Adult Immunization 101

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Acknowledgement

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Adult Immunization Resource Hub

- Developed as part of ACP's *I Raise the Rates* initiative.
- Provides updated clinical information, patient education materials, quality improvement guidance and much more.
- For more information, visit:

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- Learn core QI skills that empower you to implement practice-changing initiatives to increase adult immunization rates in your practice.
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Overview

- Adult Immunization 101
  - Adult Immunization Rates
  - ACIP Recommended Adult Vaccine Schedule
  - Vaccination Among Special Populations:
    - Diabetics
    - Healthcare workers
    - Pregnant women
    - The elderly

Disclosures

- I am biased:

  <u>Immunizations are safe and effective!!</u>

- Employment: UAMS College of Medicine
- I have received honoraria for development of many medical education resources and presentations regarding immunization, treatment of Influenza.
  - Only the first disclosure (above) is relevant to my talk today.

Opportunity and Reward

- Immunization rates are far below HP2020 goals
- Common measure of quality preventive care
  - Inpatient, outpatient
  - Adult, obstetric, pediatric
  - Primary, specialty care
- Many elements in process which can be improved
  - Front desk
  - Nursing/MA
  - Physician
  - Checkout

HP2020 = Healthy People 2020

Adult Vaccination Rates = POOR!

Vaccine [Population]	2013	2016
Influenza		
Influenza – All Adults	42.7 %	43.5 %
[All] 19 – 49 years	30.4 %	32.1 %
[All] 50 – 64 years	48.0 %	46.4 %
≥ 65 years	71.7%	70.4 %
HCW [All]	75.2 %	(no data)
PPS23 & PCV13		
High risk 19 – 49 years	21.2 %	24.0 %
≥ 65 years	59.7 %	66.9 %
Tetanus [19 – 49 years, received past 10 years]	62.9 %	62.8 %
Tetanus/Pertussis [19+, received in past 10 years]	17.2 %	26.6 %
Shingles – Zoster [Age 60+] *(2016: above HP 2020 goal!)*	24.3 %	33.4 %
Hepatitis B Vaccine [High risk 19 – 49 years]	32.6 %	32.9 %
HPV Vaccine [Women 19-26 >1 dose]	36.8%	48.5%
HPV Vaccine [Men 19-21, >1 dose]	5.9%	21.2%

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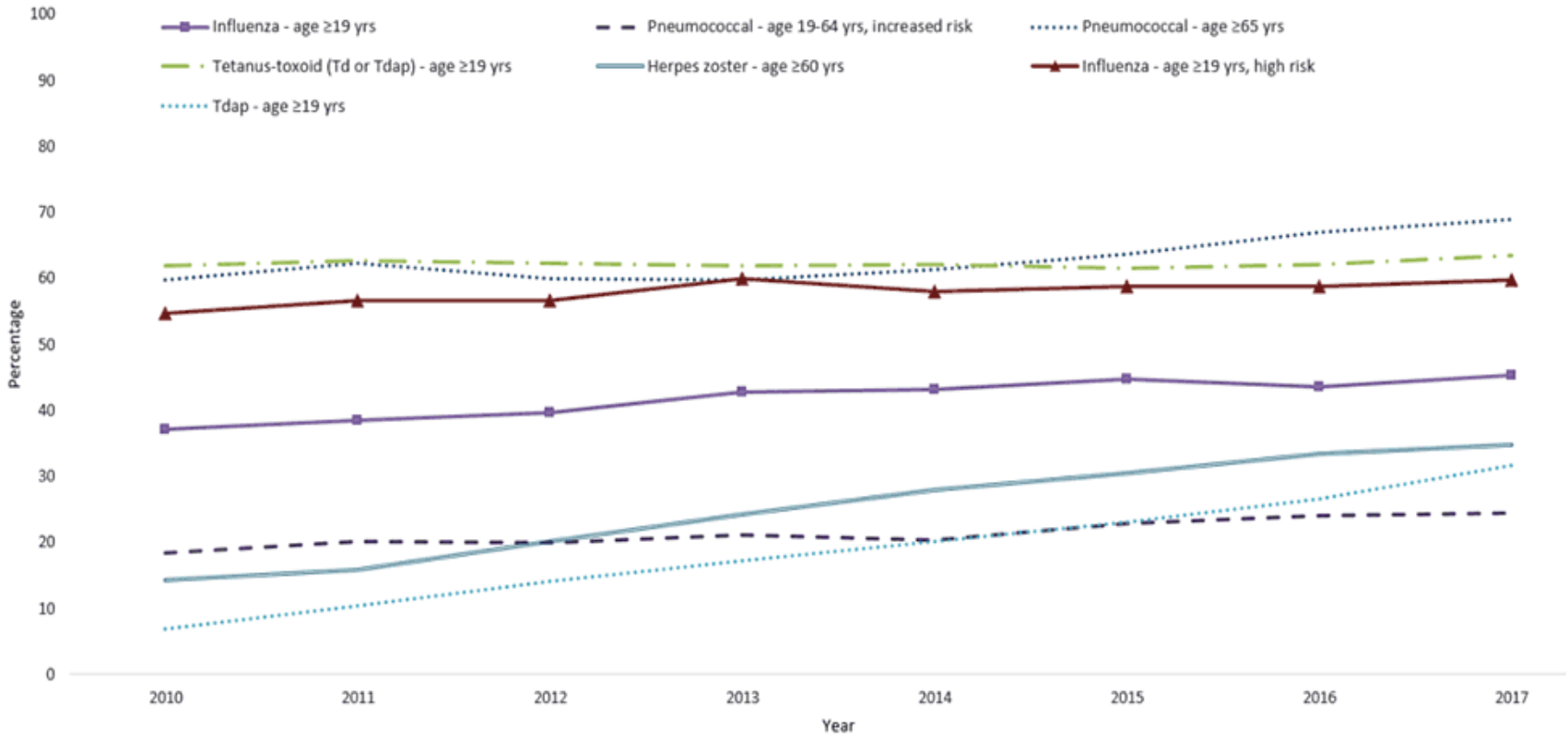
MMWR Feb 5, 2016/ Vol 65(1). http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6436a1.htm
https://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/pubs-resources/NHIS-2016.html

Data: *NHIS 2013, 2016*

Little Improvement in Most Rates Since 2010



https://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/pubs-resources/NHIS-2017.html#adult-vaccination-composite-measure

Adult Vaccination Rate Disparities: Race

Vaccine [Population]	Rate
Pneumococcal [>65 years]	
All Adults	66.9 %
Hispanic	48.6 %
White	71.0 %
Black	55.5 %
Asian	52.6 %

"…there are, unfortunately, similar disparities for most adult vaccines and we have not improved these disparities in the past 5 years. This is **absolutely unacceptable** in the United States in 2018!!" -RHH, MD 9/18/2018

https://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/pubs-resources/NHIS-2016.html

Data: *NHIS 2016*

Adult Vaccination Rate Disparities: Economic

	With health insurance						Without health insurance	
	Overall		Public		Private			
Vaccination, age group, increased-risk status	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Influenza vaccination (2015-16 season)[$]								
≥19 yrs	46.7	(45.5-47.9)[¶]	52.0	(49.7-54.4)[¶**]	44.6	(43.3-46.0)[¶]	14.8	(12.6-17.5)
19-49 yrs	35.2	(33.4-37.0)[¶]	35.4	(31.3-39.9)[¶]	35.1	(33.2-37.0)[¶]	13.5	(11.1-16.5)
50-64 yrs	48.8	(46.8-50.9)[¶††]	52.3	(47.5-57.3)[¶††]	47.9	(45.7-50.2)[¶††]	19.3	(14.5-25.6)
≥65 yrs	70.7	(68.9-72.5)[††]	68.0	(65.3-70.6)**[††]	73.4	(71.0-75.8)[††]	--[¶¶]	--
Pneumococcal vaccination, ever[§§]								
19-64 yrs, increased risk	25.6	(24.3-27.0)[¶]	31.3	(28.9-33.9)[¶**]	22.9	(21.4-24.4)[¶]	14.3	(11.5-17.5)
≥65 yrs	67.2	(65.6-68.8)[¶††]	63.3	(61.0-65.6)[¶**††]	71.4	(69.5-73.2)[¶††]	--	--
Tetanus vaccination, past 10 years* **								
≥19 yrs	63.9	(62.7-65.0)[¶]	58.4	(56.5-60.3)[¶**]	65.9	(64.7-67.1)[¶]	47.5	(44.6-50.3)
19-49 yrs	65.3	(64.0-66.7)[¶]	60.6	(57.7-63.5)[¶**]	66.6	(65.2-68.0)[¶]	47.1	(43.9-50.3)
50-64 yrs	65.7	(63.8-67.5)[¶]	61.6	(58.3-64.9)[¶**]	66.7	(64.6-68.7)[¶]	49.4	(44.1-54.7)
≥65 yrs	58.1	(56.4-59.8)[¶††]	54.7	(52.4-56.9)**[††]	61.8	(59.6-63.8)[¶††]	37.2	(20.5-57.5)
Herpes zoster (shingles) vaccination, ever[††††]								
≥60 yrs	34.1	(32.7-35.5)[¶]	30.3	(28.4-32.1)[¶**]	36.9	(35.1-38.8)[¶]	7.1	(4.0-12.3)
60-64 years	25.2	(22.9-27.6)[¶]	20.6	(16.9-24.8)[¶**]	26.5	(23.9-29.3)[¶]	--	--
≥65 yrs	37.6	(36.0-39.1)[¶††]	32.0	(29.9-34.1)[¶**††]	43.4	(41.4-45.5)[¶††]	--	--
HPV vaccination among females (at least 1 dose), ever[§§§§]								
19-26 yrs	50.0	(46.5-53.6)[¶]	42.6	(36.4-48.9)**	53.3	(49.1-57.5)[¶]	34.1	(26.0-43.4)
HPV vaccination among males (at least 1 dose), ever[§§§§]								
19-26 yrs	13.5	(11.4-15.9)	17.6	(11.7-25.6)	12.5	(10.3-15.1)	13.4	(7.9-22.0)

