Tiny Shots, Big Protection: Childhood Immunizations

Continuing Pharmacy Education

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Disclosures

The planner(s) and speaker(s) have indicated that there are no relevant financial relationships with any ineligible companies to disclose.

Learning Objectives

At the end of this session, learners should be able to:

- Outline the role of childhood immunizations in preventing disease and protecting public health
- Apply updated childhood immunization recommendations to patient care
- Recognize current misconceptions and misinformation regarding childhood immunization
- Identify effective communication strategies for addressing vaccine hesitancy in parents and caregivers

Outline

- Immunization for Individual and Public Health
- Current Childhood Vaccine Recommendations
- Vaccine Misinformation
- Pharmacist and Technician Role

Abbreviation Key

- ACIP: Advisory Committee on Immunization Practices
- AAP: American Academy of Pediatrics
- APC: Antigen Presenting Cell
- CDC: Center for Disease Control and Prevention
- HHS: Health and Human Services

Abbreviation Key

- DTaP/TDaP: Diphtheria, Tetanus, Pertussis
- Hib: Haemophilus Influenzae Type B
- Hep A: Hepatitis A
- Hep B: Hepatitis B
- HPV: Human Papillomavirus
- MMR: Measles, Mumps, Rubella
- PCV: Pneumococcal Conjugate Vaccine (PCV13, PCV15)
- PPSV: Pneumococcal Polysaccharide Vaccine (PPSV23)
- RSV: Respiratory Syncytial Virus

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Prenatal Development

Immune System Formation

- Fetal immune system is exposed to maternal antigens
- Fetus develops immune tolerance

Maternal IgG Antibody Transfer

- Cross the placenta at ~20 weeks and peak at birth
- Recognize and neutralize pathogens
- Provide passive immunity during first few months of life

Maternal Vaccination

- Increases neonatal protection by boosting antibody transfer
- Provides passive immunity until infant vaccine series begins

Proceedings of the Royal Society B: Biological Sciences. 2015;282(1821).

Pediatric Development

Birth

- Maternal IgG antibodies provide passive immunity
- Maternal antibodies can interfere with early vaccine response

Infancy

- Maternal antibodies decline, reducing passive protection
- Infant adaptive immunity matures, allowing initiation of the primary vaccine series

Childhood

- Series and booster doses spaced strategically
- Builds immunologic memory

Proceedings of the Royal Society B: Biological Sciences. 2015;282(1821).

Vaccine Timing in Early Childhood

What Parents Often Notice

- "My baby looks healthy"
- "There aren't many disease around anymore"
- "Why do we need vaccines early?"

What the Immune System is Actually Doing

- Early immunity is temporary
- Protection builds step-by-step as the immune system develops
- Vaccines are timed to protect during periods of highest vulnerability

Why Community Protection Matters for Public Health

- Infants cannot rely on individual immunity alone
- When vaccination rates decline, these immune gaps become exposed
- Protection early in life depends on reduced disease circulation

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Proceedings of the Royal Society B: Biological Sciences. 2015;282(1821).

Herd Immunity

Occurs when a certain proportion of the population is immune to a disease via vaccination or past infection

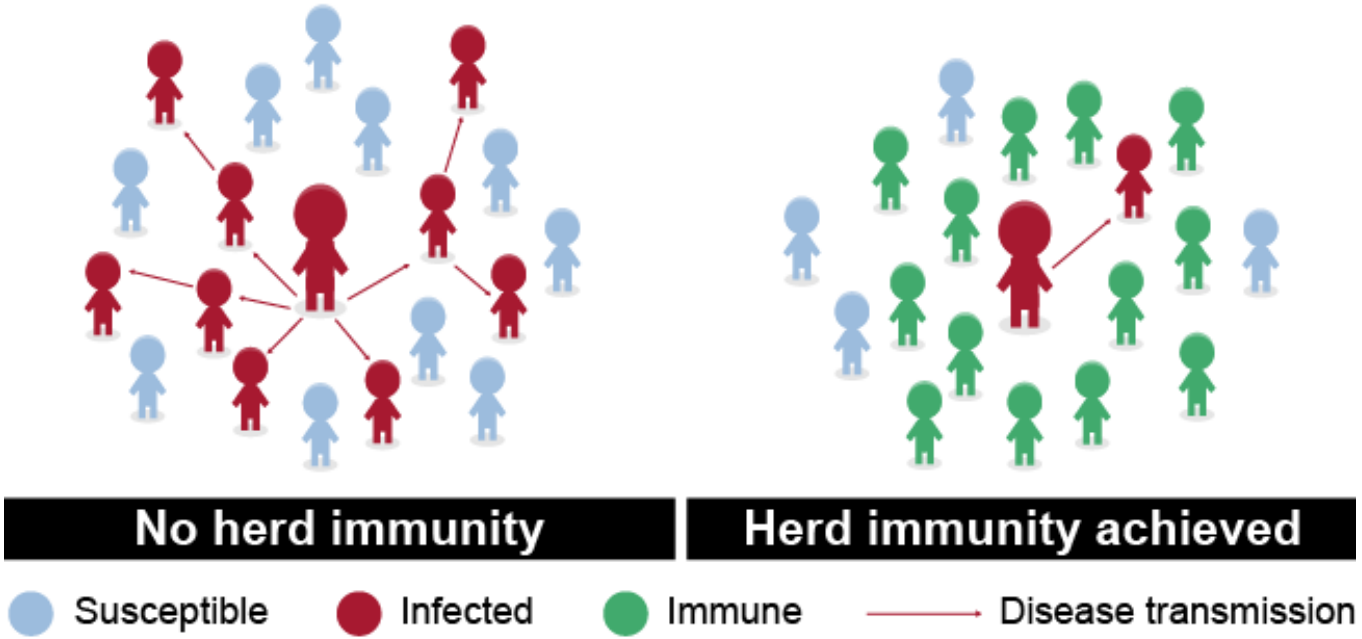
Limits disease transmission, preventing outbreaks

Protects vulnerable individuals who cannot be vaccinated

Immunity thresholds vary by disease

J Med Ethics. 2023;49(9):636-641.

Herd Immunity



Source: GAO adaptation of NIH graphic. | GAO-20-646SP

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Herd Immunity and Pediatrics

Neonates and infants rely on herd immunity for protection

School-aged children are major transmission reservoirs

High vaccination rates in this age group strongly supports public health

Small declines in pediatric coverage can lead to disease resurgence

J Pediatric Infect Dis Soc. 2025;14(11):piaf094.

