Disease Burden Among Adults for Vaccine Preventable Diseases: Medical, Social, and Economic Costs

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CDC Netconference

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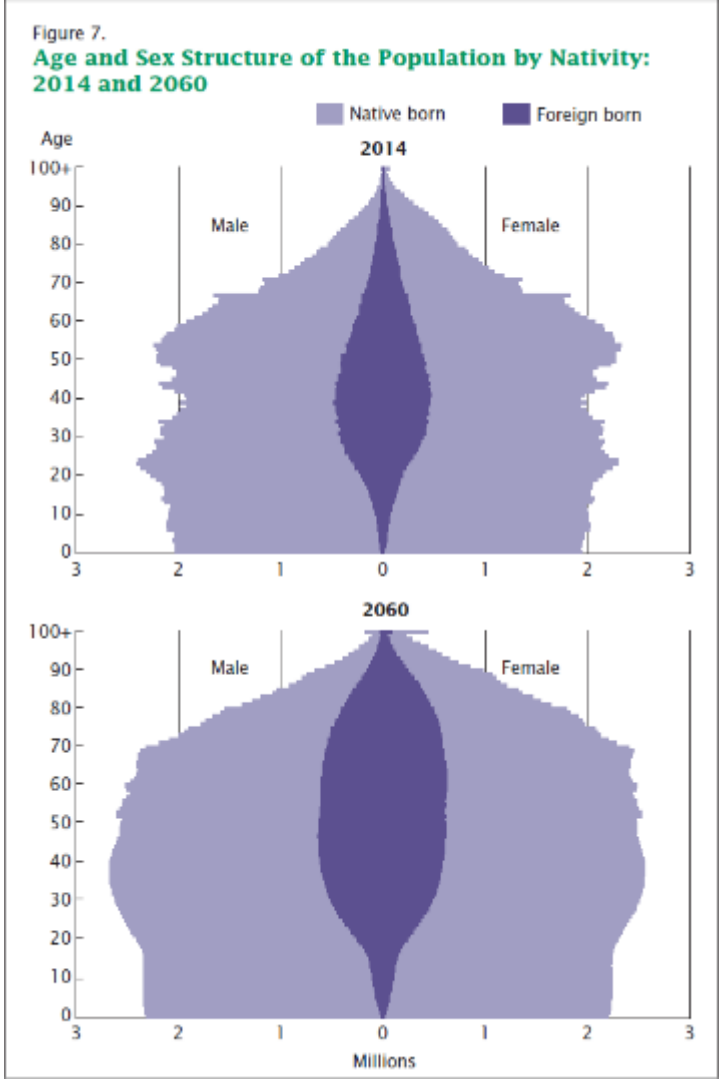
Objectives

- Describe adult immunization schedule

- Provide updates on impact of diseases among adults for which vaccines are available and current vaccination rates

U.S. Census Bureau, 2015



Figures 1 and 2 should be read with the footnotes that contain important general information and considerations for special populations.

Figure 1. Recommended immunization schedule for adults aged 19 years or older by age group, United States, 2017

Vaccine	19–21 years	22–26 years	27–59 years	60–64 years	≥ 65 years
Influenza[1]	1 dose annually				
Td/Tdap[2]	Substitute Tdap for Td once, then Td booster every 10 yrs				
MMR[3]	1 or 2 doses depending on indication				
VAR[4]	2 doses				
HZV[5]				1 dose	
HPV–Female[6]	3 doses				
HPV–Male[6]	3 doses				
PCV13[7]	1 dose				
PPSV23[7]	1 or 2 doses depending on indication				1 dose
HepA[8]	2 or 3 doses depending on vaccine				
HepB[9]	3 doses				
MenACWY or MPSV4[10]	1 or more doses depending on indication				
MenB[10]	2 or 3 doses depending on vaccine				
Hib[11]	1 or 3 doses depending on indication				

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

Recommended for adults with additional medical conditions or other indications

No recommendation

Figure 2. Recommended immunization schedule for adults aged 19 years or older by medical condition and other indications, United States, 2017

Vaccine	Pregnancy[1-4,9]	Immuno-compromised (excluding HIV infection)[3-7,11]	HIV infection CD4+ count (cells/μL)[3-7,9-11]		Asplenia, persistent complement deficiencies[7,10,11]	Kidney failure, end-stage renal disease, on hemodialysis[7,8]	Heart or lung disease, chronic alcoholism[7]	Chronic liver disease[7-9]	Diabetes[7,9]	Healthcare personnel[2,4,9]	Men who have sex with men[4,8,9]
			< 200	≥ 200							
Influenza[1]	1 dose annually										
Td/Tdap[2]	1 dose Tdap each pregnancy	Substitute Tdap for Td once, then Td booster every 10 yrs									
MMR[3]	contraindicated	1 or 2 doses depending on indication									
VAR[4]	contraindicated	2 doses									
HZV[5]	contraindicated			1 dose							
HPV–Female[6]		3 doses through age 26 yrs									
HPV–Male[6]		3 doses through age 26 yrs			3 doses through age 21 yrs						3 doses through age 26 yrs
PCV13[7]		1 dose									
PPSV23[7]		1, 2, or 3 doses depending on indication									
HepA[8]	2 or 3 doses depending on vaccine										
HepB[9]	3 doses										
MenACWY or MPSV4[10]	1 or more doses depending on indication										
MenB[10]	2 or 3 doses depending on vaccine										
Hib[11]	3 doses post-HSCT recipients only	1 dose									

