COVID-19 vaccines, boosters and kids

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TACKLING COVID-19 TOGETHER

Will my child's 2 dose vaccine course protect them, especially now that Omicron is the dominant variant?

Immunity from vaccination wanes over time after both 2 dose courses and booster doses, though protection against severe disease and hospitalization *(outcomes that are rare in children regardless of vaccination status)* is maintained at a high level longer than protection against milder infection.

A 2 dose course of an mRNA COVID vaccine (Pfizer or Moderna) provides children with strong and durable protection against severe disease. The latest data (from periods of Delta and Omicron variant dominance) shows that the **protection against COVID disease severe enough to require admission to hospital remains strong: 85-100% soon after vaccination.** For 5-11 year olds, vaccine effectiveness against hospitalisation ("VE" - see below for VE explained) has been found to be 50-75% after 6-10 weeks. For 12-17 year olds VE was estimated at 73% by 6 weeks in one large study[1], and 75-88% even beyond 20 weeks post second dose in another[2].

Multisystem Inflammatory Disease in Children (MIS-C), otherwise known as Paediatric Inflammatory Multisystem Syndrome (PIMS-TS) is a rare condition that starts in the weeks to months after COVID infection, and causes inflammation in multiple organ systems, with potentially serious or deadly outcomes. It occurs after about **1 in 2500** COVID infections, and is more likely in unvaccinated children and in those children who are hospitalized with COVID. **Vaccination with a 2 dose primary course protects against MIS-C, with Vaccine Effectiveness after 2 doses about 90%[3].**

Some adults suffer from prolonged symptoms after infection, sometimes called "long COVID". Data in adults shows that vaccinated people are less likely to experience these prolonged symptoms (ref Antonelli). Fewer children compared with adults appear to experience prolonged symptoms following SARS-CoV-2 infection with data from Victoria[4] and the UK[5] suggesting that the vast majority of children return to baseline health by 8 weeks following infection.

Does the immunity from vaccines wear off over time?

The protection provided by COVID vaccination does wane over time. This means there is an increasing risk of "breakthough" infections (infections in vaccinated or previously infected people) the more time passes since receiving the first two doses of vaccine. The dominant Omicron strain is more likely to cause breakthrough infections than previous variants.

Studies show that vaccine protection from all COVID *infections* wanes more quickly, while protection from severe disease and hospitalizations tends to last longer. Estimates of just how quickly Vaccine Effectiveness (VE – see box below) falls vary quite widely in published data. Some studies have found that by 6 months after your primary course, the initial protection (vaccine effectiveness of >90%; prevention in 9 out of 10 people

exposed) has fallen to 10-60% (only preventing 1 to 6 infections out of 10 people exposed). **VE against COVID disease severe enough to require hospitalisation lasts longer,** falling only to 53-78% by 6 months in some studies[6,7] though has been found to be maintained at around 90% in other studies[8].

In adolescents 12-16 years old, VE against the delta variant declined over 5 months after second dose vaccination from 85-90% to 58% against infection, and to 65% against severe disease[9].

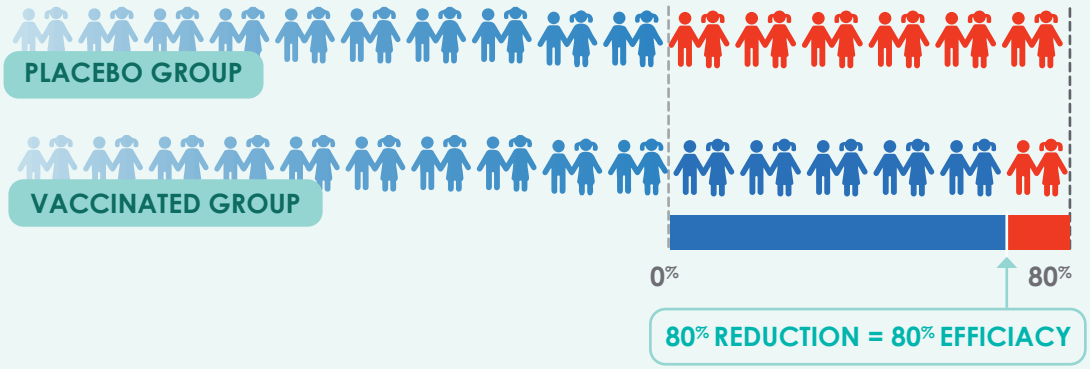
Most recently, in children 5-11 years, VE against the Omicron variant has also shown to wane over time. Over 6 weeks, VE against all infections (most of which are mild or asymptomatic) in 5-11 years old children fell from 68% to 12%, though severe disease and hospitalisation remained rare, and vaccination continued to be protective in the same study – VE 48% at 6 weeks[1].