Lack of health insurance is a powerful predictor of lack of immunization…

Adult Immunization Schedule: Age

Table 1 Recommended Adult Immunization Schedule by Age Group
United States, 2019

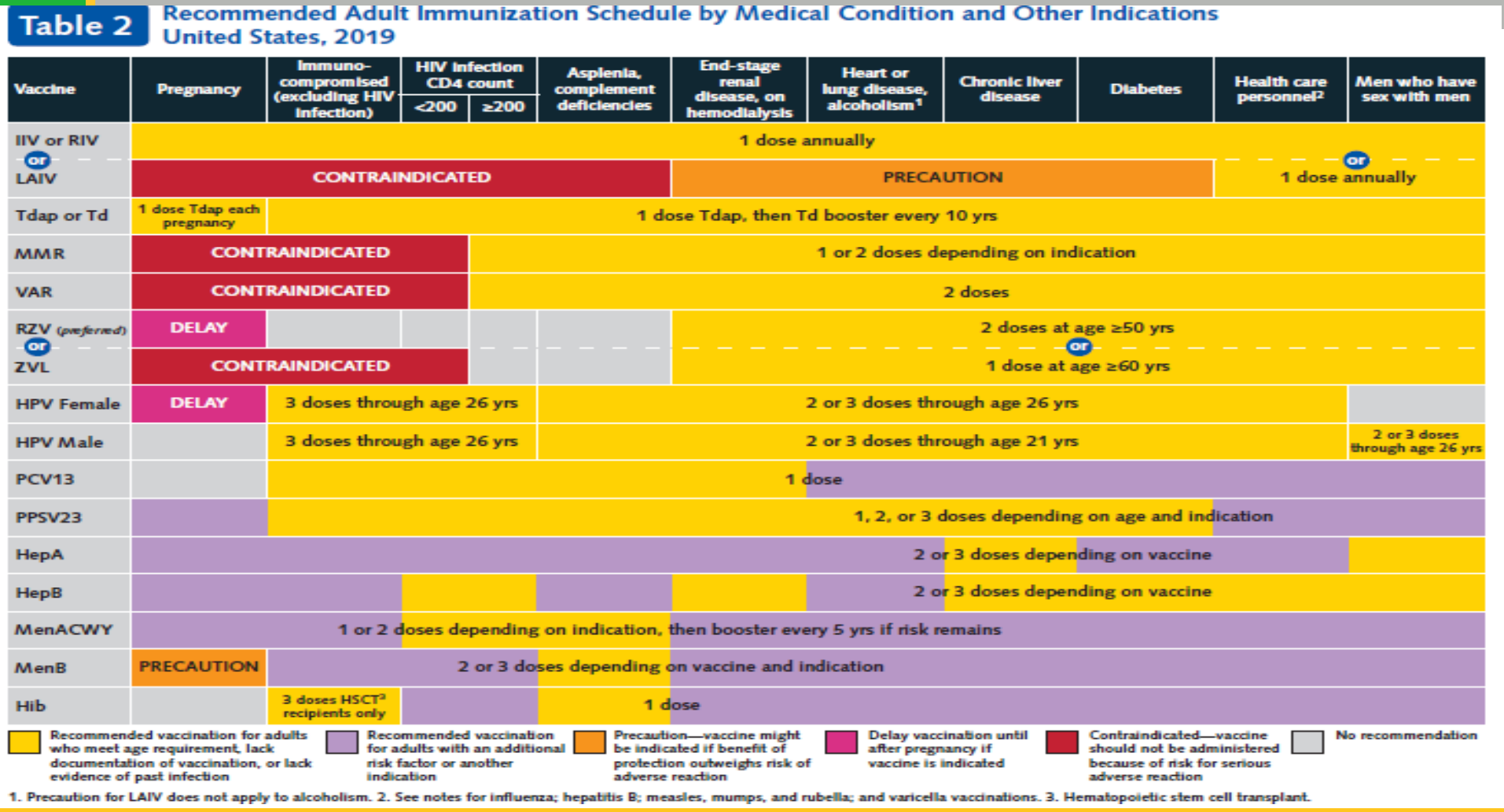
Vaccine	19–21 years	22–26 years	27–49 years	50–64 years	≥65 years
Influenza inactivated (IIV) or Influenza recombinant (RIV)	1 dose annually				
or					
Influenza live attenuated (LAIV)	1 dose annually				
Tetanus, diphtheria, pertussis (Tdap or Td)	1 dose Tdap, then Td booster every 10 yrs				
Measles, mumps, rubella (MMR)	1 or 2 doses depending on indication (if born in 1957 or later)				
Varicella (VAR)	2 doses (if born in 1980 or later)				
Zoster recombinant (RZV) (*preferred*)				2 doses	
or					
Zoster live (ZVL)				1 dose	
Human papillomavirus (HPV) Female	2 or 3 doses depending on age at initial vaccination				
Human papillomavirus (HPV) Male	2 or 3 doses depending on	age at initial vaccination			
Pneumococcal conjugate (PCV13)	1 dose				
Pneumococcal polysaccharide (PPSV23)	1 or 2 doses depending on indication				1 dose
Hepatitis A (HepA)	2 or 3 doses depending on vaccine				
Hepatitis B (HepB)	2 or 3 doses depending on vaccine				
Meningococcal A, C, W, Y (MenACWY)	1 or 2 doses depending on indication, then booster every 5 yrs if risk remains				
Meningococcal B (MenB)	2 or 3 doses depending on vaccine and indication				
Haemophilus influenzae type b (Hib)	1 or 3 doses depending on indication				

Recommended vaccination for adults who meet age requirement, lack documentation of vaccination, or lack evidence of past infection

Recommended vaccination for adults with an additional risk factor or another indication

No recommendation

Adult Immunization Schedule – Medical Indications



Vaccine Groups

"All Adults	"Risk-Based"
• Influenza	• HPV
• Pneumococcal [PCV13, PPSV23]	• MMR
• Tdap	• Varicella
• Zoster	• Meningococcal Quad [MCV4, MPSV4] MenB
	• Hepatitis A
	• Hepatitis B

Case 1

- John Francis is a 42 year old man with diabetes and hypertension seen for a 'routine follow-up' of his diabetes.
- His immunization record is shown.

Vaccine	Date	Comment
Influenza	10/1/2010	
	9/27/2013	
	11/12/2016	
	10/31/2017	
Tetanus: Td	1/18/2015	Foot wound
Meningococcal: MCV4	10/16/2015	Travel- Yemen
Hepatitis A	10/16/2015	Travel- Yemen
	6/18/2016	Travel- Yemen

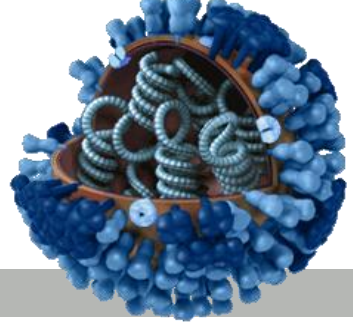
- *Which vaccines should you strongly recommend that he receive today?*

Click here to reveal the correct answer

Clinical Vaccinology: Part 1

- Influenza
- Pneumococcal (PCV13, PPSV23)
- Tdap and Td

Influenza



- Influenza: Orthomyxoviridae family [enveloped RNA virus]
  - 4 types based on surface Ag [HA, NA] + internal structure
    - A: Multiple hosts – Birds, Mammals [Man]. Many HA, NA types
    - B: Humans (only)
    - C: Humans (only) Mild illness 'URI'
    - D: Dogs (only)
  - Vaccinate from 'V[NOW!!]ble' thru 'no disease in community'

May… (or later)

- Up to 50,000 deaths annually in US from Influenza
  - 200K+ assoc. hospitalizations, chronic illnesses exacerbations
  - > 90% seasonal influenza M&M occurs in adults > 65 years
  - H3N2 strains cause greatest morbidity/mortality in adults
- Vaccination= MOST effective intervention vs. illness, death

US Influenza Vaccines => AAAA

- **Vaccinate ALL ADULTS AND kids 6+ months old ANNUALLY!!**
- **IIV: '**Inactivated influenza vaccines'
  - Administered IM to "All comers" 6+ months old
- Multiple flu vaccines approved each year
  - Differ: age(s) for whom approved, production method, +/- adjuvant in formulation,…
  - Some are **TRI-**valent, others **QUAD-**rivalent
    - NO published trials of comparative efficacy of TRI vs. QUAD
- Take home message (from ACIP… and from me):

  IMMUNIZE with a vaccine approved for (your) patient!