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Herd Immunity and Pediatrics

Herd immunity is built through consistent, widespread vaccination

J Pediatric Infect Dis Soc. 2025;14(11):piaf094.

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Vaccination Rates

78% of U.S. counties report decline in childhood vaccination rates

Average county-level coverage decreased from 93.9% → 91.3%

Consequences of Declining Rates:

Measles

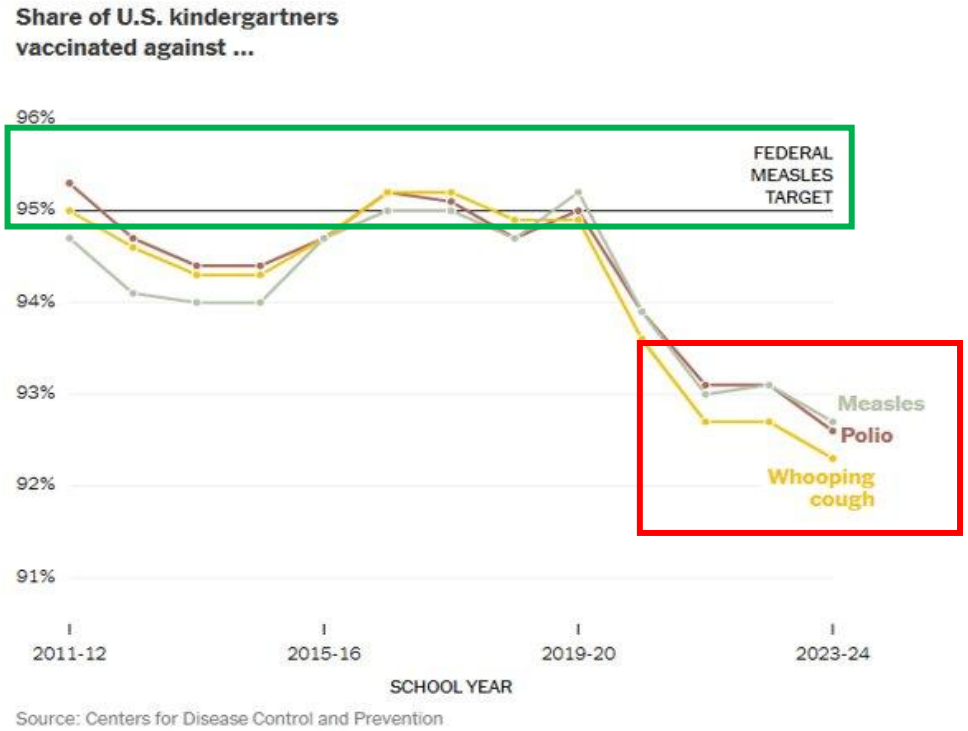
- 2,144 U.S. cases in 2025 (>30 year high)

Influenza

- 2024-25 season hospitalization peak (>10 year high)

Centers for Disease Control and Prevention. Vaccination Coverage and Exemptions among Kindergartners. SchoolVaxView.

Vaccination Rates



Centers for Disease Control and Prevention. Vaccination Coverage and Exemptions among Kindergartners. SchoolVaxView.

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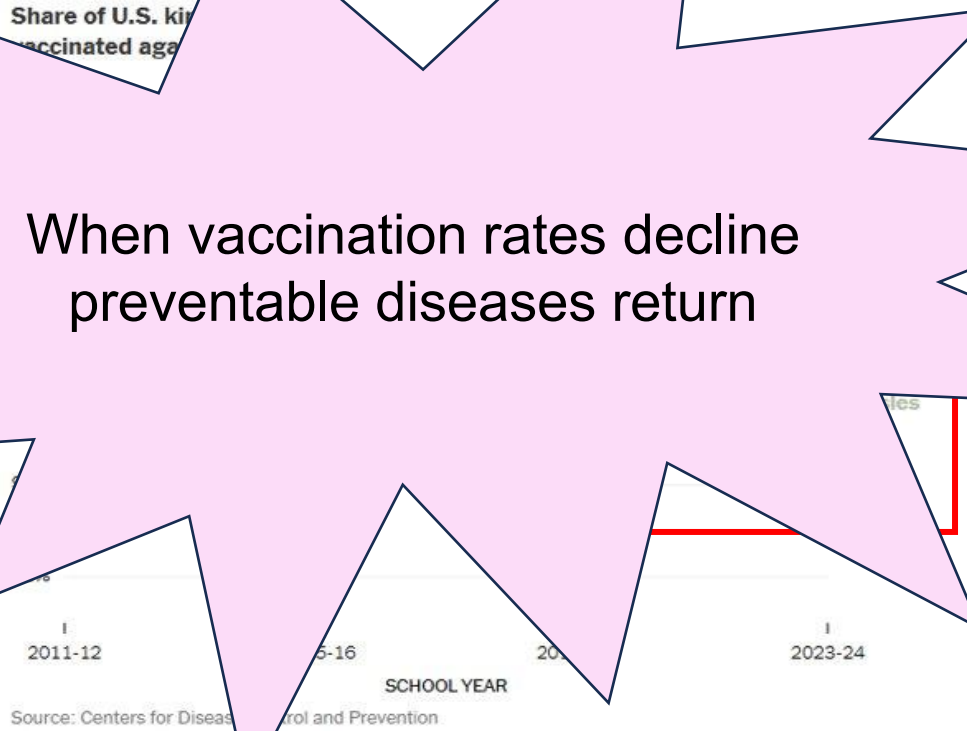
Vaccination Rates

When vaccination rates decline preventable diseases return



Centers for Disease Control and Prevention. Vaccination Coverage and Exemptions among Kindergartners. SchoolVaxView.

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Knowledge Check #1

Which statement best describes the role of childhood immunizations in public health?