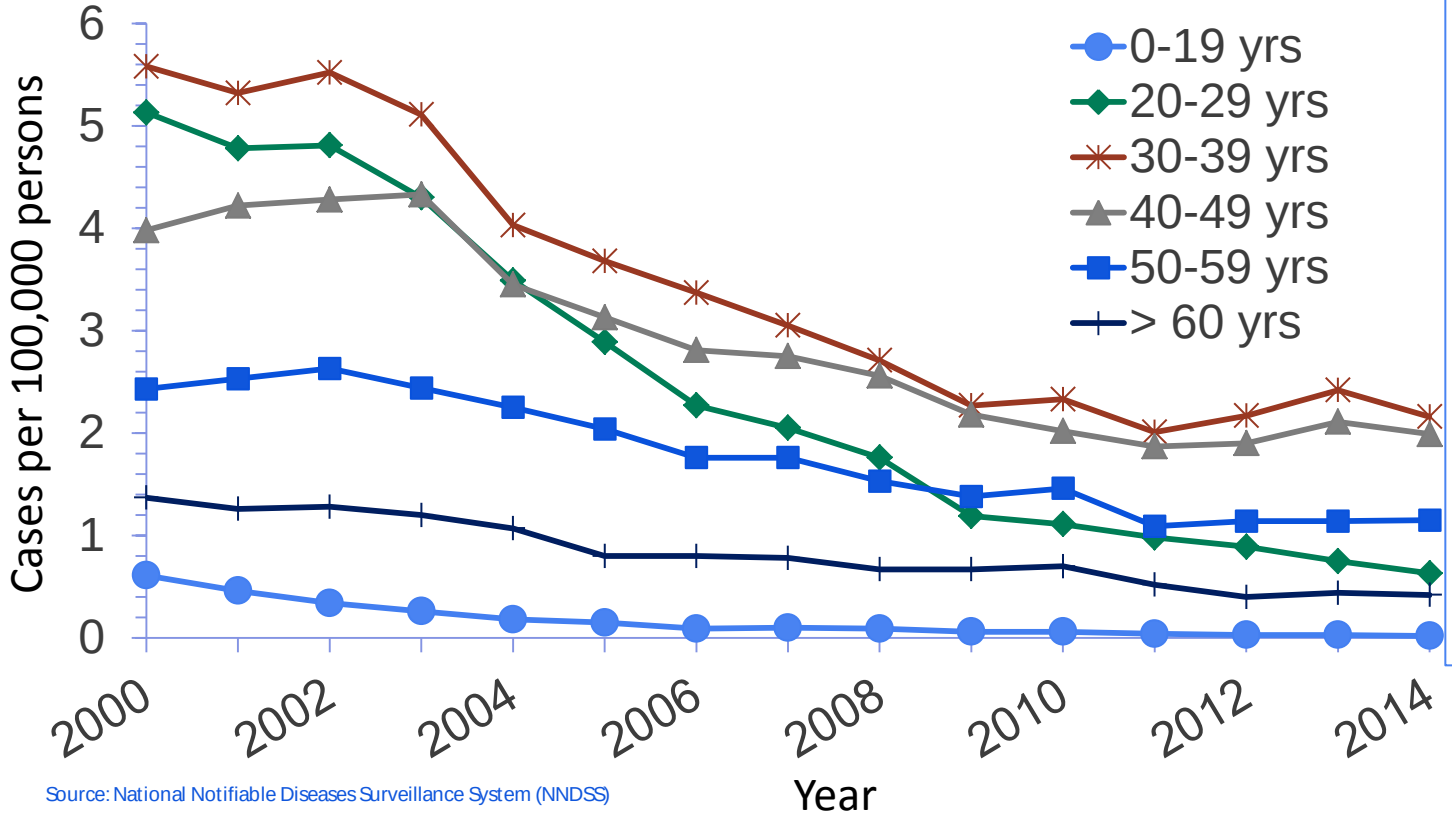
Recommended for adults who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection

Recommended for adults with additional medical conditions or other indications

Contraindicated

No recommendation

Incidence Of Acute Hepatitis B, By Age Group, Per 100,000 Persons— United States, 2000–2014

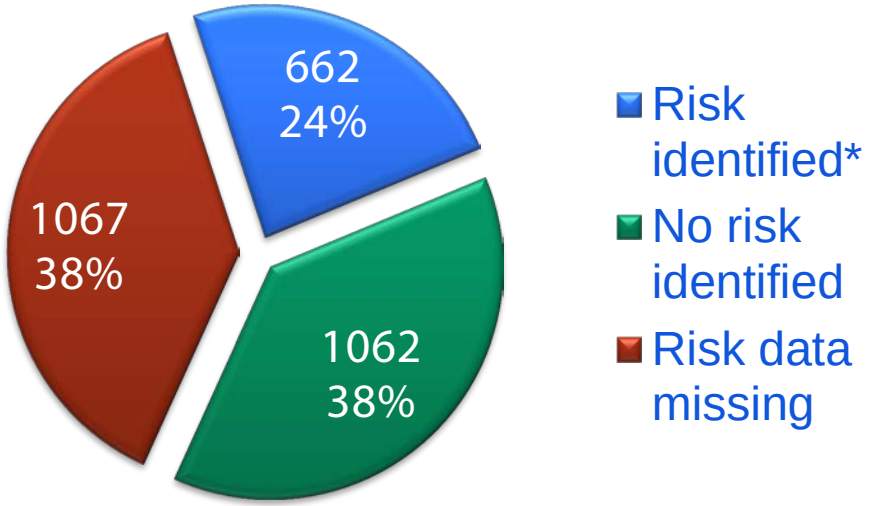


Source: National Notifiable Diseases Surveillance System (NNDSS)

- Estimated 19,200 cases acute Hepatitis B reported in US in 2014
- Persons with diabetes at twice risk of hepatitis B

Availability Of Risk Exposures/Behaviors Associated With Acute Hepatitis B – United States, 2014

- Most commonly reported risks were injection drug use, having multiple sexual partners, and surgery



* Includes case reports indicating the presence of at least one of the following risks 6 weeks to 6 months prior to onset of acute, symptomatic hepatitis B: 1) using injection drugs; 2) having sexual contact with suspected/confirmed hepatitis B patient; 3) being a man who has sex with men; 4) having multiple sex partners concurrently; 5) having household contact with suspected/confirmed hepatitis B patient; 6) occupational exposure to blood; 7) being a hemodialysis patient; 8) having received a blood transfusion; 9) having sustained a percutaneous injury; and 10) having undergone surgery.

Source: National Notifiable Diseases Surveillance System (NNDSS)

Hepatitis B Outbreaks Reported to CDC, 2008-15

- 23 outbreaks, 175 outbreak-associated cases, >10,700 persons notified for screening
- 17 outbreaks in long-term care facilities
  - at least 129 outbreak-associated HBV and approximately 1,600 at-risk persons notified for screening
  - 82% (14/17) outbreaks associated with infection control breaks during assisted monitoring of blood glucose (AMBG)
- 5 other outbreaks: free dental clinic in school gymnasium, an outpatient oncology clinic, a hospital surgery service, and two at pain remediation clinics
  - 46 outbreak-associated cases of HBV and > 8,500 persons at-risk persons notified for screening

