

Australian Technical Advisory Group on Immunisation (ATAGI)

Clinical guidance on use of
COVID-19 vaccine in Australia
in 2021 (v2.0)

Version 2.0
24 February 2021

This clinical guidance is for COVID-19 immunisation providers and program staff and is based on currently available data. It provides recommendations on the use of the Pfizer COVID-19 vaccine Comirnaty and the AstraZeneca COVID-19 Vaccine. It will be updated as new information and vaccines become available.

Changes from the previously available ATAGI Clinical guidance on COVID-19 vaccines in Australia (v1.0) include:

- *Inclusion of data on the AstraZeneca COVID-19 Vaccine*
- *Changes in COVID-19 vaccine precautions for people with a history of allergy*

Key points

- **COVID-19 vaccination is recommended for all people of eligible age (≥16 years for Comirnaty; ≥18 years for COVID-19 Vaccine AstraZeneca) to protect against COVID-19.**
- **The overarching goal of Australia’s COVID-19 vaccination program is to protect all people in Australia from the harm caused by the novel coronavirus SARS-CoV-2,¹ through preventing serious illness and death, and, as much as possible, disease transmission.**
- **Initial supply of COVID-19 vaccine will be limited. Delivery of vaccine will be prioritised initially for the following population groups, as they are at increased risk of exposure to SARS-CoV-2 or of severe COVID-19, or are working in services critical to societal functioning:**
 - **quarantine and border workers**
 - **healthcare workers at risk of exposure to persons infected with SARS-CoV-2**
 - **aged care and disability care staff and residents**
 - **older adults, initially those aged ≥80 years, with progressive vaccine delivery to those aged 70–79 years, 60–69 years, 50–59 years**
 - **adults with underlying medical conditions associated with an increased risk of severe COVID-19**
 - **Aboriginal and Torres Strait Islander adults**
 - **critical and high-risk workers, including defence, police, fire, emergency services and others.**
- **For more information please refer to the [National Rollout Strategy](#) and ATAGI Preliminary advice on principles of prioritisation for the COVID-19 vaccine.**

- Comirnaty (Pfizer Australia Pty Ltd) is provisionally registered in people aged ≥ 16 years and is given in a two-dose schedule. Comirnaty has efficacy after two doses of about 95% against symptomatic COVID-19.
- COVID-19 Vaccine AstraZeneca (AstraZeneca Pty Ltd) is provisionally registered in people aged ≥ 18 years and is given in a two-dose schedule. Efficacy against symptomatic COVID-19 ranges from about 62 to 73%, with higher efficacy seen after a longer interval (12 weeks) between doses. Efficacy from day 22 after the first dose up until 12 weeks is about 73%.
- Both vaccines have a good safety profile in clinical trials and in surveillance with widespread use in populations overseas.
- There are currently no clinical trial data to support use of COVID-19 vaccines in children aged < 16 years.
- Co-administration of COVID-19 vaccine with other vaccines is not routinely recommended. A minimum 14 day interval is advised between administration of a COVID-19 vaccine and any other vaccine, including influenza vaccine.
- Recording of COVID-19 vaccine administration in the Australian Immunisation Register (AIR) is mandatory.
- Notification of adverse events following immunisation (AEFI) should be made to the Therapeutic Goods Association (TGA) and through the specified reporting mechanisms for your state or territory.

This advice should be implemented in conjunction with other key guidelines, including:

- [COVID-19 Vaccine training](#)
- [ATAGI immunisation provider guide for obtaining informed consent for COVID-19 vaccination](#)
- [Product Information for Comirnaty available at the Therapeutic Goods Administration \(TGA\) website](#)
- [Product Information for COVID-19 Vaccine AstraZeneca at the Therapeutic Goods Administration \(TGA\) website](#)
- [COVID-19 vaccination decision guide for women who are pregnant, breastfeeding, or planning pregnancy](#)
- [COVID-19 vaccination decision guide for frail older people, including those in residential aged care facilities](#)

Contents

Key points	2
The virus: SARS-CoV-2	6
The disease: COVID-19	6
The COVID-19 vaccination program	7
Vaccine, doses and administration	7
Recommendations	10
Box 1: Medical conditions associated with increased risk of severe COVID-19 illness	12
Considerations for special populations	13
Timing of administration of influenza vaccine	14
Timing of administration of other vaccines	15
Co-administration of antipyretics/analgesics	15
Variation of schedule and interchangeability between COVID-19 vaccines	15
Comirnaty	15
COVID-19 Vaccine AstraZeneca	16
Interchangeability of vaccines	16
Repeat vaccination	16
Contraindications	17
Precautions	17
Specific allergies	17
Acute illness	18
People with bleeding disorders	18
Adverse events	18
Comirnaty	18
Table 1: Frequency of select common adverse events reported within 7 days following each dose of Comirnaty in phase II/III trial ²⁶	19
COVID-19 Vaccine AstraZeneca	19
Table 2: Frequency of select common adverse events reported within 7 days following at least one dose of COVID-19 Vaccine AstraZeneca in phase II/III trial aged >18 years of age ⁴⁰	20
Reporting adverse events	20
Vaccine information	20
Comirnaty	20
COVID-19 Vaccine AstraZeneca	21
Transporting, storing and handling vaccines	22
Comirnaty	22
COVID-19 Vaccine AstraZeneca	23
Recording vaccination	23
Serological testing for immunity	23

Impact of vaccination on future COVID-19 testing	23
Isolation or testing for COVID-19 following adverse events.....	23
Post-exposure prophylaxis.....	24
References	25

The virus: SARS-CoV-2

The pandemic of coronavirus disease (COVID-19) is caused by the severe acute respiratory coronavirus 2 (SARS-CoV-2), a virus first identified in December 2019. Bats appear to be the reservoir of SARS-CoV-2.² SARS-CoV-2 is a single-stranded RNA betacoronavirus in the same subgenus as the severe acute respiratory virus syndrome (SARS) virus, and is more distantly related to the Middle East respiratory syndrome (MERS) virus.³

SARS-CoV-2 contains four main structural proteins:⁴

- **spike (S) glycoprotein**
- **small envelope (E) glycoprotein**
- **membrane (M) glycoprotein**
- **nucleocapsid (N) protein.**

The most common target of COVID-19 vaccines is the spike protein. The spike protein contains two subunits: S1 and S2. S1 contains the receptor binding domain, which binds to the angiotensin converting enzyme 2 receptor on host cells.⁵

Several SARS-CoV-2 variant strains of concern have been identified. Some variant strains show higher transmissibility than others, such as 501Y Variant 1 (B.1.1.7) and 501Y.V2 (B.1.351).⁶ Clinically significant variations in the efficacy of different vaccines against these emerging strains are being closely examined; new data are expected in the future.

The disease: COVID-19

SARS-CoV-2 causes asymptomatic or mild disease in 81% of cases; severe illness (with dyspnoea, hypoxia or >50% lung involvement on imaging within 48 hours) in 14%; and critical illness in 5%.⁷ The most common symptoms are fever and cough.⁸ Other common symptoms include myalgia, headache, dyspnoea, sore throat, diarrhoea and nausea/vomiting. Loss of smell or taste and rhinorrhoea occur in fewer than 10% of cases.

Risk factors for severe COVID-19 (including death) include older age and the presence of certain medical conditions (refer to **Recommendations** section for further information).

Older age is an important risk factor for severe COVID-19, as shown in several international systematic reviews. In comparison with those aged <50 years, the risk of death from COVID-19 progressively increases throughout each decade of age, from about 2 times for age 50–59 years to >10 times for age ≥80 years.⁹ Findings were similar when results were adjusted for other risk factors.¹⁰ In Australia, the COVID-19 case fatality ratio increased substantially with age, from 0.6% in age 50–64 years to 7.0% in age 65–79 years and 33.8% in age ≥80 years.¹¹

There are certain occupational and environmental settings that may place individuals at higher risk of COVID-19 exposure either because of a higher risk of infected individuals being present and/or because the conditions enable rapid spread of the virus. These include healthcare facilities; aged care and disability care facilities; border and quarantine facilities; and industries such as meat processing. Refer to **Recommendations** section for further information.

