Updates in Adult Immunization Recommendations, Coverage, Policy

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Disclosure and Disclaimer

- The presenter has no conflict of interest
- The use of trade names is for identification purposes only and does not imply endorsement
- Discussions on unlicensed products and off-label uses are in the context of ACIP recommendations
- The opinions expressed in this presentation are those of the presenter and do not necessarily represent official positions of CDC or ACIP

Outline

- Updates in adult immunization schedule
- Updates in (and review) vaccines for adults
- Standards for adult immunization practice
- Business case for adult immunization

Updates in Adult Immunization Schedule

Updates in 2019 Adult Immunization Schedule

- Influenza vaccination – June 2018
  - Updated recommended use of LAIV
- Hepatitis B vaccination – Feb 2018
  - Recommended use of Heplisav-B in ≥18y
- Hepatitis A vaccination – Oct 2018
  - Recommended use of HepA in homeless
  - Pre- and post-exposure prophylaxis
- Recommended Adult Immunization Schedule, United States, 2019
  https://www.cdc.gov/vaccines/acip/

1. https://www.cdc.gov/mmwr/volumes/68/wr/mm6805a5.htm
2. https://www.cdc.gov/mmwr/volumes/67/wr/mm6715a5.htm
3. https://www.cdc.gov/mmwr/volumes/68/wr/mm6806a6.htm
4. https://www.cdc.gov/mmwr/volumes/67/wr/mm6743a5.htm

Otzi

- ~30yo former “off-the-grid” survivalist
- Sparse medical record
- Unknown vaccination history
- Your vaccination recommendations?

Recommended Adult Immunization Schedule
for ages 19 years or older

UNITED STATES
2019

How to use the adult immunization schedule

1. Determine recommended vaccinations by age **(Table 1)**
2. Assess need for additional recommended vaccinations by medical condition and other indications **(Table 2)**
3. Review vaccine types, frequencies, and intervals, and considerations for special situations **(Notes)**

Vaccines in the Adult Immunization Schedule*

Vaccines	Abbreviations	Trade names
Haemophilus influenzae type b vaccine	Hib	ActHIB Hiberix
Hepatitis A vaccine	HepA	Havrix Vaqta
Hepatitis A and hepatitis B vaccine	HepA-HepB	Twinrix
Hepatitis B vaccine	HepB	Engerix-B Recombivax HB Heplisav-B
Human papillomavirus vaccine	HPV vaccine	Gardasil 9
Influenza vaccine, inactivated	IIV	Many brands
Influenza vaccine, live attenuated	LAIV	FluMist Quadrivalent
Influenza vaccine, recombinant	RIV	Flublok Quadrivalent
Measles, mumps, and rubella vaccine	MMR	M-M-R II
Meningococcal serogroups A, C, W, Y vaccine	MenACWY	Menactra Menveo
Meningococcal serogroup B vaccine	MenB-4C MenB-FHbp	Bexsero Trumenba
Pneumococcal 13-valent conjugate vaccine	PCV13	Prevnar 13
Pneumococcal 23-valent polysaccharide vaccine	PPSV23	Pneumovax
Tetanus and diphtheria toxoids	Td	Tenivac Td vaccine
Tetanus and diphtheria toxoids and acellular pertussis vaccine	Tdap	Adacel Boostrix
Varicella vaccine	VAR	Varivax
Zoster vaccine, recombinant	RZV	Shingrix
Zoster vaccine live	ZVL	Zostavax

*Administer recommended vaccines if vaccination history is incomplete or unknown. Do not restart or add doses to vaccine series for extended intervals between doses. The use of trade names is for identification purposes only and does not imply endorsement by the ACIP or CDC.

Recommended by the Advisory Committee on Immunization Practices (www.cdc.gov/vaccines/acip) and approved by the Centers for Disease Control and Prevention (www.cdc.gov), American College of Physicians (www.acponline.org), Academy of Family Physicians (www.aafp.org), American College of Obstetricians and Gynecologists (www.acog.org), and American College of Nurse-Midwives (www.midwife.org).

Report

- Suspected cases of reportable vaccine-preventable diseases or outbreaks to the local or state health department
- Clinically significant postvaccination reactions to the Vaccine Adverse Event Reporting System at www.vaers.hhs.gov or 800-822-7967

Injury claims

All vaccines included in the adult immunization schedule except pneumococcal 23-valent polysaccharide and zoster vaccines are covered by the Vaccine Injury Compensation Program. Information on how to file a vaccine injury claim is available at www.hrsa.gov/vaccinecompensation or 800-338-2382.

Questions or comments

Contact CDC at www.cdc.gov/cdc-info or 800-CDC-INFO (800-232-4636), in English or Spanish, 8 a.m.–8 p.m. ET, Monday through Friday, excluding holidays.

Download the CDC Vaccine Schedules App for providers at www.cdc.gov/vaccines/schedules/hcp/schedule-app.html.

Helpful information

- Complete ACIP recommendations: www.cdc.gov/vaccines/hcp/acip-recs/index.html
- General Best Practice Guidelines for Immunization: www.cdc.gov/vaccines/hcp/acip-recs/general-recs/index.html
- Vaccine Information Statements: www.cdc.gov/vaccines/hcp/vis/index.html
- Manual for the Surveillance of Vaccine-Preventable Diseases (including case identification and outbreak response): www.cdc.gov/vaccines/pubs/surv-manual
- Travel vaccine recommendations: www.cdc.gov/travel
- Recommended Child and Adolescent Immunization Schedule, United States, 2019: www.cdc.gov/vaccines/schedules/hcp/child-adolescent.html

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

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				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				

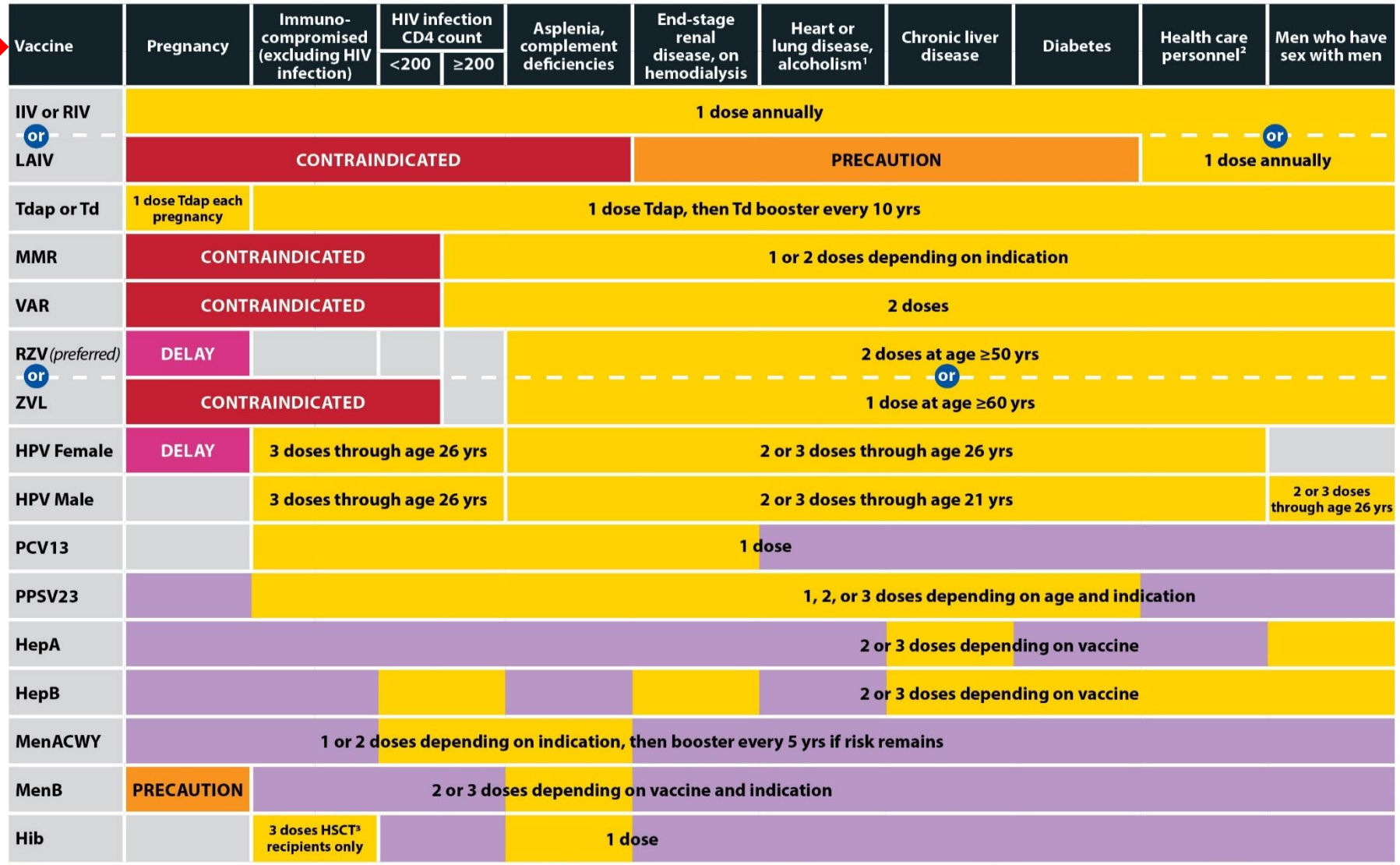
Recommended vaccination for adults who meet age requirement, lack documentation of vaccination, or lack evidence of past infection

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

No recommendation

- ✓ Flu
- ✓ Tdap/Td
- ✓ MMR
- ✓ VAR

Table 2 Recommended Adult Immunization Schedule by Medical Condition and Other Indications United States, 2019



1. Precaution for LAIV does not apply to alcoholism. **2.** See notes for influenza; hepatitis B; measles, mumps, and rubella; and varicella vaccinations. **3.** Hematopoietic stem cell transplant.

- ✓ Flu
- ✓ Tdap/Td
- ✓ MMR
- ✓ VAR
- ✓ Others depending on indication

Notes

Recommended Adult Immunization Schedule United States, 2019

Haemophilus influenzae type b vaccination

Special situations

- **Anatomical or functional asplenia (including sickle cell disease)**: 1 dose Hib if previously did not receive Hib; if elective splenectomy, 1 dose Hib, preferably at least 14 days before splenectomy
- **Hematopoietic stem cell transplant** (HSCT): 3-dose series Hib 4 weeks apart starting 6–12 months after successful transplant, regardless of Hib vaccination history

Hepatitis A vaccination

Routine vaccination

- **Not at risk but want protection from hepatitis A** (identification of risk factor not required): 2-dose series HepA (Havrix 6–12 months apart or Vaqta 6–18 months apart [minimum interval: 6 months]) or 3-dose series HepA-HepB (Twinrix at 0, 1, 6 months [minimum intervals: 4 weeks between doses 1 and 2, 5 months between doses 2 and 3])

Special situations

- **At risk for hepatitis A virus infection**: 2-dose series HepA or 3-dose series HepA-HepB as above
  - **Chronic liver disease**
  - **Clotting factor disorders**
  - **Men who have sex with men**
  - **Injection or non-injection drug use**
  - **Homelessness**
  - **Work with hepatitis A virus** in research laboratory or nonhuman primates with hepatitis A virus infection
  - **Travel in countries with high or intermediate endemic hepatitis A**
  - **Close personal contact with international adoptee** (e.g., household, regular babysitting) in first 60 days after arrival from country with high or intermediate endemic hepatitis A (administer dose 1 as soon as adoption is planned, at least 2 weeks before adoptee's arrival)

Hepatitis B vaccination

Routine vaccination

- **Not at risk but want protection from hepatitis B** (identification of risk factor not required): 2- or 3-dose series HepB (2-dose series Heplisav-B at least 4 weeks apart [2-dose series HepB only applies when 2 doses of Heplisav-B are used at least 4 weeks apart] or 3-dose series Engerix-B or Recombivax HB at 0, 1, 6 months [minimum intervals: 4 weeks between doses 1 and 2, 8 weeks between doses 2 and 3, 16 weeks between doses 1 and 3]) or 3-dose series HepA-HepB (Twinrix at 0, 1, 6 months [minimum intervals: 4 weeks between doses 1 and 2, 5 months between doses 2 and 3])

Special situations

- **At risk for hepatitis B virus infection**: 2-dose (Heplisav-B) or 3-dose (Engerix-B, Recombivax HB) series HepB, or 3-dose series HepA-HepB as above
  - **Hepatitis C virus infection**
  - **Chronic liver disease** (e.g., cirrhosis, fatty liver disease, alcoholic liver disease, autoimmune hepatitis, alanine aminotransferase [ALT] or aspartate aminotransferase [AST] level greater than twice upper limit of normal)
  - **HIV infection**
  - **Sexual exposure risk** (e.g., sex partners of hepatitis B surface antigen (HBsAg)-positive persons; sexually active persons not in mutually monogamous relationships, persons seeking evaluation or treatment for a sexually transmitted infection, men who have sex with men)
  - **Current or recent injection drug use**
  - **Percutaneous or mucosal risk for exposure to blood** (e.g., household contacts of HBsAg-positive persons; residents and staff of facilities for developmentally disabled persons; health care and public safety personnel with reasonably anticipated risk for exposure to blood or blood-contaminated body fluids; hemodialysis, peritoneal dialysis, home dialysis, and predialysis patients; persons with diabetes mellitus age younger than 60 years and, at discretion of treating clinician, those age 60 years or older)
  - **Incarcerated persons**
  - **Travel in countries with high or intermediate endemic hepatitis B**

Human papillomavirus vaccination

Routine vaccination

- **Females through age 26 years and males through age 21 years:** 2- or 3-dose series HPV vaccine depending on age at initial vaccination; males age 22 through 26 years may be vaccinated based on individual clinical decision (HPV vaccination routinely recommended at age 11–12 years)
- **Age 15 years or older at initial vaccination**: 3-dose series HPV vaccine at 0, 1–2, 6 months (minimum intervals: 4 weeks between doses 1 and 2, 12 weeks between doses 2 and 3, 5 months between doses 1 and 3; repeat dose if administered too soon)
- **Age 9 through 14 years at initial vaccination and received 1 dose, or 2 doses less than 5 months apart**: 1 dose HPV vaccine
- **Age 9 through 14 years at initial vaccination and received 2 doses at least 5 months apart**: HPV vaccination complete, no additional dose needed
- If completed valid vaccination series with any HPV vaccine, no additional doses needed

Special situations

- **Immunocompromising conditions (including HIV infection) through age 26 years**: 3-dose series HPV vaccine at 0, 1–2, 6 months as above
- **Men who have sex with men and transgender persons through age 26 years**: 2- or 3-dose series HPV vaccine depending on age at initial vaccination as above
- **Pregnancy through age 26 years**: HPV vaccination not recommended until after pregnancy; no intervention needed if vaccinated while pregnant; pregnancy testing not needed before vaccination

Adult Vaccination Tools

- Adult Vaccine Quiz
  https://www2.cdc.gov/nip/adultimmsched/
- CDC Vaccine Schedules App
  https://www.cdc.gov/vaccines/schedules/hcp/schedule-app.html

Updates in Influenza Vaccination

Influenza Vaccine Composition 2019–2020

- Trivalent vaccine
  - A/Brisbane/02/2018 A(H1N1)pdm09-like virus
  - A/Kansas/14/2017 (H3N2)-like virus
  - B/Colorado/06/2017-like (Victoria lineage) virus
- Quadrivalent vaccine
  - Trivalent vaccine viruses
  - B/Phuket/3073/2013-like (Yamagata lineage) virus

Recommended composition of influenza virus vaccines for use in the 2019-2020 northern hemisphere influenza season. WHO Global Influenza Surveillance and Response System (GISRS), February 21, 2019 (updated March 21, 2019)

Live Attenuated Influenza Vaccine

- ACIP recommended LAIV not be used in 2016–2017 and 2017–2018
  - LAIV poorly effective against A(H1N1)pdm09-like viruses, significant less effective than IIV among children 2–17 years (but effective against B and A(H3N2))
- LAIV study results
  - New H1N1pdm09-like virus (A/Slovenia/2903/2015) has improved replicative fitness than previous H1N1pdm09-like virus (A/Bolivia/559/2013) in children 24 months to <4 years
  - New LAIV candidate vaccine virus evaluation technique by manufacturer: Replicative fitness on human nasal epithelial cell culture instead of canine kidney cell culture
- For 2018–2019, age-appropriate IIV, RIV, or LAIV can be used
  - "Providers may choose to administer any licensed, age-appropriate influenza vaccine (IIV, RIV, or LAIV). LAIV is an option for those for whom it is otherwise appropriate. No preference is expressed for any influenza vaccine product. Providers should be aware that the effectiveness of the updated LAIV… is not yet known"

Grohskopf et al. MMWR 2018;67(22)

the burden of flu disease 2017 - 2018

2010-11 through 2016-17

The estimated number of flu **illnesses** during the 2017-2018 season:

49 million

9 million–34 million

More than the combined populations of Texas, and Florida

The estimated number of flu **hospitalizations** during the 2017-2018 season:

960,000

140,000–590,000

More than the number of staffed hospital beds in the U.S.

>75% adults

The estimated number of flu **deaths** during the 2017-2018 season:

79,000

12,000–51,000

More than the average number of people who attend the Super Bowl each year

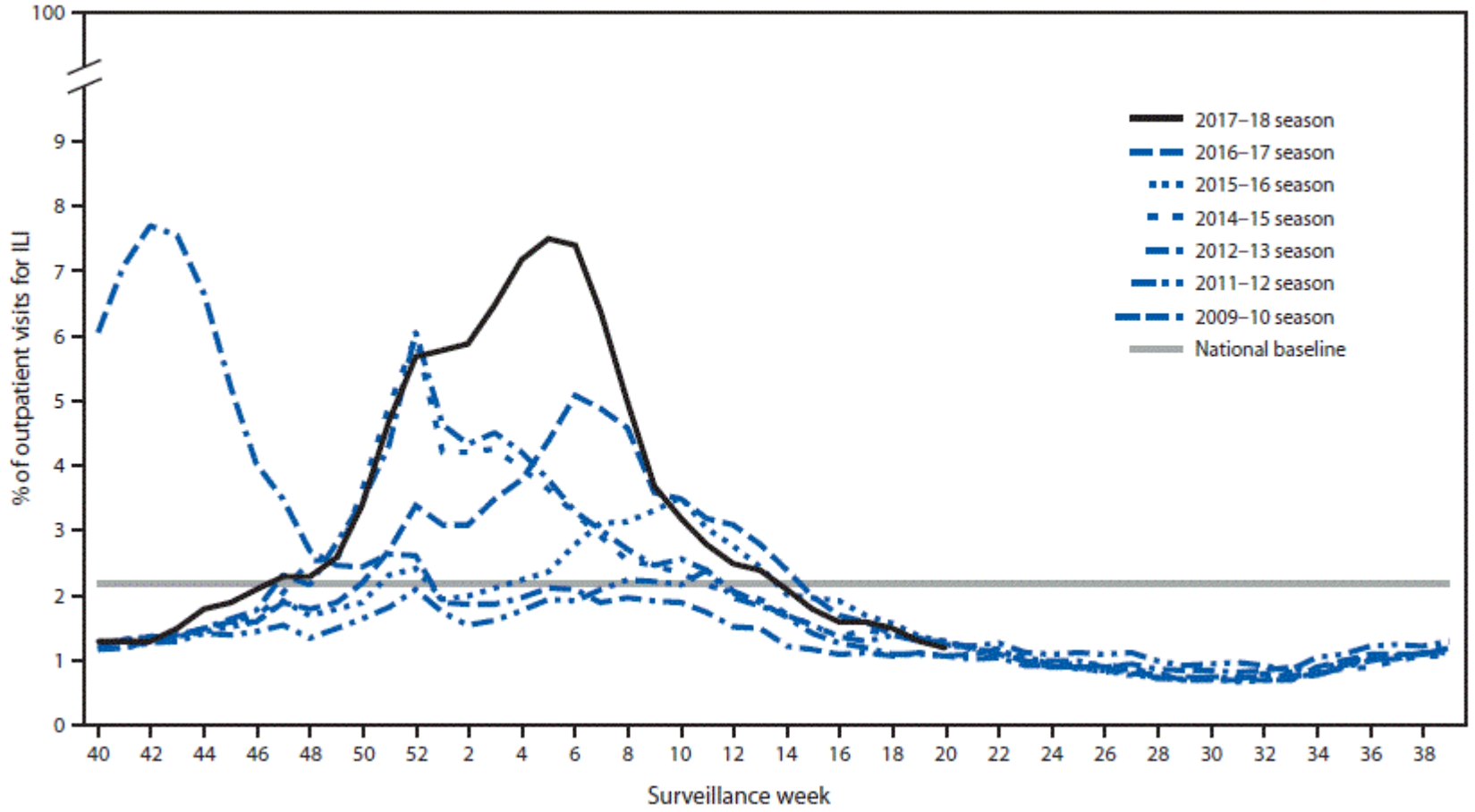
>90% adults ≥65y

DATA: Influenza Division program impact report 2017-2018, https://www.cdc.gov/flu/about/burden/index.html

