Significant progress made in 2021 on COVID-19 vaccines

An overview of major milestones achieved to date

- **31st December**: Pfizer/BioNTech granted WHO EUL
- **15th February**: AZ granted WHO EUL
- **12th March**: J&J granted WHO EUL
- **14th April**: 1 billion doses administered
- **20th March**: 1 billion doses produced
- **30th April**: Moderna granted WHO EUL
- **7th May**: Sinopharm granted WHO EUL
- **1st June**: SinoVac granted WHO EUL
- **30th September**: 30% of the world’s population have received a full initial vaccination course
- **3rd November**: Bharat’s candidate granted WHO EUL
- **August 2021**: Production first exceeds 1 bn doses per month
- **30th September**: 1 billion doses administered
- **20th March**: 1 billion doses produced

© 2021 Airfinity / Private & Confidential
Despite a big increase in vaccination rates there are concerns on variants and rising cases

An analysis of the current dominant variant, infections, deaths and vaccinations globally over time

Countries with at least one confirmed omicron case

Cases globally

Deaths globally

People vaccinated (at least 1 dose)

Boosters administered
Vaccine production forecast to hit 11.2bn doses in 2021, with a capacity of 1.4bn in December alone

Vaccine production split by candidate

- **BNT162b2 (Pfizer/BioNTech)**: 2,029,478,998 doses
- **AZD1222 (University of Oxford/AstraZeneca)**: 1,319,090,336 doses
- **BBIBP-CorV (Beijing/Sinopharm)**: 2,897,046,796 doses
- **NVX-CoV2373 (Novavax)**: 3,890,170,715 doses
- **mRNA-1273 (Moderna)**: 4,879,176,678 doses
- **CoronaVac (Sinovac)**: 4,879,176,678 doses
- **COVAXIN (Bharat/ICMR/NIV)**: 7,103,620,786 doses
- **AZD1222 (University of Oxford/AstraZeneca)**: 7,103,620,786 doses
- **mRNA-1273 (Moderna)**: 5,958,441,475 doses
- **CoronaVac (Sinovac)**: 5,958,441,475 doses
- **COVAXIN (Bharat/ICMR/NIV)**: 8,355,897,372 doses
- **AZD1222 (University of Oxford/AstraZeneca)**: 8,355,897,372 doses
- **mRNA-1273 (Moderna)**: 11,154,014,965 doses

Number of collaborations:
- **Adjuvant**: 339
- **Tech**: 339
- **Source of Materials**: 199
- **Tech and Fill/Finish**: 30
- **Distribution and Storage**: 12
- **Fill/Finish**: 11

Forecasted production:
- **31/01/2021**: 30,947,108 doses
- **28/02/2021**: 793,509,302 doses
- **31/03/2021**: 1,319,090,336 doses
- **30/04/2021**: 2,029,478,998 doses
- **30/05/2021**: 2,897,046,796 doses
- **30/06/2021**: 3,890,170,715 doses
- **30/07/2021**: 4,879,176,678 doses
- **30/08/2021**: 5,958,441,475 doses
- **30/09/2021**: 8,355,897,372 doses
- **30/10/2021**: 11,154,014,965 doses
- **31/11/2021**: 9,701,276,930 doses
- **31/12/2021**: 11,154,014,965 doses

Additional information:
- Number of collaborations: 339
- Source of materials: 199
- Tech: 339
- Tech and Fill/Finish: 30
- Distribution and Storage: 12
- Fill/Finish: 11

Date published: 15th Dec
China, EU, India and the US set to be the biggest vaccine producers in 2021

Vaccine production split by country

© 2021 Airfinity / Private & Confidential. *Other includes Belarus, Cuba, Egypt, Iran, Kazakhstan, Taiwan and Thailand. This analysis is based on where the vaccine drug substance is produced it does not take into account fill/finish occurring in other locations.
If a variant-updated vaccine is needed, production rate in 2022 would slow initially

An analysis of production forecasts if rate continues or if 50% of production is diverted to producing a variant vaccine

© 2021 Airfinity / Private & Confidential. *See appendix for methodology
Significant increase seen in donations, either direct or through COVAX

