Pneumococcal Disease

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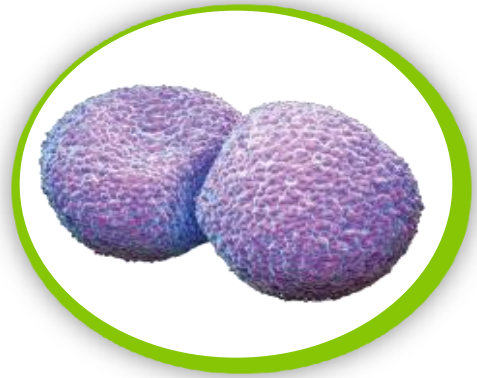
TABRIZ , IRAN

Pneumococcal Disease – Pathogen

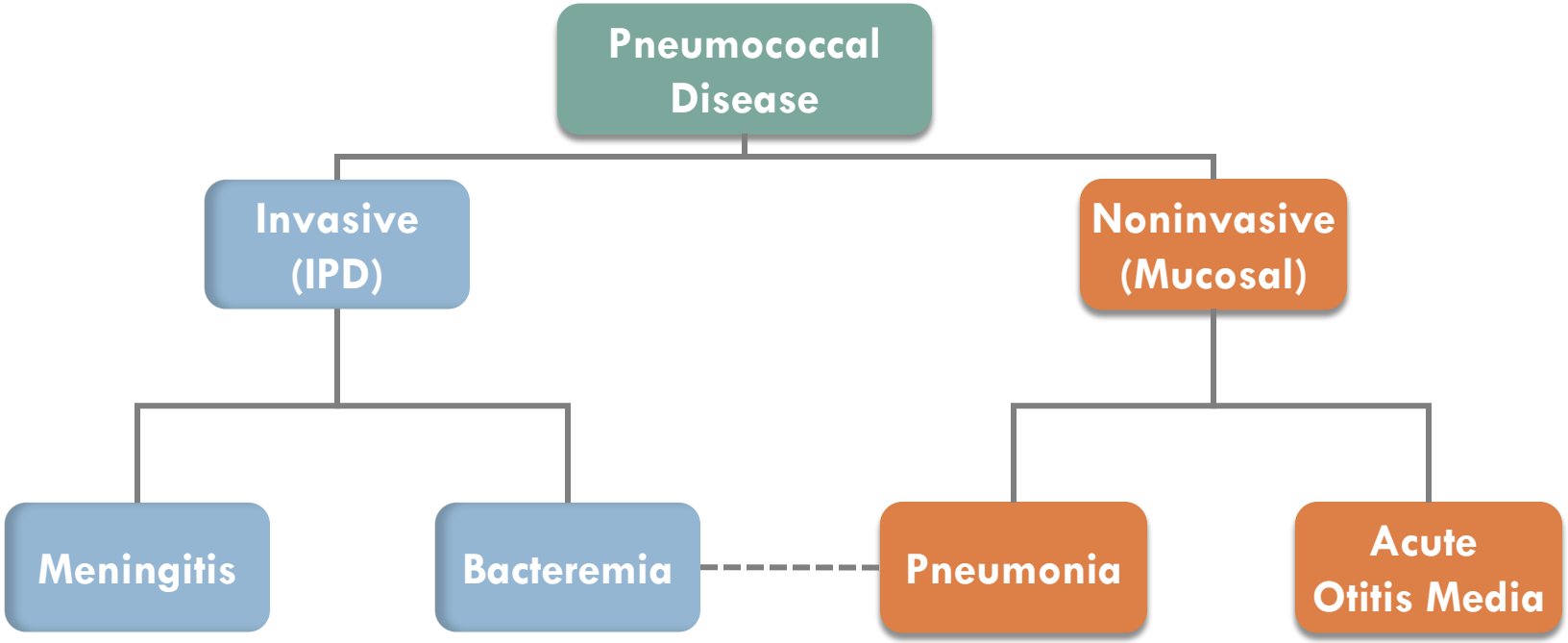
- Gram-positive, encapsulated: Capsule defines serotype[1,2]
- A leading cause of infection, including *pneumonia*, meningitis, and bacteremia[1]
- Organism has an outer polysaccharide capsule[2]
  - Defines the serotype
  - Functions as virulence factor
  - Is a vaccine target
- More than 90 serotypes of *S pneumoniae* have been identified[2]
  - All serotypes are not equally pathogenic
  - PCV13 covers 73%–100 % of serotypes in children < 5 years & 50-76 % of serotypes in adults > 50 years in Europe[3]
- Antibiotic resistance in S *pneumoniae* is a global concern[1,2]
- Detected in nasopharynx of 5%–10% of healthy adults



S pneumoniae

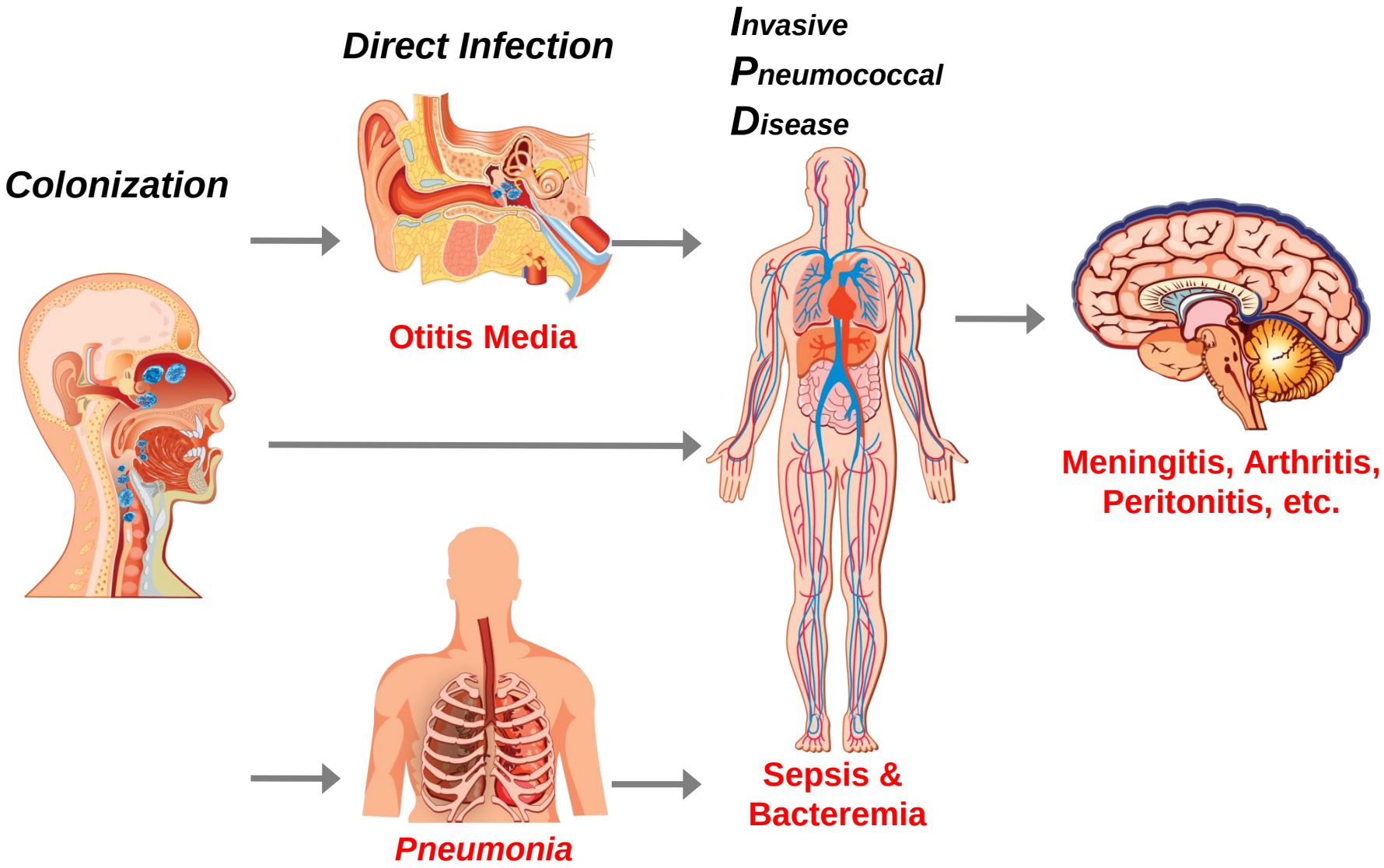
1. Pneumococcal Disease. Centers of Disease Control and Prevention Website. http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/pneumo.pdf. Revised May 2012. Accessed on July 7, 2014.
2. WHO. *Wkly Epidemiol Rec*. 2012;87(14):129-144.
3. Prevenar13, Summary of Product Characteristics. European Medicine Agency Website. http://www.ema.europa.eu/docs/en_GB/document_library/EPAR_-_Product_Information/human/001104/WC500057247.pdf. Accessed on June 18th, 2014.