CDC

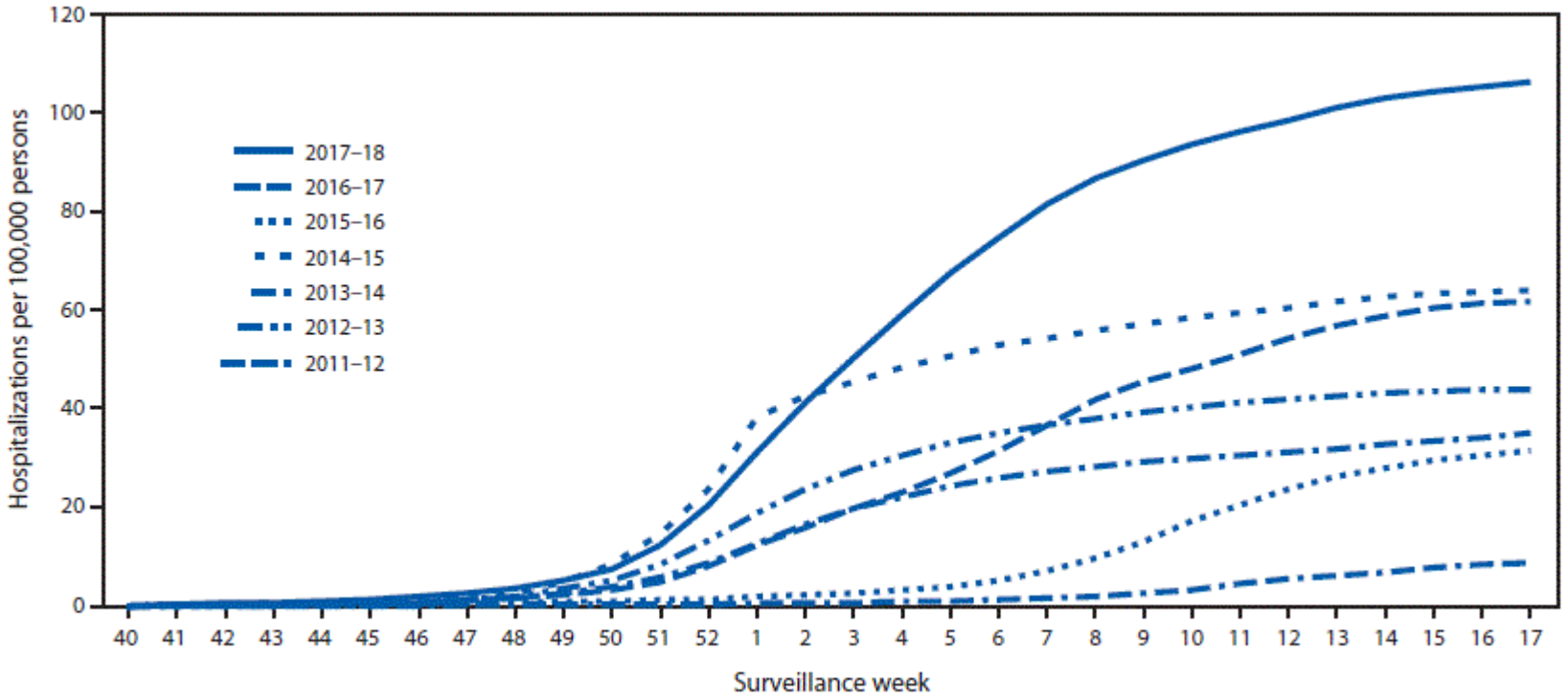
get vaccinated
www.cdc.gov/flu

Percentage of outpatient visits for influenza-like illness (ILI)* reported to CDC, by surveillance week—U.S. Outpatient Influenza-Like Illness Surveillance Network (ILINET), national summary, United States, 2017–2018† influenza season and selected previous influenza seasons



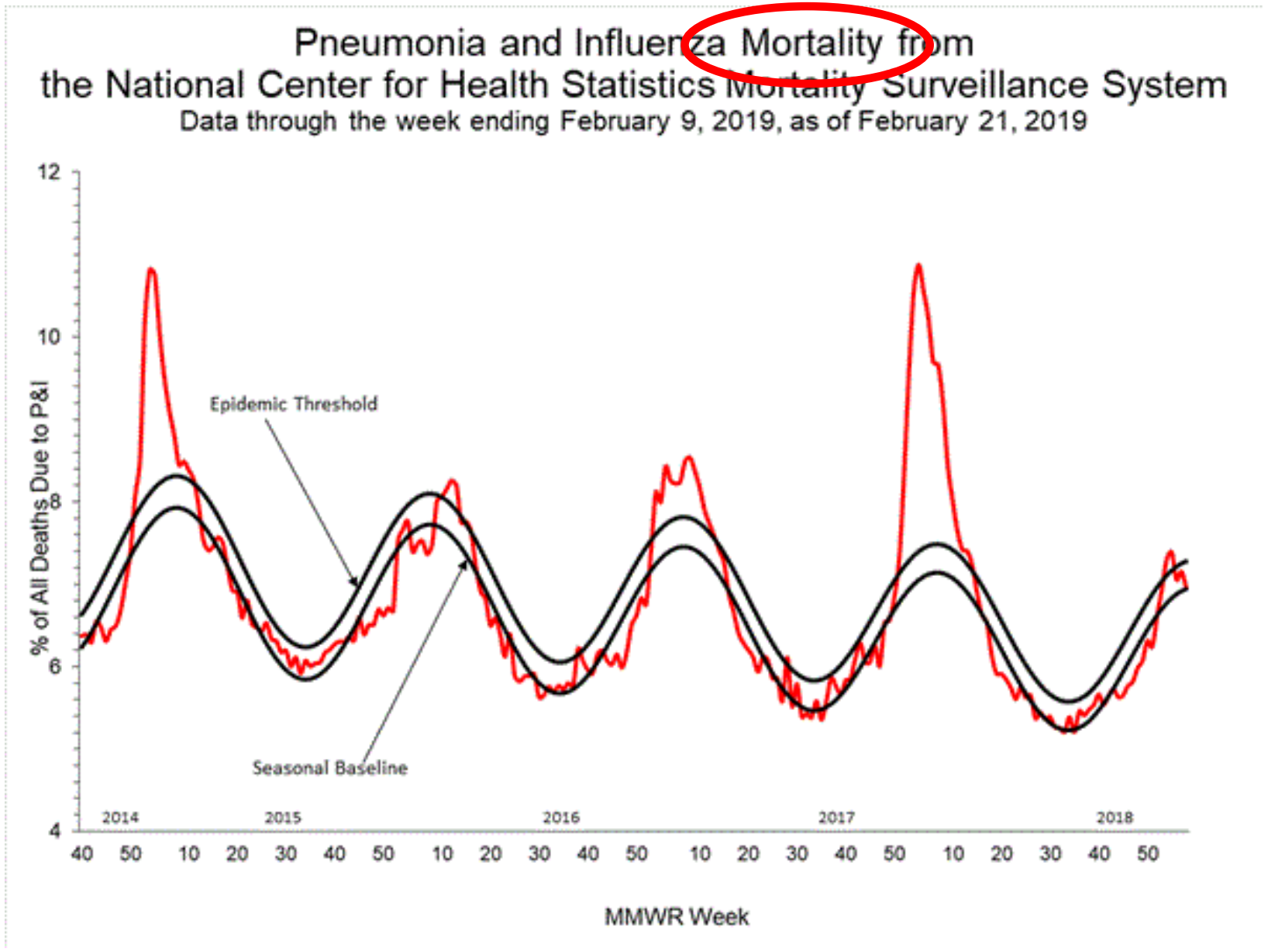
*Defined as fever (temperature of ≥100°F [≥37.8°C], oral or equivalent) and cough or sore throat, without a known cause other than influenza.
†As of June 1, 2018.

Cumulative rates of hospitalizations for laboratory-confirmed influenza by season and surveillance week—FluSurv-NET*, United States, 2011–2012 through 2017–2018 influenza seasons†



*FluSurv-NET conducts population-based surveillance for laboratory-confirmed influenza-associated hospitalizations in children aged <18 years (since the 2003–04 influenza season) and adults aged ≥18 years (since the 2005–06 influenza season). FluSurv-NET covers over 70 counties in the 10 Emerging Infections Program states (California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon, and Tennessee) and three additional Influenza Hospitalization Surveillance Project states (Michigan, Ohio, and Utah).

†As of June 1, 2018.



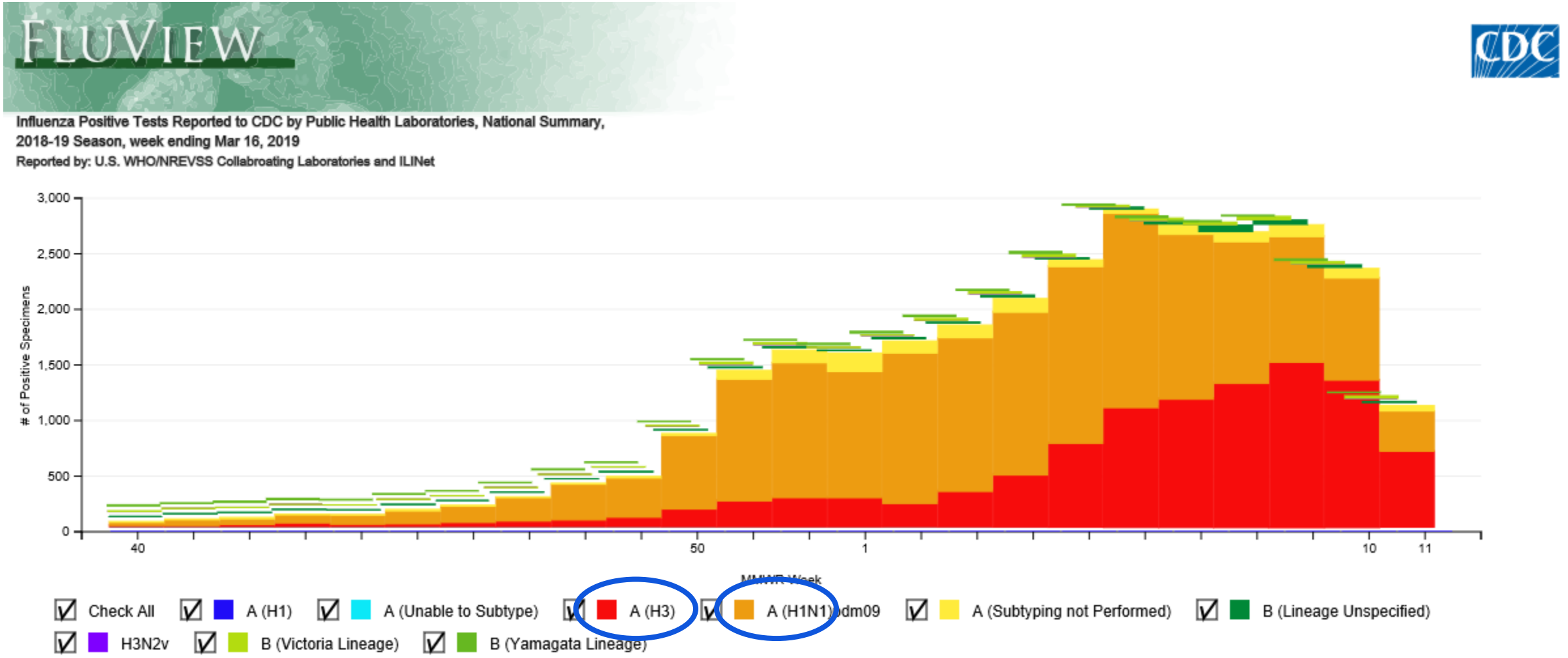
Based on National Center for Health Statistics (NCHS) mortality surveillance data

Influenza Season Severity Classifications, by Season and Age Group, 2003–2004 to 2017–2018 Influenza Seasons

Season	Children (0–17y)	Adults (18–64y)	Older Adults (≥65y)	Overall
2003-2004	Very High	Moderate	High	High
2004-2005	Low	Moderate	Moderate	Moderate
2005-2006	Low	Low	Low	Low
2006-2007	Low	Low	Low	Low
2007-2008	Moderate	Moderate	Moderate	Moderate
2008-2009	Low	Low	Low	Low
2009-2010	Very High	Moderate	Low	Moderate
2010-2011	Moderate	Moderate	Moderate	Moderate
2011-2012	Low	Low	Low	Low
2012-2013	Moderate	Moderate	High	Moderate
2013-2014	Moderate	Moderate	Moderate	Moderate
2014-2015	Moderate	Moderate	High	High
2015-2016	Low	Moderate	Low	Moderate
2016-2017	Moderate	Moderate	Moderate	Moderate
2017-2018	High	High	High	High

www.cdc.gov/flu/professionals/classifies-flu-severity.htm

Influenza positive tests through March 16, 2018–2019 season



https://gis.cdc.gov/grasp/fluview/fluportaldashboard.html

Influenza Vaccine Effectiveness

- Effectiveness of seasonal influenza vaccine for preventing medically attended, laboratory-confirmed influenza virus infection
- Varies by season, age, risk groups, match between vaccine viruses and circulating viruses

Influenza	Interim 2018–2019 (Nov 23–Feb 2)	2017–2018
Overall	47	36
A(H3N2)	44	25
A(H1N1)	46	67
B	---	42

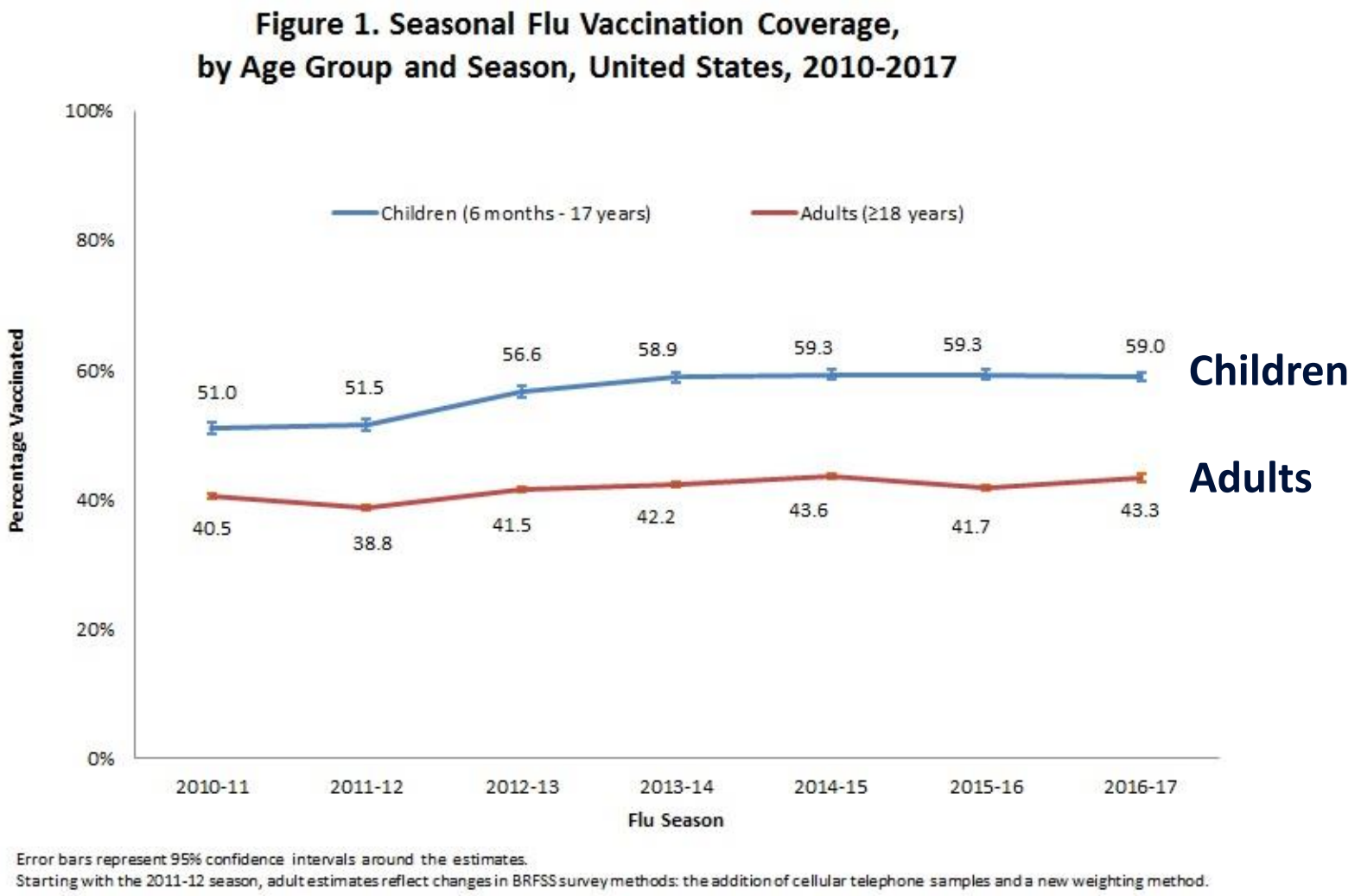
Doyle et al. MMWR 2019:68(6)
Flannery et al. MMWR 2018:67(6)

Ho-hum influenza vaccine effectiveness?

- Consider, even with VE <20% (2014–2015)
  - 11,000–144,000 influenza-associated hospitalizations prevented
  - 300–4,000 influenza-associated deaths prevented
- Also consider
  - 50–60% effective in preventing hospitalizations among elderly
  - 65% effective in preventing deaths among elderly

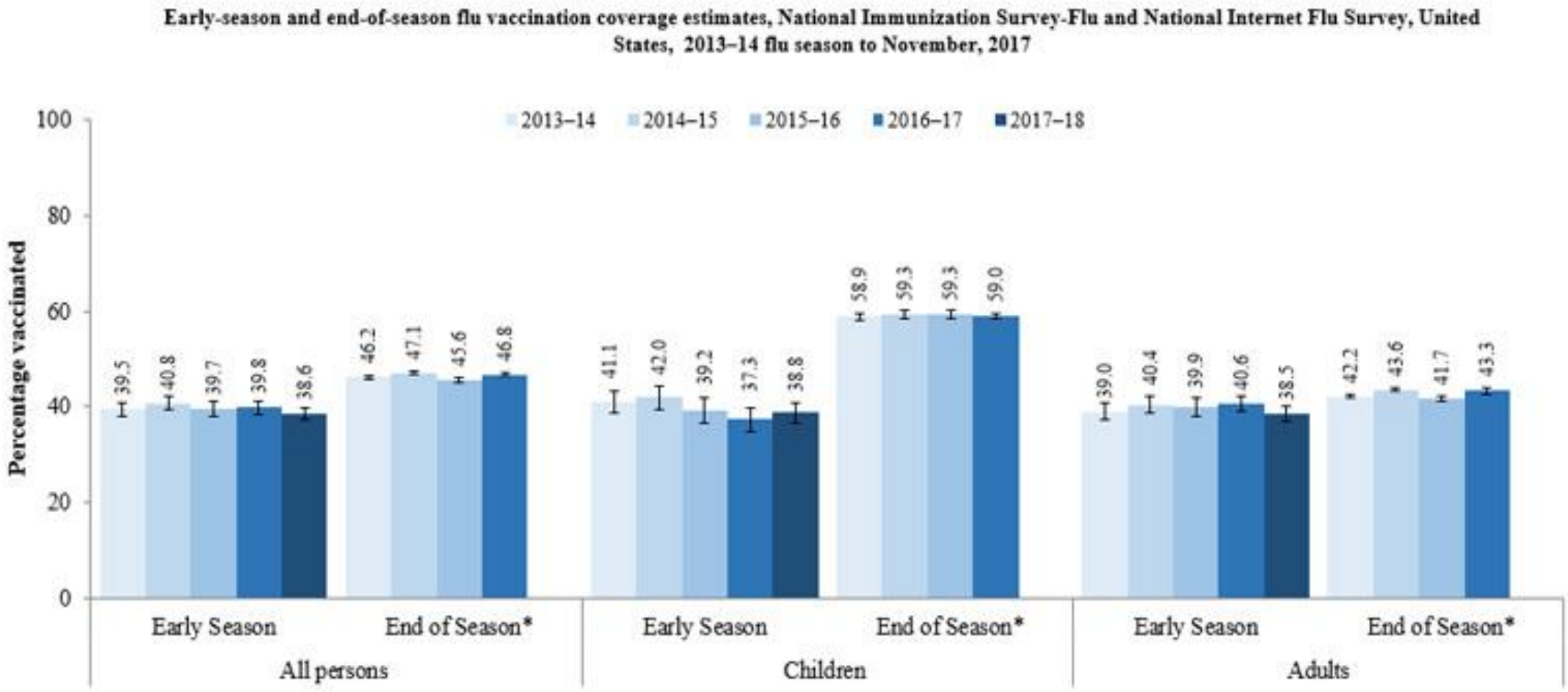
Estimated Influenza Illnesses and Hospitalizations Averted by Vaccination — United States, 2014–15 Influenza Season, www.cdc.gov/flu/about/disease/2014-15.htm

Influenza Vaccination Coverage Trend, 2010–2017



www.cdc.gov/flu/fluvaxview/coverage-1617estimates.htm

Early Season Influenza Vaccination Coverage, 2013–2018



FluVaxView. www.cdc.gov/flu/fluvaxview/nifs-estimates-nov2017.htm

Figure 5. Place of Flu Vaccination for Children and Adults Among Those Vaccinated Early, 2018–19

* "Pharmacy/Store" includes pharmacies or drugstores and local supermarkets or grocery stores.