A. They primarily protect only the vaccinated individual
B. They limit disease spread and protect vulnerable populations
C. They reduce disease severity but not transmission
D. They eliminate the need for infection-related precautions

Outline

- Immunization for Individual and Public Health
- **Current Childhood Vaccine Recommendations**
- Vaccine Misinformation
- Pharmacist and Technician Role

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Who Makes Vaccine Recommendations

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Vaccine Recommendation Bodies

ACIP

Provides recommendations to CDC

CDC

Implements recommendations into official policy

AAP

Publishes recommendations independently

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Vaccine Recommend tion Bodies

ACIP Update: 30 professional organization representatives no longer participate in workgroups to contribute their expertise

to CDC

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Current CDC Vaccine Recommendations

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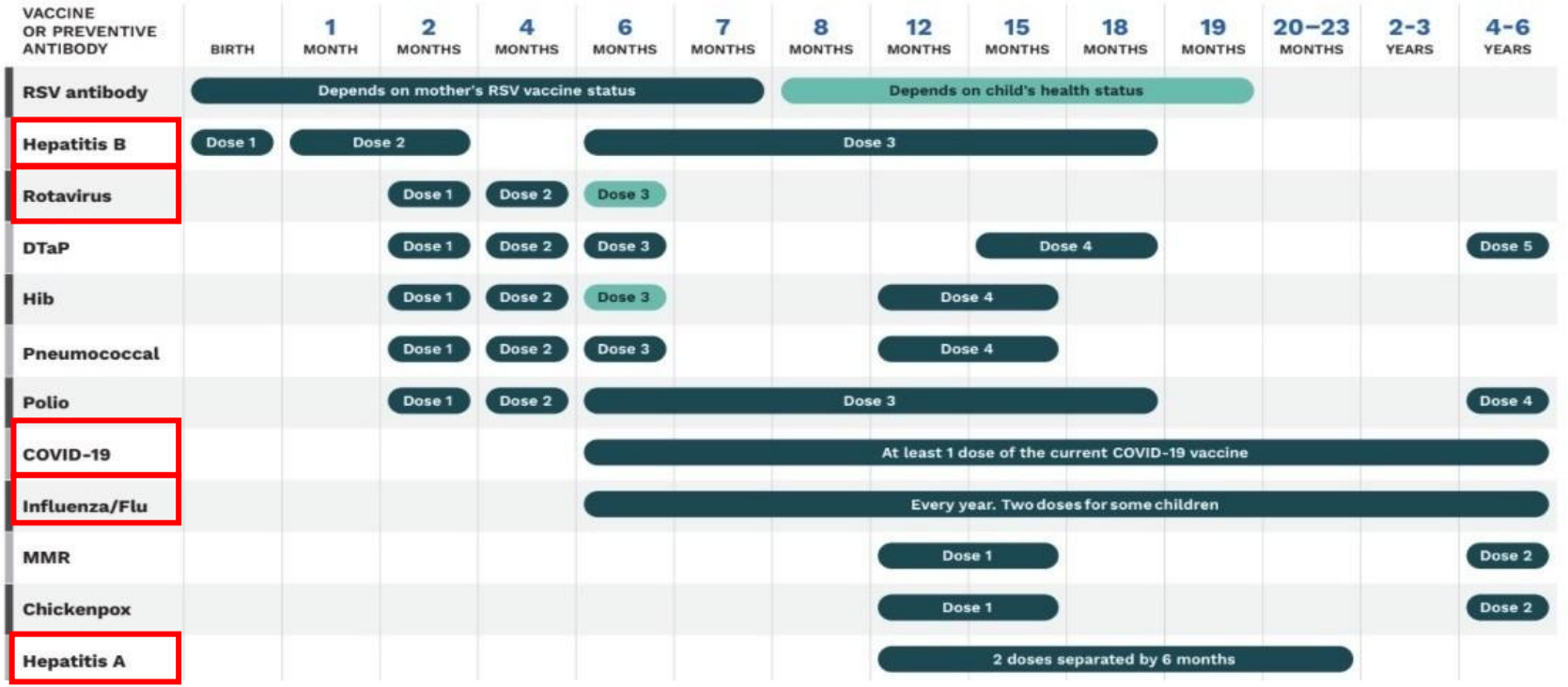
Early Childhood Vaccines



CDC. Recommended Immunizations Birth Through 6 Years Old. 2024.

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Early Childhood Vaccine Changes

Vaccines	CDC 2024	CDC 2025/2026
Hepatitis B	+	high-risk group or shared decision-making
Hepatitis A	+	
Rotavirus	+	shared decision-making
COVID-19	+	shared decision-making
Influenza	+	shared decision-making
MMR + Varicella	single injection	two split injections
RSV	palivizumab	nirsevimab

CDC. Recommended Immunizations Birth Through 6 Years Old. 2024.
CDC. Recommended Vaccinations for Children. 2026

Early Childhood Vaccine Changes

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CDC. Recommended Immunizations Birth Through 6 Years Old. 2024.
CDC. Recommended Vaccinations for Children. 2026

Recent Updates to Vaccine Recommendations

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RSV

Background

- Palivizumab (Synagis): Previous standard of care, discontinued 12/31/2025
- Abrysvo: Maternal RSV vaccine, given at 32-36 weeks gestation Sep-Jan

AAP Recommendation

- **Nirsevimab or Clesrovimab** for infants **<8 months entering first RSV season** if:
  - Mother unvaccinated or status unknown
  - Infant born <14 days after maternal vaccination
- **Nirsevimab** for **high-risk children 8-19 months entering second RSV season**

CDC Recommendation

- Follows same recommendations as AAP

CDC. RSV Immunization Guidance for Infants and Young Children. 2025
CDC. Child and Adolescent Immunization Schedule by Age. 2025
AAP. Recommended Child and Adolescent Immunization Schedule. 2025

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Wilkins, D., Wählby Hamrén, U. et al. 2024.

Study Design

- Randomized, palivizumab-controlled phase 2/3 study

Population

- High-risk infants: preterm, CLD, or CHD
- N=925

Treatment Arms

- Nirsevimab (N=614): 1 dose + 4 monthly placebo injections
- Palivizumab (N=304): 5 monthly doses

Outcomes

- RSV nAbs at days 31, 151, and 361 post dose

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Neutralizing Antibody (nAb) *Chronic Lung Disease (CLD)* *Congenital Heart Disease (CHD)*

Wilkins, D., Wählby Hamrén, U. et al. 2024.

