Pediatric Vaccine Conversations: Addressing Common Concerns

Rebecca Bakke, MD, FAAP

About our Speaker

Rebecca Bakke, MD, FAAP, is a graduate of Concordia College in Moorhead, Minnesota and the University of North Dakota School of Medicine & Health Sciences in Grand Forks, North Dakota. She completed her residency in general pediatrics at Nationwide Children's Hospital with the Ohio State University Medical Center in Columbus, Ohio. She is currently a pediatrician at Sanford Children's Southwest Clinic in Fargo, North Dakota, and has been practicing for 15 years.

What you will learn:

1. Review frequently asked questions and misconceptions healthcare providers encounter regarding childhood vaccinations.

2. Discuss clear, research-backed answers and communication strategies that effectively address vaccine-related questions from patients and caregivers.

3. Describe healthcare providers' ability to engage in productive, empathetic conversations that build trust and encourage vaccine confidence among patients and families.

Too many too soon

Case Study #1: Too many too soon

Jenna looks great! She is growing and developing perfectly. You are doing a fantastic job. Since she is 2 months old, she is due for her first set of vaccines today. That means 3 shots in her legs and one vaccine that is a drink she will take by mouth. Do you have any questions?

Three shots is a lot! I am not anti-vax, but I don't want to do them all today. It sounds like too much for her little body. Can we do the most important one today and I'll come back every few weeks for the other ones?

The Facts: Too many too soon

- When babies are born, they leave a sterile environment (the womb) and are exposed to thousands of different bacteria and organisms within minutes
- Immune systems are well equipped to handle multiple challenges at once

CHOP VEC, 2018; CDC, 2024

The Facts: Too many too soon

- **Thousands to Millions of Bacteria & Viruses:** Every day, babies encounter millions of germs—on their skin, in their mouths, through breathing, and by touching people and objects.

- **Safety and Benefit:** Most germs babies encounter every day are harmless, but vaccine-preventable diseases can be serious. Vaccines safely train the immune system to fight these threats, helping prevent severe illness and hospitalization.

Hill et al, Microbiome, 2017; Dominguez-Bello et al, PNAS, 2010; IOM, 2002

More Childhood Vaccines - But Fewer Antigens

Thanks to advances in technology, vaccines today contain fewer antigens.
Even with more vaccines, the total immunologic load is much less.

Number of Immunogenic Proteins and Polysaccharides Contained in Vaccines Over the Past 100 Years

1900	
Vaccine	Protein
Smallpox	~200
TOTAL	~200

1960	
Vaccine	Protein/Sugar
Smallpox	~200
Diphtheria	1
Tetanus	1
WC pertussis	~3000
Polio	15
TOTAL	~3217

1980	
Vaccine	Protein/Sugar
Diphtheria	1
Tetanus	1
WC pertussis	~3000
Polio	15
Measles	10
Mumps	9
Rubella	5
TOTAL	~3041

2000	
Vaccine	Protein/Sugar
Diphtheria	1
Tetanus	1
Acellular pertussis	2-5
Polio	15
Measles	10
Mumps	9
Rubella	5
Hib	2
Varicella	69
Pneumococcus	8
Hepatitis B	1
TOTAL	123-126

2021	
Vaccine	Protein/Sugar
Diphtheria	1
Tetanus	1
Acellular pertussis	2-5
Polio	15
Measles	10
Mumps	9
Rubella	5
Hib	2
Varicella	69
Pneumococcus	8
Hepatitis B	1
Rotavirus	11-16
Hepatitis A	4
TOTAL	138-146

WC = whole-cell
Offit, CHOP VEC, 2021

←Spacing Out Vaccines: The Problems→

- Increases child's vulnerability to disease
- Vaccine errors more likely
- More visits =
  - Increased risk of exposure at the clinic
  - More missed work/school
  - Overwhelm healthcare system during busy times
- Easy to get behind
- CDC/AAP schedule is tested and vetted; alternative schedules are not
- Multiple appointments more stressful for kids

Offit, CHOP VEC, 2024

Case Study #1: Too many too soon

It IS a lot of shots! I get it! And certainly having concerns doesn't make you "anti-vax." I want you to feel comfortable with whatever decision you make, so these conversations are really important. Can we talk about why I would recommend getting all of the vaccines today instead of spreading them out?

Sure.

Case Study #1: Too many too soon

We give all of these vaccines at this young age because we want to protect Jenna as soon as possible from diseases that can cause serious illness or even death. Spacing them out will make her vulnerable longer. Even though it is a lot of shots, science has advanced so much that stress on her immune system is actually much less than it was when the only vaccine we gave was the smallpox vaccine! There is really no medication that is better studied than these childhood vaccines—we take safety very seriously since we are giving them to young, healthy patients. Does that make sense? What other questions do you have?

No, that makes sense, I guess we can do them all today.

Q & A

Weighing the Risk of Measles and MMR Vaccine

Case Study #2: Weighing the Risk

The nurse just told me that Johnny is due for his MMR shot today. I am really not sure that I want him to have that. I was just watching the news, and I have heard that we are all being misled about measles. And prominent people support these claims - I feel like maybe we should rethink vaccines? I also heard that the measles vaccine routinely causes death! That's really scary.

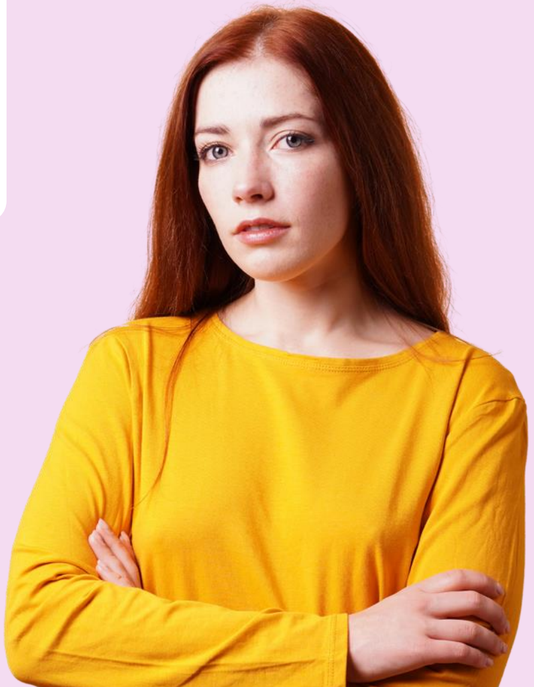
I hear you. It sounds like you've been really paying attention to what's out there, and you want to make the safest choice for your child. That makes a lot of sense. Can you tell me more about what you have heard?