† "Other Place" includes military-related places, other schools such as trade schools, residences, and other unspecified nonmedical places.

‡ Percentages may not add to 100 due to rounding.

NIS-Flu July–mid-November, 2018

Influenza and Heart Disease

- Acute respiratory illness or influenza-like illness increases acute MI risk 2x[1]
- Influenza vaccination effectiveness: Meta-analyses of studies on people with existing CVD
  - Case control studies: 29% (95%CI 9,44) against acute MI[1]
  - Randomized studies: 36% (95%CI 14,53) against major cardiac events[2]
- Recommended by American College of Cardiology and American Heart Association
  - Comparable preventive measure as:
    statins (36%), anti-hypertensives (15–18%), smoking cessation (26%)
- Association between MI and influenza[3]
  - Influenza A (IR 5.2; 95%CI 3.0,8.4)
  - Influenza B (IR 10.1; 95%CI 4.4,23.4)

1. Barnes et al. Heart 2015;101:1738–1747
2. Udell et al. JAMA 2013;310:1711–1720
3. Kwong et al. NEJM 2018;378:345–353

Vaccine Reduces Hospitalizations in Pregnant Women

- Multi-country (U.S., Canada, Australia, Israel) retrospective, test negative study review of medical records of 2 million pregnant women over 6 seasons 2010–2016[1]
- Reduced risk of hospitalization by 40%
  - Protective when underlying medical conditions (e.g., asthma, diabetes)
  - Protective in all three trimesters
- 80% pregnancies overlapped with flu season (likely exposed to flu during pregnancy)

Thompson et al. CID 2018. https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciy737/5126390

Wyatt

- 40yo cocaine smuggler
- Counterculture lifestyle –
  “free love, communes, brothels”
- Smoker, uses marijuana, LSD

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				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

- ✓ Flu
- ✓ Tdap/Td
- ✓ MMR
- ✓ VAR

Table 2 Recommended Adult Immunization Schedule by Medical Condition and Other Indications United States, 2019

Vaccine	Pregnancy	Immuno-compromised (excluding HIV infection)	HIV infection CD4 count <200	HIV infection CD4 count ≥200	Asplenia, complement deficiencies	End-stage renal disease, on hemodialysis	Heart or lung disease, alcoholism[1]	Chronic liver disease	Diabetes	Health care personnel[2]	Men who have sex with men
IIV or RIV	1 dose annually										
or										or	
LAIV	CONTRAINDICATED						PRECAUTION			1 dose annually	
Tdap or Td	1 dose Tdap each pregnancy	1 dose Tdap, then Td booster every 10 yrs									
MMR	CONTRAINDICATED	1 or 2 doses depending on indication									
VAR	CONTRAINDICATED	2 doses									
RZV *(preferred)*	DELAY				2 doses at age ≥50 yrs						
or					or						
ZVL	CONTRAINDICATED				1 dose at age ≥60 yrs						
HPV Female	DELAY	3 doses through age 26 yrs			2 or 3 doses through age 26 yrs						
HPV Male		3 doses through age 26 yrs			2 or 3 doses through age 21 yrs						2 or 3 doses through age 26 yrs
PCV13		1 dose									
PPSV23		1, 2, or 3 doses depending on age and indication									
HepA	2 or 3 doses depending on vaccine										
HepB	2 or 3 doses depending on vaccine										
MenACWY	1 or 2 doses depending on indication, then booster every 5 yrs if risk remains										
MenB	PRECAUTION	2 or 3 doses depending on vaccine and indication									
Hib		3 doses HSCT[3] recipients only			1 dose						

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

Precaution—vaccine might be indicated if benefit of protection outweighs risk of adverse reaction

Delay vaccination until after pregnancy if vaccine is indicated

Contraindicated—vaccine should not be administered because of risk for serious adverse reaction

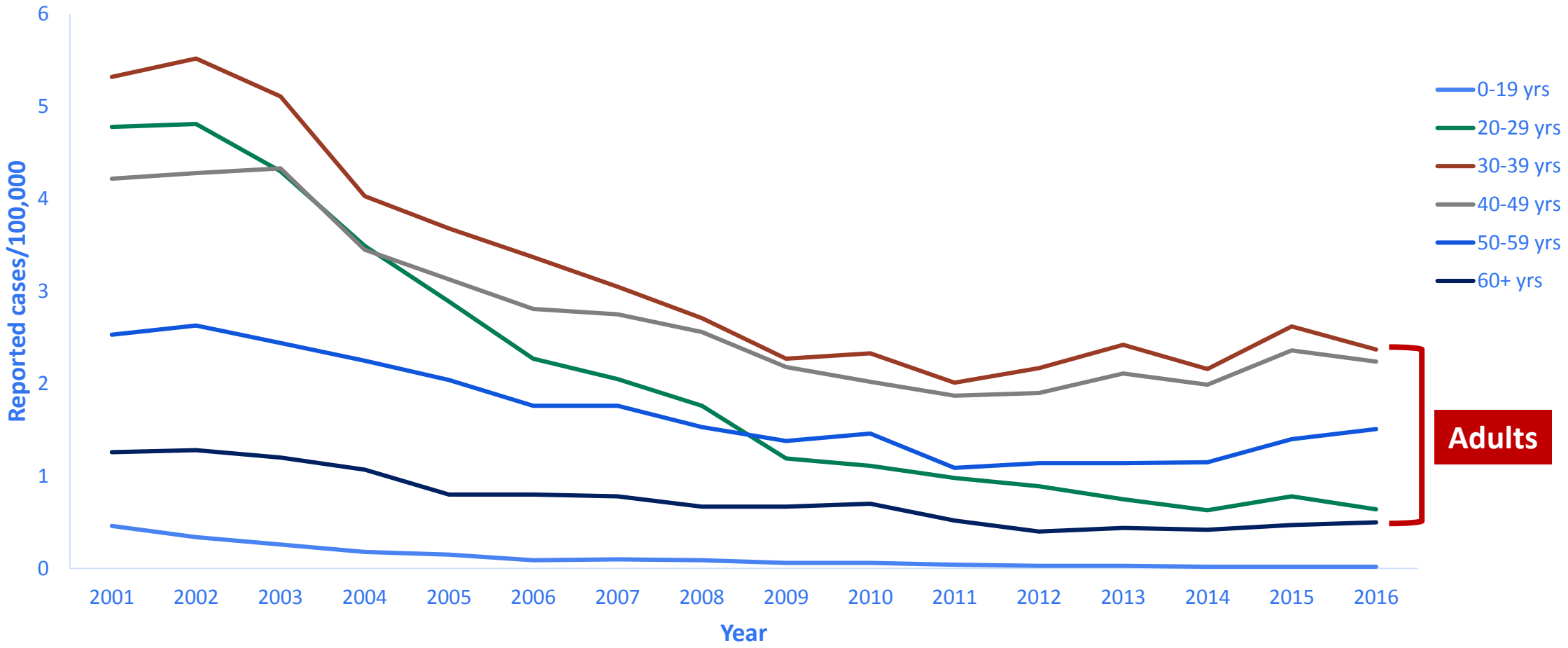
No recommendation

1. Precaution for LAIV does not apply to alcoholism. **2.** See notes for influenza; hepatitis B; measles, mumps, and rubella; and varicella vaccinations. **3.** Hematopoietic stem cell transplant.

- ✓ Flu
- ✓ Tdap/Td
- ✓ MMR
- ✓ VAR
- ✓ HepB
  - drug use
  - sexual exp
- ✓ HepA
  - drug use

Updates in Hepatitis B Vaccination

Incidence of acute hepatitis B by age group, United States, 2001–2016



National Notifiable Disease Surveillance System

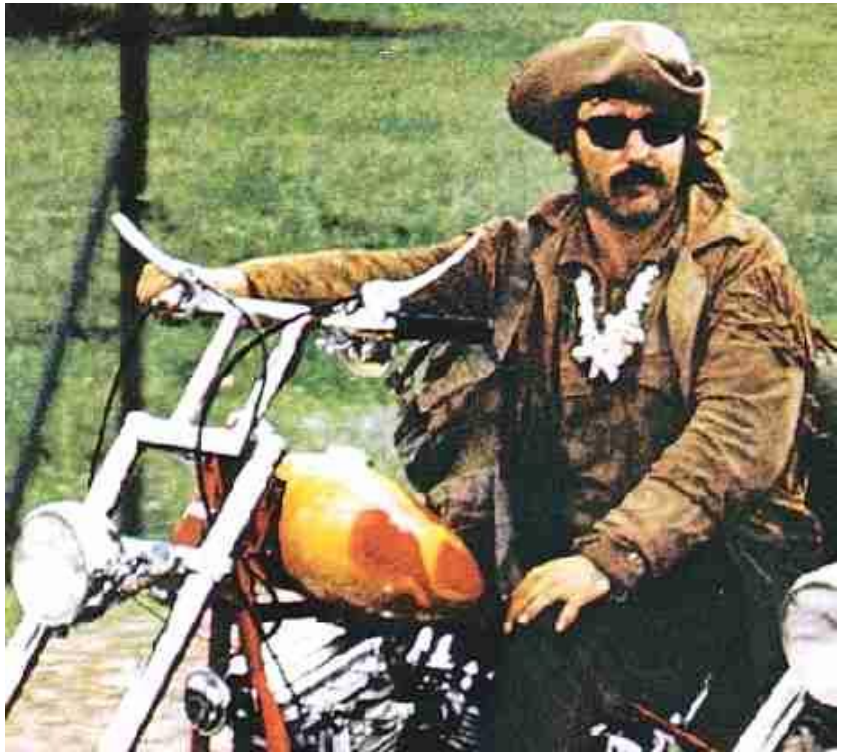
Hepatitis B Vaccination

- Routine
  - Universal vaccination of infants
  - Catch-up vaccination of children and adolescents
  - At risk adults and adults who want protection (risk factor not required for vaccination)
- Updates – Heplisav-B
  - FDA-approved for ≥18y in Nov 2017
  - Single-antigen hepatitis B vaccine for all HBV subtypes
  - 2-dose series 1 month apart Contains yeast-derived recombinant HBsAg with 1018 adjuvant (Toll-like Receptor 9 molecule of cytosine and guanine DNA moieties connected by phosphorous compound)
  - No preferential recommendation for use of Heplisav-B over other HepB
  - Heplisav-B may be used as substitute in 3- or 4-dose HepB series

Schillie et al. MMWR 2018:67(15)
HEPLISAV-B™ [Hepatitis B Vaccine (Recombinant), Adjuvanted] package insert www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM584762.pdf

Billy

- 42yo with similar social history as Wyatt
- Has alcoholic liver disease



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Varicella (VAR)	2 doses (if born in 1980 or later)				
Zoster recombinant (RZV) *(preferred)*				2 doses	
or				or	
Zoster live (ZVL)				1 dose	
Human papillomavirus (HPV) **Female**	2 or 3 doses depending on age at initial vaccination				
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Meningococcal A, C, W, Y (MenACWY)	1 or 2 doses depending on indication, then booster every 5 yrs if risk remains				
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***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

- ✓ Flu
- ✓ Tdap/Td
- ✓ MMR
- ✓ VAR

Table 2 Recommended Adult Immunization Schedule by Medical Condition and Other Indications United States, 2019

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	CONTRAINDICATED						PRECAUTION				
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RZV (preferred) or ZVL	DELAY	2 doses at age ≥50 yrs or 1 dose at age ≥60 yrs									
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No recommendation

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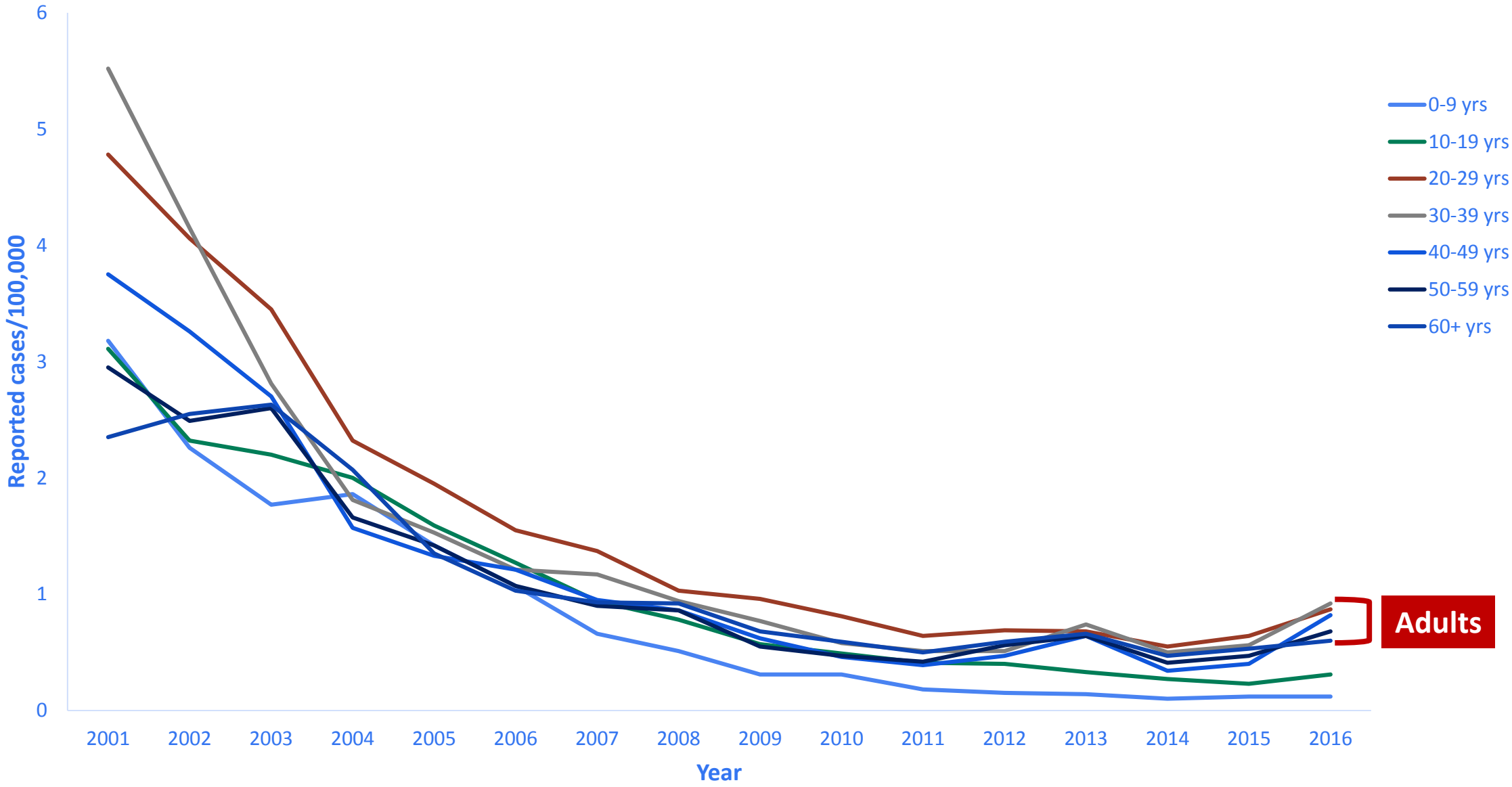
Updates in Hepatitis A Vaccination

Incidence of hepatitis A by age group, United States, 2001–2016



Hepatitis A Vaccination

- At risk for hepatitis A
  - Chronic liver disease
  - Clotting factor disorders
  - Men who have sex with men
  - Injection or non-injection drug use
  - Homelessness (updated in MMWR Feb 15, 2019)
  - Work with hepatitis A virus in research laboratory or nonhuman primates with hepatitis A virus infection
  - Travel in countries with high or intermediate endemic hepatitis A
  - Close personal contact with international adoptee (e.g., household, regular babysitting) in first 60 days after arrival from country with high or intermediate endemic hepatitis A
- Not at risk but want protection from hepatitis A

Fiore et al. MMWR May 2006:55(RR-07)
CDC. MMWR September 2009:58(36)
Doshani et al. MMWR 2019;68(6)

Hepatitis A – Multistate Outbreaks

- >7000 outbreak-associated cases in 2018, ongoing
- Widespread – AR, CA, IN, KY, MA, MI, MO, OH, TN, UT, WV, others
- Primarily among persons who use drugs, homeless, close contacts
- Since 2006, all children recommended to receive HepA, but most adults not routinely vaccinated as children

San Diego

Nashville

Detroit

www.cdc.gov/hepatitis/outbreaks/2017March-HepatitisA.htm

Homelessness

A homeless individual is defined in section 330(h)(5)(A) as “an individual who lacks housing (without regard to whether the individual is a member of a family), including an individual whose primary residence during the night is a supervised public or private facility (e.g., shelters) that provides temporary living accommodations, and an individual who is a resident in transitional housing.” A homeless person is an individual without permanent housing who may live on the streets; stay in a shelter, mission, single room occupancy facilities, abandoned building or vehicle; or in any other unstable or non-permanent situation. [Section 330 of the Public Health Service Act (42 U.S.C., 254b)]

- U.S. Department of Health and Human Services
- National Health Care for the Homeless Council

Homelessness in U.S.