Falsey, et.al. J ID 2009, June9 [Epub]; C. Bridges CDC Personal Comm. 3/2013
http://www.nejm.org/doi/full/10.1056/NEJMoa1315727
http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm474295.htm

US Influenza Vaccines => AAAA (continued)

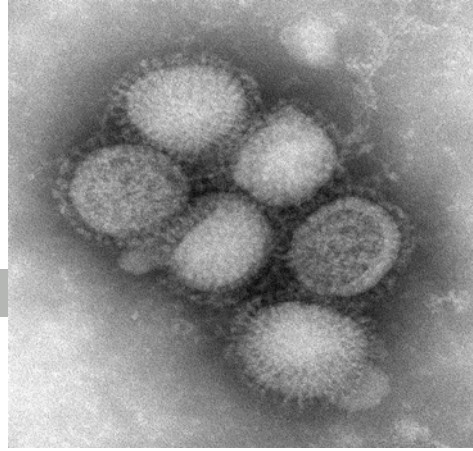
- Is there evidence to support a specific vaccine for my patient?
  - **SENIORS:**
    - **High-Dose IIV, Adjuvanted IIV** (TRI) are **at least** equivalent to standard vaccine
  - **ANAPHYLACTIC Egg Hypersensitivity/Allergy: Use egg-free vaccine**
    - **Recombinant HA vaccine:** egg-free, all HA no NA **(QUAD)**
    - **Cell culture vaccine:** essentially egg-free (femtograms of egg protein) **(TRI)**
    - **Egg allergy is NOT a contraindication to Influenza vaccination**
      - **If sensitivity is NOT anaphylactic, can use any vaccine.**
  - **'NEEDLE-PHOBIC'+ AGE 2-49 YEARS:**
    - **LAIV:** Live-attenuated, cold-adapted nasal **(QUAD)**
- **Take home: DON'T DELAY waiting on specific product: Vaccinate!**

Falsey, et.al. J ID 2009, June9 [Epub]; C. Bridges CDC Personal Comm. 3/2013
http://www.nejm.org/doi/full/10.1056/NEJMoa1315727
http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm474295.htm

Influenza Vaccine Priorities

- **ALL 6 MONTHS AND OLDER + DON'T WANT THE FLU**
- **HEALTHCARE WORKERS**
  - High risk for disease (symptomatic and asymptomatic)
  - High risk for transmission
  - If sick, not available to provide healthcare…
- **PATIENTS AT HIGHEST RISK (Spread +/- SEVERE ILLNESS)**
  - Pregnant women
  - Newborns and children < 2 years
  - Ade 65+ years
  - "Medical Comorbidities" (including BMI 40+ kg/m^2)
  - Immunecompromise
  - Household contacts of high-risk
  - Long-term care, institutionalized, crowded living conditions

Influenza 'Nuts and Bolts'



- **IIV: <u>1 dose</u> for adults** (and children 9+ years)
  - Regardless of vaccine selected
  - LAIV <u>may</u> be safely used in MOST HC settings as alternative to TIV
  - *Kids < 9 years, 1st vaccine season: 2 doses 4+ weeks apart*
- **Vaccine effectiveness is multifactorial**
  - Match between 'disease' and 'vaccine' strains
  - ~2 weeks following vaccine to develop immunity
  - Cited efficacy may not reflect all benefits
    - reduction in severe illness, deaths, hospitalization
  - Patient 'substrate' estimates:
    - 'Healthy young < 65' at ~60 – 80% v. 'Sick older > 65' at 30-40%
- **What does the future hold???**
  - Influenza Pandemics (shift or reassortment with avian, porcine virus)
  - Universal Influenza vaccine
  - Novel vaccine delivery systems

http://www.cdc.gov/vaccines/pubs/vis/downloads/vis-flu.pdf
http://www.premierinc.com/all/safety/safety-share/12-05-downloads/03-shea-hcw-flu-position-paper.pdf .
DiazGranados, et.al. NEJM 371(7), August 14, 2014.
https://cc.readytalk.com/cc/s/meetingArchive?eventId=rtv7rz2szhrw

Influenza TEST YOUR KNOWLEDGE Q1

You are seeing a 72 year old man with diabetes and coronary disease in clinic for follow-up. He has a history of egg allergy (anaphylaxis). Which of the following is correct re: influenza vaccination in this man?

a. Administer any influenza vaccine, the risk is negligible
b. Administer LAIV [nasal vaccine]
c. You should administer hdIIV
d. You should administer RIV
e. Do NOT administer influenza vaccine, it is contraindicated in severe egg allergy.

Click here to reveal the correct answer

Influenza TEST YOUR KNOWLEDGE Q2

A 75 year old man with multiple medical issues comes into your clinic. He tells you that he is spending much of his time in the Nursing Home with his wife. What vaccine do you recommend to protect him (and her) from influenza?

a. Standard Influenza vaccine
b. High-Dose Influenza vaccine
c. Recombinant Influenza vaccine
d. Doesn't matter which vaccine, just get flu vaccine into his arm!
e. Vaccinate early in season and revaccinate late in season to assure adequate protection through season

Click here to reveal the correct answer

Influenza

TEST YOUR KNOWLEDGE Q3

Which influenza strain causes the highest morbidity and mortality in seniors?

a. B
b. A: H1N1
c. A: H2N2
d. A: H3N2
e. A: H5N1

Click here to reveal the correct answer

Influenza TEST YOUR KNOWLEDGE Q4

When should you start and when can you stop vaccinating for influenza each year?

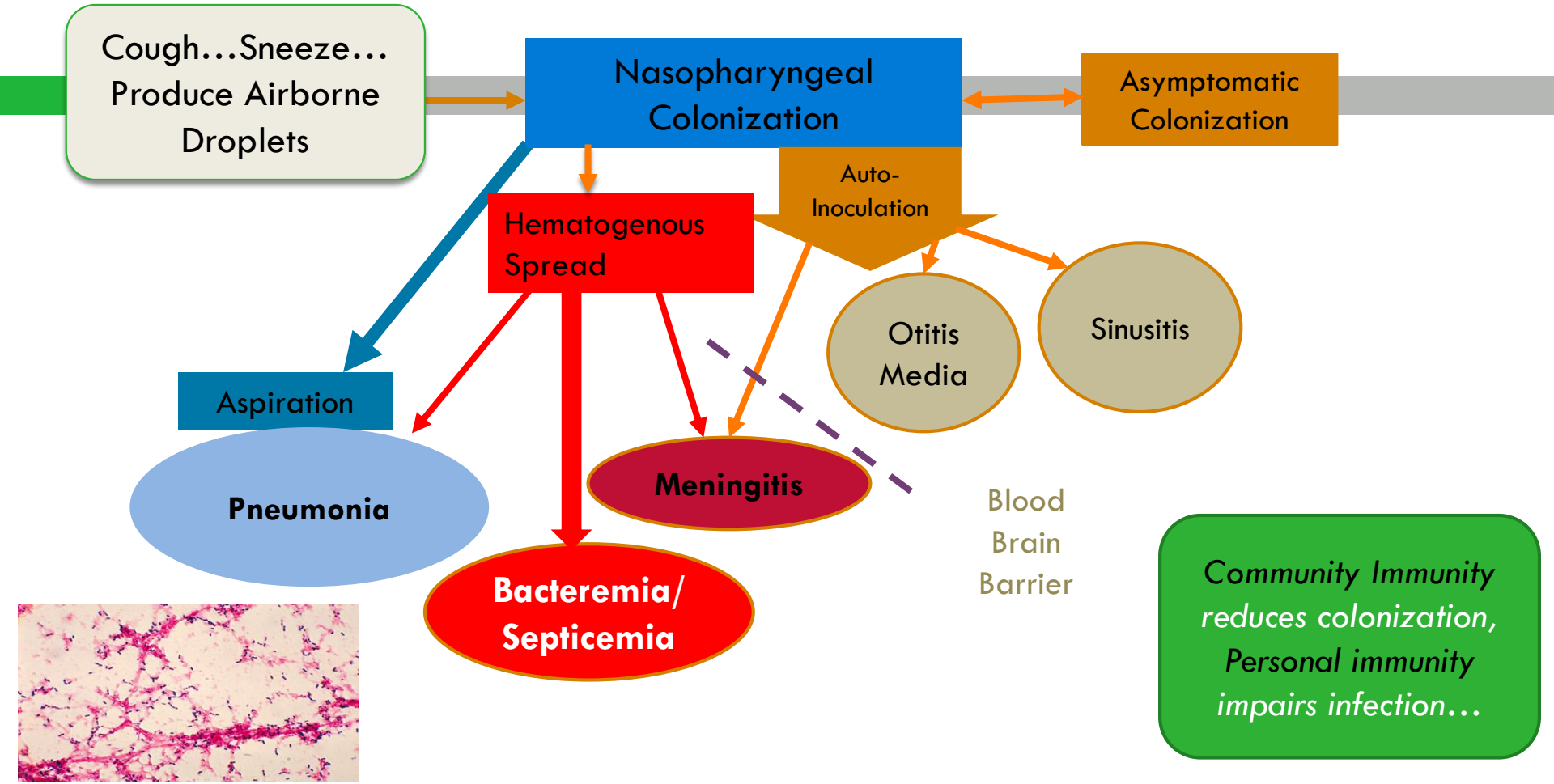
a. Sept 1, Jan 1
b. Sept 1, March 1
c. August 1, February 1
d. August 1, April 1
e. Vaccine available, Disease is gone

Click here to reveal the correct answer

High Value Care + Adult Influenza Vaccination

- **DO NOT:** *give partial dose influenza vaccine **or** multiple doses* in 1 season
  - There is no evidence for either of these practices!
- **DO NOT:** *delay vaccination* awaiting arrival of a different vaccine
  - Missed opportunities to vaccinate are major cause for under-vaccination.
- **DO:** *give influenza vaccine (separate needle/site) with other indicated immunizations*
  - It is safe to give influenza vaccination with any other indicated adult vaccine
- **DO:** *vaccinate all healthcare workers to minimize transmission*
  - To patients, healthcare team, families and community
- **DO:** *vaccinate all patients in hospitals, LTC facilities, crowded living situations.*
  - Other than acute febrile illness, which may reduce vaccine effectiveness, there is no reason to delay for fear of 'making current illness worse' or 'worsened surgical outcomes…'

Pneumococcal Disease: Pathophysiology



Result: >2000 Adults 65^{+} die annually from invasive pneumococcal disease (IPD):
Bacteremia, sepsis, meningitis

Henriques-Normark B, Tuomanen EI. *Cold Spring Harb Perspect Med.* 2013;3(7). pii: a010215; van der Pol T, Opal SM. *Lancet*. 2009;374(9700):1543-1556.

