COVID–19 Intel Report

Prepared for the IFPMA, BIO and DCVMN Press Briefing
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16\textsuperscript{th} December 2021
Significant progress made in 2021 on COVID-19 vaccines

An overview of major milestones achieved to date

14th April
1 billion doses administered

20th March
1 billion doses produced

15th February
AZ granted WHO EUL

12th March
J&J granted WHO EUL

August 2021
Production first exceeds 1 bn doses per month

30th April
Moderna granted WHO EUL

7th May
Sinopharm granted WHO EUL

1st June
SinoVac granted WHO EUL

3rd November
Bharat's candidate granted WHO EUL

30th September
30% of the world’s population have received a full initial vaccination course

31st Dec
Pfizer/BioNTech granted WHO EUL

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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

- New cases smoothed per million
- New deaths smoothed per million
- People vaccinated (at least 1 dose)

Countries with at least one confirmed omicron case

- 82 countries
- Countries are color-coded based on the dominant variant:
  - Omicron dominant
  - Delta dominant
  - No data/non-VoC/VoI dominant

Date published: 15th Dec
Vaccine production forecast to hit 11.2bn doses in 2021, with a capacity of 1.4bn in December alone

Vaccine production split by candidate

- **Ad26COVS1 (J&J)**
- **AZD1222 (University of Oxford/AstraZeneca)**
- **BBIBP-CorV (Beijing/Sinopharm)**
- **BNT162b2 (Pfizer/BioNTech)**
- **mRNA-1273 (Moderna)**
- **NVX-CoV2373 (Novavax)**
- **COVAXIN (Bharat/ICMR/NIV)**
- **CoronaVac (Sinovac)**
- **Other**

**Forecasted**

- 31/01/2021: 2,029,478,998
- 31/03/2021: 2,897,046,796
- 31/05/2021: 3,890,170,715
- 31/07/2021: 4,879,176,678
- 31/09/2021: 5,958,441,475
- 31/11/2021: 7,103,620,786
- 31/12/2021: 8,355,897,372
- 30/01/2021: 449,137,108
- 28/02/2021: 1,319,090,336
- 31/03/2021: 2,029,478,998
- 30/04/2021: 2,897,046,796
- 31/05/2021: 3,890,170,715
- 30/06/2021: 4,879,176,678
- 30/07/2021: 5,958,441,475
- 31/08/2021: 7,103,620,786
- 30/09/2021: 8,355,897,372
- 31/10/2021: 9,701,276,930
- 30/11/2021: 11,154,014,965

Number of collaborations

- **Adjuvant**
- **Distribution and Storage**
- **Fill/Finish**
- **Source of Materials**
- **Tech**
- **Tech and Fill/Finish**
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.

Date published: 15th Dec
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

A total of 19.8 bn produced to date in this scenario

Forecast for when first omicron vaccines could be made available

A total of 16.4 bn produced to date in this scenario
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%

Canada: 1,649,593,000
European Union: 615,944,000
Japan: 119,375,000
United Kingdom: 724,604,000
United States: 107,627,000

Boosters for elderly

Canada: 82,043,000
European Union: 492,077,000
Japan: 97,287,000
United Kingdom: 632,579,000
United States: 90,152,000

Boosters for all adults

Canada: 73,820,000
European Union: 492,077,000
Japan: 97,287,000
United Kingdom: 632,579,000
United States: 90,152,000

COVAX supply secured directly
Country contributions to COVAX
Bilateral donations (from one country to another)
Significant impact on protection against infection from omicron, awaiting more data on hospitalisations and boosters

Comparison of vaccine effectiveness against different variants

Protection against symptomatic infection*

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Pfizer/BNT</th>
<th>Moderna</th>
<th>AZ</th>
<th>J&amp;J</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection</td>
<td>87% 91%</td>
<td>74% 68%</td>
<td>34% 6%</td>
<td>61% 69%</td>
</tr>
</tbody>
</table>

Protection against hospitalisation*

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Pfizer/BNT</th>
<th>Moderna</th>
<th>AZ</th>
<th>J&amp;J</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection</td>
<td>93% 93%</td>
<td>94% 70%</td>
<td>95% 76%</td>
<td>95% 81%</td>
</tr>
</tbody>
</table>