S. pneumoniae Disease Classification



1. Ludwig E, et al. *Eur Respir Rev*. 2012; 21(123):57-65.
2. Atkinson W, Wolfe S, Hamborsky J, McIntyre L, eds. Epidemiology and Prevention of Vaccine-Preventable Diseases. 12th ed. Washington DC: Public Health Foundation. 2009:217-230.
3. Jansen AG, et al. *Clin Infect Dis*. 2009; 49:e23-e29.

Pathogenesis of Pneumococcal Diseases



Adapted from Schmitt HJ, Manila 2012.

- **The basis of immunity was shown by Neuceld and Rimpau to be the presence of factores) in serum that facilitate ingestion by white blood cells/WBC) a process they called opsonization**

- **Antimicrobials and vaccines have substantially reduced the incidence of, and morbid outcomes from pneumococcal infection. However, acquisition of antibiotic resistance the more limited impact of vaccines on mucosal disease (eg, pneumonia, otitis media). The emergence of no vaccine serotypes and a growing immunocompromised population provide challenges for ongoing control of this prevalent and invasive pathogen.**

Diagnosis

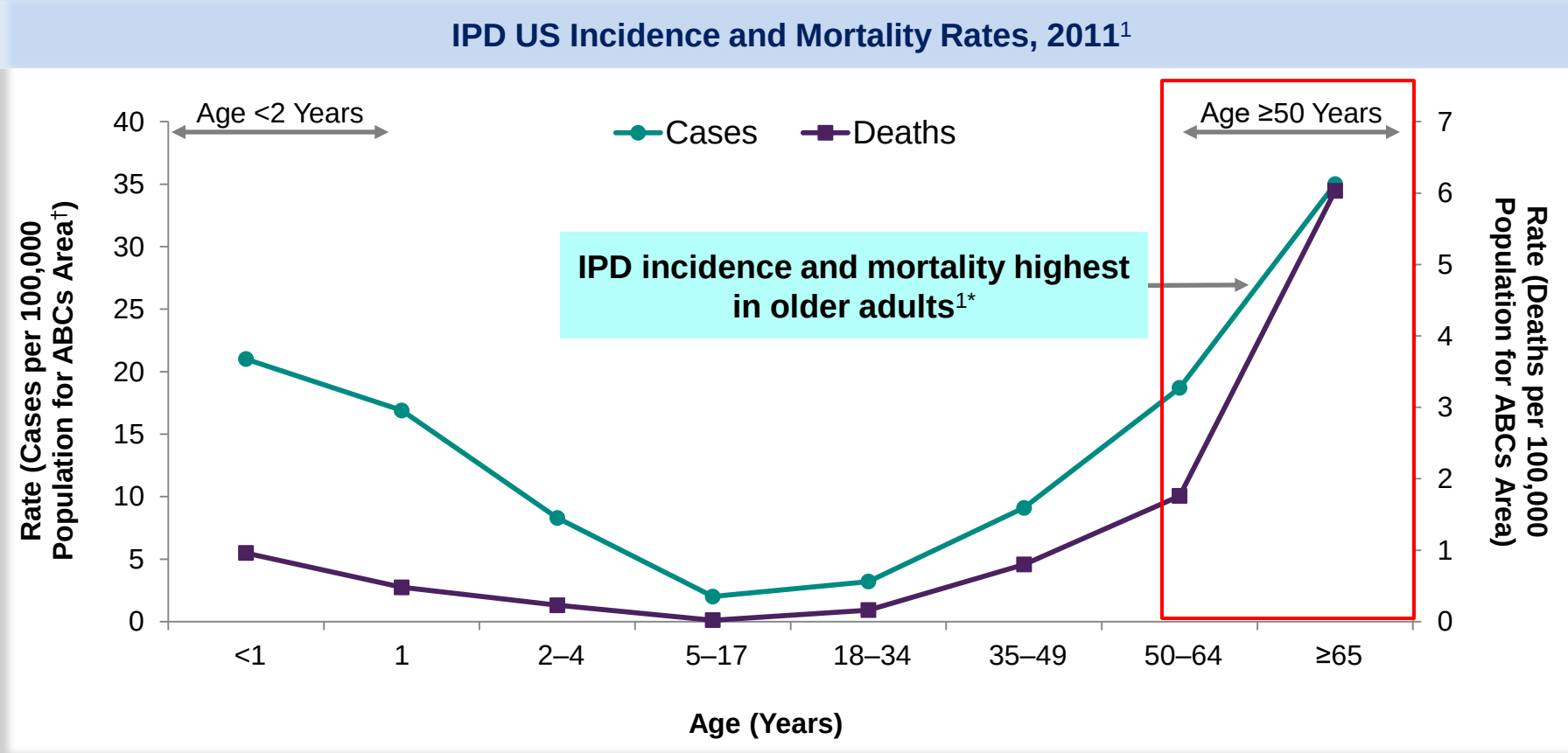
- **Gram stain and culture of good quality sputum (> 10 neutrophils . Epithelial cell) from patients with pneumonia support a presumptive diagnosis of pneumococcal pneumonia. Blood cultures are positive in about 20% of patients with pneumococcal pneumonia, establishing a diagnosis of proven pneumococcal pneumonia.**

- **Detection of pneumococcal cell wall polysaccharide in urine (approximately 70% sensitive in adults with bacteremia; not specific in children) or of capsular polysaccharide in urine (sensitive, but limited to a small number of serotypes) is diagnostic of pneumococcal infection.**

- **Detection of pneumococci by gram stain and culture of cerebrospinal fluid establishes the diagnosis of clinical manifestions**

- **The spectrum of pneumococcal infection rages from asymptomatic pharyngeal colonization to mucosal disease (otitis nedia, sinusitis, pneumonia) to invasive disease (bacteria in a normally sterile site: bacteremia, meningitis empyema, endocarditis, arthritis)**

Highest Incidence and Mortality Rates of IPD at Extremes of Age



IPD=invasive pneumococcal disease.

1. CDC. ABCs Report: *Streptococcus pneumoniae*, 2011. http://www.cdc.gov/abcs/reports-findings/survreports/spneu11.html. Accessed on August, 27, 2013.

Factors Associated with Increased Risk of Pneumococcal Disease in Adults

Age	Host Factors		External Factors	Behavioral
	Immunocompetent	Immunocompromised		
< 2 y/o >50 y/o	• Underlying medical conditions – CCVD – CPD – Diabetes – Functional and anatomic asplenia – Alcoholism – CLD – Cerebrospinal fluid leaks	• HIV • CRF, nephrotic syndrome • Cancer (solid, hematological) • Organ and bone marrow transplant • Auto-immune diseases • Immunosuppressive therapy, corticosteroids • Primary immunodeficiences	• Socioeconomic • Environmental – Preceding viral respiratory infection – Residence in an institution (e.g., nursing home)	• Smoking • Heavy alcohol use

CCVD: Cardiovascular and cerebrovascular disease; CPD: Chronic pulmonary disease.
CLD: Chronic liver disease; CRF: Chronic renal failure.

1. Advisory Committee on Immunization Practices. *Ann Intern Med.* 2009;150(1):40-4.
2. Nuorti JP. Epidemiology of invasive pneumococcal disease in adults: Implications for prevention. *National Public Health Institute; University of Helsinki.* 2000. http://ethesis.helsinki.fi/julkaisut/laa/kliin/vk/nuorti/epidemio.pdf. Accessed on July 07, 2014..
3. Rahier JF, et al. *Rheumatology* (Oxford). 2010;49(10):1815-27.

Comorbidities Can Increase IPD Incidence in Adults of All Ages

	2–15 Years		16–64 Years		≥65 Years	
	IR	OR	IR	OR	IR	OR
No Risk Group	3.9	1.0	5.2	1.0	17.9	1.0
Asplenia / Splenic Dysfunction	19.0	4.7	12.0	2.3	13.0	0.7
Chronic Respiratory Disease	50.0	**12.7**	91.0	**16.8**	91.0	**5.1**
Chronic Heart Disease	16.0	4.1	36.0	6.9	54.0	3.0
Chronic Kidney Disease	46.0	11.7	34.0	6.5	16.0	0.9
Chronic Liver Disease	117.0	29.6	172.0	33.3	129.0	7.2
Diabetes	15.0	3.8	24.0	4.6	41.0	2.3
Immunosuppression	162.0	41.0	88.0	17.1	209.0	11.7
HIV Infection	398.0	**100.0**	316.0	**61.2**	95.0	5.3

IR = Incidence Rate
OR = Odds Ratio

van Hoek AJ, et al. *J Infect*. 2012; 65(1):17-24.