Children and adolescents with COVID-19 are commonly asymptomatic or have mild or moderate symptoms. A systematic review that included data on illness severity in 1,475 children with COVID-19 reported asymptomatic infection in 15%, mild illness in 42%, moderate illness in 39%, severe illness in 2% and critical illness in 0.7%.¹²

A rare but serious condition associated with COVID-19 in children is Paediatric Inflammatory Multisystem Syndrome Temporally associated with SARS-CoV-2 (PIMS-TS), which can present with features similar to those of Kawasaki disease or toxic shock syndrome.¹³

Further information about COVID-19 is available in the [COVID-19 CDNA National Guideline for Public Health Units](#) and information about Australian epidemiology is available on the [Department of Health website](#), including regular epidemiological reports.

The COVID-19 vaccination program

The aim of the COVID-19 vaccination program in Australia is to reduce COVID-19 related harm by preventing serious illness and death, and, as much as possible, disease transmission. Information on COVID-19 vaccination program implementation in Australia is available on the [Department of Health website](#).

The epidemiology of COVID-19 is a key determinant in advising on the most appropriate use of COVID-19 vaccines, in addition to the characteristics and availability of COVID-19 vaccines.

In Australia, outbreak control measures (including contact tracing, testing and isolation; border control and quarantine; and physical distancing) have been successful in limiting the spread of COVID-19 in the community.¹⁴ Sporadic disease outbreaks continue to occur following virus introduction from international travellers.

In settings where there is no sustained SARS-CoV-2 community transmission, the initial focus of a vaccine program is to prevent importation of cases and demonstrate reciprocity to critical (particularly frontline) workers.¹⁵ As more vaccine doses become available, older adults should be included, as they are at the highest risk of severe illness or death.

Both Comirnaty and COVID-19 Vaccine AstraZeneca are safe and efficacious and either vaccine is suitable for use in anyone in the approved age groups who does not have a vaccine-specific contraindication. Refer to the **Vaccine information** section for further information.

The initial supply of Comirnaty will be limited, and there are additional challenges regarding logistics and distribution of Comirnaty, including the requirement for ultra-cold transportation and storage and limited duration of stability at 2–8°C. COVID-19 Vaccine AstraZeneca is available in greater volumes and is transported and stored at 2–8°C.

Vaccine, doses and administration

The following COVID-19 vaccines have been provisionally approved for use in Australia. The [TGA website](#) provides access to the TGA approved Product Information for each vaccine.

Refer also to **Vaccine information** section for more details.

Comirnaty (generic name BNT162b2)

Sponsor:	Pfizer Australia Pty Ltd
Approved age for use:	≥16 years
Presentation:	Multi-dose vial without preservative, each vial containing 6 doses in 0.45 mL. Requires dilution with 1.8 mL of sterile 0.9% NaCl without preservative into each multi-dose vial.
Volume/strength:	0.3 mL (30 µg) per dose
Schedule:	2 doses, at least 21 days apart
Administration route:	Intramuscular injection into deltoid muscle
Ingredients:	Each 0.3mL dose contains 30 mcg mRNA encoding the SARS-CoV-2 spike glycoprotein
	- List of excipients:
	○ ((4-hydroxybutyl)azanediyl)bis(hexane-6,1-diyl)bis(2-hexyldecanoate) (ALC-0315)
	○ 2-[(polyethylene glycol)-2000]-N,N-ditetradecylacetamide (ALC-0159)
	○ Distearoylphosphatidylcholine (DSPC)
	○ Cholesterol
	○ Potassium chloride
	○ Monobasic potassium phosphate
	○ Sodium chloride
	○ Dibasic sodium phosphate dihydrate
	○ Sucrose
	○ Water for injections

COVID-19 Vaccine AstraZeneca

Sponsor:	AstraZeneca Pty Ltd
Approved age for use:	≥18 years
Presentation:	Multi-dose vial without preservative, each vial containing 10 doses in 5 mL.
Volume/strength:	0.5 mL per dose
Schedule:	2 doses, 12 weeks apart (minimum interval 4 weeks apart)
Administration route:	Intramuscular injection into deltoid muscle
Ingredients:	Each 0.5 mL dose contains 5x10 ¹⁰ viral particles of ChAdOx1-S ^a
	- List of excipients:
	○ Histidine
	○ Histidine hydrochloride monohydrate\
	○ Sodium chloride
	○ Magnesium chloride hexahydrate
	○ Disodium edetate (EDTA)
	○ Sucrose
	○ Ethanol absolute
	○ Polysorbate 80
	○ Water for injection

a. Recombinant, non-replicating chimpanzee adenovirus vector encoding the SARS-CoV-2 Spike glycoprotein

Recommendations

COVID-19 vaccination is recommended for all people of eligible age (≥16 years for Comirnaty; ≥18 years for COVID-19 Vaccine AstraZeneca) to protect against COVID-19.

Both Comirnaty and COVID-19 Vaccine AstraZeneca are suitable for use in all groups indicated below. Refer to the **Vaccine information** section for further information.

There will be a limited supply of COVID-19 vaccines in the initial phases of the COVID-19 vaccination program. Therefore, vaccine allocation will be determined on the basis of a number of factors, such as timing of supply, priority target groups and logistical considerations.

The following population groups will be prioritised initially:

People with occupational risk of exposure to SARS-CoV-2

People in certain occupations are at increased risk of being infected with SARS-CoV-2 and/or transmitting the virus to vulnerable people who have risk factors for severe illness. These include:

- healthcare workers at increased risk of exposure to persons infected with SARS-CoV-2: frontline healthcare workers have a seven-fold increased risk of severe COVID-19 compared with non-essential workers (RR 7.42; 95% CI: 5.52–10.00)¹⁶
- quarantine and border workers
- aged care and disability care staff
- critical and high-risk workers, including defence, police, fire and emergency services; certain laboratory staff; meat processing workers; and select others.

Residents of aged care and disability care facilities

Aged care facilities have been the setting for a number of serious COVID-19 outbreaks in Australia.¹⁷

Older adults

Delivery of COVID-19 vaccines to older adults should be prioritised, starting with adults aged ≥80 years, and sequentially progressing to lower age groups (70–79, 60–69 and 50–59 years), due to the progressive increase in risk of severe disease and death with increasing age. Older age is by far the strongest risk factor associated with morbidity and mortality from COVID-19.^{7,10,18}

Early evidence suggests that COVID-19 vaccines are effective in older adults, particularly against severe outcomes such as hospitalisation. For vaccine-specific efficacy estimates, refer to the section **Vaccine information**. One prospective cohort study which included 266, 202 people aged ≥ 80 years who received *either* Comirnaty or COVID-19 Vaccine AstraZeneca assessed vaccine effectiveness against hospitalisation from COVID-19 at 28-34 days after the first dose and reported a VE of 81% (95% CI 65 to 90).¹⁹ Most of these participants received COVID-19 Vaccine AstraZeneca.

Aboriginal and Torres Strait Islander adults

Aboriginal and Torres Strait Islander adults are at increased risk of severe illness and death from COVID-19 because of multiple factors.²⁰ These include a high prevalence of underlying chronic health conditions associated

with severe COVID-19 and a greater likelihood of living in communities where social distancing cannot be practised.²⁰

While the impact of COVID-19 on Aboriginal and Torres Strait Islander peoples to date has been mitigated by existing control measures (especially restriction of movement into communities), the factors above warrant prioritisation for vaccination. Precise age cut-offs for vaccination should be decided taking into account logistics and vaccine availability, with the initial focus being on older Aboriginal and Torres Strait Islander adults.