Pneumococcal Vaccines

- **PPSV23** = 'adult standard' = purified capsule polysaccharide
  - 23 types → cause ~ 88 % invasive disease
  - Immunity lasts at least 5 years following 1 dose
  - Local reactions – only common AE
  - All who live to 65+ need at least 1 dose. Revaccinate only those who require and receive vaccine before 65 years.
- **PCV13**='pediatric standard' vaccine = conjugated to protein
  - 13 types → ~50% IPD in immunocompromised adults
  - 1 dose in adult life (sole exception is 'immune system reset')
  - No published efficacy studies in adults [PCV7 data in HIV, reports, etc.]
- ACIP recommends combined strategy [PCV13 + PPSV23] in adults at highest risk

PPS 23 Vaccine Effectiveness

- 7 Meta-Analyses of RCT [Most recent Cochrane, 1/2013]
  - Conclusions inconsistent re: cause specific outcomes
    - Agreement: REDUCTION in IPD
    - NO reduction ALL CAUSE mortality, pneumonia
- 3 Meta-Analyses of Observational Studies
  - Consistent results: vaccine is effective for prevention of IPD
- RCT Results
  - Invasive PNC Dz: Odds ratio [consistent] 0.26 (CI 0.25-0.46)
  - Pneumonia: Odds ratio [signif. heterogeneity] 0.71 (CI 0.52-0.97)
  - Mortality: Odds ratio 0.87 (CI 0.69-1.10)
- Summary
  - Data = PPS prevents IPD
  - *There is not compelling data for VV all-cause Pneumonia, Mortality*

Fine, et.al. ArchivesIM 1994(154): 2666. Hutchinson et.al. CanJFP 1999(45): 2381. Watson, et.al. Vaccine 2002(20): 2166. Conaty, et.al. Vaccine 2004(22): 3214. Dear, et.al. Cochrane DB Syst Rev 2004, Issue 3. Moberley , et.al. Cochrane DB Syst Rev 2008, Issue 1. Moberly, et.al. Cochrane DB Syst Rev 2013, Issue 1.

PCV13 Adult Vaccine Effectiveness

- **CAPiTA**
  - PC RCT PCV13 unimmunized adults 65+ years, Netherlands
  - PCV7 in Dutch infants since 6/2006 -> PCV10 in March 2011
  - 84,000+ participants PCV13 v. Placebo
  - Enrolled 9/2008-1/2010, follow-up ended 8/2013
  - PCV13 reduces bacteremic CAP with vaccine–type PNC **(Primary)**
  - PCV13 reduces nonbacteremic CAP, other IPD **(Secondary)**
  - Serologic and urinary Ag used to identify PNC infection
  - Considered by ACIP in making current Pneumococcal recs.

http://www.nejm.org/doi/full/10.1056/NEJMoa1408544

Adult Pneumococcal Vaccine: By The Numbers

- Two vaccines
  - PCV13
  - PPSV23
- Three intervals
  - 8 weeks when PCV13 before PPSV23 for highest risk medical conditions
  - 1 year between PCV13 and PPSV23:
    - When PPSV23 is given before PCV13
    - AND when both vaccines are given after age 65 years
  - 5 years minimum between doses of PPSV23
- Maximum doses in adult lifetime
  - 1 PCV13 [with only 1 uncommon and specific exception]
  - 3 PPSV23 [If highest risk medical condition and first dose before 59 yr]

Pneumococcal Immunization

HIGHEST Risk **PCV 13 + PPSV23**

Immune compromised [IC], 'Anatomic Risk'

Adults 65+ [Shared decision making 2019]

NO

INCREASED Risk **PPSV23 ONLY**

Smokers, Chronic Medical Conditions – Not Immunocompromised

NO

AVERAGE Risk **NO PNEUMOCOCCAL VACCINE**

Young [< 65], No Chronic Medical Conditions

Pneumococcal Immunization I

PPSV23 ALONE for INCREASED RISK

All cigarette smokers ≥ 19 years old

Chronic conditions ≥19 years old

- Diabetes
- Lung disease: asthma, COPD
- Cardiovascular disease
- Liver disease
- Kidney disease

(*EXCEPT ESRD, nephrotic syndrome:* PCV13 + PPSV23 recommended)

After this 1 dose, no further Pneumococcal vaccine is recommended until patient becomes **Highest Risk** by **AGE 65+ *or*** develops a **HIGHEST RISK** medical **CONDITION**.

- Immunity lasts at least 5 years following 1 dose
- REVACCINATION ONCE after 65 years [AND ≥5 years after initial dose] for those vaccinated prior to age 65

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5934a3.htm
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6140a4.htm

Pneumococcal Immunization II

PCV13 then PPSV23 for HIGHEST RISK CONDITIONS

1. **Disease:**
   - CANCER (systemic Tx): solid tumors, hematologic malignancies, myeloma, etc.
   - HIV
   - Immune deficiency: inherited and other (CVID, etc.)
   - End-stage kidney disease ESRD, nephrotic syndrome
2. **Iatrogenic:**
   - MEDS: Steroids (20 mg/d or greater), biologic immunomodulators, XRT, others
   - TRANSPLANTS: solid organ, bone marrow, stem cell
3. **Asplenia:**
   - ANATOMIC: splenectomy (best if immunized prior to)
   - FUNCTIONAL: hemoglobinopathy, sickle cell, other

- -

4. **Anatomic:** (*Loss of blood-brain barrier protection*)
   - CSF leak, cochlear implant

See table for details…

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6140a4.htm
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6337a4.htm

Pneumococcal Immunization III

PPSV23 + *Shared-Decision Making* re: PCV13 for 65 years+

All adults 65+ should receive PPSV23

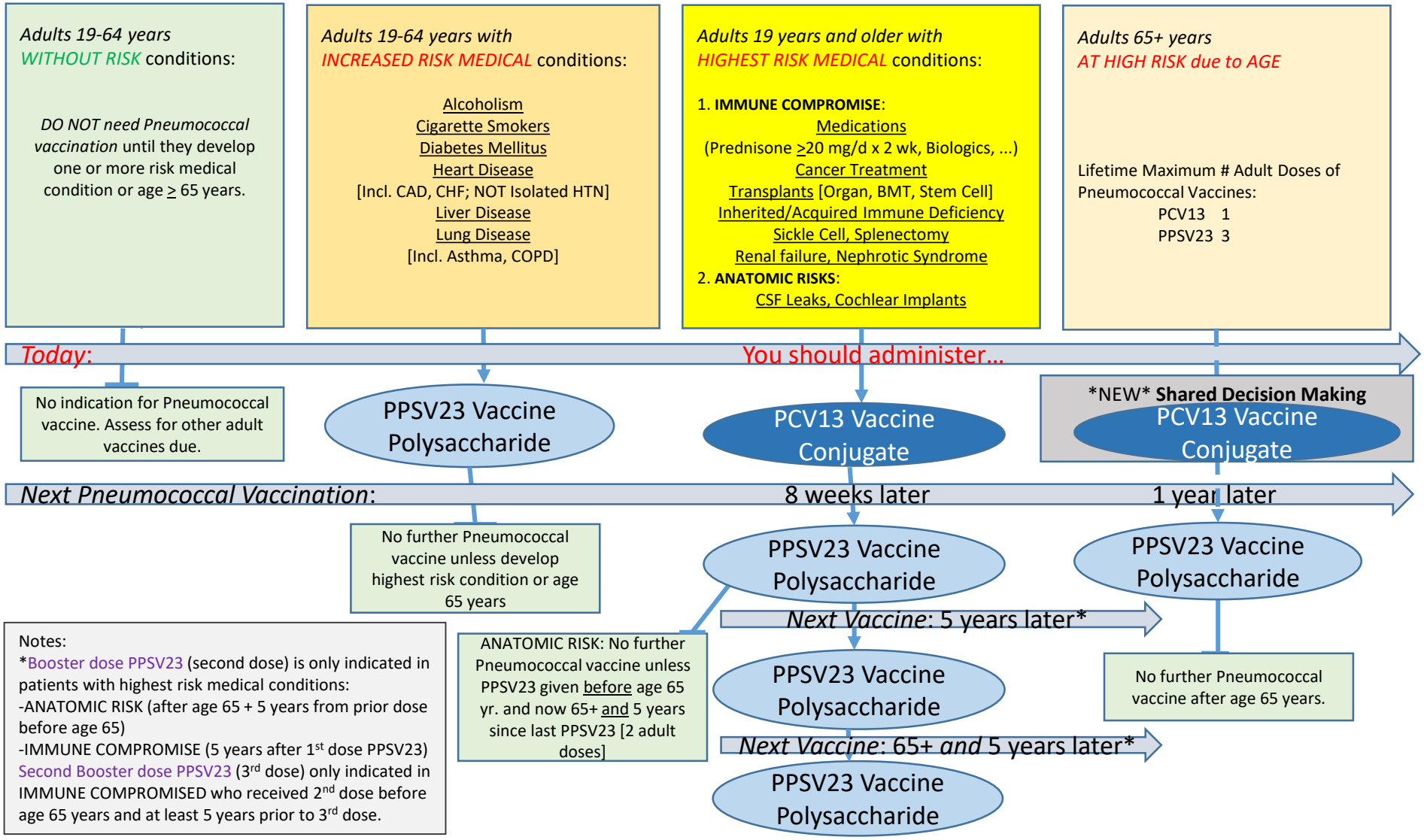
- Shared decision making, grade 'B' recommendation for PCV13 in adults 65+ years without other indications for PCV13
- Wait 1 year between PCV13 and PPSV23 vaccines
- *ACIP voted to change rec. based on reduction in risk of invasive pneumococcal infections identified in surveillance presented at June 2019 meeting.*

Shared Decision Making
Discussion between provider and patient about potential benefits and risks of vaccine vs. not vaccinating.