Although Omicron causes more infections in vaccinated children, data suggests that it causes more mild disease in most cases compared to previous variants, even in very young children. Just 1.5-3% of **children under 5 years old** infected with COVID are unwell enough to require hospital admission, and 0.1-0.4% of infected children need ICU level care[10-12].

What does Vaccine Effectiveness mean?

Vaccine Effectiveness (VE) is shown as a percentage.
It refers to the percentage of cases prevented in a vaccinated group who otherwise would have been infected in an unvaccinated group. It doesn't mean that the vaccine "works X% of the time".

Let's use an example from above – 2 doses of a COVID vaccine have a VE of 90% against developing MIS-C after COVID infection. That means that out of a large population of children exposed to COVID, vaccination will prevent 9 out of 10 cases of MIS-C that would have happened if the same group hadn't been vaccinated.



What about boosters? How do boosters work? Why do we need more than one dose of a vaccine?

"Booster" doses are used for lots of different vaccines (in fact, most of the vaccines on the Australian Immunisation schedule need repeated doses or boosters), and they all work on the same principle. The body's immune response to infection is improved with repeated exposure. This immune "training" works in several ways: making more antibody, training more specific antibody-producing cells, and increasing the number as well as the variety of other immune cells in readiness for a future response. In laboratory studies, booster doses of COVID-19 vaccines have been shown to have these effects[13].

The same study[14] that showed VE against infection in adults declining to 10-35% 6 months after dose 2 found that after a booster, VE against infection increased again to 60-75% and VE against hospitalisation was

boosted to 90%. Other studies in adults have consistently shown that booster doses are effective in increasing VE back to high levels (86-93%)[15, 16]. **Adults who had not had a booster were 10 to 20 times more likely to be infected or hospitalized** with Delta variant COVID than adults who had had a booster[16], though protection against severe disease needing hospitalisation lasts longer, with **VE against hospitalisation has been found to be 75-80% at 3-5 months post booster vaccination** in adult[7].

There is little data on the effectiveness of booster doses in protecting children from the Omicron strain, since boosters haven't been used in children for as long as 2 dose primary courses. Data from Israel[17] found a significant difference in 16-29 yr olds in infection rates between individuals who had had a booster and those who hadn't, though severe disease was rare in all young people studied.

The protection from boosters will also wane over time. UK data (in adults) showed that VE against hospitalisation was 75-95% 9-14 weeks after booster dose[18].

What about younger children?

Current Australian recommendations are for a 2 dose vaccine course in 5 to 15 year olds, and 2 doses plus a booster in 16 year olds and older, though vaccines for younger children, and boosters for children currently receiving two doses, might be recommended in the future.

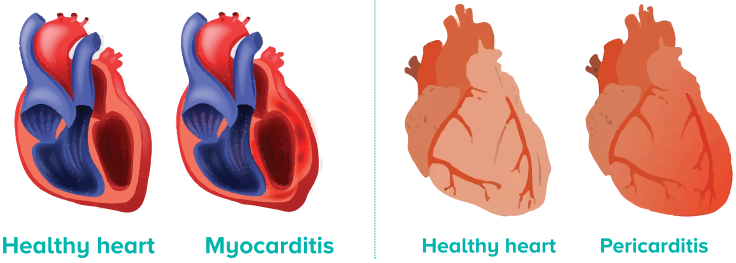
Because most large studies of vaccine effectiveness and safety are done in adults, it takes longer for enough data to emerge to support the safety and efficacy of vaccinating children, especially with vaccine doses and time intervals different from adults.