People with medical conditions that increase their risk of severe COVID-19

People aged ≥ 16 years with certain underlying chronic medical conditions, outlined in Box 1, are at increased risk of severe illness with COVID-19 and should be prioritised for vaccination, particularly those who have multiple comorbidities, including older age.^{7,8,18,21}

Box 1: Medical conditions associated with increased risk of severe COVID-19 illness

Individuals at high risk of severe COVID-19 illness

Organ transplant recipients who are on immune suppressive therapy

Those who have had a bone marrow transplant in the last 24 months

Those on immune suppressive therapy for graft versus host disease

Those who have haematological cancers, for example, leukaemia, lymphoma or myelodysplastic syndrome (diagnosed within the last 5 years)

Those having chemotherapy or radiotherapy

Individuals at moderate risk of severe COVID-19 illness

Those with chronic renal (kidney) failure

Those with heart disease (including coronary heart disease and cardiac failure)

Those with chronic lung disease (excludes mild or moderate asthma)

Those who have a non-haematological cancer (diagnosed in the last 12 months)

Those who have diabetes

Severe obesity with a BMI ≥ 40 kg/m²

Those with chronic liver disease

Those with some neurological conditions (stroke, dementia, other)

Those with some chronic inflammatory conditions and treatments

Those with other primary or acquired immunodeficiency

Those with poorly controlled blood pressure

Note: More information on the vaccination program for adults aged <50 years who are not covered under any priority groups will be available on the program [website](#).

Considerations for special populations

People who are immunocompromised

COVID-19 vaccine is recommended for people who are immunocompromised because of their increased risk of severe illness with COVID-19.²²

There are many causes and varying degrees of immunocompromise, and the risk of COVID-19 will vary according to the number and type of underlying conditions, medical management and other factors.

At the current time, there are no data specifically on the safety and efficacy of COVID-19 vaccination for people who are immunocompromised. In principle there are no theoretical safety concerns for Comirnaty (a non-live vaccine) or COVID-19 Vaccine AstraZeneca (a non-replicating viral vector vaccine) in people who are immunocompromised, on the basis of a general understanding of vaccine characteristics. However, the immune response to vaccination may be reduced in these people, which may result in lower vaccine effectiveness and protection compared with that in non-immunocompromised individuals.

COVID-19 vaccine is also recommended for people with HIV. A small number of people (n=120) with stable HIV infection were recruited into the phase II/III trial for Comirnaty, and immunogenicity and safety data for this group are anticipated.²³ A cohort of people with stable HIV infection were recruited into a phase I/II trial of COVID-19 Vaccine AstraZeneca, and immunogenicity and safety data for this group are anticipated.²⁴

Before vaccination, people with immunocompromise should be counselled about the safety and efficacy of COVID-19 vaccine, and lack of data in immunocompromised recipients. People with immunocompromise who have been vaccinated should be advised to continue taking other protective measures against SARS-CoV-2.

Children

COVID-19 vaccines are not currently registered or recommended for use in children aged <16 years. Data on vaccine safety, immunogenicity and efficacy are not available from clinical trials in this age group. Healthy children have a much lower risk of severe illness from COVID-19 in comparison to adults.¹²

Guidance will be revised when evidence on the efficacy and safety of the use of COVID-19 vaccines in children becomes available.

Women who are pregnant, breastfeeding or planning pregnancy

Use of COVID-19 vaccine during pregnancy is not routinely recommended, but is not contraindicated. There are no clinical trial data on the safety of Comirnaty or COVID-19 Vaccine AstraZeneca in pregnancy or effect on pregnancy outcomes.

Some pregnant women may choose to be vaccinated after considering the benefits and risks of vaccination. In particular, COVID-19 vaccination may be considered in pregnant women who are in a high-risk priority group for vaccination, have a higher risk of exposure to SARS-CoV-2 infection, or where the woman has underlying medical conditions that put her at high risk of serious complications from COVID-19. Further information is available in the [COVID-19 vaccination decision guide for women who are pregnant, breastfeeding, or planning pregnancy](#).

Women who are breastfeeding or who are planning pregnancy can receive COVID-19 vaccine. There are no theoretical concerns regarding the safety of Comirnaty or COVID-19 Vaccine AstraZeneca in these groups.

If a COVID-19 vaccine is inadvertently administered during pregnancy, routine monitoring for adverse events following immunisation is advised.

Pregnant women with COVID-19 have a higher rate of hospitalisation, intensive care unit admission and mechanical ventilation, but not death, than age-matched non-pregnant women.²⁴ The risk of preterm delivery is also increased.²⁵ There is no evidence to suggest that SARS-CoV-2 infection in pregnancy increases the risk for congenital anomalies.²⁶

There were 23 women who participated in the phase II/III trial of Comirnaty and became pregnant shortly after receiving the vaccine.²⁷ These participants and many others who are being vaccinated with Comirnaty in programs worldwide are being followed in various studies for pregnancy outcomes. Developmental and reproductive toxicology studies in animals have not shown harmful effects in pregnancy from Comirnaty.²⁸ Although mRNA vaccines have not been studied in pregnant women, they are not live vaccines, and the theoretical risk of fetal harm is very low.

COVID-19 Vaccine AstraZeneca contains a non-replicating viral vector. Very limited data are available on the safety of viral vector vaccines in pregnancy. Preliminary findings from animal developmental and reproductive toxicity studies of COVID-19 Vaccine AstraZeneca show no indication of harm to the development of the fetus.

People with a past history of COVID-19

Past infection with SARS-CoV-2 is not a contraindication to vaccination. Evidence suggests that past infection reduces the risk of reinfection for at least 6 months.²⁹ Individuals who have had PCR-confirmed SARS-CoV-2 infection may wish to defer vaccination for up to 6 months from the time of their infection.

In the phase II/III trial of Comirnaty, the vaccine was administered to a small number of people with serological evidence of previous SARS-CoV-2 infection. There were no specific safety issues reported among these individuals. A similarly high overall efficacy was shown when participants who had had previous SARS-CoV-2 infection were also included for analysis, but a separate estimate of efficacy for these individuals was not reported.

In the pooled analysis of phase II/III trials of COVID-19 Vaccine AstraZeneca, 718 participants (3%) were found to be seropositive, and the safety profile was consistent across participants with or without prior evidence of SARS-CoV-2 infection at baseline. Seropositive participants had increased anti-spike antibody responses after the first dose, but not after the second.³⁰

Serological testing or other testing to detect current or previous infection with SARS-CoV-2 before vaccination is neither necessary nor recommended before vaccination.

Timing of administration of influenza vaccine

Routine administration of a COVID-19 vaccine and influenza vaccine on the same day is not currently recommended, given the current absence of data on the immunogenicity and safety of these vaccines when co-administered.

This advice may change as further information becomes available.

The preferred minimum interval between receipt of a COVID-19 vaccine and any inactivated influenza vaccine is 14 days. Co-administration or near administration (e.g. within days) of two or more vaccines can sometimes lead to a higher frequency of mild to moderate adverse events or make the attribution of potential adverse events to vaccination more challenging.

There are circumstances where shortening the intervals between or co-administering a dose of influenza vaccine and COVID-19 vaccine on the same day may be justified, such as:

- if adherence to the preferred minimum interval (14 days) will likely lead to an individual or a target population for either of these vaccines missing the opportunity to receive vaccine doses.
- there is an imminent need to administer either of these vaccines because of the prevailing local epidemiological situation, for example, for protection from influenza or COVID-19.

If inadvertent co-administration of an influenza vaccine and COVID-19 vaccine occurs, revaccination is not required for either vaccine. The patient should be informed of the possibility of an increased likelihood of common adverse effects and be asked to [report any untoward adverse events](#).