Distribution of serotypes of *Streptococcus pneumoniae* strains in Tehran

Serotype	Pediatric carriage isolates (n = 40)		Clinical strains (n = 36)		Total (n = 76)	
	number	%	number	%	number	%
1	1	2.5	2	5.5	3	3.9
3	6	15	1	2.7	7	9.2
4	3	7.5	1	2.7	4	5.2
6A/B	6	15	5	13.8	11	14.4
9V	2	5	1	2.7	3	3.9
11A	1	2.5	2	5.5	3	3.9
12F	2	5	1	2.7	3	3.9
14	3	7.5	2	5.5	5	6.5
19A	7	17.5	8	22.2	15	19.7
19F	2	5	3	8.3	5	6.5
22F	1	2.5	2	5.5	3	3.9
23F	2	5	4	11.1	6	7.9
33F	1	2.5	1	2.7	2	2.6
Nontypeable	3	7.5	3	8.3	6	7.9

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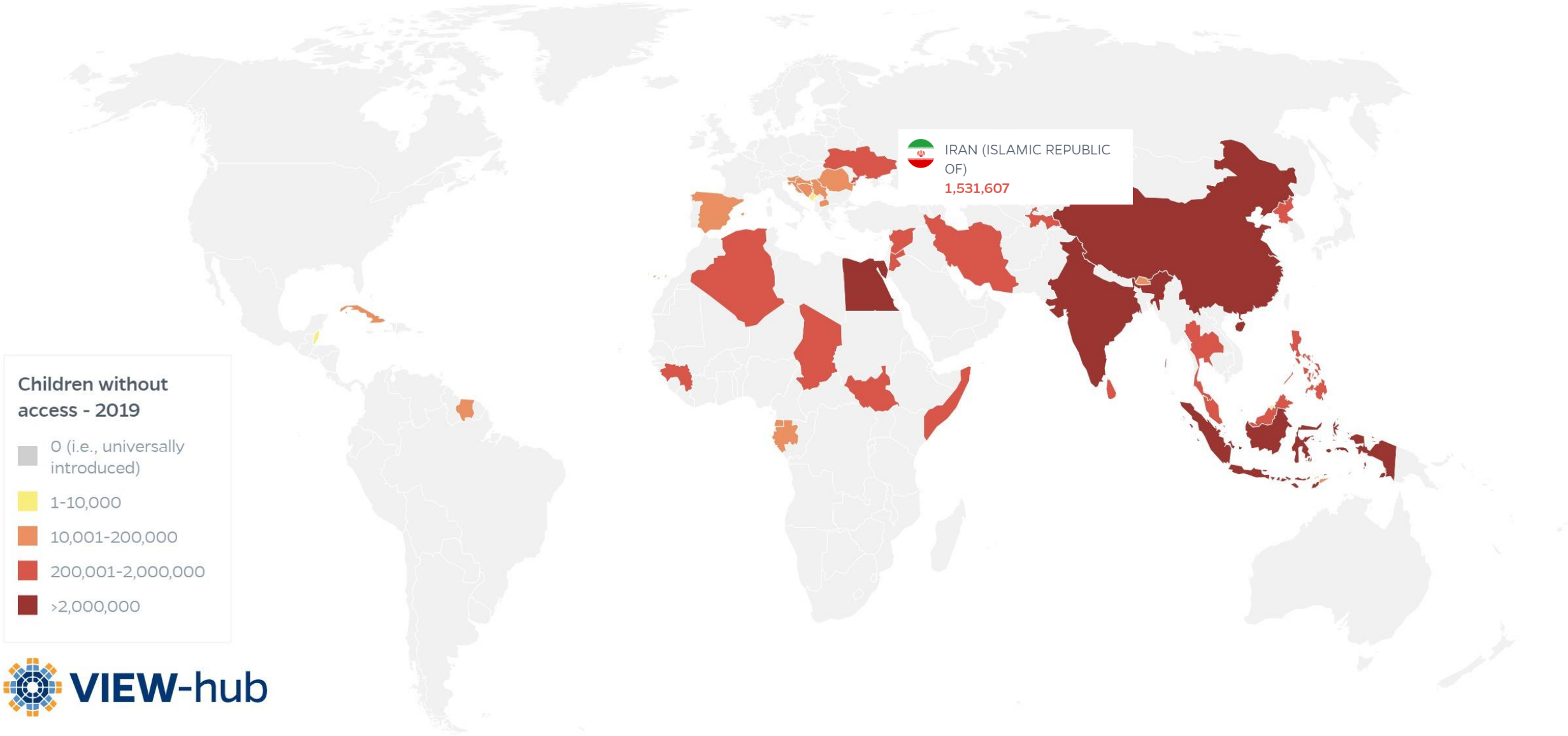

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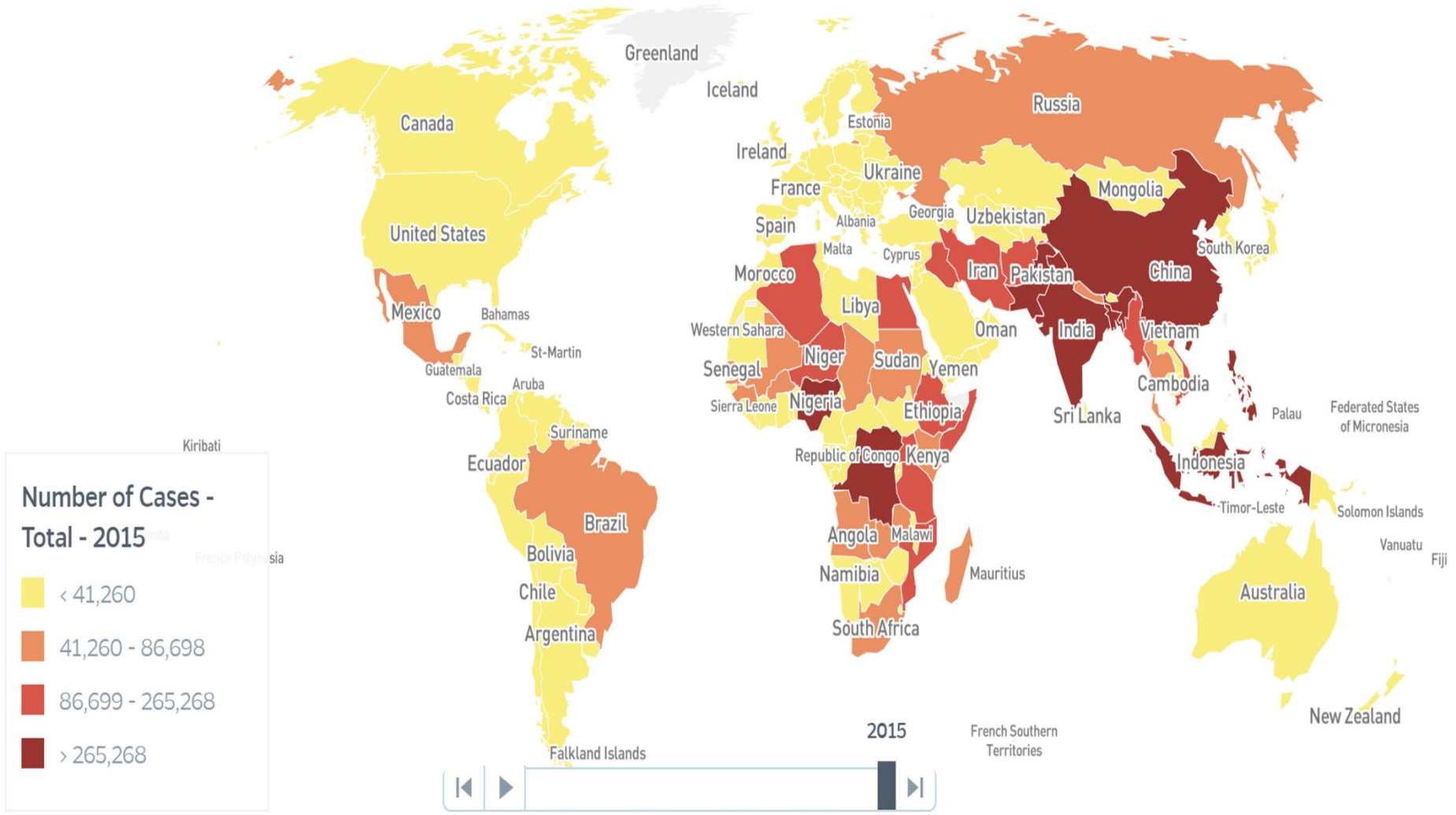
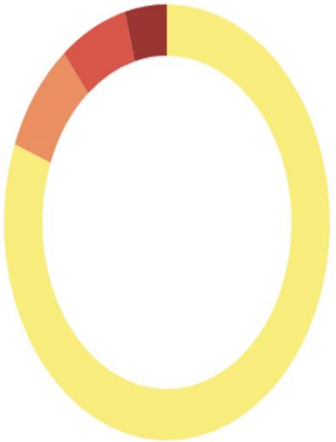
Total Number of Pneumococcal cases



	Global	Gavi
‹ 41,260	**156**	47
41,260 - 86,698	**16**	11
86,699 - 265,268	**13**	9
› 265,268	**8**	6



