THE RE-EMERGENCE OF VACCINE-PREVENTABLE DISEASE (VPD)

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Disclosures

I have no actual or potential conflicts of interest in relation to this program/presentation

Objectives

- Understand the impact of immunizations nationally and globally
- Recognize the factors associated with a rise in vaccine preventable diseases (VPDs)
- Review the VPDs associated with current outbreaks in NJ

    Measles

    Mumps

    Pertussis

    Neisseria meningiditis

Introduction: Impact of Vaccination

- Since vaccine programs began in the US in the 1960s, incidences of vaccine-preventable diseases (VPD) have dropped dramatically
- Among children born in the US during 1994–2023, routine childhood vaccinations have prevented approximately 508 million cases of illness, 32 million hospitalizations, and 1,129,000 deaths, resulting in direct savings of $540 billion and societal savings of $2.7 trillion
- Globally immunization currently prevents 3.5 million to 5 million deaths every year
- Smallpox has been eradicated worldwide
- Measles was also declared eliminated in the U.S. in the year 2000
- Polio was eliminated from the U.S. in 1979
- In 2020 there were fewer cases of paralysis in the world from polio than ever, two of the three strains of wild poliovirus have been eliminated worldwide
- Vaccination saves at least $10 in direct and societal costs for every $1 spent

CDC 2024: https://www.cdc.gov/vaccines/index.html
Zhou et al. MMWR 2024 DOI: http://dx.doi.org/10.15585/mmwr.mm7331a2
WHO, 2024: https://www.who.int/health-topics/vaccines-and-immunization#tab=tab_1
Feldman et al. 2021:PMID: 33580243; PMCID: PMC7929016.
Kubin 2017: https://doi.org/10.1016/j.pedn.2018.11.011

Resurgence of VPD in the United States

- Until the organisms that cause infectious diseases are eradicated, VPD remain a threat
- VPD continue to occur despite vaccinations
  - 300 children die from VPD every year
- Several disease outbreaks are increasing
  - 3 VPDs (measles, mumps, and pertussis) continue to have steady outbreaks
- Factors influencing vaccination trends and its effect on herd immunity rates bolsters the impact of disease resurgences
- Herd immunity: When a large enough percentage of a population has immunity to a contagious disease, providing indirect protection to the rest of the population

Porteous et al. DOI: 10.1213/ANE.0000000000001196

Recent cases and surveillance of VPD


Increase in Global and Domestic Measles Cases and Outbreaks: Ensure Children in the United States and Those Traveling Internationally 6 Months and Older are Current on MMR Vaccination

Print

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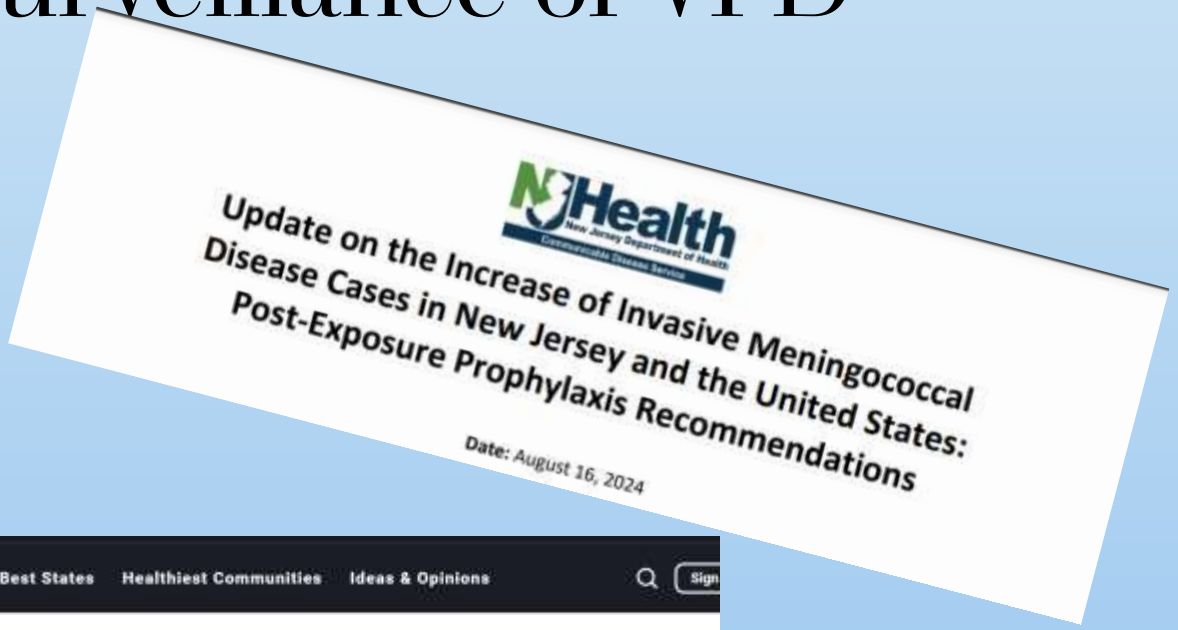
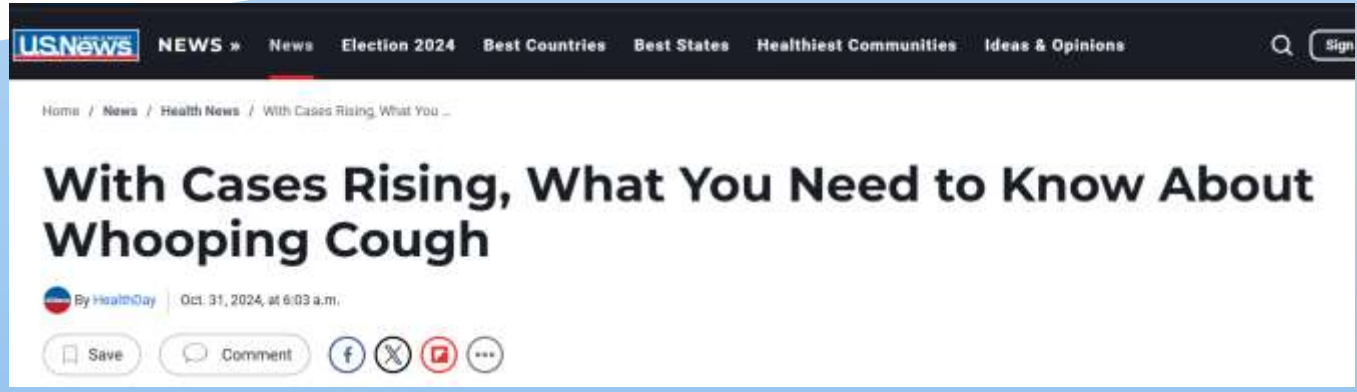
This is an official CDC HEALTH ADVISORY

Distributed via the CDC Health Alert Network
March 18, 2024, 12:30 PM ET
CDCHAN-00504


NJ Health
New Jersey Department of Health
Communicable Disease Service

Update on the Increase of Invasive Meningococcal Disease Cases in New Jersey and the United States: Post-Exposure Prophylaxis Recommendations

Date: August 16, 2024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Home / News / Health News / With Cases Rising, What You ...

