Immunization Updates

Nathan Richards, MD
Assistant Professor - Clinical
Department of Internal Medicine
Division of General Internal Medicine and Geriatrics
The Ohio State University Wexner Medical Center

MedNet21
Center for Continuing Medical Education

The Ohio State University Wexner Medical Center

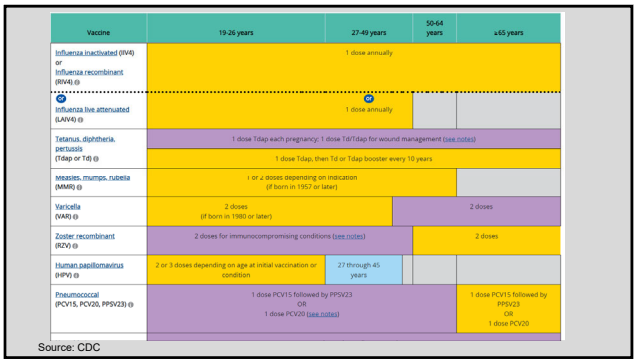
Objectives

1. Demonstrate a clear understanding of the pediatric and adult vaccination schedule
2. Apply the 2022 ACIP updates to your clinical practice

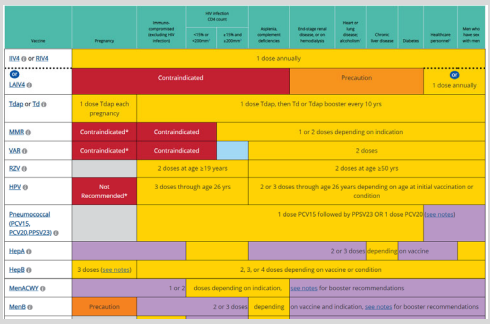
Using the schedule

To make vaccination recommendations, healthcare providers should:

1. Determine needed vaccines **based on age** (Table 1)
2. Assess for **medical conditions and other indications** (Table 2)
3. Review **special situations** (Vaccination Notes)
4. Review **contraindications and precautions to vaccination** (Appendix)

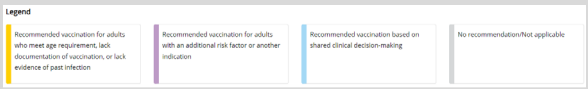


Source: CDC

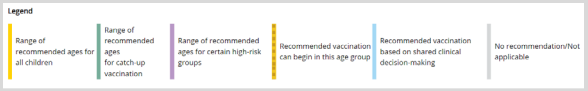


Source: CDC

Adults



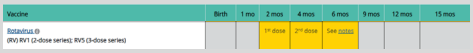
Children



Source: CDC

Pediatric specific vaccines

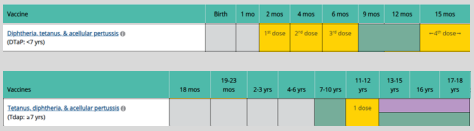
Rotavirus



- 2 or 3 dose series depending on the formulation
- Infants age out of eligibility relatively early
  - Series can't be started on or after age 15 weeks and 0 days
  - Maximum age for the final dose is age 8 months and 0 days
- History of intussusception or SCID are contraindications
- Take precaution with altered immunocompetence and chronic GI disease

Source: CDC

DTaP (diphtheria, tetanus, pertussis)



- Preferred formulation for children < 7 years old
- Total of 5 doses in early childhood
- Consider wound management

Source: CDC

Vaccines for kids and adults

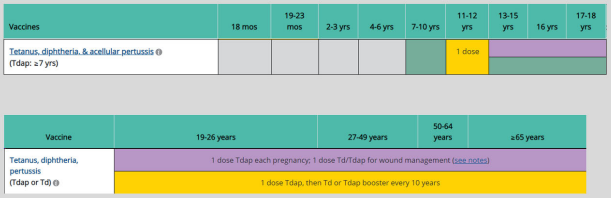
Influenza

- Indicated for all patients 6 months and older
- Age considerations
  - Children 6 months through 8 years who are getting a flu shot for the first time or who have only previously ever received 1 flu shot, should get 2 doses separated by 1 month
  - Consider recombinant flu (Flublok) for those 50-64
  - Use high dose for those >/= 65 years of age
- Egg allergy is not a contraindication to egg-based flu vaccines