NO additional/booster doses of PCV13 or PPSV23 recommended after age 65 years

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5934a3.htm
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6140a4.htm

ADULT PNEUMOCOCCAL VACCINE: Risk Groups and Recommendations 2019



Notes:
*Booster dose PPSV23 (second dose) is only indicated in patients with highest risk medical conditions:
-ANATOMIC RISK (after age 65 + 5 years from prior dose before age 65)
-IMMUNE COMPROMISE (5 years after 1st dose PPSV23)
Second Booster dose PPSV23 (3rd dose) only indicated in IMMUNE COMPROMISED who received 2nd dose before age 65 years and at least 5 years prior to 3rd dose.

https://www.cdc.gov/vaccines/schedules/downloads/adult/adult-combined-schedule.pdf

R. Hopkins, MD. UAMS COM. 7/29/19.
Developed for educational purposes.

Pneumococcal

TEST YOUR KNOWLEDGE Q1

Which of the following would be medical indications for PCV13 vaccine in adult patients?

a. Type 1 diabetes mellitus
b. NASH cirrhosis
c. Cigarette smokers
d. Pregnant women
e. Heart transplant recipients

Click here to reveal the correct answer

Pneumococcal TEST YOUR KNOWLEDGE Q2

Which of the following is most correct about the use of PCV13 and PPSV23 vaccines in adults?

a. PCV13 should not be administered to adults who received the vaccine as a child except if they have a bone marrow/stem cell transplant.

b. Only 1 dose of PCV13 is recommended in adults (1 exception).

c. PCV13 should be given AFTER PPSV23 if at all possible

d. PCV13 and PPSV23 should be separated by ~6 months in adults 65+

e. PPSV23 booster doses should be given every 5 years after 1st dose

Click here to reveal the correct answer

Pneumococcal TEST YOUR KNOWLEDGE Q3

William is 63. He required splenectomy for abdominal trauma in his 40's. He received PPSV23 prior to surgery; but did not receive any subsequent pneumococcal vaccinations. He was admitted to your hospital service through ED with bacteremic Pneumococcal pneumonia 8 days ago and is now ready to be discharged. Do you recommend he receive Pneumococcal immunization at this time? If so, what is your specific recommendation?

Click here to reveal the correct answer

Pneumococcal 'Nuts and Bolts'

PCV13 [1 dose in adults] PPSV23 [1 – 3 doses based on risk]

- **Increased Risk Patients:**
  - Pneumococcal polysaccharide (PPSV23) – *NOW*
  - No further Pneumococcal vaccination until/unless
    AGE >65 YEARS OR
    Develops HIGHEST RISK MEDICAL CONDITION
- **Highest Risk Medical Condition Patients:**
  - Pneumococcal (PPSV23) vaccine-naive patients (ideal situation):
    - PCV13 followed by PPSV23 at least 8 weeks later
    - Booster PPSV23 in 5 years (AND final PPSV23 at 5+ years/65+ years)
  - Previously PPSV23 – vaccinated patients:
    - PCV13 at least 1 year after prior dose PPSV23
    - Booster PPSV23 at least 5 years after prior PPSV23
      (*AND* must be 8+ weeks after PCV13)
    - Final PPSV23 after 65+ years and at least 5 years after last dose

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6140a4.htm
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6337a4.htm

Pneumococcal 'Nuts and Bolts'-continued

PCV13 [1 dose in adults] PPSV23 [1 – 3 doses based on risk]

- **Patients 65 and older (High Risk):**
  - **All adults should receive 1 dose PPSV23 after age 65 years**
    - ***If PRIOR* PPSV23, should also be at least 5 years since (last dose) PPSV23**
    - ***IF PRIOR* dose PCV13, should also be at least 1 year since PCV13**
  - **Shared decision Making: Grade B Recommendation for PCV13 vaccine**
    - ACIP June 2019: voted to change Grade A recommendation for all 65+ to receive PCV13
      - Pneumococcal infections declining in 65+ population, due to 'herd immunity'
    - In general, PCV13 should be administered prior to PPSV23
    - PCV13 must be given at least 1 year after last PPSV23
    - CMS [M'CARE] will only pay if > 11+ months between PCV13/PPSV23
  - **No additional/booster PPSV23 if sole indication is age > 65 years**

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6140a4.htm
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6337a4.htm

Tetanus, Diphtheria and Pertussis

- Diphtheria:
  - Rare in US [<5 cases in past 10 years]
  - Still causes disease internationally, >50 % mortality w/o Tx
- Tetanus:
  - Uncommon in US [~200 cases/16 deaths US 2009-15]
  - Most deaths in elderly
- Pertussis:
  - Endemic, most disease adolescent/adult
  - 2016 **U.S.**: 17,972 cases, six infant **deaths**
  - '100 days cough'= Hi Morbidity…
  - Mortality highest in infants

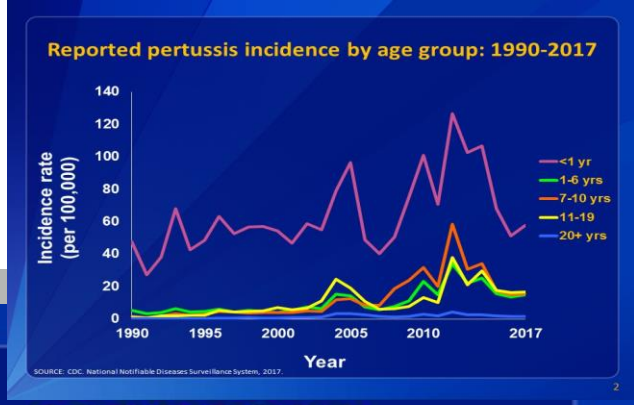
https://www2.cdc.gov/vaccines/ed/surveillance/

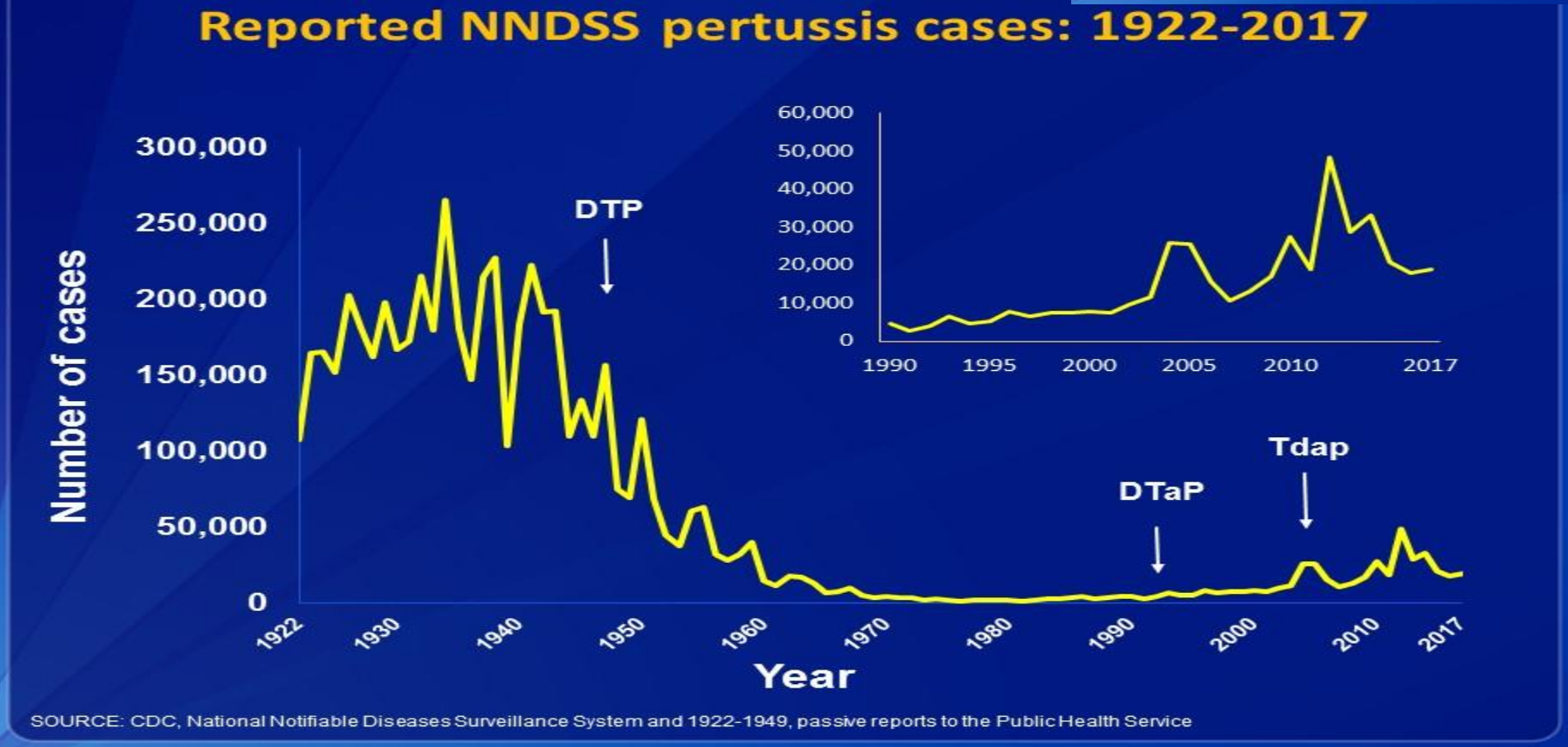
Td -- Tdap

- Pertussis incidence increasing since 1970's [to 40K cases/yr]
  - Passive reporting likely underestimates true disease burden
  - Community outbreaks: Most in fall, winter and in all ages
  - Nosocomial Disease: Academic, Community
    - [Med/Surg, OR, L&D, NICU, Oncology]
    - Residential Care
- Adults don't usually have 'classic' triphasic disease
  - Most have persistent Cough: Median 4 months [6 studies]
    - 20-40 % 'Whoop', 40 – 55 % Posttussive emesis
  - 12-32 % Lymphocytosis
  - ~10% develop complications [Pneumonia most common]