- In 2017, 1.4 million people used emergency shelter or transitional housing (not including unsheltered)
- Estimated 2mil–3.5mil persons experience homelessness each year, persons of color disproportionately affected
- Per night, estimated 500,000 persons experience homelessness, 35% in unsheltered locations
- Persons experiencing homelessness 1–11x risk of mortality compared to general population
- 2–3x increased risk of HAV infection, 2–3x increased severe outcomes

U.S. Department of Housing and Urban Development. 2017 annual homeless assessment report
Koh HK. JAMA 2016
Gambatese M. Am J Public Health 2013
Doshani et al. MMWR 2019;68(6)

Hepatitis A Vaccination Update – Routine Vaccination for Homelessness

- Routine HepA series for persons age ≥1y who experience homelessness
- Substantial benefit to vaccination
  - Cost/risk vaccinating much lower than not vaccinating
  - Fewer hospitalizations, transplantations, deaths
- Reduce risk for large outbreaks
- Clinical assessment needed for hepatitis A virus exposure risk in homelessness

Doshani et al. MMWR 2019;68(6)

Hepatitis A Vaccination Update – PEP

- PEP with HepA or IG is effective when administered within 2 weeks of exposure
  - In 2007, IG more efficacious than HepA in adults >40y, therefore preferred
  - In 2017, study on ↓IG potency prompted recommendation to ↑IG dosage
- Benefits of IG compared to HepA?
  - Uncertain timing between exposure and prophylaxis
  - HepA induces active immunity, longer duration of protection
  - HepA easier to administer, greater availability and acceptability

Recommended PEP for Hepatitis A	
2007	**2019**
• **Age 1–40 – HepA** • **Age >40y – IG, give HepA if IG not available**	• **Age 1–40 – HepA** • **Age >40y – May also receive IG in addition to HepA depending on risk**

Note: Persons with immunocompromising conditions or chronic liver disease should receive IG and HepA. Completing 2-dose series HepA not necessary for PEP; however, for long-term immunity, second dose HepA should be administered ≥6 mos

Nelson et al. MMWR 2018;67(43)

Hoke Colburn

- 63yo former NASCAR driver with hypertension, hypercholesterolemia; smoker PPD for 30y, quit 10y ago
- MI 5y ago, MVA 3 yrs ago, s/p splenectomy

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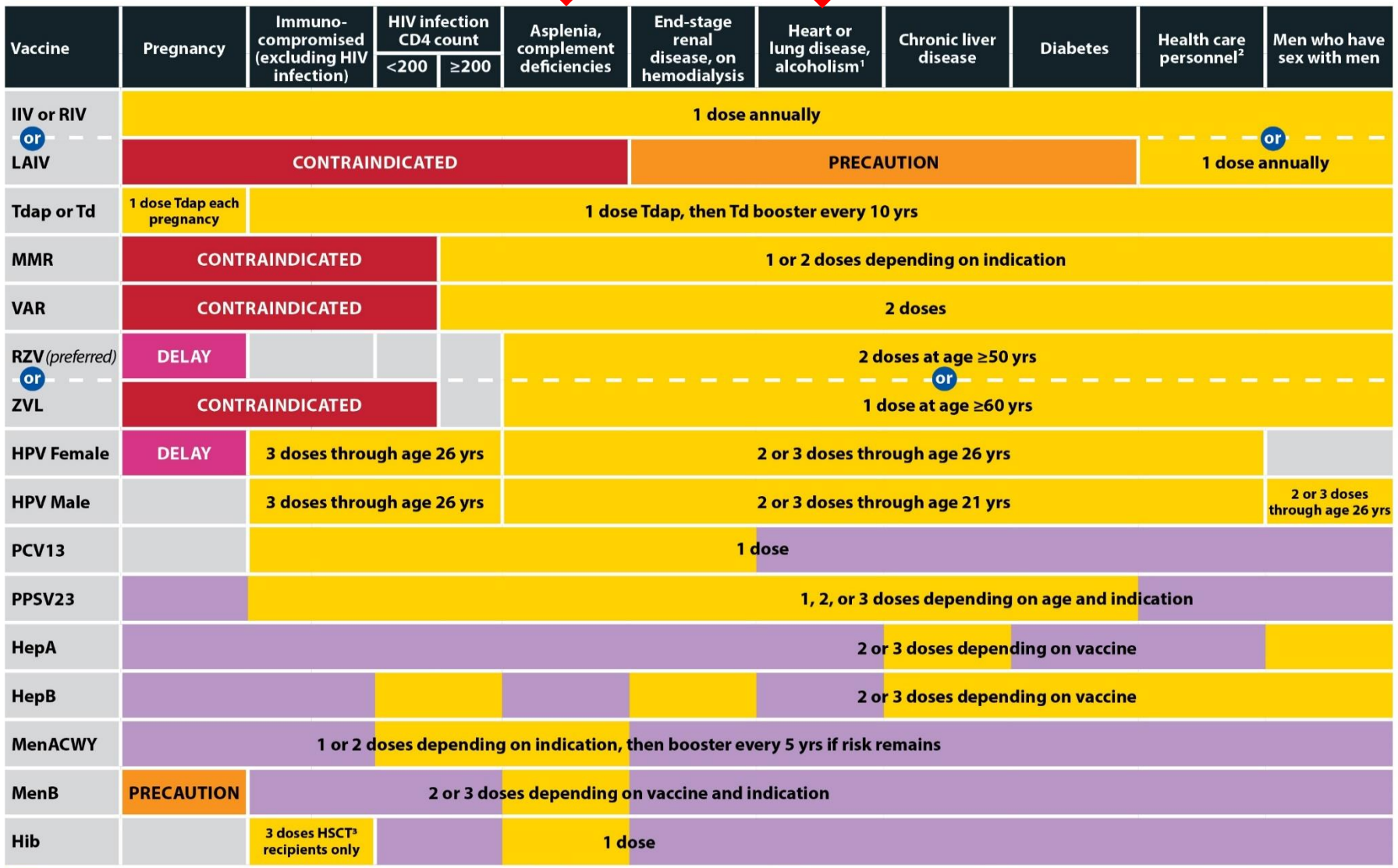
No recommendation

- ✓ Flu
- ✓ Tdap/Td
- ✓ Zoster

Table 2 Recommended Adult Immunization Schedule by Medical Condition and Other Indications United States, 2019



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- ✓ Flu
- ✓ Tdap/Td
- ✓ Zoster
- ✓ Pneumo
- ✓ Mening
- ✓ Hib

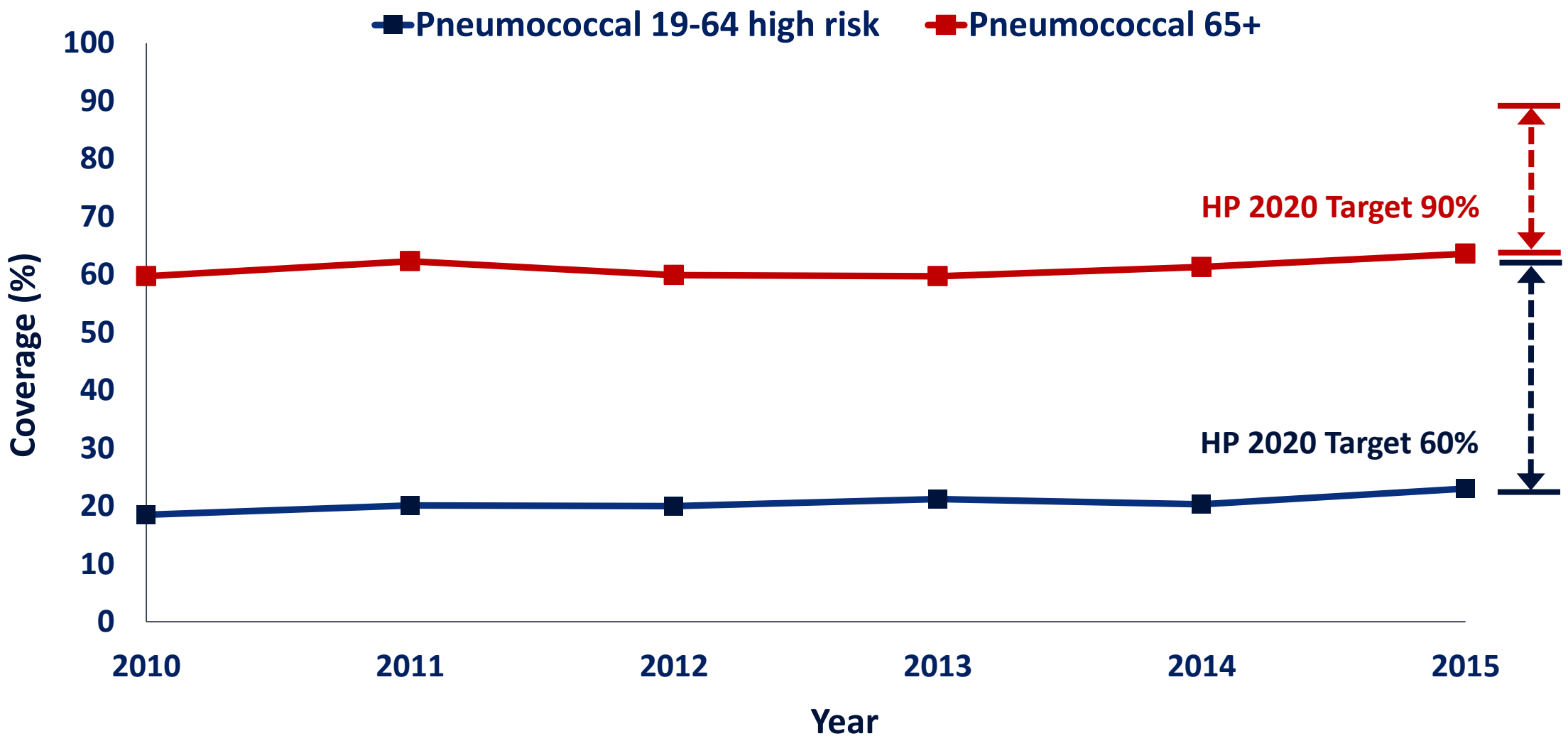
Updates in Pneumococcal Vaccination

Pneumococcal Disease

- *Streptococcus pneumoniae*, causes pneumonia, ear infections, sinus infections, invasive pneumococcal disease (IPD) including meningitis and bacteremia
- >30,000 cases, >3000 deaths reported per year
- 89% cases, almost all deaths occur among adults
- Adults at increased risk for pneumococcal disease
  - Age ≥65y (24 cases IPD per 100,000 in 2016)
  - Age 19–64y with following (8 cases IPD per 100,000 in 2016)
    - Chronic illnesses (heart, liver, kidney, lung disease; diabetes)
    - Alcoholism
    - Weakened immune system (HIV, cancer, asplenia)
    - Cochlear implants, cerebrospinal fluid leak
    - Cigarette smoking

CDC. Active Bacterial Core Surveillance. http://www.cdc.gov/abcs/reports-findings/survreports/spneu13.pdf, https://www.cdc.gov/pneumococcal/surveillance.html

Pneumococcal Vaccination Coverage for Adults, NHIS 2010–2015



Pneumococcal Vaccination Recommendations… Distilled

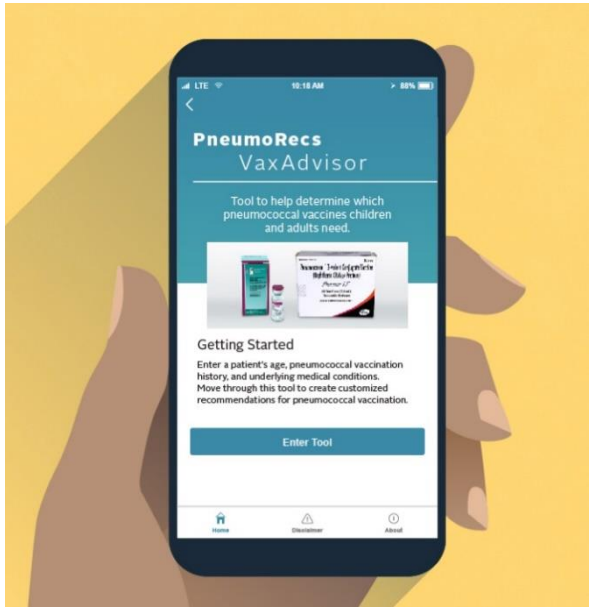
- Age ≥65y (high risk)
  - Give PCV13, then PPSV23 in ≥1 yr
- Immunocompromised (20x risk)
  - Give PCV13, then PPSV23 in ≥8 wks
  - Give second PPSV23 ≥5 yrs after first PPSV23
  - Follow recommendations at age ≥65 as appropriate
- Chronic disease, alcoholism, smoker (3–7x risk)
  - Give PPSV23
  - Follow recommendations at age ≥65 as appropriate

Pneumococcal Vaccination – Updates

- Routine use of PCV13 for adults age ≥65y
  - Recommendation made in 2014 in the setting of decreasing incidence of pneumococcal ds
  - Re-evaluate recommendation in 4 years after accounting for indirect effects
- PCV13-type disease burden significantly reduced
  - Reduction due to indirect effects
  - Small remaining disease burden primarily caused by serotype 3
- In context of indirect effects to date
  - Pneumococcal disease still public health importance
  - But impact uncertain on pneumonia and mortality associated with PCV13-type ds
  - Desirable effects from continued use of PCV13 in ≥65y expected to be small, but still outweigh risks
  - Use of PCV13 in series with PPSV23 in ≥65y probably not efficient allocation of resources

Pneumococcal Vaccination Tools

- Pneumococcal Vaccine Timing for Adults https://www.cdc.gov/vaccines/vpd/pneumo/downloads/pneumo-vaccine-timing.pdf
- PneumoRecs VaxAdvisor Mobile App https://www.cdc.gov/vaccines/vpd/pneumo/hcp/pneumoapp.html



J. Quincy Magoo

- 70yo man generally healthy other than mistaking wife for a hat, severe myopia
- Had very painful shingles 10y ago, received zoster vaccine (“not the new one”) 3y ago

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VAR	CONTRAINDICATED	2 doses									
RZV *(preferred)*	DELAY				2 doses at age ≥50 yrs						
or					or						
ZVL	CONTRAINDICATED				1 dose at age ≥60 yrs						
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Updates in Zoster Vaccination

Zoster Vaccine Effectiveness

- Recombinant Zoster Vaccine (Shingrix)
  - 97% effective among 50yo, 60yo, 70yo (91% effective against PHN ≥50yo)
  - 91% effective among ≥70yo
  - Immunogenicity persisted through 9y post-vaccination
- Zoster Vaccine Live (Zostavax)
  - 51% effectiveness (66% effective against PHN)
  - Among ≥60y, protection wanes within 5y, protection >5y uncertain

- Lal H, et al. NEJM 2015
- Cunningham AL, et al NEJM 2016
- Oxman MN, et al. NEJM 2005
- Dooling et al. MMWR 2018

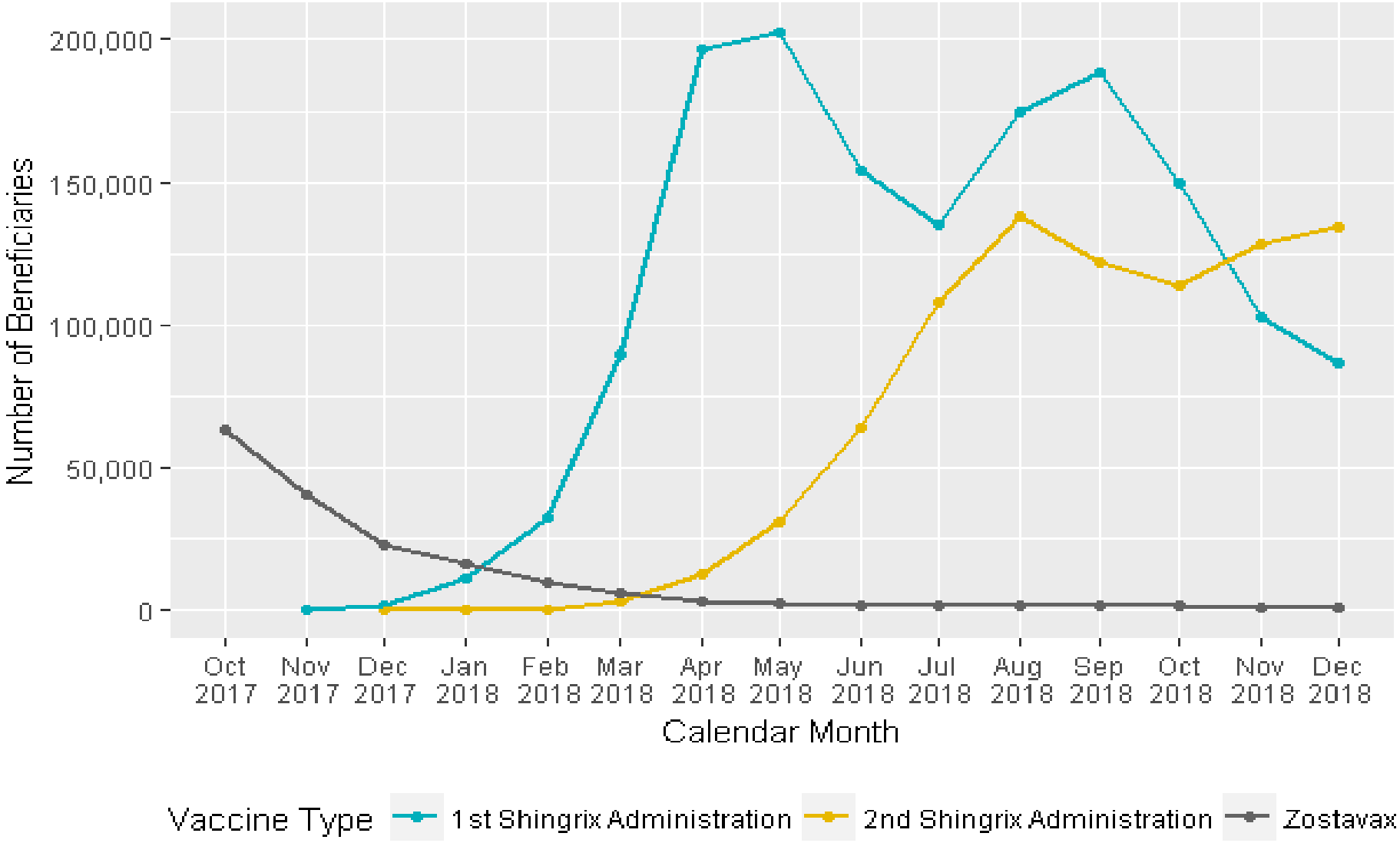
Zoster Vaccination Recommendations

- 2 doses recombinant zoster vaccine (RZV) 2–6 mos apart to adults ≥50y regardless of past herpes zoster or receipt of zoster vaccine live (ZVL)
- 2 doses RZV 2–6 mos apart to adults who previously received ZVL at least 2 mos after ZVL
- For adults ≥60y, either RZV or ZVL (RZV is preferred)

I watched my sister suffer with shingles. That's why I made sure we both got vaccinated.

- Dooling et al. MMWR 2018;67(3):103-108

Zoster vaccination among Medicare beneficiaries, Oct 2017–Dec 2018



Unpublished. Presented at ACIP meeting, February 2019

RZV Availability and Safety Updates

- In 2018, 8.6 million doses distributed, more doses expected in 2019
- RZV shortage due to high demand will continue, providers will continue to experience shipping delays (vaccine manufacturer to continue manage supply by order limits)
- Despite shortage, >75% Medicare beneficiaries completed 2-dose series
- Post-licensure safety monitoring in VAERS consistent with safety profile in pre-licensure clinical trials
- Vaccine Safety Datalink detected statistical signal based on small number of Guillain Barre syndrome, but data (100k doses, 4 GBS cases) insufficient to identify safety issue—safety monitoring to continue

Phoebe Buffay

- 31yo singer/songwriter “Smelly Cat”
- G1P0 in gestation week 33
- Uncomplicated pregnancy

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- ~~✓ ?MMR~~
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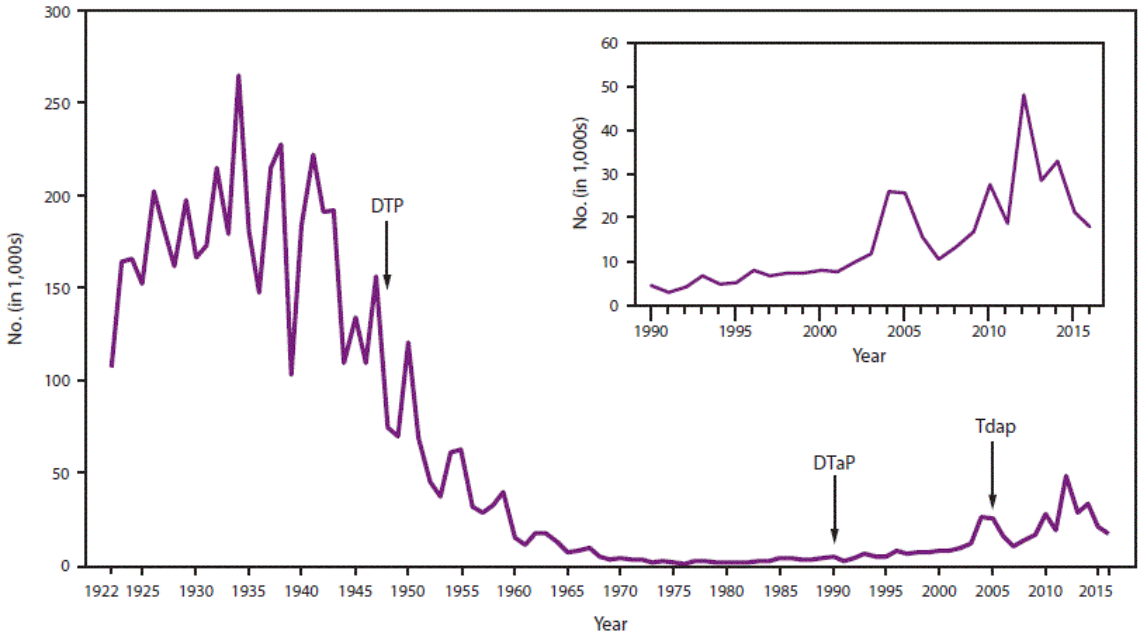
Updates in Tdap Vaccination

Pertussis

- 18,975 cases in 2017 (10,000–50,000 cases per year)
  - 4,080 (21.5%) age 20+ yrs
- Burden among older adults unknown
  - Under-recognized cause of cough illness
  - Atypical clinical presentation in adults
  - Low suspicion by providers
- Increases in pertussis cases
  - Mostly in children
  - Led to Tdap recommendation age 11–12y
  - Adults should get Tdap is did not receive in adolescence