Influenza

- Cultural considerations
  - Flublok has no egg protein
  - Some formulations have porcine products
- Take precaution for anyone who had GBS within 6 weeks of a prior influenza vaccine. Only give if benefit outweighs risk.
- Intranasal is a live attenuated vaccine (avoid in immunocompromised, pregnancy, chronic cardiovascular or pulmonary disease)
  - Can be given starting at age 2

Tdap (tetanus, diphtheria, pertussis)



Vaccines	18 mos	19-23 mos	2-3 yrs	4-6 yrs	7-10 yrs	11-12 yrs	13-15 yrs	16 yrs	17-18 yrs
Tetanus, diphtheria, & acellular pertussis (Tdap: ≥7 yrs)						1 dose			

Vaccine	19-26 years	27-49 years	50-64 years	≥65 years
Tetanus, diphtheria, pertussis (Tdap or Td)	1 dose Tdap each pregnancy; 1 dose Td/Tdap for wound management (see notes)			
	1 dose Tdap, then Td or Tdap booster every 10 years			

Source: CDC

Tdap (tetanus, diphtheria, pertussis)

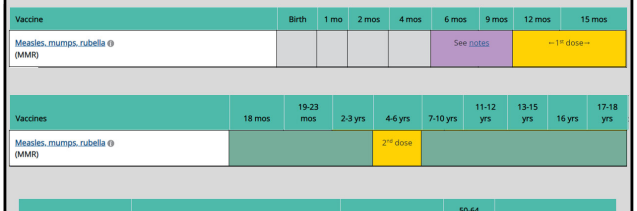
- Formulation used for ages 7 and up
- Adolescent dose given at age 11-12
- Adult boosters: Td OR Tdap every 10 years
- 3 doses if the patient did not receive a primary series
- Updated every pregnancy
- Contraindications – encephalopathy within 7 days of vaccine (Tdap)
- Precautions
  - GBS within 6 weeks of any tetanus toxoid containing vaccine
  - Progressive or unstable neurologic disorder (Tdap)

Tetanus prophylaxis for wounds

Previous doses of tetanus toxoid*	Clean and minor wound		All other wounds¶	
	Tetanus toxoid-containing vaccine△	Human tetanus immune globulin	Tetanus toxoid-containing vaccine△	Human tetanus immune globulin◇
<3 doses or unknown	Yes§	No	Yes§	Yes
≥3 doses	Only if last dose given ≥10 years ago	No	Only if last dose given ≥5 years ago▼	No

Source: Up to Date

Measles, mumps, rubella



Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos
Measles, mumps, rubella (MMR)					See notes		←1st dose→	

Vaccines	18 mos	19-23 mos	2-3 yrs	4-6 yrs	7-10 yrs	11-12 yrs	13-15 yrs	16 yrs	17-18 yrs
Measles, mumps, rubella (MMR)				2nd dose					

Vaccine	19-26 years	27-49 years	50-64 years	≥65 years
Measles, mumps, rubella (MMR)	1 or 2 doses depending on indication (if born in 1957 or later)			

Source: CDC

Measles, mumps, rubella

- Routine 2 dose series for children starting at age 12 months
  - Travel considerations
  - *Avoid using combination vaccine (MMR-varicella) for the first dose*
- Give to adults with no prior evidence of immunity (records, labs, born before 1957)
- Live vaccine
- Give after pregnancy for those who are Rubella NI (non-immune)
- 1 versus 2 doses depending on indication

Varicella

Source: CDC

Varicella

- Routine 2 dose series for children starting at age 12 months
  - *Avoid using combination vaccine (MMR-varicella) for the first dose*
- Give to adults with no prior evidence of immunity (records – vaccine records or physician documentation of clinical disease, labs, born before 1980)
- Live vaccine
- 1980 rule doesn't apply to healthcare workers

