Measles & Vaccine Information

Measles and Measles Vaccine Background

Measles is a dangerous virus and is the most transmissible of all known communicable diseases. Prior to the introduction of measles vaccine, the US experienced roughly 400,000 documented measles cases and 400 deaths every year, almost all in children under the age of 5. One in five persons infected with measles requires hospitalization, and the disease is particularly dangerous in young children and non-immune adults. Complications of measles infection include pneumonia as well as severe inflammatory conditions of the brain, intestinal tract, and eyes. Furthermore, measles virus infection destroys a large number of disease-fighting white blood cells, and measles victims are more vulnerable to a host of infections for several years after recovering. Although measles is more severe in children with underlying disease, malnutrition, and vitamin A deficiency, the above complications and data are true of healthy children and adults in the US and other developed/wealthy countries.

Measles vaccines in the US contain a live, attenuated (weakened) measles virus that generates a high level of immunity and has an excellent safety record. Measles vaccine is combined with the live vaccines for mumps and rubella (German measles) in the MMR vaccine. A vaccine is now available that adds varicella (chicken pox), which is administered exclusively to children (MMRV). One dose of MMR vaccine provides 93% protection against measles infection, and a second dose increases protection to 97%.
Because measles is so explosively contagious, a population must have 95% immunity to prevent outbreaks and achieve effective herd immunity. A number of people in our communities cannot achieve robust immunity to measles through vaccination, including children under 12 months of age or persons with immunocompromising diseases or on immunosuppressive therapy. These vulnerable people depend on the immunity of those around them to protect them from measles. For these reasons, experts recommend that >95% of children in a community are vaccinated against measles.

Anti-Vaccine Context

By the year 2000, the CDC had declared measles eliminated in the US, and the country experienced fewer than 100 cases per year. Unfortunately, measles vaccination rates have been falling over the last 20 years, and outbreaks are becoming more common. Current data from CDC identify 14 states with MMR vaccination rates lower than 90% for kindergartners.

Growing “vaccine skepticism” has fueled our 20-year trend of falling MMR vaccination rates. The anti-vaccine movement exploded after Andrew Wakefield, a British surgeon, published a study in the journal *The Lancet* in 1998 linking MMR vaccine to autism. The erroneous MMR-autism link became a *cause celebre* for many influential public figures in the early 2000’s.

In the 12 years after Wakefield's paper was published, multiple research groups were unable to reproduce his study's findings, and subsequent studies actually reaffirmed the fact that there is no association between MMR vaccine and autism. An investigation revealed that Wakefield had intentionally manipulated and falsified the data his group used in the paper. Investigative reporting also uncovered that Wakefield had founded a diagnostic company for "autistic colitis" and was conspiring with a law firm to bring legal action against vaccine manufacturers. Wakefield thus stood to make tens of millions of dollars from his purported link between MMR and autism. In 2007, the medical journal *The Lancet* finally retracted Wakefield's paper based upon these investigation findings, after 10 of Wakefield's 12 co-authors had rescinded their authorship. In 2010, the UK's General Medical Council found Wakefield and Dr. John Walker-Smith (another co-author) guilty of professional misconduct, and Wakefield was banned for life from practicing medicine in the UK.

Since the U.S. CDC declaration of measles elimination 2000, the US has experienced a number of notable measles outbreaks:

- 2008 - California: An unvaccinated 7-year-old who traveled to Europe contracted measles, leading to an outbreak affecting 11 additional unvaccinated children.
- 2001 – Multi-state: The country experienced 220 reported cases of measles, a significant increase compared to previous years.
- 2013 - Texas: An outbreak occurred among members of a church in Newark, Texas, after unvaccinated individuals contracted measles during international travel, leading to at least 20 cases.
- 2014 - Ohio: An outbreak in an underimmunized Amish community resulted in 383 cases,
- 2015 - California: A significant outbreak linked to Disneyland in Anaheim led to 147 cases across multiple states.
- 2017 - Minnesota: A measles outbreak occurred primarily among the Somali-American community, resulting in 78 confirmed cases.
- 2018 - New York: An outbreak in New York City and surrounding areas led to 423 confirmed cases, predominantly affecting Orthodox Jewish communities.
- 2019 – Multi-state: The country faced the largest number of reported measles cases since 1992, with 1,274 cases across 31 states.
- 2025 - Texas and multiple states: An ongoing outbreak has resulted in 935 confirmed cases, at least 121 hospitalizations (mostly children), and three confirmed deaths. These are the first U.S. measles fatalities in a decade and, sadly, include the first the US measles fatality in a child in 20 years.

These outbreaks underscore the importance of maintaining high rates of vaccination coverage to prevent the resurgence of measles.

Vaccine Recommendations

Children: Current CDC childhood vaccine guidance recommends a first dose of MMR vaccination for children between 12 – 15 months of age, with a second dose administered between the ages of 4 – 6 years. This two-dose schedule essentially produces lifelong immunity.