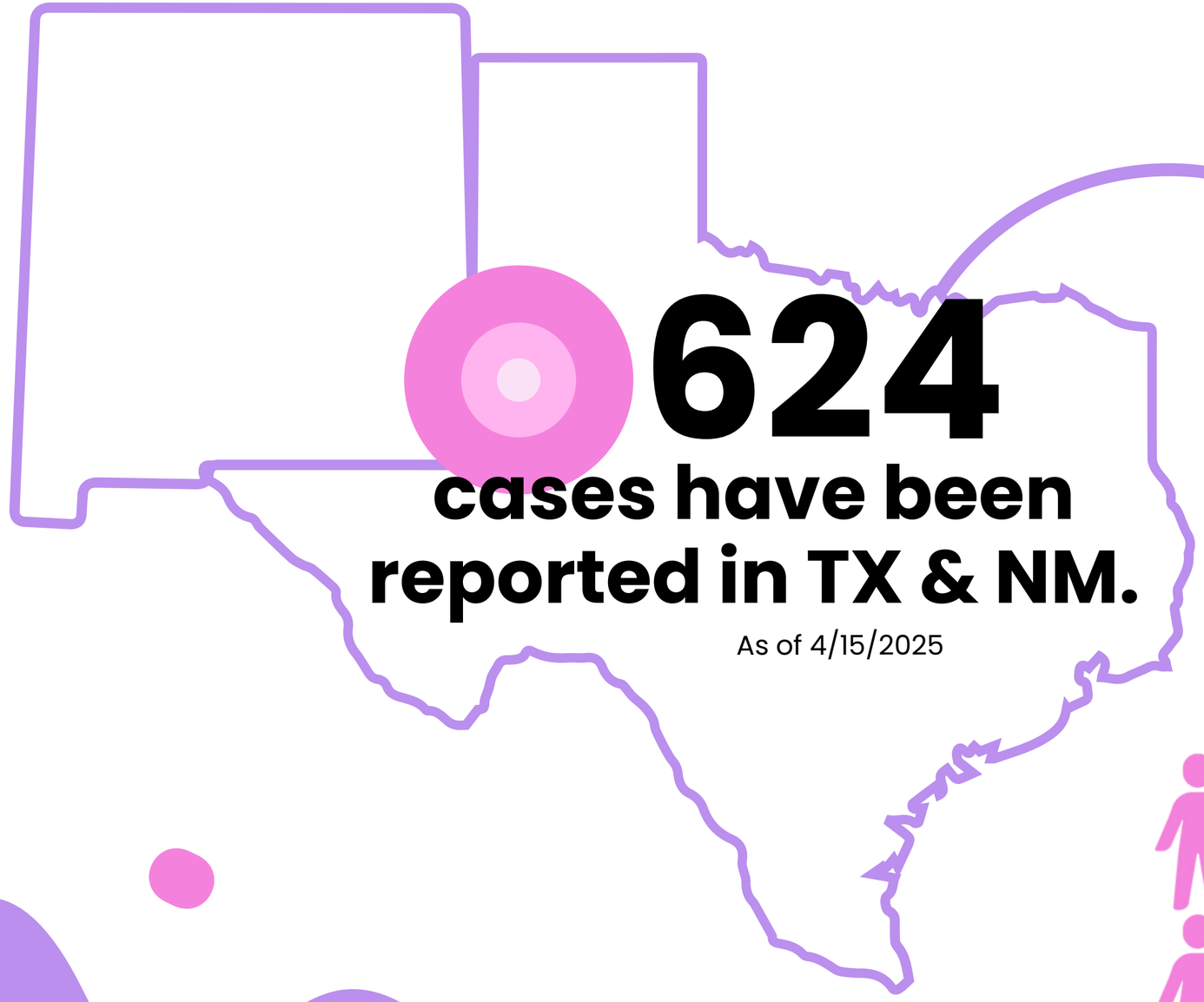
Case Study #2: Weighing the Risk

Well, the news made it sound like measles is just a normal childhood illness, and we all got through it fine before. And if the vaccine is actually dangerous—if it's really killing kids—why would I risk it?

I can see why that would be concerning. You're weighing both sides here—whether measles is truly a big deal and whether the vaccine could actually be harmful. Would it be okay if I shared some information that might help?

Yeah, I mean, I just want the truth. It's so confusing when someone in charge is saying one thing, and doctors are saying another.



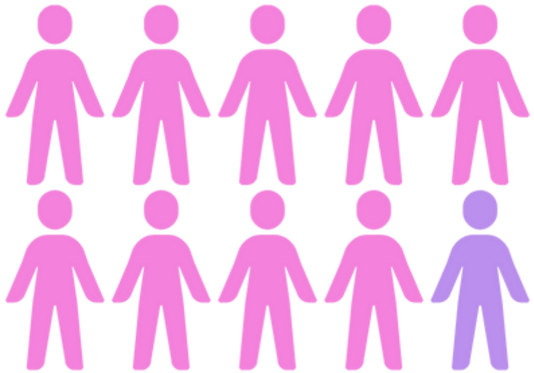


624

cases have been reported in TX & NM.

As of 4/15/2025

In 2024, there were a total of 285 cases *nationwide*.



Over 95% of cases are in unvaccinated individuals.

Texas DHHS, 2025; CDC, 2025

One death from a preventable disease is one too many.

In 2025, there have been three deaths from measles - some of the first to occur from the virus in over a decade in the U.S.