Results

RSV nAb Geometric Mean Fold Rise (GMFR)			
	Day 31 (95% CI)	Day 151 (95% CI)	Day 361 (95% CI)
Nirsevimab	334 (282-395)	116 (103-130)	17 (15-19)
Palivizumab	7 (5-9)	11 (9-13)	1 (1-1)

- Day 151: nirsevimab 11-fold above palivizumab
- Day 361: nirsevimab 17-fold above baseline

Neutralizing Antibody (nAb)
Geometric Mean Fold Rise (GMFR)

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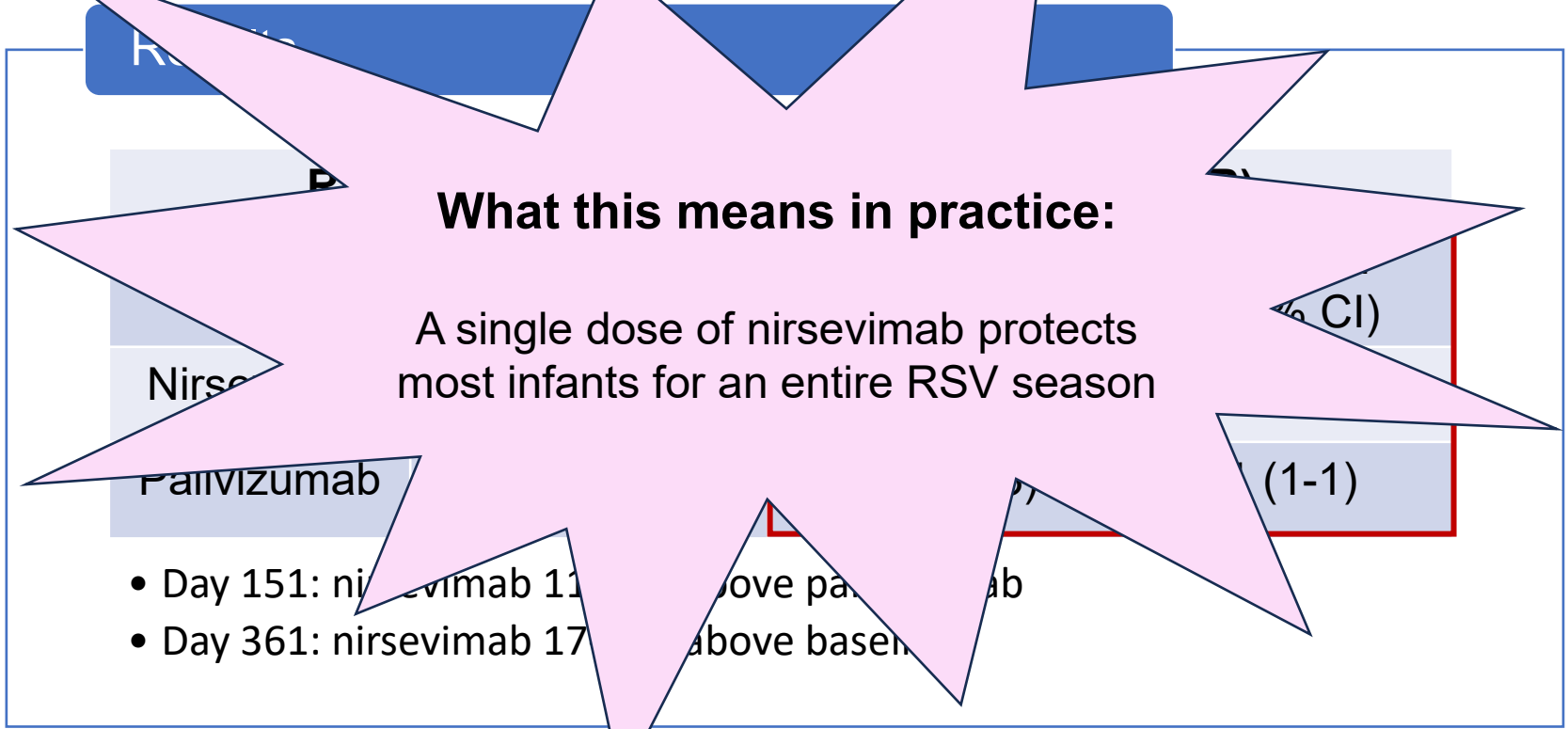
Wilkins, D., Wählby Hamré[illegible] U. et al. 2024.



What this means in practice:

A single dose of nirsevimab protects most infants for an entire RSV season

Neutralizing Antibody (nAb)
Geometric Mean Fold Rise (GMFR)

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Hepatitis B Vaccine

Background

- Universal Hep B birth dosing since 1991 reduced pediatric infections by 99%
- Infants are highly vulnerable: ~90% infected at birth develop chronic infection

AAP Recommendation

- Dose 1: At birth
- Dose 2: ≥ 4 weeks after dose 1
- Dose 3: ≥ 8 weeks after dose 2 and ≥ 16 weeks after dose 1

CDC Recommendation

- Infants born to hepatitis B-negative mothers:
  - Shared decision making; initial dose >2 months old
- Infants born to hepatitis B–positive or unknown-status mothers:
  - Vaccine within 12 hours of birth

Bixler D, et al. *Public Health Rep.* 2023.
CDC. Child and Adolescent Immunization Schedule by Age. 2025
AAP. Recommended Child and Adolescent Immunization Schedule. 2025

Lee, et al. 2006.

Study Design

- Systematic review and meta-analysis

Population

- Newborns of HBsAg-positive mothers who received the vaccine within 1 month of life
- 5 trials (N = 403)

Treatment Arms

- Plasma derived or recombinant vaccine (N = 252)
- Placebo (N = 151)

