COVID-19 Global Trends and Analyses

Volume 2: Vaccines and Viral Variants Update

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SUMMARY

Vaccines

- Currently, **16 vaccines** are being used around the world. AstraZeneca/Oxford's vaccine is used in 181 countries, making it the most widely adopted. It is followed by Pfizer/BioNTech, which is used in 111 countries, then Sinopharm/Beijing, currently administered in 63 countries.
- As of 31 July, **4.11 billion vaccine doses** had been administered worldwide, equal to 53 doses for every 100 people. But the distribution across countries is highly uneven.
- The global distribution of COVID-19 vaccines has been marked by inequality. 85 per cent of doses given worldwide have been administered in high- and upper-middle-income countries. **Only 0.3 per cent of doses have been administered in low-income countries.**
- By 31 July, more than 12 million doses of COVID-19 vaccines had been administered in Australia, equivalent to 32.9 per 100 people. Around **15 per cent of the population are fully vaccinated.**
- As COVID-19 cases continue to surge in most Southeast Asian countries, such as Myanmar, Thailand, Malaysia, Cambodia, Vietnam and Indonesia, vaccination rates remain low with the exception of Singapore (which is 51 per cent fully vaccinated).
- As of 28 July, across the 54 countries on the African continent, at least one dose of vaccine has been administered to 61 million people, 3.2 per cent of the population. **Only 1.4 per cent has been fully vaccinated.**
- COVAX has so far shipped over 153.6 million COVID-19 vaccines to 137 countries. This is far short of the goal of delivering two billion doses in 2021.
- Updated follow-up data from the Pfizer-BioNTech clinical trial has shown high efficacy in multiple countries, including populations with diverse characteristics of age, sex, race/ethnicity. The vaccine efficacy at 6 months post vaccination was 91.3 per cent for infection and 96.7 per cent for severe disease and 100 per cent for the Beta variant.
- A UK study published in the *NEJM* found effectiveness after **one dose of vaccine** (Pfizer or AstraZeneca) was notably lower among persons with the **Delta variant** (30.7%) than among those with the Alpha variant (48.7%); the results were similar for both vaccines. With the Pfizer vaccine, the **effectiveness of two doses** was 93.7 per cent among persons with the Alpha variant and 88.0 per cent among those with the Delta variant. With the AstraZeneca vaccine, the effectiveness of two doses was 74.5 per cent among persons with the Alpha variant and 67.0 per cent among those with the Delta variant.
- However, vaccine effectiveness **against hospitalisation** was similar for Delta as for Alpha: 94 per cent after one dose of Pfizer and 96 per cent after two doses and 71 per cent after one dose of AstraZeneca and 92 per cent after two doses.
- In an outbreak of 469 COVID-19 cases in Massachusetts, 74 per cent of cases occurred in fully vaccinated persons. Testing identified the Delta variant in 90 per cent of specimens. **Viral loads in 127 fully vaccinated patients were similar to those among 84 patients who were unvaccinated**, not fully vaccinated, or whose vaccination status was unknown.

- In the latest TGA report, during the week up to 29 July, **six additional cases of blood clots** with low blood platelets were assessed as TTS likely to be linked to the AstraZeneca vaccine. All but one was over 70. This brings the total number of cases of TTS to 93 from 6.3 million doses of the AstraZeneca vaccine administered to date (1.47 per 100,000 doses).

Variants of Concern

- In just a few weeks, the **Delta variant** has become the dominant strain across India and has spread to more than 100 nations, including the United Kingdom, Russia, Portugal, Myanmar, Nepal, Fiji, Vietnam and Singapore. It has caused community outbreaks in Australia, in Melbourne, Sydney, Adelaide, Darwin, Perth and Brisbane.
- Preliminary evidence from England and Scotland suggests that people infected with Delta are about twice as likely to end up in hospital, compared with those infected with Alpha.
- Delta is moderately resistant to vaccines, particularly in people who have received just a single dose (see above).
- An investigation of daily sequential PCR testing of 167 cases in Guangdong indicated the **viral load of the first positive test of Delta infections was ~1000 times highe**r than that of the strains back in the initial epidemic wave of 2020, suggesting the potential faster viral replication rate and more infectiousness of the Delta variant at the early stage of the infection.
- Their results showed the time interval from the exposure to first PCR positive among close contacts in the quarantined population (n=29) was 6.00 days in the 2020 epidemic (peak at 5.61 days) and was 4.00 days in the 2021 (n=34) epidemic (peak at 3.71 days).
- According to the US CDC, the highly infectious Delta variant now accounts for **an estimated 83 per cent** of new coronavirus cases in the United States — a dramatic increase from early July, when it crossed the 50 per cent threshold to become the dominant variant in the country.
- **Lambda** (also known as C.37) was first detected in Peru in August 2020 and has spread to 29 countries, many in Latin America. In Peru, Lambda is now responsible for more than 90 per cent of new COVID-19 cases, a steep rise from less than 0.5 per cent in December. The country has already suffered the world's worst mortality due to COVID-19; the disease has killed about 0.54 percent of the population.
- A study by the University of Chile found that a single dose of the CoronaVac vaccine was only 3 per cent effective, but that rose to 56.5 per cent after both doses.
- Another study in Chile observed an **increased infectivity** mediated by the Lambda spike protein that was higher than that of the Alpha and Gamma variants.
- Compared to the Wild type (lineage A), **neutralisation was decreased** by 3.05-fold for the Lambda variant while it was 2.33-fold for the Gamma variant and 2.03-fold for the Alpha variant. They concluded that their results indicate that mutations present in the spike protein of the Lambda variant of interest confer increased infectivity and immune escape from neutralising antibodies elicited by CoronaVac.

GLOBAL SCIENTIFIC UPDATES

SARS-CoV-2 Vaccines Update

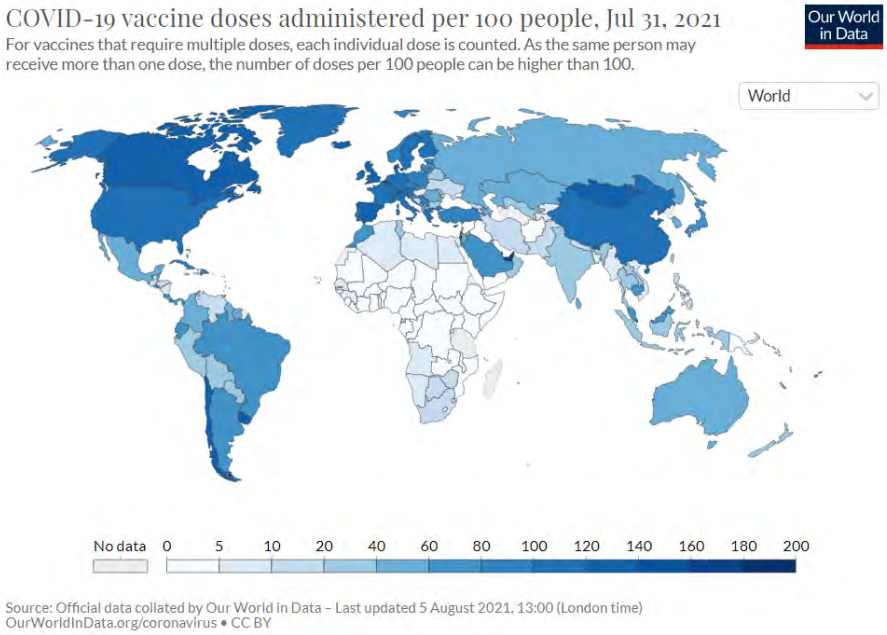
Overview of current vaccines

This table is reproduced with permission from the Melbourne Children's Campus weekly update.

