

## **A18. MEASLES: MEASLES VIRUS**

**Disease:** Measles

**Synonyms:** Red measles, rubeola, hard measles, morbilli, morbillivirus  
French: rougeole. German: masern. Spanish: sarampión

**Microbe:** Measles virus

**Microbiology:** Enveloped, single-stranded RNA virus

**Disease:** High fever, cough, runny nose, pink eye, and rash for 1–2 wk. Can cause ear infection, pneumonia, encephalitis, seizures, hearing loss, intellectual disability, and death.

**Transmission:** Via airborne droplets exhaled by infected people (e.g., coughing, sneezing, talking) or oral secretions. Measles is the most contagious of all viruses. Before vaccines were available, all children were assumed to contract measles eventually.

**Geography:** Found around the globe.

**Timeline:** 1954: Enders and Peebles isolate the measles virus.

1963: First measles vaccines licensed in the U.S., both a live, attenuated vaccine and a killed whole-virus vaccine. The killed measles vaccine was withdrawn after 1967 for lack of efficacy. The initial live measles vaccine was injected along with IGIM until a further attenuated strain was introduced in 1965.

1971: Trivalent measles-mumps-rubella (MMR) vaccine licensed in the U.S.

1989: Sharp increase in measles incidence. ACIP and AAP recommend 2-dose vaccination schedule.

## B 9. HEPATITIS A VACCINE: HAVRIX, VAQTA

<b>Setting:</b>	Routine vaccine for children and travelers of wide age span
<b>Products:</b>	Hepatitis A vaccine: Havrix (GSK), Vaqta (Merck)
<b>Category:</b>	Vaccine, inactivated, with aluminum adjuvant
<b>Microbe:</b>	Hepatitis A virus
<b>Dosage Form:</b>	Suspension
<b>Packaging:</b>	

PACKAGE CONTENTS	CONCENTRATION	STORAGE	HANDLING
Havrix: 0.5-mL syringe, 1-mL syringe	720 ELISA units per 0.5 mL or 1440 ELISA units per 1 mL	Refrigerate	Swirl until uniform
Vaqta: 0.5-mL syringe or vial, 1-mL syringe or vial	25 units per 0.5 mL or 50 units per 1 mL	Refrigerate	Swirl until uniform

### Excipients:

- ▶ Havrix: Aluminum hydroxide (adjuvant). Amino acids, phosphate-buffered sodium chloride, polysorbate 20, cellular protein, formaldehyde, neomycin
- ▶ Vaqta: Aluminum hydroxyphosphate sulfate (adjuvant). Sodium chloride, sodium borate, formaldehyde, cellular protein and DNA, bovine albumin, neomycin

**Indication:** Prevention of hepatitis A infection

**Contraindication:** Severe hypersensitivity to a component

### Dosing, Route, & Schedule:

AGE GROUP	DOSE	ROUTE	SERIES	SCHEDULE
12–23 mo	0.5 mL	IM	1 dose + booster	6 mo apart

2–18 y, if not vaccinated earlier	0.5 mL	IM	1 dose + booster	6–18 mo apart
≥ 19 y	1 mL	IM	1 dose + booster	6–18 mo apart
Immune compromised ≥ 18 y exposed to HAV in past 2 wk	0.5 mL	IM	1 dose + IGIM (then HepA booster later)	

Second dose provides long-lasting immunity.

Travel: May be given as young as 6 mo. Younger infants may benefit from IGIM. Adults ≥ 40 y/o traveling within 2 wk, immune-compromised people, and people with chronic liver disease may need vaccine plus IGIM.

See also catch-up schedules published by CDC.