Timing of administration of other vaccines

Routine co-administration of a COVID-19 vaccine on the same day as another vaccine is not recommended. (For specific guidance on influenza vaccine, refer to **Timing of administration of influenza vaccine** section.)

There should be a minimum interval of 14 days between receipt of a COVID-19 vaccine and any other vaccine, whether live or non-live. Although immune interference is unlikely between vaccines that do not contain common antigens, there are currently no immunogenicity or safety data on co-administration of Comirnaty or COVID-19 Vaccine AstraZeneca with other vaccines.

If a COVID-19 vaccine has inadvertently been administered on the same day or within 14 days before or after other vaccines, no vaccine doses need to be repeated.

An individual risk–benefit assessment is necessary to consider shortening of the interval between, or offer same day administration of, a COVID-19 vaccine with another vaccine. This may be considered if there is a high risk of imminent exposure to the vaccine-targeted disease, or it is highly likely that the opportunity of receiving either vaccine will be missed. If same day or reduced-interval vaccination is proposed, patients should be counselled about the possible adverse events from each vaccine and advised to [report adverse events](#).

Co-administration of antipyretics/analgesics

Prophylactic use of paracetamol or ibuprofen is not recommended before receiving a COVID-19 vaccine. Antipyretics and analgesics can be taken after vaccination for management of vaccine-related side effects such as fever and myalgia, if required.

Variation of schedule and interchangeability between COVID-19 vaccines

Comirnaty

The recommended interval between two doses of Comirnaty is at least 21 days. The minimum acceptable interval between the two doses is 19 days. It is recommended to complete the two-dose course within 6 weeks. This allows time for logistical considerations, including supply and timing of access to vaccine at the individual and clinic levels. These limits are based on the range of intervals between doses studied in clinical trials.

Shortening of the minimum acceptable interval may result in a sub-optimal immune response. If two doses have inadvertently been given at a shorter than the minimum acceptable interval, it is not currently recommended that a vaccine dose is repeated. This is because there are no data on administration of more than two vaccine doses and there is still a likelihood of good protection in that individual.

Longer intervals between first and second doses may need to be recommended during program rollout if epidemiological considerations warrant a change (e.g., during an outbreak response to ensure available doses are provided as first doses to as many people as possible).

If the second dose of Comirnaty is administered later than the recommended interval, no vaccine doses need to be repeated.

Although Comirnaty may provide partial protection against COVID-19 as soon as 12 days after the first dose, this protection is likely to be short lived. A two-dose course is recommended for all individuals for optimal protection.

COVID-19 Vaccine AstraZeneca

The recommended interval between two doses of COVID-19 Vaccine AstraZeneca is 12 weeks. The minimum interval between doses is 4 weeks.

In clinical trials, the timing of administration of COVID-19 Vaccine AstraZeneca ranged from approximately 4 weeks up to 26 weeks. In a post-hoc analysis, vaccine efficacy following the second dose of COVID-19 Vaccine AstraZeneca progressively increased with a longer interval between doses and appeared to be greatest when the interval was ≥ 12 weeks. Short-term efficacy from 3 weeks after the first dose, before the second dose and up to 12 weeks post vaccination was about 73% (95% CI: 48.79–85.76).³¹ Also refer to the **Vaccine information** section for further information.

Shortening the interval from 12 weeks to no less than 4 weeks between doses is acceptable and may be appropriate in certain circumstances, for example, imminent travel or anticipated risk of COVID-19 exposure. If a dose has been inadvertently given before the minimum 4-week interval, it is not currently recommended that the vaccine dose be repeated.

If the second dose of COVID-19 Vaccine AstraZeneca is administered later than the recommended interval, no vaccine doses need to be repeated.

Interchangeability of vaccines

On the basis of currently available information, Comirnaty and COVID-19 Vaccine AstraZeneca are not considered interchangeable. The two-dose course should be completed with the same vaccine. There are no data yet on the efficacy of mixed schedules.

If an individual develops anaphylaxis or a severe allergic reaction after the first dose of a COVID-19 vaccine, an alternate brand can be considered for the second dose. If an alternate brand is used for the second dose, a third dose of COVID-19 vaccine does not need to be given.

Repeat vaccination

Additional or booster doses beyond the two-dose course are not currently recommended.

Data on the real-world effectiveness and duration of protection from Comirnaty and COVID-19 Vaccine AstraZeneca, including against current and emerging strains (variants) of SARS-CoV-2, will be gathered over coming months and years, and will need to be assessed to inform future recommendations.

Contraindications

The only absolute contraindications to a COVID-19 vaccine are:

- anaphylaxis after a previous dose of the same vaccine
- anaphylaxis to any component of the vaccine, including:
 - anaphylaxis to polyethylene glycol (PEG) for Comirnaty
 - anaphylaxis to polysorbate 80 for COVID-19 Vaccine AstraZeneca

The observed rate of anaphylaxis after Comirnaty administration in the United States was 4.7 cases per million doses administered.³² 89% of cases occurred within 30 minutes of vaccination.³² Comirnaty contains PEG, and it is possible that this component is implicated in anaphylaxis.³³ However, anaphylaxis following PEG is reported to be extremely rare (37 case reports between 1977 and 2016).³³

Anaphylaxis to polysorbate 80, which is an excipient in COVID-19 Vaccine AstraZeneca and is also included in many other vaccines, is rare.³⁴ The reported rate of anaphylaxis to COVID-19 Vaccine AstraZeneca in the UK vaccination program as of January 2021 was 1 case per million doses administered.³⁵

There were no reports of anaphylaxis to Comirnaty or to COVID-19 Vaccine AstraZeneca in clinical trials.

Precautions

Specific allergies

The following individuals should be assessed for suitability for vaccination before being given a vaccine dose, if necessary in consultation with an allergist/immunologist or specialist immunisation clinic:

- people with immediate (within 4 hours) and generalised symptoms of a possible allergic reaction (e.g. urticaria/hives) to a previous dose of a COVID-19 vaccine
- people with a generalised allergic reaction (without anaphylaxis) to any component of the COVID-19 vaccine to be administered (e.g. PEG in Comirnaty or polysorbate 80 in COVID-19 Vaccine AstraZeneca)
- people with a prior history of anaphylaxis to previous vaccines and/or multiple drugs (injectable and/or oral) where ingredients such as PEG or polysorbate 80 may conceivably be the cause
- people with a known systemic mast cell activation disorder with raised mast cell tryptase that requires treatment.

If people in these categories are vaccinated, they may require vaccination in a facility with medical staff in attendance, and to be observed for 30 minutes following administration of a COVID-19 vaccine dose.

See also [ASCIA guidelines](#) for more information.

All other vaccine recipients, including those with a history of allergy; anaphylaxis to food, drugs, venom or latex; or allergic conditions, including asthma, atopic dermatitis (eczema) or allergic rhinitis (hay fever), should be observed for at least 15 minutes following administration of the vaccine at the clinic site in accordance with the current recommendations in the Australian Immunisation Handbook. It is important that all providers are trained in [anaphylaxis management](#).

For individuals who are suspected to have had an allergic reaction to their first dose of a COVID-19 vaccine, expert advice through the specialist immunisation service of their state/territory or a specialist allergist/immunologist should be sought. They may need a clinical assessment to make a decision regarding the second vaccine dose, including to potentially receive a different vaccine brand.

Before and during each vaccination session, providers should check that up-to-date protocols, equipment, medicines and trained staff to manage anaphylaxis are available. Refer to the [Preparing for vaccination](#) section of the Australian Immunisation Handbook.

As part of routine care, all vaccine recipients should be given information on adverse events following immunisation and when to seek medical attention.