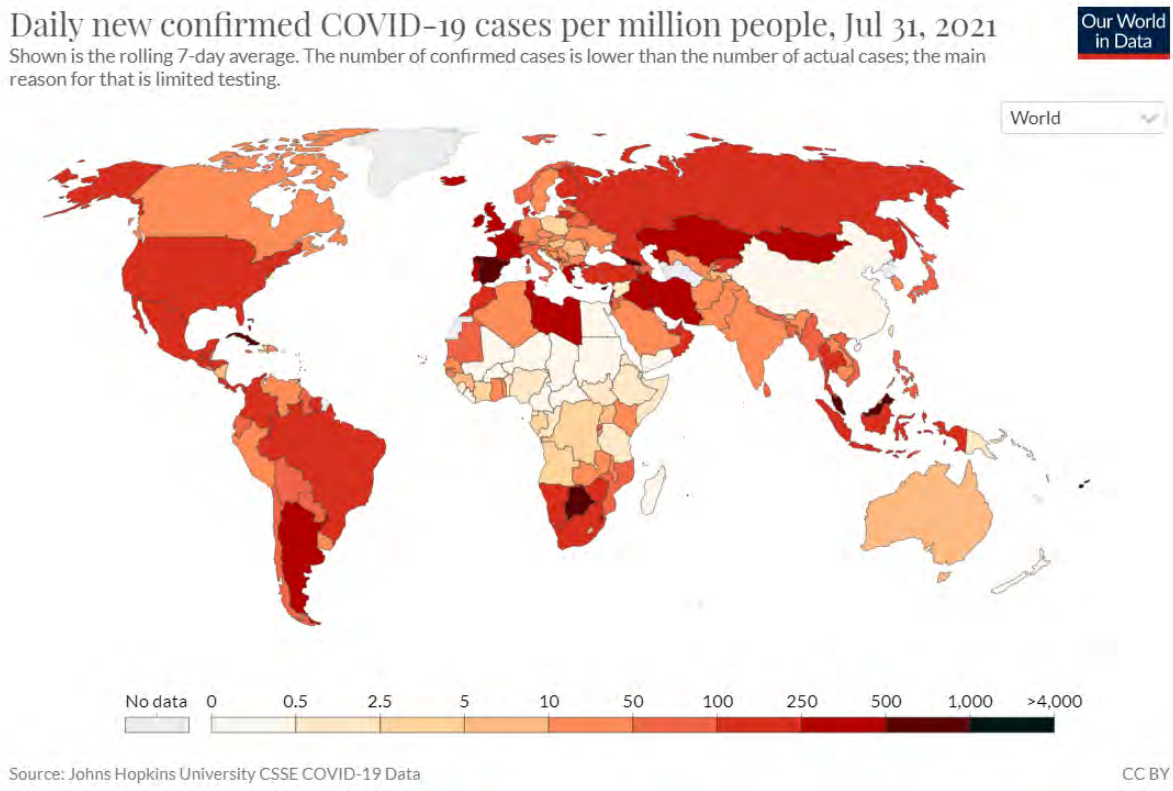
	ASTRAZENECA	GAMALEYA	JOHNSON & JOHNSON	MODERNA	NOVAVAX	PFIZER/BIONTECH	SINOVAC	SINOPHARM	BHARAT BIOTECH
VACCINE TYPE	Viral vector (chimpanzee adenovirus ChAdOx1)	Viral vector (recombinant adenovirus types 5 and 26)	Viral vector (recombinant adenovirus type 26)	mRNA	Protein subunit	mRNA	Inactivated virus	Inactivated virus	Inactivated virus
Available Through COVAX	✓	-	✓	-	✓	✓	-	-	-
Doses Required	8-12 weeks apart* 4-12 weeks apart (Product Information)	3 weeks apart		4 weeks apart*	3 weeks apart	3-4 weeks apart*	2-4 weeks apart*	3-4 weeks apart*	3 weeks apart
Shipping, Storage & Presentation	Normal cold chain requirements (2-8°C); 10-dose vials	-18.5°C (liquid form); 2-8°C (dry form)	Shipped at -20°C; 2-8°C for up to 3 months; 5-dose vials	-25°C to -15°C; 10-dose vials	2-8°C; 10-dose vials	-80°C to -60°C; 2-8°C for up to 1 month; 6-dose vials	2-8°C; Single-dose vials	2-8°C; Single-dose vials/ pre-filled syringes	2-8°C; 10-dose or 20-dose vials
Approval by a Stringent Regulatory Authority (SRA)	WHO EUL, EMA, TGA, MHRA	Under review by WHO SAGE	WHO EUL, EMA, FDA, MHRA	WHO EUL, EMA, FDA	Under review by WHO SAGE	WHO EUL, EMA, FDA, TGA, MHRA	WHO EUL	WHO EUL	-

Global Rollout of Vaccines

As of 31 July, 4.11 billion vaccine doses had been administered worldwide, equal to 53 doses for every 100 people. But the distribution across countries is highly uneven. **The map below** shows the per cent of people who have received at least one dose of vaccine.



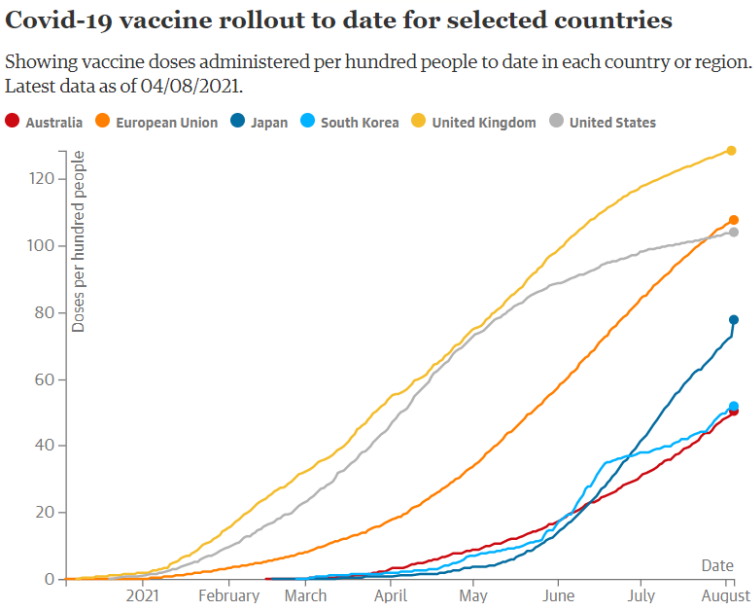
The second map below shows the cases per million people in the past 14 days. If vaccines were distributed according to caseload, the greatest needs are in South, Central and Southeast Asia, Southern and Northern Africa, and South America. The Pacific is difficult to visualise but other than Fiji and PNG, has a relatively low case load.



Currently, 16 vaccines are being used around the world. AstraZeneca/Oxford's vaccine is used in 181 countries, making it the most widely adopted. It is followed by Pfizer/BioNTech, which is used in 111 countries, then Sinopharm/Beijing, currently administered in 63 countries.

High Performers

The threshold for COVID-19 vaccine coverage to achieve population (or 'herd') immunity is still unknown but expert estimates range between 70 and 90 per cent. **Malta** is vaccinating its people faster than any other nation. About 83 per cent of the population has received the two doses needed to be fully vaccinated. (Almost all the vaccines currently being used internationally require two doses several weeks apart. People are not fully vaccinated until they receive the second dose.) It is followed by Iceland (74%), Seychelles (70%), UAE (69%), Bahrain (63%), Chile (62%), Uruguay (61%), Qatar (59%), and Mongolia and Israel (58%). The UK ranks #12 and the US #24. **Australia** ranks #88 in the world for the proportion of people fully vaccinated.