The Atlantic

HEALTH

HIS DAUGHTER WAS AMERICA'S FIRST MEASLES DEATH IN A DECADE

A visit with a family in mourning

By Tom Bartlett

Photographs by Jake Dockins

MARCH 11, 2025

SHARE SAVE

Annual measles cases and deaths, United States

As of April 5, 2025. Bars=cases; Black circles=deaths

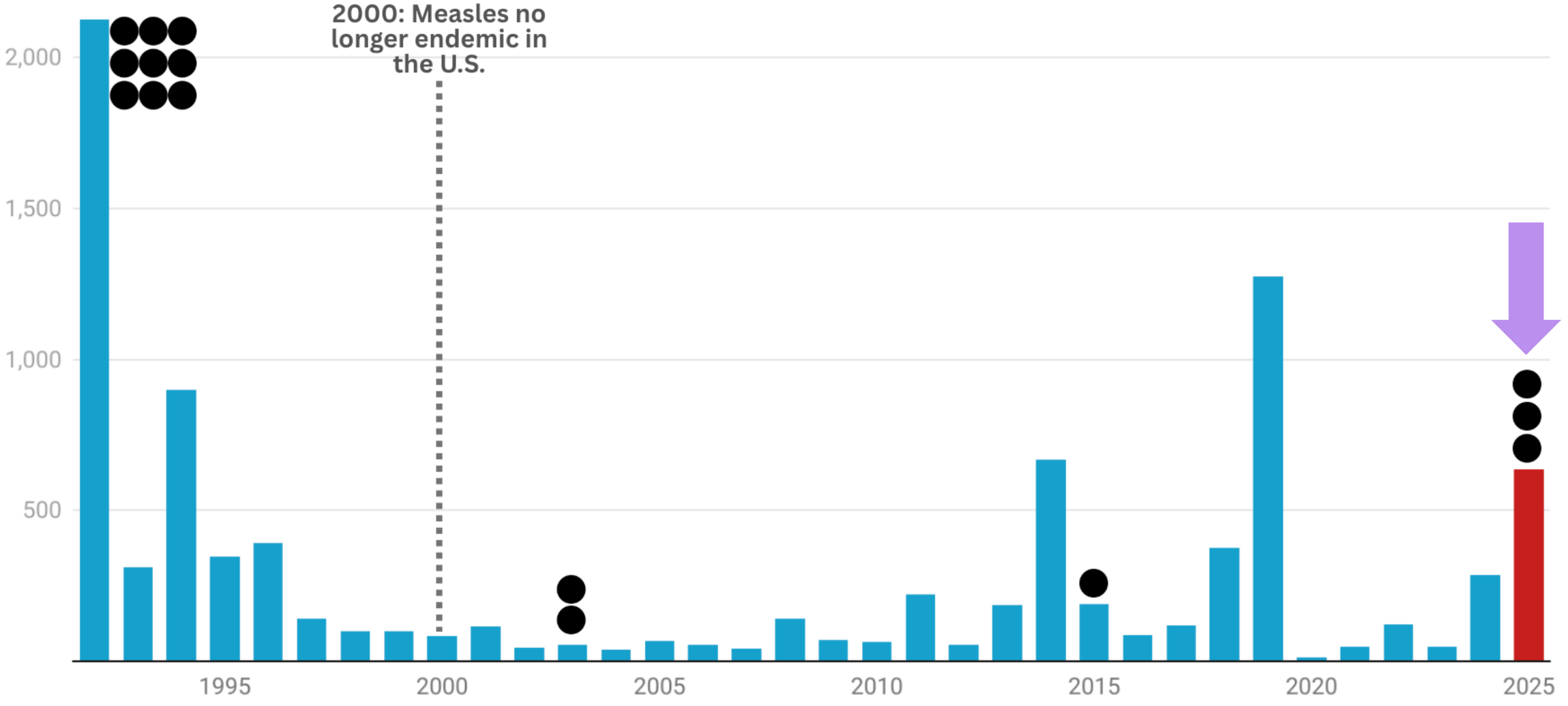


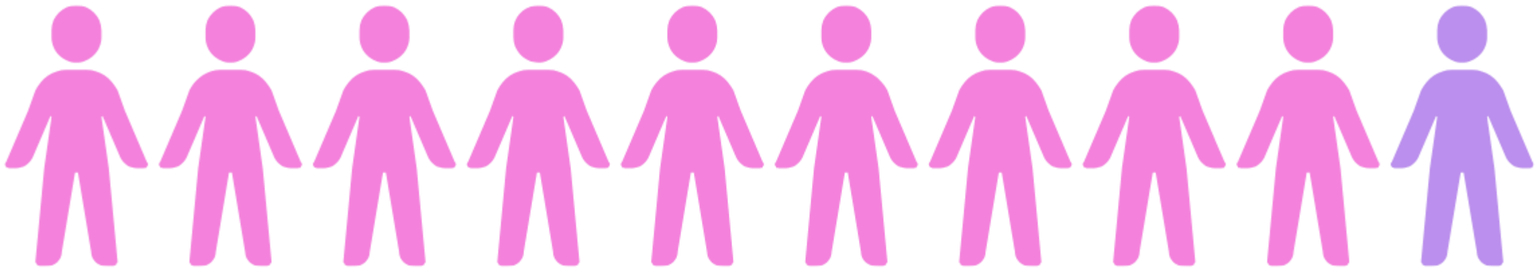
Chart: Your Local Epidemiologist • Source: Yale School of Public Health SITREP • Created with Datawrapper

Measles is Highly Contagious

Measles is the ***most contagious disease*** in the world.

A person with measles can ***spread it to others even before they have the disease*** - from 4 days before developing the measles rash.

If ONE person has measles, ***9 out of 10 people*** who are not immune (had measles or been vaccinated against it) will ALSO become infected.



CDC, 2025; CIRE Handout; Kondamudi & Waymack, StatPearls, 2023

Immune Amnesia

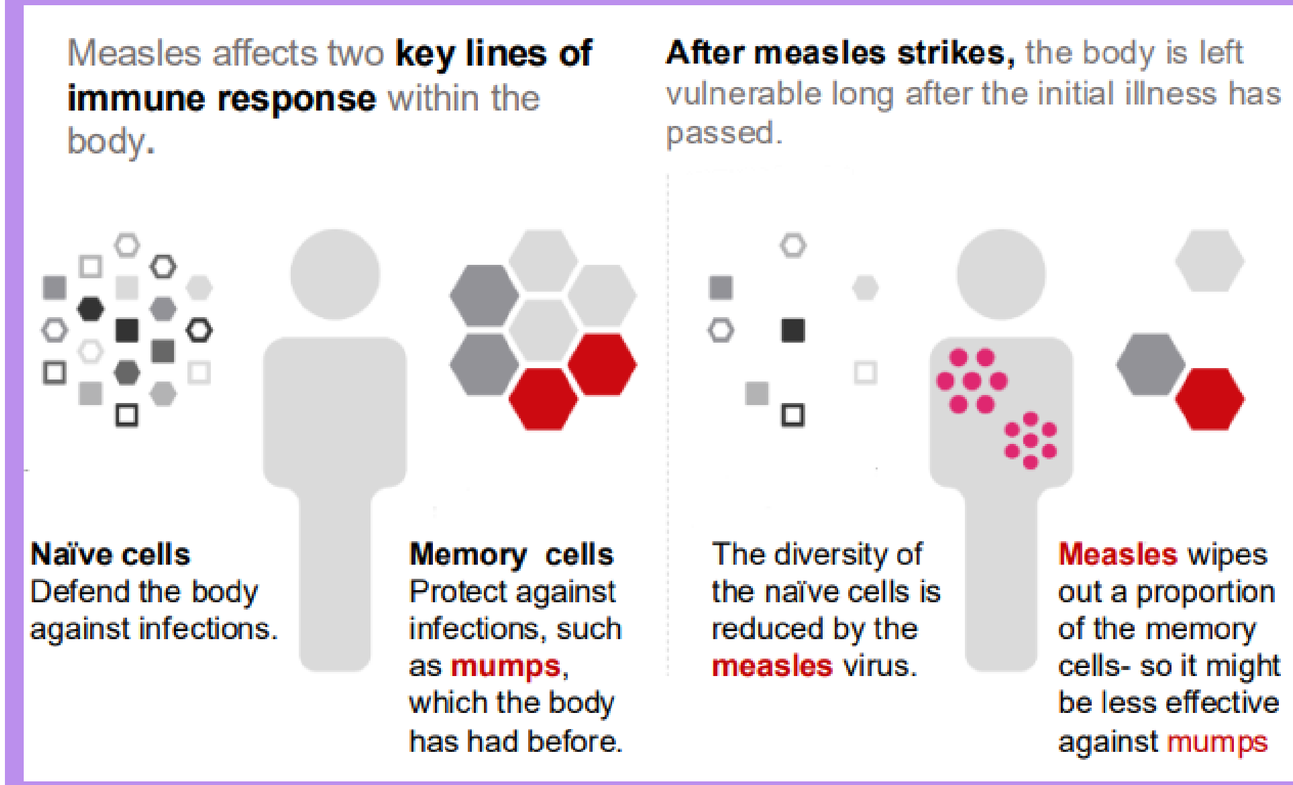
A condition where the immune system forgets previously acquired immunity following a measles infection.

HOW does this happen?

The virus destroys memory cells in the immune system = loss of previous acquired immunity.

- *11-73% reduction in one's antibodies*
- *Children who recover from measles have a higher risk of dying from other infections for 2-3 years due to loss of immunity*

How measles leaves the body vulnerable.



Mina et al, Science, 2019; YALE ESF-8, Special Report, 2025; CIRE Handout

Subacute Sclerosing Panencephalitis (SSPE)

A very rare but fatal disease of the central nervous system that can develop 7-10 years after a person has fully recovered from a measles infection.

- 4-11 per 100,000 cases of measles result in SSPE.
- Treatment may ease symptoms, but SSPE is ALWAYS fatal.
- People with this disease die ~1-3 years after diagnosis.

Rocke & Belyayeva, StatPearls, 2023; CIRE Handout

MEASLES IS VERY PREVENTABLE

The measles, mumps, rubella (MMR) vaccine is highly effective:

93% **effective at preventing measles after 1 dose**

97% **effective at preventing measles after 2 doses**

Extensive research, including numerous high-quality studies involving millions of children, demonstrates that the MMR vaccine is safe and effective, with serious adverse events being extremely rare, and the benefits of vaccination far outweighing the risks of measles.