With Cases Rising, What You Need to Know About Whooping Cough

By HealthDay | Oct. 31, 2024, at 6:03 a.m.

Save Comment


CDC: Spike in measles cases poses threat to US elimination status

Lisa Schnirring, April 11, 2024

Topics: Measles


HEALTH

As New Jersey investigates mumps outbreak, experts share what to know about symptoms, protection

Infectious disease doctors share the differences between mumps and measles

By Shiv Sudhakar Fox News

Published March 10, 2024 2:58pm EDT

Factors associated with the rise of VPDs

- **Parental refusal to vaccinate**
  - Vaccines Unnecessary
  - Religious Exemptions
  - Personal/Philosophical Exemptions
  - Safety Concern Refusals
- **Under-vaccination**
- **Waning immunity:** mumps, acellular pertussis, tetanus
- **Less effective vaccines:** influenza
- **Global travel leading to imported cases**
- **COVID**
  - immunization delivery has decreased significantly during the COVID-19 pandemic
  - >60 national vaccine programs have been disrupted or suspended
- **Climate change:**

  Seasonality has been detected in pneumococcal transmission, with wintertime conditions leading to higher transmission.

  For meningococcal disease, there is some evidence that incidence decreases as temperature increases or, similarly, that low humidity increases transmission

Kubin, 2019: https://doi.org/10.1016/j.pedn.2018.11.011
Feldman et al. 2021 . doi: 10.1093/cid/ciab127..
Mahmud et al. 2020. https://doi.org/10.1007/s40572-020-00293-2

Undervaccination: Vaccine Compliance and Completion

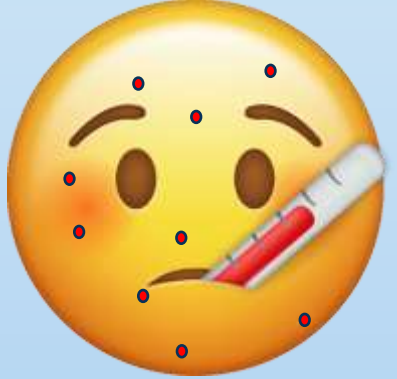
- **Vaccine compliance** is defined as the proportion of children who receive each dose during the recommended age-appropriate window
- **Vaccine completion** is the accumulation of the required number of ACIP (Advisory Committee on Immunization Practices) recommended doses by a specific age regardless of the time of vaccine administration
- **Under-vaccination** refers to the total number of days a vaccine is delayed beyond the recommended age range
- Overall compliance with recommended vaccines appears high, immunization completion rates vary by antigen, age, measurement period, and geographical region leaving populations unprotected and vulnerable
- A study of over 11,000 children revealed that while 70% had completed recommended vaccines by two years of age, approximately 75% did not receive all recommended doses at the appropriate times
    - At least one dose of vaccine was administered late in 74% of the cases.
    - Completion rates were lowest during the ages of 8 and 18 months, with greater than seven months elapsing; leaving infants unvaccinated for at least seven months

Kurosky et al.2016 doi: 10.1016/j.vaccine.2015.11.011

Measles surveillance

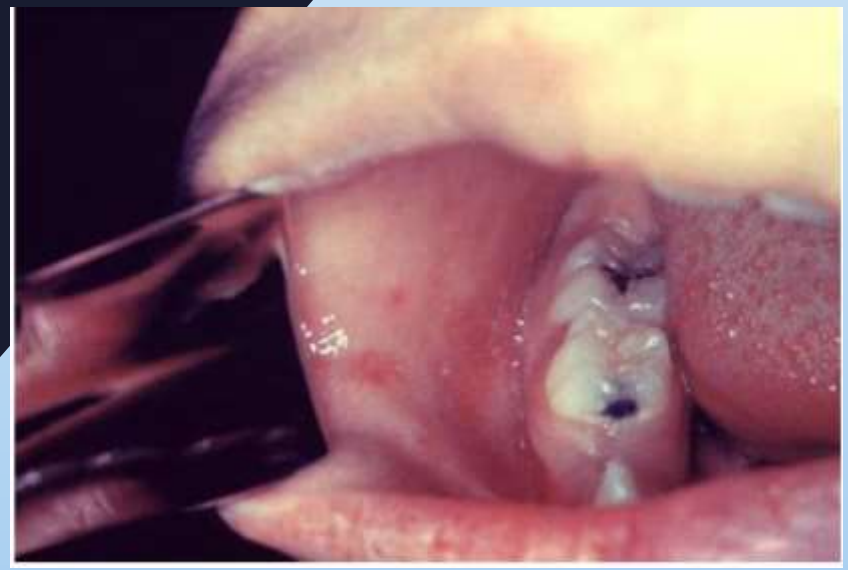
- From January 1 to October 18, 2024, the CDC has been notified of 271 confirmed U.S. cases of measles across 32 jurisdictions, including 15 outbreaks
- Many of the cases reported in 2024 are linked to international travel and are among children and individuals who had not received measles-mumps-rubella (MMR) vaccine
- In Monmouth County NJ, as of October 28, 2024, 5 confirmed measles cases have been identified in individuals with close contact with the original measles case
- All five cases are unvaccinated

Measles (rubeola)



- Measles is an acute viral respiratory illness
- It is characterized by:
  - •prodrome of fever (as high as 105°F), malaise, and cough, coryza, and conjunctivitis (three "C"s)
  - •A pathognomonic enanthema (Koplik spots)
  - •Followed by a maculopapular rash
- The rash usually appears about 14 days after a person is exposed
  - The rash spreads from the head to the trunk to the lower extremities
- Patients are considered to be contagious from 4 days before to 4 days after the rash appears.
  - Sometimes immunocompromised patients do not develop the rash
- Highly contagious; one person infected with measles can infect 9 out of 10 unvaccinated individuals with whom they come in close contact
  - Measles virus can remain active and contagious in the air or on infected surfaces for up to 2 hours after a person coughs or sneezes

Feldman AG, O'Leary ST, Danziger-Isakov L. The Risk of Resurgence in Vaccine-Preventable Infections Due to Coronavirus Disease 2019-Related Gaps in Immunization. Clin Infect Dis. 2021 Nov 16;73(10):1920-1923. doi: 10.1093/cid/ciab167. PMID: 33580243; PMCID: PMC7929016



Your child needs vaccines as they grow!