Prevention

- **Two vaccines provide protection against invasive pneumococcal disease. The 13- valent pneumococcal polysaccharide – protein conjugate vaccine (PCV 13) recommended for all children, provides them with > 90% protection against bacteremia, up to 30% against pneumonia and some protection against otitis media and meningitis It also provide adults with 75% protection against bacteremia and 45% against pneumonia caused by vaccine specific serotypes.**

- **The 23 – valent pneumococcal polysaccharide vaccine for adults (PPSV23) provides 54% to 81% protection against bacteremia but efficacy is limited for pneumonia, PPSV23 alone is recommended for persons under 65 years with underlying disease, serial immunization with PCV13 then PPSV23, is approved for adults ≥ 65 years (given 1 year apart) and immunocompromised adults (given ≥ 8 weeks apart)**
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- **Widespread pneumococcal vaccination of children has reduced the incidence of invasive disease and hospitalization for pheumonia in all age groups in the United States.**

CDC recommendation for Adults & Elderly

Comorbidity	ACIP
Healthy Adults	≥ 65 years PCV13 --- PPV23 ≤ 65 years PPV23
Functional or Anatomical Asplenia	PCV13 --- PPV23 (Second PPV23 after 5 years)
Cochlear Implantation / CSF Leak	PCV13 --- PPV23
Immunocompromised conditions	PCV13 --- PPV23 (Second PPV23 after 5 years)
Immunocompetent with underlying disease	PPV23

Immunocompromised Conditions: Congenital or acquired immunodeficiency, HIV infection, Chronic Renal Failure, Nephrotic Syndrome, Leukemia, Lymphoma, Hodgkin Disease, Generalized Malignancy, Iatrogenic Immunosuppression, SoT & Multiple Myeloma

Immunocompetent Conditions: Chronic Heart Disease, Chronic Lung Disease, Alcoholism, Chronic Liver Disease & Smoking

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Table 2. Vaccination of Persons With HIV Infection

Vaccine	Low-Level or No Immunosuppression[a] Recommendation	Strength, Evidence Quality	High-Level Immunosuppression[b] Recommendation	Strength, Evidence Quality
Haemophilus influenzae b conjugate	U: age <5 y R: age 5–18 y[c]	Strong, high Strong, low	U: age <5 y R: age 5–18 y[c]	Strong, high Strong, low
Hepatitis A	U	Strong, moderate	U: age 1 y	Strong, moderate
Hepatitis B[d]	R	Strong, moderate	R	Strong, moderate
Diphtheria toxoid, tetanus toxoid, acellular pertussis	U	Strong, moderate	U	Strong, moderate
Tetanus toxoid, reduced diphtheria toxoid, and reduced acellular pertussis	U	Strong, very low	U	Strong, very low
Tetanus toxoid, reduced diphtheria toxoid	U	Strong, low	U	Strong, low
Human papillomavirus (HPV4)[e]	U: 11–26 y	Strong, very low	U: 11–26 y	Strong, very low
Influenza-inactivated (inactivated influenza vaccine)	U	Strong, high	U	Strong, high
Influenza-live attenuated (live attenuated influenza vaccine)	X[f]	Weak, very low	X	Weak, very low
Measles, mumps, and rubella–live	U: age 12 mo–13 y U: age ≥14 y	Strong, moderate Weak, very low	X: age 12 mo–13 y X: age ≥14 y	Strong, moderate Strong, moderate
Measles, mumps, and rubella–varicella–live	X	Strong, very low	X	Strong, very low
Meningococcal conjugate[g]	U: age 11–18 y	Strong, moderate	U: age 11–18 y	Strong, moderate
Pneumococcal conjugate (PCV13)	U: age <5 y R: age 5 y[h] R: age 6–18 y[h] R: age ≥19 y[i]	Strong, moderate Strong, moderate Strong, low Strong, low	U: age <5 y R: age 5 y R: age 6–18 y R: age ≥19 y[i]	Strong, moderate Strong, moderate Strong, low Strong, very low
Pneumococcal polysaccharide (PPSV23)[j]	R: age ≥2 y	Strong, moderate	R: age 2–18 y R: adult (CD4 T lymphocytes <200 cells/mm^3)	Strong, moderate Weak, low
Polio–inactivated (inactivated poliovirus vaccine)	U	Strong, moderate	U	Strong, moderate
Rotavirus–live	U	Strong, low	U	Weak, very low
Varicella–live	U: age 1–8 y U: age ≥9 y	Strong, high Strong, very low	X	Strong, moderate
Zoster–live	X	Strong, low	X	Strong, moderate

Table 3. Vaccination of Patients With Cancer

Vaccine	Prior to or During Chemotherapy Recommendation	Strength, Evidence Quality	Starting ≥3 mo Postchemotherapy and ≥6 mo Post Anti–B-Cell Antibodies for Inactivated Vaccines; See Each Live Vaccine for Interval Recommendation	Strength, Evidence Quality
Haemophilus influenzae b conjugate	U[a]	Weak, low	U	Strong, moderate
Hepatitis A	U[a]	Weak, low	U	Strong, very low
Hepatitis B	U[a]	Weak, low	U R: adults	Strong, moderate Strong, very low
Diphtheria toxoid, tetanus toxoid, acellular pertussis; tetanus toxoid, reduced diphtheria toxoid, and reduced acellular pertussis	U[a]	Weak, low	U: age 0–18 y R: adults with acute lymphoblastic leukemia or lymphoma	Strong, moderate Weak, very low
Human papillomavirus	U: 11–26 y[a]	Weak, very low	U	Strong, very low
Influenza-inactivated (inactivated influenza vaccine)	U[a]	Strong, low-moderate[a]	U[b]	Strong, moderate
Influenza-live attenuated (live attenuated influenza vaccine)	X	Weak, very low	U	Strong, low
Measles, mumps, and rubella–live	X[c]	Strong, moderate	Starting at 3 mo: U	Strong, low
Measles, mumps, and rubella–varicella–live	X[c]	Strong, moderate	Starting at 3 mo: U	Weak, very low
Meningococcal conjugate	U[a]	Weak, low	U	Strong, low
Pneumococcal conjugate-13 (PCV13)	R: <6 y R: age ≥6 y[d]	Strong, low Strong, very low	U	Strong, low
Pneumococcal polysaccharide (PPSV23)	R: age ≥2 y	Strong, low	U	Strong, low
Polio–inactivated (inactivated poliovirus vaccine)	U[a]	Weak, low	U	Strong, low
Rotavirus–live	X	Strong, very low	Not applicable	
Varicella–live	X[c]	Strong, moderate	Starting at 3 mo: U[e]	Weak, very low
Zoster–live	X[c]	Strong, very low	Starting at 3 mo: U[e]	Weak, very low

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Table 4. Vaccinations Prior to or After Allogeneic or Autologous Hematopoietic Stem Cell Transplant

Vaccine	Pre-HSCT: Recommendation	Pre-HSCT: Strength, Evidence Quality	Post-HSCT: Recommendation; Earliest Time Posttransplant; Number of Doses	Post-HSCT: Strength, Evidence Quality
Haemophilus influenzae b conjugate	U	Strong, moderate	R; 3 mo; 3 doses	Strong, moderate
Hepatitis A	U	Strong, very low	R; 6 mo; 2 doses	Weak, low
Hepatitis B	U	Strong, low	R; 6 mo; 3 doses	Strong, moderate
DTaP, DT, Td, Tdap	U	Strong, low	R; age <7 y: DTaP; 6 mo; 3 doses R; age ≥7 y: DTaP*; 6 mo; 3 doses OR 1 dose Tdap, then 2 doses DT* or Td; 6 mo	Strong, low Weak, very low DTaP: weak, moderate DT, Td: weak, low
Human papillomavirus	U: 11–26 y	Strong, very low	U; 6 mo; 3 doses	Weak, very low
Influenza-inactivated (inactivated influenza vaccine)	U	Strong, low	R; 4 mo	Strong, moderate
Influenza-live attenuated (live attenuated influenza vaccine)	X	Weak, very low	X	Weak, very low
Measles, mumps, and rubella–live	U[a]	Strong, very low	X[b]	Strong, low
Measles, mumps, and rubella–varicella–live	U[a]	Weak, very low	X	Strong, very low
Meningococcal conjugate	U	Strong, very low	R; age 11–18 y; 6 mo; 2 doses	Strong, low
Pneumococcal conjugate (PCV13)	R[c]	Strong, low	R; 3 mo; 3 doses	Strong, low
Pneumococcal polysaccharide (PPSV23)	R[c]	Strong, very low	R; ≥12 mo post if no GVHD	Strong, low
Polio-inactivated (inactivated poliovirus vaccine)	U	Strong, very low	R; 3 mo; 3 doses	Strong, moderate
Rotavirus–live	X	Weak, very low	X	Weak, very low
Varicella–live	U[a]	Strong, low	X[d]	Strong, low
Zoster–live	R[a,e]: age 50–59 y* U[a]: age ≥60 y	Weak, very low Strong, low	X X	Strong, low Strong, low