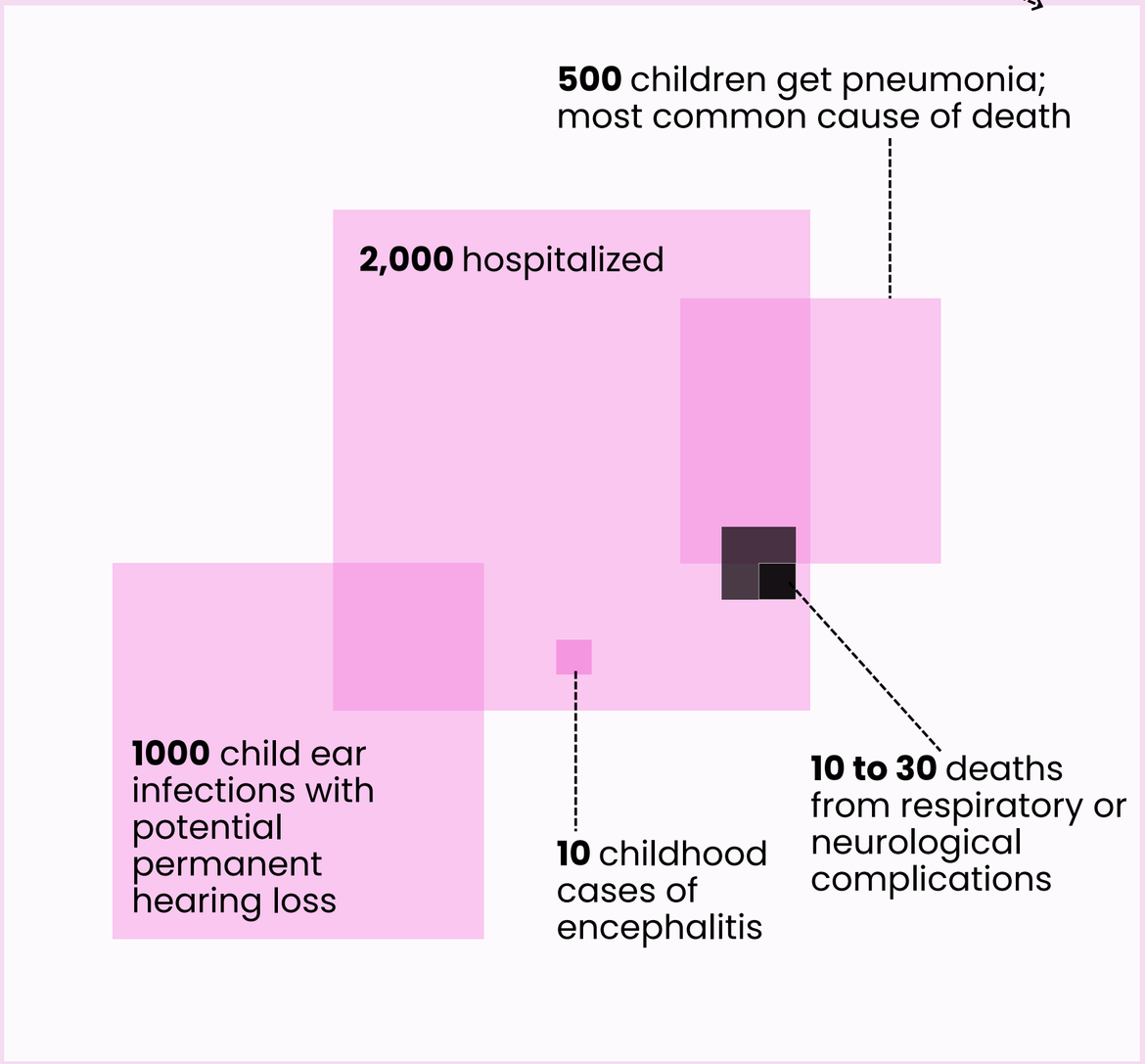
CDC, 2025

25+ articles refute a connection between MMR vaccine and the development of autism. *Let's look at a few...*

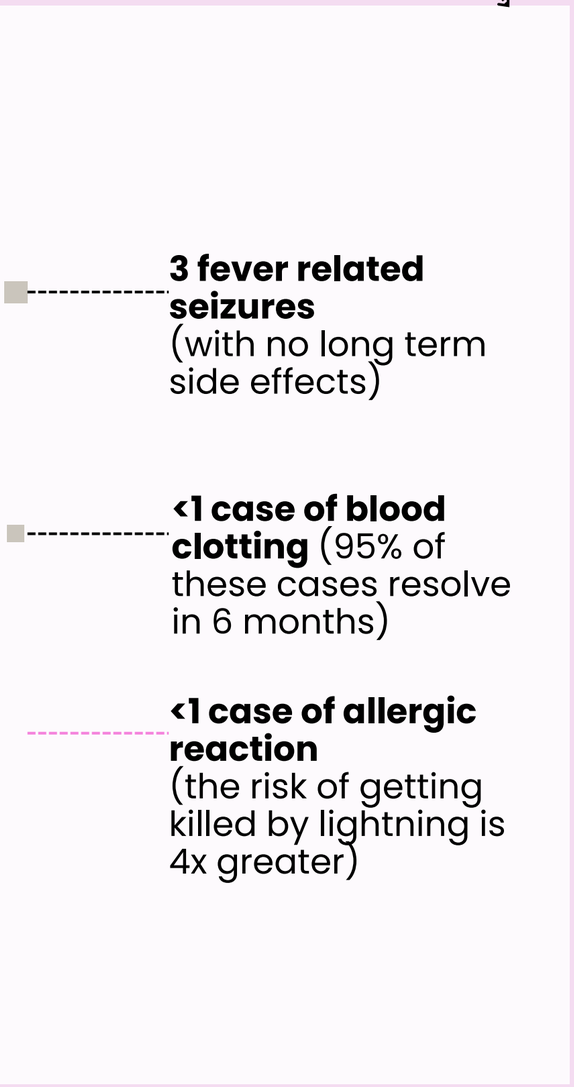
Study	Location & Sample Size	Findings
Madsen et al., 2002	Denmark, 537,000+ children	No difference in autism rates between vaccinated and unvaccinated children.
Andrews et al., 2004	UK, 500,000+ children	No link between MMR and autism, even in high-risk children.
DeStefano et al., 2013	U.S., CDC study - 1,000+ children	No increased autism risk from MMR vaccine.
Taylor et al., 2014	Meta-analysis, 10 studies, 1.2M+ children	Comprehensive review found no association between MMR and autism.
Uno et al., 2015	Japan, 400+ children	Autism rates continued to rise even after MMR was discontinued, disproving causation.
Hviid et al, 2019	Denmark, 650,000+ children	MMR vaccine does not increase risk for autism, nor does it trigger autism in susceptible children.

Comparing the risk: Measles vs MMR Vaccine

Effects per 10,000 people who get measles



Effects per 10,000 people who get MMR Vaccine



Potentially serious complications shown in pink

NYT, 2020

Case Study #2: Weighing the Risk

I completely understand how confusing this can be, especially when there are mixed messages from people in leadership. The truth is, measles used to be one of the deadliest childhood diseases. Before the vaccine, hundreds of kids died from it every year in the U.S., and thousands were hospitalized with complications like pneumonia and brain swelling. Even today, in outbreaks, we still see kids getting very sick.

I guess I didn't realize measles could be that bad.

It's easy to forget because we don't see measles much anymore—that's because the vaccine has worked so well. But measles isn't just about the rash and fever - it can lead to death. Just in the outbreak in Texas this year, two previously healthy children have died from the virus. And even in kids who recover, measles can erase hard-earned immune memory, leaving them vulnerable to other infections like pneumonia and the flu.

What do you mean?

Case Study #2: Weighing the Risk

Measles can cause a condition called immune amnesia, where the immune system "forgets" how to fight off infections. This can affect both children and adults after a measles infection, though the severity varies. As a result, they become more vulnerable to other diseases they were previously protected against. Even after recovering from measles, a person may experience more frequent illnesses in the following months or years.

Wait, so measles wipes out immunity to other diseases?

Exactly. That’s why after measles outbreaks, we sometimes see an increase in other infections like pneumonia and ear infections. It’s like hitting the reset button on the immune system.

That’s terrifying. I’ve never heard of that before. BUT what about the vaccine causing deaths? That’s terrifying.

Case Study #2: Weighing the Risk

I completely understand why that would be alarming. But I want to reassure you—decades of research have shown that the MMR vaccine is extremely safe. The claim that it routinely causes death is simply not true. Severe reactions are incredibly rare—much, much rarer than the complications from measles itself.

But how do we know for sure? Isn’t the CDC looking into the vaccine causing autism?