http://www.cdc.gov/vaccines/vpd-vac/pertussis/
http://www.cdc.gov/vaccines/vpd-vac/combo-vaccines/DTaP-Td-DT/Tdap.htm

Pertussis: Vaccination Impact





1

Td -- Tdap

- Tdap Recommendation: All Adults
  - 1 dose to replace one dose Td [booster or primary]
  - Subsequent Td q10yr
  - May give any time following last Td

- Special emphasis:
  - Parents, childcare, other adults with close infant contact
  - **HEALTHCARE**

- **Tdap intrapartum** all women, <u>every pregnancy</u>
  - Regardless of interval/prior Tdap [best @ 27 – 36 weeks gestation]
  - Focus: Protect infants [Highest M&M group] by passive immunity
  - No specific recommendation for 'ring vaccination' of family (<u>is</u> reasonable)

Td and Tdap TEST YOUR KNOWLEDGE Q1

Select the best answer:

Which of the following patients needs Tdap vaccination today?

a. 65 year old man: Td at age 64, last dose '20 years ago'
b. 75 year old man: dirty wound, unknown Tetanus vax status
c. 60 year-old going to visit daughter, new grandson [Tdap 2012]
d. 65 year-old Internist in for checkup, last Tdap at age 55
e. Patients a and b above.

Click here to reveal the correct answer

Td and Tdap TEST YOUR KNOWLEDGE Q2

Which of the following is most correct re: Tdap vaccination in pregnancy?

a. Tdap is recommended in 1st pregnancy only
b. Tdap is recommended before 27 weeks gestation each pregnancy
c. Tdap is recommended at 27-35 weeks each pregnancy
d. Tdap is recommended at 35 weeks or later each pregnancy
e. Tdap is contraindicated in pregnancy

Click here to reveal the correct answer

System-Based Practice re: Td, Tdap

Tdap	Td
• Once in all adults	• Every 10 years
• Every pregnant woman/pregnancy at 27-35 weeks	• None

- Insurance Coverage
  - All ACA-Compliant Private plans: Covered, no copay
  - Medicare:
    - Injury/wound related - covered under part B [link Dx/CPT]
    - Preventively: covered under part D (Drug benefit)
  - Medicaid: (rules differ by state program)
    - Usually covered in pregnancy 'bundle',
    - Other situations: check with your state Medicaid program.

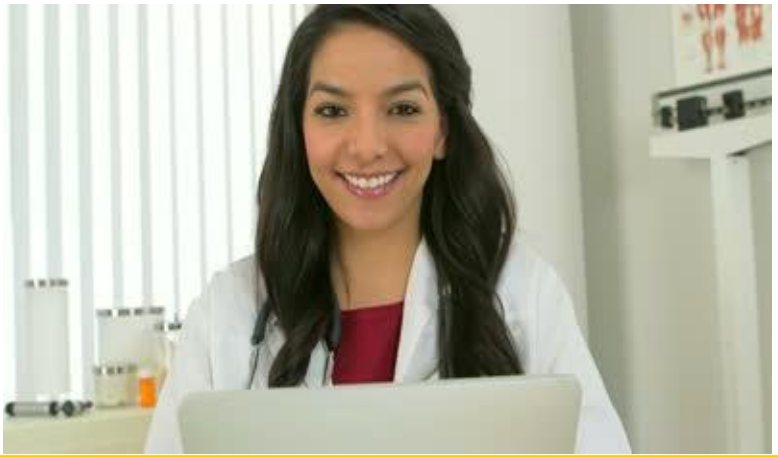
Clinical Vaccinology: Part 2

- HPV
- Hepatitis B
- Healthcare Provider Vaccination

Case 2

- Maria Alvarez is a 24 year old medical student with no significant past medical history. She is here today for an 'annual preventive exam.'
- Which vaccines should you make sure she receives? As a healthcare worker in training, what vaccines should she receive?

Click here to reveal the correct answer(s)



Cervical Cancer

Genital Warts

HPV

- HPV is common –and vaccine preventable- cause for Cancer(s)
  - Cervical CA is second most common cause CA death in women
    - US: ~10 women die every day of cervical cancer
  - Anal CA and penile CA in men definitively linked to HPV
  - HPV causes many oropharyngeal (and other CA)
- ~20 million current HPV infections
  - By age 50, 80% SA women will have acquired genital HPV
    - Many clear spontaneously but no way to identify which will do so…
  - 6.2 million new genital HPV infections/year in US
    - 74% in women 15 – 24 years of age
  - 70% Cervical CA worldwide due to HPV serotypes 16 [54%], 18 [13%]
    - Additional 15% due to HPV serotypes 31, 33, 45, 52, 58
  - >90% Genital warts due to HPV serotypes 6, 11

http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5602a1.htm

HPV Vaccine

NOTE: This is a CANCER PREVENTION vaccine, not a sex vaccine!

- HPV9 Vaccine:
  - Contains types 6, 11, 16, 18, 31, 33, 45, 52, 58
  - **3 doses over 6+ months for adults**
    - 2 dose Series for those who start series before 15 years of age
  - No need to start over if completion delayed
  - Effective >8 yrs, only for types patient has *NOT previously acquired*
- Women, Men: vaccinate between ages 9 and 26
- Vaccine licensed to age 45: [June 2019 ACIP]
  - **SDM:** Shared decision making
- Contraindications/Cautions:
  - Local reaction, bronchospasm reported
  - Not recommended in pregnancy – no proven AE [administer after delivery]
  - Immunosuppression can reduce efficacy
- VAX DOESN'T CHANGE CERVICAL CA SCREENING RECOMMENDATIONS!!

HPV TEST YOUR KNOWLEDGE Q1

You are seeing James, a 23 year-old man, in STD clinic. He has been healthy other than a 1 week history of urethral discomfort. He was referred to you by his girlfriend who was recently found to have PID. He does not know his immunization history.

Which of the following do you recommend today re: Vax?

a. Urethral swab for HPV, vaccinate if test positive
b. Urethral swab for HPV, vaccinate if test negative
c. No test, give HPV9 vaccine today, final dose in 6 months
d. No test, HPV9 today, dose 2 in 1 month, dose 3 in 6 mo.
e. HPV vaccine only recommended in men to age 21 yr.

Click here to reveal the correct answer

HPV TEST YOUR KNOWLEDGE Q2

MA is a healthy 19 year old woman who has come in on 3/1/2019 for a 'checkup' prior to moving into a dorm at a local college. She provides you with the immunization record shown. What vaccines do you

Vaccine	Date	Other MAW, DOB 9/1/1999
Influenza	10/3/2016, 11/4/2017, 9/2/2018	IIV4
Tdap	9/11/2011, 9/2/2018	[Primary series complete 2005]
HPV	1/12/2015, 10/21/2016	HPV4
MCV4	10/12/2012, 9/2/2018	
MenB	9/2/2018	
MMR, VAR	12/12/2000, 6/11/2013	

Click here to reveal the correct answer

Hepatitis B: Underused Risk-based Adult vaccine

- **Behavioral and social:**
  - >1 sex partner in 6 months
  - Household contacts and sex partners of HBsAg+ people
  - MSM
  - IVDU
  - Inmates in long-term correctional facilities
- **Occupational**
  - Health care, public safety workers, staff working with developmentally disabled
- **Medical**
  - Persons with Diabetes mellitus under 60 years of age [MD discretion at 60+ yr]
  - Persons with (any) chronic liver disease
  - Persons living with HIV
  - People seeking STD evaluation or treatment
  - Hemodialysis patients and ESRD patients awaiting dialysis
- **Travel**: risk destination or activity
- **All adults who want to be protected** from hepatitis B

Hepatitis B and Diabetes

- ACIP recommends Hepatitis B vaccine in unimmunized diabetic patients (October 2011)
  - **ALL** diabetic patients aged 19-59 years
  - Age 60+ at discretion of the treating physician
    - Risk is likely greatest: injectable meds, glucose checks, sharing supplies…
  - *HBV immunization is a common gap in Diabetes care practice*!
- Why?
  - Patients with DM have 2.1 fold higher risk for acute HBV v. non-DM
  - NASH is common in patients with diabetes
    - NASH, as one type chronic liver disease, ^^^ HBV–associated Morbidity/mortality
  - NHANES: Seroprevalence for HBV [Anti – HBVc IgG] is 60% higher in DM