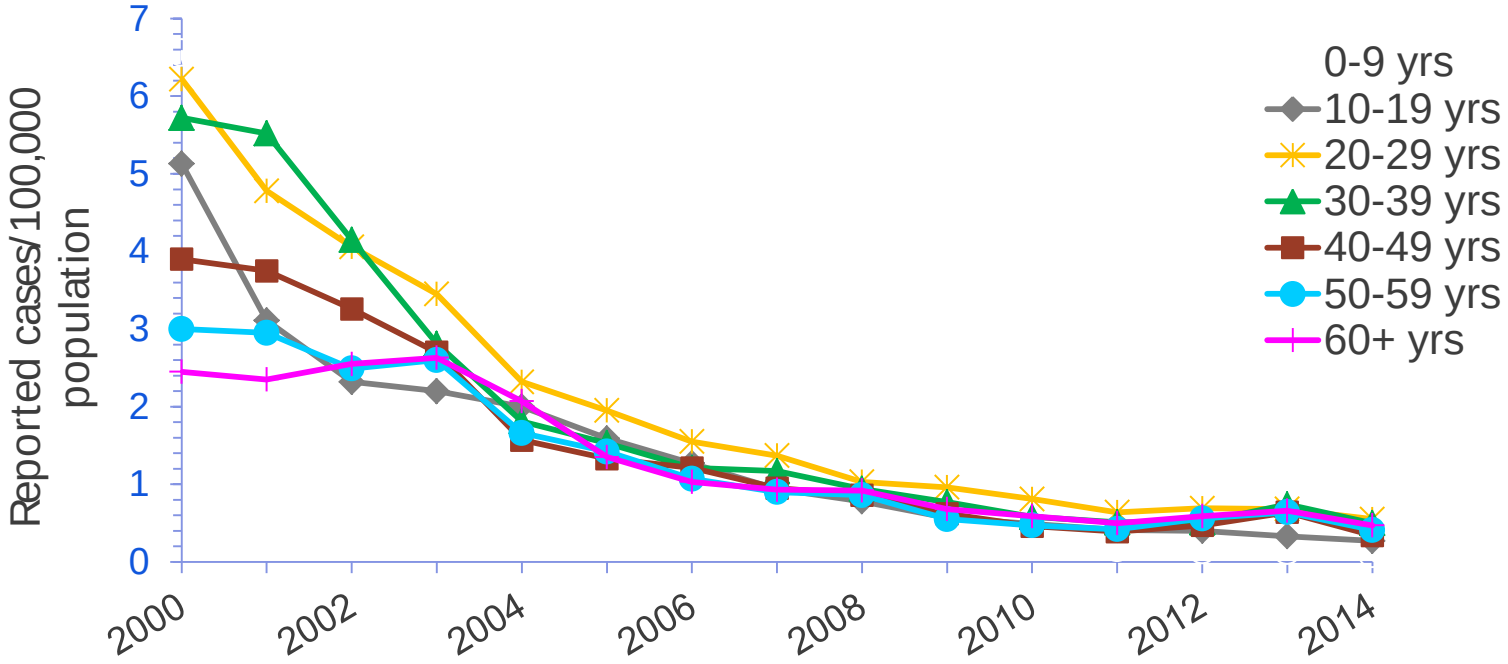
www.cdc.gov/hepatitis/statistics/healthcareoutbreaktable.htm

Impact of Vaccination – Hepatitis B

- In 2011, added adults with diabetes to those recommended for HepB vaccination
  - <60 years: vaccinate as soon as feasible after diagnosis of diabetes
  - 60 years and older: at provider discretion depending on risk of HVB, need for assisted blood glucose monitoring, likely immune response to vaccination
- 90% vaccine effectiveness (VE) after completing 3-dose series
- Effectiveness estimated to be lower in persons with diabetes with increasing age at time of vaccination
  - 90% VE age <40 years
  - 80% VE 41–59 years
  - 65% VE 60–69 years
  - <40% VE if 70 years or older with diabetes

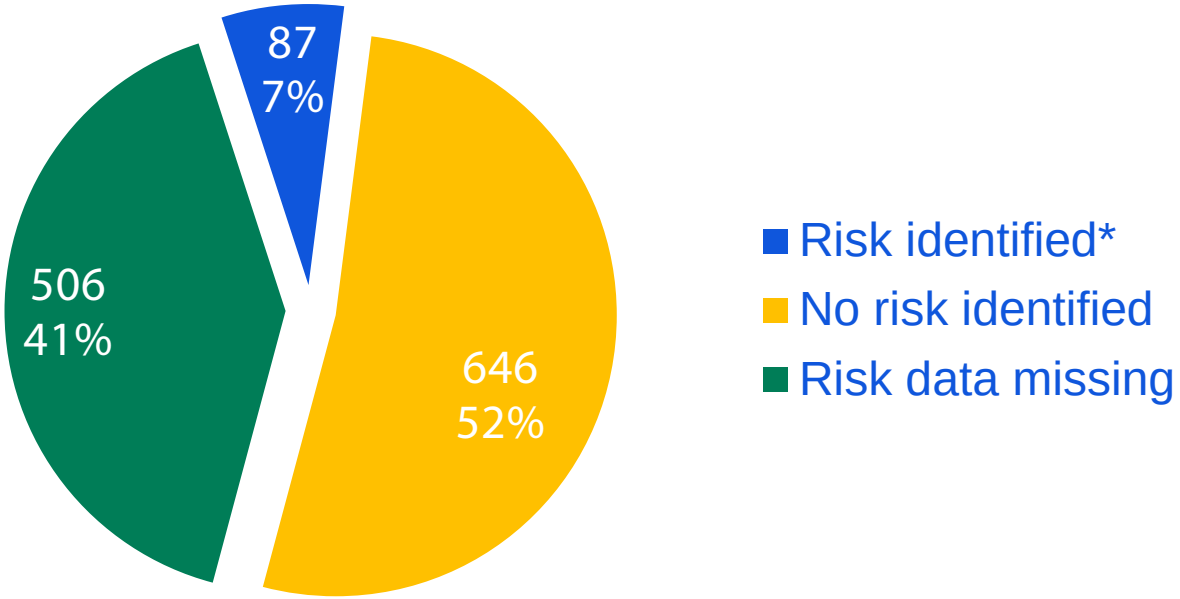
CDC. Use of hepatitis B vaccine for adults with diabetes mellitus. MMWR 2011;60:1709-1711.

Incidence Of Acute Hepatitis A, By Age Group — United States, 2000–2014



Source: CDC, National Notifiable Diseases Surveillance System (NNDSS)

Availability Of Risk Exposures/Behaviors Associated With Acute Hepatitis A — United States, 2014



- Among those with reported risk, most commonly reported were international travel, injection drug use, contact with daycare center, child or employee, and foodborne or waterborne outbreak.

Source: CDC, National Notifiable Diseases Surveillance System (NNDSS)

* Includes case reports indicating the presence of at least one of the following risks 2–6 weeks prior to onset of acute, symptomatic hepatitis A: 1) having traveled to hepatitis A-endemic regions of Mexico, South/Central America, Africa, Asia/South Pacific, or the Middle East; 2) having sexual/household or other contact with suspected/confirmed hepatitis A patient; 3) being a child/employee in day care center/nursery/preschool or having had contact with such persons; 4) being involved in a foodborne/waterborne outbreak; 5) being a man who has sex with men; and 6) using injection drugs.

