)
SARS-CoV-2 in Schools

• Vaccination works!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

• Mitigation strategies work!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
  • Do not let the virus into the school
  • Prevent transmission of the virus in school
  • Remove sources of infection in school
Mitigation strategies

• Do not let the virus into the school
  • No ill children in school
  • Routine surveillance

• Prevent transmission of the virus in school
  • Masking indoors
  • Ventilation
  • Distancing (when not masked)

• Remove sources of infection in school
  • Contact tracing