Challenges in Hepatitis B vaccination

- Response to standard Hepatitis B vaccines lower in patients with:
  - Obesity
  - Diabetes Mellitus [more so with longer duration of disease]
  - Renal failure
  - Increasing age
  - Immune compromising conditions
- >90 % response rate for vaccination in adults < 40 years
- ~75% response rate for vaccination of adults at 60 years
- ACIP does not recommend a specific vaccine product for HBV immunization except in immune compromise and hemodialysis

https://www.cdc.gov/mmwr/volumes/67/rr/rr6701a1.htm

Hepatitis B Vaccines

- **Formulations/Route: IM**
  - Standard vaccines: standard schedule is 3 doses over 6+ months
    - Multiple alternate schedules demonstrated effective (3-4 doses)
  - Combination Hepatitis A/B vaccine for those needing protection from HAV, HBV
  - High dose vaccine, specific schedule for Dialysis, Immune compromised patients
  - TLR-Adjuvanted HBV Vaccine (approved 2017) 2 doses over 1 month
  - If series delayed, do not restart. Complete series w/ same vax as prior dose(s)

- Currently best method to assess HBV immunity is to measure HBsAb BUT primary immunity induced by vaccine is cell-mediated
  - Many will mount anamnestic response without prior measureable antibody

Hepatitis A Vaccination

- Risk-based adult recommendation
- Recommended for ALL children [Catch up 6/2019]
- Homelessness IS an indication [eff. 2/2019]
  - National outbreak assoc. with homeless, drug use

Adult HAV Indications:

Homelessness	Drug users (Injection and Non-injection)
Travelers to any at risk destination	MSM
HIV	Chronic Liver Disease
Clotting factor recipients	Lab workers at risk
Anyone desiring immunity	

- Effective vaccines, 2 doses for lifelong protection

https://www.cdc.gov/mmwr/volumes/68/wr/pdfs/mm6806a6-H.pdf
https://www.usatoday.com/story/news/health/2019/08/10/hepatitis-vaccine-outbreak-spreads-shadows-opioid-epidemic/1967284001/

Hepatitis B

TEST YOUR KNOWLEDGE Q1

For which of the following patients is the ACIP recommendation for Hepatitis B vaccine 'at the individual physician's discretion (level B)?

a. 28 year-old Peace Corps volunteer posted to work in SE Asia
b. 38 year-old woman with chronic HCV
c. 42 year-old man with newly diagnosed DM2 on oral meds
d. 62 year-old man with uncontrolled DM2 on insulin
e. 70 year-old woman caring for her son with chronic active HBV

Click here to reveal the correct answer

Hepatitis B

TEST YOUR KNOWLEDGE Q2

Which of the following patients is least likely to develop immunity following hepatitis B vaccination?

a. A 25 year-old medical student
b. A 40 year-old nurse
c. A 55 year-old with chronic HTN and newly diagnosed DM 2
d. A 70 year-old with CKD stage 4 and DM2 x 20 years

Click here to reveal the correct answer

Healthcare Workers

- Key in implementation of Adult Immunization
  - Education: Multiple studies show that…
    - **STRONG PRESUMPTIVE MD recommendation → Increases vaccine uptake**
    - "You need _ _ _ vaccine today because _ _ _. "
- HCW need preventive benefits for 'themselves'
  - Potential source for disease transmission to

    Patients

    Other staff

    Communities

    Their own Families
  - Potential for Vax Preventable Illness to impair patient care
    - Adverse effects on efficiency and/or
    - Absent: Prevents HCW from taking care of patients

Healthcare Worker Vaccination

- Annual influenza immunization!!
- Tdap: All should receive 1 adult dose
  - Then Td every 10 years (sooner if 'risky wounds')
- MMR: Proof of immunity and/or 2 vaccine doses
- Varicella: Proof of immunity and/or 2 vaccine doses
- HBV: 3 dose series
  - Titer 1 month after series
    - Repeat entire series x 1 if titer < 10 IU
  - No recommendation to screen/recheck titer otherwise

Uncommon Vaccination Situations: Adult

- Splenectomy [Splenic Dysfunction]
  - High risk for encapsulated GNB infections
  - Meningococcal [MCV4 and MenB] vaccination
    - Initial series and boost every 5 years
  - HiB vaccination if not immunized in childhood
- Stem Cell Transplants
  - 'Immune system reset'
  - Start over with inactivated vaccination (~infant imm)

HCP

TEST YOUR KNOWLEDGE Q1

John is a 27 year old who is in your office for a screening evaluation prior to starting residency. The most recent sections of his immunization record is shown. Based on this data, which vaccines do you recommend for him today?

Vaccine	Date J. R. Johns DOB 4/6/1991
Influenza (IIV)	9/14/2016, 1/12/2017, 10/14/2018
MMR	11/1/1993, 3/2/1999
VAR	11/1/1993
Tdap	11/2/1999, 2/14/2008
Hepatitis B	10/4/1995, 12/6/1995, 6/6/1996
MCV4	6/1/2009, 8/18/2009

Remove cover for correct answer(s)

HCP

TEST YOUR KNOWLEDGE Q2

One of your interns sticks his head into the work room and tells you that he stepped on a hypodermic needle (which then punctured his foot) in the parking lot when walking to his car last night after he 'got off short call.' He cleaned the wound and denies any symptoms today. You insist that he be evaluated immediately by employee health.

He received Tdap ~10 years ago; completed HBV immunization (and had + confirmatory HBsAb titer early this year).

What do you recommend re: immunization?

Click here to reveal the correct answer

Clinical Vaccinology: Part 3

- Vaccination of Pregnant Women
- Zoster

Case 3

- Christine Pulaski is a 32 year old pregnant woman with no significant past medical history who presents for a prenatal visit in her first trimester.
- Which vaccinations should she receive during pregnancy? Which vaccinations are contraindicated?

Click here to reveal the correct answer

Vaccinate Pregnant Women

- Influenza vaccine recommended in all pregnant women, every pregnancy: **FluVax4Mom4Baby**!!
  - Inactivated vaccine only
  - Safe/Can be given any trimester of each pregnancy
- Tdap vaccine is recommended in all pregnant women, every pregnancy: **Tdap at 27-36wk4Baby!**
  - Passive Ab transfer maximized at this time
  - Protect infant until can begin active immunization (2m)
  - Recommend assess Tdap status of all household contacts and bring up to date all 'deficient' contacts

Pregnancy

TEST YOUR KNOWLEDGE Q1

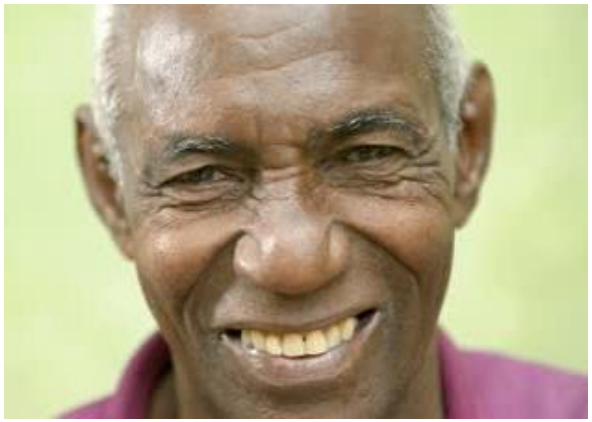
Jill is a 29 year old G3P2 woman who is in your office for followup of her chronic HTN on November 1. She is currently ~30 weeks pregnant with her 3rd child. Received Influenza vax. in 1st pregnancy and Tdap vaccine in both prior pregnancies [2017, 2016] but had arm soreness each time. What do you advise re: vaccines today?

a. Give influenza, hold off Tdap since had reaction
b. Give both vaccines together (Same syringe/injection) today
c. Give both vaccines, separate sites
d. Give Tdap today, wait 2 weeks and then Influenza

Click here to reveal the correct answer

Case 4

- Christopher Watkins is a 68 year old man with a prior 10 – week history of a persistent cough presenting for his annual Medicare wellness visit.



- Mr. Watkins lives with his daughter and his 2 young grandchildren (ages 6 months and 2 years). Which vaccines should Mr. Watkins receive?

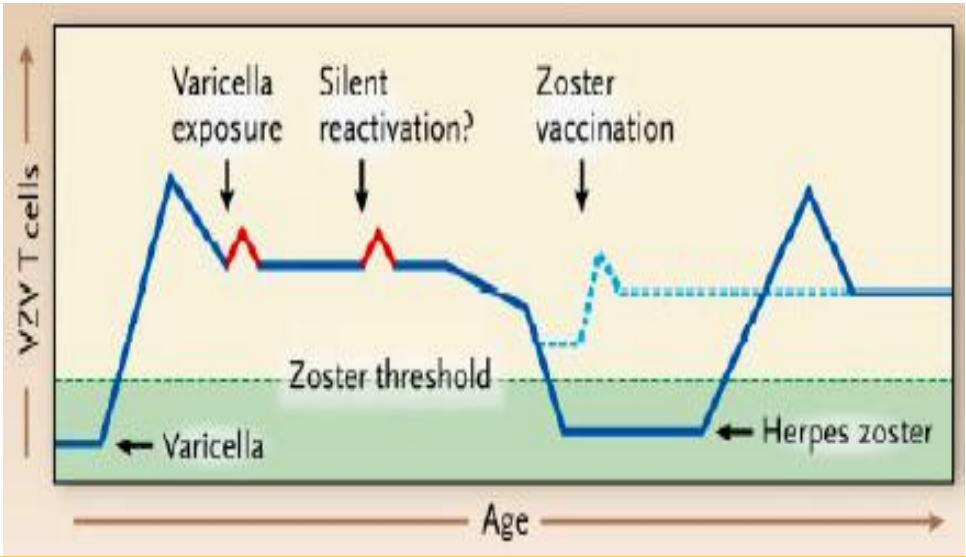
Click here to reveal the correct answer

Zoster Pathophysiology: Epidemiology

- Most who have varicella will have measureable Ab for life
  - Zoster occurs when CMI 'surveillance' declines
  - Reactivation or Varicella exposure re-stimulates CMI

[Cycle can repeat serially… shingles can recur!]