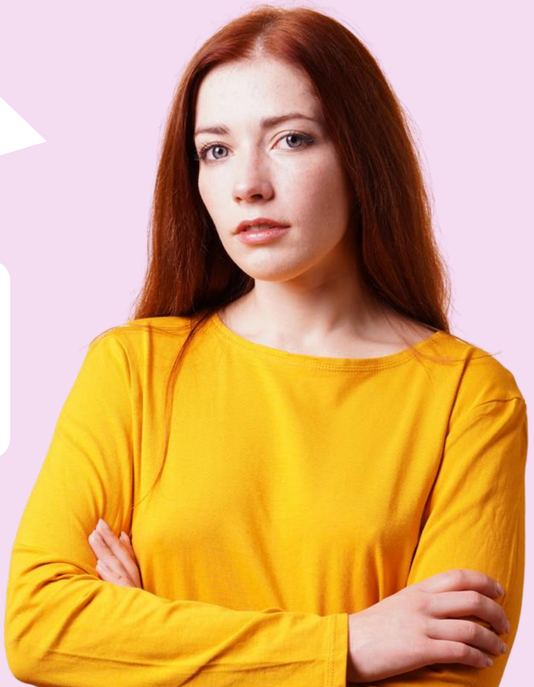
Great question. We've used the MMR vaccine since the 1970s and have safety data from millions of children. Scientists closely monitor vaccine safety, and there's no evidence the MMR vaccine causes harm. Many studies have specifically looked for a link to autism and found none. In contrast, measles can be deadly.

I don’t know… I just feel like I don’t know who to trust anymore.

Case Study #2: Weighing the Risk

I totally get that. It’s overwhelming when there’s so much conflicting information. My goal isn’t to pressure you—it’s to make sure you have all the facts so you can make the best decision for your child. If you’d like, I can show you some of the actual research and safety data so you can review it yourself.

Yeah, I think I’d like to see that. I just want to be sure I’m doing the right thing.



That makes total sense. I really appreciate how much thought you’re putting into this. Let’s go over the information together, and I’m happy to answer any questions you have.

Q&A

Are these shots really necessary?

Case Study #3: Are these shots really necessary?

Since Mateo is 2 months old, it is time for his first set of vaccines! We have combination vaccines in our clinic, so this means he will get two shots in his thighs, and one vaccine that is a drink by mouth. Do you have any questions?

I know today's the first round of vaccines, but I've been reading up a bit, and honestly, I'm not sure they're really necessary. We don't see these diseases in the U.S. anymore, and from what I've read, they were already going away before vaccines were introduced thanks to better hygiene and nutrition.

Thank you for sharing that. It's completely understandable to want to know what's best for your baby—and it's great that you're doing your homework. Would it be okay if I talked through a few things that might help?

Ok, sure.

It’s true! Many of these diseases are now very rare in the U.S. thanks to vaccines and other advancements in public health. ***BUT:***

We live in an interconnected, global society, and diseases like polio and measles are just a plane ride away.

Infections such as *Clostridium tetani* (tetanus) live in our natural environment, and so the threat will never be eliminated.

DID YOU KNOW?

Smallpox has been ***eradicated*** worldwide, and we no longer vaccinate against this disease - thanks to vaccines!

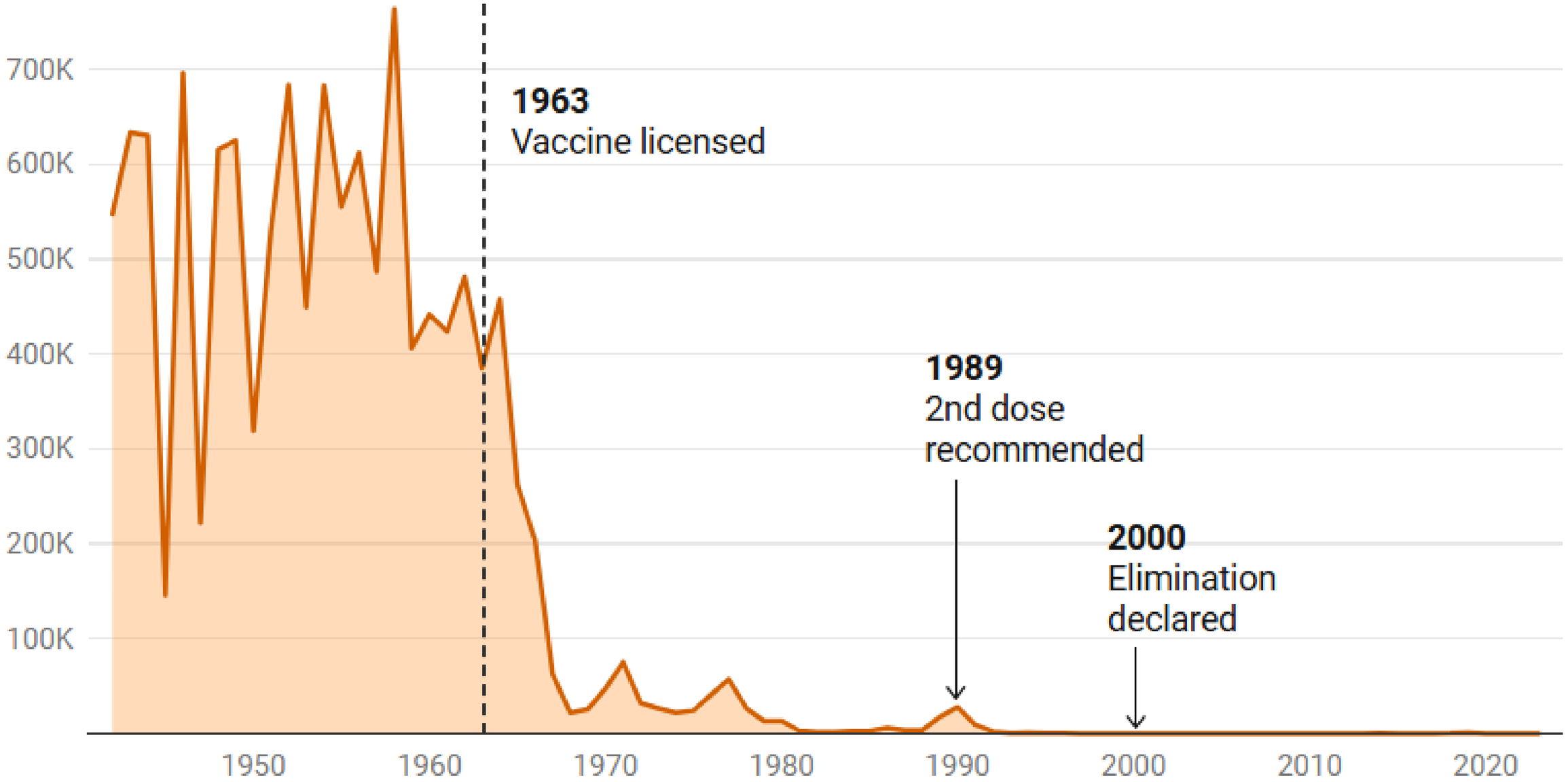
Talbird et al, Pediatrics, 2022; CDC, 2024; CDC HAN, March 14, 2024

Improved hygiene and nutrition, among other factors, can certainly lower the incidence of some diseases.

Data documenting the number of cases of a disease before and after the introduction of a vaccine, however, demonstrate that ***vaccines are overwhelmingly responsible for the largest drops in disease rates.***