Table 5. Vaccinations Prior to or After Solid Organ Transplant

Vaccine	Pretransplant: Recommendation	Pretransplant: Strength, Evidence Quality	Starting 2–6 mo Posttransplant: Recommendation	Starting 2–6 mo Posttransplant: Strength, Evidence Quality
Haemophilus influenzae b conjugate	U	Strong, moderate	U	Strong, moderate
Hepatitis A	U: age 12–23 mo R: ≥2 y	Strong, moderate Strong, moderate	R, if not completed pretransplant	Strong, moderate
Hepatitis B	U: age 1–18 y R: ≥18 y	Strong, moderate Strong, moderate	R, if not completed pretransplant[a]	Strong, moderate
Diphtheria toxoid, tetanus toxoid, acellular pertussis; tetanus toxoid, reduced diphtheria toxoid, and reduced acellular pertussis	U	Strong, moderate	U, if not completed pretransplant	Strong, moderate
Human papillomavirus	U: females 11–26 y U: males 11–26 y	Strong, moderate Strong, low	U: females 11–26 y U: males 11–26 y	Strong, moderate Strong, low
Influenza-inactivated (inactivated influenza vaccine)	U	Strong, moderate	U[b]	Strong, moderate
Influenza-live attenuated (live attenuated influenza vaccine)	X	Weak, low	X	Weak, low
Measles, mumps, and rubella–live	R[c]: 6–11 mo U[d]: age ≥12 mo	Weak, very low Strong, moderate	X	Strong, low
Measles, mumps, and rubella–varicella–live	U[d]	Strong, moderate	X	Strong, low
Meningococcal conjugate	U	Strong, moderate	U	Strong, moderate
Pneumococcal conjugate (PCV13)	U: age ≤5 y R: age ≥6 y[e]	Strong, moderate Strong, very low	U: Age 2–5 y R: age ≥6 y if not administered pretransplant[e]	Strong, moderate Strong, very low
Pneumococcal polysaccharide (PPSV23)	R: age ≥2 y	Strong, moderate	R: age ≥2 y, if not administered pretransplant	Strong, moderate
Polio-inactivated (inactivated poliovirus vaccine)	U	Strong, moderate	U	Strong, moderate
Rotavirus–live	U[c]	Strong, moderate	X	Strong, low
Varicella–live	R[f]: 6–11 mo U[d]	Weak, very low Strong, low	X[g]	Strong, low
Zoster–live	R[h]: age 50–59 y U[i]: age ≥60 y	Weak, low Strong, moderate	X	Strong, low

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Table 6. Vaccination of Persons With Chronic Inflammatory Diseases on Immunosuppressive Medications

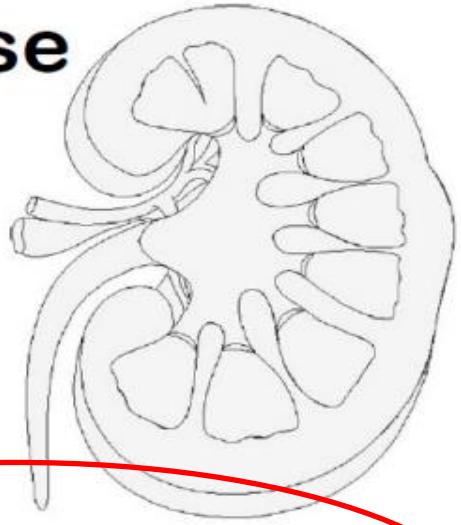
Vaccine	Planned Immunosuppression		Low-level Immunosuppression[a]		High-level Immunosuppression[a]	
	Recommendation	Strength, Evidence Quality	Recommendation	Strength, Evidence Quality	Recommendation	Strength, Evidence Quality
Haemophilus influenzae b conjugate	U	Strong, moderate	U	Strong, low	U	Strong, low
Hepatitis A	U	Strong, moderate	U	Strong, low	U	Strong, low
Hepatitis B	U	Strong, moderate	U	Strong, low	U	Strong, low
Diphtheria toxoid, tetanus toxoid, acellular pertussis; tetanus toxoid, reduced diphtheria toxoid; tetanus toxoid, reduced diphtheria toxoid, and reduced acellular pertussis	U	Strong, moderate	U	Strong, low	U	Strong, low
Human papillomavirus	U: 11–26 y	Strong, moderate	U: 11–26 y	Strong, low	U: 11–26 y	Strong, very low
Influenza-inactivated (inactivated influenza vaccine)	U	Strong, moderate	U	Strong, moderate	U	Strong, moderate
Influenza-live attenuated (live attenuated influenza vaccine)	X	Weak, very low	X	Weak, very low	X	Weak, very low
Measles, mumps, and rubella–live	U[b]	Strong, moderate	X	Weak, very low	X	Weak, very low
Measles, mumps, and rubella–varicella–live	U[b]	Strong, low	X	Weak, very low	X	Strong, very low
Meningococcal conjugate	U	Strong, moderate	U	Strong, moderate	U	Strong, low
Pneumococcal conjugate (PCV13)	R[c]	Strong, moderate	U: <6 y R: ≥6 y[c]	Strong, low strong, very low	U: <6 y R: ≥6 y[c]	Strong, low strong, very low
Pneumococcal polysaccharide (PPSV23)	R: age ≥2 y	Strong, low	R: age ≥2 y	Strong, low	R: age ≥2 y	Strong, very low
Polio-inactivated (inactivated poliovirus vaccine)	U	Strong, moderate	U	Strong, moderate	U	Strong, low
Rotavirus–live	U	Strong, moderate	X	Weak, very low	X	Weak, very low
Varicella–live	U[b]	Strong, moderate	X[d]	Weak, very low	X	Strong, moderate
Zoster–live	R: age 50–59 y[e] U: age ≥60 y	Weak, low strong, low	R: age 50–59 y[e] U: age ≥60 y	Weak, very low Strong, very low	X	Weak, very low

Table 7. Vaccination of Persons With Asplenia or a Sickle Cell Disease, Cochlear Implants, or Cerebrospinal Fluid Leak

Vaccine	Asplenia or a Sickle Cell Disease		Cochlear Implants[a] or Cerebrospinal Fluid Leak	
	Recommendation	Strength, Evidence Quality	Recommendation	Strength, Evidence Quality
Haemophilus influenzae b conjugate	U: age <5 y R: age ≥5 y	Strong, moderate weak, low	U	Strong, moderate
Hepatitis A	U	Strong, moderate	U	Strong, moderate
Hepatitis B	U	Strong, moderate	U	Strong, moderate
Diphtheria toxoid, tetanus toxoid, acellular pertussis; tetanus toxoid, reduced diphtheria toxoid; tetanus toxoid, reduced diphtheria toxoid, and reduced acellular pertussis	U	Strong, moderate	U	Strong, moderate
Human papillomavirus	U	Strong, moderate	U	Strong, moderate
Influenza-inactivated (inactivated influenza vaccine)	U	Strong, moderate	U	Strong, moderate
Influenza-live attenuated (live attenuated influenza vaccine)	X	Weak, very low	U	Strong, moderate
Measles, mumps, and rubella–live	U	Strong, moderate	U	Strong, moderate
Measles, mumps, and rubella–varicella–live	U	Strong, moderate	U	Strong, moderate
Meningococcal conjugate	R: age 2–55 y[b]	Strong, low	U	Strong, moderate
Meningococcal polysaccharide	R: age >55 y[b]	Strong, low	U	Strong, moderate
Pneumococcal conjugate (PCV13)	U: age <6 y[c] R: age ≥6 y[d]	Strong, moderate Strong, very low	U: age <6 y[c] R: age ≥6 y[d]	Strong, moderate strong, low
Pneumococcal polysaccharide (PPSV23)	R: age ≥2 y[e]	Strong, low	R: age ≥2 y[e]	Strong, moderate
Polio-inactivated (inactivated poliovirus vaccine)	U	Strong, moderate	U	Strong, moderate
Rotavirus–live	U	Strong, moderate	U	Strong, moderate
Varicella–live	U	Strong, moderate	U	Strong, moderate
Zoster–live	U	Strong, moderate	U	Strong, moderate

Guidelines for Vaccinating

Kidney Dialysis Patients and Patients with Chronic Kidney Disease



summarized from
Recommendations of the Advisory Committee on Immunization Practices (ACIP)

Table 1. Guidelines for administering PCV13 and PPSV23 vaccines for infants and children (ages 0-18) with chronic kidney disease

