COVID-19 UPDATE

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Chief, Division of Infectious Diseases
Professor of Medicine and Adjunct Professor of Epidemiology
• Where we are in
  • The World
  • The US
  • North Carolina
  • Medical Center
• Spike Protein – The key so far
• Vaccines
• Treatment
• Variants
• Questions
COVID-19 in the World

Global Cases
111,824,687

Cases by Country/Region/Sovereignty
- US: 28,191,010
- India: 11,016,834
- Brazil: 10,195,160
- Russia: 4,142,126
- United Kingdom: 4,138,233
- France: 3,669,562
- Spain: 3,153,971
- Italy: 2,818,888
- Turkey: 2,646,526
- Germany: 2,400,919
- Colombia: 2,229,663
- Argentina: 2,049,715
- Mexico: 2,043,652
- Poland: 1,648,962
- Iran: 1,590,605
- South Africa: 1,504,588
- Ukraine: 1,358,871
- Indonesia: 1,290,408

Global Deaths
2,476,526


Last Updated at (M/D/YYYY)
2/23/2021, 7:23 AM

192 countries/regions

US >28,000,000 cases (~25% of world’s total), >500,000 deaths): deaths undercounted; a leading cause of death in the US;
NC >850,000 cases (>11,000 deaths), First case reported March 3, 2020

Source: COVID Tracking Project

Note: Data reported on 4 February includes 1,507 historical deaths in Indiana identified through an audit of death records and test results

The Spike Protein: Key to the Disease and Protection


Atomic model for binding of the SARS-CoV-2 spike protein to the ACE2 receptor on the membrane of a human cell – Ahmet Yildiz, University of California, Berkeley; Mert Gur, Istanbul Technical University.
Vaccines
mRNA Vaccines for SARS-CoV-2

mRNA (message) is for the Spike Protein

Pfizer mRNA vaccine

Durability of the Moderna mRNA response
# COMPARISON OF NEWER VACCINES

<table>
<thead>
<tr>
<th></th>
<th>Johnson &amp; Johnson</th>
<th>AstraZeneca</th>
<th>Novavax</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>Adenovirus (human)</td>
<td>Adenovirus (chimpanzee)</td>
<td>Nanoparticles (plus adjuvant)</td>
</tr>
<tr>
<td><strong>Antigen</strong></td>
<td>Spike protein</td>
<td>Spike protein</td>
<td>Spike protein</td>
</tr>
<tr>
<td><strong>Doses</strong></td>
<td>One</td>
<td>Two doses, 12 weeks apart</td>
<td>Two doses, 21 days apart</td>
</tr>
<tr>
<td><strong>Study participants</strong></td>
<td>~44,000</td>
<td>~12,000</td>
<td>~30,000</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>&gt;18 years</td>
<td>&gt;18 years</td>
<td>&gt;18 years</td>
</tr>
<tr>
<td><strong>Effectiveness</strong></td>
<td>72% US, 66% LA, 57% SA (Mod-Severe Ds)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>82.4%* (Symptomatic Ds)</td>
<td>89.3% UK, ~50% SA (Symptomatic Dis)</td>
</tr>
<tr>
<td><strong>Long-term storage</strong></td>
<td>2 yrs, -20°C; 3 mo, 2-8 °C</td>
<td>6 mo, 2-8 °C</td>
<td>Stable at 2-8 °C</td>
</tr>
<tr>
<td><strong>Administration</strong></td>
<td>Intramuscular (IM)</td>
<td>Intramuscular (IM)</td>
<td>Intramuscular (IM)</td>
</tr>
</tbody>
</table>

LA, Latin America; SA, South Africa; Refrigerator temperatures, 2-8 °C

*Reduction in virus transmission reported, AstraZenica 67%; 1, 100% effective at preventing hospitalization or death

COMMUNITY PROTECTION BASED ON VACCINE EFFICACY, DURATION OF PROTECTION, AND COVERAGE

Dr. Fauci stated that 70% to 85% of US population needs to be fully vaccinated for US to return to normal (<2% vaccinated at present)

Dr. Michael Osterholm stated that a surge fueled by variant B.1.1.7 strain is likely to occur “in the next 6-14 weeks”


Vaccine doses per 100 people in countries with highest total vaccinations

<table>
<thead>
<tr>
<th>Country</th>
<th>Doses per 100 people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Israel</td>
<td>85</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>56.2</td>
</tr>
<tr>
<td>UK</td>
<td>27.2</td>
</tr>
<tr>
<td>US</td>
<td>19.1</td>
</tr>
<tr>
<td>Turkey</td>
<td>7.8</td>
</tr>
<tr>
<td>Germany</td>
<td>6</td>
</tr>
<tr>
<td>Brazil</td>
<td>3.3</td>
</tr>
<tr>
<td>China</td>
<td>2.8</td>
</tr>
<tr>
<td>Russia</td>
<td>2.7</td>
</tr>
<tr>
<td>India</td>
<td>0.8</td>
</tr>
</tbody>
</table>

TABLE 1 | $R_0$ values and corresponding herd immunity threshold values of infectious diseases (5, 6, 13, 14).