Outcomes

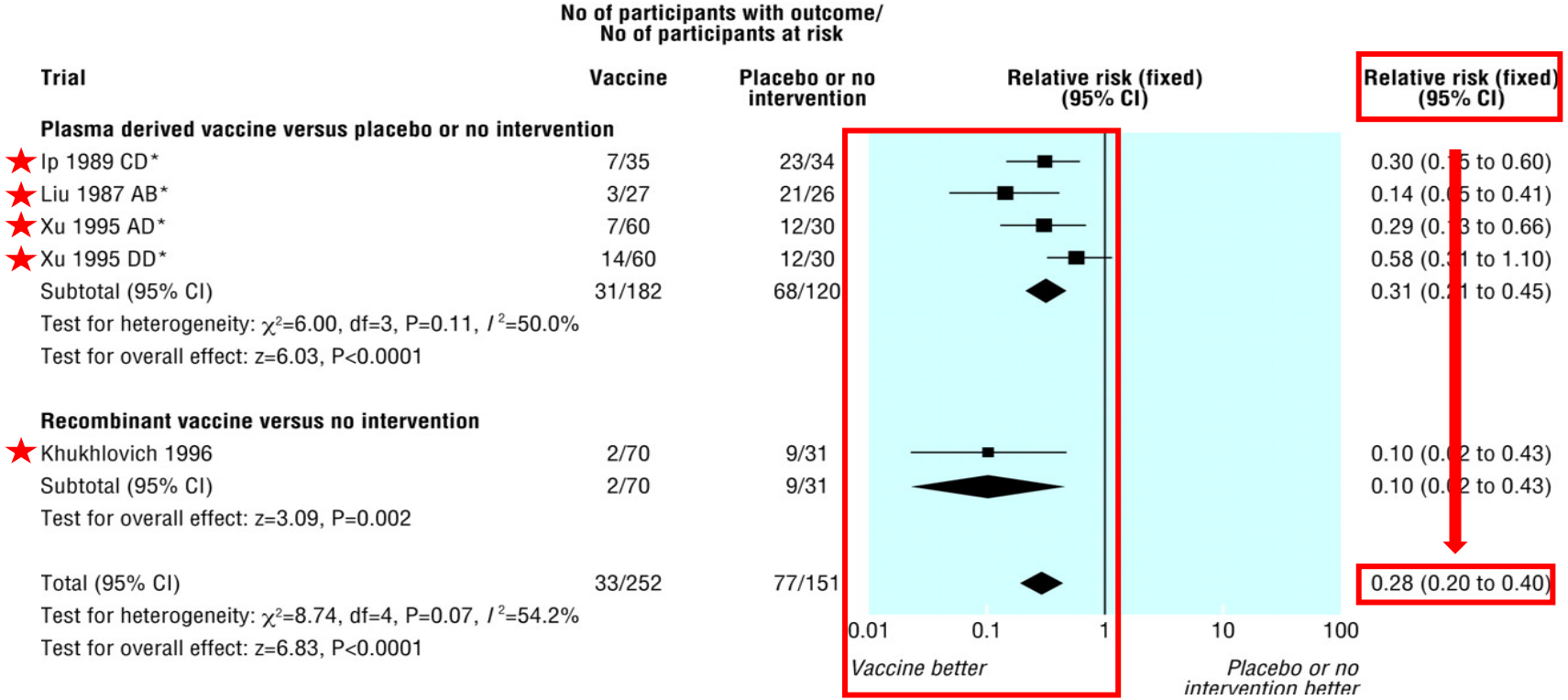
- Occurrence of hepatitis B infection

Lee, et al. 2006.

Results

Hepatitis B Occurrence			
	Vaccine (%)	Placebo (%)	Relative Risk (95% CI)
Plasma Derived Vaccine (4 trials)	31/182 (17)	68/120 (57)	0.31 (0.21-0.45)
Recombinant Vaccine (1 trial)	2/70 (2)	9/31 (29)	0.10 (0.02-0.43)
All Trials Combined	33/252 (13)	77/151 (51)	0.28 (0.20-0.40)

Lee, et al. 2006.



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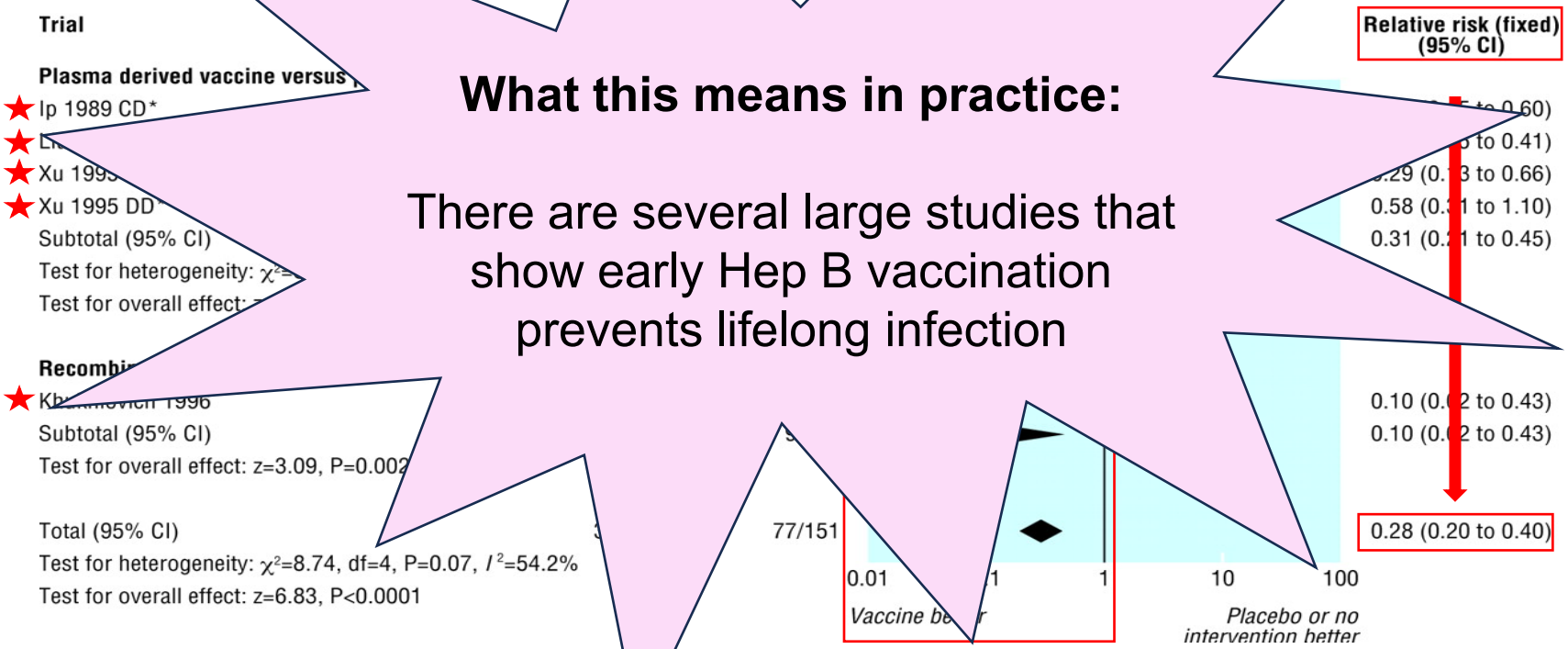
Lee, et al. 2006.



What this means in practice:

There are several large studies that show early Hep B vaccination prevents lifelong infection

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COVID-19 Vaccine

Background

- COVID-19 continues to circulate with seasonal surges
- Vaccination reduces risk of severe disease and hospitalization

AAP Recommendation

- All children 6–23 months
- Children 2–18 years in the following groups: high risk/living with someone high risk for severe infection, long-term care settings, previously unvaccinated

CDC Recommendation

- Children ≥6 months based on shared clinical decision-making

J. Clin. Med. 2024; 13(2):424.
Pediatrics. 2025; 156 (5): e2025073924.

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Muñoz FM, et al. 2023.