2024 Recommended Immunizations for Birth Through 6 Years Old

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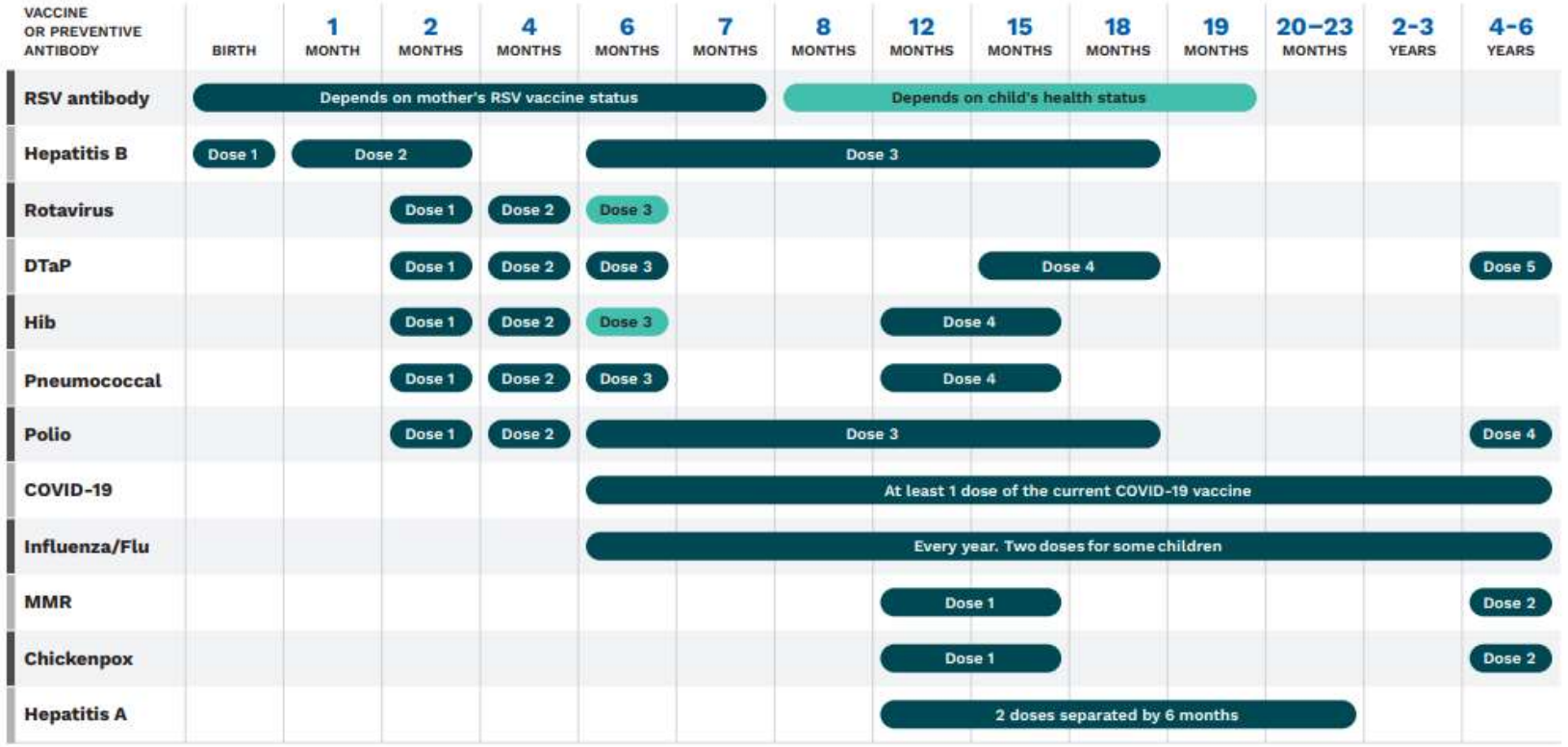

KEY

- ALL children should be immunized at this age.
- SOME children should get this dose of vaccine or preventive antibody at this age

Talk to your child's health care provider for more guidance if:

1. Your child has any medical condition that puts them at higher risk for infection.
2. Your child is traveling outside the United States.
3. Your child misses a vaccine recommended for their age.

CDC U.S. CENTERS FOR DISEASE CONTROL AND PREVENTION

FOR MORE INFORMATION
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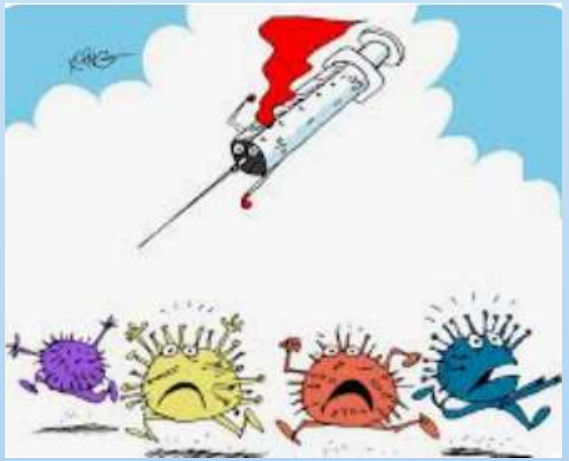
CIT Measles

- The Community Immunity Threshold (CIT) for measles is about 92-94%. This means that 92-94% of the population need to be immune to measles (through vaccination or previous infection) to prevent/limit spread of measles infections in their community
- To eliminate measles in a population, ≥95% of the population needs to be vaccinated with 2 doses of vaccine

https://www.aap.org/en/patient-care/measles/measles-vaccine/?srsltid=AfmBOorZxJE3zaYYfvaWgT8Cf20tzlFCs5pWBQ5oIQekGvJSVikikirG

Measles vaccination rates



- Before the pandemic, two states (Colorado and Idaho) reported kindergarten measles vaccination rates below the 90% level necessary to ensure herd immunity against measles; it is likely that many additional US states are now below the herd-immunity threshold
- Measles outbreaks have already occurred this year in at least half of the 26 countries who suspended their measles vaccination programs

Feldman AG, O'Leary ST, Danziger-Isakov L. The Risk of Resurgence in Vaccine-Preventable Infections Due to Coronavirus Disease 2019-Related Gaps in Immunization. Clin Infect Dis. 2021 Nov 16;73(10):1920-1923. doi: 10.1093/cid/ciab127. PMID: 33580243; PMCID: PMC7929016.

5 important facts

"Well whatever he has, it's contagious."