Acute illness

Vaccination should be deferred in people with an acute illness, including febrile illness (axillary temperature $\geq 38.5^{\circ}\text{C}$). This is a general precaution for all vaccines and will also avoid potential misattribution of symptoms from the acute illness as being due to the vaccine or vice-versa.

People with bleeding disorders

People with bleeding disorders and people who are receiving anticoagulant therapy may develop haematomas at intramuscular injection sites. Prior to vaccination, the recipient and/or guardian should be informed about this risk. Comirnaty should be administered by intramuscular injection. Subcutaneous administration of Comirnaty is not recommended, as no data are available on the safety or immunogenicity of Comirnaty given via this route.

When administering an intramuscular injection to an individual with a bleeding disorder, a 23 or 25 gauge needle should be used, and firm pressure applied to the site without rubbing for at least 2 minutes.³⁶

For detailed information on how to safely administer vaccines intramuscularly to people with bleeding disorders, refer to [Vaccination for people with bleeding disorders](#) section in the Australian Immunisation Handbook.

Adverse events

Comirnaty

In the phase II/III trial of Comirnaty, adverse events reported within 7 days following vaccination were very common but generally mild to moderate and well tolerated.

Injection site reactions were very common, particularly pain at the injection site (refer to Table 1). Injection site pain was reported with similar frequency after dose 1 and dose 2, but occurred slightly more frequently in younger people aged 16 to 55 years (83% post dose 1 and 78% post dose 2) than in older adults aged >55 years (71% and 66 %, respectively). Injection site redness and swelling occurred in <10% of all participants. These local reactions were generally mild to moderate, had a median time of onset on the day after vaccination and resolved within 1 to 2 days.

Systemic adverse events reported after Comirnaty vaccination were more common following the second dose (refer to Table 1). The median onset of systemic adverse events was 1–2 days after vaccine receipt, with resolution in a median of 1 day.²⁶ Adverse events were generally milder and less frequent in adults aged >55 years than in those aged 16–55 years. Most adverse events were of mild to moderate severity and did not affect daily activities. The reported rates of diarrhoea and vomiting did not differ between vaccine and placebo recipients.

The median duration of follow-up for adverse events was 2 months after the second dose. Lymphadenopathy, though uncommon (<1%), was more common in vaccine recipients than in placebo recipients (64 cases [0.3%] versus 6 cases [<0.1%]) and is likely related to the expected immune response to the vaccine. The cases of lymphadenopathy were generally mild to moderate and resolved after a median time of 10 days. There were four

ATAGI Clinical Guidance on COVID-19 Vaccine in Australia_v2.0

cases of Bell's palsy (acute peripheral facial paralysis) in the vaccination group (with onset at 3, 9, 37 and 48 days after a dose respectively), and no cases in the placebo group.²⁶ However, this observed frequency was consistent with the expected background rate of Bell's palsy in the general population and thus may not have a causal relationship to vaccination.

There were no substantive differences in the frequency of adverse events overall observed in the clinical trial by age, sex, race, ethnicity or baseline SARS-CoV-2 status subgroups. There was no evidence of enhanced COVID-19 disease in vaccinated individuals who developed SARS-CoV-2 infection after completing vaccination, with only one severe case in the eight vaccine failures.³⁷

Anaphylaxis after Comirnaty has been reported rarely. Refer to **Contraindications** for further information.

Table 1: Frequency of select common adverse events reported within 7 days following each dose of Comirnaty in phase II/III trial²⁶

	16–55 years of age		>55 years of age	
	Dose 1	Dose 2	Dose 1	Dose 2
Injection site pain	83%	78%	71%	66%
Fever	4%	16%	1%	11%
Fatigue	47%	59%	23%	51%
Headache	42%	52%	25%	39%
Chills	14%	35%	6%	23%
Muscle pain	21%	37%	14%	28%
Joint pain	11%	22%	9%	19%
Required paracetamol	28%	45%	20%	38%

COVID-19 Vaccine AstraZeneca

In the phase II/III trials of COVID-19 Vaccine AstraZeneca, adverse events reported within 7 days following vaccination were very common (86%) but the majority were mild or moderate.²⁹ Injection site tenderness (63.7%) and pain (54.2%) were the most commonly reported. Fatigue (53.2%) and headache (52.6%) were the most frequently reported systemic adverse events.²⁹ (refer to Table 2).

Local or systemic solicited adverse events were most commonly reported on day 1 following vaccination. These reactions were generally mild to moderate and resolved within a few days. The most common systemic solicited adverse effects at day 7 were fatigue, headache and malaise.

Adults aged ≥65 years reported fewer local or systemic solicited adverse events, or any ≥ grade 3 solicited adverse events than younger adults.^{29, 37} Most adverse events did not affect daily activities. Adverse events reported after the second dose were milder and less frequent than after the first dose.

Reports on unsolicited adverse events were collected through 28 days following a dose of the COVID-19 Vaccine AstraZeneca. Most of the unsolicited adverse events were mild to moderate in severity and consistent with adverse events commonly observed following vaccination.²⁹

In the combined interim analysis of four clinical trials, one case of transverse myelitis was reported in the vaccine arm, which occurred 14 days after dose 2.³⁸ The observed rate of this and other neuroinflammatory events in vaccine and control recipients was consistent with the background rates of these events in the population and could not be attributed to vaccination.

Anaphylaxis after COVID-19 Vaccine AstraZeneca has been reported rarely. Refer to **Contraindications** for further information.

Table 2: Frequency of select common adverse events reported within 7 days following at least one dose of COVID-19 Vaccine AstraZeneca in phase II/III trial aged >18 years of age⁴⁰

	18–55 years		56–69 years		≥70 years	
	Dose 1	Dose 2	Dose 1	Dose 2	Dose 1	Dose 2
Injection site pain	61%	49%	43%	34%	20%	10%
Injection site tenderness	76%	61%	67%	59%	49%	47%
Fatigue	76%	55%	50%	41%	41%	33%
Headache	65%	31%	50%	34%	41%	20%
Muscle pain	53%	35%	37%	24%	18%	18%
Fever	24%	0%	0%	0%	0%	0%

Reporting adverse events

All notifications of adverse events following immunisation should be made through the [usual reporting mechanisms](#). Refer also to the [Reporting to immunisation registers](#) section of the Australian Immunisation Handbook.

The safety of COVID-19 vaccines will be actively monitored by the TGA as well as state and territory governments.

Vaccine information

Comirnaty

A phase II/III trial of Comirnaty is ongoing with >43,000 individuals aged ≥12 years enrolled. An interim analysis, with a duration of observation of 2 months post dose 2, reported vaccine efficacy (VE) of 95.0% (95% CI: 90.3–97.6) in preventing symptomatic laboratory-confirmed COVID-19 in people aged ≥16 years (median age 52 years, range 16–89 years for vaccine recipients) without evidence of prior infection with SARS-CoV-2. Sub-group analyses demonstrated similarly high efficacy in adults aged ≥65 years (VE 94.7 [95% CI: 66.7–99.9]) and in adults with at least one medical comorbidity or obesity (VE 95.3 [95% CI: 87.7–98.8]).

In this interim analysis, short-term efficacy after a single dose was 52.4% (95% CI: 29.5–68.4), with protective effect observed starting 12 days after dose 1. There is also evidence of efficacy against severe illness, although the estimate is imprecise due to the lower number of people overall who developed severe disease (VE 88.9% ATAGI Clinical Guidance on COVID-19 Vaccine in Australia_v2.0

after first dose [95% CI: 20.1–99.7]).³⁷ In a preprint analysis of a population level prospective cohort study in Scotland, vaccine effectiveness against hospitalisation from COVID-19 at 28–34 days after a single dose of Comirnaty was 85% (95% CI 76 – 91).¹⁹

No data are currently available to assess efficacy for prevention of asymptomatic infection, although serological data are awaited. The duration of protection has not been determined.