Deliveries of vaccines through COVAX or through direct donations over time

Forecast surplus doses available for March 2022

-16%

<table>
<thead>
<tr>
<th>Country</th>
<th>Boosters for elderly</th>
<th>Boosters for all adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>1,649,593,000</td>
<td>1,385,915,000</td>
</tr>
<tr>
<td>European Union</td>
<td>615,944,000</td>
<td>73,820,000</td>
</tr>
<tr>
<td>Japan</td>
<td>119,375,000</td>
<td>492,077,000</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>724,604,000</td>
<td>97,287,000</td>
</tr>
<tr>
<td>United States</td>
<td>107,627,000</td>
<td>90,152,000</td>
</tr>
<tr>
<td>Bilateral donations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>10,170,000</td>
<td></td>
</tr>
<tr>
<td>European Union</td>
<td>615,944,000</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>119,375,000</td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td>724,604,000</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>107,627,000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Bilateral donations</th>
<th>Country contributions to COVAX</th>
<th>COVAX supply secured directly</th>
</tr>
</thead>
<tbody>
<tr>
<td>28/02/2021</td>
<td>10,170,000</td>
<td>615,944,000</td>
<td>169,593,000</td>
</tr>
<tr>
<td>31/03/2021</td>
<td>45,245,310</td>
<td>615,944,000</td>
<td>532,979,000</td>
</tr>
<tr>
<td>30/04/2021</td>
<td>76,299,650</td>
<td>119,375,000</td>
<td>432,940,000</td>
</tr>
<tr>
<td>31/05/2021</td>
<td>111,755,400</td>
<td>724,604,000</td>
<td>364,647,000</td>
</tr>
<tr>
<td>31/06/2021</td>
<td>146,771,680</td>
<td>107,627,000</td>
<td>297,960,000</td>
</tr>
<tr>
<td>31/07/2021</td>
<td>325,957,160</td>
<td>103,929,690</td>
<td>216,053,000</td>
</tr>
<tr>
<td>31/08/2021</td>
<td>471,178,270</td>
<td>119,452,610</td>
<td>140,092,000</td>
</tr>
<tr>
<td>31/09/2021</td>
<td>617,652,870</td>
<td>110,439,900</td>
<td>119,939,000</td>
</tr>
<tr>
<td>30/10/2021</td>
<td>859,857,914</td>
<td>157,833,230</td>
<td>316,768,200</td>
</tr>
<tr>
<td>30/11/2021</td>
<td>1,107,109,024</td>
<td>238,028,710</td>
<td>316,768,200</td>
</tr>
</tbody>
</table>

Bilateral donations (from one country to another)

Country contributions to COVAX

COVAX supply secured directly

-16%
Significant impact on protection against infection from omicron, awaiting more data on hospitalisations and boosters

Comparison of vaccine effectiveness against different variants

<table>
<thead>
<tr>
<th>Vaccine Combination</th>
<th>Protection against symptomatic infection*</th>
<th>Protection against hospitalisation*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pfizer/BNT</td>
<td>87%</td>
<td>93%</td>
</tr>
<tr>
<td>Moderna</td>
<td>91%</td>
<td>94%</td>
</tr>
<tr>
<td>AZ</td>
<td>68%</td>
<td>93%</td>
</tr>
<tr>
<td>J&amp;J</td>
<td>69%</td>
<td>95%</td>
</tr>
<tr>
<td>Overall</td>
<td>74%</td>
<td>70%</td>
</tr>
<tr>
<td>Delta</td>
<td>61%</td>
<td>94%</td>
</tr>
<tr>
<td>Omicron</td>
<td>6%</td>
<td>95%</td>
</tr>
</tbody>
</table>

Estimated protection against symptomatic infection restored from boosters

- Pfizer/BNT:
  - 2x AZ + 1x Pfizer/BNT: 94%
  - 2x Pfizer/BNT + 1x Pfizer/BNT: 93%

- Moderna:
  - 2x AZ + 1x Pfizer/BNT: 71%
  - 2x Pfizer/BNT + 1x Pfizer/BNT: 76%

Data on vaccine effectiveness against Omicron is extremely limited and based on a very small number of studies so should be interpreted with caution. This slide summarises what is currently published.

© 2021 Airfinity / Private & Confidential. *Data is obtained from Airfinity's meta analysis tool which estimates effectiveness based on all publicly available information.
## Promising COVID-19 vaccine candidates in the pipeline

### Overview of candidates and clinical trial phase

<table>
<thead>
<tr>
<th>Category</th>
<th>Preclinical</th>
<th>Phase I</th>
<th>Phase I/II</th>
<th>Phase II</th>
<th>Phase II/III</th>
<th>Phase III</th>
<th>Phase IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein Subunit</td>
<td>157</td>
<td>7</td>
<td>8</td>
<td>2</td>
<td>4</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>Genetic Vaccine (viral vector)</td>
<td>64</td>
<td>12</td>
<td>12</td>
<td>8</td>
<td>8</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>Genetic Vaccine (mRNA)</td>
<td>28</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Genetic Vaccine (DNA)</td>
<td>54</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Whole Virus</td>
<td>30</td>
<td>4</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>358</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
</tr>
</tbody>
</table>

- **Number of candidates discontinued**: 9
- **Variant updated vaccines**: 4
- **Alternative route of administration**: 2
- **Able to store in fridge**: 13
- **Able to store at room temperature**: 1

© 2021 Airfinity / Private & Confidential

Date published: 15th Dec
Lots of innovation expected in 2022 for COVID-19 vaccines