Number of reported pertussis cases — United States, 1922–2016



- https://www.cdc.gov/pertussis/downloads/pertuss-surv-report-2017.pdf
- http://pediatrics.aappublications.org/content/early/2017/03/30/peds.2016-4091
- MMWR 2012;61(25):468–470

Pertussis Vaccination

- Adults, general
  - If previously not vaccinated should get Tdap; then Td booster every 10 years
  - ~70% effective in first year after vaccination, 30–40% 4y post-vaccination
- Pregnant women
  - Direct protection for mom, indirect protection for baby
  - Tdap early in gestation weeks 27–36 for each pregnancy*
  - 88% effectiveness in preventing infant pertussis before first dose DTaP

*ACIP off-label recommendation

MMWR 2018;67(2);1–44
MMWR 2012;61:ND:719–732
MMWR 2013;62(07):131–135

Tdap Vaccination Coverage, Internet Panel Survey, 2018

Characteristic		Coverage
Overall		54.4
Age	18–24	49.0
	25–34	57.9
	35–49	50.6
Race/Ethnicity	White, non-Hispanic	59.3
	Black, non-Hispanic	42.9
	Hispanic	48.8
	Other, non-Hispanic	56.5
Marital status	Married	58.6
	Unmarried	47.4
Education	High school diploma or less	46.2
	Some college	54.5
	College degree	57.8
	More than college degree	59.0
Poverty status	At or above poverty	58.3
	Below poverty	43.7

Kahn et al. MMWR September 2018:67(38)

Steven Urkel

- 17yo nerdy-cool fashionista
- Received first dose of HPV vaccine at age 12 but didn’t complete series

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				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

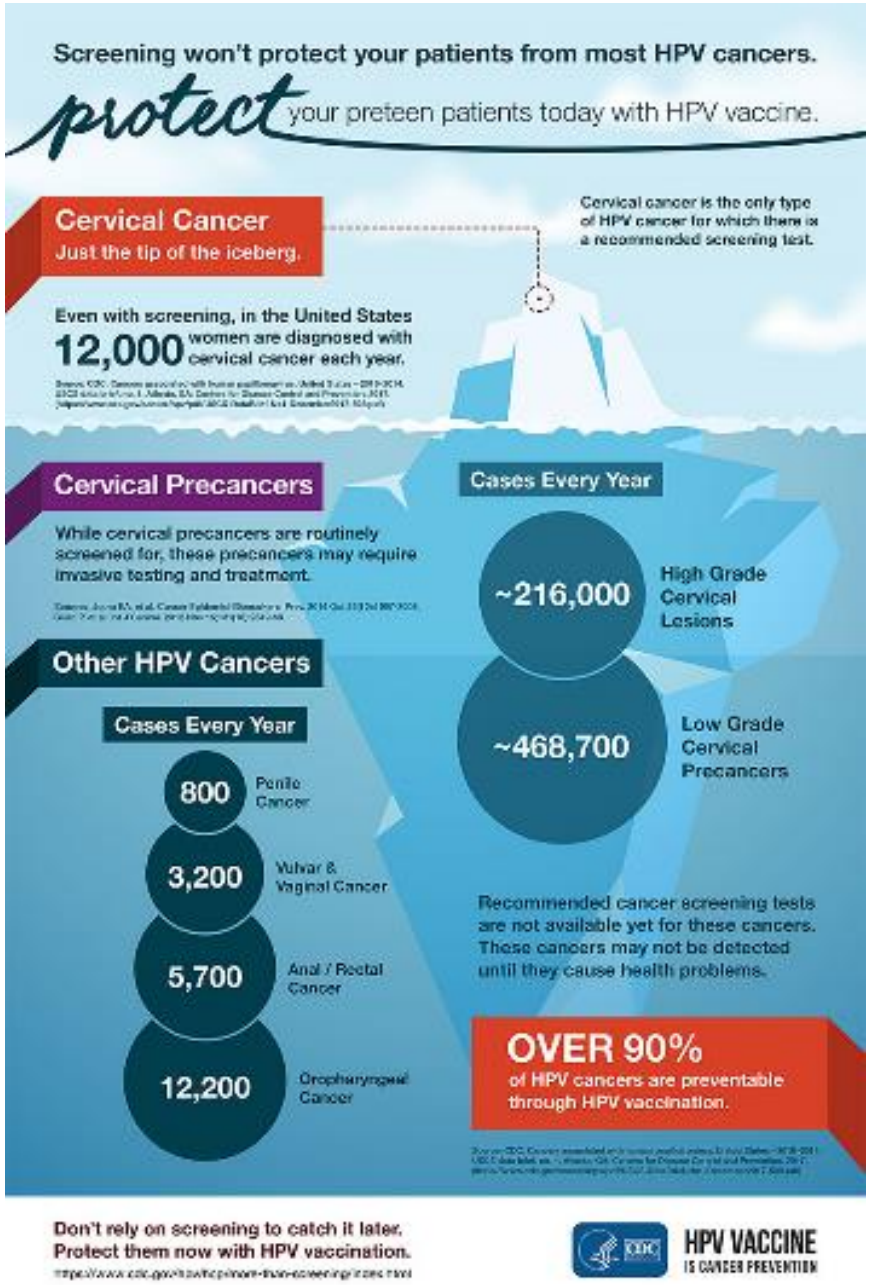
No recommendation

- ✓ Flu
- ✓ Tdap/Td
- ✓ ?MMR
- ✓ ?VAR

Updates in HPV Vaccination

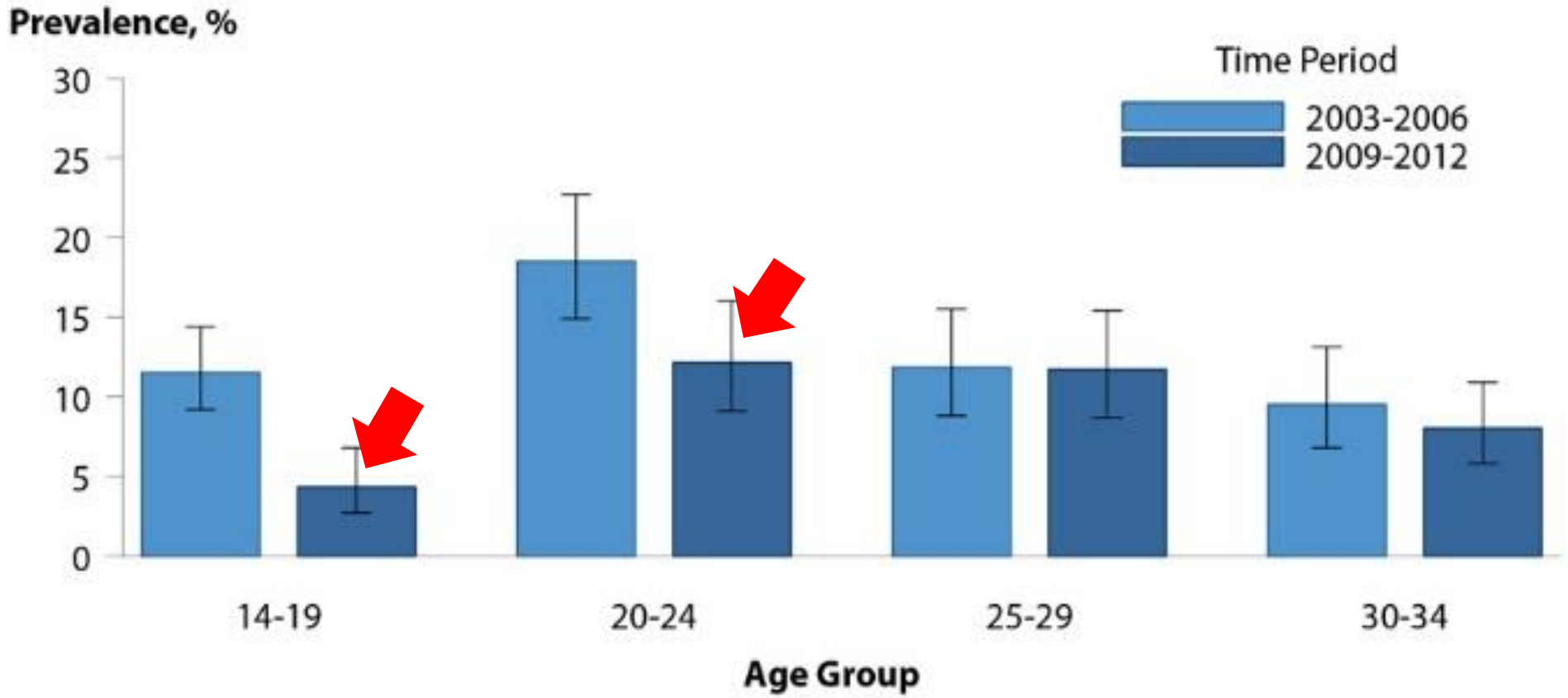
Human Papillomavirus

- ~14 million infected each year
  - Causes 30,700 cancers in women and men each year
- Disease burden among women (per year)
  - Cervical cancers (12,000)
  - High grade cervical lesions (216,000)
  - Low grade cervical pre-cancers (468,700)
- Other cancers (per year)
  - Oropharyngeal (12,200)
  - Anal/rectal (5,700)
  - Vulvar/vaginal (3,200)
  - Penile (800)
- >90% HPV cancers preventable by vaccination



Impact of HPV Vaccination

Human Papillomavirus — Cervicovaginal Prevalence of Types 6, 11, 16 and 18 Among Females Aged 14–34 Years by Age Group and Time Period, National Health and Nutrition Examination Survey (NHANES), 2003–2006 and 2009–2012



Markowitz LE, Liu G, Hariri S, et al. Prevalence of HPV after introduction of the vaccination program in the United States. Pediatrics 2016;137(3):e20151968

HPV Vaccination Recommendations

- Routinely recommended at age 11–12 years
- Females through 26y and males through 21y (males 22–26y may be vaccinated)
  - Age ≥15y at initial vaccination – 3 doses at 0, 1–2, 6 mos
  - Age 9–14y at initial vaccination, received 1 dose – 1 dose
  - Age 9–14y at initial vaccination, received 2 doses – vaccination complete
- Immunocompromised, through 26y
  - 3 doses at 0, 1–2, 6 mos
- MSM and TG through 26y
  - 2 or 3 doses depending on age at initial vaccination

HPV Vaccination – Updates

- Impact of vaccination, cost-effectiveness studies, economic modeling indicate current recommendations have cost-effective profile
- “Mid-adult” (≤30y, ≤45y) vaccination strategy would be much less cost-effective
- Future considerations
  - No change in current recommendations
  - Harmonize upper ages for catch-up vaccination for females and males
  - If older than catch-up age, individual clinical decision through age 45y

Updates in Meningococcal Vaccination

Linda Lee Danvers (Kara Zor-El)

- 19yo Kryptonian but physiologically human
- Freshman at Stanhope College, lives on campus
- Frequently flies internationally

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

- ✓ Flu
- ✓ Tdap/Td
- ✓ MMR
- ✓ VAR
- ✓ HPV

Table 2 Recommended Adult Immunization Schedule by Medical Condition and Other Indications United States, 2019

Vaccine	Pregnancy	Immuno-compromised (excluding HIV infection)	HIV infection CD4 count <200	HIV infection CD4 count ≥200	Asplenia, complement deficiencies	End-stage renal disease, on hemodialysis	Heart or lung disease, alcoholism[1]	Chronic liver disease	Diabetes	Health care personnel[2]	Men who have sex with men
IIV or RIV	1 dose annually										
or										or	
LAIV	CONTRAINDICATED						PRECAUTION			1 dose annually	
Tdap or Td	1 dose Tdap each pregnancy	1 dose Tdap, then Td booster every 10 yrs									
MMR	CONTRAINDICATED	1 or 2 doses depending on indication									
VAR	CONTRAINDICATED	2 doses									
RZV *(preferred)*	DELAY				2 doses at age ≥50 yrs						
or					or						
ZVL	CONTRAINDICATED				1 dose at age ≥60 yrs						
HPV Female	DELAY	3 doses through age 26 yrs			2 or 3 doses through age 26 yrs						
HPV Male		3 doses through age 26 yrs			2 or 3 doses through age 21 yrs						2 or 3 doses through age 26 yrs
PCV13		1 dose									
PPSV23		1, 2, or 3 doses depending on age and indication									
HepA	2 or 3 doses depending on vaccine										
HepB	2 or 3 doses depending on vaccine										
MenACWY	1 or 2 doses depending on indication, then booster every 5 yrs if risk remains										
MenB	PRECAUTION	2 or 3 doses depending on vaccine and indication									
Hib		3 doses HSCT[3] recipients only			1 dose						

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

Precaution—vaccine might be indicated if benefit of protection outweighs risk of adverse reaction

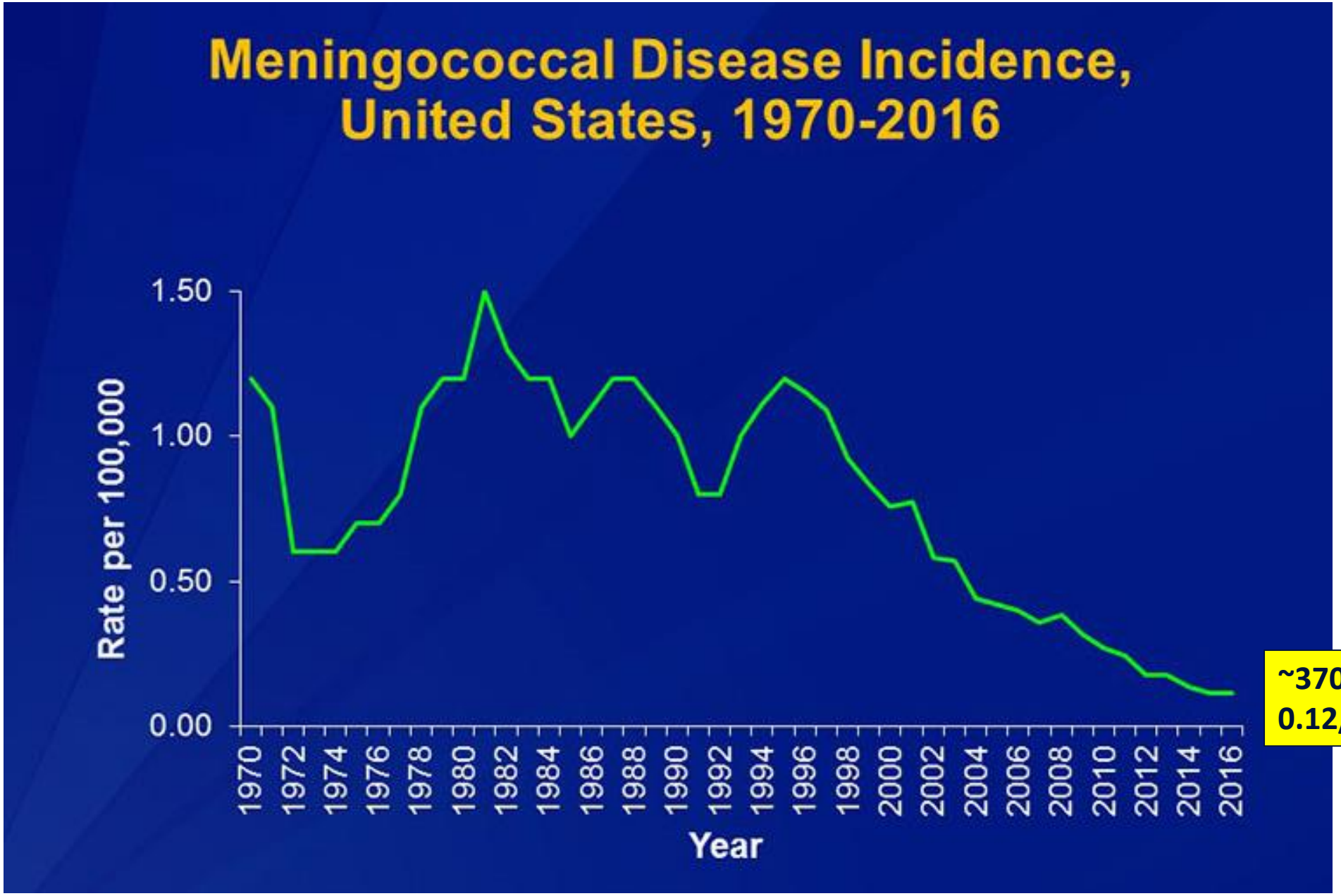
Delay vaccination until after pregnancy if vaccine is indicated

Contraindicated—vaccine should not be administered because of risk for serious adverse reaction

No recommendation

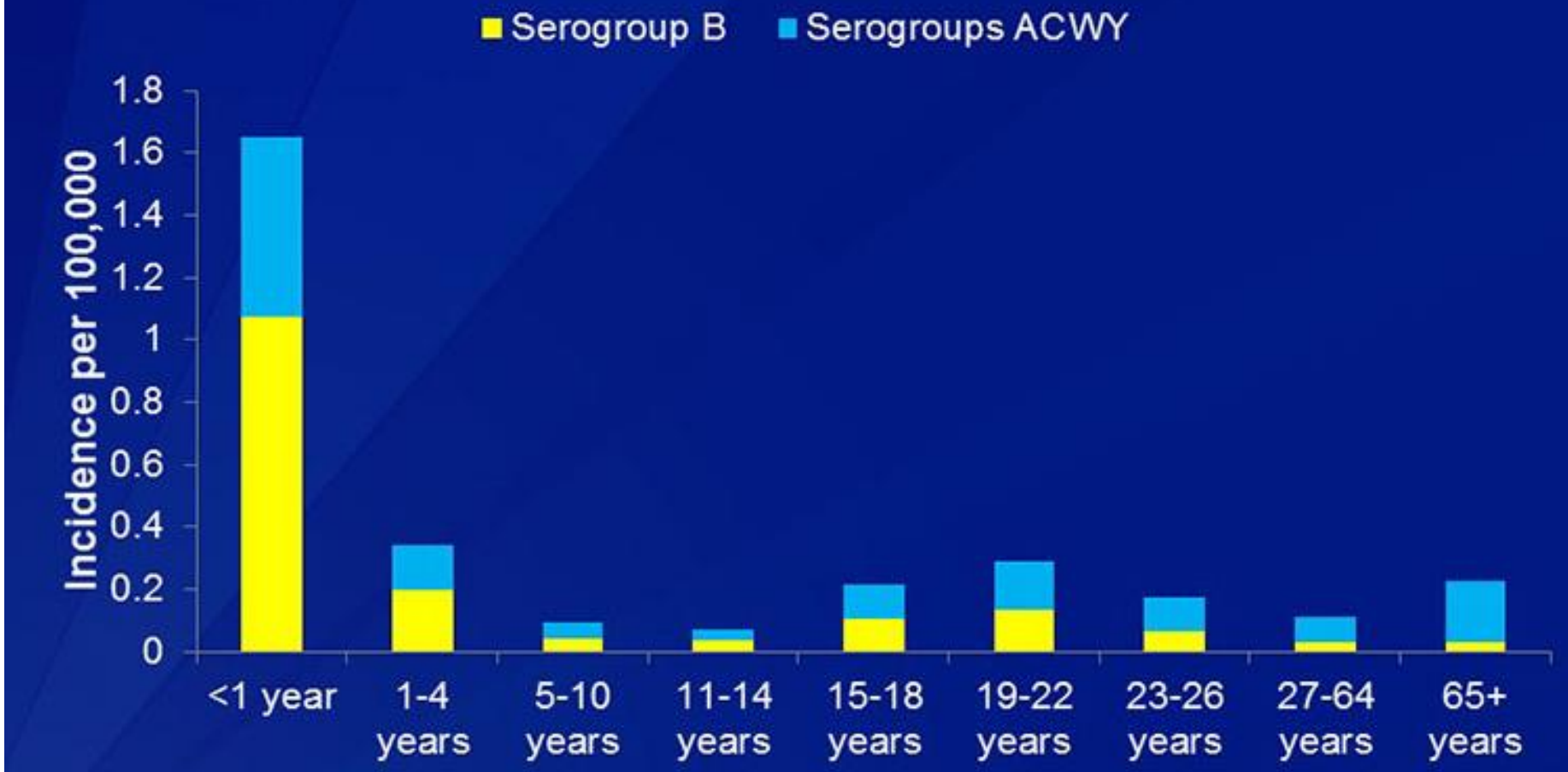
1. Precaution for LAIV does not apply to alcoholism. **2.** See notes for influenza; hepatitis B; measles, mumps, and rubella; and varicella vaccinations. **3.** Hematopoietic stem cell transplant.

- ✓ Flu
- ✓ Tdap/Td
- ✓ MMR
- ✓ VAR
- ✓ HPV
- ✓ Mening



National Notifiable Disease Surveillance System

Meningococcal Incidence by Serogroup* and Age-Group, 2007–2016



SOURCE: CDC; National Notifiable Diseases Surveillance System with additional serogroup data from Active Bacterial Core surveillance and state health departments.

