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The Unvaccinated Patient: Medical & Clinical Implications

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Disclosures

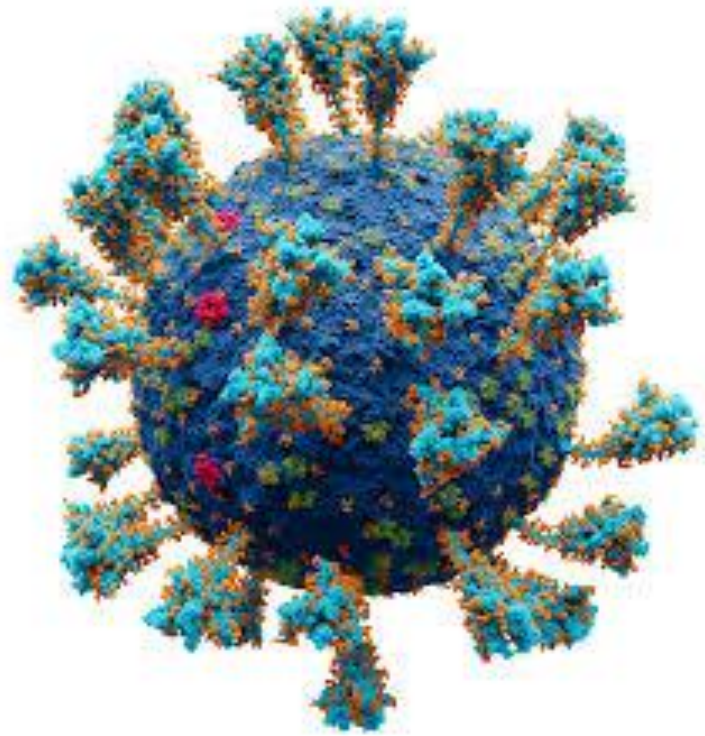


In the past 36 months, I have received honoraria from the following:

GSK, Pfizer, MSD, Abbott Medical, CSL, AMGEN, Moderna, Immunisation Coalition, Pharmaceutical Society of Australia, Australasian College of Pharmacy, United Clinical, Praxhub, HealthEd, GPCE

How do we contemplate the impact of being unvaccinated?

- Understanding the problem
- Individuals
- Society
- Pathogens
- Health systems



Understanding the problem: vaccination rates

POPULATION as at 2022		RATE	POPULATION as at 2022		RATE
1-year-olds UTD		93.8%	70+-year-olds	Zoster	41%
2-year-olds UTD		92%	70+-year-olds First Nations	Zoster	37%
5-year-olds UTD		94.3%	Older Adult	13vPCV	34%
1-year-old First Nations UTD		91%	Older Adult First Nations	13vPCV	38%
2-year-old First Nations UTD		89%	Adults 65-74 years	Influenza	68%
5-year-old First Nations UTD		96%	Adults 75+ years	Influenza	73%
15-year-old girls	HPV x 1	85%	15-year-old girls First Nations	HPV x 1	83%
	dTpa	87%		dTpa	82%
	ACWY	76%		ACWY	66%
15-year-old boys	HPV x 1	83%	15-year-old boys First Nations	HPV x 1	78%
	dTpa	87%		dTpa	82%
	ACWY	76%		ACWY	66%

Understanding the problem: vaccination rates



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Only **51%** of **older adults** receive all funded vaccines annually

50% of **measles cases** occur in people aged 19+

Of 4.1 million unvaccinated Australians, **92%** are **adults**



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Just **40%** of **at-risk adults** get their annual flu vaccine

Only **13%** of **at risk Indigenous young adults** receive the pneumococcal vaccine

93% of **children** and **73%** of **adolescents** receive all funded vaccines

Implications for individuals

DISEASE	CFR, UNVACCINATED	NOTES	DISEASE	CFR, UNVACCINATED	NOTES
Measles	1-3%	Up to 30% some countries	Polio (0.5% paralysis rate)	Paralysed children 2-5%, paralysed adults 15-30%	Death without artificial breathing
SSPE	100%		Meningococcal	10-20%	Untreated
Pertussis	3.7%		Tetanus	50% 10-20%	Untreated Treated
Diphtheria	5-10% untreated		Mumps encephalitis	1%	
Varicella	30% 0.02%	Newborns, untreated Adults	COVID	0.88%	Treated
Flu A H5N1 Spanish Flu Seasonal Flu	53% 2.5-9% 0.1-0.5%	Avian flu Treated Treated	Rubella	1:30,000 33% for CRS	