The public health success of the measles vaccine

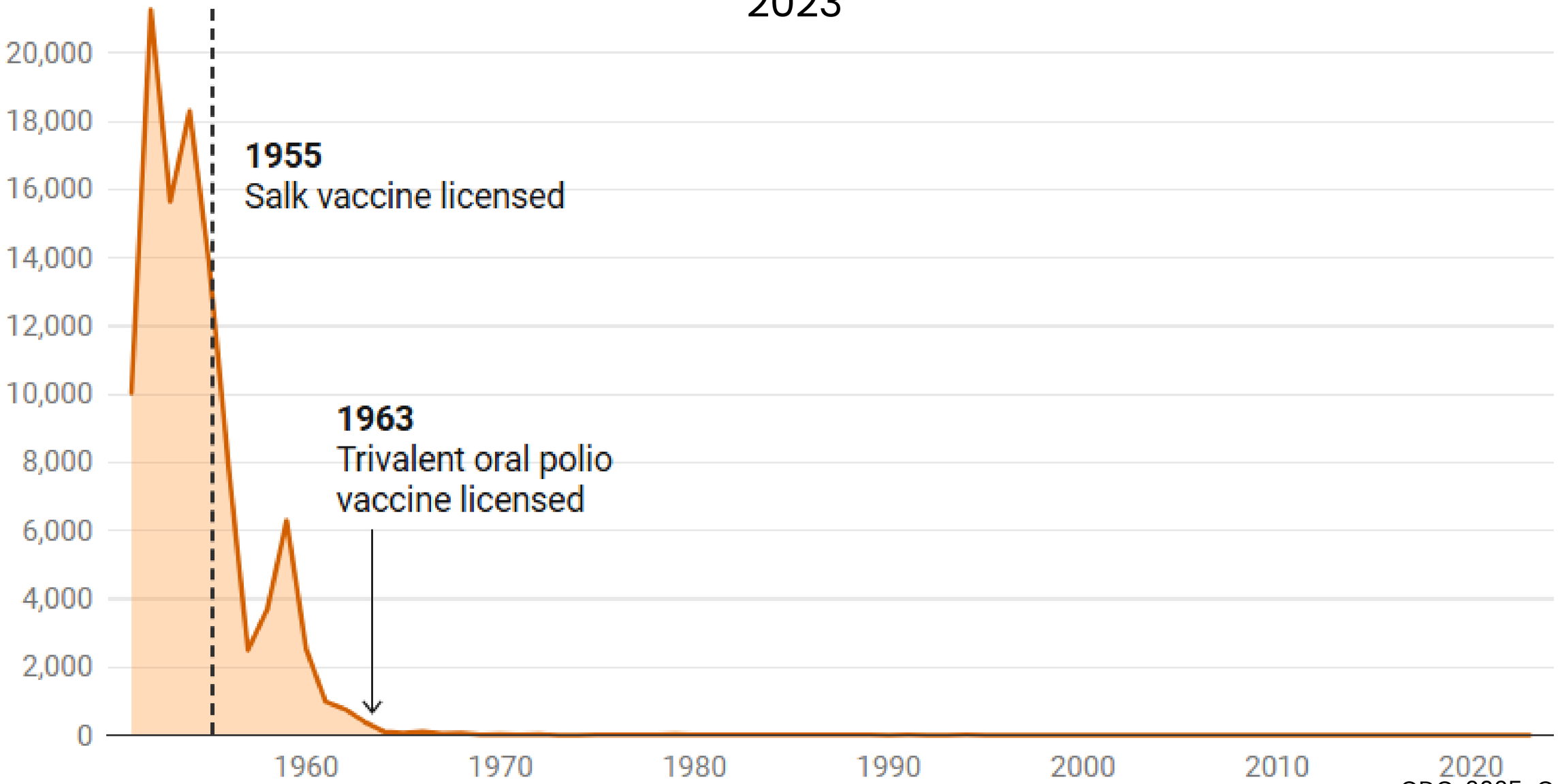
Reported number of measles cases in the US, 1942–2023



CDC, 2025; CAP, 2025

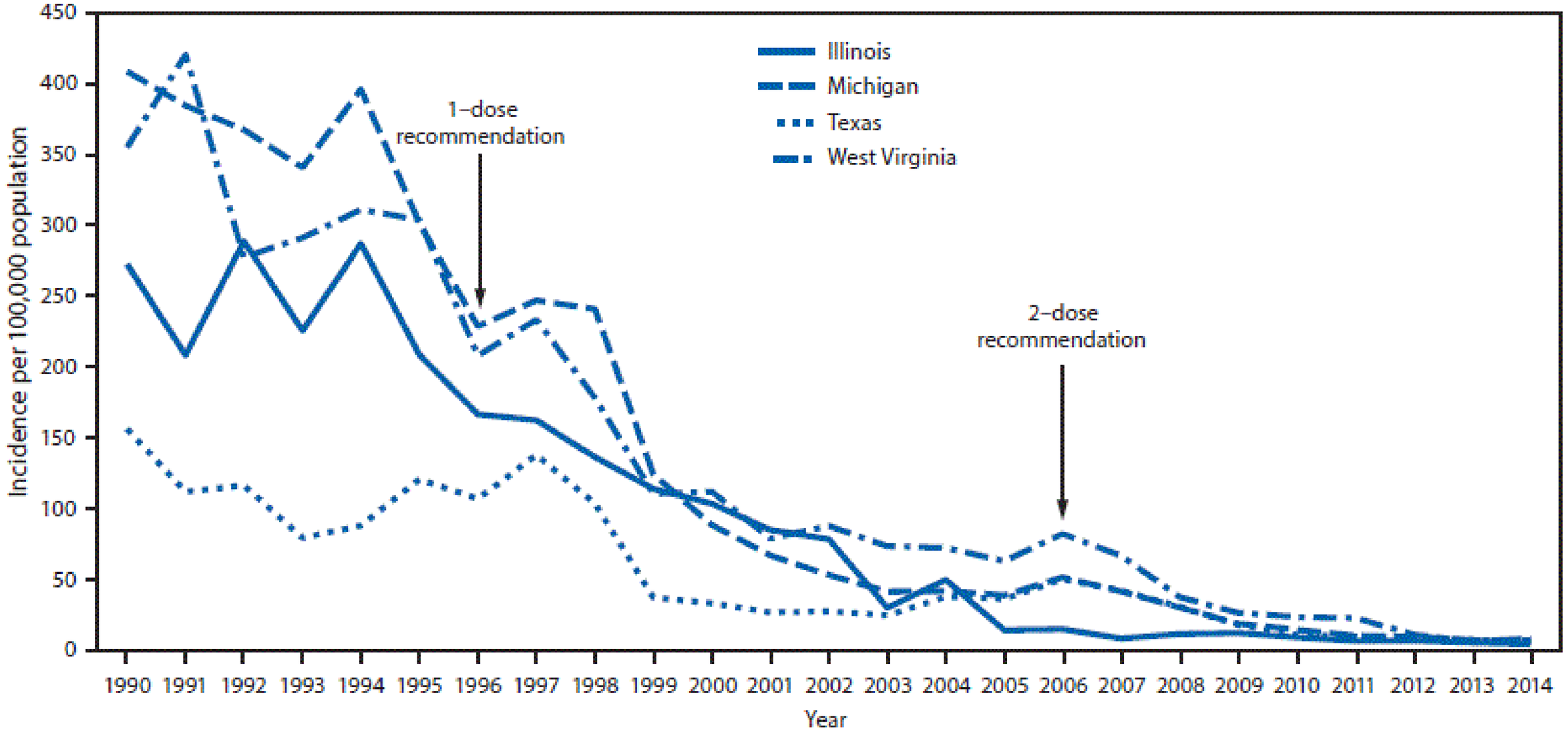
The public health success of the polio vaccine

Annual number of new cases of paralytic poliomyelitis in the US, 1951–2023



CDC, 2025; CAP, 2025

Varicella incidence per 100,000 population in states that have reported varicella cases to CDC annually since before implementation of the varicella vaccination program — Illinois, Michigan, Texas, and West Virginia, 1990–2014



Lopez et al, MMWR, 2016

Routine Vaccination Saves Lives

Disease	Illnesses prevented	Hospitalizations prevented	Deaths prevented
Diphtheria	7,528,000	7,528,000	752,800
Tetanus	5,000	5,000	700
Pertussis	80,738,000	3,646,000	28,400
Haemophilus influenzae type b	536,000	495,000	20,300
Polio	1,847,000	786,000	21,900
Measles	104,984,000	13,172,000	85,000
Mumps	63,355,000	2,020,000	300
Rubella	54,225,000	199,000	400
Congenital rubella syndrome	17,000	26,000	1,900
Hepatitis B	6,061,000	940,000	90,100
Hepatitis A	4,048,000	1,969,000	123,200
Varicella	106,270,000	272,000	1,900
Pneumococcus-related diseases	47,804,000	1,969,000	123,200
Rotavirus	30,265,000	819,000	400
Total	**507,683,000**	**31,955,000**	**1,128,800**

Zhou et al, MMWR, 2024; CAP, 2025; Shattock et al, Lancet, 2024

Assessing Measles Outbreak Risk in the United States

An example of a school with 100 children and 1 infectious child, at different levels of MMR coverage

MMR coverage	# children susceptible	Chance of an outbreak
97%	6	16%
95%	8	29%
93%	10	36%
90%	13	51%
85%	18	61%
80%	22	64%
70%	32	78%

CDC, 2024

Case Study #3: Are these shots really necessary?