A summary of vaccines in the pipeline

**Flu/RSV/COVID-19 combination vaccines**

- **Moderna**: One Flu/COVID combination vaccine (mRNA-1073) and one universal antiviral vaccine.
- **Novavax**: NanoFlu/NVX-CoV2373
- **Immunovative Therapies/Mirror Biologics**: Flu/RSV/COVID-19

**Alternative routes of administration**

- Intranasal
- Oral
- Needle-free injection

**Omicron variant updated vaccines**

- Unapproved vaccines: 12
- Tweaked vaccines: 6

**Brand-new Omicron vaccines**

- Preclinical studies: 3-4 months
- Clinical trials: 5 months

**Tweaked Omicron vaccines**

- Variant analysis: 2 weeks
- Relatively small human trials: 2-3 months
- Regulatory approval process: 2 weeks

**September 2022**

The estimated time at which the first brand-new Omicron vaccines could receive approval

© 2021 Airfinity / Private & Confidential. *ZyCoV-D was approved for emergency use in India in September 2021

Date published: 15th Dec
→ Copyright notice
All intellectual property rights in this publication and the information published herein are the exclusive property of Airfinity and may only be used under licence from Airfinity. Without limiting the foregoing, by accessing this publication you agree that you will not copy or reproduce or recirculate or distribute or use any part of its contents in any form or for any purpose whatsoever except under valid licence from Airfinity. Unauthorised distribution is strictly prohibited.

→ Disclaimer
The data and other information published herein are provided on an "as is basis". Airfinity makes no warranties, express or implied, as to the accuracy, adequacy, timeliness, or completeness of the data or fitness for any particular purpose. Airfinity shall not be liable for any loss, claims or damage arising from any party's reliance on the data and disclaim any and all liability relating to or arising out of use of the data to the full extent permissible by law.
Airfinity forecasts have been realistic to observed production

Comparison of Airfinity forecasts (made in early February) vs observed production up until July
### Other vaccines include

- COVIran Barekat (Shifa Pharmed)
- CoviVac (Chumakov Federal Scientific Center)
- CoVLP (Medicago/GSK)
- EpiVacCorona (VECTOR)
- FINLAY-FR-2 (Finlay Vaccine Institute)
- GRAd-COV2 (Reithera/LeukoCare/Univercells)
- INO-4800 (Inovio Pharma)
- LUNAR-COV19 (Arcturus)
- MVC-COV1901 (Medigen/Dynavax)
- NVX-CoV2373 (Novavax)
- QazCovid-in (RI for Biological Safety Problems)
- Razi Cov Pars (Razi Vaccine and Serum Research Institute)
- S-268019 (Shionogi)
- SCB-2019 (Clover/Dynavax)
- UB-612 (Covaxx/Vaxxinity)
- Vaccine (Sanofi/GSK)
- VLA2001 (Valneva/Dynavax)
- ZF2001 (Anhui Zhifei)
- ZyCoV-D (Zydus Cadila)
- Ad5-nCoV (CanSino)
- CIGB-66 (Center for Genetic Engineering and Biotechnology (CIGB))
Appendix

Definitions for types of production

**Definitions:**

**Source of materials:**
Public announcements to supply raw materials for vaccine candidates

**Distribution and storage:**
Public announcements to distribute and/or store vaccines after production (separate from procurement deal)

**Adjuvant:**
Public announcements to produce and supply adjuvant for vaccine formulations

**Fill and finish:**
Public announcements to fill and finish vaccines into vials and syringes

**Tech:**
Public announcements to produce active vaccines or vaccine components.
### Studies included in the Airfinity vaccine meta effectiveness tool

**Omicron study:**
https://khub.net/documents/135939561/430986542/Effectiveness+of+COVID-19+vaccines+against+Omicron+variant+of+concern.pdf/f423c9f4-91cb-0274-c8c5-70e8fad50074

<table>
<thead>
<tr>
<th>Number of studies used in Airfinity Meta analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pfizer-BNT</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>Overall effectiveness</td>
</tr>
<tr>
<td>Effectiveness against Delta</td>
</tr>
<tr>
<td>Effectiveness against hospitalisations</td>
</tr>
<tr>
<td>Effectiveness against Delta hospitalisations</td>
</tr>
</tbody>
</table>
In this scenario it is assumed that vaccine production is reduced by 50% for 3 months to implement production of a new variant-specific vaccine, then there is an exponential increase in Omicron-specific vaccine production over the following 3 months, bringing production back to a rate of 1.4 billion doses produced per month. Following this period, vaccine production continues at a constant rate equal to the rate at the end of 2021 (current rate). Here the total production of vaccines is separated by the cumulative production of vaccines targeting wild-type Covid-19 and Omicron-specific vaccines.
More info.

→ Press
Sarah Harper
Media and Communications Manager
+44 777 365 9099
sarah@airfinity.com