Burden of Disease Among U.S. Adults for Selected Diseases with Vaccines Available - Zoster

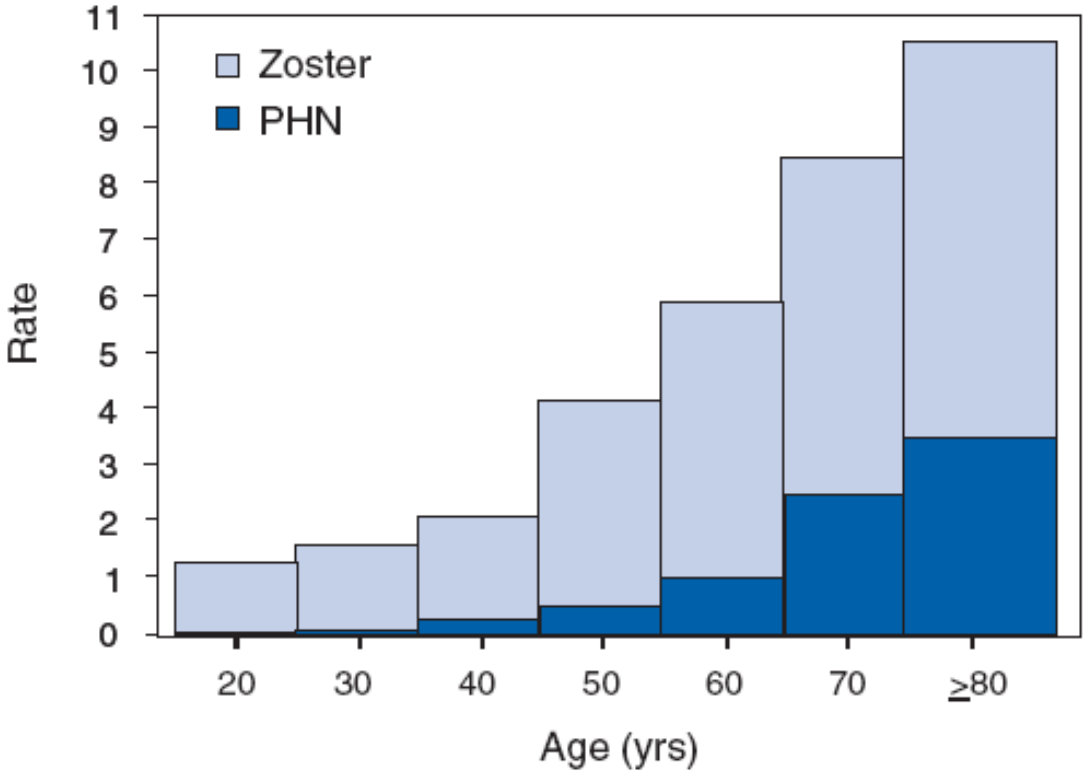
- **Zoster (shingles)[1]**
  - About 1 million cases of zoster annually U.S.
    - 10-11/1000 per year in persons ≥60 yrs
    - Lifetime risk 32%
  - Thoracic, cervical, and ophthalmic involvement are most common
  - Approximately 10-25% with complication herpes zoster ophthalmicus (HZO)
  - Risk of severe prolonged pain, post-herpetic neuralgia, increases with age

FIGURE 2. Case of herpes zoster ophthalmicus

Photo/MN Oxman, University of California, San Diego

1. CDC. Prevention of Herpes Zoster. MMWR 2008. 57(RR-5): 1-30.

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



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

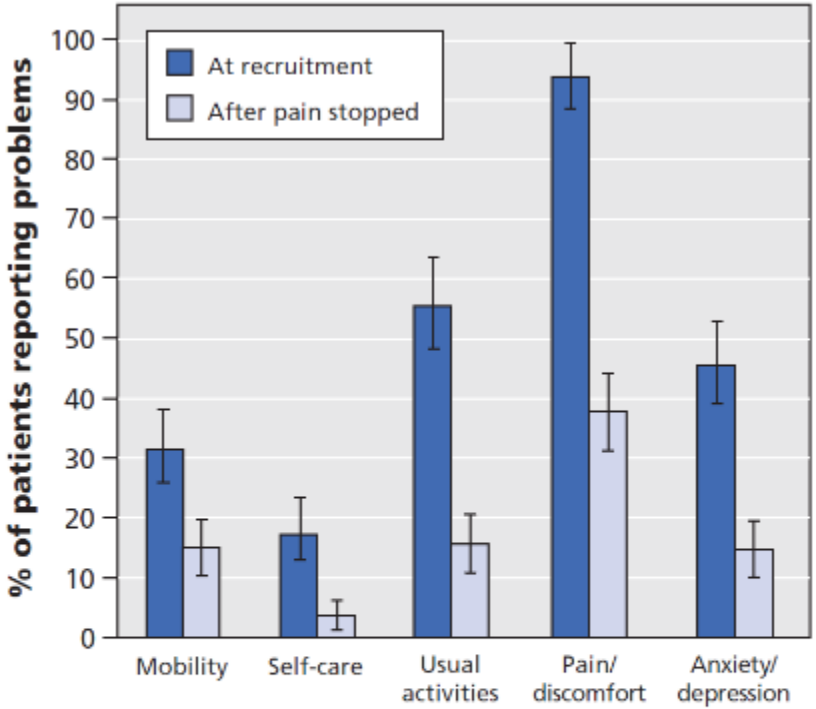


Figure 1: Impact of herpes zoster on health-related quality of life. Shown are the percentages of participants (n = 261) who reported problems in the EuroQol EQ-5D domains at the time of recruitment (< 14 days after rash onset) and after the pain stopped. Median duration of pain was 32.5 days. Error bars = 95% confidence intervals.

Drolet M, et al. The impact of herpes zoster and postherpetic neuralgia on health-related quality of life: a prospective study. CMAJ 2010.

Impact of Vaccination - Zoster

- Vaccine effectiveness varies by the disease outcome

- Zoster (Shingles) live attenuated vaccine effectiveness (VE):
    - 51% against shingles
    - 66% against post-herpetic neuralgia (PHN),
    - 80% against most prolonged and extreme cases of PHN[1]

1. Oxman MN, et al. NEJM 2005;352:2271-84.

Unlicensed Zoster Vaccine – Results of Clinical Trials Presented to Advisory Committee on Immunization Practices (ACIP)

- **Inactivated adjuvanted herpes zoster subunit vaccine**
  - Not licensed – Biologics License Application submitted to US FDA in October 2016
  - VE against shingles: 96% (95% CI=93-98%) with VE estimates similar for 50, 60, and 70 year old participants[1]
  - 17% of vaccinated and 3% of placebo with Grade 3 symptoms
- **Subsequent studies done on adults ≥70 years found VE=90% (CI 84-94%)[2]**
- **Points to need for improved platform for delivery of current and future adult vaccines and potential for additional vaccines with high VE in older adults**