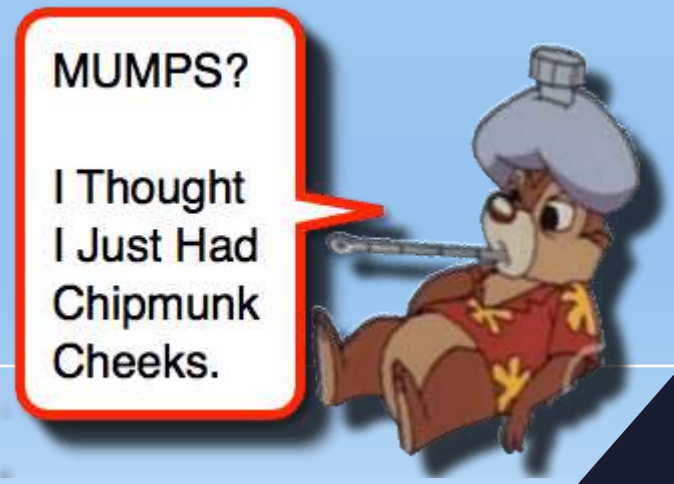
- **Measles is circulating, and undervaccinated communities are at risk**
- **Know when to consider a measles diagnosis, and what to do**
  - Consider measles in patients presenting with febrile rash illness and clinically compatible measles symptoms
  - Obtain both a serum sample and a throat swab (or nasopharyngeal swab).
  - Urine samples may also contain virus, and when feasible to do so, collecting both respiratory and urine samples can increase the likelihood of detecting measles virus.
  - Don't forget, healthcare providers are required to report any suspected measles cases to their local health department.
- **MMR vaccine is highly effective — are all your patients up-to-date?**
  - One dose of MMR vaccine is approximately 93% effective at preventing measles; two doses are approximately 97% effective
  - The second dose of MMR is administered to address primary vaccine failure
- **Consider postexposure prophylaxis for susceptible patients after known exposure**
  - Either administer MMR vaccine within 72 hours of initial measles exposure, or immunoglobulin (IG) within 6 days of exposure
  - Do not administer MMR vaccine and IG simultaneously, as this practice invalidates the effectiveness of the vaccine
- **Known cases need isolation — make sure your staff are adequately informed and protected**
  - Airborne precautions
  - Infected people should be isolated for 4 days after they develop a rash

NJDOH Vaccine Preventable Disease Program
Phone: (609) 826-4860

https://www.nj.gov/health/cd/vpdp.shtml

Mumps surveillance

- The U.S. Centers for Disease Control and Prevention (CDC) has reported at least 50 cases of mumps from over 20 states this year
- March 2024 - cluster of mumps cases in Hunterdon County among eight family members who traveled internationally



Mumps

- Symptoms usually take 2 to 3 weeks to appear after contact with the virus. Many children have no symptoms, or very mild symptoms. The most common symptoms of mumps include:
- Pain and swelling in the salivary glands, especially in the jaw area
- Trouble talking and chewing
- Earache
- Fever
- Headache
- Muscle aches
- Tiredness
- Loss of appetite

Transmission

- Mumps is a very contagious viral illness that infects the pair of salivary glands in front of the ears.
- An infected person can spread mumps anytime from a few days before their glands start to swell, up to 5 days after the swelling begins.
- Mumps is spread by contact with fluids from the mouth, nose, and throat when an infected person coughs, sneezes, or talks (droplet precautions)
- Mumps can be prevented by vaccine

One dose of MMR vaccine is:	• 93% effective against measles • 72% effective against mumps • 97% effective against rubella
Two doses of MMR vaccine are:	• 97% effective against measles • 86% effective against mumps

https://www.cdc.gov/mumps/vaccines/index.html

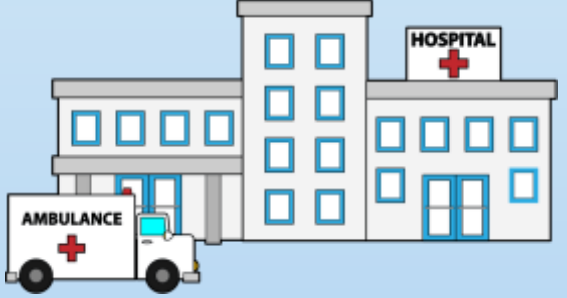
Pertussis (whooping cough)

- In 2024, reported cases of pertussis increased across the United States, indicating a return to more typical trends (10,000 cases/year)
- More than **five times as many cases** have been reported as of week 43, reported on October 26, 2024, compared to the same time in 2023
- The number of reported cases this year is higher than what was seen at the same time in 2019, prior to the pandemic
- In 2024: New Jersey is experiencing a similar increase in pertussis cases
- Cases have occurred across the state with a mix of: unvaccinated individuals (mostly infants), vaccinated individuals (school-aged children), and individuals with unknown vaccination history (mostly adults)

Pertussis: clinical course

- **Incubation period**
- 1–2 weeks
- **Catarrhal phase**
- 1–2 weeks, characterized by a low-grade fever, runny nose, and a cough that gradually worsens
- **Paroxysmal phase**
- 2–4 weeks, characterized by severe, spasmodic coughing fits that end with a high-pitched "whoop" when inhaling
- **Convalescent phase**
- 1–3 weeks, characterized by a gradual decline in coughing until child normalizes

Pertussis complications



- About 1 in 3 babies younger than 1 year old who get whooping cough need acute care hospitalization
- Babies younger than 1 year old who are treated in the hospital can have:
  - **Apnea**: 2 in 3 (68%)
  - **Pneumonia** (lung infection): 1 in 5 (22%)
  - **Convulsions** (violent, uncontrolled shaking): 1 in 50 (2%)
  - **Encephalopathy** (disease of the brain): 1 in 150 (0.6%)
- One in 100 (1%) will **die** from their complications.
- Compared to COVID-19 with a 1 in 10,000 case-fatality rate in children, the case-fatality rate for unvaccinated children with pertussis can approach 3%
- Pertussis remains one of the top ten causes of infant mortality worldwide with an estimated 24 million cases and 160,000 deaths annually in children younger than 5

Shi et al. 2021. https://doi.org/10.1186/s12879-021-06732-1

Vaccine Efficacy

- Efficacy of the pertussis component for children who get all 5 doses on schedule, DTaP fully protects:

  98% of children within the year following the last dose.