- Lifetime risk of Zoster ~33% [~ 99.5% adults sero + prior Varicella]
  - At 85 – lifetime risk ~ 50%
  - PHN = most common AE
    - Up to 1/3 pt with Zoster
    - More common
      - >70 years with Zoster
      - Immunocompromised
  - Vaccination stimulates CMI



Arvin A. NEJM 2005;352:2266-77.
http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5705a1.htm

Zoster vaccines

- RZV (Shingrix) Adjuvanted Subunit vaccine
  - Available since 2017
  - Refrigerated- must be reconstituted/2 doses, given IM
  - FDA Licensed/ACIP Recommended in adults 50+
  - ACIP PREFERRED over ZVL (~90% efficacy vs. 60%)
- ZVL (Zostavax) Live-attenuated vaccine
  - Available since 2006
  - Frozen- must be reconstituted/given SQ within 1 hr
  - ACIP Recommended in adults 60+ [FDA licensed 50+]
  - Contraindicated in Immune compromise, Pregnancy

Zoster: RZV (Preferred)

- Vaccinate adults 50+
  - 2 doses IM
  - Adjuvanted vaccine- can cause arm pain, low grade fever
    - Local AE with 1st dose does not predict AE with second dose
  - Regardless of prior episode(s) of Zoster
  - Regardless of whether/not received ZVL
    - At least 2 months after ZVL
  - No need to test and/or vaccinate vs. Varicella first
  - No need to defer for 'at risk contacts'– no transmission risk
  - No booster.

Implementing Zoster Vaccination

- RZV has a preferential recommendation
  - ZVL can be given to 60+ adults w/o immune compromise
- Current vaccine shortage is improving
  - Manufacturer has ‘vaccine finder’ on Website
- Private Insurance ACA-Conforming plans
  - RZV covered 100% without copay
- Medicare and Medicaid
  - Medicare Coverage under Part D (Drug plan)
  - Medicaid Coverage determination is state by state…

Zoster

TEST YOUR KNOWLEDGE Q1

A 62 year old family physician requests Shingles vaccine. Which of the following is most correct about this vaccine?

a. Zostavax [ZVL] is a live virus vaccine, it should not be given as he may spread the virus after vaccination.

b. Shingrix [RZV] is a subunit vaccine. A single dose should be given to prevent shingles in this person.

c. ZVL is recommended 5 years later in all adults who received RZV

d. RZV is recommended in all adults who previously received ZVL

e. ACIP recommendations and FDA licensure for ZVL and RZV are similar with the exception that ZVL should not be given in immune compromised adults.

Click here to reveal the correct answer

Zoster

TEST YOUR KNOWLEDGE Q2

Which of the following is correct about the new subunit Zoster vaccine [RZV]?

a. Must be stored in 2 vials and frozen
b. Must be given within 2 hours of reconstitution
c. Must be given IM
d. Reactions after first dose preclude completion of series
e. If diluent misplaced can be reconstituted with saline

Click here to reveal the correct answer

Summary

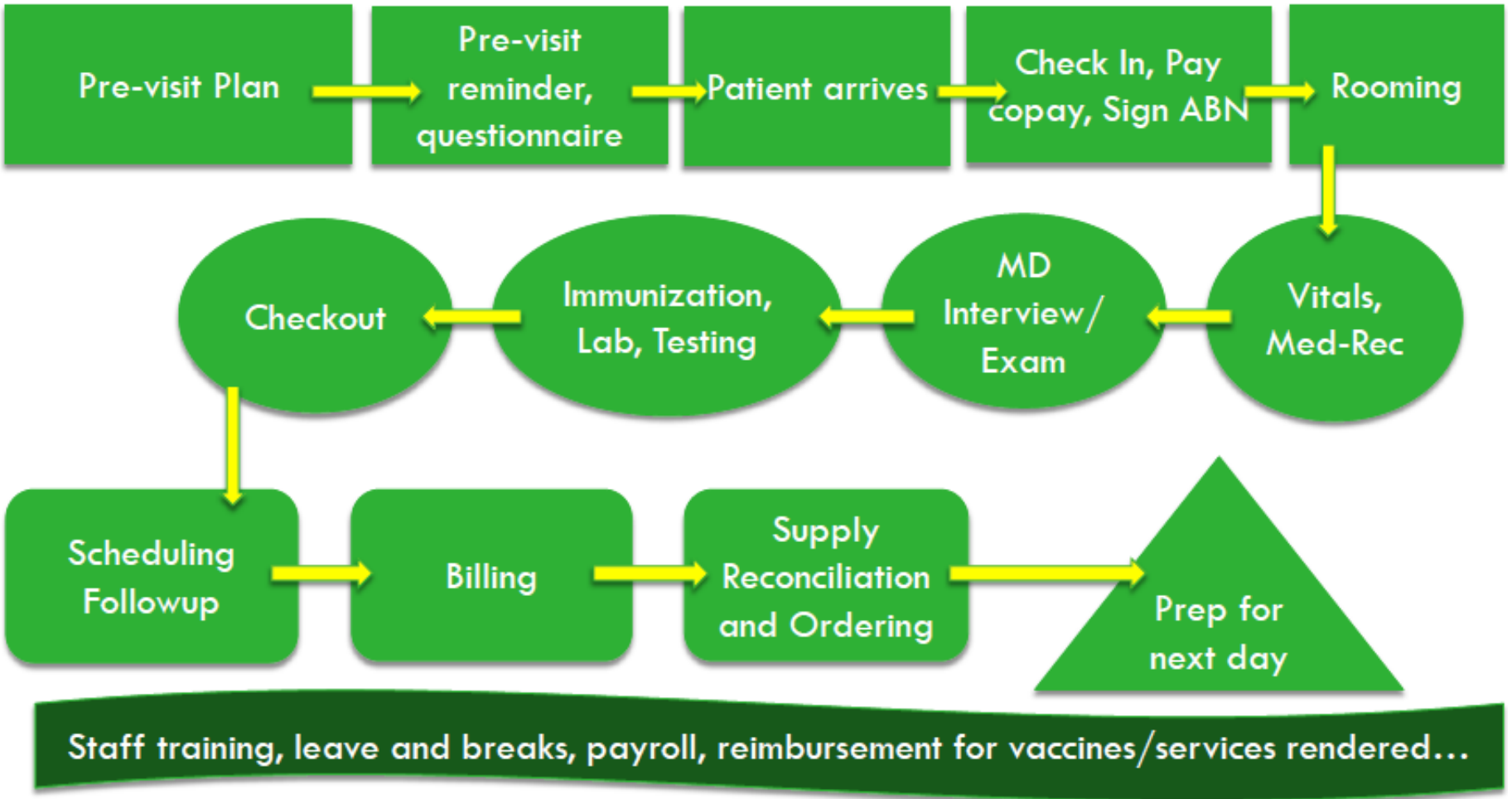
- Current vaccination rates are well below targets
- Vaccines can prevent morbidity and mortality associated with vaccine preventable disease
- Adult immunization is complex, rapidly changing
- Physician recommendation is key to patient uptake!

Additional Resources

- https://www.acponline.org/clinical-information/clinical-resources-products/adult-immunization
- https://www.acponline.org/practice-resources/acp-quality-improvement/acp-advance

Team: Critical for Successful Immunization

Even if the process was *this simple and linear*... This is too much for 1 person to manage!



Components of Successful Teams

- Leader [Leadership Skills]
- Content expert (May or may not be leader)
- Team members
  - Represent all key constituencies in practice
  - Each member has a voice and a role
- Develop common understanding of problem
- Engage members of team on process/steps to fix
- Assure shared goals for team members
- Rewards for success shared

Team Preparation

- A patient representative on team can be valuable
- Team members don't need to be vaccine experts
  - Team members must understand WHY vaccination is important
  - AND have basic knowledge about immunization
- Team members don't need to be engineers but must
  - Understand their role in process
  - Know how their role affects up- and down-stream steps

How to implement a successful vaccination program

- TOP priority: *Strong presumptive recommendation!*
- TEAMWORK
- TOOLS
  - Standing orders https://www.standingorders.org/
  - Pre-visit planning https://edhub.ama-assn.org/steps-forward/module/2702514
  - Managing immunization hesitancy [next slide]
  - Drop in (and/or outreach) immunization program
  - Partner with others- pharmacy, public health,…
- TRACKING
  - Know your numbers (vaccination rate, inventory, costs, reimb.)

Pearls for helping hesitant patients…

- **Emphasize *benefits*** of getting vaccinated TODAY
  - Vaccination today provides protection faster than delay…
- **Provide education** materials or trusted websites
- **Send reminders** about needed vaccines
- **Document the conversation** in the patient record
  - Offer 'drop in vaccination' or 'shot only' opportunity
  - Note reason for refusal/delay, leverage this at future visit
  - Plan to continue the conversation or vaccinate at next visit, specify this in your documentation
  - '**Close the deal**' by following up and vaccinating as planned!