Human papilloma virus

Source: CDC

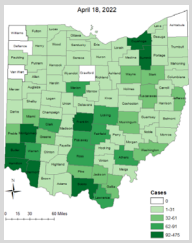
Human papilloma virus

- Routine through age 26 (2 dose series if first dose initiated prior to age 15)
  - *3 dose series regardless of age for kids with immunocompromising conditions*
- Shared decision making 27-45 (insurance/coverage consideration)
- Cancer prevention vaccine!
- Make sure to discuss with young adults. Parents may have declined during adolescence, but patients may be interested in vaccination when they are making their own medical decisions

Hepatitis A

Source: CDC

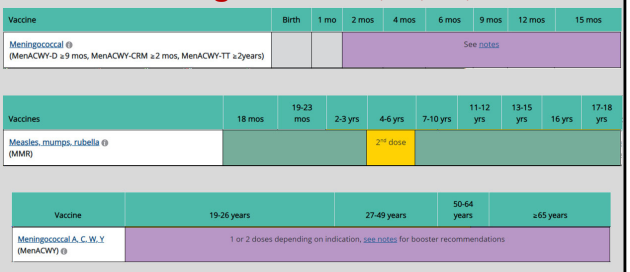
Hepatitis A



Source: Ohio Department of Health

- Routine series for children
  - *Target age is 12-23 months*
- Can give to any adult desiring vaccination
- Recommend to anyone with risk factors – liver disease, HIV, MSM, IVDU, homelessness, travel, etc.
- Can be given in a combo vaccine with hepatitis B (Twinrix) for 18 and up

Meningococcal A, C, W, Y

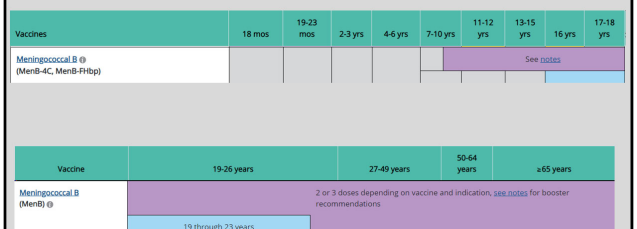


Source: CDC

Meningococcal A, C, W, Y

- Routine for children starting at age 11
  - Special situations – travel and asplenia
- Special indications for adults – asplenia (anatomic or functional), HIV, complement deficiency (including inhibitor medications), travel to endemic countries
  - 1 versus 2 doses depending on indication
- For the at risk patients – boosters every 5 years
- Ideally, use the same formulation for the whole series but they are interchangeable
- Menactra can't be given with Prevnar (although Menactra will no longer be manufactured)

Meningococcal B



Source: CDC

Meningococcal B

- Shared decision making for healthy adolescents and young adults.
- Give for those with risk factors as well (same as men A)
  - Minimum age is 10 years
- Consider periodic boosters
- Trumenba and Bexsero are not interchangeable
- Trumenba is a 3 dose series for those receiving it for underlying medical conditions
- Precaution with Bexsero if the patient has a Latex sensitivity
- *Can give with men A but do at a different anatomic site if feasible*

Haemophilus influenza type B

Source: CDC

Haemophilus influenza type B

- Routine series for children starting at 2 months of age
  - Catch up series is complicated
- *Vaxelis (hexavalent vaccine) is not recommended for use as the booster dose at age 12-15 months*
- Only given for special indications for adults
  - anatomic or functional asplenia and after stem cell transplant

Update alert!

Hepatitis B

Source: CDC

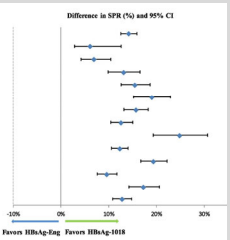
Hepatitis B

- *2022 update: now recommended routinely for all adults up to age 59. Give to those 60 and above with additional risk factors or indications*
- Other indications – chronic liver disease, HIV, sexual exposure risk, IVDU, risk of blood exposure (HCW, dialysis, diabetes), incarceration, travel
- Routine for children starting at birth
  - Monovalent form only prior to 6 weeks of age
  - Consider HBIG indications
- Conventional vaccines include Energix-B and Recombivax-HB