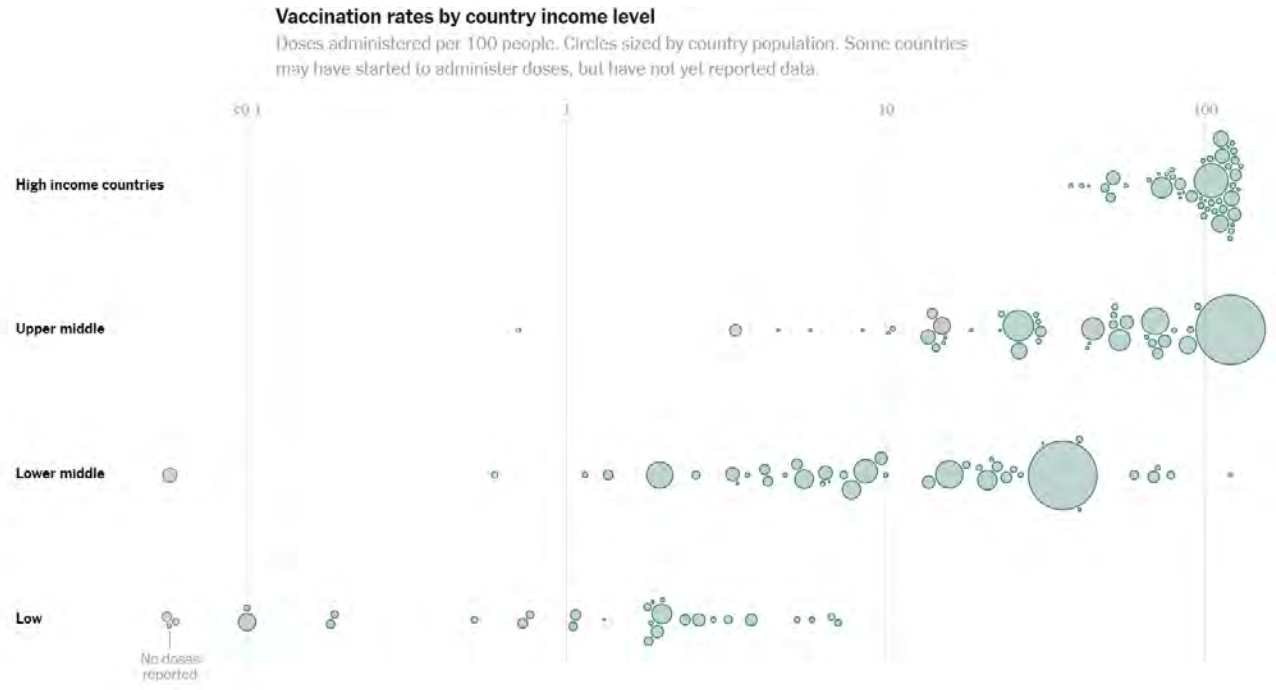


Global Vaccine Inequity

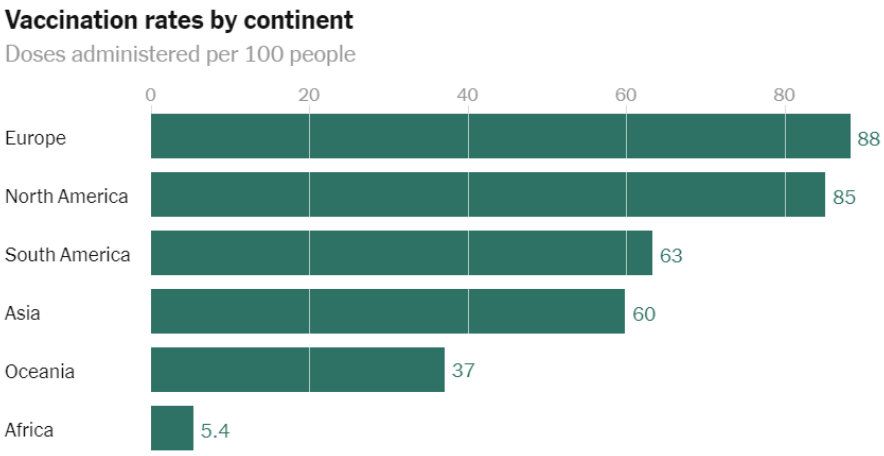
The global access to and distribution of COVID-19 vaccines has been marked by inequality. 85 per cent of doses given worldwide have been administered in high- and upper-middle-income countries. **Only 0.3 per cent of doses have been administered in low-income countries.**

Most people in the poorest countries will need to wait another two years before they are vaccinated against COVID-19, according to an article in *Nature*. Around 11 billion doses are needed to fully vaccinate 70 per cent of the world's population against COVID-19. As of 4 July, 3.2 billion doses had been administered. At the current vaccination rate, this will increase to around six billion doses by the end of the year, researchers from the International Monetary Fund, based in Washington DC, project.

The following figure indicates the gap in coverage (doses per 100) by income levels.



There is also a striking divide between continents. Africa has the slowest vaccination rate of any continent, with Burundi and Eritrea yet to start mass vaccination campaigns.

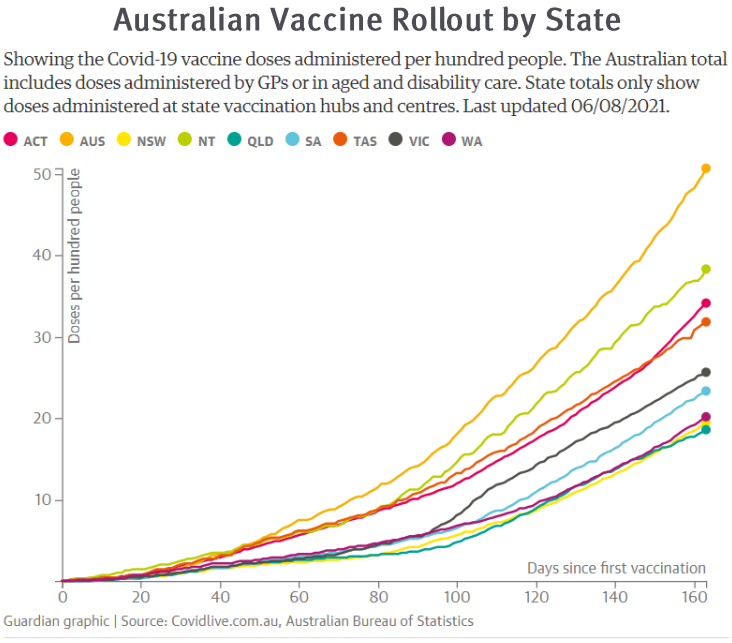


Australia | Vaccine Rollout and Trends

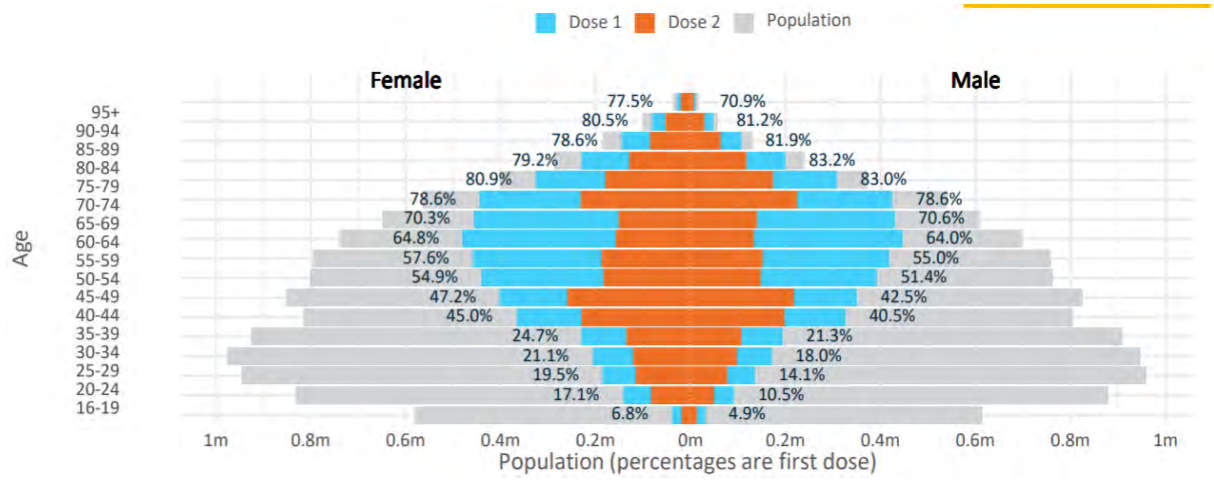
By 31 July, more than 11 million doses of COVID-19 vaccines had been administered, equivalent to 37.5 per 100 people. Around 16 per cent of the total population and 19 percent of the eligible population (›16 years) are fully vaccinated. Vaccinations have now reached one million doses per week. Australia ranks #36 in percentage of the population fully vaccinated in the 38 countries of the OECD.

At the current pace of 1,211,357 doses a week, Australia can expect to reach the 40 million doses needed to fully vaccinate the adult population in early January 2022.

In the current community outbreak of the Delta variant in Greater Sydney where there is an increased risk of SARS-CoV-2 infection and constrained supply of Pfizer vaccine, ATAGI has now advised that people in that city aged over 18 should strongly consider getting vaccinated with any available vaccine, including COVID-19 Vaccine AstraZeneca. Those considering AstraZeneca should give informed consent and ATAGI is recommending a shorter 4-8 week interval between 1st and 2nd dose to increase effectiveness against the variant. In another move to vaccinate as many people with their first dose as possible, the period between Pfizer doses has been extended from three to six weeks in Sydney and Melbourne.