1. Lal H, et al. NEJM 2015
2. Cunningham AL, et al NEJM 2016

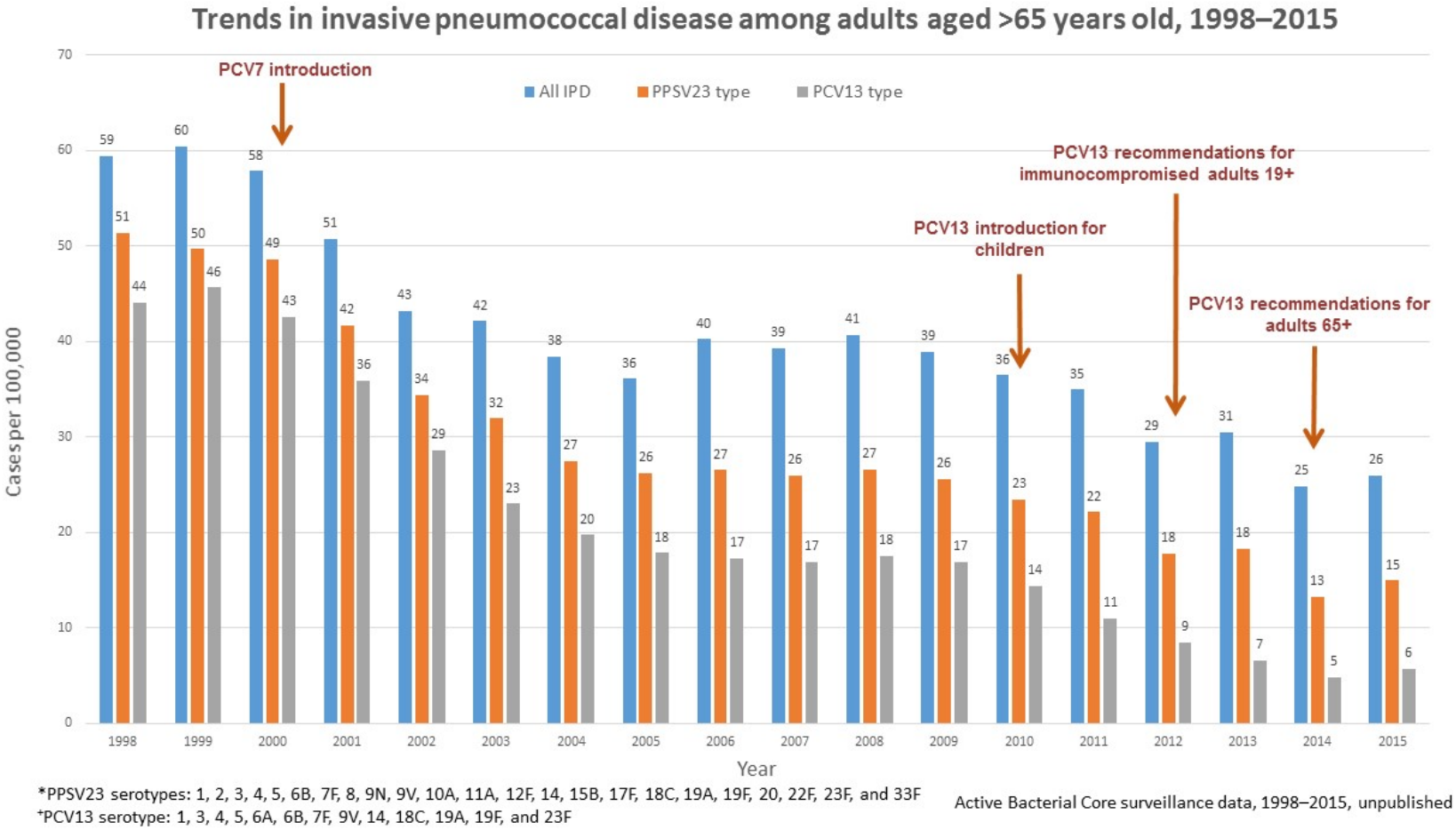
Burden of Disease – *Streptococcus pneumoniae*

- Significant declines invasive pneumococcal disease (IPD) since pneumococcal conjugate vaccines introduced in United States (PCV7 in 2000 and PCV13 in 2010) for children[1]

- For children <5 years of age:
  - 100 cases/100,000 in 1998 to 9 cases/100,000 in 2015.
  - IPD caused by PCV13 serotypes: 91/100,000 in 1998 to 2/100,000 in 2015.

- Adults ≥65 years with highest rates of IPD
  - 59 cases/100,000 in 1998 to 23 cases/100,000 in 2015
  - Reductions mostly attributable to the conjugate vaccines 1998-2015
    - PPSV vaccination first covered by Medicare in 1981[2]

1. www.cdc.gov/pneumococcal/surveillance.html
2. Hinman, et al. Financing immunizations in the United State. Clin Infect Dis (2004) 38 (10): 1440-1446.

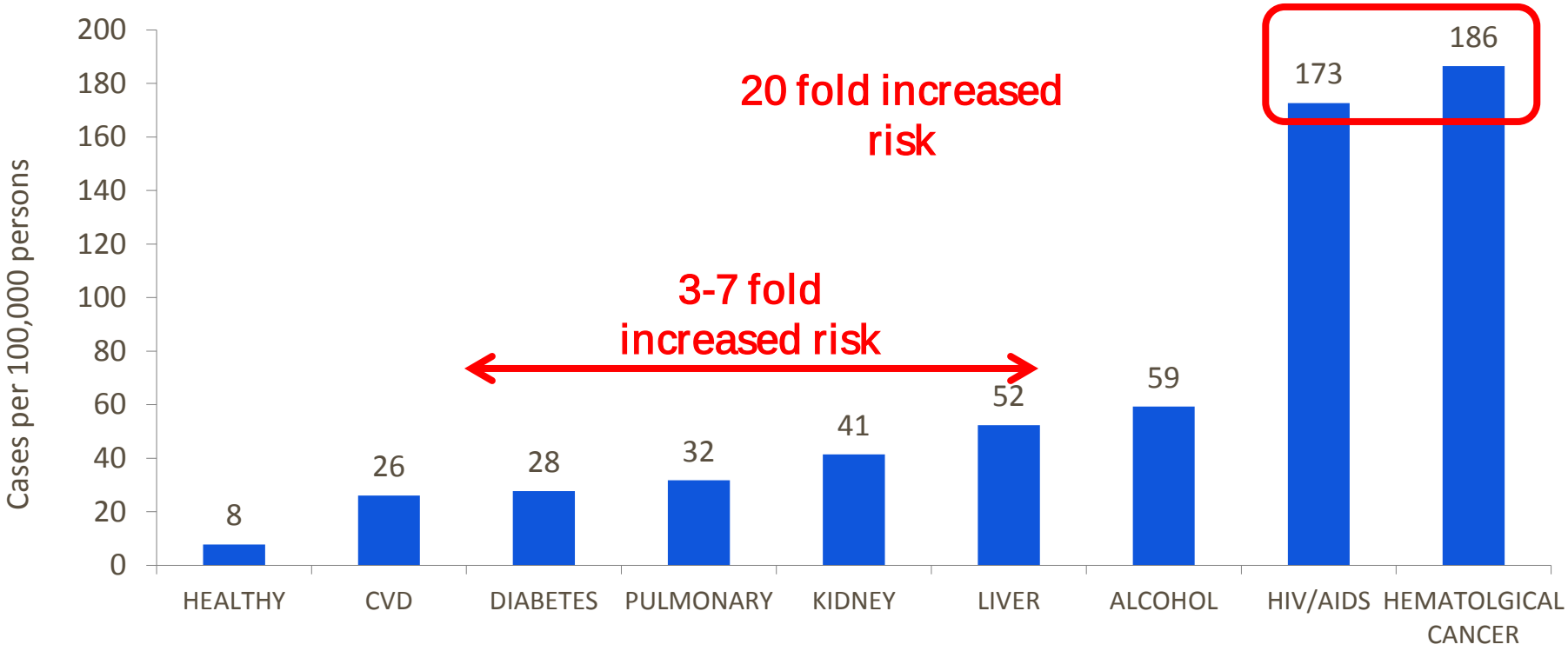


*PPSV23 serotypes: 1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19A, 19F, 20, 22F, 23F, and 33F
†PCV13 serotype: 1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, and 23F