This ongoing phase II/III trial also includes participants with well-controlled chronic medical conditions. An interim sub-analysis of those with some specified medical conditions showed a similar vaccine efficacy to those without such conditions (95.3% [95% CI: 87.7–98.8] versus 94.7% [95% CI: 85.9–98.6]³⁷).

Data on the safety and efficacy of Comirnaty in children aged <16 years are not yet available. Children aged ≥12 years were enrolled in the phase II/III trial of Comirnaty, and safety and immunogenicity of the vaccine in adolescents aged 12–15 years will be reported in the final analysis. Data on safety, immunogenicity or efficacy of Comirnaty in people living with HIV (who were included in the clinical trial if stable) have not yet been published.

Women who were pregnant or breastfeeding; people with conditions with high risk of severe COVID-19 (including residents in a long-term care facility) or with immunocompromising conditions; or those taking immunosuppressive therapy were excluded from the trial.³⁷ Data on the safety of Comirnaty vaccination in these populations will be available in the future from additional clinical trials and post-marketing studies.

COVID-19 Vaccine AstraZeneca

Phase II/III trials of COVID-19 Vaccine AstraZeneca are ongoing with >57,000 individuals aged ≥18 years enrolled. An interim analysis was conducted of pooled data as of 4 November 2020 from two ongoing randomised, blinded, controlled trials: a phase II/III study, COV002, in adults aged ≥18 years in the UK and a phase III study, COV003, in adults aged ≥18 years in Brazil. Analysis of these data showed the overall vaccine efficacy was 70.4% (95 CI: 54.8–80.6%) in preventing symptomatic laboratory-confirmed COVID-19, in people aged ≥18 years 15 or more days after the second dose in the primary efficacy study population.³⁸ The median duration of follow up 15 or more days after the second dose was 48 days. This was based on 131 cases (30 among 5807 who received COVID-19 Vaccine AstraZeneca versus 101 among 5,829 who received the control vaccine).³⁸

Updated analysis on pooled data as of 7 December 2020 reported a vaccine efficacy of 63.09% (95% CI: 51.81–71.73) in preventing symptomatic laboratory-confirmed COVID-19 in people aged ≥18 years who received two standard doses.⁴¹ This was based on 271 cases (74 among 7,201 who received COVID-19 Vaccine AstraZeneca versus 197 among 7,178 who received the control vaccine).³⁸ Efficacy from day 22 after the first dose until up to 12 weeks post vaccination was 73% (95% CI: 48.79–85.76).³⁰

In clinical trials, the timing of administration of COVID-19 Vaccine AstraZeneca ranged from approximately 4 weeks up to 26 weeks. Among participants receiving two standard recommended doses with a dose interval within the range of 4 to 12 weeks, the overall vaccine efficacy for prevention of symptomatic laboratory-confirmed COVID-19 was 59.5% (95% CI: 45.8–69.7), based on 218 cases.⁴² The vaccine efficacy varies with dose interval. The vaccine efficacies for prevention of symptomatic laboratory-confirmed COVID-19 varied with the time interval <6 weeks, 6–8 weeks, 9–11 weeks and ≥12 weeks between the first and second dose and were 54.9% (95% CI: 32.7–69.7), 59.9% (95% CI: 32.1–76.4), 63.7% (95% CI: 28.0–81.7) and 82.4% (95% CI: 62.7–97.7), respectively.⁴¹

Among trial participants who contributed to the interim analysis for efficacy, <6% were aged ≥65 years. Among participants of this age group, there were only four and eight cases of COVID-19, respectively, occurring in recipients of COVID-19 Vaccine AstraZeneca and of control vaccine. However, there were no cases of COVID-19 hospitalisations, severe disease or COVID-19 deaths among trial participants aged ≥65 years who received COVID-19 Vaccine AstraZeneca.⁴¹ These small numbers preclude the assessment of the efficacy of COVID-19 Vaccine AstraZeneca in this age group at this time. Immune responses to COVID-19 Vaccine AstraZeneca among subjects aged ≥65 years showed that SARS-CoV-2 specific neutralising antibody levels after two doses were within the range of levels measured in serum samples from people who had recovered from COVID-19 (convalescent serum samples) and similar to those in younger adults after adjusting for dosing intervals, suggesting that protection

from the vaccine in this age group is likely. However, the level of antibody that correlates with clinical protection has not yet been established.

Additional information on the efficacy of COVID-19 Vaccine AstraZeneca in adults aged ≥ 65 years is anticipated to be available in late March 2021 based on a Phase III clinical trial underway in the USA and South America (NCT04516746), which aims to recruit about 30,000 participants, including at least 25% of participants aged ≥ 65 years.⁴³

An interim sub-analysis of people with specified medical conditions in the Phase II/III trials showed a similar vaccine efficacy to those without such conditions. A total of 2,068 (39.3%) participants had at least one pre-existing comorbidity (defined as a BMI ≥ 30 kg/m², cardiovascular disorder, respiratory disease or diabetes). In pooled data analysis (as of 7 December 2020), participants who had one or more comorbidities had a vaccine efficacy of 58.3% (95% CI: 33.6–73.9).⁴²

Asymptomatic COVID-19 cases were assessed in study COV002 and no efficacy was demonstrated against asymptomatic and/or unknown SARS-CoV-2 infection in either the low dose/low dose or standard dose/standard dose groups.

In a preprint analysis of a population level prospective cohort study in Scotland, vaccine effectiveness against hospitalisation from COVID-19 at 28-34 days after a single dose of COVID-19 Vaccine AstraZeneca was 94% (95% CI 73 to 99).¹⁹ There were very few people with severe disease and hospitalisation in the interim analysis of clinical trials to assess vaccine efficacy against severe disease and hospitalisations. In the SDSA population, there were 0 out of 4,440 participants who received COVID-19 Vaccine AstraZeneca who were hospitalised, and 4 out of 4,455 in the control group.³⁹

Data on immunogenicity or efficacy of COVID-19 Vaccine AstraZeneca in people living with HIV (who were included in the clinical trial if stable) have not yet been published. Women who were pregnant or breastfeeding; people with conditions with high risk of severe COVID-19 (including residents in a long-term care facility) or with immunocompromising conditions; or those taking immunosuppressive therapy were excluded from the clinical trials of COVID-19 Vaccine AstraZeneca.

Transporting, storing and handling vaccines

Comirnaty

Comirnaty vaccine vials have a shelf life of 6 months at -90°C to -60°C . Frozen vials should be thawed at 2°C to 8°C . For a carton of 195 vials, this requires 3 hours. Frozen vials can also be thawed at room temperature (up to 30°C) for 30 minutes, for immediate use. Once thawed the vaccine should not be re-frozen. Refer to the product information for more detailed guidance regarding thawing of vials.

After thawing, the shelf life is 5 days at 2°C to 8°C . Undiluted vaccine vials can be stored at up to 30°C for 2 hours (including thawing time). After dilution, vials must be kept at 2°C to 30°C and used within 6 hours from the time of dilution (not including the 2-hour maximum window for storage of an undiluted vial at up to 30°C). Do not freeze the diluted vaccine.

Comirnaty is presented in a multi-dose vial containing 0.45 mL of undiluted vaccine and must be reconstituted by diluting with 1.8 mL of sterile 0.9% sodium chloride. The vaccine does not contain a preservative. Do not use bacteriostatic 0.9% sodium chloride. The total quantity after dilution will be 2.25 mL. Do not shake the vial. It is preferable to administer vaccine doses immediately after dilution.

During storage, minimise exposure to room light, and avoid exposure to direct sunlight and ultraviolet light.

For additional information refer to the National Vaccine Storage Guidelines [Strive for 5](#).

COVID-19 Vaccine AstraZeneca

The shelf life of COVID-19 Vaccine AstraZeneca is 6 months at 2°C to 8°C.