You're absolutely right that things like clean water and better hygiene helped improve overall health. But when we look at the sharp, dramatic drops in diseases like polio, it happened after the vaccine was introduced. In the 1950s, polio paralyzed over 15,000 people every year in the U.S.—and after the vaccine came out in 1955, the numbers dropped quickly. We haven't had a case of naturally occurring polio in the U.S. since 1979.

So it's gone?

It's gone here because we keep vaccinating—but polio still exists in other parts of the world. And it really is just a plane ride away. In fact, there was a case of paralytic polio in New York in 2022—an unvaccinated adult got infected after the virus was brought in from overseas and spread in an under-vaccinated community.

Wait, really?

Case Study #3: Are these shots really necessary?

Yes. All it takes is one vulnerable person traveling to a place where vaccine-preventable diseases still circulate, then coming back to a community where not enough people are vaccinated. That's how outbreaks happen—even with diseases we thought were gone. What stands out to you about what I shared?

Wow, I guess I hadn't really thought about it like that. I appreciate you acknowledging that other things have also impacted rates of diseases, beyond vaccines.

Vaccines have worked so well that we just don't see these diseases anymore. But stopping vaccinations doesn't mean the risk disappears. It's like taking the locks off your doors because you haven't had a break-in—you only notice the danger when it's too late.

That's a good point.

Case Study #3: Are these shots really necessary?

What other questions do you have about Mateo’s vaccines today?

I guess I don’t have any other questions. I’m just not sure I’m ready to make a decision today.

Of course, I want you to feel confident in the decision you make. I recommend these vaccines to all my patients - I feel it is an important part of keeping Mateo on track and healthy. If you’d like, I can provide some handouts that break down what we’ve talked about today, and we can check back in at his next appointment. Would that be okay with you?

Yes, sounds like a plan. Thanks for taking the time to talk to me about this today.

Q&A

Is the remedy worse than the disease?

Case Study #4: Is the remedy worse than the disease?

Alright Isaac, you are ready for kindergarten! I can't wait to hear about it! Before you start, you are due for some vaccines so you don't get sick and you don't get your classmates sick. Mom, Isaac is due for vaccines for MMR, chickenpox, tetanus and polio before starting school. Any questions?

We will pass on the chickenpox vaccine. I had chickenpox as a kid and I am fine, and he's so healthy I know he will be fine, too. Plus, our neighbor got a nasty rash after that vaccine, and I don't have time to deal with that right now.

Is the remedy worse than the disease?

Varicella (Chickenpox) Disease	Varicella (Chickenpox) Vaccine
Rash (300-500 blisters)	Rash (30 blisters): 4/100 patients
Pneumonia or encephalitis: 1/1000 patients	Low grade fever
Birth defects: 1/50 infants whose moms have Varicella	Pain/swelling at site of injection
Bacterial co-infections	**The benefits of a varicella vaccine:** ***Since the chickenpox vaccination program began in the United States, there has been over 97% decrease in chickenpox cases. Hospitalizations and deaths have become rare.***
Guillain-Barré syndrome (GBS) - rare	
Death (100/year prior to vaccine)	

Lopez et al, CDC Pink Book, 2024; Offit, CHOP VEC, 2023

Is the remedy worse than the disease?

Rotavirus Disease	Rotavirus Vaccine
Fever, upset stomach, vomiting, watery diarrhea (sometimes lasting multiple days). Symptoms generally last 3-9 days.	low-grade fever, mild vomiting and diarrhea
Intussusception occurs in 1 in 100,000 cases of rotavirus	**Intussusception occurs in 1 in 20,000-100,000** doses of rotavirus vaccine administered
400,000+ clinic visits each year in US	
200,000+ ER visits each year in the US	
55,000-70,000 hospitalizations each year in the US	
20-60 Deaths each year in US	

The benefits of a rotavirus vaccine:

9 in 10 ***infants vaccinated are protected from severe rotavirus disease.***

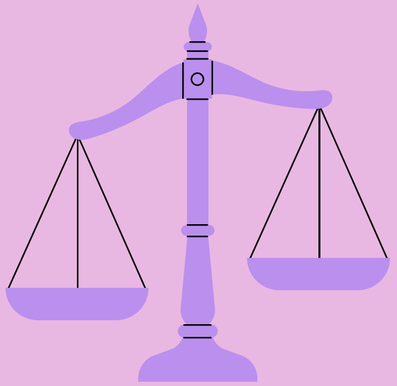
7 in 10 ***infants vaccinated are protected from rotavirus disease of any severity.***

94-96% ***of vaccinated children are protected from hospitalization.***

Offit, CHOP VEC, 2024; Cortese & Haber, CDC Pink Book, 2024; immunize.org, 2023

It is important to acknowledge that vaccine side effects exist.

- All meaningful medical interventions have some risk
- Tolerance is low for vaccine-related complications since those that get the vaccines are young and healthy
- Pre- and post-market surveillance helps to pick up rare side effects (1 per 100,000 or a million doses administered)



Serious complications are extremely rare.

Side effects from vaccines must be considered along with the potential complications from the diseases they prevent.

CDC, 2025

Case Study #4: Is the remedy worse than the disease?

I'm sorry to hear about your neighbor! You are right, this vaccine can cause a mild rash and low grade fever about 1-2 weeks after it is given. However, it's extremely mild compared to the rash from chickenpox disease, and if he's infected, he will likely be out of school for 1-2 weeks! And while Isaac is healthy and is likely to recover without issue, if he gives chickenpox to a newborn baby or someone who is immunocompromised, they could get seriously sick. Also, one of the major reasons we vaccinate against this is because women who get chickenpox when they are pregnant can have babies with serious birth defects.

Hmmm. My sister is pregnant. I'll have to do some more research.

Sure! I know you don't take these decisions lightly. Can I offer you some resources to help with your research?

Sure.

