Background

- Despite large numbers of vaccinations following the initial vaccine rollout, the United States, India, Chile and Europe have had a surge in COVID-19 cases. It is suspected that relaxation of public health measures, as well as the new variants of COVID-19, may have contributed to this. New variants may be more transmissible and less susceptible to antibodies produced by vaccines or previous infection.(1-6)

- While preliminary research from Israel suggests that vaccination reduces transmission, vaccination alone is insufficient to contain COVID-19.(7, 8)

Evidence

- Viruses constantly change through mutation and, over time, new variants of a virus are expected to occur. Some variants have characteristics that have a significant impact on transmissibility, severity of disease and the effectiveness of vaccines.(9)

- For SARS-CoV-2, there are currently four variants of concern as determined by the World Health Organization (WHO).(10) The WHO has recently assigned simple labels for key variants of SARS-CoV-2, included below.(11)

- The four variants of concern include:
  - Alpha (B.1.1.7), which originated in the United Kingdom. Currently 136 countries are reporting detection of the variant.
  - Beta (B.1.351), which originated in South Africa. Currently 92 countries are reporting detection of the variant.
  - Gamma (B.1.1.28.1 or P.1), which originated in Brazil. Currently 54 countries are reporting detection of the variant.
  - Delta (B.1.617.2), which originated in India. Currently 64 countries are reporting detection of the variant.(12)

- There are news reports of a ‘hybrid’ variant in Vietnam that is a combination of Alpha and Delta. Currently, the WHO has not made an assessment of the variant and understands this variant to be Delta with an additional mutation.(13, 14)

- There are additional variants of concern from individual jurisdictions, such as California. These have been labelled ‘variants of concern’ by the US Centers for Disease Control and Prevention.(15)

- Recent analysis on effective reproduction numbers and global spread of variants has indicated the Delta variant is expected to rapidly become the dominant variant over the coming months. (16)

- There is emerging evidence on the impact of variants on COVID-19 vaccines. Generally, vaccines are effective at neutralising Alpha, while there is reduced neutralisation for Gamma and Beta. Early reports show limited reduction in neutralisation of Delta. All variants elicit cross-reactive neutralising antibodies. Additional findings suggest reduced vaccine effectiveness against variants of concerns within certain time periods after vaccination.(6, 12, 16-19)
Table 1. Vaccination rates (select countries) as at 22 June 2021

<table>
<thead>
<tr>
<th>Country</th>
<th>Average daily vaccine doses*</th>
<th>Population covered (%)**</th>
<th>Time to cover 75% of the population***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>103,349</td>
<td>12.9%</td>
<td>10 months</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>415,067</td>
<td>55.8%</td>
<td>2 months</td>
</tr>
<tr>
<td>United States</td>
<td>1,132,945</td>
<td>49.7%</td>
<td>5 months</td>
</tr>
<tr>
<td>Canada</td>
<td>424,229</td>
<td>43.2%</td>
<td>2 months</td>
</tr>
<tr>
<td>Israel</td>
<td>3,173</td>
<td>58.8%</td>
<td>2.5 years</td>
</tr>
<tr>
<td>India</td>
<td>3,046,225</td>
<td>10.2%</td>
<td>19 months</td>
</tr>
<tr>
<td>Taiwan</td>
<td>100,753</td>
<td>3.3%</td>
<td>11 months</td>
</tr>
<tr>
<td>Vietnam</td>
<td>132,046</td>
<td>1.3%</td>
<td>3 years</td>
</tr>
</tbody>
</table>

More than 2.66 billion doses have been administered across 180 countries.

* Average daily vaccine doses based on the last seven days.
** Population covered divides the doses administered for each vaccine type by the number of doses required for full vaccination.
*** Time to cover 75% of the population based on the number of doses required and the current average daily vaccine doses.

COVID-19 vaccination rates

The following graph shows the daily (rolling seven-day average) vaccination rates in Australia, the United Kingdom, United States, Canada, Israel and India, from December 2020 to late June 2021.

Figure 1. Daily vaccination rates (select countries), December 2020 – June 2021

COVID-19 cases and vaccinations

The following graphs show COVID-19 cases and vaccination rates in Australia, the United Kingdom, United States, Canada, Israel, India, Taiwan and Vietnam. Figure 2 shows the percentage of the population that has been diagnosed with COVID-19 (confirmed cases); received at least one vaccine dose; and received two vaccine doses (fully vaccinated) for select countries.