Implications for individuals



DISEASE	SEQUELAE	DISEASE	SEQUELAE
Measles	Acute encephalitis 1/1000 Pneumonia, otitis media, secondary infection, SSPE	Polio	Acute flaccid paralysis 1% Post-polio syndrome 25-40%
Influenza	Pneumonia, otitis media	Meningococcal	Encephalitis, hearing loss, vision loss, loss of limb, intellectual disability
Pertussis	Encephalopathy, seizures, subdural haematomas, pneumonia, pneumothorax, pulmonary HT	Tetanus	Fractures, pneumonia, respiratory failure, arrhythmias, seizures
Diphtheria	Myocarditis, paralysis, cutaneous diphtheria/skin ulcers on arms/legs	Mumps encephalitis	Orchitis, male infertility, encephalitis, meningitis, hearing loss, miscarriage
Varicella	Bacterial infection of skin, pneumonia, encephalitis, pneumonitis, cerebellar ataxia	COVID	Post-viral fatigue, long COVID syndrome, multiple organ manifestations

Implications for society: herd immunity

Table 1. Herd Immunity Thresholds (Approximate) for Infection Elimination

Infection	R_0	Herd immunity threshold
Diphtheria	6-7	85%
Measles	12-18	83-94%
Mumps	4-7	75-86%
Pertussis	12-17	92-94%
Polio	5-7	80-86%
Rubella	6-7	83-85%
Smallpox	5-7	80-85%
Pandemic influenza (H1N1)	1.6?	~40%

Taken, in part, from Fine[3]³

Implications for society: herd immunity

- Aim for herd immunity is 95%
- Measles herd immunity requires 92% minimum
- Australia surpassed the threshold at 2021
- Country wide vaccinations rates for measles is 92.65% (2024)
- December 2023 fully immunised
 - 93.16% for all one-year-olds
 - 91.24% for all two-year-olds

AREA as at 2023	AGE GROUP	VACCINATION RATE
WA measles	All	91.36%
QLD measles	All	91.93%
WA all vaccines	1-year-olds	92.12%
WA all vaccines	2-year-olds	89.74%
NT all vaccines	5-year-olds	92.14%
NSW Richmond Valley all vaccines	1-year-olds	74.72%
NSW Richmond Valley all vaccines	2-year-olds	79.22%
QLD GC Hinterland all vaccines	5-year-olds	79.82%
QLD Noosa all vaccines	5-year-olds	81.09%
SA Outback all vaccines	2-year-olds	81.5%
NT Barkly all vaccinations	1-year-olds	81.67%

<https://www1.racgp.org.au/newsgp/clinical/australian-child-vaccination-rates-continue-to-fal>

Implications for society: herd immunity

Although Australia [eliminated measles](#) by March 2014, outbreaks have occurred in multiple states and territories this year. Between 1 January and 27 May 2025, 77 people were [diagnosed with measles in Australia](#). Most were young people aged 20 to 49 years who are either unvaccinated or unsure of their vaccination status, and associated with overseas travel.

Whooping cough cases are at their highest level in 35 years – so why the surge?