Unknown serogroup (19%) and other serogroups (5%) excluded

At Increased Risk for Meningococcal Disease

- Adolescents
- Certain medical conditions
  - Asplenia, including sickle cell disease
  - Complement deficiency
  - Eculizumab use
- Increased risk for exposure
  - Microbiologists
  - First-year college students living in residence halls (OR 3.6; CI=1.6–8.5)
  - Disease outbreaks

Harrison LH, Dwyer DM, Maples CT, Billmann L. Risk of meningococcal infection in college students. JAMA 1999;281:1906-10

CHARLES D. BAKER
Governor

KARYN E. POLITO
Lieutenant Governor

The Commonwealth of Massachusetts

Executive Office of Health and Human Services
Department of Public Health
William A. Hinton State Laboratory Institute
305 South Street, Jamaica Plain, MA 02130
Bureau of Infectious Disease and Laboratory Sciences
Tel: (617) 983-6550
Fax: (617) 983-6925
www.mass.gov/dph

MARYLOU SUDDERS
Secretary

MONICA BHAREL, MD, MPH
Commissioner

TO: Healthcare Providers

FROM: Larry Madoff, MD, Director, Division of Epidemiology and Immunization
Catherine M. Brown, DVM, MSc, MPH, State Epidemiologist

DATE: January 22, 2019

RE: Update: Invasive Meningococcal Disease among People Experiencing Homelessness

In January 2018, the Massachusetts Department of Public Health (MDPH) reported that two people experiencing homelessness in Greater Boston had been diagnosed with invasive meningococcal disease (IMD) serogroup C. Since that time, there have been three additional cases of IMD serogroup C among people in this population, and one additional case in a person with close connections to the homeless community. The most recent onset was December 2018. Cases have ranged in age from 33-59 and five of the six have been male. None of the cases appear to have received quadrivalent meningococcal vaccine (MenACWY) prior to becoming ill. The results of genetic sequencing demonstrate that all six isolates have similar molecular profiles.

Prompt recognition and antibiotic treatment of meningococcal disease is critical. Symptoms of meningococcal bacteremia may include fever, fatigue, nausea, vomiting, cold hands and feet, chills, severe muscle aches or

MenACWY and MenB Recommendations

MenACWY

- Asplenia
- HIV infection
- Persistent complement deficiency
- Complement inhibitor use
- Travel to country with ↑mening
- Outbreak serogroup A, C, W, Y
- Microbiologists
- Military recruits
- First-year college student in dorm
- Booster every 5y if risk remains

MenB

- Asplenia
- Persistent complement deficiency
- Complement inhibitor use
- Outbreak serogroup B
- Microbiologists
- (Clinical decision for healthy 16–23y)
- (Clinical decision for healthy 16–23y)

MenB Updates – Booster or Not?

- Serogroup B antibody wanes 1–2y after primary series
- After booster dose, persists for >2y
- Limited data show no serious adverse events associated with booster
- Should MenB booster be recommended?
  - Asplenia, complement deficiency, complement inhibitor use, microbiologists
  - Increased risk during outbreak

Sidney Crosby

- 27yo Pittsburgh Penguin, up-to-date on immunization
- Other than occupational injuries, in good health
- Showed up for practice looking cheeky
- Pennsylvania HD declared mumps outbreak at team facility

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

No recommendation

- ✓ Flu
- ✓ Tdap/Td
- ✓ MMR
- ✓ VAR

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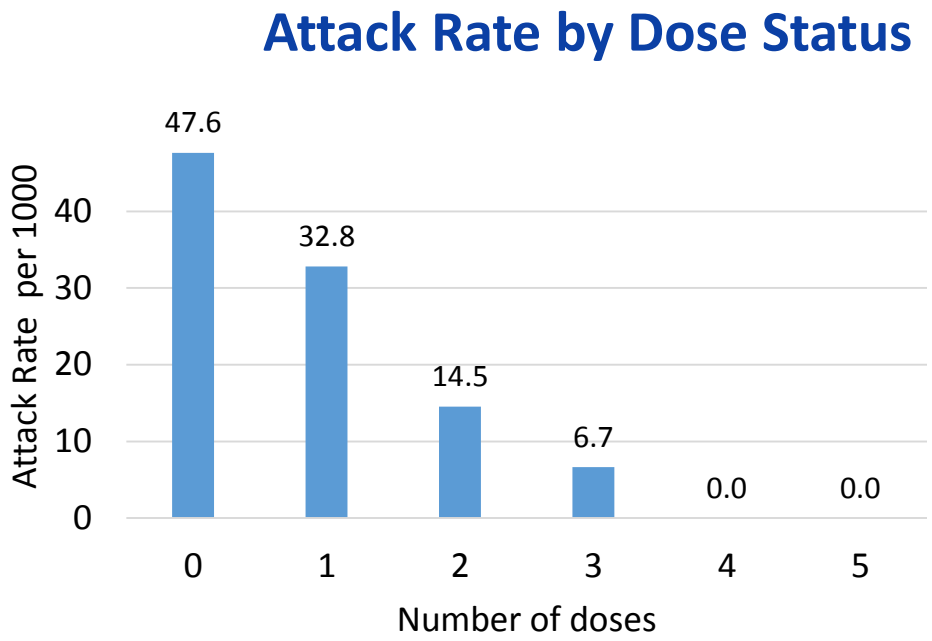
- ✓ Flu
- ✓ Tdap/Td
- ✓ MMR
- ✓ VAR
- ✓ No other based on other indication

Updates in MMR Vaccination

University of Iowa Mumps Outbreak, 2015-2016

- Lower attack rate for mumps in students vaccinated with MMR-3 vs. MMR-2 ($p<0.001$)
- Increase in the risk for mumps with increased time since MMR-2
- Receipt of MMR-3 associated with a 78%* lower risk for mumps than receipt of MMR-2 (95% confidence interval: 61%-88%)



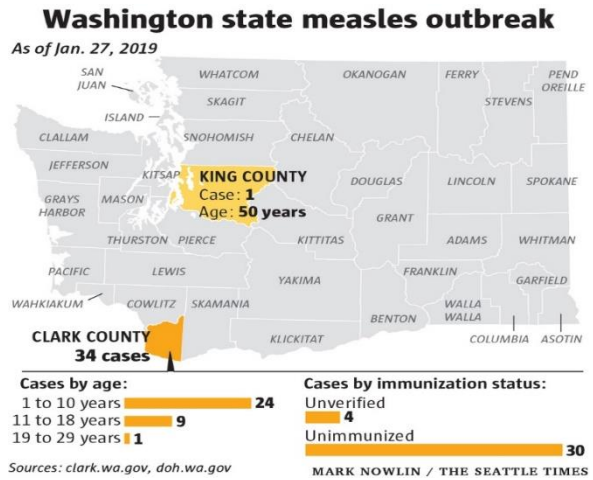
*Postvaccination window of 28 days and after adjustment for the number of years since MMR2; vaccine effectiveness was 68% (95% confidence interval: 42%-83%) when cases prior to campaign were excluded.

Cardemil et al. *N Engl J Med* 2017

Additional Dose MMR During Mumps Outbreak

- Administer third dose MMR to persons who previously received 2 doses mumps-containing vaccine and identified by public health authority to be at increased risk for mumps in an outbreak
- Factors indicating increased risk
  - High numbers of cases
  - Widely distributed cases
  - Settings likely to facilitate transmission (schools, colleges, correctional facilities, congregate living facilities)
  - Ongoing transmission
  - Place of residence during outbreak
  - Intensity and duration of close contact
  - Social networks

Marin et al. MMWR 2018;67(1):33–38



The New York Times

New York Confronts Its Worst Measles Outbreak in Decades

Borough Park, Brooklyn, has seen 35 cases of measles in an outbreak affecting more than 200 people in ultra-Orthodox Jewish communities in New York and New Jersey. Bryan Thomas for The New York Times

MEASLES ALERT

Measles

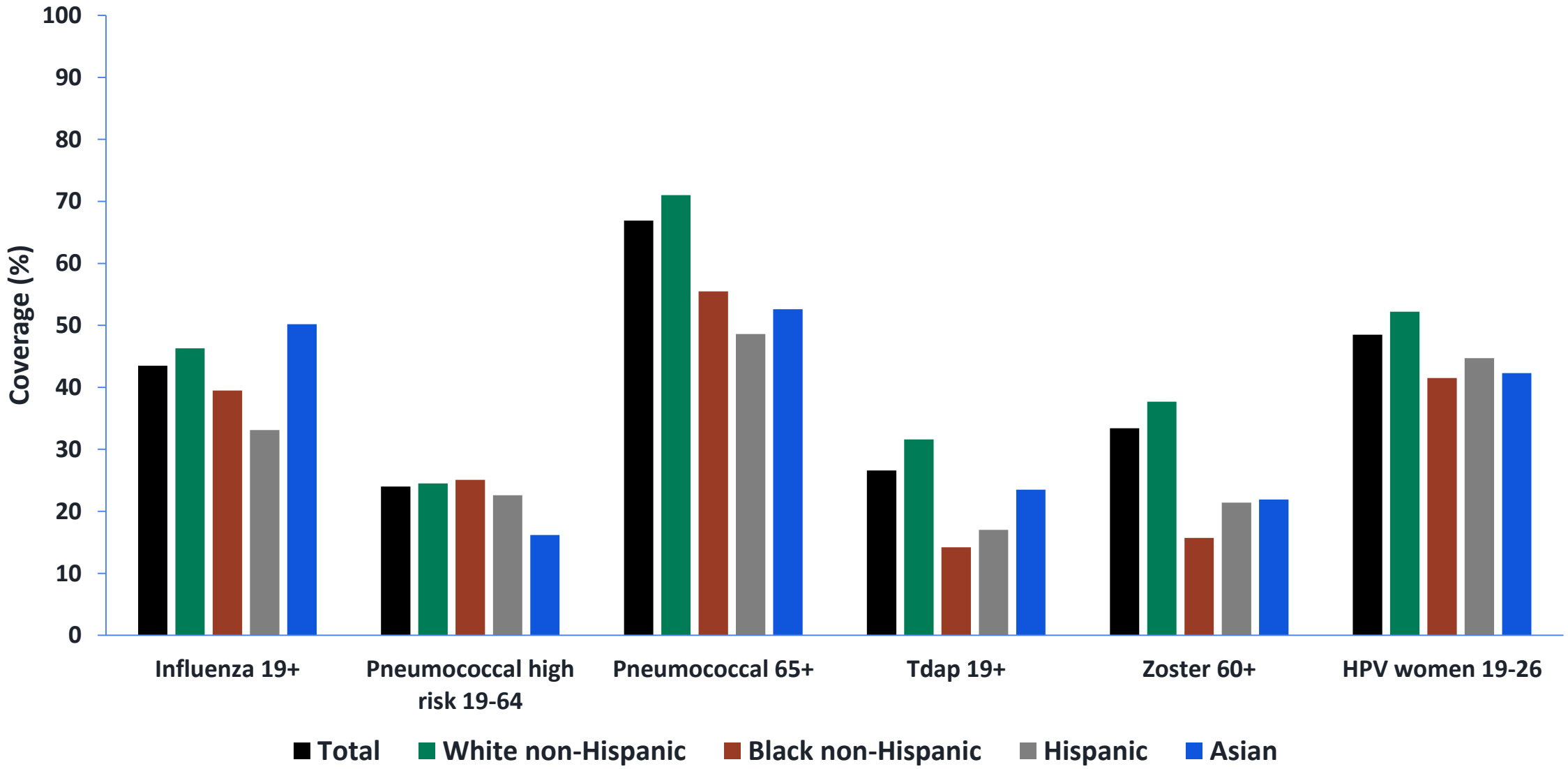
- Paramyxovirus
- Respiratory transmission
- Rash onset 7–21 days
- Fever, cough, coryza, conjunctivitis, Koplik spots
- 30% cases develop complications—otitis media, pneumonia, encephalitis
- In U.S., higher in late winter and spring
- Vaccine efficacy 95%s, dose 2 at 4–6 yrs
- Adults at risk – college students, healthcare workers, international travelers

MMR Vaccination

- Routine 2-dose series for children at 12–15 mos and 4–6 yrs
- Catch up for adults
  - Born before 1957 considered immune (except health care workers)
  - Born in 1957 or later without evidence of immunity
  - Evidence of immunity
    - Documented receipt of MMR
    - Laboratory evidence of immunity or disease

Standards for Adult Immunization Practice

Vaccination Coverage among Adults in United States, National Health Interview Survey, 2016

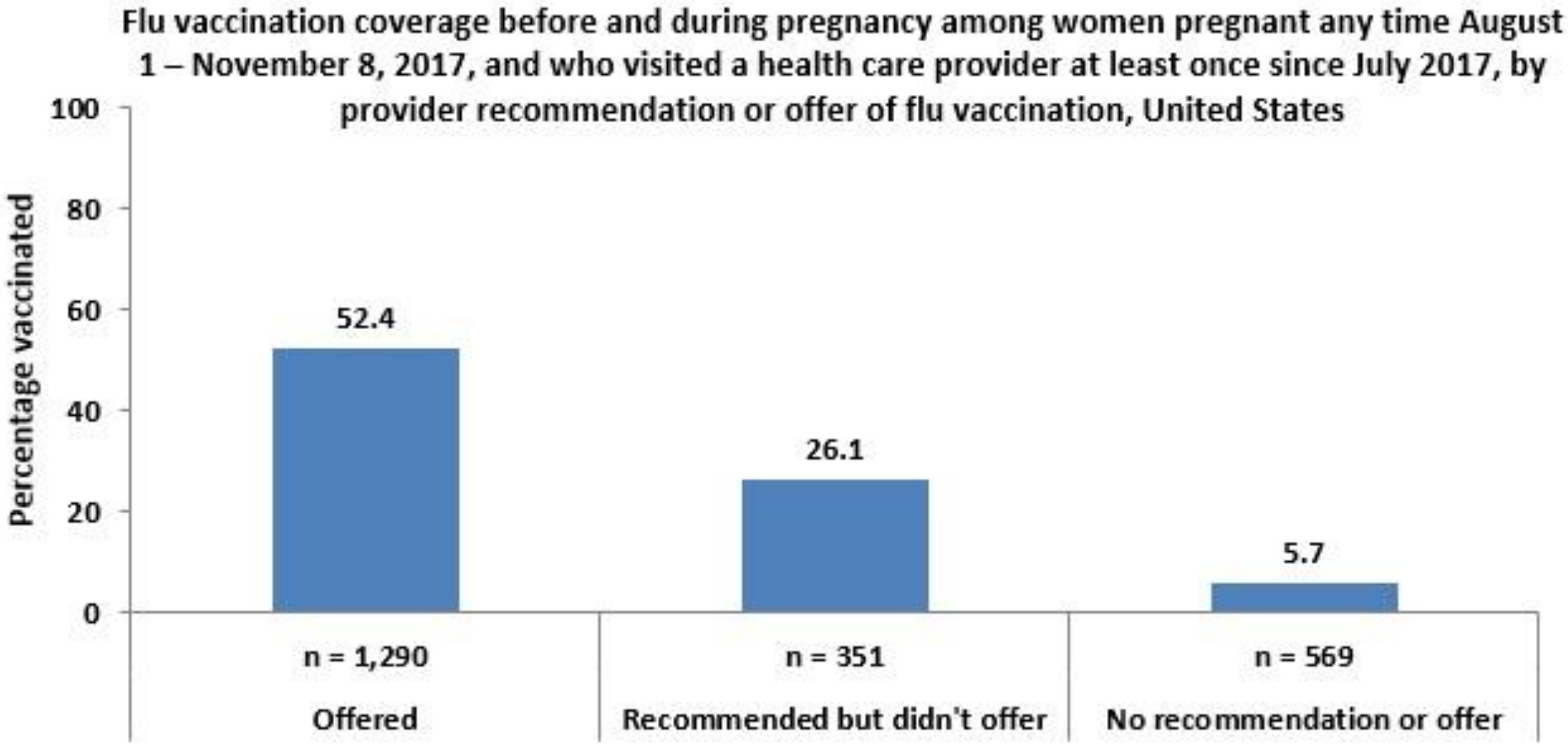


https://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/pubs-resources/NHIS-2016.html

Standards for Adult Immunization Practice

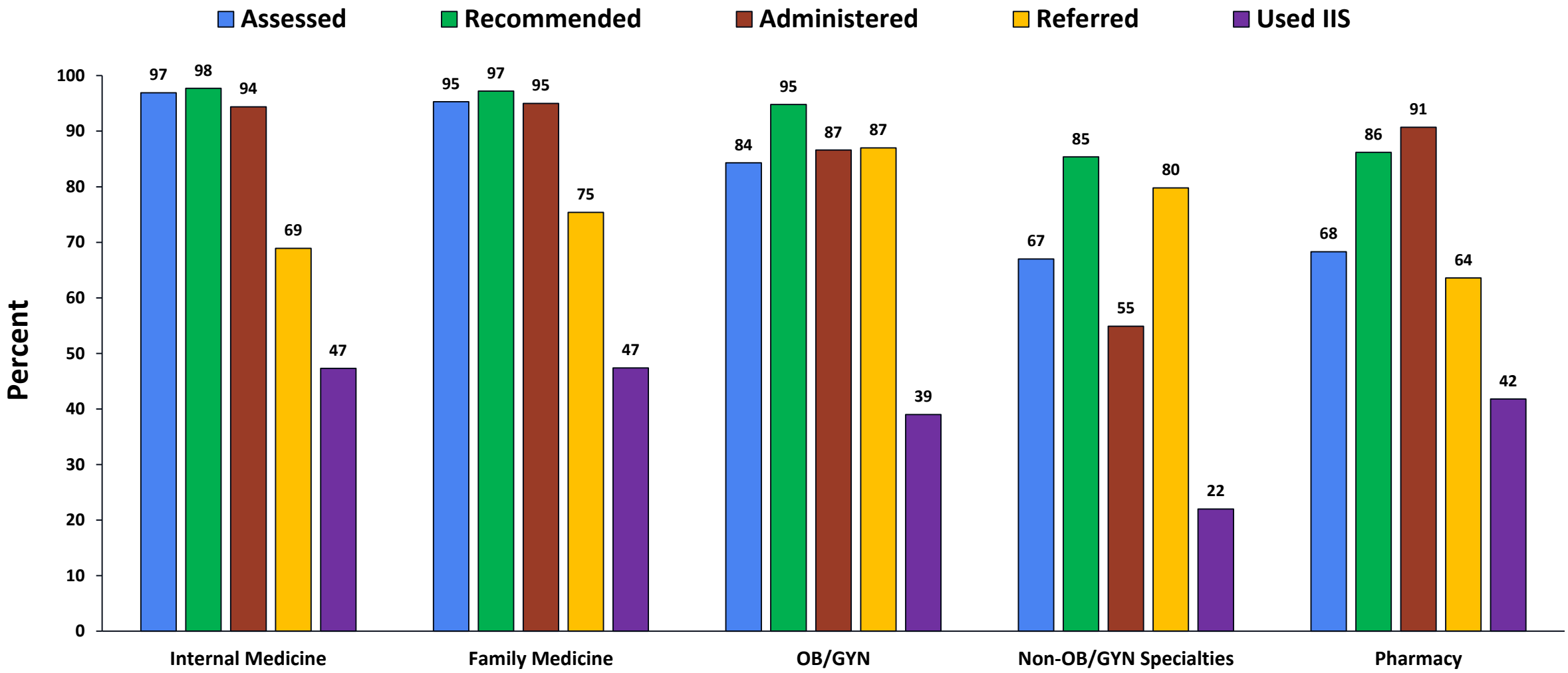
- All health care providers, including those who do not provide vaccine services, have role in ensuring adult patients up-to-date on vaccines
- Call to action for adult health care providers to
  - **ASSESS** vaccination status of all patients at every clinical encounter
  - Strongly **RECOMMEND** vaccines that patients need
  - **ADMINISTER** needed vaccines or **REFER** to a vaccine service provider
  - **DOCUMENT** vaccines received by patients in state vaccine registries