COVID-19 Vaccines Administered by Age and Sex



AUS	16+	50+	70+
Dose 1	**42.44%** (8,751,409 doses / 20,619,959 people)	**67.15%** (5,875,441 doses / 8,749,703 people)	**80.17%** (2,352,896 doses / 2,934,706 people)
Dose 2	**20.80%** (4,289,820 doses / 20,619,959 people)	**29.32%** (2,565,420 doses / 8,749,703 people)	**44.81%** (1,314,970 doses / 2,934,706 people)

South Asia | Vaccine Rollout and Trends

So far, **India** has provided at least one dose to 31 per cent of the population. Just less than 7 per cent have been fully vaccinated. Vaccine inequity within India persists particularly by rural-urban status and gender. In South Asia, tiny **Bhutan** has the highest rate of vaccinations having administered at least one dose to 64 per 100 but **Maldives** has the highest rate of fully vaccinated at 49 per cent. In other countries in the region, fully vaccinated rates are low, such as Nepal (4.6%), Sri Lanka (8%), Pakistan (3%), Bangladesh (2.6%) and Afghanistan (0.6%).

Southeast Asia | Vaccine Rollout and Trends

As COVID-19 cases continue to surge in most Southeast Asian countries, such as Myanmar, Thailand, Malaysia, Cambodia, Vietnam and Indonesia, vaccination rates remain low except for Singapore (which is 51 per cent fully vaccinated).

Other than Singapore, Cambodia (40%) has the highest rate of one vaccine dose, followed by Malaysia (35%), Thailand (17%), Indonesia (16%), Laos (15%), Myanmar (6.5%) and Vietnam (4.3%). In Timor-Leste, which is just recovering from its largest surge of infections, 18 per cent of the population has received one dose of vaccine.

Africa | Vaccine Rollout and Trends

As of 28 July, across the 54 countries on the African continent, at least one dose of vaccine has been administered to 61 million people, 3.2 per cent of the population. Only 1.4 per cent has been fully vaccinated. The highest coverage rate is in **Seychelles** where 70 per cent of the population has been fully vaccinated, followed by **Mauritius**, which has fully vaccinated 34 per cent of the population and **Morocco** (32%). The only other African countries that have fully vaccinated more than one per cent of their populations are **Equatorial Guinea** (9%), **Tunisia** (7%), **Comoros** (6%), **Botswana** (5%), **Zimbabwe** (4.5%), **South Africa** (4%), **Rwanda** (2%), **Togo** (2%), **Senegal** (1.6%), **Namibia** (1.4%) and **Ghana** (1.3%). Not a single dose has been administered in Burundi and Eritrea.

With financial help from the World Bank, the African Union has secured 400 million doses of the single-shot vaccine developed by Johnson & Johnson. This vaccine should cover 30 per cent of the adult population, COVAX should supply enough doses to cover 30 per cent more, and, with additional bilateral agreements, more than 60 per cent vaccine coverage can be achieved.

Africa has been looking to expand its vaccine manufacturing capability. A South African firm will begin producing the Pfizer-BioNTech coronavirus vaccine, the first time that any vaccine will be produced in Africa. The Biovac Institute based in Cape Town will manufacture the vaccine for distribution across the 54 countries of Africa. The production will begin in 2022 with a goal of reaching more than 100 million finished doses annually. The Institut Pasteur in Dakar, Senegal has announced a partnership with the European Commission and others to establish a vaccine manufacturing facility.

COVAX Progress | Vaccine Rollout and Trends

COVAX was created last year to ensure COVID-19 vaccines were made available around the world, with richer countries subsidising costs for poorer nations. The scheme hopes to distribute enough vaccines to protect at least 20 per cent of the population in 92 low- or medium-income countries - starting with healthcare workers and the most vulnerable groups. Its initial goal was to provide two billion doses of vaccines worldwide in 2021, and 1.8 billion doses to 92 poorer countries by early 2022.

COVAX has so far shipped over 153.6 million COVID-19 vaccines to 137 countries. This is far short of the goal of delivering two billion doses in 2021. The ban on exports of the Indian manufactured AstraZeneca has been a major blow to the program. Much depends on when the Novavax vaccine, which is the second largest planned source of vaccines for COVAX, will become available. Novavax has announced a delay in seeking authorisation until the third quarter of the year.

In addition to procurement problems, some countries have had major storage and distribution Issues. For example, Chad received 100,000 doses of the Pfizer vaccine in June, but five weeks later, some 94,000 doses remained unused. Chad lacks adequate low temperature freezers required to store the vaccine. Nearby in Benin, only 267 shots were being given each day — a pace so slow that 110,000 of the program's AstraZeneca doses expired.

Recent developments include:

- The EU has announced that the bloc will donate a further 100 million doses of COVID-19 vaccines to low and middle income countries by year-end, using the COVAX facility as the main channel.
- The US administration is buying 500 million doses of Pfizer (at a reduced price) for distribution through COVAX. This donation is worth US$3.5 billion.
- Australia has provided one million doses of AstraZeneca to Pacific countries, including PNG, Timor-Leste, Solomon Islands, Samoa, Tuvalu, Fiji, Tonga and Vanuatu. Australia will also send 2.5 million doses to Indonesia.
- China has donated around 30 million vaccine doses to at least 59 countries, according to data published by researchers from the Duke Global Health Innovation Centre in Durham, North Carolina.
- The WHO is calling on its member states to support a huge effort to vaccinate at least 10 per cent of people in every country by September, along with a "drive to December" to vaccinate at least 30 per cent by the end of the year.
- The director-general of the WHO criticised Pfizer, Moderna and other vaccine manufacturers focused on developing — and selling — COVID-19 vaccine booster shots to high-income countries, saying they should focus instead on providing vaccines to nations that have had little access to first doses.

Vaccine Confidence and Hesitancy

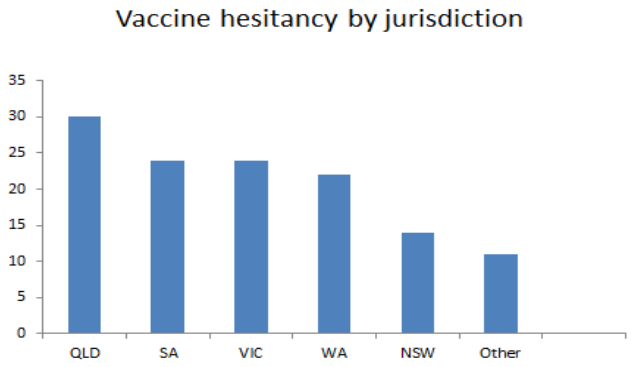
Attitudes towards COVID-19 vaccines in Australia

The latest Essential Poll found that 63 per cent of respondents now say they would either get the vaccine as soon as possible, they've already been vaccinated, they have already had their first dose of a COVID-19 vaccine, or they are fully vaccinated. About 27 per cent say they will get the vaccine, but not straight away, while 11 per cent say they will never get vaccinated.

In the waiting cohort, 41 per cent say they are waiting for the Pfizer vaccine to be available later in 2021, while 29 per cent say they are waiting to see how others react to the vaccine first before signing up, and 13 per cent say they assume it will be too hard to get an appointment. Only 31 per cent of respondents believe the vaccination rollout will be completed within a year.

Another survey by the University of Melbourne taken the week of 20 July, found that 21.5 per cent of the adult population was vaccine hesitant, compared to 33 per cent at the end of May. Vaccine acceptance is rising in all states and age groups. During the fourth week of the lockdown in Greater Sydney, vaccine hesitancy plummeted to 14.6 per cent in NSW, from 33 per cent eight weeks earlier. Only 7.6 per cent of NSW respondents said they would refuse a COVID-19 vaccine.

The survey reveals the most reluctant to receive a jab are those aged 18-44 years and Queenslanders, with three-in-10 of those respondents in the hesitant camp.



Misinformation about Vaccines in Africa

In January 2021, former Tanzanian President John Magufuli cast doubt on the effectiveness of vaccines against COVID-19, and even denied the existence of SARS-CoV-2 in his country. After his death, his successor, Samia Suluhu Hassan, decided to take a different approach when she said the country "cannot isolate ourselves as an island while the world is moving in a different direction." Even though a committee to advise the government on COVID-19 has been set up and its members are public-health and medical experts, and strict COVID-19-prevention measures have been reintroduced, Tanzania has been slow to develop any vaccination plans. There remains formidable opposition to vaccines against COVID-19 in Tanzania, even among prominent scientists.

However, on 28 July Ms Hassan was vaccinated with the Johnson & Johnson vaccine in public launching a national vaccination drive. She was joined by the prime minister, the chief justice and other leaders in taking the jab and sought to reassure people about the efficacy and safety of the vaccines. The United States has announced the delivery via COVAX of more than one million doses to Tanzania. Tanzania went well over a year without updating its number of confirmed COVID-19 cases but has now resumed reporting the data to the Africa CDC, reporting 408 cases in the country on 29 July.