COVID has had a relatively lower impact in Australia when compared to many European and North American countries, so it's been appropriate to wait for more data to emerge to ensure that the balance of risk and benefit is understood as well as possible.

It may be that boosters are recommended for younger children in Australia when more data is available – both the UK and US are currently offering boosters to 12-15 year olds, and Israel is offering boosters to children 5 and above.

There is strong data from Australia[19] and overseas[10-12] to show that children are quite unlikely to suffer severe disease if they are infected with the Omicron variant (though severe outcomes do still happen). Further, vaccines are less effective in preventing transmission with Omicron than with previous variants, so early childhood vaccination would have a less dramatic effect on COVID transmission and spread[20].

What about possible adverse events following immunisation? Are they more common in children, and are they more common after booster doses?



Myocarditis and pericarditis, which are inflammation of the heart muscle and the tissue that line the heart, are known to be associated with mRNA vaccines. These rare reactions occur most frequently in young males, with the highest rates in the 12-18 year olds boys. Different countries have reported different rates, likely because of differences in how cases are identified, but most seem to report between 50 and 160 cases of myocarditis per million doses (that's one in every 6,250-20,000 doses given) in the highest risk group, which is teenage boys receiving their second dose of vaccine. Other age groups, and girls, have much lower risk – less than 2 cases per million doses in boys and girls 5-11 years old, and less than 10 cases per million in teenage girls[21, 22].

While myocarditis can be a serious disease, most patients who develop myocarditis after vaccination recover fully and quickly – about half of them need admission to hospital, most of whom were discharged within 4 days, and less than 1% of all cases needed intensive care[23].

Data from Israel and the USA indicates a **lower rate of these complications after booster doses than primary course doses[24, 25].** Out of the 11.4 million booster doses given in Australia up to the end of February 2022, only 17 reports of likely myocarditis and 49 reports of likely pericarditis have been received by the TGA[26], mostly in adults(less than 1 case per 100,000 doses) – this monitoring continues.

Will there be a fourth dose, or even more?

We really don't know yet. Fourth doses have only been given in adults in Israel, and only since late 2021. Early data suggests that a fourth dose (a "second booster") does offer some benefit against Omicron infection, though this is an area of emerging research that we'll continue to watch[27]. There are some individuals at greater risk of severe COVID-19 are more likely to benefit from a fourth dose when compared with the general public but a decision has not yet been made about this need in the Australian program.

Should I go out and get COVID while my kid's immunity is highest post vaccine?

No! Infection with Omicron, while usually mild, still carries risks of serious illness and serious long term complications. Further, infection with Omicron is not a guarantee against repeat infections in the future – this infectious variant has caused many "breakthrough" infections in both vaccinated and in previously infected people, and research does not show that the immune response to a new COVID exposure after previous infection is "better" in any way than the immune response in vaccinated individuals[28, 29].

What's the rest of the world doing?

Different countries have different recommendations around vaccinating children, with most variation in teenage years. This may be due to differences in the local experience and progress over time of the pandemic, varying local data, policy concerns, and public opinion.

<table>
<tr><th></th><th><5 years old</th><th>5-11 years old</th><th>12-17 years old</th><th>Adults</th></tr>
<tr><td>USA</td><td rowspan="5">Only in clinical trials (currently ongoing)</td><td rowspan="5">2 dose primary course (+ third dose in some</td><td>2 dose primary course + booster for all children</td><td rowspan="5">2 dose primary course + booster for all adults >18</td></tr>
<tr><td>United Kingdom</td><td>2 dose primary course, + booster only if at risk</td></tr>
<tr><td>Canada</td><td>2 dose primary course, + booster only if at risk</td></tr>
<tr><td>New Zealand</td><td>2 dose primary course, + booster only if at risk</td></tr>
<tr><td>Australia</td><td>2 dose primary course, then booster for all 16-17 year olds</td></tr>
</table>

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This resource was developed by Dr Sam Brophy-Williams and reviewed by Professor Christopher Blyth and Dr Dan Yeoh. This document is correct as of 16 March 2022. Please continue to check online for the most recent version/information.