  About 71% of children 5 years after getting the last dose of DTaP

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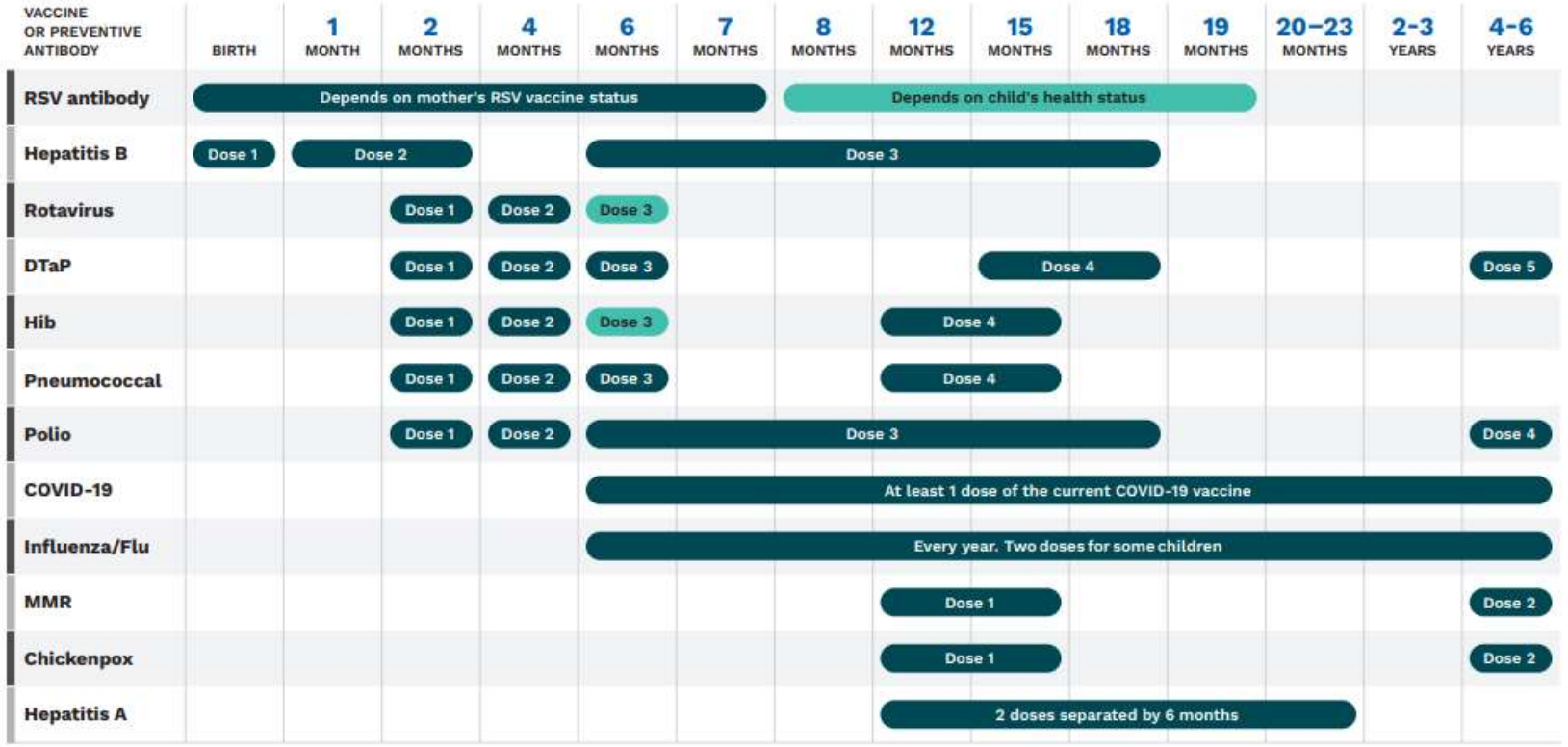

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Older children and teens need vaccines too!

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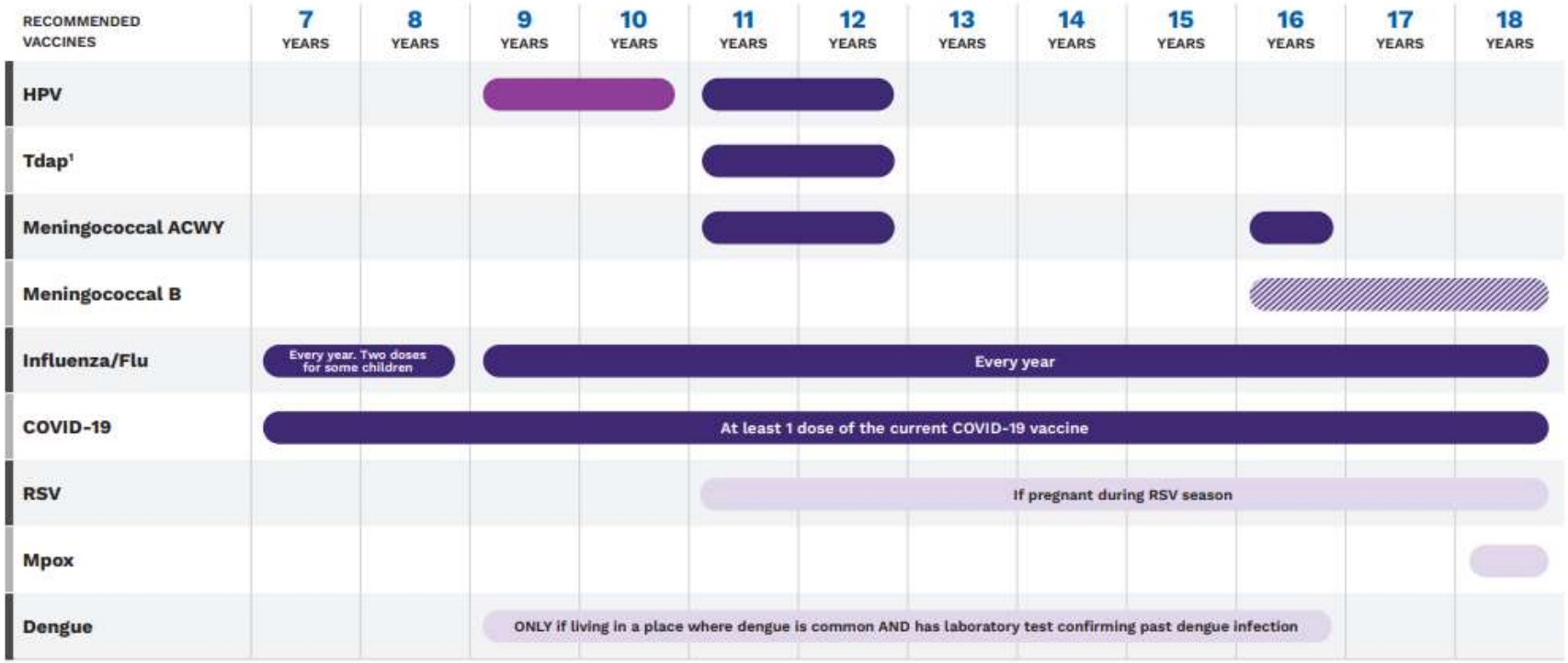

[1] One dose of Tdap is recommended during each pregnancy

KEY

- ALL children in age group should get the vaccine
- ALL children in age group can get the vaccine
- SOME children in age group should get the vaccine
- Parents/caregivers should talk to their health care provider to decide if this vaccine is right for their child

Talk to your child's health care provider for more guidance if:

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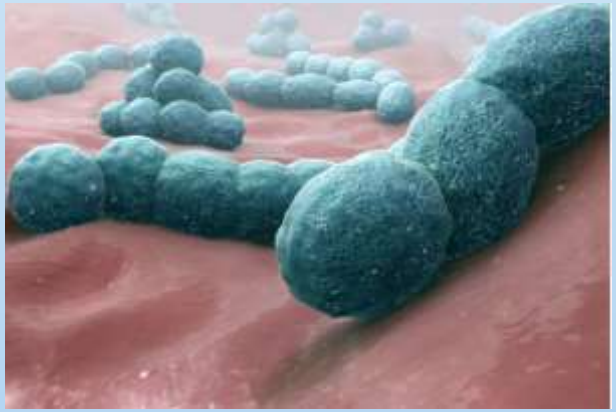
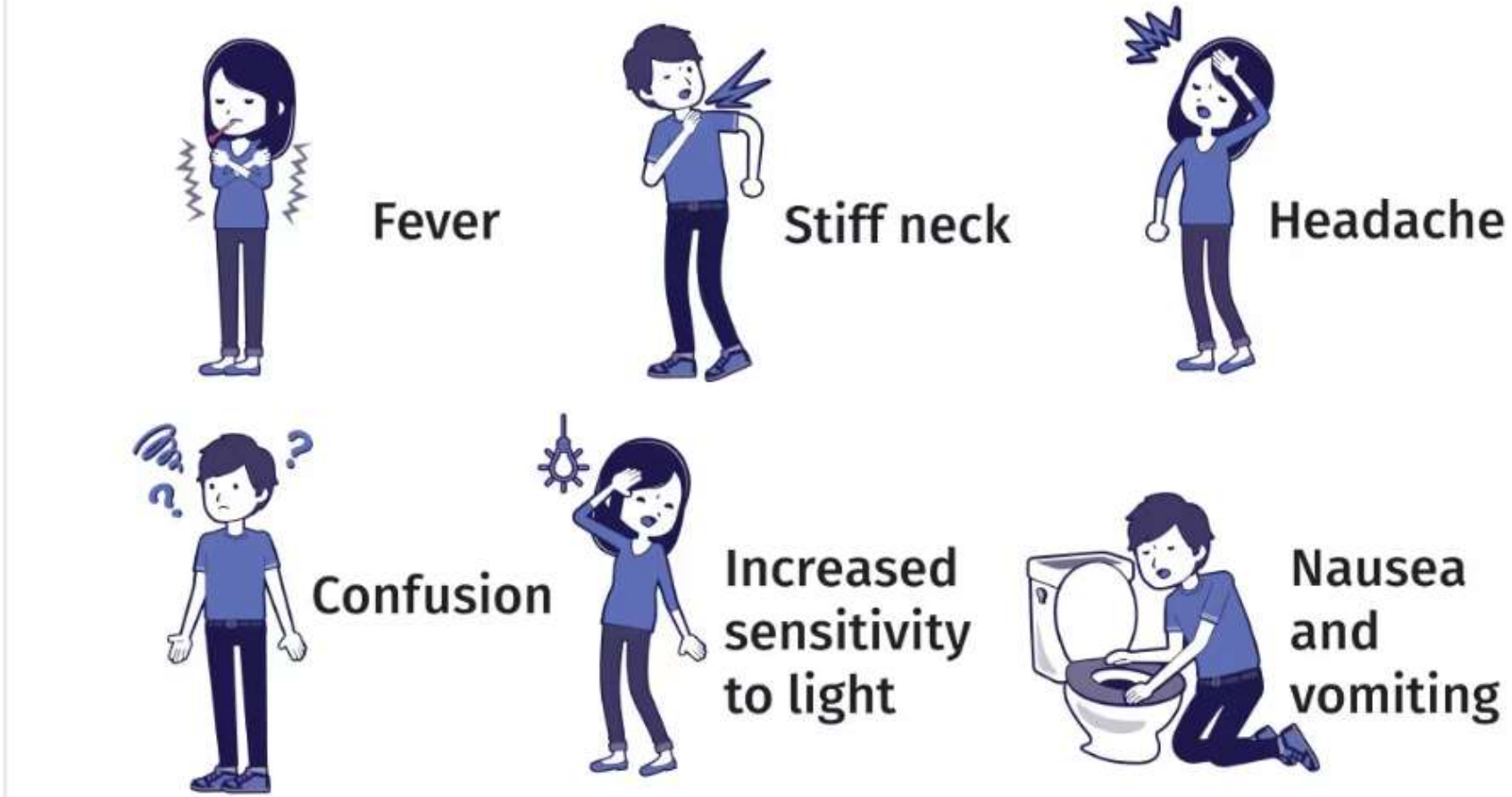
Meningococcal disease



- Serious illness caused by *Neisseria meningitidis*
- Flulike symptoms with typical petechial-purpuric rash
- Can quickly progress to invasive disease causing meningitis and/or bacteremia
- 3 serogroups cause majority of disease in US (B, C, Y)
- 10-15% case fatality
- Transmission via respiratory droplets



Fever, stiff neck, and headache are common meningitis symptoms.

This is an official

CDC HEALTH ADVISORY

Distributed via the CDC Health Alert Network
March 28, 2024, 1:30 PM ET
CDCHAN-00505

Increase in Invasive Serogroup Y Meningococcal Disease in the United States

Summary

The Centers for Disease Control and Prevention (CDC) is issuing this Health Alert Network (HAN) Health Advisory to alert healthcare providers to an increase in invasive meningococcal disease, mainly attributable to *Neisseria meningitidis* serogroup Y (Figure). In 2023, 422 cases were reported in the United States, the highest annual number of cases reported since 2014. As of March 25, 2024, 143 cases have been reported to CDC for the current calendar year, an increase of 62 cases over the 81 reported as of this date in 2023. A specific meningococcal strain, sequence type (ST) 1466, is responsible for most (101 of 148, 68%) serogroup Y cases with available sequence type data that were reported across the United States in 2023. Cases caused by this strain are disproportionately occurring in people ages 30–60 years (65%), Black or African American people (63%), and people with HIV (15%). In addition, most cases of invasive meningococcal disease caused by ST-1466 in 2023 had a clinical presentation other than meningitis: 64% presented with bacteremia, and at least 4% presented with septic arthritis. Of 94 patients with known outcomes, 17 (18%) died; this case-fatality rate is higher than the historical case-fatality rate of 11% reported for serogroup Y cases in 2017–2021. **Healthcare providers should 1) have a heightened suspicion for meningococcal disease, particularly among populations disproportionately affected by the current increase, 2) be aware that patients may present without symptoms typical of meningitis, and 3) ensure that all people recommended for meningococcal vaccination, including people with HIV, are up to date for meningococcal vaccines.**

Background

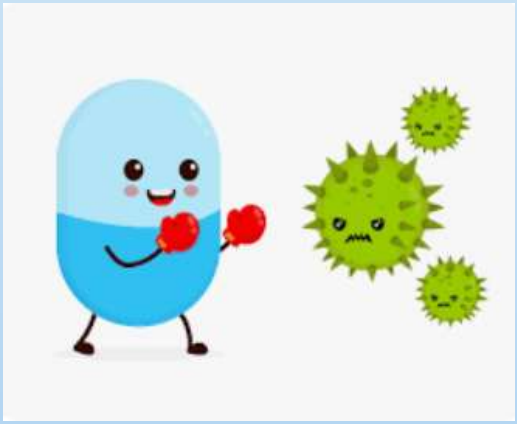
Meningococcal disease, caused by the bacterium *Neisseria meningitidis*, is a rare but severe illness with a case-fatality rate of 10–15% even with appropriate antibiotic treatment. Meningococcal disease most often presents as meningitis, with symptoms that may include fever, headache, stiff neck, nausea, vomiting, photophobia, or altered mental status; or as meningococcal bloodstream infection, with symptoms that may include fever and chills, fatigue, vomiting, cold hands and feet, severe aches and pains, rapid breathing, diarrhea, or, in later stages, a dark purple rash. While initial symptoms of meningococcal disease can at first be non-specific, they worsen rapidly, and the disease can become life-threatening within hours. Immediate antibiotic treatment for meningococcal disease is critical. Survivors may experience long-term effects such as deafness or amputations of the extremities.