Study Design

- Randomized, placebo-controlled, phase 2/3 trial

Population

- Healthy children stratified into 6-23 months and 2-4 years
- N = 1254

Treatment Arms

- COVID-19 Vaccine (N=873): 3 dose series
- Placebo (N = 381): 3 placebo injections

Outcomes

- First occurrence of COVID-19 after Dose 3

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Medically attended lower respiratory tract infection (MALRI)

Muñoz FM, et al. 2023.

Results

COVID-19 Infections			
	Vaccine (N=873)	Placebo (N=381)	Vaccine Efficacy % (95% CI)
6 months to 4 years	13	21	73.2 (43.8-87.6)
6 months to <2 years	4	8	75.8 (9.7-94.7)
2 to 4 years	9	13	71.8 (28.6-89.4)

- Most common adverse events: mild-moderate fever/fatigue
- Few participants withdrew owing to events
- No deaths occurred

Muñoz FM, et a 2023.

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6 month

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2 to 4 years

.6-89.4)

- Most com adve ts: n erate feve gue
- Few participants wit owing to ts
- No deaths occurred

What this means in practice:

Vaccination against COVID-19 reduces symptomatic infection with acceptable short-term safety profile

MMR/Varicella

Background

- Available as a combined measles, mumps, rubella, and varicella or separate
- Recent discussion regarding separation due to evidence relating to febrile seizures

AAP Recommendation

- Continues to recommend giving families the choice between MMRV and MMR+V

CDC Recommendation

- Varicella as standalone rather than combination for children ages <4 years

CDC. Child and Adolescent Immunization Schedule by Age. 2025
AAP. Recommended Child and Adolescent Immunization Schedule. 2025

Klein, NP. et al. 2010.

Study Design

- Comparative study using Vaccine Safety Datalink data from 2000-2008

Population

- Children aged 12-23 months that received first dose of either MMRV or MMR+V
- N=459,461

Treatment Arms

- MMRV (N=83,107)
- MMR+V, both vaccines given in same visit (N=376,354)

Outcomes

- Seizure occurrence, days 7-10 after vaccination

Klein, NP. et al. 2010.

Results

Post-Vaccination Seizures, days 7-10				
	MMRV (n=83,107)	MMR+V (n=376,354)	RR (95% CI)	P-value
Seizures	77 (0.093%)	174 (0.046%)		<0.001
Seizure Risk After Vaccination*			1.98 (1.43-2.73)	<0.001

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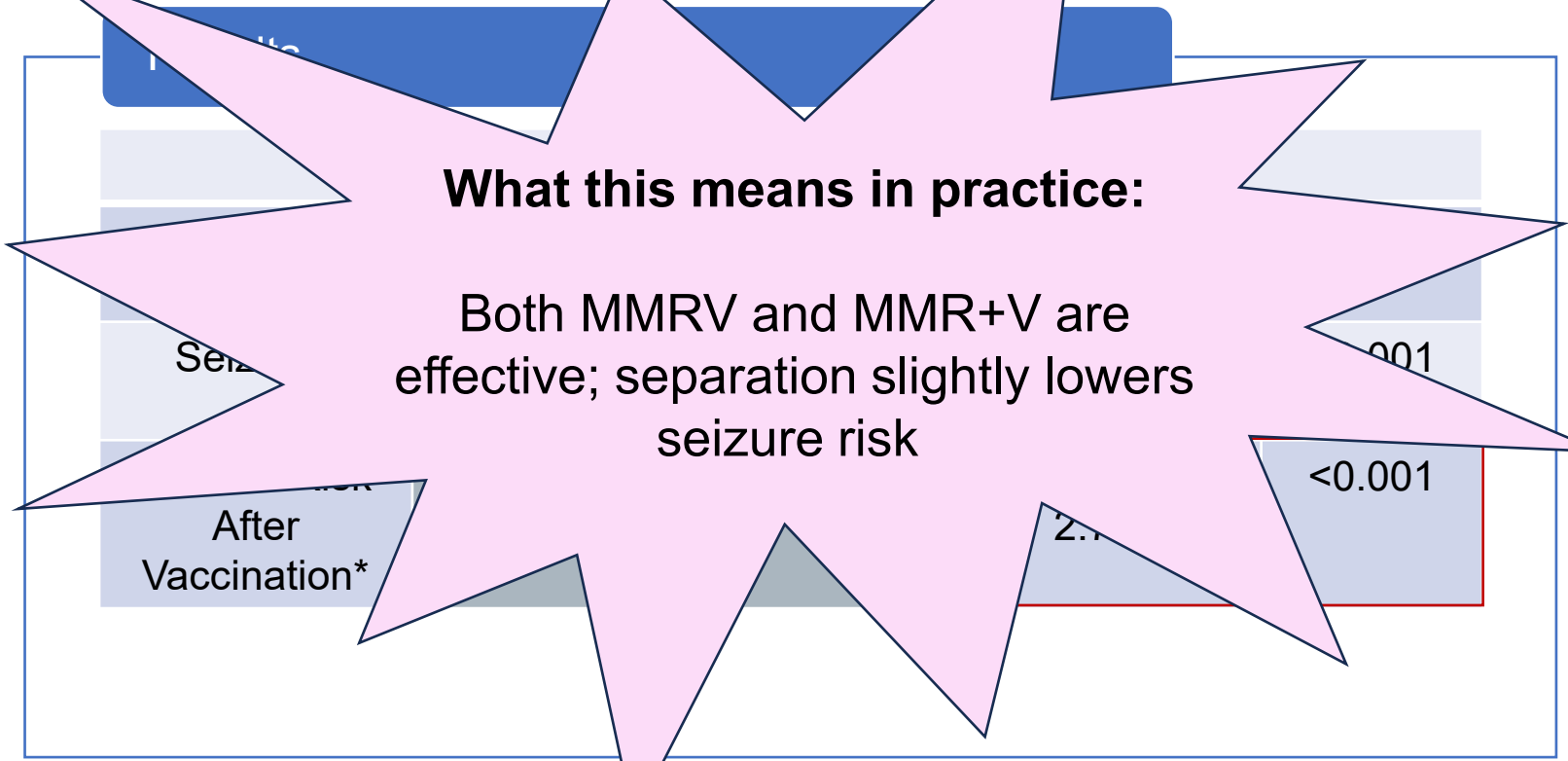
RR: Relative Risk

Klein, NP. et al 2010.