Hepatitis B

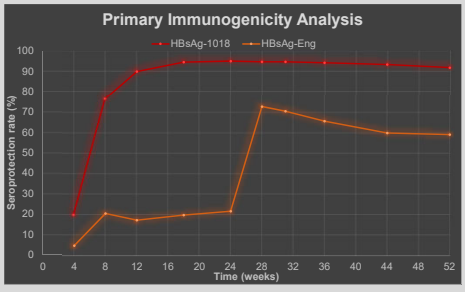
- Heplisav-B, approved in 2017
  - Novel adjuvant to improve immune response
  - 2 dose series given 1 month apart
  - Only for ages 18 and up
  - Not much data in dialysis patients and immunosuppressed patients
  - Efficacy for use in non-responders has not been well established

Population	HBsAg-1018 (2 Doses)		HBsAg-Eng (3 Doses)		Difference in SPR (95% CI)
	N	SPR (%)	N	SPR (%)	
All Subjects	4376	95.40%	2289	81.30%	14.20% (12.5%-15.9%)
18—29 years	174	100.00%	99	93.90%	6.10% (2.8%-12.6%)
30—39 years	632	98.90%	326	92.00%	6.90% (4.2%-10.4%)
40—49 years	974	97.30%	518	84.20%	13.10% (9.9%-16.6%)
50—59 years	1439	95.20%	758	79.70%	15.50% (12.6%-18.7%)
60—70 years	1187	91.60%	588	72.60%	18.90% (15.2%-23.0%)
Men	2203	94.50%	1150	78.80%	15.70% (13.1%-18.3%)
Women	2173	96.40%	1139	83.80%	12.60% (10.4%-15.0%)
Diabetes[a]	640	90.00%	321	65.10%	24.90% (19.3%-30.7%)
No diabetes	3762	96.20%	1968	83.90%	12.30% (10.6%-14.1%)
Obese[b]	2165	94.70%	1076	75.40%	19.40% (16.7%-22.2%)
Non-obese	2208	96.10%	1212	86.60%	9.60% (7.6%-11.7%)
Smoker	1371	95.90%	711	78.60%	17.30% (14.2%-20.6%)
Non-smoker	3005	95.20%	1578	82.40%	12.80% (10.8%-14.8%)



[a] Comparison is the SPR at week 28 for both HBsAg-1018 and HBsAg-Eng groups.
[b] Data for 3 participants with unknown BMI are not shown. Obese is BMI ≥30 kg/m^2.
Note: All comparisons p < 0.0000001.

Jackson S, Lentino J, Kopp J, Murray L, Ellison W, Rhee M, Shockey G, Akella L, Erby K, Heyward WL, Janssen RS. Immunogenicity of a two-dose investigational hepatitis B vaccine, HBsAg-1018, using a toll-like receptor 9 agonist adjuvant compared with a licensed hepatitis B vaccine in adults. Vaccine. 2018;36(5):668. Epub 2017 Dec 27. https://www.sciencedirect.com/science/article/pii/S0264410X17317917#f0010

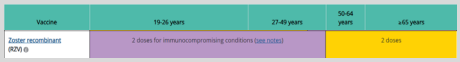


W.L. Heyward et al. / Vaccine 31 (2013) 5300–5305

Heplisav vs conventional vaccines

- So which to give?
  - Either are acceptable
  - Conventional is fine for most healthy patients
  - Insurance considerations?
  - Does the patient desire combo vaccination
  - Non-responders
  - How quickly is protection needed?
  - Likelihood of follow up?
  - Can consider for groups of patients less likely to respond but safety and efficacy data in these groups is not as robust – shared decision making

Zoster



Vaccine	19-26 years	27-49 years	50-64 years	≥65 years
Zoster recombinant (RZV) ⊟	2 doses for immunocompromising conditions (see notes)			2 doses

- Indicated routinely for all adults age 50 and up
- *2022 update: indicated for patients 19 and older with immunocompromising conditions (or planned immunosuppression)*
- Association with GBS
- Counsel on systemic reactogenicity

Source: CDC

Specific immunosuppressing conditions

- Stem cell transplant
  - Autologous – administer 3-12 months after transplant
  - Allogenic – administer 6-12 months after transplant
  - Vaccination prior to discontinuation of antivirals is preferred
- Solid organ transplant
  - Administer prior to transplant when possible
  - If not, then administer at least 6-12 months after transplant at a time of stable graft function and maintenance immunosuppression