**Efficacy:** In various trials, 94% to 100% reduced disease incidence or induction of antibodies.

**Pregnancy:** Use if clearly needed. Most antibodies cross the placenta during the third trimester.

**Breastfeeding:** Inactivated vaccines generally considered safe during lactation

**Adverse Events:**

INJECTION SITE	SYSTEMIC	UNCOMMON
Soreness, pain, redness, tenderness, warmth	Headache, fever, irritability, drowsiness, loss of appetite, syncope	Anaphylaxis, Guillain-Barré syndrome

**Drug Interactions:**

INTERACTING AGENT	MECHANISM	CLINICAL MANAGEMENT
Immune-suppressing treatments	Immune suppression, could reduce vaccine efficacy	Delay vaccination until therapy stopped, if possible

**Counseling:** Advise travelers how to follow safe food and water guidelines. See [cdc.gov/travel](http://cdc.gov/travel)

### **c13. RABIES IMMUNE GLOBULIN (RIG): HYPERRAB, IMO GAM RABIES, KEDRAB**

- Setting:** Passive immunization for prophylaxis of rabies
- Products:** Rabies Immune Globulin (RIG): HyperRAB (Grifols), Imogam Rabies (Sanofi), Kedrab (Kamada)
- Category:** IgG antibodies, human, polyclonal
- Microbe:** Rabies virus
- Dosage Form:** Solution
- Packaging:**

PACKAGE CONTENTS	CONCENTRATION	STORAGE	HANDLING
HyperRAB: 1-mL vial, 3-mL vial, 5-mL vial	300 units per mL	Refrigerate	Do not shake
Imogam Rabies: 2-mL vial	150 units per mL	Refrigerate	Do not shake
Kedrab: 2-mL vial, 10-mL vial	150 units per mL	Refrigerate	Do not shake

- Excipients:** Glycine
- Indication:** Passive immunization for rabies prophylaxis when given with rabies vaccine.
- Contraindication:** None. Do not give to people who completed pre- or post-exposure prophylaxis, to avoid interfering with anamnestic response to vaccination.

#### **Dosing, Route, & Schedule:**

AGE GROUP	DOSE	ROUTE	REGIMEN
All ages	20 units per kg	Infiltrate wound with full dose. Inject any	Inject any remaining RIG IM at site distant from vaccination. Post-exposure rabies prophylaxis requires several doses of

	remainder IM	rabies vaccine – see CDC guidelines
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If large volume required (e.g., > 2 mL for small children, > 5 mL for adolescents or adults), may be given in divided doses.

See CDC guidelines.

**Pregnancy:** Use if clearly needed.

**Breastfeeding:** Use if clearly needed.

**Adverse Events:**

INJECTION SITE	SYSTEMIC	UNCOMMON
Pain, nodule	Headache, fever, muscle pain, joint pain, abdominal pain, dizziness, bruising, fatigue, vomiting, diarrhea, flatulence, nasal congestion, oropharyngeal pain	Anaphylaxis, thrombotic events

**Safety Issues:** Check dosing calculations. RIG concentrations vary between products.

**Drug Interactions:**

INTERACTING AGENT	MECHANISM	CLINICAL MANAGEMENT
Injectable live-virus vaccines	Interference with immune response to vaccination	Separate IgG and vaccination according to type and dose of IgG or blood product

## D 5. BY AGE: CHILDREN AGE 6 MONTHS

Case:

Anna, age 6 mo

Date: September 1

Vaccination History:

On schedule so far

Series	Dose 1	Dose 2	Dose 3	Dose 4	Dose 5	More
Hepatitis B	03/01/xx	05/01/xx	? ? ?			
RSV-nirsevimab	03/01/xx					
Rotavirus	05/01/xx	07/01/xx	? ? ?			
DTaP	05/01/xx	07/01/xx	? ? ?			
Haemophilus	05/01/xx	07/01/xx	? ? ?			
Pneumococcal	05/01/xx	07/01/xx	? ? ?			
Poliovirus	05/01/xx	07/01/xx	? ? ?			

Medical History:

Fussy last night, temperature 99.5°F (37.5°C)

Step A: What do we know about the patient?