What this means in practice:

Both MMRV and MMR+V are effective; separation slightly lowers seizure risk

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RR: Relative Risk

Considerations of MMRV Data

Seizure Risk

- Febrile seizures occur in ~2-5% of children (CDC)
- Data included children with concurrent febrile illnesses
- Seizures occurred in <1% of children in either group

Vaccines for Children (VFC) Program

- ~50% of US children qualify for the VFC program
- Due to seizure risk, CDC suggests MMR+V for those <4 years old
- CDC voted to continue MMRV use in the same age group within the VFC program

CDC. About the Vaccines for Children (VFC) Program. 2025.
CDC. Health and Economic Benefits of Routine Childhood Immunizations in the Era of the Vaccines for Children Program. 2023.

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Evidence & Practice Change

Vaccines	Clinical Evidence Supports	Implement Into Practice
RSV	Single dose vaccination protects for whole season	Prevention for most infants
Hep B	Meta-analysis showed decrease in HBV and near elimination in children	Early-life vaccination supported
COVID-19	Showed efficacy and favorable safety profiles	Routine, recommended immunization
MMR/ Varicella	Combination vaccines studies indicated increased febrile seizure risk	Shared-decision making

Wilkins et al., *Pediatrics* 2024; Zar et al., *NEJM* 2025; Lee et al., *BMJ* 2006; Klein et al., *Pediatrics* 2010; Muñoz et al., *NEJM* 2023; Hviid et al., *Ann Intern Med* 2019; CDC & AAP Immunization Schedules (2024–2026)

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Knowledge Check #2

Which of the following statements is incorrect?

A. A single dose of RSV immunization provides protection for the RSV season in most infants
B. Early hepatitis B vaccination is supported by evidence, showing decreased infection and near elimination in children
C. COVID-19 vaccines have demonstrated efficacy and favorable safety profiles
D. Combination MMR/Varicella vaccines have not been associated with any increased risk of febrile seizures and do not require shared decision-making

Outline

- Immunization for Individual and Public Health
- Current Childhood Vaccine Recommendations
- **Vaccine Misinformation**
- Pharmacist and Technician Role

Vaccine Misinformation

Children receive too many vaccines

Vaccines cause autism

Children do not need Hep B vaccination before age 12 since it is transferred sexually

Vaccine Misinformation

Children receive too many vaccines

Vaccines cause autism

Children do not need Hep B vaccination before age 12 since it is transferred sexually

Number of Pediatric Vaccines

Misinformation:

- U.S. Department of Health and Human Services (HHS) claim children receive **~92 vaccines** to be compliant with CDC schedule

Fact:

- Children who follow the CDC's recommended immunization schedule get **~30 vaccines**

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ABC. RFK Jr. said US children receive up to 92 vaccine doses. 2025.

Extended Spacing of Vaccines

Benefits:

- Easier assessment of adverse reactions
- Willingness of parents to vaccinate their children
- Some immunity is better than none

Risks:

- Lack of adequate immunity
- More appointments/higher costs
- Repeated stress for additional vaccine visits
- Mixed messages regarding importance of scheduling

Vaccine Misinformation

Children receive too many vaccines

Vaccines cause autism

Children do not need Hep B vaccination before age 12 since it is transferred sexually

Vaccines and Autism

Misinformation:

- Stemmed from a now-discredited 1998 study alleging a MMR—Autism link

Fact:

- 2019 study found no link between vaccines and autism
- Study included > 650,000 children born from 1999-2010

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Cleveland Clinic. Feb 3, 2025.

Disproval of 1998 MMR-Autism Trial

Diagnoses

- 3 of 9 children reported with regressive autism never received autism diagnosis

Pre-existing conditions

- All 12 children were reported "previously normal"
- 5 children had pre-existing behavioral concerns

Recruitment and funding

- Case series of only 12 children
- Participants were recruited through anti-MMR campaigners
- Commissioned and funded for planned litigation

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Deer, B. How the case against the MMR vaccine was fixed. BMJ. 2011.

Hviid, A. et al. 2019.

Study Design

- Nationwide cohort study

Population

- Children born in Denmark from 1999—2010
- N=657,461

Treatment Arms

- MMR-vaccinated children (N=625,842)
- MMR-unvaccinated children (N=31,619)

Outcomes

- Diagnosis of autism

Hviid, A. et al. 2019.

Results

Diagnosis of Autism				
	Vaccinated (N=625,842)	Unvaccinated (N=31,619)	Hazard Ratio (95% CI)	P-value
All children	5992 (0.96%)	525 (1.66%)	0.93 (0.85-1.02)	0.085
Male	4844	416	0.97 (0.87-1.08)	
Female	1148	109	0.79 (0.64-0.97)	