Public Health Reports 2014;129:115–123



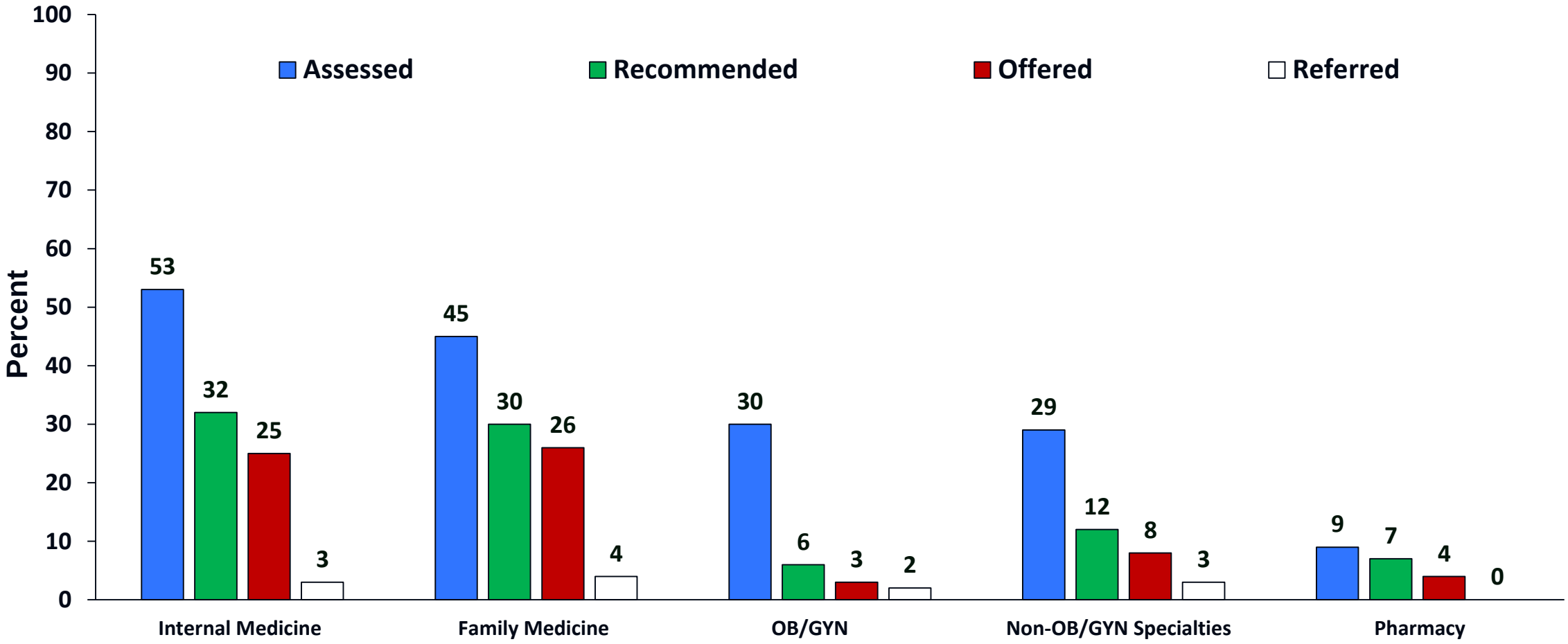
CDC. Pregnant Women and Flu Vaccination, Internet Panel Survey

Reported implementation of standards components among health care providers, by provider specialty, U.S., 2016 (N=1,918)



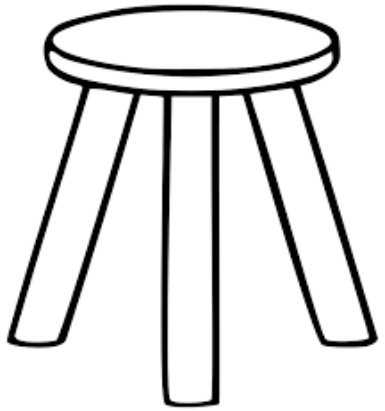
www2.cdc.gov/vaccines/ed/pickup/ciinc/2017/CIINC_4_26_2017.pdf

Reported implementation of standards components among adults with provider or pharmacy visits, Internet Panel Survey, U.S., 2016 (N=1,476)



www2.cdc.gov/vaccines/ed/pickup/ciinc/2017/CIINC_4_26_2017.pdf

Strategies to promote adult immunization



- Administrative
  - Immunization Champion
  - Management support
  - Effective policy
- Programmatic
  - On-site
  - No cost (or low cost)
  - Standing orders
  - Reminder-recall
  - Immunization information system
- Communication
  - Patient values and needs
  - Provider recommendations


WIIFM?

Business Case for Adult Immunization

Background – Child and Adolescent Immunization

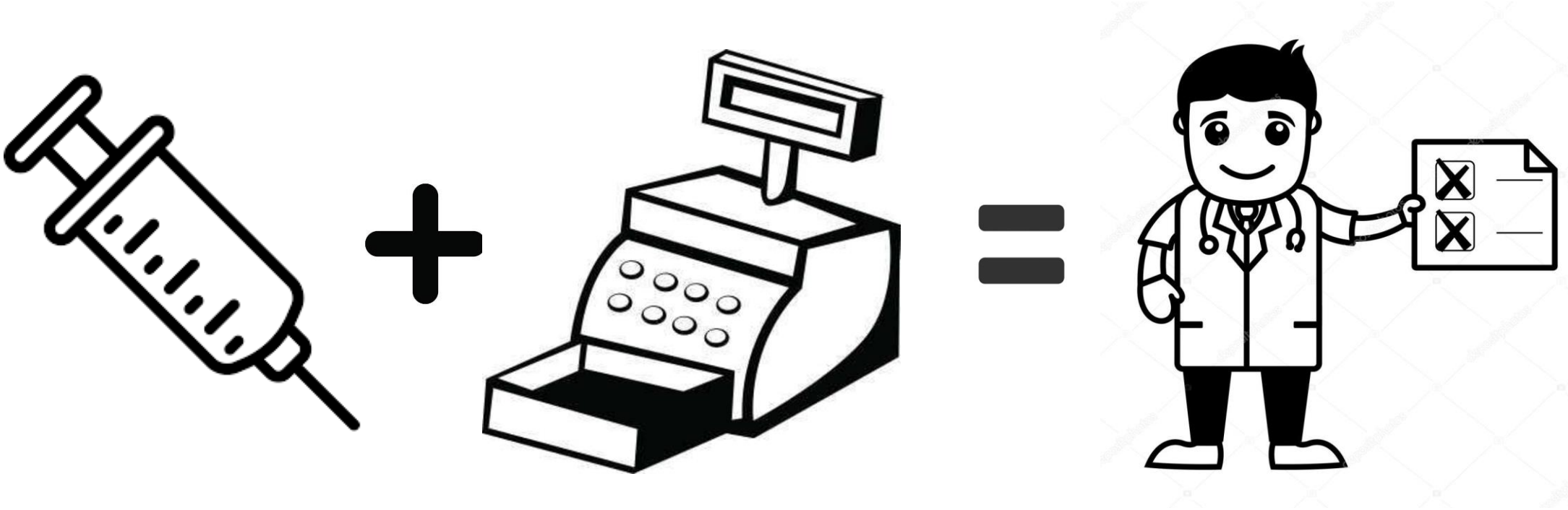
- Immunization delivery infrastructure
  - Public and private payers must recognize that provider practice as business entity
  - Provider practice must run on sound, generally accepted business principles to remain viable (be paid for full direct and indirect costs and overhead expenses)
- Business case for pediatric vaccination
  - Cost – vaccine purchase, cost of managing vaccine inventory
  - Payment – vaccines, vaccine administration
  - Complaint that cost > Payment
- Incentivize providers to participate in immunization efforts by appropriate payment for vaccines

AAP. The Business Case for Pricing Vaccines. Rev March 2012
Guthrie et al. Financing of Childhood and Adolescent Vaccines. Pediatrics 2009:124(Supplement 5)

Business case for adult immunization? Shifting health care landscape

- >50% providers employed in health systems
- In health systems, vaccine purchase and payment is not an issue, but it is in private practice
- Prioritization of vaccination in patient care (chronic, acute, other preventive services)
- Evolving vaccine delivery model – vaccination services in pharmacies
- Payment model shift from volume to value increased focus on preventive services (MACRA)

Credit: Abby Bownas, Adult Vaccine Access Coalition



Business Case: Barriers and Costs

- Barriers in business case for adult vaccination[1]
  - Costs too high to enter market to provide vaccination services
  - Complaint that payment does not cover costs
- Cost of vaccination in adult provider practices[2]
  - IM and FM – median 5 min ($7–8)/vaccination, Ob/Gyn – median 29 min ($43)/vaccination
  - Dependent of volume of vaccination, cost of counseling (even if declined)

1. Credit: Abby Bownas, Adult Vaccine Access Coalition
2. Shen et al. Vaccine 2019:37(6)

Adult immunization is not traditional business case

- Diverse business case scenarios
  - Capital outlay for health systems, small- or medium-sized practices
  - Spans multiple specialties
  - Competing priorities of vaccination among other patient care needs
  - For health systems, priorities to manage costs associated with populations
- Outliers – Medicaid, ob/gyn practices, pharmacies

Credit: Abby Bownas, Adult Vaccine Access Coalition

“It’s the economy, Stupid”*

- For providers who currently vaccinate adults**
  - Accountable Care Organizations (ACOs) to participate in Shared Savings Program for Medicare patients
  - More data needed to identify ways to save costs
  - Advocate for payment on vaccination counseling
- For providers who do not currently vaccinate adults**
  - Group purchasing organizations
  - Third party supply/storage systems

*James Carville Carville's original phrase was one of the three messages to focus on for the Clinton 1992 presidential campaign. The other two messages were "Change vs. more of the same" and "Don't forget health care."

**Credit: Abby Bownas, Adult Vaccine Access Coalition

Bottom Lines

- Disease bad, vaccine good
- Implement standards for adult immunization practice, importance of provider recommendations
- Use proven strategies (e.g., standing orders, provider reminders, patient recall, immunization information system)
- Work on effective messaging and communication strategies
- Stay tuned for more information on business case for adult immunization

Resources

- State and local health department immunization programs
- Centers for Disease Control and Prevention
- Advisory Committee on Immunization Practices
- National Vaccine Program Office
- National Adult and Influenza Immunization Summit
- Professional organizations

THANK YOU!

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

Updates in Influenza Vaccination

ACIP Influenza Vaccination Updates for 2018–2019

- Vaccine composition
- Reinstated use of LAIV
- Use in egg allergy
- Vaccine licensure and labeling

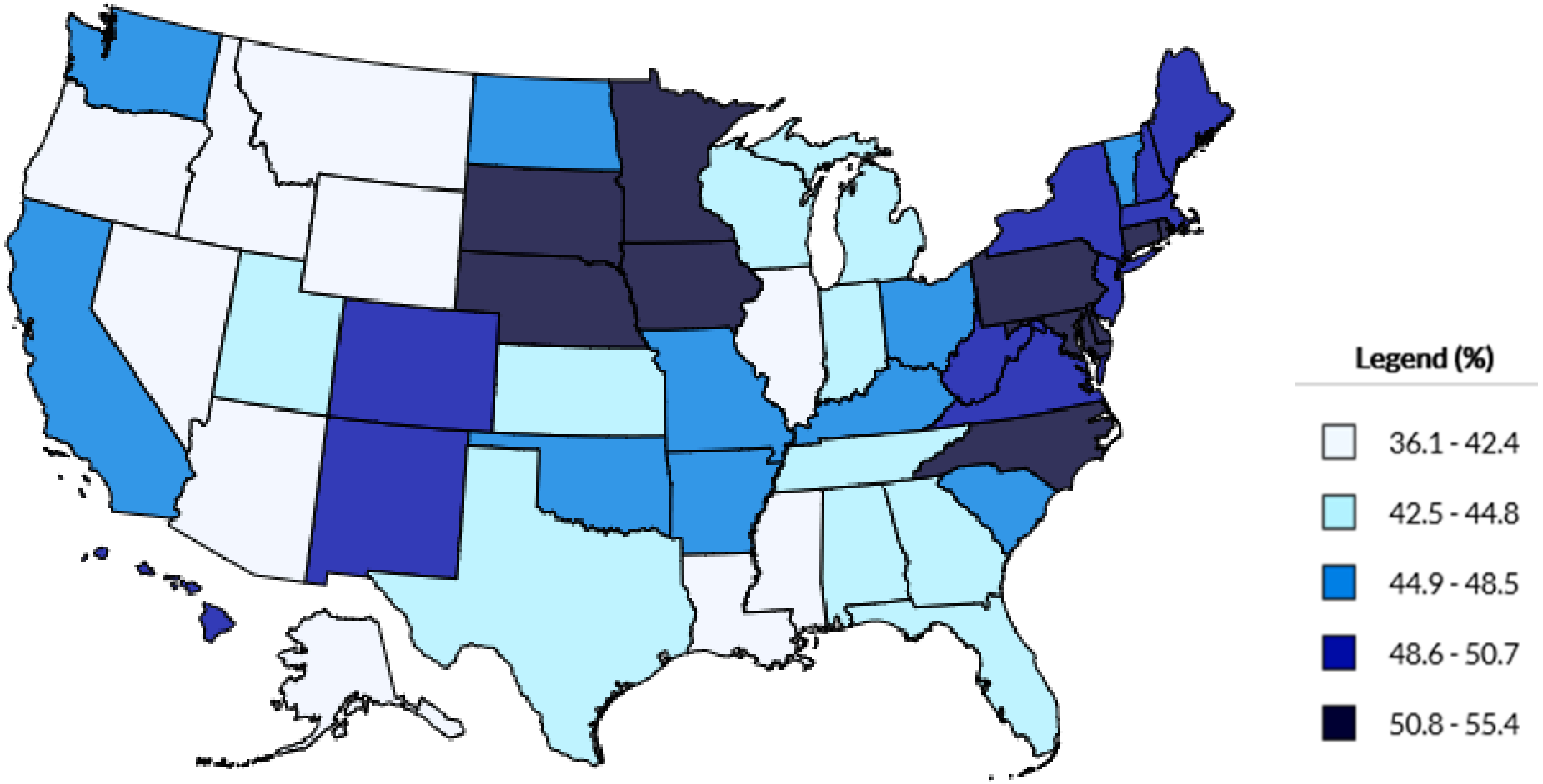
Grohskopf et al. Prevention and control of seasonal influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices—United States, 2018–19 influenza season. MMWR 2018;67(3):1–20

Egg Allergy

- Studies evaluated use of LAIV in egg-allergic children, and no cases of anaphylaxis occurred[1–3]
- ACIP recommendation: Persons with history of egg allergy of any severity may receive any age-appropriate influenza vaccine (IIV, RIV, LAIV)
  - Hives only: Any IIV, RIV, LAIV appropriate for age and health status
  - Other reactions (e.g., angioedema, respiratory distress): Any IIV, RIV, LAIV appropriate for age and health status in medical setting under supervision of provider who can recognize and manage severe allergic reactions
  - Previous severe allergic reaction to influenza vaccine, regardless of suspected vaccine component, is contraindication to influenza vaccination

1. Des Roches et al. Safe vaccination of patients with egg allergy by using live attenuated influenza vaccine. J Allergy Clin Immunol Pract 2015;3:138–9
2. Turner PJ et al. Safety of live attenuated influenza vaccine in young people with egg allergy: multicentre prospective cohort study. BMJ 2015;351:h6291
3. Turner PJ et al. Safety of live attenuated influenza vaccine in atopic children with egg allergy. J Allergy Clin Immunol 2015;136:376–81

Influenza Vaccination Coverage Estimates, 2016–2017



FluVaxView. Influenza vaccination coverage 2016–2017 www.cdc.gov/flu/fluvaxview/reportshtml/trends/index.html

Flu Vaccination Coverage* Among Adults by Mid-November 2018, by Race/Ethnicity, National Internet Flu Survey, United States,† 2018–19 Influenza Season

Race/Ethnicity‡	November 2018 %§ ± 95% CI‖	Difference from Nov 2017 ± 95% CI
Adults (≥18 years)	44.9 ± 1.8	6.4 ± 2.4¶
White, non-Hispanic	45.8 ± 2.2	8.2 ± 3.0¶
Black, non-Hispanic	40.8 ± 4.6	0.4 ± 6.3
Hispanic	43.4 ± 4.6	7.6 ± 6.2¶
Other non-Hispanic or multiple races**	47.0 ± 6.0	-1.1 ± 8.1

* Estimates of the percentage of people vaccinated are based on interviews conducted November 1–15, 2018 and reported vaccinations from July 2018 through mid-November 2018.

† Excludes U.S territories.

‡ Race is reported by respondent; people of Hispanic ethnicity may be of any race.

§ Percentage vaccinated. Percentages are weighted to the U.S. population.

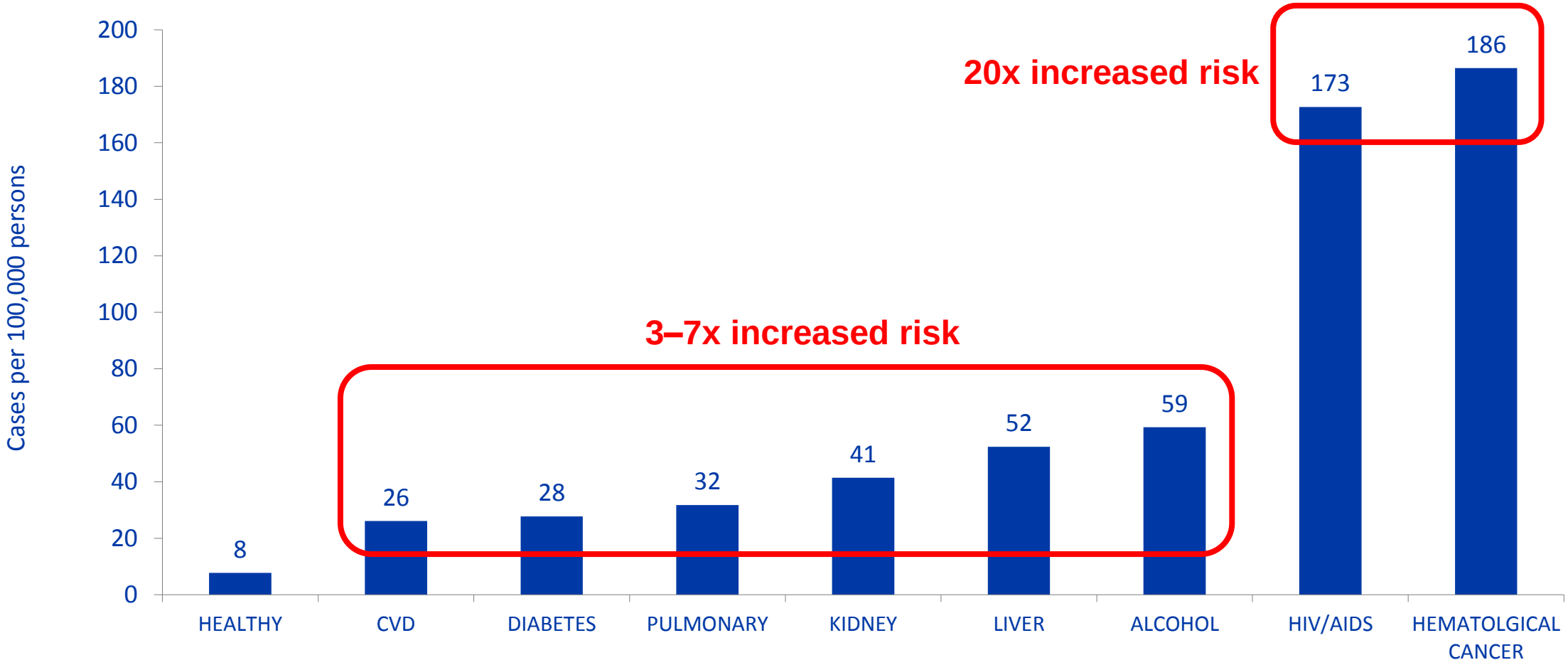
|| Confidence interval (CI) half-widths.

¶ Statistically significant difference between November 2018 and November 2017 by t-test ($p<0.05$).

** Includes Native Hawaiian or other Pacific Islander, multiracial, and other races.

Updates in Pneumococcal Vaccination

Incidence of Invasive Pneumococcal Disease among Adults Aged 18–64 Years with Select Underlying Conditions, United States, 2009



Kyaw. JID 2005;192:377–386

Pneumococcal Vaccination: Why PCV13 and PPSV23?