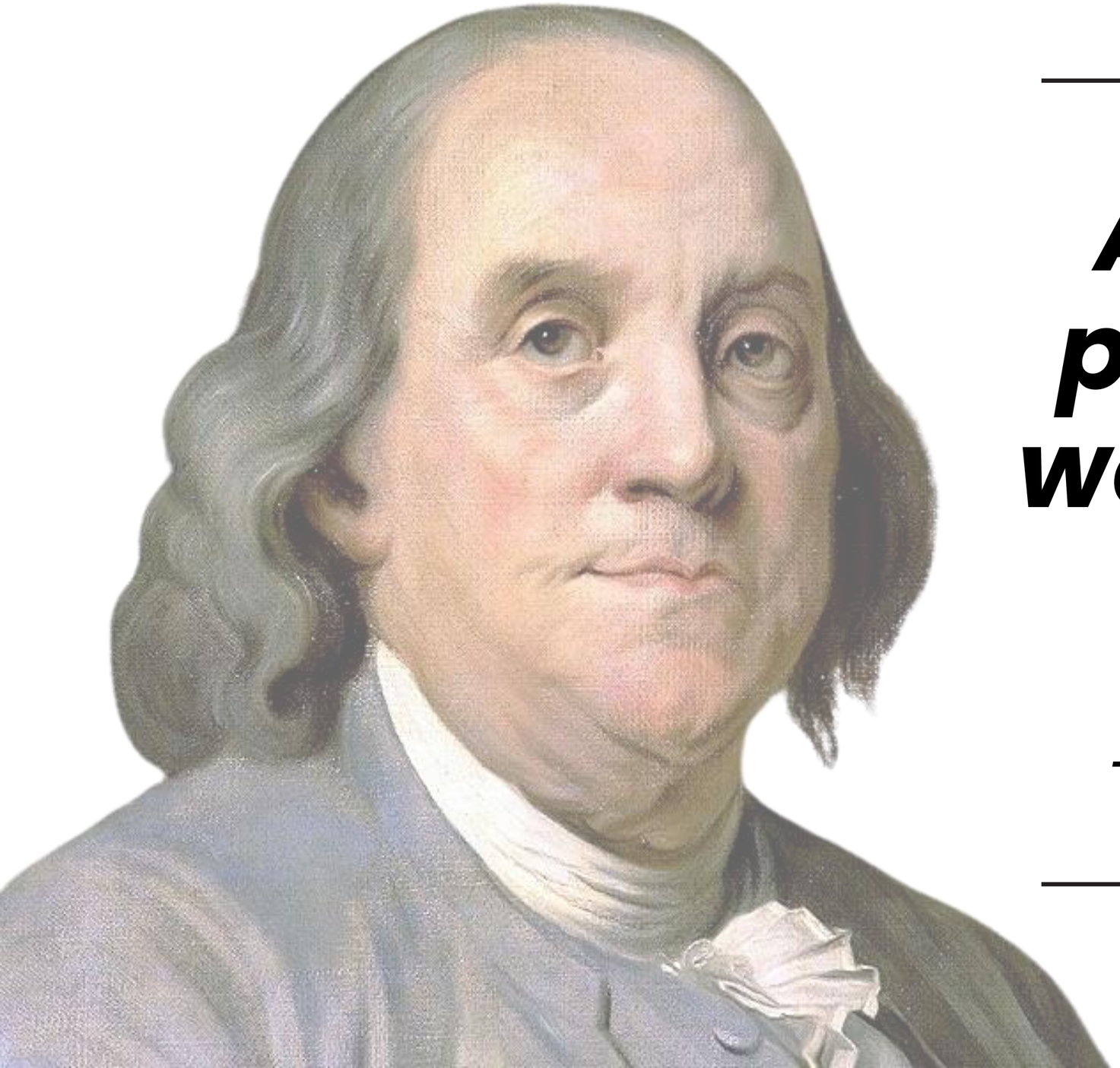
Q & A

An Ounce of Prevention

Case Study #5: An Ounce of Prevention

Great to see you today, Marta! Good luck in your soccer game this weekend. Now that you are 10, you are due for the HPV vaccine, which prevents certain kinds of cancer. I will have my nurse give that to you before you leave. Any questions?

Whoa! Already? We are not doing that vaccine, she's only 10! Besides, if she just gets regular Pap smears as an adult, she won't have to worry about getting cervical cancer.



An ounce of prevention is worth a pound of cure.

-Benjamin Franklin

An Ounce of Prevention:

Human Papillomavirus (HPV)

HPV Vaccine

~100% protection from persistent HPV infection, cervical intraepithelial neoplasia and adenocarcinoma in situ

99% prevention of genital warts

Within 10 years of HPV vaccination approval, HPV types 6,11,16 and 18 decreased by:

86% in 14-19 year old females

71% in 20-24 year old females

Meites, CDC Pink Book, 2024

An Ounce of Prevention:

Human Papillomavirus (HPV)

Pap Smear

Detects pre-cancerous changes in cervical cells

Includes HPV testing

Does not prevent cervical cancer, but allows for early detection and treatment

When pre-cancerous/cancerous cells are found, further procedures and treatment are necessary.

It is important to acknowledge that the HPV vaccine doesn't cover every single HPV strain that causes cancer - the vaccine is not 100% effective (but close!)

Meites, CDC Pink Book, 2024

Comparing the risks:

HPV disease per year in U.S.	HPV vaccine
11,000 Cervical Cancer	Redness, swelling at injection site
196,000 cervical precancers	Low grade fever
Other cancers: 14,000 back of throat 6,500 anus 3,500 vulvar & vaginal 900 penile	Anaphylaxis (1-3 in 1,000,000 doses administered)

CDC, 2024

An Ounce of Prevention:

Measles

MMR Vaccine

97% effective at preventing measles after 2 doses

Measles - Treatment

Antibiotics are **NOT** effective (virus)

Antibiotics may be helpful for those with secondary infections.

Treatment is supportive

- Complications: Otitis media, pneumonia, encephalitis
- 1 in 5 unvaccinated individuals will be hospitalized
- 1-3 out of 1000 infected will die
- Risk of immune amnesia and SSPE

Olson et al, StatPearls, 2023; AAP, 2025

CNN Health

Some measles patients in West Texas show signs of vitamin A toxicity, doctors say, raising concerns about misinformation

By Neha Mukherjee, CNN

4 minute read · Published 8:40 PM EDT, Wed March 26, 2025

THE MYTH:

Vitamin A and cod liver oil can prevent measles.

THE FACTS:

Vitamin A/Cod Liver Oil <u>do not prevent measles</u>.

Giving high doses of vitamins may be <u>dangerous</u>.

- *Hypervitaminosis A*
  - *Fat-soluble vitamin*
  - *Too much can cause blurred vision, headaches, liver damage*

Vitamin A is recommended to <u>treat measles</u>. (AAP, WHO, NFID)

- *Evidence in some African countries has shown that vitamin A therapy can help to reduce measles mortality*
- *Questionable benefit in more developed countries*

AAP, 2025

An Ounce of Prevention:

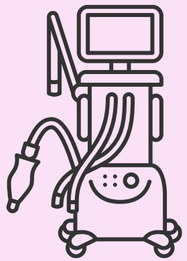
Polio

IPV (Inactivated Polio Vaccine)

~100% effective at preventing polio

Polio - Treatment

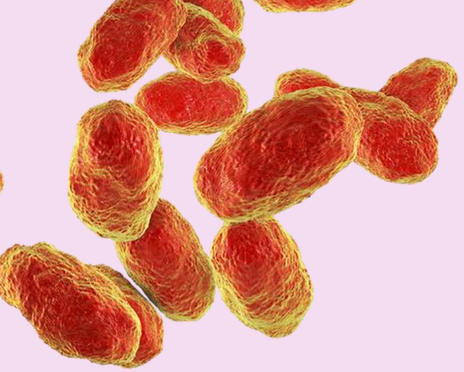
Antibiotics are **NOT** effective (virus)



Treatment is supportive

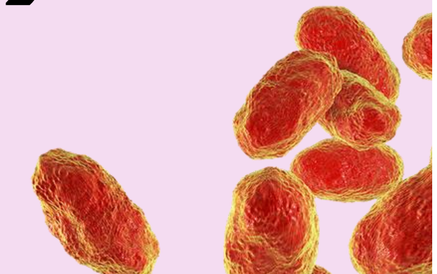
- Ventilator support
- Physical/occupational therapy
- Adaptive equipment (braces and wheelchairs)

Estivariz, CDC Pink Book, 2024



An Ounce of Prevention:

***Haemophilus influenza type b* (Hib)**



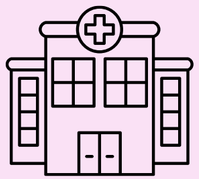
Hib Vaccine

95% effective at preventing hib after primary series

Incidence has declined 99% since pre-vaccine era.

Hib - Treatment

Treatable with antibiotics (bacteria)



<u>HOWEVER:</u> Hospitalization almost always necessary

- 20% of survivors of Hib meningitis have long term neurological sequelae (even with treatment)

CDC, 2024; CDC, 2021

Case Study #5: An Ounce of Prevention

I get it, 10 seems young to be thinking about this, but we want her protected before she is exposed to the virus. The vaccine is safe and young kids have a great immune response. And remember, Pap smears just detect cancer early. This vaccine can prevent her from getting it at all.

It just seems so soon! If you don't mind telling me, have your kids gotten this vaccine?

I don't mind at all, they absolutely have. In fact, every pediatrician in our practice has given this vaccine to their own kids when they were old enough. I wouldn't ask you to do anything for Marta that I wouldn't do for my own child.

That is really reassuring - ok let's do it!

Q & A

Questions?