Older Australians urged to get tetanus shot after Sydney woman's death, two other cases in New South Wales

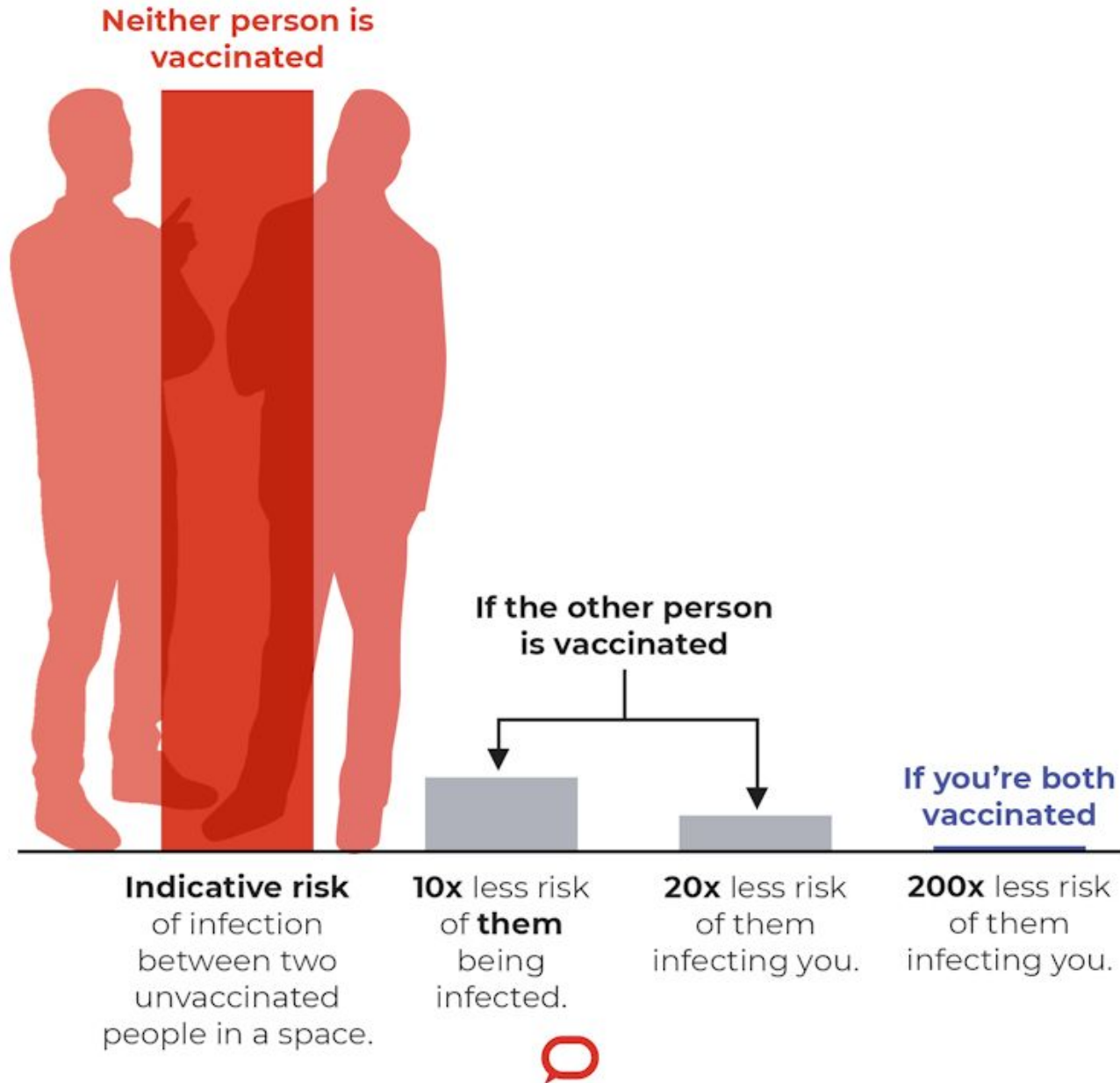
To 14 April 2026, 84 diphtheria cases have been notified nationally (55 in Northern Territory; 26 in Western Australia; 2 in Queensland and 1 in South Australia).

The number of diphtheria cases reported in Australia in 2026 to date substantially exceeds the total annual number of cases recorded in any previous year since national surveillance began.

What's the risk of socialising with vaccinated or unvaccinated people?