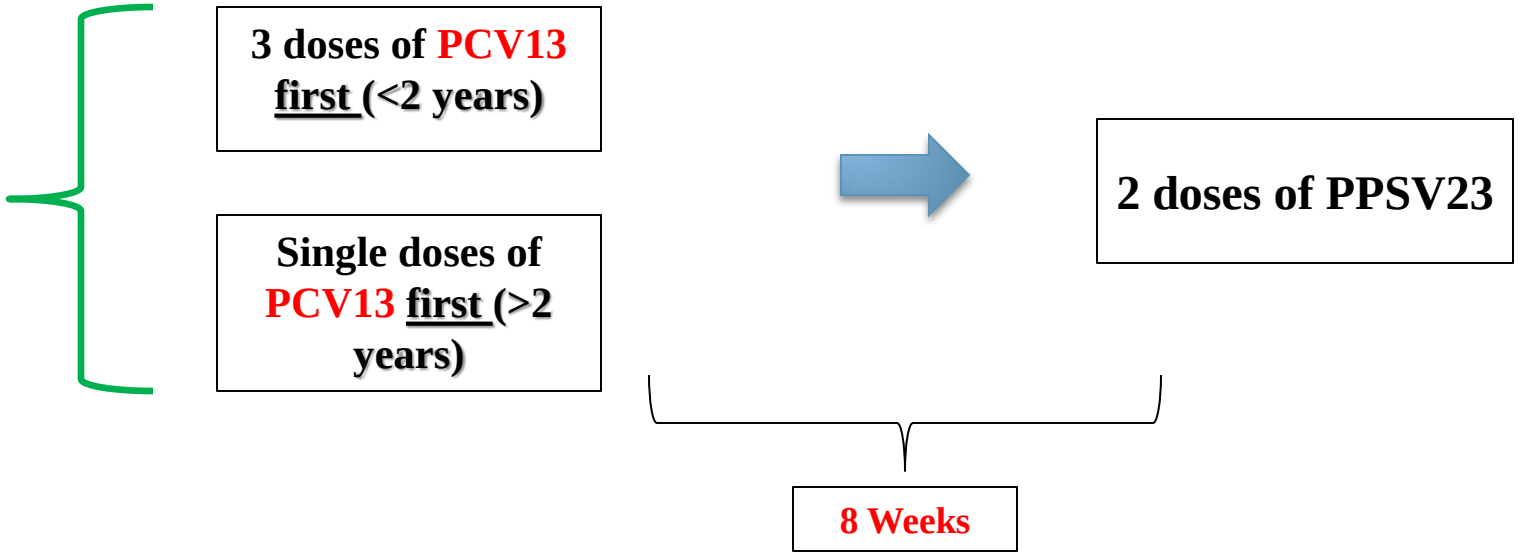
Infants and Children (ages 0-18)				
Vaccination History	**Recommended Regimen**			**Notes**
Never vaccinated with PCV7 or PCV13 up to age 59 months	Routine vaccination for PCV13 (4 dose series)	Administer 1 dose of PPSV23 at age ≥2 years and ≥8 weeks after last indicated dose of PCV13	Administer 1 dose of PPSV23 5 years later	The ACIP recommendation for routine vaccination with PCV13 and the vaccination schedules for infants and toddlers through age 59 months who have not received any previous PCV7 or PCV13 doses are the same as those previously published for PCV7. PCV13 is recommended as a 4-dose series at ages 2, 4, 6, and 12–15 months.[11]
Completed all recommended doses of PCV7	Administer 1 dose of PCV13 ≥8 weeks later	Administer 1 dose of PPSV23 at age ≥2 years and ≥8 weeks after last indicated dose of PCV13	Administer 1 dose of PPSV23 5 years later	For children who have underlying medical conditions, a single supplemental PCV13 dose is recommended through 71 months of age. This includes children who have received PPSV23 previously. PCV13 should be administered at least 8 weeks after the most recent dose of PCV7 or PPSV23. This will constitute the final dose of PCV for these children.[11]
Children aged 24-71 months who received <3 doses of PCV7 before age 24 months	Administer 2 doses of PCV13 now	Administer 1 dose of PPSV23 ≥8 weeks later after last indicated dose of PCV13	Administer 1 dose of PPSV23 5 years later	Children aged 24–71 months with underlying medical conditions who received <3 doses of PCV7 before age 24 months should receive a series of 2 doses of PCV13 followed by 1 dose of PPSV23 administered ≥8 weeks later.[11]
Children aged 24-71 months who received any incomplete schedule of 3 doses of PCV7 before age 24 months	Administer 1 dose of PCV13 now	Administer 1 dose of PPSV23 ≥8 weeks later	Administer 1 dose of PPSV23 5 years later	Children aged 24–71 months with underlying medical conditions who received any incomplete schedule of 3 doses of PCV7 before age 24 months should receive 1 dose of PCV13 followed by 1 dose of PPSV23 administered ≥8 weeks later.[11]
Completed all recommended doses of PCV13	Administer 1 dose of PPSV23 at age ≥2 years and ≥8 weeks after last indicated dose of PCV13	Administer 1 dose of PPSV23 5 years later		A second dose of PPSV23 is recommended 5 years after the first dose of PPSV23 for children who have anatomic or functional asplenia, including SCD, HIV infection, or other immunocompromising condition.[11]
Children aged 6-18 years who have not received PCV13	Administer 1 dose of PCV13 now			One dose of PCV13 is recommended by ACIP for children aged 6-18 years with high-risk conditions such as functional or anatomic asplenia, immunocompromising conditions, cochlear implants, or CSF leaks.[10]

Table 2. Guidelines for administering PCV13 and PPSV23 vaccines for adults (ages 19-64) with chronic kidney disease

Adults (ages 19-64)				
Vaccination History	**Recommended Regimen**			**Notes**
Never vaccinated with PCV13 or PPSV23	Administer 1 dose of PCV13 dose now	Administer 1 dose of PPSV23 ≥ 8 weeks later	Administer 1 dose of PPSV23 ≥ 5 years later	ACIP recommends that adults aged ≥19 years with immunocompromising conditions, functional or anatomic asplenia, CSF leaks, or cochlear implants, and who have not previously received PCV13 or PPSV23, should receive a dose of PCV13 first, followed by a dose of PPSV23 at least 8 weeks later. Subsequent doses of PPSV23 should follow current PPSV23 recommendations for adults at high risk. Specifically, a second PPSV23 dose is recommended 5 years after the first PPSV23 dose for persons aged 19–64 years with functional or anatomic asplenia and for persons with immunocompromising conditions. Additionally, those who received PPSV23 before age 65 years for any indication should receive another dose of the vaccine at age 65 years, or later if at least 5 years have elapsed since their previous PPSV23 dose.[10]
Previously vaccinated with 1 dose PPSV23 ≥ 1 year ago; never vaccinated with PCV13	Administer 1 dose of PCV13 dose now	Administer 1 dose of PPSV23 ≥ 8 weeks after PCV13, which must be ≥ 5 years after first dose of PPSV23		
Previously vaccinated with 2 doses of PPSV23 (last dose was ≥ 1 year ago); never vaccinated with PCV13	Administer 1 dose of PCV13 dose now			
Previously vaccinated with ≥ 1 dose PCV13 (≥8 weeks ago); never vaccinated with PPSV23	Administer 1 dose of PPSV23 now	Administer 1 dose of PPSV23 ≥5 years later		
Previously vaccinated with ≥ 1 dose PCV13 (≥8 weeks ago) and 1 dose PPSV23	Administer 1 dose of PPSV23 ≥5 years after first PPSV23 dose			

Vaccination in HIV population

- The **risk of IPD is 30 to 100 times greater** in HIV-positive individuals compared to HIV-negative

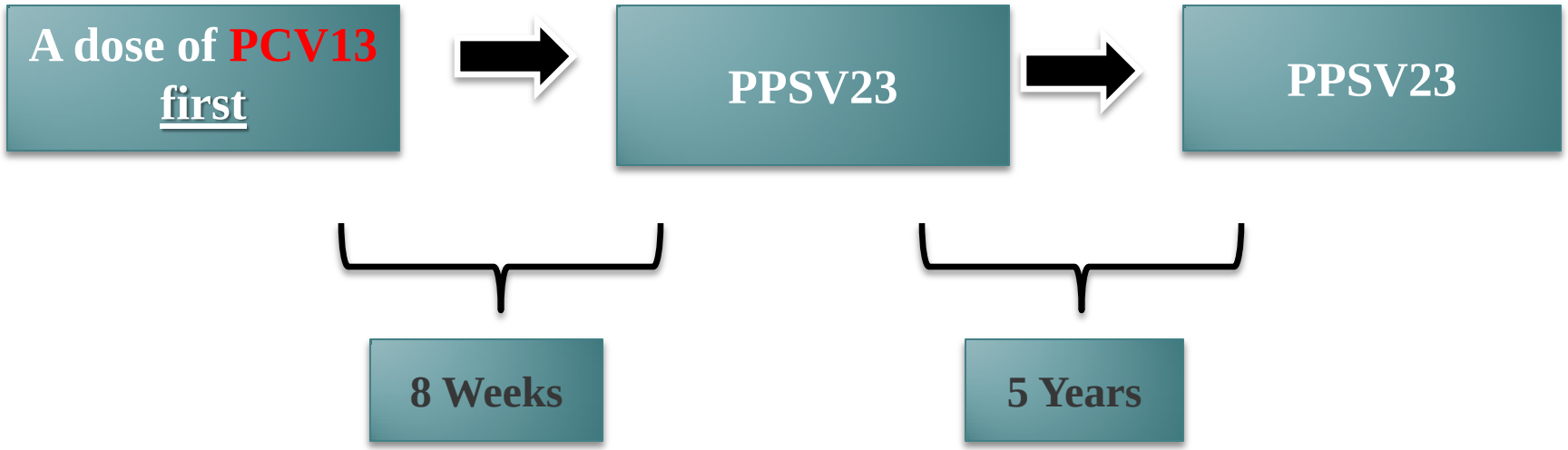


- Age at injection time of Polysaccharide vaccination should be at least 2 years and after 5 years revaccination is recommended.