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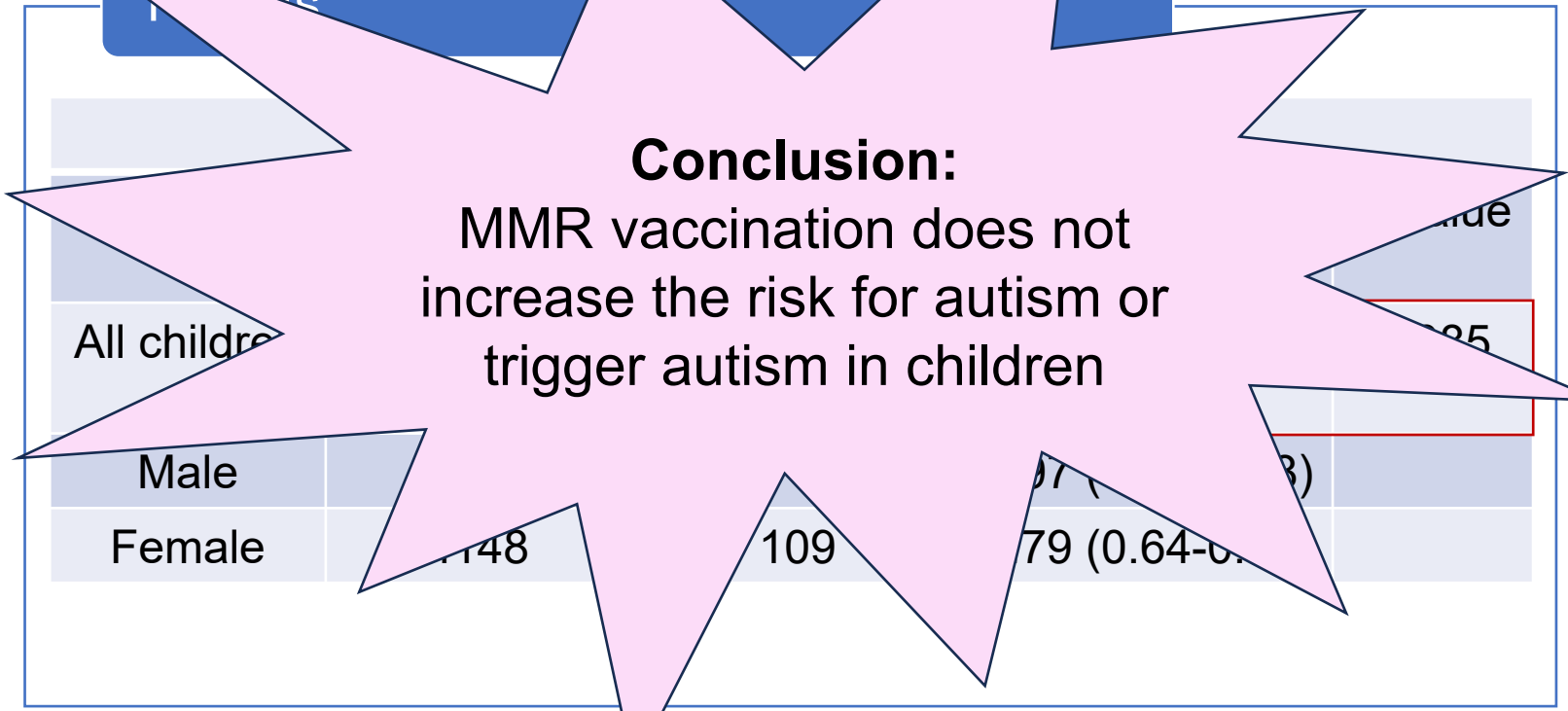
Hviid, A. et al. 2019.

Conclusion:
MMR vaccination does not increase the risk for autism or trigger autism in children



All childre			
Male			
Female	148	109	79 (0.64-0.

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Vaccines and Autism

Autism and Vaccines

QUESTIONS AND CONCERNS | PAGE 2 OF 9 | ALL PAGES ↓

For Everyone
NOV. 19, 2025

CDC updates from 11/19/25

KEY POINTS

- The claim "vaccines do not cause autism" is not an evidence-based claim because studies have not ruled out the possibility that infant vaccines cause autism.
- Studies supporting a link have been ignored by health authorities
- HHS has launched a comprehensive assessment of the causes of autism, including investigations on plausible biologic mechanisms and potential causal links.

CDC. Autism and Vaccines. 2025

Vaccine Misinformation

Children receive too many vaccines

Vaccines cause autism

Children do not need Hep B vaccination before age 12 since it is transferred sexually

Hepatitis B

Misinformation:

- Hep B is only sexually transmitted
- Hep B vaccination should be delayed to 12 years of age

Fact:

- Hep B can be transmitted through bodily fluids, blood, sexually, or perinatally
- Crucial to vaccinate in infancy
- Can be transmitted during birth or by other positive contacts

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Johns Hopkins. Why Hepatitis B Vaccination Begins at Birth. 2025

Hepatitis B

"Silent Killer"— 50-90% of adults with chronic infection are unaware of status until serious liver damage develops

Children are particularly susceptible and more likely to develop chronic infection that leads to life-threatening complications

CDC's update states that birth dose should only be given if mother is Hep B positive or status unknown

Johns Hopkins University Bloomberg School of Public Health. Sept 24, 2025.
CDC. Recommended Vaccinations for Children. Feb 11, 2026.

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Hepatitis

infection

develops

kely to

CDC' pdate s hat bi se should o be given if mother is Hep ositive or s us unknown

CDC's update from 1/6/26:

If mother Hep B negative: shared-decision making & first dose delayed until ≥ 2 months old

Johns Hopkins University Bloomberg School of Public Health. Sept 24, 2025.
CDC. Recommended Vaccinations for Children. Feb 11, 2026.

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Knowledge Check #3

Which of the following statements is true?

A. Children receive 92 vaccines to complete the age 0-18 CDC immunization schedule
B. Hepatitis B infections are exclusively sexually transmitted
C. Extended spacing of vaccinations does not affect the body's mounted immune response
D. A large trial from 1998 linking the MMR vaccine to autism was discredited and proven fraudulent

Outline

- Immunization for Individual and Public Health
- Current Childhood Vaccine Recommendations
- Vaccine Misinformation
- **Pharmacist and Technician Role**

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Reframing the Narrative

- The AAP and FrameWorks Institute recommend vaccine messaging that emphasizes collective health and prevention

- Key framing strategies:

Community protection (schools, childcare, parks)	Vaccination supports long-term health and prevention	Immunization is a routine public health practice

Communicating About Vaccinations: Evidence-Based Recommendations to Shift the Narrative. American Academy of Pediatrics. Published November 13, 2024.

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Vaccine Hesitancy

Differentiate between hesitancy and access issues

Target interventions based on barrier

Pediatr Infect Dis J. 2022;41(5):e243-e245.

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Use Intentional Language

- Use language that emphasizes prevention and preparedness

Fight disease	→	Prepare the immune system
Decision to vaccinate	→	Manage routine vaccinations
Herd immunity	→	Community immunity

Communicating About Vaccinations: Evidence-Based Recommendations to Shift the Narrative. American Academy of Pediatrics. Published November 13, 2024.

Pharmacist and Technician Role

- Vaccine promotion and misinformation prevention are public health responsibilities

- Key roles:

Assess immunization status	Provide evidence-based recommendations	Serve as a trusted source of vaccine information

Communicating About Vaccinations: Evidence-Based Recommendations to Shift the Narrative. American Academy of Pediatrics. Published November 13, 2024.

Knowledge Check #4

Which approach is most likely to reduce misunderstanding during vaccine discussions?

A. Emphasizing disease severity using fear-based messaging
B. Correcting misinformation by labeling it as disinformation
C. Focusing only on individual vaccine decisions
D. Using neutral, preparation-oriented language

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ADVOCATE HEALTH

Questions?

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