Active Bacterial Core surveillance data, 1998–2015, unpublished

www.cdc.gov/abcs/reports-findings/survreports/spneu-types.html

Incidence of IPD in adults aged 18--64 years with selected underlying conditions, United States, 2009



Kyaw, JID 2005;192:377-86

Impact of Vaccination – Pneumococcal Vaccines

- PCV13 (pneumococcal conjugate vaccine):
  - 45% efficacy against vaccine-type pneumococcal pneumonia
  - 75% efficacy against vaccine-type invasive pneumococcal disease (IPD) among adults aged ≥65 years

- PPSV23 (pneumococcal polysaccharide)
  - 74% (CI 55-86%) in meta-analysis against IPD
  - Limited evidence regarding effective against non-IPD pneumonia

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

Receipt of claims for pneumococcal vaccination among Medicare beneficiaries ≥65 years, CMS, United States, September 2009-September 2015

Slide courtesy of Carla Black, CDC, Presented at National Immunization Conference 2016, Atlanta

* Denominator in each time period includes all beneficiaries continuously enrolled in Medicare parts A and B for the duration of the period.

Influenza Health Impact

- Influenza disease burden varies year to year
  - Millions of cases and average of 226,000 hospitalizations annually with >75% among adults[1]
  - 3,000-56,000 deaths annually, >90% among adults[2,4]
- Direct medical costs in U.S.: ~$10.4 billion[3]
- Add in loss of work and life: ~$87 billion

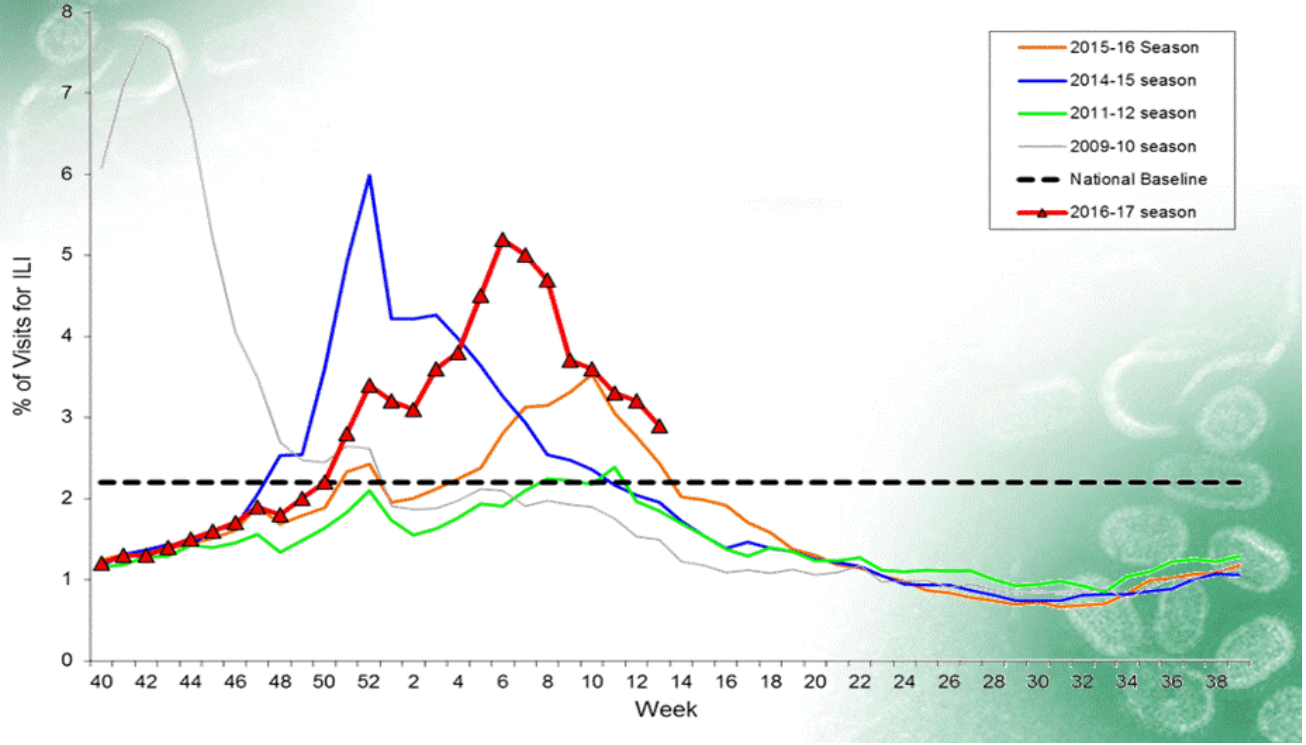
1. Thompson WW, et al. Influenza-Associated Hospitalizations in the United States. JAMA 2004; 292: 1333-1340
2. CDC. Estimates of deaths associated with seasonal influenza – United States, 1976-2007. MMWR. 2010;59(33):1057-1062.
3. Molinari, et al. The annual impact of seasonal influenza in the US: Measuring disease burden and costs. *Vaccine* 2007;25 :5086–5096.
4. www.cdc.gov/flu/about/disease/2015-16.htm.

FLUVIEW

A Weekly Influenza Surveillance Report Prepared by the Influenza Division

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Percentage of Visits for Influenza-like Illness (ILI) Reported by the U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet), Weekly National Summary, 2016-2017 and Selected Previous Seasons