Of the six *N. meningitidis* serogroups — A, B, C, W, X, and Y — responsible for most meningococcal disease worldwide, the four serogroups B, C, W, and Y circulate in the United States. Vaccines against serogroups A, C, W, Y (MenACWY) and serogroup B (MenB) are available in the United States. MenACWY vaccines are routinely recommended for adolescents and for people with other risk factors or underlying medical conditions, including HIV.

NJ surveillance

- In 2023, 17 total confirmed meningococcal disease cases were reported in NJ. This was the largest number of NJ meningococcal cases since 2013 where a total of 20 cases were reported (included an outbreak of serogroup B occurring on a college campus).
- As of August 16, a total of 15 cases have been reported in NJ for 2024

Chemoprophylaxis



- Close contacts of persons with meningococcal disease should receive antimicrobial chemoprophylaxis, regardless of vaccination status, because they are at increased risk for infection
- Rifampin, ceftriaxone, and ciprofloxacin have typically been 90%–95% effective in reducing nasopharyngeal carriage of *N. meningitidis*
- **Increasing rates of ciprofloxacin-resistant strains**

Current available vaccines

MenACWY is recommended for these groups:

- All children and teens, ages 11 through 18 years (catch up vaccination of people age 19 through 21 who have not received a dose since turning 16 can be considered)
- People age 2 months and older who have a damaged or missing spleen.
- People age 2 months and older with a complement disorder (an immune system disorder) or who take a complement inhibitor (e.g., eculizumab [Soliris], ravulizumab [Ultomiris], sutimlimab [Enjaymo]).
- People who are at risk during an outbreak caused by a vaccine serogroup.
- People with HIV infection.
- People who are or will be a first-year college student living in a residential facility.
- People age 2 months and older who reside in or travel to certain countries in sub-Saharan Africa as well as to other countries for which meningococcal vaccine is recommended (e.g., travel to Mecca, Saudi Arabia, for the annual Hajj).
- People working with meningococcus bacteria in laboratories.

Meningococcal Vaccines Available in U.S.

TRADE NAME (MFR)	SEROGROUPS INCLUDED	YEAR LICENSED	APPROVED AGES
Menveo (GSK)	A, C, W, Y	2010	2 months–55 years*
MenQuadfi (Sanofi)	A, C, W, Y	2020	2 years and older
Trumenba (Pfizer)	B	2014	10–25 years†
Bexsero (GSK)	B	2015	10–25 years†
Penbraya (Pfizer)	A, B, C, W, Y	2023	10–25 years†

MenB is recommended for these groups:

- People age 10 years and older who have a damaged or missing spleen.
- People age 10 years and older with a complement disorder (an immune system disorder) or who take a complement inhibitor (e.g., eculizumab [Soliris], ravulizumab [Ultomiris], sutimlimab [Enjaymo]).
- People who are at risk due to a meningococcal serogroup B outbreak.
- People working with meningococcus bacteria in laboratories.

MenB vaccines are not routinely recommended for all adolescents or college students.

Shared clinical decision making

Older children and teens need vaccines too!

2024 Recommended Immunizations for Children 7–18 Years Old

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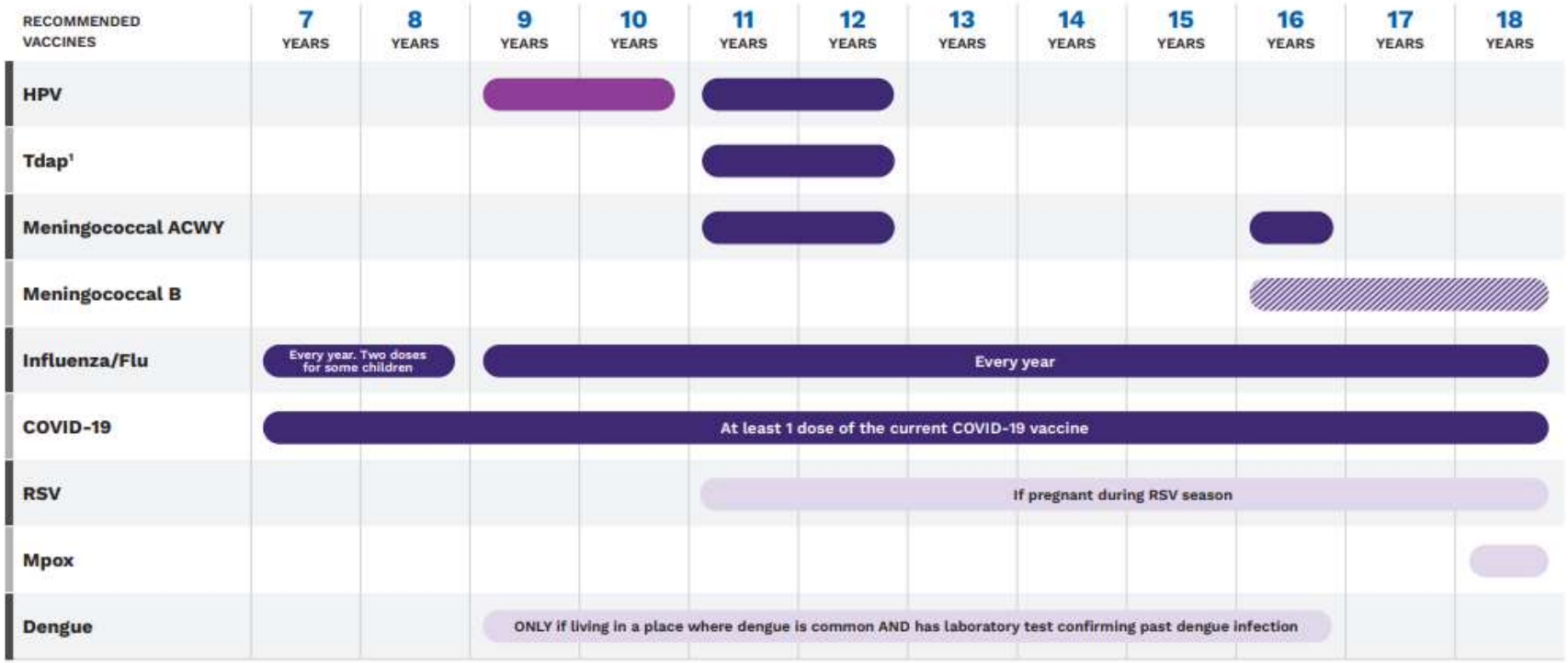

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Or visit: **www.cdc.gov/vaccines/parents**