Richard Mihigo, coordinator of the Immunization and Vaccine Development Program of WHO's Regional Office for Africa, says vaccine hesitancy in Africa is not being driven by people's fears alone. According to Mihigo, international groups are fuelling anti-vaccine tendencies that had not been seen in Africa before COVID-19. Since the COVID-19 pandemic began in

the DRC in 2020, misinformation has been a major force slowing down progress, according to warnings from MSF. Misinformation is further complicated by scepticism about the seriousness of COVID-19 relative to that of Ebola and other leading causes of death in the DRC.

Oyewale Tomori, a Nigerian professor of virology and chairman of Nigeria's Ministerial Expert Advisory Committee on COVID-19, says that politicians receiving the vaccine overseas allowed distrust to germinate among citizens. Some were concerned that the vaccine being administered in Nigeria might not be the same vaccine that politicians flew abroad to receive.

A single approach may not be effective in tackling vaccine hesitancy across Africa, says Mihigo, due to differences between countries. Even within countries, vaccine concerns vary from one place to another. "There are countries where up to 50 or even 60 per cent of people are not keen to be vaccinated and others where most of the population are willing to be vaccinated. This is something that needs to be addressed very comprehensively and very strategically," Mihigo says. Efforts should be geared toward effective communication and should be driven by an understanding of what people are believing, thinking and fearing.

The WHO technical advisory group on behavioural insights and sciences for health recommends that behavioural research has shown that vaccine acceptance and uptake can be increased by adopting the three strategies:

1. Creating an enabling environment – making vaccination easy, quick and affordable, in all relevant respects.

2. Harnessing social influences – especially from people who are particularly trusted by and identified with members of relevant communities.

3. Increasing motivation – through open and transparent dialogue and communication about uncertainty and risks, including around the safety and benefits of vaccination.

A common theme is engagement with local communities in developing and implementing tailored strategies to support vaccination uptake. Working in partnership with communities, building trust and ensuring that messages come from trusted endorsers are keys to successful strategies. Local context needs to be considered and ongoing metrics and research for continuous evaluation and adaption are required.

Vaccine Pipeline and Effectiveness Update

Key Definitions

- **Vaccine efficacy** refers to the performance of a vaccine in a controlled clinical trial (study) situation. COVID-19 vaccine efficacy results from different trials cannot be directly compared against each other. They must be interpreted in the context of study designs (including case definitions, clinical endpoints, access to testing), target populations, and epidemiological considerations (including circulating Variants of Concern)
- **Vaccine effectiveness** (VE) refers to the performance of a vaccine in a population under real-world conditions and uses an observational study design. The key outcomes to evaluate in VE are symptomatic disease and severe disease. Other outcomes are death, any infection and transmission and often require targeted special studies with more resources.

The following tables are reproduced with permission from the Melbourne Children's Campus weekly update, number 20, July 29.

All COVID-19 vaccines in late phase development report high vaccine efficacy against severe COVID-19 and favourable safety profiles.

COVID-19 Vaccine Efficacy

VACCINE	VACCINE EFFICACY			
	SYMPTOMATIC INFECTION	MODERATE-SEVERE	SEVERE	HOSPITALISATION/DEATH
AstraZeneca	UK: 66.7% (57.4-74.0)[13] USA, Chile, Peru: 76%[14] (not peer-reviewed) Single dose in UK (22-90 days post-vaccination): 76.0% (59.3 to 85.9)[13] Efficacy with different interval between doses in UK: 12+ weeks: 82.4% (2.7-91.7) <6 weeks: 54.9% (32.7-69.7)[13]	-	Severe/critical and hospitalisation in USA, Chile, Peru: 100%[14] (not peer-reviewed) UK: 100% (15 cases in the placebo group)[13]	Hospitalisation in UK: 100% (9 cases in placebo group)[13]
Gamaleya	Russia: 91.6% (85.6–95.2)[15] Sinlge dose (Sputnik Light) in Argentina: 78.6%[16]	Moderate-severe: 100% (20 cases in the placebo group)[15]	-	-
Johnson & Johnson	-	Moderate to severe/critical: All sites: 66.1% (55.0-74.8) USA: 72.0% (58.2-81.7) Latin America: 61.0% (46.9-71.8) South Africa: 64.0% (41.2-78.7)[17]	85.4% (54.2-96.9)[17]	100% (7 deaths in placebo group)[17]
Moderna	USA: 94.1% (89.3-96.8)[18] USA: >90%[19] 12-17 years in USA: 93% (1 case in vaccine arm)[20]	-	USA: 100% (30 cases in placebo group)[18] US: >95%[19]	USA: 100% (1 death in placebo group)[18]
Novavax	UK: 89.7% (80.2-94.6)[21] US and Mexico: 90.4% (82.9-94.6)[22]	US and Mexico: 100% (87.0-100)[22]	-	-
Pfizer/BioNTech	Argentina, Brazil, Germany, South Africa, Turkey and the USA: 94.6% (89.9–97.3)[23] 12-15 years in USA: 100%[24] Infection over 6 months: 91.3% (89.0-93.2)[63]	-	Argentina, Brazil, Germany, South Africa, Turkey and the USA: 88.9% (20.1–99.7)[23]	-
Sinovac	Brazil: 50.7% (35.9-62.0) Chile: 67% (65-69) Indonesia: 65% (20-85)[25] Turkey: 83·5% (65·4-92·1)[26]	Requiring medical assistance in Brazil: 83.7% (58.0-93.7) Moderate-severe: 100% (56.4-100.0)[27]	-	Hospitalisation: Brazil: 100% (56-100) Chile: 85% (83-97) Turkey: 100% (20-100)[25]
Sinopharm	UAE, Bahrain, Egypt and Jordan: 78.1% (64.9-86.3)[25]	-	-	Hospitalisation in UAE, Bahrain, Egypt and Jordan: 78.7% (26.0-93.9)[25]
Bharat Biotech	India: 77.8% (65.2-86.4)[28]	-	India: 93.4% (57.1-99.8)[28]	-

Vaccine Effectiveness Summary at-a-glance

VACCINE	AGAINST DEATH	AGAINST HOSPITALISATION/ SEVERE DISEASE	AGAINST SYMPTOMATIC INFECTION	AGAINST ANY INFECTION
AstraZeneca	-	Single dose: 92-94%[29,31]	Single dose: 50-60%[31,39]	Single dose: 44%[31]
Johnson & Johnson	-	-	-	77%[36]
Moderna	-	-	Single dose: 72%[39]	-
Pfizer/BioNTech	91-97%[41–45]	92-98%[31,40–45] Single dose: 85%[29]	82-97%[31,40,41,43,48] Single dose: 61%[39]	63-95%[31,41–43,46,49,50]
Sinovac	80-95%[44,51]	85-91%[44,51]	67%[51]	60%[44]
Sinopharm	-	-	90%[25]	-

Vaccine Effectiveness

Adapted from the Melbourne Children's Campus & WHO Weekly COVID-19 Vaccine Update

	Death	Severe disease or Hospitalization	Symptomatic Infection	Any Infection
AstraZeneca 1 dose		92 – 94 %	50%	44%
AstraZeneca (Delta) 1 dose		92% 71 – 88%		60% 33 – 67%
Pfizer 1 dose	91 – 97%	92 – 98 % 85%	82 – 97% 61%	63 – 95%
Pfizer (Delta) 1 dose		96 % 78 – 94 %		79 – 88% 33 – 56%

mRNA Vaccines

Efficacy of the Pfizer/BioNTech vaccine remains high over 6 months follow-up

A pre-print report, which contains updated follow-up data from the Pfizer-BioNTech clinical trial, has shown high efficacy of the Pfizer vaccine in multiple countries, including populations with diverse characteristics of age, sex, race/ethnicity. The vaccine efficacy at 6 months post vaccination was 91.3% (89.0-93.2) for infection and 96.7% (80.3-99.9) for severe disease and 100% (53.5-100) for the beta variant.

The efficacy peaked at 96.2% at seven days to two months after the second dose and then declined to 83.7% at four months, with an average of 6% every two months. Researchers have said that trials to evaluate the efficacy of booster trials after a longer interval are under way. Looking at safety, the researchers noted that decreased appetite, lethargy, asthenia, malaise, night sweats, and hyperhidrosis were new adverse events attributable to the Pfizer vaccine. Overall, few participants had serious adverse events or adverse events leading to study withdrawal.