Estimated protection against symptomatic infection restored from boosters

<table>
<thead>
<tr>
<th>Booster Schedule</th>
<th>Overall</th>
<th>Delta</th>
<th>Omicron</th>
</tr>
</thead>
<tbody>
<tr>
<td>2x AZ + 1x Pfi/BNT</td>
<td>94% 94%</td>
<td>71% 71%</td>
<td>94% 94%</td>
</tr>
<tr>
<td>2x Pfi/BNT + 1x Pfi/BNT</td>
<td>93% 93%</td>
<td>76% 76%</td>
<td>93% 93%</td>
</tr>
</tbody>
</table>

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

- **Preclinical**: 358 candidates, 157 Protein Subunit, 64 Genetic Vaccine (viral vector), 28 Genetic Vaccine (mRNA), 54 Whole Virus, 30 Unknown

- **Phase I**: 55 candidates, 16 Protein Subunit, 12 Genetic Vaccine (DNA), 12 Genetic Vaccine (mRNA), 7 Whole Virus, 7 Unknown

- **Phase I/II**: 38 candidates, 17 Protein Subunit, 8 Genetic Vaccine (DNA), 7 Genetic Vaccine (mRNA), 6 Whole Virus, 6 Unknown

- **Phase II**: 22 candidates, 11 Protein Subunit, 5 Genetic Vaccine (DNA), 5 Genetic Vaccine (mRNA), 2 Whole Virus, 2 Unknown

- **Phase II/III**: 41 candidates, 19 Protein Subunit, 4 Genetic Vaccine (DNA), 4 Genetic Vaccine (mRNA), 11 Whole Virus, 4 Unknown

- **Phase III**: 2 candidates, 1 Protein Subunit, 1 Genetic Vaccine (DNA), 1 Genetic Vaccine (mRNA), 1 Whole Virus, 1 Unknown

- **Phase IV**: 7 candidates, 4 Protein Subunit, 3 Genetic Vaccine (DNA), 3 Genetic Vaccine (mRNA), 1 Whole Virus, 1 Unknown

- **Variant updated vaccines**: 4 candidates

- **Alternative route of administration**: 2 candidates

- **Able to store in fridge**: 13 candidates

- **Able to store at room temperature**: 1 candidate

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**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderna</td>
<td>One Flu/COVID combination vaccine (mRNA-1073) and one universal anti-viral vaccine.</td>
</tr>
</tbody>
</table>

**Novavax** NanoFlu/NVX-CoV2373

**Immunovative Therapies/Mirror Biologics** Flu/RSV/COVID-19

**Phase I/II**

<table>
<thead>
<tr>
<th>Planned/Announced</th>
<th>Discovery</th>
<th>Preclinical</th>
<th>Phase I/II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>

**Alternative routes of administration**

- Intranasal
- Oral
- Needle-free injection

<table>
<thead>
<tr>
<th>Route</th>
<th>Preclinical</th>
<th>Phase I</th>
<th>Phase II</th>
<th>Phase III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>27</td>
<td>9</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>6</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Omicron variant updated vaccines**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Approval Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>J&amp;J</td>
<td>September 2022</td>
</tr>
<tr>
<td>Moderna</td>
<td></td>
</tr>
<tr>
<td>Pfizer</td>
<td></td>
</tr>
<tr>
<td>Sinovac</td>
<td></td>
</tr>
<tr>
<td>Sputnik</td>
<td></td>
</tr>
<tr>
<td>Soberana</td>
<td></td>
</tr>
</tbody>
</table>

**Brand-new Omicron vaccines***

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

**Tweaked Omicron vaccines**

- Variant analysis: 2 weeks
- Relatively small human trials (209-500 subjects): 2-3 months
- Regulatory approval process: 2 weeks

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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 Pharmad)
- 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)
- AdS-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.
Appendix

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></th>
<th>Pfizer-BNT</th>
<th>AstraZeneca</th>
<th>Moderna</th>
<th>J&amp;J</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall effectiveness</strong></td>
<td>47</td>
<td>17</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td><strong>Effectiveness against Delta</strong></td>
<td>16</td>
<td>8</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td><strong>Effectiveness against hospitalisations</strong></td>
<td>16</td>
<td>5</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td><strong>Effectiveness against Delta hospitalisations</strong></td>
<td>11</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>
Methodology for production forecast in the scenario that 50% of production is diverted to a variant-updated vaccine

Appendix

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.

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