Sick today? **Fussy, 99.5°F**

Allergies? **None**

Prior severe reaction? **No**

Medical history? **Unremarkable**

Family immune problem? **No**

Recent medications? **None**

Recent blood products? **No**

Recent vaccinations? **None**

Pregnant? **No**

Answers from parents: **Unremarkable, other than current temperature of 99.5°F (37.5°C)**

Step B: What vaccines are routinely recommended for children at this age?

Step C: Is the patient overdue for any recommended vaccines?

Step D: Should any vaccines be deferred due to contraindications, precautions, or special situations?

Step E: Should any vaccines or antibodies be added to today's plan?

Step F: What vaccines should be given during today's visit?

Discuss VIS content. What is the primary language spoken at home?

**After-visit Care:**What to do?

**Counseling:** What to say?

**ASSIGNMENT:** Work up your plan for today's visit, then advance to next FLASH FACT for answers and explanations.

[FLIP when ready]

Case:

Anna, age 6 mo

Date: September 1

Vaccine History:

On schedule so far

Series	Dose 1	Dose 2	Dose 3	Dose 4	Dose 5	More
Hepatitis B	03/01/xx	05/01/xx	???			
RSV-nirsevimab	03/01/xx					
Rotavirus	05/01/xx	07/01/xx	???			
DTaP	05/01/xx	07/01/xx	???			
Haemophilus	05/01/xx	07/01/xx	???			
Pneumococcal	05/01/xx	07/01/xx	???			
Poliovirus	05/01/xx	07/01/xx	???			

Medical History:

Fussy last night, temperature of 99.5°F (37.5°C)

**Step A:** What do we know about the patient?

» Answers from parents: No concerns other than fussiness and slight temperature elevation.

**Step B:** Vaccines routinely recommended at this age?

Additional doses of HepB, Rota, DTaP, Hib, PCV, and IPV

+ COVID-19      Appropriate vaccine: Start initial series: ≥ 6 mo

+ Flu              Influenza vaccine (1 or 2 doses per season)

**Step C:** Is the patient overdue for any recommended vaccines?

» No. Vaccinations so far given on time.

**Step D:** Vaccines to defer based on patient history?» None. **Mild temperature elevation is no reason to hold vaccination.** See FLASH FACT F 3: INVALID CONTRAINDICATIONS.**Step E:** Vaccines or antibodies to add based on patient history?



» **Yes, based on the calendar!** September 1 is early in the influenza-vaccine season. Children need two vaccine doses in their first season of being vaccinated against influenza, so start today. For children born Oct–Mar (for 48 contiguous states), give nirsevimab (extended half-life mAb) at birth. For children born Apr–Sep (48 states), give nirsevimab when entering first RSV season if < 8 mo old. In other locations, follow public-health guidelines.

**Step F:** What vaccines should be given during today's visit?

BIRTH	AGE 2 MO	AGE 4 MO	AGE 6 MO <b>TODAY!</b>	FOLLOW-UP	
<ul style="list-style-type: none"> <li>✓ HepB</li> <li>✓ Nirsevimab</li> </ul>	<ul style="list-style-type: none"> <li>✓ HepB</li> <li>✓ Rota</li> <li>✓ DTaP</li> <li>✓ Hib</li> <li>✓ PCV</li> <li>✓ IPV</li> </ul>	<ul style="list-style-type: none"> <li>✓ Rota</li> <li>✓ DTaP</li> <li>✓ Hib</li> <li>✓ PCV</li> <li>✓ IPV</li> </ul>	<ul style="list-style-type: none"> <li>3rd HepB</li> <li>+ 3rd Rota</li> <li>+ 3rd DTaP</li> <li>+ 3rd Hib</li> <li>+ 3rd PCV</li> <li>+ 3rd IPV</li> <li>+ 1st COVID-19</li> <li>+ 1st Flu</li> </ul>	<p>Make an appointment to return for COVID-19 #2 and Flu #2, several wk later</p>	

**Note:** Consider using DTaP-based combination products to reduce number of injections needed.

Combination product options at this age include Pediarix, Vaxelis, and Pentacel.