Sadlier C, Benn*pneumoniae infection in HIV-infected individuals. Cochrane Database of Systematic Reviews 2016, Issue 1. Art. No.: CD002236. DOI:* ett K, Matthews A, Mockler D, Wilson F, Bergin C. Pneumococcal vaccine for preventing *Streptococcus*10.1002/14651858.CD002236.pub2

Vaccination in recipients of Solid Organ Transplant

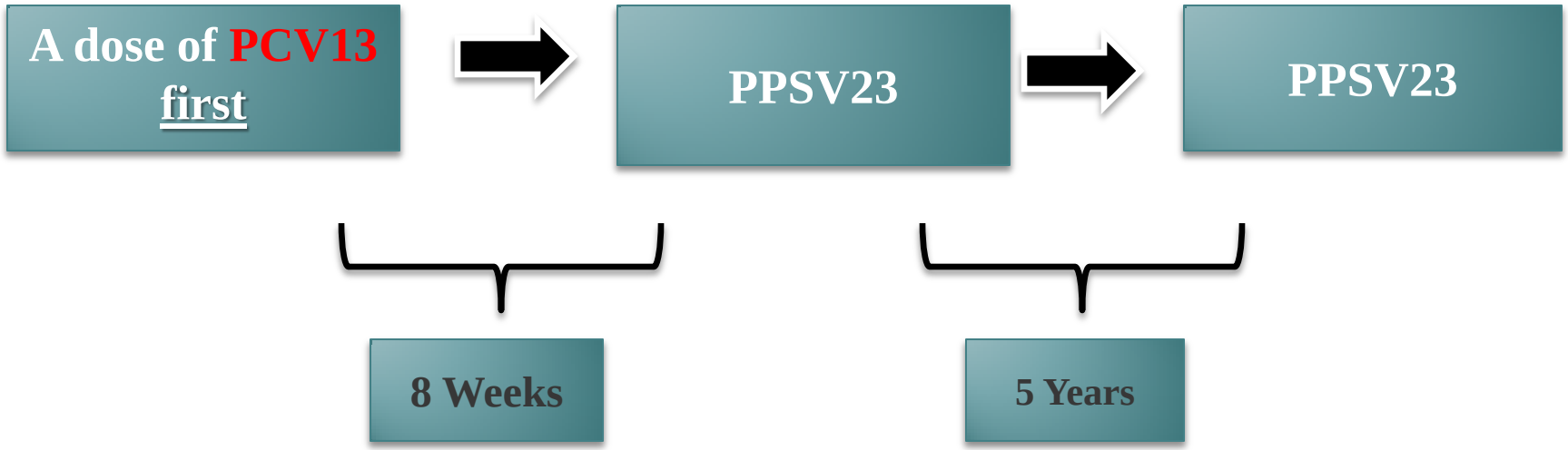
PCV13 should be administered 2 to 6 months after SOT.



Rubin et al. IDSA, 2013, CID 2014:58

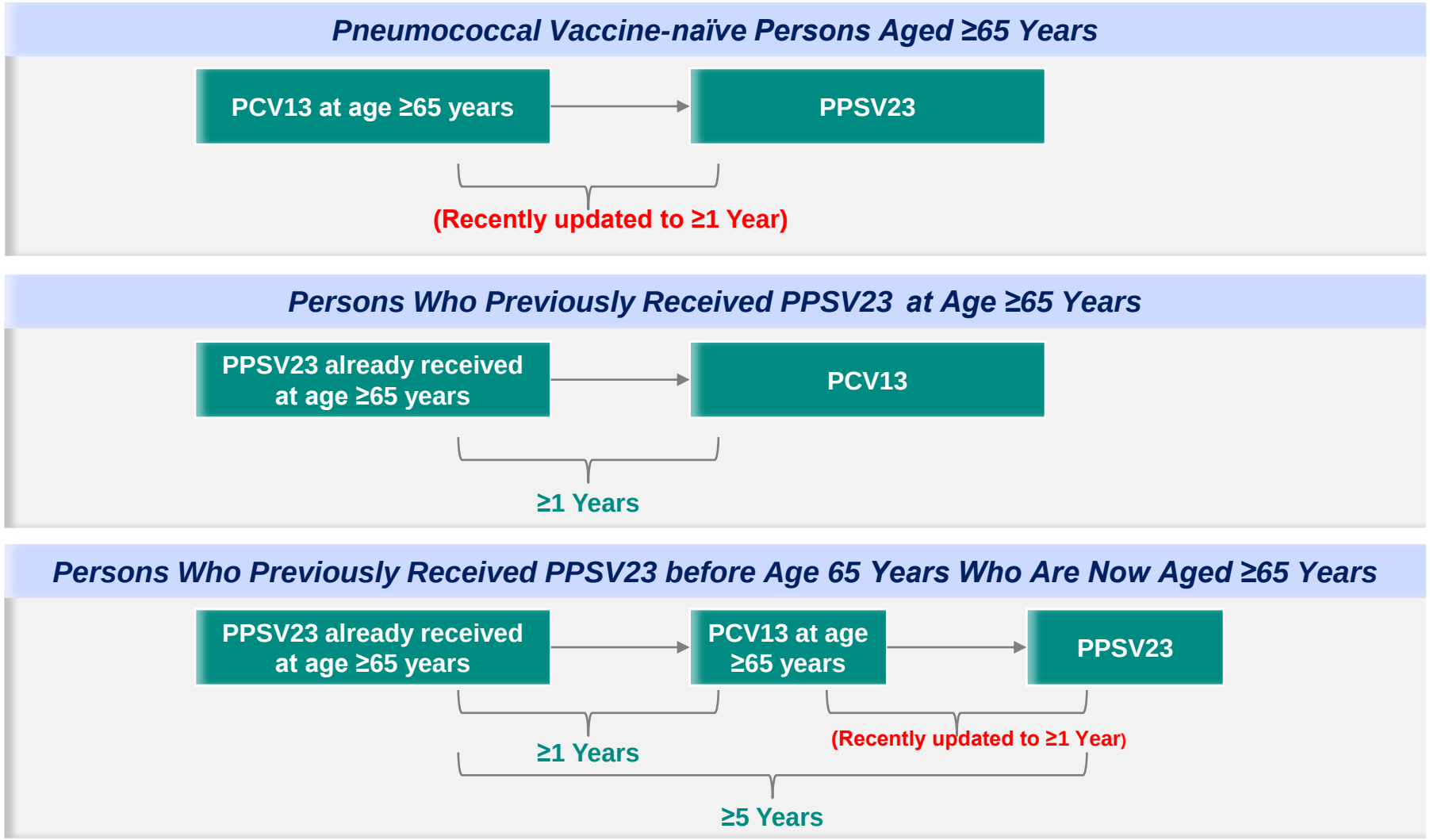
Vaccination in Asplenic Patients

Children with functional or anatomic asplenia, particularly those with sickle cell disease are at very high risk for IPD (i.e., incidence rates of 5,000–9,000 per 100,000 population)