FLUVIEW

A Weekly Influenza Surveillance Report Prepared by the Influenza Division

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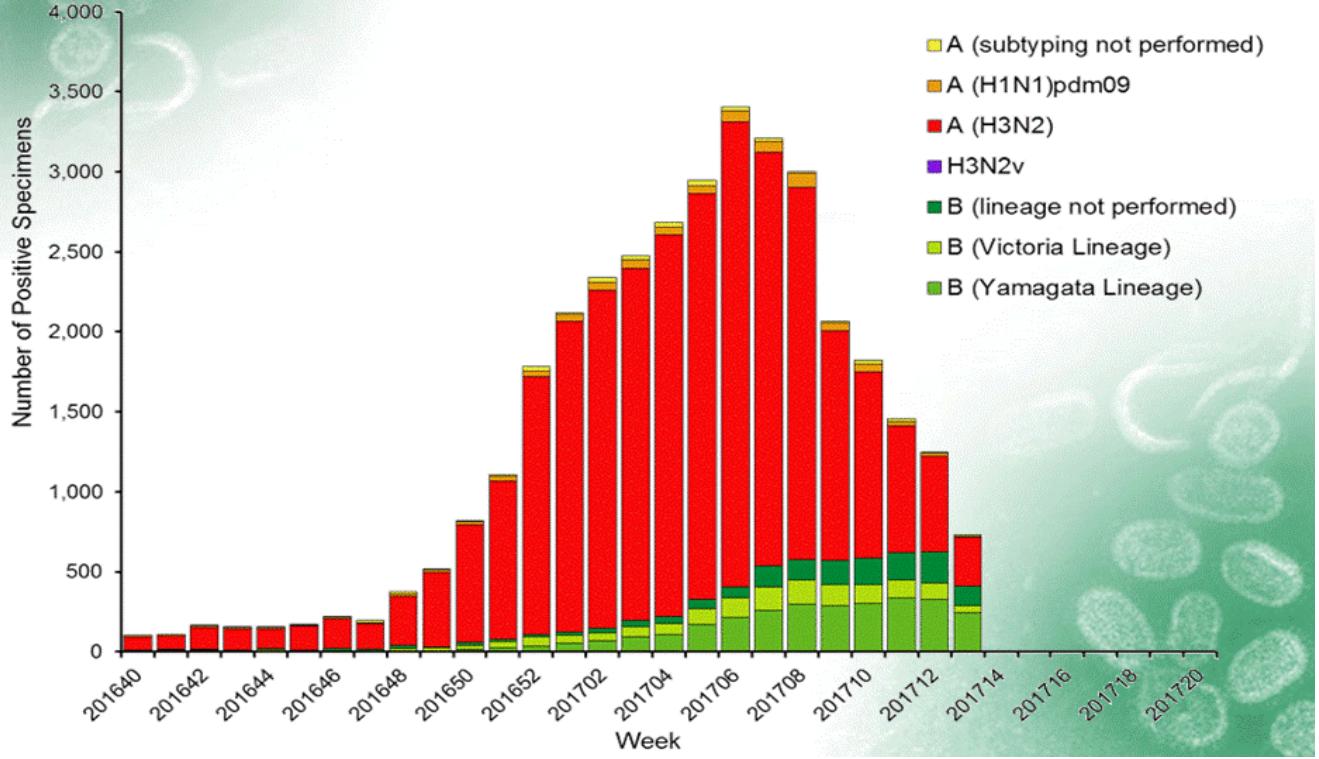
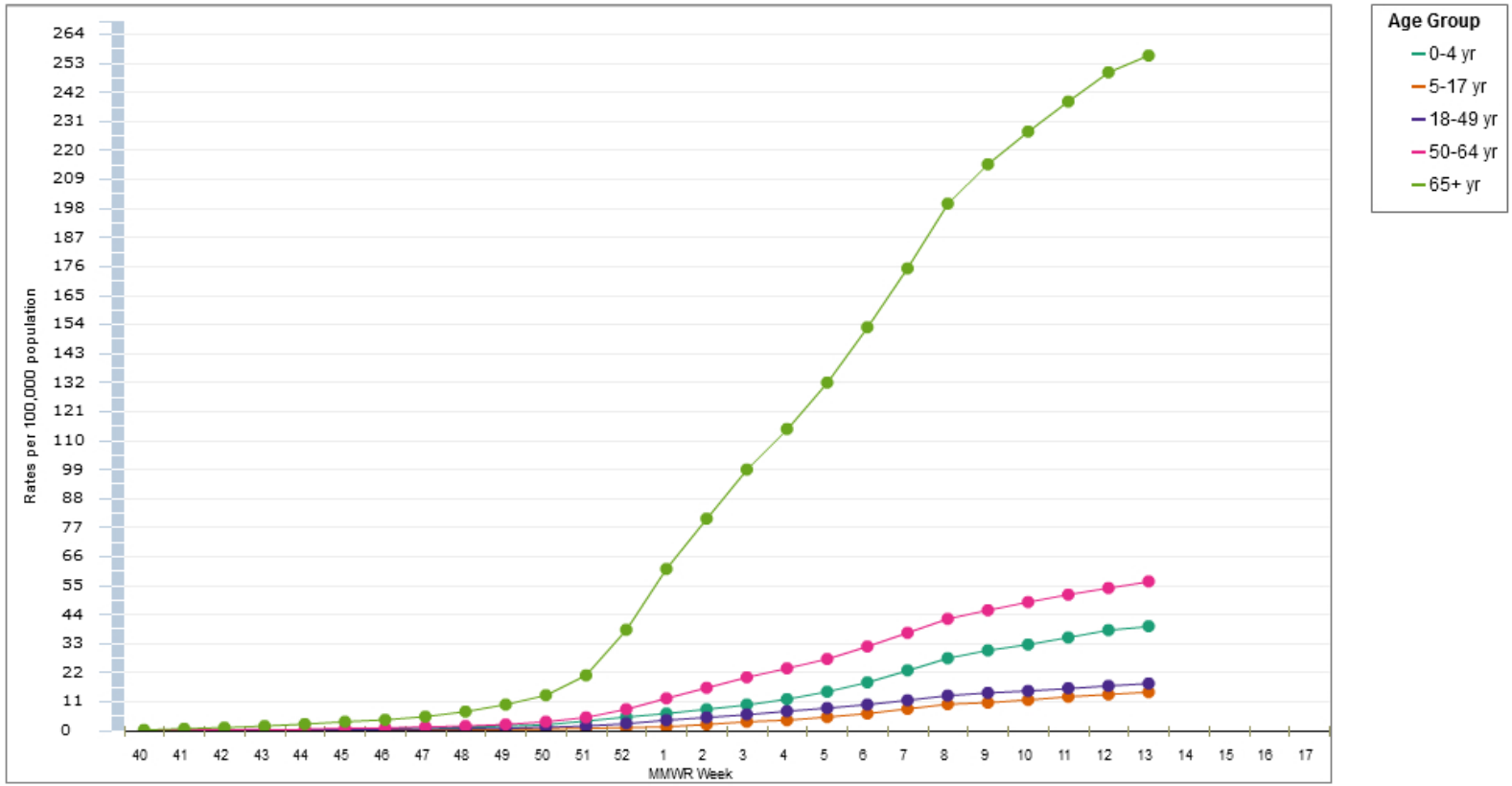
CENTERS FOR DISEASE CONTROL AND PREVENTION

Influenza Positive Tests Reported to CDC by U.S. Public Health Laboratories, National Summary, 2016-2017 Season