As shown in CDC's "Recommended Child & Adolescent Immunization Schedule," there are timing options at this age for several vaccines, depicted by the width of the cells.

Discuss VIS content. VIS translations in > 45 languages at [www.immunize.org/vis/](http://www.immunize.org/vis/)

**After-visit Care:** Document vaccination. Treat symptoms of post-vaccination events.

**Counseling:** Tell us about adverse events. Schedule return visit for next doses.

## SECTION E. TRAVEL HEALTH



### E 1. TRAVEL HEALTH & TRAVEL MEDICINE

More people travel outside the United States each year. Travel to exotic places is now commonplace. The hazards they encounter are myriad — some of which are infectious diseases. CDC's *Yellow Book: Health Information for International Travel* describes > 80 distinct infectious diseases. Only a few of these are vaccine-preventable. Travel Health involves much more than a few shots before departure. The **FLASH FACTS** in SECTION E review major diseases and risk factors affecting the health of travelers.

**Travel Health:** Efforts to promote health and protect travelers from health hazards encountered during their journeys — to help them stay healthy and avoid becoming ill. Main tool: Pre-travel consultation.

**Travel Medicine:** Clinical discipline of diagnosing and treating illness(es) contracted during travel, typically provided by infectious-disease specialists.

**Individuality.** The needs of individual travelers vary greatly, even if they travel to the same country. Risk also varies by season, altitude, lodging, activities, mode of travel, among other factors. Ultimately, these

risks are not quantifiable. Good advice can help reduce risk and increase the odds that the traveler will have a great experience.

If 100,000 travelers go to a developing country for a month, roughly ...  
30,000 to 75,000 will develop some health problem (#1 is traveler's diarrhea),  
8,000 will see a physician about a health problem,  
5,000 will stay in bed,  
300 will be hospitalized,  
50 will be air-evacuated back home, and  
1 will die.

**Exposure.** We will address travel risks arrayed across six categories, based on route of exposure. Interspersed will be segments about specific types of risks and ways to mitigate them.

<b>Routes of Exposure</b>	Food & Drink Blood & Body Fluids	Environment Animals	Insects Respiratory Pathogens
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**Plan Ahead.** Ideally, the traveler seeks advice and begins planning 4–6 wk before departure. This allows time for a full immune response to vaccinations. But even the traveler departing tomorrow can benefit from your advice given today.

Travel is a wonderful way to learn about other cultures and better understand yourself. Live vicariously through the travelers you meet and help keep them healthy with the advice offered in the following FLASH FACTS.

**Workflow.** For workflow and business considerations in designing, staffing, and operating a travel health clinic, see [shoreland.com/downloads/pdf/pharmacyclinicguide.pdf](http://shoreland.com/downloads/pdf/pharmacyclinicguide.pdf)

### F30. HOW VACCINES WORK; VACCINE VS. ANTIBODY

**Vaccine:** A medication containing antigens that stimulates the body's immune response against diseases.

Vaccines cause recipients to make antibodies and other cellular immune responses.

Vaccines contain **antigens** (with what immunologists call **epitopes**). An antigen is a live or inactivated substance (e.g., protein, polysaccharide) capable of evoking antibody production.

**Epitopes** are sites on an antigen where IgG antibodies attach.

**Antibody:** A specific type of protein produced by certain B-lymphocytes (plasma cells) that attack and help destroy antigens found on bacteria or viruses. An antitoxin is an antibody that binds and neutralizes a specific toxin.

	VACCINES	ANTIBODIES, IMMUNE GLOBULINS
Effect	Active immunity	Passive immunity
Mechanism of action	Evoke personal protection	Provide borrowed protection
Clinical role	For prevention	Typically for post-exposure prevention or for treatment. Exceptions: IGIM, nirsevimab
When given	Typically before exposure	Typically after exposure, although IGIM and nirsevimab given as prophylaxis
Onset of protection	~ 2 wk	Within hours
Duration of protection	Prolonged effect (years)	Transient effect (weeks to months)