In Australia, COVID-19 Vaccine AstraZeneca is supplied in multi-dose vials, with 5 m in each vial, containing 10 doses each. Dilution is NOT required.

Unopened multi-dose vials are to be stored at 2°C to 8°C and in outer carton, to protect from light.

After first opening, chemical and physical in-use stability has been demonstrated from the time of vial puncture to administration for no more than 6 hours at room temperature up to 30°C, or no more than 48 hours in a refrigerator at 2°C to 8°C. The vial can be re-refrigerated, but after first opening the cumulative storage time at room temperature must not exceed 6 hours, and the total cumulative storage time must not exceed 48 hours.

Recording vaccination

Recording of administration of each and every dose of COVID-19 vaccine on AIR is mandatory.

This will assist in ensuring that the correct vaccine and interval is used for the second dose, and in identifying patients who are due for a second dose. This will also allow verification or provision of evidence of completion of COVID-19 vaccination, if required.

For more information, refer to the Services Australia website: [AIR for health professionals](#).

Serological testing for immunity

Testing for anti-spike antibodies or neutralising antibodies to demonstrate immunity against SARS-CoV-2 in vaccinated individuals is not recommended. An immune correlate of protection has not yet been established for SARS-CoV-2 infection or COVID-19 in humans.⁴⁴

Impact of vaccination on future COVID-19 testing

Receipt of a COVID-19 vaccine will not affect the results of nucleic acid testing or rapid antigen testing for diagnosis of SARS-CoV-2 infection.

Since both Comirnaty and COVID-19 Vaccine AstraZeneca encode the spike protein of SARS-CoV-2, vaccination may affect any subsequent serological diagnostic testing and result in detection of antibody to the spike protein, but will not affect the results of anti-nucleocapsid antibody testing.

Isolation or testing for COVID-19 following adverse events

Testing for SARS-CoV-2 infection or implementing (non-medically recommended) isolation of someone who develops symptoms of fever, headache, fatigue or other systemic symptoms within and lasting for <48 hours after receipt of a COVID-19 vaccine is not necessarily required. If a vaccine recipient develops typical vaccine-related adverse events (refer to **Adverse events** section) and there is complete absence of respiratory symptoms (including loss of smell), it is more likely that they have an expected vaccine response. However, vaccine-induced protection is not immediate, and it is possible that SARS-CoV-2 could be contracted within several days before or after vaccination (this would not constitute vaccine failure).

Local public health guidance should be followed irrespective of a history of vaccination. Criteria for SARS-CoV-2 testing varies depends, in part, on local epidemiology and during outbreak management.

For Comirnaty, the median time of onset of systemic adverse events was 1–2 days after vaccine receipt, with resolution in a median of 1 day. For COVID-19 Vaccine AstraZeneca, local or systemic solicited adverse events were most commonly reported on day 1 following vaccination, and generally resolved within a few days.

Post-exposure prophylaxis

COVID-19 vaccines are not recommended for post-exposure prophylaxis use, as no data are available to support such a use. The median incubation period for SARS-CoV-2 is 5–6 days (with a range of 1 to 14 days in most people) and vaccination after exposure is unlikely to generate sufficient immunity within this period to prevent infection in a previously unvaccinated exposed individual.

However, local public health authorities may recommend prioritising COVID-19 vaccination for certain populations related to local outbreaks or settings with community transmission of COVID-19. For latest information refer to the CDNA [National guidelines for public health units](#) on COVID-19.

References

1. Australian Technical Advisory Group on Immunisation (ATAGI). Preliminary advice on general principles to guide the prioritisation of target populations in a COVID-19 vaccination program in Australia. November 2020. Available at: <https://www.health.gov.au/resources/publications/atagi-preliminary-advice-on-general-principles-to-guide-the-prioritisation-of-target-populations-in-a-covid-19-vaccination-program-in-australia>. Accessed 17 February 2021.
2. Perlman S. Another Decade, Another Coronavirus. *N Engl J Med*. 2020;382(8):760-762. doi:10.1056/NEJMe2001126.
3. Gorbalenya AE et al. The species severe acute respiratory syndrome related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nat Microbiol* 2020;5:536–544.
4. Dhama K, Sharun K, Tiwari R, et al. Coronavirus Disease 2019 - COVID-19. *Clinical Microbiology Reviews* 2020;33. DOI: 10.1128/CMR.00028-20
5. Amanat F, Krammer F. SARS-CoV-2 Vaccines: Status Report. *Immunity*. 2020;52:583-589. doi: 10.1016/j.immuni.2020.03.007.
6. Fontanet A, Autran B, Lina B, Kieny MP, Karim SSA, Sridhar D. SARS-CoV-2 variants and ending the COVID-19 pandemic. *The Lancet*. 11 February 2021. doi: 10.1016/S0140-6736(21)00370-6.
7. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. *JAMA*. 2020;323(13):1239-1242. doi:10.1001/jama.2020.2648
8. Stokes EK, Zambrano LD, Anderson KN, Marder EP, Raz KM, El Burai Felix S, Tie Y, Fullerton KE. Coronavirus Disease 2019 Case Surveillance - United States, January 22-May 30, 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69:759-765. doi: 10.15585/mmwr.mm6924e2. PMID: 32555134; PMCID: PMC7302472.
9. Docherty AB, Harrison EM, Green CA, Hardwick HE, Pius R, Norman L, Holden KA, Read JM, Dondelinger F, Carson G, et al. Features of 20 133 UK patients in hospital with covid-19 using the ISARIC WHO Clinical Characterisation Protocol: prospective observational cohort study. *BMJ*. 2020;369:m1985.
10. Williamson EJ, Walker AJ, Bhaskaran K, et al. Factors associated with COVID-19-related death using OpenSAFELY. *Nature*.2020;584: 430–436. <https://doi.org/10.1038/s41586-020-2521-4>
11. COVID -19 National Incident Room Surveillance Team. COVID-19 Australia: Epidemiology Report 32. *Commun Dis Intell*. 2021;45 <https://doi.org/10.33321/cdi.2021.45.1>
12. Liguoro I, et al. SARS-COV-2 infection in children and newborns: a systematic review. *European Journal of Pediatrics*. 2020, May 18;1-18. doi: 10.1007/s00431-020-03684-7
13. Jiang L, Tang K, Levin M, Irfan O, Morris SK, Wilson K, Klein JD, Bhutta ZA. COVID-19 and multisystem inflammatory syndrome in children and adolescents. *Lancet Infect Dis*. 2020;20:e276-e288. doi: 10.1016/S1473-3099(20)30651-4.
14. Price DJ, Shearer FM, Meehan MT, McBryde E, Moss R, Golding N, Conway EJ, Dawson P, Cromer D, Wood J, Abbott S, McVernon J, McCaw JM. Early analysis of the Australian COVID-19 epidemic. *Elife*. 2020;9:e58785. doi: 10.7554/eLife.58785
15. Omer S, et al. WHO SAGE roadmap for prioritizing uses of COVID-19 vaccines in the context of limited supply. World Health Organization (2020).
16. Mutambudzi M, Niedwiedz C, Macdonald EB, Leyland A, Mair F, Anderson J, Celis-Morales C, Cleland J, Forbes J, Gill J, Hastie C, Ho F, Jani B, Mackay DF, Nicholl B, O'Donnell C, Sattar N, Welsh P, Pell JP, Katikireddi SV, Demou E. Occupation and risk of severe COVID-19: prospective cohort study of 120 075