AAFP AMERICAN ACADEMY OF FAMILY PHYSICIANS

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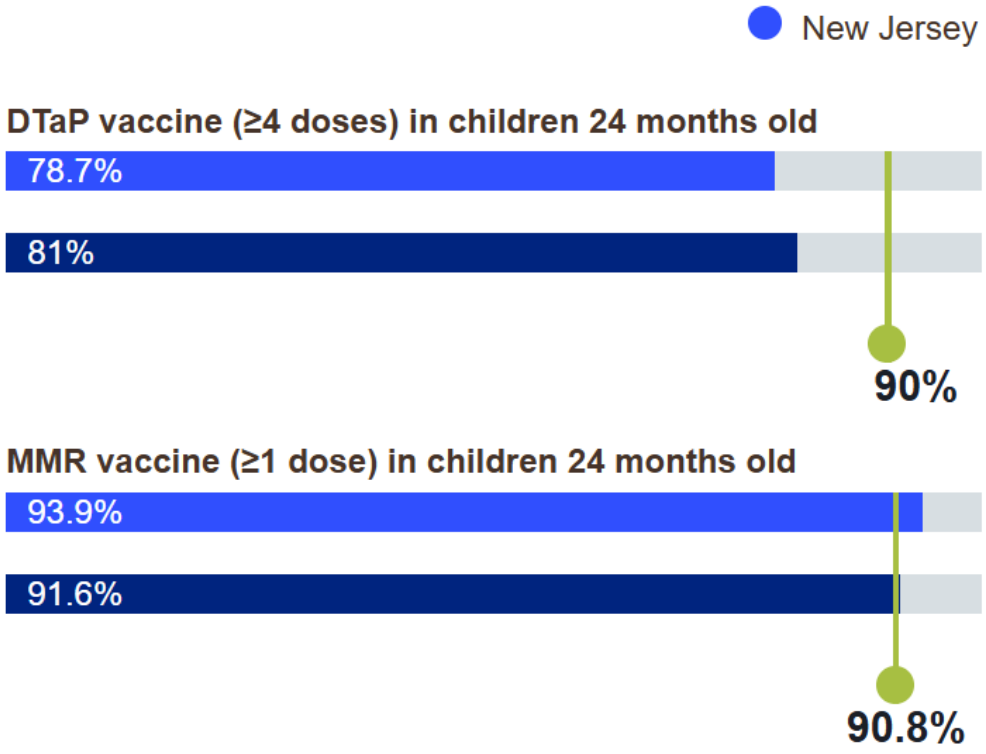
How New Jersey Compares with National Rates



The combined 7-series vaccination includes ≥4 doses of DTaP, ≥3 doses of poliovirus vaccine, ≥1 dose of measles-containing vaccine, full series of Hib vaccine (≥3 or ≥4 doses, depending on product type), ≥3 doses of HepB, ≥1 dose of varicella vaccine, and ≥4 doses of PCV.

https://www-doh.nj.gov/doh-shad/topic/Immunization.html

Implications for Practice

- 20% of US parents reported that they were “hesitant about childhood shots” in 2019
- A small proportion of parents (1% to 3%) refuse all vaccines and may have more fixed beliefs and attitudes about vaccines
- A Vaccine Safety Datalink (VSD) study confirmed that most children received early childhood vaccinations on time (68.4% for children born in 2017)
- Receiving fewer than the recommended number of vaccines at each visit was more common (2.04%) than the small but increasing number of children who received no vaccines in the first 2 years of life (0.35% in 2004 to 1.28% in 2017)
- On-time routine vaccination decreased in the years immediately after the coronavirus disease 2019 (COVID-19) pandemic

  ?missed well-visit appointments vs changes in vaccine hesitancy during the pandemic
- Some US and Canadian surveys have shown that vaccine hesitancy has not changed significantly since the onset of the pandemic
- **Majority of hesitant parents likely have some ambivalence toward vaccination decisions and many may be receptive to information and guidance about routine childhood vaccines that improve their confidence and uptake for their children**

O’Leary et al. Pediatrics (2024). https://doi.org/10.1542/peds.2023-065483

References

American Academy of Pediatrics (2024, November). Measles Vaccine. https://www.aap.org/en/patient-care/measles/measles-vaccine/?srsltid=AfmBOorZxJE3zaYYfvaWgT8Cf20tz1FCs5pWBQ5oIQekGvJSVikikirG

Centers for Disease Control and Prevention (2024, November). Global Immunization: vaccine preventable diseases. https://www.cdc.gov/global-immunization/diseases/index.html

Centers for Disease Control and Prevention (2024, March 28,). Health Alert Network: Increase in invasive serogroup Y meningococcal disease in the United States. https://emergency.cdc.gov/han/2024/han00505.asp

Centers for Disease Control and Prevention (2024, November). Vaccines and Immunizations: vaccines and the disease they prevent. https://www.cdc.gov/vaccines/by-disease/index.html

Centers for Disease Control and Prevention (2024, November). Vaccines and Immunizations: vaccine schedules. https://www.cdc.gov/vaccines/imz-schedules/index.html

Feldman AG, O'Leary ST, Danziger-Isakov L. The risk of resurgence in vaccine-preventable infections due to Coronavirus disease 2019-related gaps in immunization. Clin Infect Dis. 2021;73(10):1920-1923. doi: 10.1093/cid/ciab127. PMID: 33580243; PMCID: PMC7929016

Kubin, L. Is there a resurgence of vaccine-preventable diseases in the U.S.? J Pediatr Nurs. 2019 (44): 115-118. https://doi.org/10.1016/j.pedn.2018.11.011

Kurosky SK, Davis KL, Krishnarajah G. Completion and compliance of childhood vaccinations in the United States. Vaccine 2016;34(3):387-94. doi:10.1016/j.vaccine.2015.11.011

Mahmud, A.S., Martinez, P.P., He, J. *et al.* The impact of climate change on vaccine-preventable diseases: insights from current research and new directions. Curr Envir Health Rpt 2020: 7:384–91. https://doi.org/10.1007/s40572-020-00293-2

New Jersey Department of Health (2024, November). Communicable Disease Service: Vaccine preventable disease program. https://www.nj.gov/health/cd/vpdp.shtml

O'Leary ST, Opel DJ, Cataldi JR, et al. Strategies for improving vaccine communication and uptake. Pediatrics 2024; 153 (3): e2023065483. https://doi.org/10.1542/peds.2023-065483

Porteous GH, Hanson NA, Sueda LA, et al. Resurgence of vaccine-preventable diseases in the United States: anesthetic and critical care implications. Anesth Analg 2016;122(5):1450-73. doi: 10.1213/ANE.0000000000001196. PMID: 27088999

Shi, T., Wang, L., Du, S. et al. Mortality risk factors among hospitalized children with severe pertussis. BMC Infect Dis 2021: 21:1057. https://doi.org/10.1186/s12879-021-06732-1

World Health Organization (2024, September 12). 2023 WHO and UNICEF estimates of national immunization coverage. https://www.who.int/health-topics/vaccines-and-immunization#

Zhou F, Jatlaoui TC, Leidner AJ, et al. Health and economic benefits of routine childhood immunizations in the era of the vaccines for children program — United States, 1994–2023. MMWR Morb Mortal Wkly Rep 2024;73:682–685. DOI: http://dx.doi.org/10.15585/mmwr.mm7331a2

Keep vigilant:
Contact local health department
NJDOH Vaccine Preventable Disease Program
Phone: (609) 826-4860