Reduced effectiveness of mRNA vaccines during an outbreak of the Gamma variant in Canada

Residents in a Toronto residential aged care facility were offered the Moderna vaccine while staff were offered the Pfizer vaccine between late December 2020 and February 2021. By late March, 81 per cent of residents and 54 per cent of staff had received two vaccine doses and a further 6 per cent of residents and 13 per cent of staff had received one dose. The study is a pre-print paper, not yet peer reviewed.

In mid-April, an outbreak of the Gamma (P.1) variant was declared. Over the next 24 days, 31/124 residents and 22/224 staff tested positive for SARS-CoV-2. Vaccine effectiveness (VE) against SARS-CoV-2 symptomatic infection was 52.5 per cent in residents and 66.2 per cent in staff. VE against severe illness was 78.6 per cent in residents. Two of 19 vaccinated resident cases died. Outbreak management required both vaccination and infection control measures.

Spike-antibody waning after second dose of Pfizer and AstraZeneca

To identify early indications of waning antibody levels to the spike protein (S-antibody) after complete two-dose vaccination, the authors of this paper, published in *The Lancet*, did a cross-sectional analysis of fully vaccinated adults (aged ≥18 years) who submitted capillary blood samples for Virus Watch, a longitudinal community cohort study in England and Wales.

Participants contributed a single sample, taken at a median of 42 days after their second dose. 197 (33%) of 605 samples were from Pfizer vaccinees and 405 (67%) samples were from AstraZeneca vaccinees. The median interval between first

and second doses was 77 days. A significant trend of declining S-antibody levels was seen with time for both AstraZeneca and Pfizer, with levels reducing by about five-fold for AZ, and by about two-fold for Pfizer, between 21–41 days and 70 days or more after the second dose.

The data suggest waning of S-antibody levels in infection-naive individuals over a 3–10-week period after a second dose of either vaccine. These data are consistent with the decline in Spike-antibody and neutralising antibody levels observed after infection, although memory B-cell populations appear to be maintained. As such, the clinical implications of waning antibody levels post-vaccination are not yet clear, and it remains crucial to establish S-antibody thresholds associated with protection against clinical outcomes. The study implies that booster vaccination shots may be necessary to maintain adequate immunity in the coming years.

CoronaVac (Sinovac)

Effectiveness of CoronaVac in Chile

Described in the *NEJM*, a large prospective cohort study was conducted in Chile from 2 February 2 through 1 May, 2021, and included approximately 10.2 million persons. Among persons who were fully immunised, the adjusted vaccine effectiveness (VE) was **65.9 per cent for the prevention of COVID-19 (a composite of 4 outcomes)** and 87.5 per cent for the prevention of hospitalisation, 90.3 per cent for the prevention of ICU admission, and 86.3 per cent for the prevention of COVID-19–related death. The VE results were maintained in both age-subgroup analyses, notably among persons 60 years of age or older.

Efficacy and Safety of CoronaVac in Phase 3 Trial in Turkey

Published in *The Lancet*, the authors report a double-blind, randomised, placebo-controlled phase 3 trial of CoronaVac in Turkey. Among 11,303 volunteers screened between Sept 14, 2020, and Jan 5, 2021, 10,218 were randomly allocated. During a median follow-up period of 43 days, nine cases of PCR-confirmed symptomatic COVID-19 were reported in the vaccine group (31·7 cases per 1000 person-years) and 32 cases were reported in the placebo group (192·3 cases per 1000 person-years) 14 days or more after the second dose, yielding **a vaccine efficacy of 83·5 per cent** against symptomatic COVID-19. The most common adverse events were fatigue and injection site pain.

Sinopharm, Beijing

In this pre-print paper, virus neutralizing antibody titres, as a rapidly available but highly predictive surrogate marker, were measured after two doses of the Sinopharm vaccine in 450 subjects in Hungary. Results were analysed in a multivariable model accounting for age, sex and time since the administration of the second dose of the vaccine.

Sex and time since the second dose had little association with the antibody titres. Age, however, was highly relevant: measurable antibody levels were present in about 90 per cent of individuals below the age of 50, but antibody production after vaccination was strongly reduced with increasing age. A large number of elderly subjects, reaching 25 per cent at 60 years, and up to 50 per cent at ages over 80, were found not to produce any protective antibody.

Gamaleya/Sputnik V

Sputnik V — also known as Gam-COVID-Vac — was the first COVID-19 vaccine to be registered for use in any nation, and it has since been approved in 67 countries, including Brazil, Hungary, India and the Philippines. But the vaccine — and its one-dose version Sputnik Light — has yet to receive approval for emergency use from the European Medicines Agency (EMA) or the WHO. Despite the absence of approval from the EMA or the WHO, several countries, including South Korea, Argentina and India, are already manufacturing Sputnik V. And India plans to pump out at least 850 million doses, to help speed up the vaccination of its population.

It is a virus vector vaccine similar to the AstraZeneca-Oxford and Johnson & Johnson-Janssen vaccines. But instead of using one engineered adenovirus, as those two vaccines do, Sputnik V uses different adenoviruses, called rAd26 and rAd5, for the first and second doses, respectively.

Phase 3 trial results, published in *The Lancet* in February by the vaccine's developers, suggested that it is **91.6 per cent effective at preventing symptomatic COVID-19 infection and 100 per cent effective at preventing severe infection.** Figures released by the UAE Ministry of Health, on some 81,000 individuals who had received two doses of the vaccine, suggested 97.8 per cent efficacy in preventing symptomatic COVID-19 and 100 per cent efficacy in preventing severe disease.

Russia's phase III study also found that even one dose was 73.6% effective at preventing moderate to severe disease. This led the Russian health authorities to approve the one-dose Sputnik Light — which uses the rAd26 vector — in May, on the basis of data from the country's own vaccination program, which suggested that it was 79.4 per cent effective at preventing symptomatic disease.

Since then, an as-yet unpublished study from the Buenos Aires health ministry in Argentina, involving 40,387 vaccinated and 146,194 unvaccinated people aged 60–79 years, found that a single dose of Sputnik Light reduced symptomatic infections by 78.6 per cent, hospitalisations by 87.6 per cent and deaths by 84.7 per cent.

Unlike for both the Oxford–AstraZeneca and Johnson & Johnson vaccines, there have been **no reports of rare blood clotting disorders from Russian health authorities or from the other nations using Sputnik V.**

Bharat Biotech

The Bharat Biotech vaccine is an inactivated viral vaccine like CoronaVac and Sinopharm. The most recent efficacy data are as follows;

Symptomatic infection: 77.8 per cent

Symptomatic infection ≥60 years: 67.8 per cent

Symptomatic infection 18-59 years: 79.4 per cent

Symptomatic infection with comorbidities: 66.2 per cent

Severe disease: 93.4 per cent

Asymptomatic infection: 63.6 per cent

Symptomatic and asymptomatic infection: 68.8 per cent

Infection with Delta variant: 65.2 per cent

Efficacy of current vaccines against Delta variant

The following table is reproduced with permission from the Melbourne Children's Campus weekly update.

Vaccine Efficacy/Effectiveness against Delta VOC

VACCINE	LAB STUDIES	VACCINE EFFICACY/EFFECTIVENESS	
		ANY INFECTION*	HOSPITALISATION AND DEATH*
AstraZeneca	✓	Effectiveness: Single dose 33-67%[51] 2 doses: 60%[51,52]	Effectiveness: Single dose: 71-88%[51,53] 2 doses: 92%[51]
Gamaleya	✓	-	-
Johnson & Johnson	✓	-	-
Moderna	✓	Effectiveness: Single dose: 72%[51]	Effectiveness: Single dose: 96%[51]
Pfizer/BioNTech	✓	Effectiveness: Single dose: 33-56%[51] 2 doses: 79-88%[51,52]	Effectiveness: Single dose: 78-94%[51,53] 2 doses: 96%[53]
Bharat Biotech	✓	Efficacy: 65.2%[28]	-

*This table provides a summary; details are available in the Vaccine Efficacy/Effectiveness Against Variants table on Page 8

Infection and Vaccine-Induced Neutralizing-Antibody Responses to the Delta and Kappa Variants

Published in *NJEM*, researchers at Emory University found that the Kappa (B.1.617.1) variant was 6.8 times less susceptible, and the Delta (B.1.617.2) variant was 2.9 times less susceptible, to neutralization by serum from persons who had recovered from COVID-19 and from vaccinated persons than was the strain most common In the US during 2020. Despite this finding, a majority of the convalescent serum samples (79% against Kappa and 96% against Delta) and all serum samples from vaccinated persons still had detectable neutralizing activity above the threshold of detection against both variants through three months after infection or after the second dose of vaccine. Thus, protective immunity conferred by the mRNA vaccines is most likely retained against the Kappa and Delta variants.