Specific immunosuppressing conditions

- Patients with cancer
  - When possible, administer prior to chemo, radiation, immunosuppressive medication, or splenectomy
  - If not, then administer when:
    - The immune system is not acutely suppressed
    - The immune system is likely to be most robust for those patients on continuous chemotherapy
  - If on anti-B cell therapy (ie Rituximab), then give 4 weeks prior to the next dose

Specific immunosuppressing conditions

- HIV
  - Anti-viral therapy and controlled HIV may lead to an improved response to vaccination
  - However, delaying vaccination is not absolutely required
  - Patients with advanced HIV should receive the vaccine, because risk of shingles in these patients is high
- Autoimmune and inflammatory conditions
  - Ideally, give when the underlying disease is controlled and not in an acute flare
  - When possible, give prior to starting immunosuppressing medications
    - If not possible, then give when immunosuppression is anticipated to be low
  - For patients on anti-B cell therapy, give vaccine 4 weeks prior to next dose

Pneumococcus

Source: CDC

Pneumococcus

- ***2022 updates for adults:***
  - *PCV15 (Vaxneuvance) and PCV20 (Prevnar 20) approved in 2021*
  - *PCV13 is out (except for kids and BMT patients)*
  - *PPSV23 is still available*
- *For adults, there are two options:*
  - *PCV15 followed by PPSV23*
  - *PCV20 alone*

Pneumococcus

- Indications
  - all adults 65 and up
  - Immunocompromising conditions
    - Chronic renal failure, nephrotic syndrome, immunodeficiency, iatrogenic immunosuppression, generalized malignancy, HIV, leukemia, lymphoma, myeloma, solid organ transplant, asplenia, sickle cell disease, other hemoglobinopathies
  - Cochlear implant
  - CSF leak
  - Alcoholism
  - Chronic heart, lung, or liver disease
  - Cigarette smoking
  - Diabetes mellitus

PCV15 + PPSV23

- Pros
  - 4 additional strains covered
- Cons
  - Requires 2 shots
  - More complicated
  - Patients must follow up (5 less strains covered compared to PCV20 if the series is not completed)

PCV20

- Pros
  - Single shot completes series for all ages
  - More cost effective
- Cons
  - 4 less strains covered
  - One strain did not meet noninferiority cutoff but was still immunogenic

- For patients who have previously received Prevnar 13
  - Follow the usual schedule for Pneumovax 23 if not previously given or if doses are due
  - Data is lacking to support the role for Prevnar 20 as a second dose in this situation
  - However, ACIP suggests Prevnar 20 may be given in place of Pneumovax 23 if the latter is unavailable.

Pneumococcus

- Routine for children started at age 2 months using PCV13
  - PCV15 can also now be used in place of PCV13. it was approved by the FDA and ACIP this summer
- PPSV23 in children
  - Indications: Chronic heart disease, chronic lung disease (includes asthma treated with high dose, oral steroids), diabetes mellitus, CSF leak, cochlear implant, sickle cell disease and other hemoglobinopathies, asplenia, congenital or acquired immunodeficiency, HIV, chronic renal failure, nephrotic syndrome, malignant neoplasms, leukemia, lymphoma, Hodgkin disease, other diseases associated with immunosuppressing drugs or radiation therapy, solid organ transplantation, multiple myeloma, chronic liver disease, alcoholism
- Administer at least 8 weeks after PCV13

Areas of uncertainty

- Which regimen is better for immunocompromised patients?
- Pediatrics –
  - PCV20 to be looked at in children next year
- Repeat dosing/boosters?

Final special considerations

Catch up vaccines

Haemophilus influenzae type b	6 weeks	**No further doses needed** if first dose was administered at age 15 months or older. **4 weeks** if first dose was administered before the 1st birthday. **8 weeks (as final dose)** if first dose was administered at age 12 through 14 months.	**No further doses needed** if previous dose was administered at age 15 months or older. **4 weeks** if current age is younger than 12 months **and** first dose was administered at younger than age 7 months and at least 1 previous dose was PRP-T (ActHib®, Pentacel®, Hiberix®), Vaxelis® or unknown **8 weeks and age 12 through 59 months (as final dose)** if current age is younger than 12 months ***and*** first dose was administered at age 7 through 11 months; OR if current age is 12 through 59 months ***and*** first dose was administered before the 1st birthday, ***and*** second dose was administered at younger than 15 months; OR if both doses were PedvaxHIB® and were administered before the 1st birthday	**8 weeks (as final dose)** This dose only necessary for children age 12 through 59 months who received 3 doses before the 1st birthday.	