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Infectious diseases</th>
<th>$R_0$ value</th>
<th>Herd immunity threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Small pox</td>
<td>5-7</td>
<td>80-85%</td>
</tr>
<tr>
<td>2</td>
<td>Mumps</td>
<td>4-7</td>
<td>75-86%</td>
</tr>
<tr>
<td>3</td>
<td>Measles</td>
<td>12-18</td>
<td>92-94%</td>
</tr>
<tr>
<td>4</td>
<td>Diphtheria</td>
<td>6-7</td>
<td>85%</td>
</tr>
<tr>
<td>5</td>
<td>Perussis</td>
<td>12-17</td>
<td>92-94%</td>
</tr>
<tr>
<td>6</td>
<td>Polio</td>
<td>4-13</td>
<td>75-92%</td>
</tr>
<tr>
<td>7</td>
<td>Rubella</td>
<td>6-7</td>
<td>83-86%</td>
</tr>
<tr>
<td>8</td>
<td>H1N1 (2000 Pandemic)</td>
<td>1.6</td>
<td>40%</td>
</tr>
<tr>
<td>9</td>
<td>SARS</td>
<td>2-4</td>
<td>50-75%</td>
</tr>
<tr>
<td>10</td>
<td>SARS-CoV-2 (COVID-19)</td>
<td>5.7</td>
<td>82.5%</td>
</tr>
</tbody>
</table>

Note: Total vaccinations refers to the number of doses given, not necessarily the number of people vaccinated

Source: Our World In Data, 1030 GMT on 22 Feb with latest available data

BBC
Monoclonal Antibodies
Against the Spike Protein
For Treatment and for Prevention
**BLAZE-1 PHASE 3: PRIMARY ENDPOINT**

<table>
<thead>
<tr>
<th>COVID-19 RELATED HOSPITALIZATION OR DEATH BY ANY CAUSE BY DAY 29</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
</tr>
<tr>
<td>Placebo</td>
</tr>
<tr>
<td>Bamlanivimab 2800 mg + Etesevimab 2800 mg</td>
</tr>
</tbody>
</table>

**Death by any cause by day 29**

<table>
<thead>
<tr>
<th><strong>N</strong></th>
<th><strong>Events</strong></th>
<th><strong>Rate</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo</td>
<td>517</td>
<td>10*</td>
</tr>
<tr>
<td>Bamlanivimab 2800 mg + Etesevimab 2800 mg</td>
<td>518</td>
<td>0</td>
</tr>
</tbody>
</table>

70% reduction vs. placebo

No deaths of any cause with antibody therapy

*8 of 10 deaths were deemed COVID-19 related
BLAZE-2: COVID-19 PREVENTION IN RESIDENTS

RESIDENTS WITH SYMPTOMATIC COVID-19
(Prevention Population)

COVID-19 PREVENTION
Odds ratio: 0.20
p-value: 0.00026
Up to 80% reduction in risk

DEATH DUE TO COVID-19
Placebo: 4 of 139 residents
Bamlanivimab: 0 of 160 residents
No deaths due to COVID-19 on bamlanivimab
1,170 administrations
In 2021
1,657 since start-up
11/20/2020
COVID-19 Variants

Changes in the Spike Protein that Escape Neutralizing Antibody or Increase Transmission
COVID-19 VARIANTS IN US

- The United Kingdom (UK) identified a variant called B.1.1.7 with a large number of mutations in the fall of 2020. This variant spreads more easily and quickly than other variants and may be associated with an increased risk of death compared to other variant viruses. This variant was first detected in the US at the end of December 2020.


- In Brazil, a variant called P.1 This variant contains a set of additional mutations that may affect its ability to be recognized by antibodies. This variant was first detected in the US at the end of January 2021.

Neutralization of SARS-2 Virus Constructs with plasma from vaccine recipients.
Spread of 501Y.V2 Variant – Is this a warning for US

- Assessment of 2589 SARS-CoV-2 genomes from samples in South Africa collected between March and November 2020\(^1\)
  - 501Y.V2 displaced the other 3 main South Africa variants starting in November
- As of December 21, 2020, more than 300 genomes of 501Y.V2 had been identified\(^2\)

1. Tegally. MedRxiv. 2020;[Preprint]. Note: This study has not been peer reviewed.
Questions?