In high-risk settings (outbreak or prior to international travel), most expert groups suggest that children who received an initial MMR after age 12 months but have not yet received a booster can receive the second MMR dose, with at least 1 month passing between first and second dose. In some circumstances, physicians and public health authorities may recommend vaccination for children at risk between the ages of 6 - 12 months. In most cases, these children will be recommended to continue with the standard vaccination schedule afterward, but those decisions should be made in consultation with a pediatric specialist.

Adults: Every adult should have adequate evidence of high-level immunity against measles. For most, this means **documentation** of two doses of MMR vaccine.
Depending on when you were born, your prior vaccination and immunity status can vary widely. If you were born:

- Before 1957: Unless you were raised in a cave way up in the mountains, you had measles as a child. We assume that you have lifelong immunity.* [1]
- Between 1957 – 1967: You may have received a measles vaccine as a child (almost certainly if born after 1963), but it may have been an inactivated vaccine, which provided inferior protection.
- Between 1968 – 1977: You should have received one dose of live-attenuated measles vaccine as a toddler (MMR after 1971), but you may or may not have received a second dose. A second dose was possible/probable upon entrance to a university or military service.
- After 1977: You should have received two doses of MMR, with the second likely occurring between ages 11 – 12 years.
- After 1989: You should have received the current schedule of MMR doses (roughly at 1 y/o and 4 y/o).

Essentially, if you were born after 1957, you want to have **written documentation** of **two** doses of a **live** measles vaccine.

If you are a healthcare worker exposed in an outbreak or in other high-risk settings, you should have **formal** documentation of measles immunity, regardless of your birth year. Formal documentation consists of any one of these:

- *Written record* of two doses of a live measles vaccine.
- *Laboratory-documented* measles infection (very rare)
- Protective antibody titer against measles (blood test)

If you have any doubts about your vaccination status, I recommend getting a dose of MMR vaccine. If you think you were never vaccinated as a child or if you are considered a healthcare worker/high-risk category and have no written documentation of measles vaccination, you should get a two-shot series of MMR. You can get a blood test to document antibodies against measles, but this adds an extra step and delay, and you may ultimately need the vaccine anyway.

MMR vaccination also gives you additional protection against mumps and rubella. MMR effectiveness against mumps is slightly lower than for measles, immunity does wane over time, and we are seeing periodic outbreaks of mumps. In addition to parotid gland swelling that makes you look like a chipmunk, mumps can cause severe inflammation of the testicles, ovaries, and brain. These are much less humorous than the chipmunk part. Rubella is a mild disease in kids and adults, but it causes catastrophic birth defects in babies born to mothers infected early in pregnancy. So, an extra dose (or two) of MMR has additional benefits.

MMR vaccine has an excellent safety profile. No legitimate study has linked MMR to an increased risk of autism or other developmental disorders, and we have no data to suggest that combining M+M+R increases risk over separating vaccines. Of course, no vaccine, drug, or treatment is completely free of risk. We do see serious adverse complications from MMR, but they are fortunately extraordinarily rare. It is also true that some people are injured by seatbelts every year. That doesn't mean that you shouldn't wear your seatbelt – you are much, much more likely to have your life saved by that seatbelt than to be injured by it.

Bottom Line

The trend of increasing measles cases likely will continue. If you have seen with your own eyes your immunization record, and it contains 2 doses of live measles vaccine (MMR), you do not need to do anything else. You are protected from measles. If this is not true, you should read the recommendation section above.

Interesting References and Reading

- CDC information and guidance on measles vaccine: https://www.cdc.gov/measles/vaccines/index.html
- CDC website on measles outbreaks and vaccination statistics: https://www.cdc.gov/measles/data-research/index.html
- CDC website on school vaccine exemptions trends and with interactive vaccination trends by state: https://www.cdc.gov/schoolvaxview/data/index.html
- A good review article of measles from *The Lancet* – I can provide the pdf version if folks do not have UNMC library access: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(17)31463-0/fulltext
- Cochrane systematic review of MMR vaccines. Cochrane is generally respected as providing the most thorough and in-depth reviews of medical science evidence for safety and efficacy. This is dense reading and not for the faint of heart. https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD004407.pub4/full
- A review of the book by Brian Deer, the investigative journalist that broke the Wakefield case: https://pmc.ncbi.nlm.nih.gov/articles/PMC7759370/
- British Medical Journal piece by Deer on Wakefield's money-making scheme: https://www.bmj.com/content/342/bmj.c5258.long

[1] **We do exclude healthcare workers from this assumption given the high risk of exposure and consequence of nosocomial transmission. Healthcare workers (and others at very high risk, e.g. exposed or in an outbreak) need formal documentation of immunity.*