- UK Biobank participants. *Occup Environ Med*. 2020:oemed-2020-106731. doi: 10.1136/oemed-2020-106731
17. Australian Government, Department of Health. COVID-19 cases in aged care services – residential care, 2021, <https://www.health.gov.au/resources/covid-19-cases-in-aged-care-services-residential-care> [20/01/2021]
 18. Petrilli CM, et al. Factors associated with hospital admission and critical illness among 5279 people with coronavirus disease 2019 in New York City: prospective cohort study. *BMJ*. 2020;369:m1966. doi: 10.1136/bmj.m1966.
 19. Vasileiou E, Simpson Colin, Robertson C, et al. Effectiveness of First Dose of COVID-19 Vaccines Against Hospital Admissions in Scotland: National Prospective Cohort Study of 5.4 Million People (preprint). Available at SSRN: <https://ssrn.com/abstract=3789264>
 20. Yashadhana, Aryati, et al. "Indigenous Australians at increased risk of COVID-19 due to existing health and socioeconomic inequities." *The Lancet Regional Health-Western Pacific* 1 (2020).
 21. Zheng, Zhaohai, et al. "Risk factors of critical & mortal COVID-19 cases: A systematic literature review and meta-analysis." *Journal of Infection* (2020).
 22. Gao Y, Chen Y, Liu M, Shi S, Tian J. Impacts of immunosuppression and immunodeficiency on COVID-19: A systematic review and meta-analysis. *J Infect*. 2020;81:e93-e95. doi:10.1016/j.jinf.2020.05.017
 23. Medicines & Healthcare products Regulatory Agency. Public Assessment Report Authorisation for Temporary Supply. COVID-19 mRNA Vaccine Comirnaty (Comirnaty RNA), 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/944544/COVID-19_mRNA_Vaccine_Comirnaty_UKPAR_PFIZER_BIONTECH_15Dec2020.pdf [21/01/21]
 24. US National Institutes of Health. COVID-19 vaccine (ChAdOx1 nCoV-19) trial in South African Adults with and without HIV-infection. <https://clinicaltrials.gov/ct2/show/NCT04444674>
 25. Ellington S, Strid P, Tong VT, et al. Characteristics of Women of Reproductive Age with Laboratory-Confirmed SARS-CoV-2 Infection by Pregnancy Status - United States, January 22-June 7, 2020. *MMWR Morb Mortal Wkly Rep* 2020;69(25): 769-75.
 26. World Health Organization. Generic protocol: a prospective cohort study investigating maternal, pregnancy and neonatal outcomes for women and neonates infected with SARS-CoV-2, 2 December 2020. No. WHO/2019-nCoV/pregnancy_and_neonates/2020.1. World Health Organization, 2020.
 27. United States Food and Drug Administration. Pfizer-BioNTech COVID-19 Vaccine (Comirnaty, PF-07302048) Vaccines and Related Biological Products Advisory Committee Briefing Document. Available at: <https://www.fda.gov/media/144246/download>. Accessed 21/01/2021
 28. World Health Organization. Interim recommendations for use of the AZD1222 (ChAdOx1-S (recombinant)) vaccine against COVID-19 developed by Oxford University and AstraZeneca. February 2021. Available at: https://www.who.int/publications/i/item/WHO-2019-nCoV-vaccines-SAGE_recommendation-AZD1222-2021.1. Accessed 16/02/2021
 29. Lumley SF, et al. Antibody Status and Incidence of SARS-CoV-2 Infection in Health Care Workers. *N Engl J Med*. 2020:NEJMoa2034545. doi: 10.1056/NEJMoa2034545.
 30. Medicines and Healthcare Products Regulatory Agency. Public Assessment Report Authorisation for Temporary Supply. COVID-19 Vaccine AstraZeneca, solution for injection in multidose container COVID-19 Vaccine (ChAdOx1-S [recombinant]). December 2020. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/949772/UKPAR_COVID_19_Vaccine_AstraZeneca_05.01.2021.pdf. Accessed 16 February 2021

31. UK Joint Committee on Vaccination and Immunisation (JCVI). Optimising the COVID-19 vaccination programme for maximum short-term impact. Short statement. 31 December 2020. Available from: https://www.cas.mhra.gov.uk/ViewandAcknowledgment/ViewAttachment.aspx?Attachment_id=103741
32. Shimabukuro TT, Cole M, Su JR. Reports of anaphylaxis after receipt of mRNA COVID-19 vaccines in the US - December 14, 2020 - January 18, 2021. *JAMA*. 12 February 2021. doi: 10.1001/jama.2021.1967.
33. Castells MC, Phillips EJ. Maintaining Safety with SARS-CoV-2 Vaccines. *New England Journal of Medicine*. 2020. DOI: 10.1056/NEJMra2035343
34. Wenande E, Garvey LH. Immediate-type hypersensitivity to polyethylene glycols: a review. *Clinical & Experimental Allergy* 2016;46:907-922.
35. Medicines and Healthcare products Regulatory Agency. Coronavirus vaccine - weekly summary of Yellow Card reporting. <https://www.gov.uk/government/publications/coronavirus-covid-19-vaccine-adverse-reactions/coronavirus-vaccine-summary-of-yellow-card-reporting>. Accessed 17 February 2021
36. National Center for Immunization and Respiratory Diseases. General recommendations on immunization – recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*. 2011;60:1-64. Erratum in: *MMWR Recomm Rep*. 2011;60:993.
37. Polack FP, et al. Safety and efficacy of the Comirnaty mRNA covid-19 vaccine. *New England Journal of Medicine* (2020).
38. Voysey M, et al. Safety and efficacy of the ChAdOx1 nCoV-19 vaccine (AZD1222) against SARS-CoV-2: an interim analysis of four randomised controlled trials in Brazil, South Africa, and the UK. *Lancet* 2020; 397: 99–111. [https://doi.org/10.1016/S0140-6736\(20\)32661-1](https://doi.org/10.1016/S0140-6736(20)32661-1)
39. Therapeutic Goods Administration (TGA). Australian Public Assessment Report (AUSPAR) <https://www.tga.gov.au/auspar/auspar-chadox1-s>. Accessed 17 February 2021.
40. Ramasamy MN, et al. Safety and immunogenicity of ChAdOx1 nCoV-19 vaccine administered in a prime-boost regimen in young and old adults (COV002): a single-blind, randomised, controlled, phase 2/3 trial. *Lancet*. 2021 Dec 19;396(10267):1979-1993. doi: 10.1016/S0140-6736(20)32466-1. Epub 2020 Nov 19. Erratum in: *Lancet*. 2021 Dec 19;396(10267):1978. PMID: 33220855; PMCID: PMC7674972.
41. World Health Organization. AZD1222 vaccine against COVID-19 developed by Oxford University and AstraZeneca: Background paper (draft). February 2021. Available at: https://www.who.int/publications/i/item/WHO-2019-nCoV-vaccines-SAGE_recommendation-AZD1222-background-2021.1. Accessed 17 February 2021
42. European Medicines Agency. COVID-19 Vaccine AstraZeneca. Product Information as approved by the CHMP on 29 January 2021, pending endorsement by the European Commission. Annex I: Summary of product characteristics. 29 Jan 2021. Accessed 8 February 2021. https://www.ema.europa.eu/en/documents/product-information/covid-19-vaccine-astrazeneca-product-information-approved-chmp-29-january-2021-pending-endorsement_en.pdf
43. National Library of Medicine (US). ClinicalTrials.gov [Internet]. Bethesda (MD): January 2021. Identifier NCT04516746; Phase III Double-blind, Placebo-controlled Study of AZD1222 for the Prevention of COVID-19 in Adults. Available from: <https://clinicaltrials.gov/ct2/show/NCT04516746>. Accessed 16/02/21
44. Poland GA, et al. SARS-CoV-2 immunity: review and applications to phase 3 vaccine candidates. *The Lancet*. 2020;396:1595-1606. [https://doi.org/10.1016/S0140-6736\(20\)32137-1](https://doi.org/10.1016/S0140-6736(20)32137-1)