http://www.cdc.gov/vaccines/pubs/pinkbook/pneumo.html
CDC 2015

Sequence and Spacing in adults > 65 years

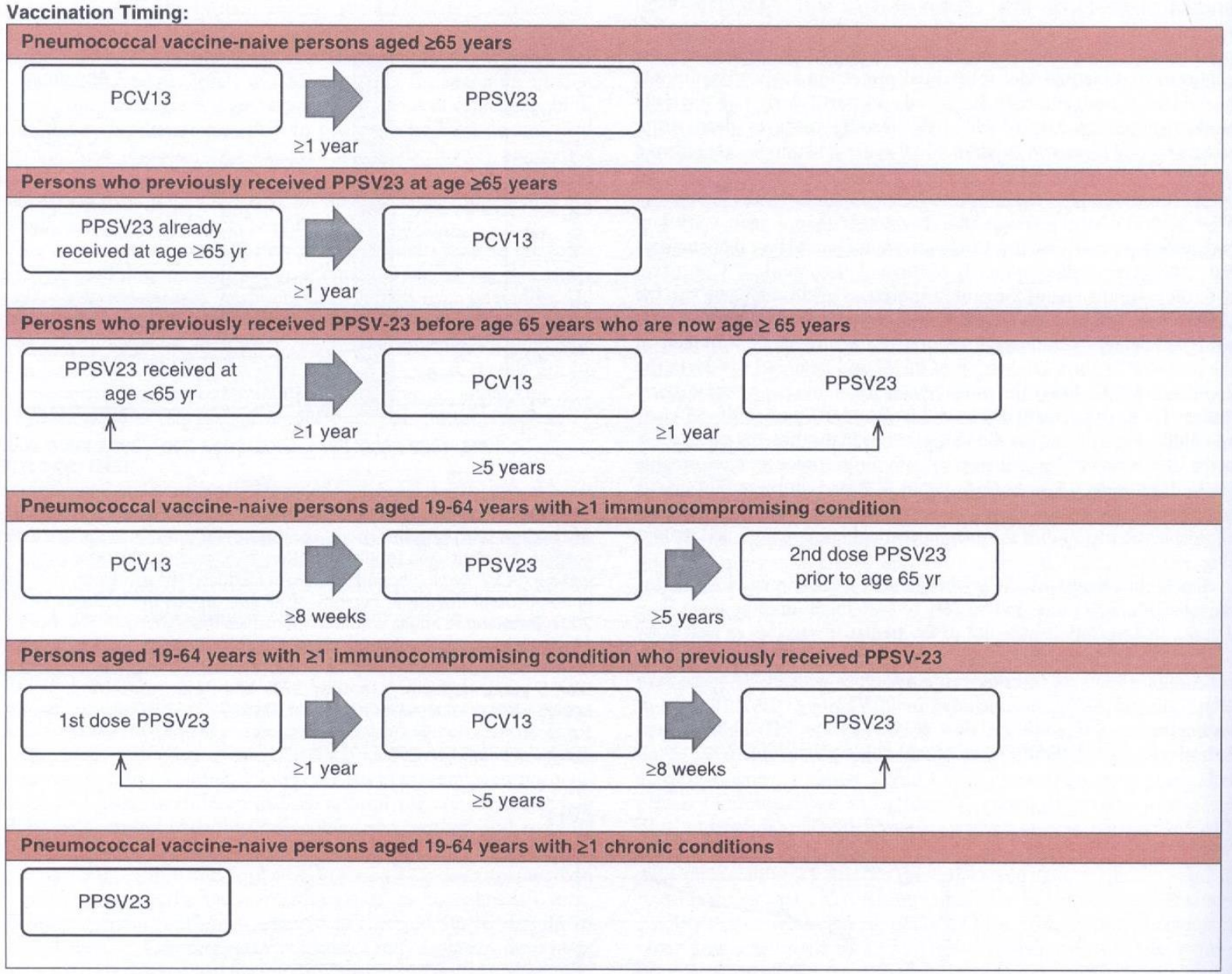


Abbreviations: PCV13 = 13-valent pneumococcal conjugate vaccine; PPSV23 = 23-valent pneumococcal polysaccharide vaccine.
* Minimum interval between sequential administration of PCV13 and PPSV23 is 1 year

Indications for Adult Pneumococcal Vaccination

Indications:

PPSV-23 Alone	Both PCV-13 and PPSV-23
Patients 19-64 years with ≥1 choronic condition below:	**All patients ≥65 years**
Cigarette smoking	**Patients 19-64 years with ≥1 immunocompromising condition below:**
Chronic heart disease (CHF, cardiomyopathy)	Cerebrospinal fluid leak
Chronic lung disease (asthma, COPD)	Cochlear implant
Diabetes mellitus	Congenital or acquired immunodeficiency
Alcoholism	HIV infection
Chronic liver disease (cirrhosis)	Functional or anatomic asplenia
Reside in nursing home or long-term care facility	Chronic renal failure or nephronic syndrome
	Malignancy
	Solid organ transplant
	Immunosuppression (glucocorticoids, radiation)



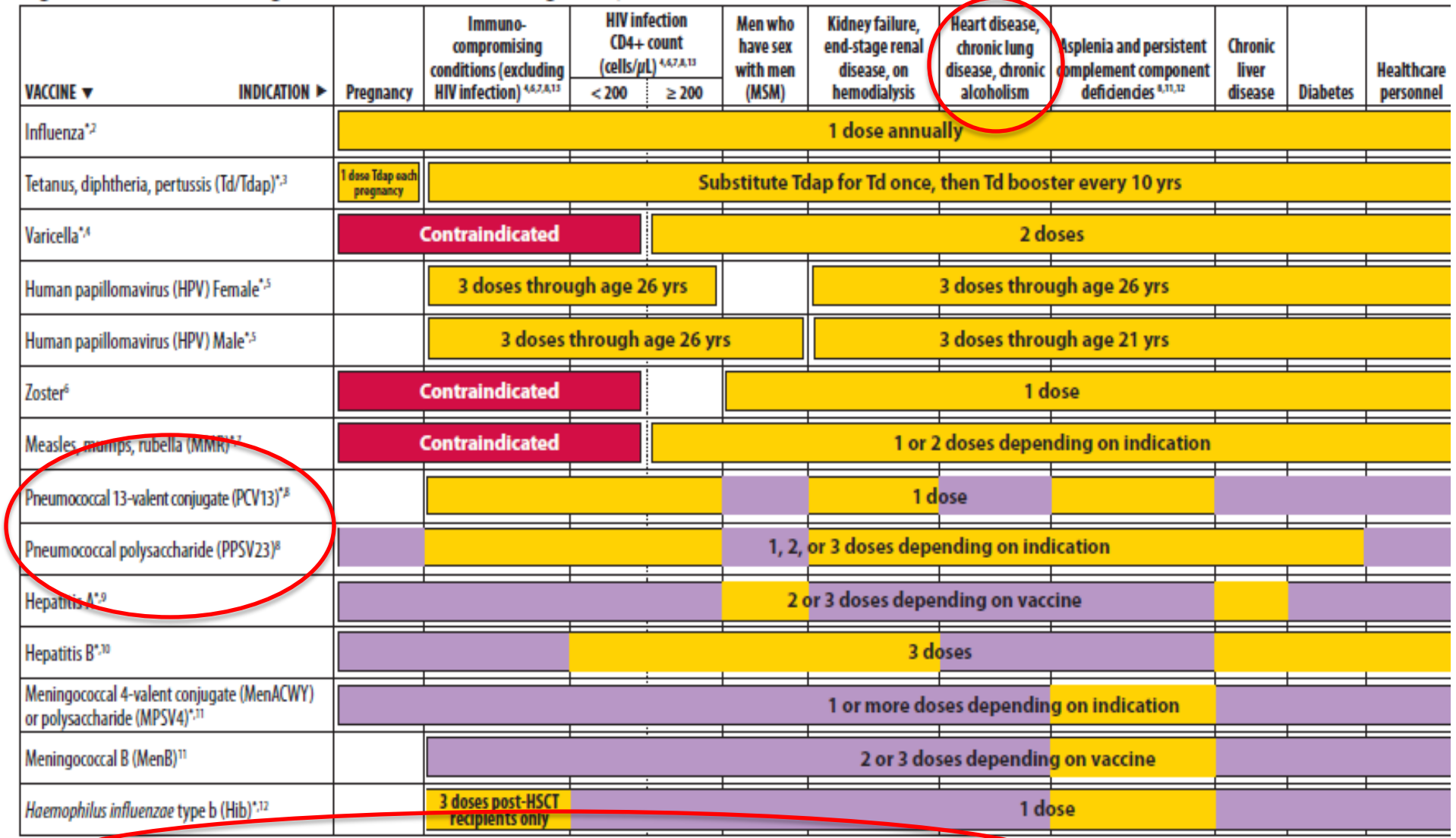
Refer to http://www.cdc.gov/vaccines/acip/index.html

FIG. 199.9 Recommendations for pneumococcal vaccination (PCV13 and PPSV23) in adults age 19 years and older. *Schedule is integrated from references* **359**–361 and 364–366. CHF, *Congestive heart failure;* COPD, *chronic obstructive pulmonary disease;* HIV, *human immunodeficiency virus;* PCV13, *pneumococcal conjugate vaccine (Prevnar);* PPSV23, *pneumococcal polysaccharide vaccine (Pneumovax).*

Therapy

- **B-lactam antibiotics are mainstay of therapy for pneumococcal infection**
- **B-lactams in treatment of meningitis, but typically not pneumonia**
- **Vancomycin is added initially with meningitis**

Figure 2. Vaccines that might be indicated for adults aged 19 years or older based on medical and other indications[1]



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These schedules indicate the recommended age groups and medical indications for which administration of currently licensed vaccines is commonly recommended for adults aged ≥19 years, as of February 2016. For all vaccines being recommended on the Adult Immunization Schedule: a vaccine series does not need to be restarted, regardless of the time that has elapsed between doses. Licensed combination vaccines may be used whenever any components of the combination are indicated and when the vaccine's other components are not contraindicated. For detailed recommendations on all vaccines, including those used primarily for travelers or that are issued during the year, consult the manufacturers' package inserts and the complete statements from the Advisory Committee on Immunization Practices (www.cdc.gov/vaccines/hcp/acip-recs/index.html). Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.