The graphs thereafter (Figures 3–10) show data specific to each of these countries, including the daily number of confirmed COVID-19 cases; the cumulative number of people who have received at least one vaccine dose (per 100 population); and the cumulative number of people fully vaccinated (per 100 population) from November 2020 to late June 2021.

These graphs should be interpreted with caution as there are other factors that may influence the number of cases in addition to vaccine rates, including the level of social restrictions. The number of people fully vaccinated in Australia is only available from late May onwards.

Note, there is variation in x axis scales and some gaps in time series across these graphs due to missing data.

**Figure 2. Cumulative COVID-19 cases and vaccinations (select countries) as at 23 June 2021**
Figure 3. COVID-19 cases and vaccinations, Australia, November 2020 – June 2021

Figure 4. COVID-19 cases and vaccinations, United Kingdom, November 2020 – June 2021
COVID-19 Critical Intelligence Unit: COVID-19 vaccines, cases and variants

Figure 5. COVID-19 cases and vaccinations, United States, November 2020 – June 2021

Figure 6. COVID-19 cases and vaccinations, Canada, November 2020 – June 2021
Figure 7. COVID-19 cases and vaccinations, Israel, November 2020 – June 2021

Figure 8. COVID-19 cases and vaccinations, India, November 2020 – June 2021
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Figure 9. COVID-19 cases and vaccinations, Taiwan, November 2020 – June 2021

![Figure 9](image1.png)


Figure 10. COVID-19 cases and vaccinations, Vietnam, November 2020 – June 2021

![Figure 10](image2.png)

COVID-19 variant distribution

The following graphs show the COVID-19 variant distribution for Australia, the United Kingdom, United States, Canada, Israel, India, Taiwan and Vietnam. Specifically, they show COVID-19 variant distribution for cases sequenced, and the percentage of total COVID-19 cases sequenced, from November 2020 to late June 2021.

For most countries, weekly counts are shown; however, only monthly counts were available for Canada. Note, there is variation in x axis scales.

Figure 11. COVID-19 variant distribution for a sample of cases that have been sequenced, Australia, November 2020 – June 2021
Figure 12. COVID-19 variant distribution for a sample of cases that have been sequenced, United Kingdom, November 2020 – June 2021

Figure 13. COVID-19 variant distribution for a sample of cases that have been sequenced, United States, November 2020 – June 2021

In brief documents are not an exhaustive list of publications but aim to provide an overview of what is already known about a specific topic. This brief has not been peer-reviewed and should not be a substitute for individual clinical judgement, nor is it an endorsed position of NSW Health.
Figure 14. COVID-19 variant distribution for a sample of cases that have been sequenced, Canada, December 2020 – June 2021

Figure 15. COVID-19 variant distribution for a sample of cases that have been sequenced, Israel, November 2020 – June 2021
Figure 16. COVID-19 variant distribution for a sample of cases that have been sequenced, India, November 2020 – June 2021

Figure 17. COVID-19 variant distribution for a sample of cases that have been sequenced, Taiwan, November 2020 – June 2021
Figure 18. COVID-19 variant distribution for a sample of cases that have been sequenced, Vietnam, November 2020 – June 2021

Notes:

- With regards to the above figures on COVID-19 variants, all SARS-CoV-2 sequences were downloaded from the GISAID EpiCOV™ Database. PANGO lineage (variant) classification for each individual sequence was provided by GISAID.(23)
- Dates displayed are based on the sample collection date. Sequences with collection dates specifying the year only were excluded, while collection dates specifying the year and month were assigned to the 15th of that month.
- Sequences with lengths ≤20,000 base pair were removed from the analysis as were non-human hosts.
- Only a non-random sample of cases are sequenced and for many countries the proportion of cases sequenced is very low. As a result, this report does not indicate the true prevalence of the variants but rather a best estimate currently available.
- All data used to generate these graphs is subject to the GISAID terms and conditions.(24)

Sources:

- Data on variants enabled by GISAID. Accessed 23 June 2021.(23)
- Data on total number of cases sourced from Our World in Data; accessed 23 June 2021.(25)

Method

The NSW Health Critical Intelligence Unit maintains living evidence tables on COVID-19 vaccines and SARS-CoV-2 variants. To inform this brief, a review of the evidence included in the living tables was undertaken on 27 April 2021 and updated on 21 June 2021. Supplementary Google searches using the terms COVID-19 vaccines, surges and variants were also undertaken.
COVID-19 Critical Intelligence Unit: COVID-19 vaccines, cases and variants

References

23. GISAID. In focus [Internet]. Germany; GISAID; 2021. [cited 10 June 2021]. Available from: https://www.gisaid.org/.