Source: CDC

Insurance coverage

- Private plans – mostly required to cover vaccines under the ACA
- Medicaid – vaccines covered but there could be copays depending on the state
- Medicare
  - Part B covers influenza, pneumococcus
  - Part D covers shingles, Tdap
- Vaccines for children (VFC) – no cost
- Federally funded health centers – may offer sliding scale
- Health departments – can direct patients where to go for low cost vaccines

Travel

- Yellow fever
- Typhoid (oral form no longer being manufactured)
- Rabies (pre or post-exposure prophylaxis)
- Polio (routine for children but for adults usually only if there is planned travel and no prior vaccination)
- Japanese encephalitis
- Hepatitis A and B
- Cholera
- Anthrax
- Dengue

Pregnancy considerations

- Avoid any live attenuated vaccines
- Tdap every pregnancy
- Rubella vaccine after delivery for Rubella NI mothers
- Varicella vaccine after pregnancy for non-immune mothers
- Delay Shingrix in pregnancy

Asplenia considerations

- Pneumococcus
- Hib
- Men ACWY
- Men B

- If planned splenectomy, vaccine prior to surgery if possible

Live attenuated vaccines

- Adenovirus
- BCG
- Dengue
- Intranasal flu (LAIV)
- OPV
- MMR
- Varicella
- Oral typhoid
- Rotavirus
- Smallpox
- Yellow fever
- Live zoster

Final Summary

Vaccine schedules are confusing and ever changing!

Bookmark the link to the CDC's vaccine schedule website and reference often.

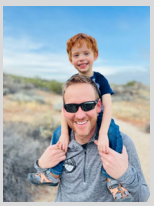
Make sure to review this year's updates in more detail

References

- Jackson S, Lentino J, Kopp J, Murray L, Ellison W, Rhee M, Shockey G, Akella L, Erby K, Heyward WL, Janssen RS. Immunogenicity of a two-dose investigational hepatitis B vaccine, HBsAg-1018, using a toll-like receptor 9 agonist adjuvant compared with a licensed hepatitis B vaccine in adults. Vaccine. 2018;36(5):668. Epub 2017 Dec 27.
- Heyward WL, Kyle M, Blumenau J, Davis M, Reisinger K, Kabongo ML, Bennett S, Janssen RS, Namini H, Martin JT. Immunogenicity and safety of an investigational hepatitis B vaccine with a Toll-like receptor 9 agonist adjuvant (HBsAg-1018) compared to a licensed hepatitis B vaccine in healthy adults 40-70 years of age. Vaccine. 2013;31(46):5300. Epub 2013 May 30.
- Clinical considerations for use of Recombinant Zoster Vaccine (RZV, Shingrix) in immunocompromised adults aged >/= 19 years. Centers for Disease Control and Prevention. https://www.cdc.gov/shingles/vaccination/immunocompromised-adults.html
- Adult Immunization Schedule. Centers for Disease Control and Prevention. https://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html#note-hepb
- Teo E, Lok A. Hepatitis B immunization in adults. Up to Date. https://www.uptodate.com/contents/hepatitis-b-virus-immunization-in-adults?search=hep%20b%20vaccination&source=search_result&selectedTitle=2~129&usage_type=default&display_rank=1#H2

References

- Thwaites L. Tetanus. Up to Date. https://www.uptodate.com/contents/tetanus?search=tetanus%20prophylaxis&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1
- Hibberd P. Seasonal Influenza Vaccination in Adults. Up to Date. https://www.uptodate.com/contents/seasonal-influenza-vaccination-in-adults?search=influnza%20vaccination&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1
- Weekly update: Hepatitis A Statewide Community Outbreak. Up to Date. https://odh.ohio.gov/know-our-programs/Hepatitis-Surveillance-Program/Hepatitis-A-Statewide-Community-Outbreak/



Thank you