- PCV13 age ≥65y
  - 45% effective against vaccine-type pneumococcal pneumonia
  - 75% effective against vaccine-type IPD
- PPSV23
  - 74% effective in meta-analysis against IPD
  - Not effective against non-IPD pneumonia

Bonten MJ, et al. NEJM 2015;372:1114-25
Moberley S, et al. Cochrane Database Syst Rev 2013

Table 1. Medical conditions or other indications for administration of PCV13 and PPSV23 for adults

Medical indication	Underlying medical condition	PCV13 for ≥ 19 years	PPSV23* for 19 through 64 years		PCV13 at ≥ 65 years	PPSV23 at ≥ 65 years
		Recommended	Recommended	Revaccination	Recommended	Recommended
None	None of the below				✓	✓ ≥ 1 year after PCV13
Immunocompetent persons	Alcoholism		✓		✓	✓ ≥ 1 year after PCV13 ≥ 5 years after any PPSV23 at < 65 years
	Chronic heart disease†					
	Chronic liver disease					
	Chronic lung disease§					
	Cigarette smoking					
	Diabetes mellitus					
	Cochlear implants	✓	✓ ≥ 8 weeks after PCV13		✓ If no previous PCV13 vaccination	✓ ≥ 8 weeks after PCV13 ≥ 5 years after any PPSV23 at < 65 years
	CSF leaks					
Persons with functional or anatomic asplenia	Congenital or acquired asplenia	✓	✓ ≥ 8 weeks after PCV13	✓ ≥ 5 years after first dose PPSV23	✓ If no previous PCV13 vaccination	✓ ≥ 8 weeks after PCV13 ≥ 5 years after any PPSV23 at < 65 years
	Sickle cell disease/other hemoglobinopathies					
Immunocompromised persons	Chronic renal failure	✓	✓ ≥ 8 weeks after PCV13	✓ ≥ 5 years after first dose PPSV23	✓ If no previous PCV13 vaccination	✓ ≥ 8 weeks after PCV13 ≥ 5 years after any PPSV23 at < 65 years
	Congenital or acquired immunodeficiencies¶					
	Generalized malignancy					
	HIV infection					
	Hodgkin disease					
	Iatrogenic immunosuppression‡					
	Leukemia					
	Lymphoma					
	Multiple myeloma					
	Nephrotic syndrome					
	Solid organ transplant					

*This PPSV23 column only refers to adults 19 through 64 years of age. All adults 65 years of age or older should receive one dose of PPSV23 5 or more years after any prior dose of PPSV23, regardless of previous history of vaccination with pneumococcal vaccine. No additional doses of PPSV23 should be administered following the dose administered at 65 years of age or older.

†Including congestive heart failure and cardiomyopathies

§Including chronic obstructive pulmonary disease, emphysema, and asthma

¶Includes B- (humoral) or T-lymphocyte deficiency, complement deficiencies (particularly C1, C2, C3, and C4 deficiencies), and phagocytic disorders (excluding chronic granulomatous disease)

‡Diseases requiring treatment with immunosuppressive drugs, including long-term systemic corticosteroids and radiation therapy

Updates in Hepatitis B Vaccination

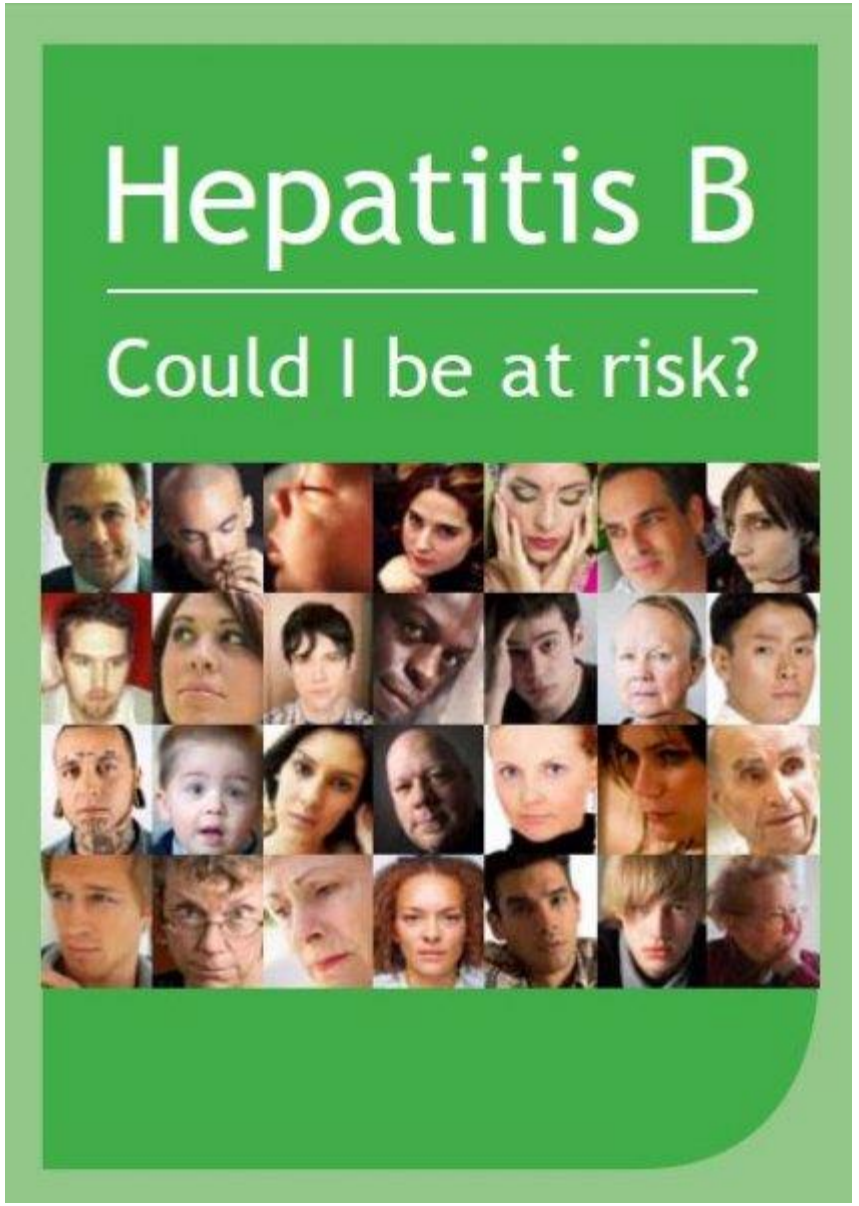
Hepatitis B

- Transmitted via blood or sexual contact
- Symptomatic illness in 30%–50% infected older children, adolescents, adults
- Chronic infection at increased risk for cirrhosis and liver cancer
- ~95% new HBV infections among adults
- Adults at risk
  - Injection drug use
  - Sexual exposure
  - Household contacts
  - Occupational (HCWs)
  - Hemodialysis
  - HCV infection
  - Chronic liver disease
  - Diabetes
  - Developmentally disabled in long-term care facilities
  - Correctional facilities
  - Travel to endemic areas

Schillie et al. MMWR 2018:67(1)
CDC. Viral Hepatitis Surveillance–United States, 2016

Hepatitis B (2)

- Incidence (per 100,000)
  - 0.2 for <19y
  - 2.6 for 30–39y
  - 0.5 for ≥60y
- 3,218 cases acute HBV infection reported in 2016 (estimated 20,900 cases)

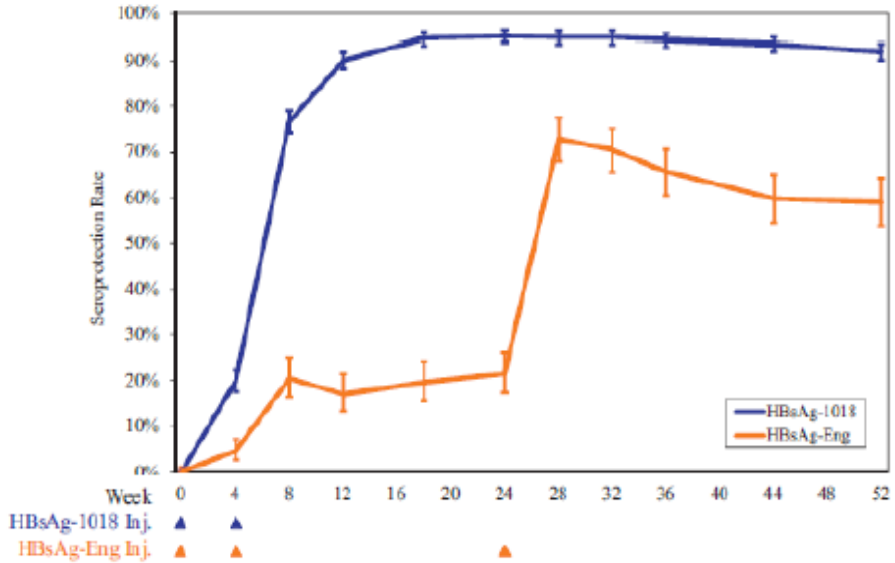


CDC. Viral Hepatitis Surveillance–United States, 2016

Heplisav-B – Seroprotection and Safety

- Immunogenicity
  - 90%–100% (2 doses Heplisav-B) vs. 70%–90% in comparison group (3 doses Engerix-B)
  - Diabetes Type II: 90% (2 doses) vs. 65% (3 doses)
  - Chronic kidney disease: 90% (3 doses) vs. 81% (4 double doses)
- Safety and reactogenicity
  - Mild and serious adverse events similar
    - Mild: 46% vs. 46%
    - Serious: 5% vs. 6%
  - Cardiovascular events not significantly different
    - 0.3% vs. 0.1%
  - Potentially immune-mediated adverse events similar (e.g., granulomatosis with polyangiitis, Grave's disease)
    - 0.1%–0.2% vs. 0%–0.7%

Healthy adults aged 40-70 years



Jackson S, Lentino J, Kopp J, et al. 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 2017; 36:668-74

Janssen R, Bennett S, Namini H, et al. Immunogenicity and Safety of Two Doses of Investigational Heplisav Compared to Three Doses of Licensed Hepatitis B Vaccine (Engerix-B) in Two Phase 3 Trials. Journal of Hepatology 2013; 58(Suppl 1):S574

HEPLISAV-B™ [Hepatitis B Vaccine (Recombinant), Adjuvanted] package insert www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM584762.pdf

Updates in Hepatitis A Vaccination

Hepatitis A Vaccination Update – PrEP for Travelers

Traveler	PrEP	Notes
• Healthy adults age <40 yrs	1 dose HepA	Complete 2-dose series HepA per routine schedule
• Infants age 6–11 mos	1 dose HepA	HepA dose does not count towards routine 2-dose series
• Infants age <6 mos • Persons vaccine contraindicated	IG	Repeat IG every 2 months if still at risk
• Adults age ≥40 yrs • Persons immunocompromised • Persons with chronic liver disease	IG + 1 dose HepA	Complete 2-dose series HepA per routine schedule

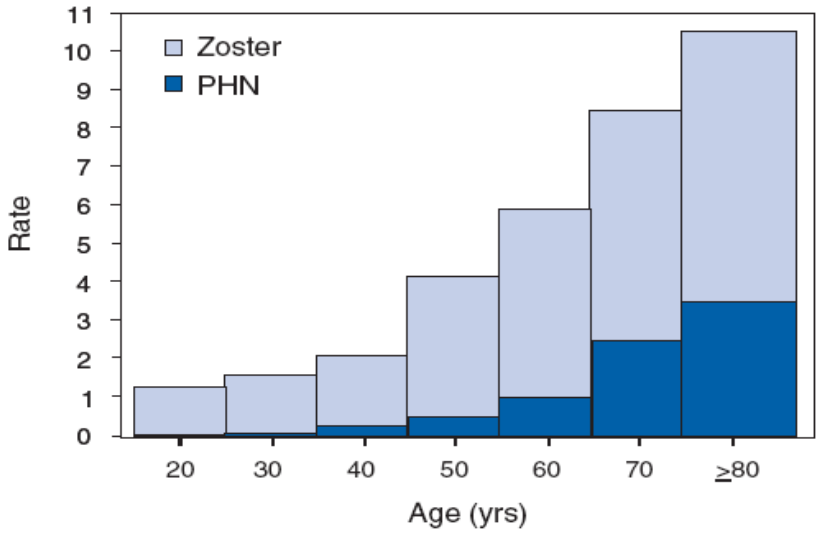
Nelson et al. MMWR 2019;67(43)

Updates in Zoster Vaccination

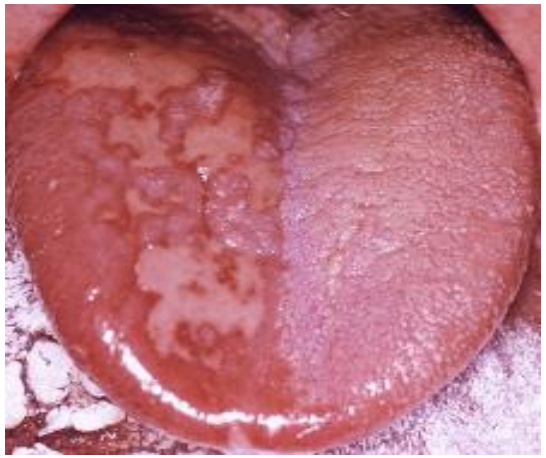
Zoster (Shingles)

- Caused by varicella zoster (chickenpox) virus
- Thoracic, cervical, ophthalmic zoster most common
- After recovery, can reactivate later (shingles)
- Risk increases with age, lifetime risk 32%
- ~1 million cases annually
- Post herpetic neuralgia (PHN)

FIGURE 3. Rate* of zoster and postherpetic neuralgia (PHN)†, by age — United States



*Per 1,000 person-years.
†Defined as ≥30 days of pain.



CDC. MMWR 2008;57(RR-5):1–30
Drolet et al. CMAJ 2010

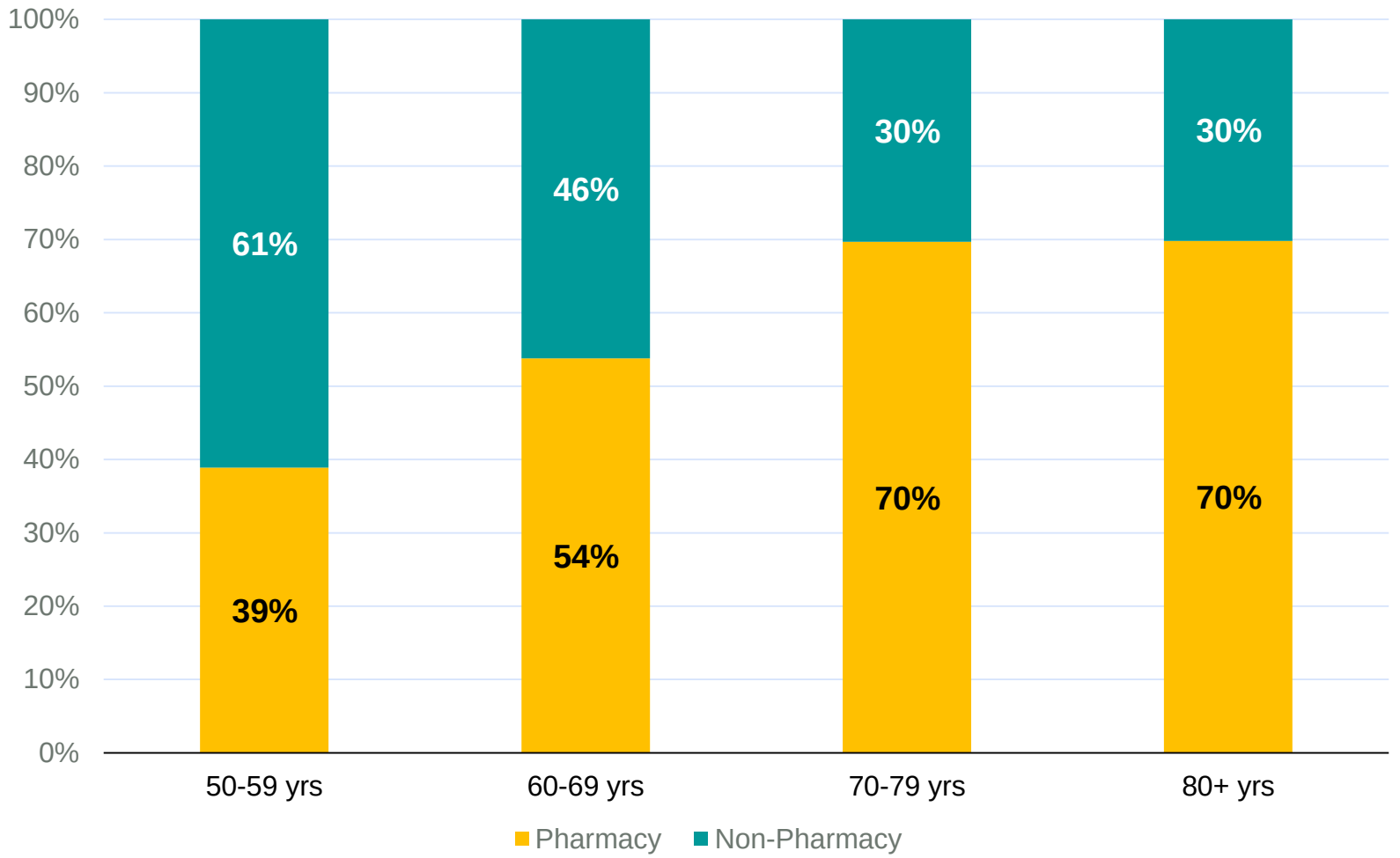
RZV Details

- Adverse events
  - No difference for serious events
  - More common grade 3 reactions compared to placebo (17% vs. 3%)
  - Pain 78%, myalgia 45%, fatigue 45%
- Cost effectiveness
  - $31,000/QALY average for ≥50y ($47,000 [50–59y]–$9,700 [80–89y])
  - Revaccination after ZVL – similar or lower than other adult vaccines ($117,000 [50–59y]–$15,000 [80–89y])
- Storage and handling, administration
  - Refrigerator stable
  - Reconstitute adjuvant suspension and lyophilized IgE protein
  - Administer IM immediately, or store 2–8°C (6h max)

More RZV Details

- Recommended populations
  - Adults with chronic medical conditions
  - Adults taking low-dose immunosuppressive therapy, anticipating or have recovered from immunosuppression (immunocompromised adults excluded from Phase III efficacy studies, no ACIP recommendations for these adults—currently under review)
- Relevant patient history
  - Administer regardless of history of varicella (chickenpox) vaccine, zoster vaccine live (ZVL, Zostavax), or episodes of shingles
  - No need to screen for history of varicella
- Adults already received ZVL
  - No vaccine interference or safety problems when RZV administered ≥5y after ZVL
  - Consider shorter interval if >70yo (protection from ZVL 38% if over 3y
  - Minimum interval 8 weeks (expert opinion)

RZV administration in pharmacy vs. non-pharmacy, IIS (MN, MI, OR, ND, WI, NYC), Oct 2017–Dec 2018 (N = 751,405)



Unpublished. Presented at ACIP meeting, February 2019

Updates in Meningococcal Vaccination

MenACWY and HIV

- HIV infection increases risk of invasive meningococcal disease
- Routine use of MenACWY for HIV-infected persons age ≥2 mos
  - Number of doses depends on age, ≥2y should receive 2 doses separated by 8 weeks


Morbidity and Mortality Weekly Report

Recommendations for Use of Meningococcal Conjugate Vaccines in HIV-Infected Persons — Advisory Committee on Immunization Practices, 2016

MenB Primer

- Use in persons ≥10y* at increased risk of disease
- May use in healthy adolescents and young adults 16–23y (16–18y preferred) not at increased risk, based on individual clinical decision
- Administer MenB as either 2-dose series of MenB-4C (Bexsero) or 2- or 3-dose series of MenB-FHbp (Trumenba)
- Use same vaccine product for all doses
- May administer MenB-4C or MenB-FHbp concomitantly with other vaccines indicated for age, but at different site
- No product preference

*Off-label ACIP recommendation (label: children 2 months through 9 years of age are not recommended to receive MenB)
www.cdc.gov/mmwr/preview/mmwrhtml/mm6422a3.htm?s_cid=mm6422a3_w

Indications for MenB: Age ≥10y* at Increased Risk

- Persistent complement component deficiencies
- Taking eculizumab (complement inhibitor)
- Anatomical or functional asplenia (includes sickle cell disease)
- Microbiologists routinely exposed to isolates of *Neisseria meningitidis*
- At increased risk because of serogroup B meningococcal disease outbreak

*ACIP off-label recommendation

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6422a3.htm?s_cid=mm6422a3_w

MenB Series Intervals

- At increased risk for meningococcal disease, serogroup B outbreaks, HIV infection
  - 2 doses MenB-4C (Bexsero) at 0, 1–6 mos
  - 3 doses MenB-FHbp (Trumenba) at 0, 1–2, 6 mos
- Healthy adolescents and young adults age 16–23y (16–18y preferred) not at increased risk
  - 2 doses MenB-4C at 0, 1–6 mos
  - 2 doses MenB-FHbp at 0, 6 mos

Patton et al. MMWR 2017:66(19)

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  - 2 doses MenB-4C at 0, 1–6 mos
  - 2 doses MenB-FHbp at 0, 6 mos

Patton et al. MMWR 2017:66(19)