Effectiveness of Two Covid-19 Vaccines against the Delta Variant in the UK

A UK study published in the *NEJM* found effectiveness after one dose of vaccine (Pfizer or AstraZeneca) was notably lower among persons with the Delta variant (30.7%) than among those with the Alpha variant (48.7%); the results were similar for both vaccines. With the Pfizer vaccine, the effectiveness of two doses was 93.7 per cent among persons with the Alpha variant and 88.0 per cent among those with the Delta variant. With the AstraZeneca vaccine, the effectiveness of two doses was 74.5 per cent among persons with the Alpha variant and 67.0 per cent among those with the Delta variant.

Summary: Only modest differences in vaccine effectiveness were noted with the Delta variant as compared with the Alpha variant after the receipt of two vaccine doses. Absolute differences in vaccine effectiveness were more marked after the receipt of the first dose.

Vaccines highly effective against hospitalisation from Delta variant

A pre-print article from Public Health England analysed the risk of hospitalisation with Delta among more than 14,000 vaccinated and unvaccinated symptomatic cases of COVID-19. Vaccine efficacy against hospitalisation was similar for Delta as for Alpha: 94 per cent after one dose of Pfizer and 96 per cent after two doses and 71 per cent after one dose of AstraZeneca and 92 per cent after two doses.

Janssen/Johnson & Johnson (J&J) vaccine may be less effective against Delta and Lambda variants

This study, published as a pre-print, compared the neutralization titres of serum antibodies from individuals immunised with three U.S. FDA Emergency use authorization vaccines (Pfizer/BioNTech, Moderna and J&J) against viruses with four variants of concern, Delta Plus and Lambda spike proteins. The results demonstrate a high level of cross-neutralization by antibodies elicited by Pfizer and Moderna on the variants but significantly decreased neutralization by those elicited by the single dose J&J. The authors conclude that it is likely that neutralizing antibody titres against the VOCs elicited by the single shot J&J could be improved by boosting with a second immunisation or by a heterologous boost with one of the mRNA vaccines.

Vaccine Breakthrough Infections in a large public gathering outbreak

An early release outbreak investigation published in the US CDC's Morbidity and Mortality Weekly Report garnered much attention in the media in late July due to a high rate of vaccine breakthrough infections. 469 COVID-19 cases were identified among Massachusetts residents who travelled to multiple large public events in a Barnstable County, Massachusetts. The town has a vaccination coverage of 69 per cent of the eligible population. Seventy-four per cent of cases occurred in fully vaccinated persons - those who had completed a 2-dose course of an mRNA vaccine [Pfizer-BioNTech or Moderna] or had received a single dose of Janssen [Johnson & Johnson] vaccine ≥14 days before exposure). Testing identified the Delta variant in 90 per cent of specimens from 133 patients. Real-time RT-PCR Ct (cycle threshold – a surrogate for viral load) values in specimens from 127 fully vaccinated patients (median = 22.77) were similar to those among 84 patients who were unvaccinated, not fully vaccinated, or whose vaccination status was unknown (median = 21.54).

While this report could not conclude about the VE against the Delta variant, it highlighted that the variant is highly transmissible, particularly in high-risk settings such as indoor mass gatherings. The authors concluded that multi-pronged prevention strategies including masking and vaccination are required.

On July 27, the CDC added an interim recommendation for fully vaccinated people to wear a mask in public indoor settings or areas of substantial or high transmission.

Vaccine Science Update

Benefits of Vaccination

Reduced household transmission after vaccination

In a letter to the *NEJM*, researchers from England described comparing the risk of secondary infection (defined as a positive SARS-CoV-2 test 2 to 14 days after the positive test for the index case) among unvaccinated household contacts of persons with SARS-CoV-2 infection who had received at least one dose of the AstraZeneca or Pfizer vaccine 21 days or more before testing positive with the risk among unvaccinated household contacts of unvaccinated persons with infection.

Overall, the likelihood of household transmission was approximately 40 to 50 per cent lower in households of index patients who had been vaccinated 21 days or more before testing positive than in households of unvaccinated index patients; the findings were similar for the two vaccines. Most of the vaccinated index patients in the data set (93%) had received only the first dose of vaccine. Assessment of infection risks among household contacts according to the timing of vaccination of the index patient showed protective effects when the vaccine had been administered at least 14 days before the positive test.

Vaccine Safety

Since early March 2021, reports have emerged in many countries of a rare but serious side effect involving thrombosis (clotting) with thrombocytopaenia (low blood platelet count) in young healthy people who had received the AstraZeneca-Oxford vaccine. This clotting syndrome is now commonly known as thrombosis with thrombocytopenia syndrome (TTS) and has been associated with only adenoviral vector vaccines (currently AstraZeneca and Johnson and Johnson). Some cases have involved clotting in a large vein such as in the brain or abdominal veins. The mechanism that causes TTS is not fully understood, but it appears to be a form of immune reaction to the platelets in the blood which causes clotting.

Australian COVID-19 vaccine weekly safety report

In the latest TGA report, during the week up to 29 July, the total number of cases of TTS was 90 from 6.3 million doses of the AstraZeneca vaccine administered to date (1.47 per 100,000 doses). No cases in Australia have been reported after the second dose of AstraZeneca. There have been 5 deaths, resulting in a case-fatality rate of 5.6 per cent.

Although estimates of risk based on small numbers of cases are imprecise, the incidence of TTS is estimated in Australia at around:

- 2.7 per 100,000 in those <60 years; and
- 1.6 per100,000 in those ≥60 years.

This is similar to rates in the UK where up to 21 July, 24 million first doses have been given with a rate of TTS of 2.1 per 100,000 in those aged 18-49 and 1.1 per 100,000 in those over 50. The case fatality rate was 18 per cent with 73 deaths, including six after the second dose.

The Australian Technical Advisory Group on Immunisation (ATAGI) has provided risk-benefit information for the Australian context that recommends AstraZeneca as the preferred vaccine for adults aged over 60 years and Pfizer as the preferred vaccine for people aged 16-59 years, based on low exposure risk. On July 24, an updated recommendation was made in response to the Delta outbreak in NSW that individuals aged 18 years and above in greater Sydney should strongly consider getting vaccinated with any available vaccine including AstraZeneca. In addition, people in areas where outbreaks are occurring can receive the second dose of the AstraZeneca vaccine 4 to 8 weeks after the first dose, rather than the usual 12 weeks, to bring forward optimal protection.

Myocarditis following immunisation with mRNA COVID-19 vaccines in members of the US military

In a paper published in *JAMA*, the authors describe a case series of 23 male military patients who presented with acute onset of marked chest pain within 4 days after receipt of an mRNA COVID-19 vaccine. All military members were previously healthy with a high level of fitness. Seven received the Pfizer vaccine and 16 received the Moderna vaccine. A total of 20/23 patients had symptom onset following the second dose of an appropriately spaced 2-dose series. Diagnostic tests confirmed the diagnoses of myocarditis. Additional testing did not identify other aetiologies for myocarditis, including acute COVID-19 and other infections, ischemic injury, or underlying autoimmune conditions. All recovered with supportive clinical care. The military administered more than 2.8 million doses of mRNA COVID-19 vaccine in this period.

FDA issues warning on Johnson and Johnson vaccine

The FDA has warned that Johnson & Johnson's coronavirus vaccine can lead to an increased risk of a rare neurological condition known as Guillain-Barré syndrome. Although the regulators found that the chances of developing the condition are low, they appear to be three to five times higher among recipients of the Johnson & Johnson vaccine than among the general population in the US. CDC officials have identified 100 suspected cases of Guillain-Barré among recipients of Johnson & Johnson's one-dose shot through a federal monitoring system that relies on patients and health care providers to report adverse effects of vaccines. Ninety-five per cent of those cases were considered serious and required hospitalisation.

Effectiveness of COVID-19 vaccines in immunocompromised individuals

Serologic Status and Toxic Effects of the SARS-CoV-2 Pfizer Vaccine in Patients Undergoing Treatment for Cancer

Published in *JAMA Oncology*, this cohort study evaluated serologic status and safety of the Pfizer vaccine in 232 patients receiving active treatment for cancer and 261 health care workers who served as controls. After the first dose of the vaccine, 29 per cent of the patients were seropositive compared with 84 per cent of the controls; after the second dose, the seropositive rate of the patients reached 86 per cent, and reported adverse events resembled those of healthy individuals. The Pfizer vaccine appeared to be safe with satisfactory levels of seropositivity in patients undergoing treatment for cancer, although protection may occur later compared with the healthy population.