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Implications for society: herd immunity

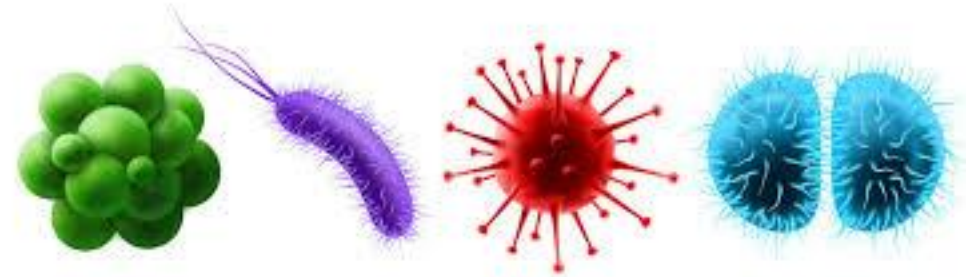
<https://findanexpert.unimelb.edu.au/news/33197-your-unvaccinated-friend-is-roughly-20-times-more-likely-to-give-you-covid>

Implications for pathogens: shift in age

- Vaccines make illnesses rarer, transmission of disease changes
- Herd immunity makes vaccine hesitant people more confident in not vaccinating
- Some are unwilling to vaccinate to provide protection to the many
- As fewer individuals are affected, the age at first infection rises
- Rubella age at infection shifted from 10-19 yrs to 15-29 yrs with vaccination, though total numbers decreased
- Some diseases are more severe at older ages- those affected last are worse off
- Rates of negative outcomes for infections in unvaccinated people in an era of near-herd immunity
 - Measles 4.5
 - Varicella 2.2
 - Rubella 5.8

Implications for pathogens: increased “susceptibles”

- Eradication and elimination strategies can have consequences if re-emergence of pathogens occur
- Elimination is local achievement of zero incidence of a pathogen
- Eradication is elimination on a global scale
- Ecology of pathogens change as societies near elimination
- Pockets of susceptible populations build up
- People stop getting vaccinated as false sense of security build
- Society becomes complacent through decreased public interest and public health measure adherence
- Natural immunity wanes
- Delayed clinical recognition of diseases can occur when cases reemerge



Klepac P, Funk S, Hollingsworth TD, Metcalf CJ, Hampson K. Six challenges in the eradication of infectious diseases. *Epidemics*. 2015 Mar;10:97-101.

Implications for pathogens: evolutionary pressures



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- Changing host and environmental conditions lead to genetic changes in pathogens
 - New phenotypic properties
 - Can infect new hosts
 - Changes in virulence
 - Antimicrobial resistance
 - Vaccine escape
- Eradication of one pathogen leaves a niche that can be filled by another
- Environmental and societal changes increase the exposure of humans to zoonoses
 - 30 new pathogens have emerged in the last 35 years, mostly zoonoses

Date	Emerging diseases ^a
1970	Yellow fever (Yellow fever virus)
1980s	AIDS (Human immune deficiency viruses)
1989	Hepatitis C (Hepatitis C virus)
1993	Hantavirus disease (Hantaviruses)
1996	Meningococcal encephalitis (<i>Neisseria meningitides</i>)
2002	SARS (SARS-CoV-1 virus) ^a
2006	Non-polioencephalomyelitis virus
2007	Zika (Zikavirus) (Micronesia)
2009	H1N1 influenza (Influenza A virus)
2011	Peste des petits ruminants (Peste des petits ruminants virus)
2012	MERS (MERS-CoV) ^a
2013	Yellow fever (Yellow fever virus)
2014	Ebola (Ebola virus)
2015	Zika (Zikavirus) (Brazil)
2019	Covid 19 (SARS-CoV-2 virus) ^a
2022	Mpox virus ^a

<https://www.sciencedirect.com/science/article/pii/S2949915125000368>
<https://pmc.ncbi.nlm.nih.gov/articles/PMC5327784/>

Implications for health systems

- Preventable hospitalisations
- Hospitalisations for infectious disease preventing use of resources for other patients
- Health costs
- Economic costs
- Depletion of resources
- Epidemics and pandemics
- Disaster preparedness and planning



<https://www.sciencedirect.com/science/article/pii/S0264410X16309434>

<https://pmc.ncbi.nlm.nih.gov/articles/PMC9235251/>

- Surveillance systems