Antibody Response after a Third Dose of the Moderna Vaccine in Kidney Transplant Recipients with Minimal Serologic Response to 2 Doses

Studies have reported low seroconversion rates (58% after the second dose) in solid organ transplant recipients who received an mRNA SARS-CoV-2 vaccine. Based on this evidence, the French National Authority for Health issued a recommendation in April 2021 to administer a third vaccine dose in immunosuppressed patients who did not respond after 2 doses.

A follow up study published in *JAMA* found that one month after the second dose, 159 kidney transplant recipients had IgG levels less than 50 AU/mL. The third dose was injected a median of 51 days after the second dose. The antibody response was measured a median of 28 days after the third vaccine injection, and 78 patients (49%) had antibody levels greater than 50 AU/mL. Patients who had a weak response after the second dose were more likely to develop an antibody response after the third dose compared with those without an antibody response (81.3% vs 27.4%, respectively). Patients taking tacrolimus, mycophenolate, and steroids were less likely to develop anti–SARS-CoV-2 antibodies than those treated with other regimens (35% vs 63%, respectively).

Pfizer-BioNTech and AstraZeneca-Oxford vaccine effectiveness and immune response among individuals in clinical risk groups, including immunocompromised patients

In a pre-print paper, researchers report using GP electronic health record data, sentinel virology swabbing and sentinel antibody testing within a cohort of over 700 general practices across England (representing 10% of the population) to

estimate antibody response to vaccination and vaccine effectiveness against medically attended COVID-19 among individuals in clinical risk groups.

There was no notable reduction in S-antibody positivity or titres in most clinical risk groups. The only clinical risk group with significantly reduced S-antibody response after one and two doses was the **immunocompromised group** who had a 68 per cent reduction in the geometric mean titre after two doses. Reduced vaccine effectiveness against clinical disease was also noted in the immunosuppressed group after one dose; however, after a second dose of either vaccine, high levels of effectiveness were seen (Pfizer: 73.0%; AstraZeneca 74.6%).

GLOBAL SCIENTIFIC UPDATES

Variants of Concern Update

Naming of SARS-CoV-2 Variants

On 1 June, the expert group convened by the WHO has recommended using labelled letters of the Greek Alphabet as a more practical way to discuss variants with non-scientific audiences. More information is available here.

Delta (B.1.617.2) variant

First reported in October 2020, SARS-CoV-2 lineages Delta and Kappa have been increasingly detected in India and other countries. In just a few weeks, the Delta variant has become the dominant strain across India and has spread to more than 100 nations, including the United Kingdom, Russia, Portugal, Myanmar, Nepal, Fiji, Vietnam and Singapore. It has caused community outbreaks in Australia, in **Melbourne, Sydney, Adelaide, Darwin, Perth and Brisbane.**

Delta data

The Delta variant has been linked to a resurgence of COVID-19 in Nepal, Southeast Asia, a number of European and African countries and elsewhere, but its UK spread has given scientists a clear picture of the threat it poses. Delta seems to be around 60 per cent more transmissible than the already highly infectious Alpha variant (also called B.1.1.7) identified in the United Kingdom in late 2020.

Delta is moderately resistant to vaccines, particularly in people who have received just a single dose. A Public Health England study published on 22 May found that a single dose of either AstraZeneca's or Pfizer's vaccine reduced a person's risk of developing COVID-19 symptoms caused by the Delta variant by 33 per cent, compared to 50 per cent for the Alpha variant. A second dose of the AstraZeneca vaccine boosted protection against Delta to 60 per cent (compared to 66 per cent against Alpha), while two doses of Pfizer's jab were 88 per cent effective (compared to 93 per cent against Alpha). Another recent Public Health England study found that people who have had one vaccine dose are 75 per cent less likely to be hospitalised, compared with unvaccinated individuals, and those who are fully protected are 94 per cent less likely to be hospitalised.

Preliminary evidence from England and Scotland suggests that people infected with Delta are about twice as likely to end up in hospital, compared with those infected with Alpha.

Viral infection and transmission in a large well-traced outbreak caused by the Delta SARS-CoV-2 variant in China

In a paper published as a pre-print, researchers at the Guangdong CDC report the first local transmission of the Delta SARS-CoV-2 variant in mainland China. All 167 infections could be traced back to the first index case. The investigation of

daily sequential PCR testing of the quarantined subjects indicated the viral load of the first positive test of Delta infections was ~1000 times higher than that of the 19A/19B strains infections back in the initial epidemic wave of 2020, suggesting the potential faster viral replication rate and more infectiousness of the Delta variant at the early stage of the infection.

Their results showed the time interval from the exposure to first PCR positive among close contacts in the quarantined population (n=29) was 6.00 days in the 2020 epidemic (peak at 5.61 days) and was 4.00 days in the 2021 (n=34) epidemic (peak at 3.71 days). In response to this parameter, the government required people leaving the Guangzhou city from airports, train stations and shuttle bus stations to show proof of a negative COVID-19 test within 72 hours on June 6 and further shortened to 48 hours on June 7, in contrast to the seven days in the 2020 epidemic.

Delta becomes the dominant strain in the United States

According to the US CDC, the highly infectious Delta variant now accounts for an estimated 83 per cent of new coronavirus cases in the United States — a dramatic increase from early July, when it crossed the 50 per cent threshold to become the dominant variant in the country. In some regions, the percentage is even higher — particularly where vaccination rates are low, such as Missouri, Alabama, Oklahoma, Arkansas, Louisiana and Mississippi.

The new figure comes as new cases have been increasing across the US, though cases, hospitalisations and deaths remain a fraction of their peaks. The seven-day average now shows more than 77,000 new daily cases, up from about 12,000 one month ago.

Lambda (C.37) variant

Lambda (also known as C.37) was first detected in Peru in August 2020 and has spread to 29 countries, many in Latin America. In Peru, Lambda is now responsible for more than 90 per cent of new COVID-19 cases, a steep rise from less than 0.5 per cent in December. The country has already suffered the world's worst mortality due to COVID-19; the disease has killed about 0.54 percent of the population.

In neighbouring Chile, where the primary vaccine is China's CoronaVac, Lambda accounts for 31 per cent of sequenced cases in the last 60 days. The high case numbers are occurring even though 58.6 per cent of Chile's population is fully vaccinated and another 10 per cent has received a single dose. A study by the University of Chile found that a single dose of the CoronaVac vaccine was only 3 per cent effective, but that rose to 56.5 per cent after both doses.

The possibility that Lambda might be able to dodge the immune system led the WHO to designate it as a Variant of Interest (VOI) on 14 June. WHO categorises a virus as a VOI when genetic changes in the virus are so significant that they may affect its transmissibility, disease severity, immune escape, diagnosis or therapy; and it spreads rapidly through a community.

The Lambda spike protein presents seven nonsynonymous mutations and a deletion in the Spike gene (Δ247-253, G75V, T76I, L452Q, F490S, T859N) and a deletion in the ORF1a gene (Δ3675-3677) also found in VOCs Alpha, Beta, and Gamma. The novel mutations within the receptor binding domain (L452Q and F490S) may contribute to its increased transmissibility and could result in susceptibility to re-infection or a reduction in protection provided by current vaccines.

SARS-CoV-2 Lambda Variant Remains Susceptible to Neutralisation by mRNA 2 Vaccine-elicited Antibodies and Convalescent Serum

In a study published as a pre-print, virus with the Lambda spike had higher infectivity and was neutralised by convalescent sera and vaccine-elicited antibodies with a relatively minor 2.3-3.3-fold decrease in titre on average. The virus was neutralised by the Regeneron therapeutic monoclonal antibody cocktail with no loss of titre.

Infectivity and immune escape of the new SARS-CoV-2 variant of interest Lambda

In a study in Chile, published as a pre-print, researchers found results somewhat different to the previous study. They observed an increased infectivity mediated by the Lambda spike protein that was even higher than that of the Alpha and Gamma variants. Compared to the Wild type (lineage A), neutralisation was decreased by 3.05-fold for the Lambda

variant while it was 2.33-fold for the Gamma variant and 2.03-fold for the Alpha variant. They concluded that their results indicate that mutations present in the spike protein of the Lambda variant of interest confer increased infectivity and immune escape from neutralising antibodies elicited by CoronaVac.

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