Laboratory-Confirmed Influenza Hospitalizations

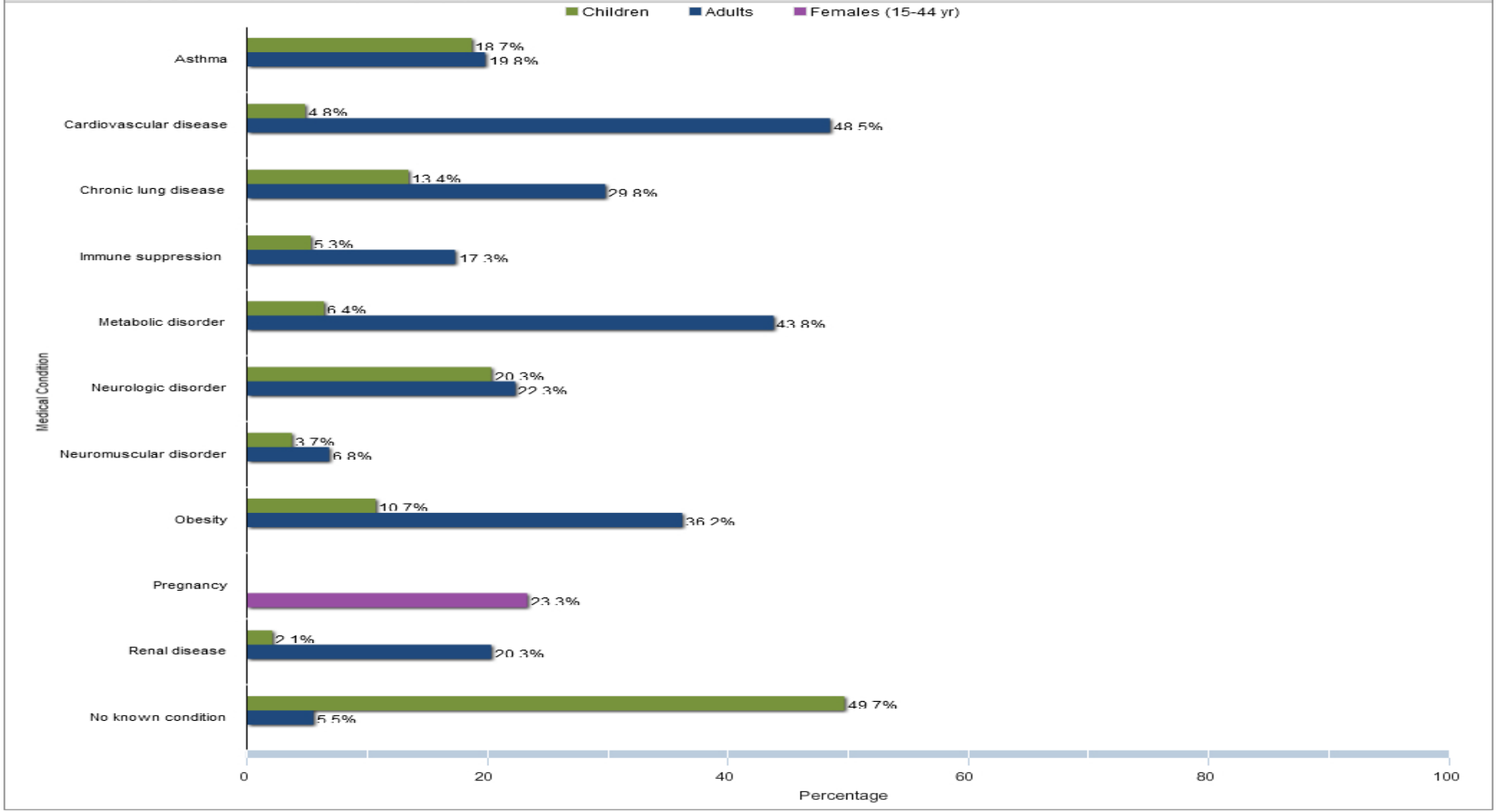
Preliminary cumulative rates as of Apr 01, 2017



Laboratory-Confirmed Influenza Hospitalizations

Preliminary data as of Apr 01, 2017

Selected Underlying Medical Conditions: 2016-17 Season

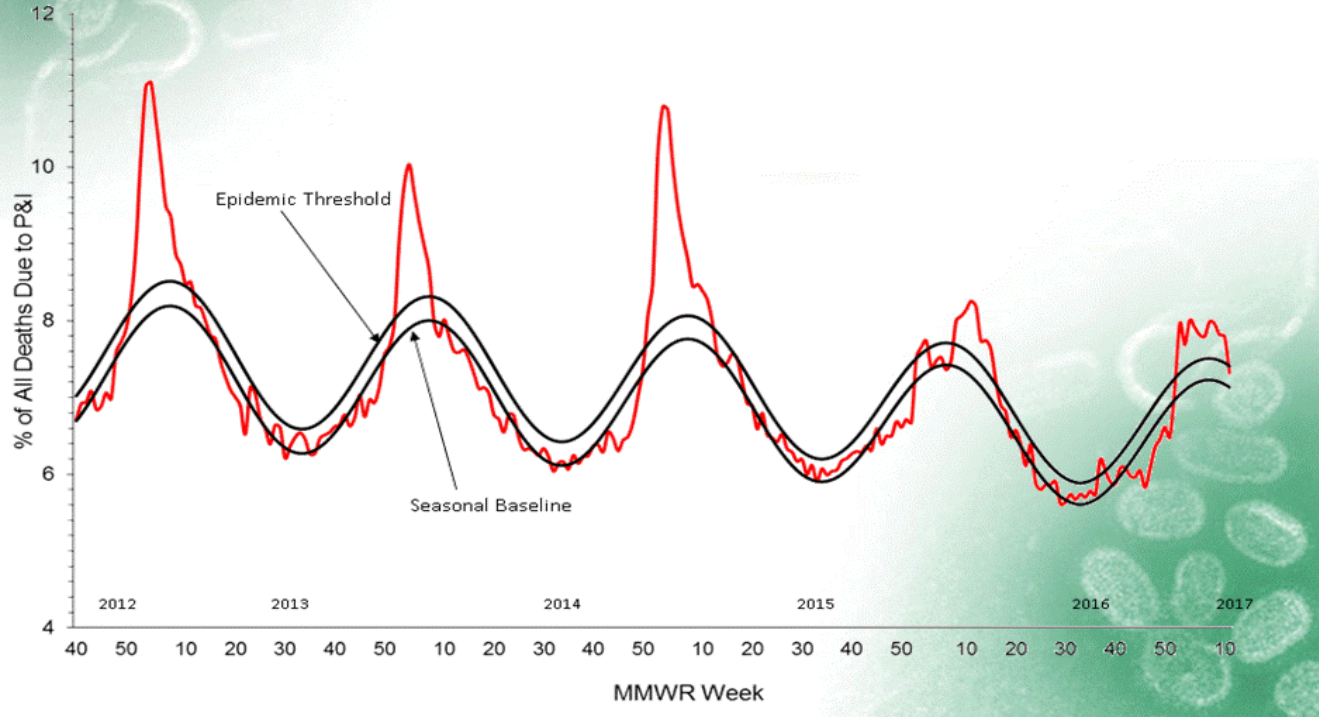


FLUVIEW

A Weekly Influenza Surveillance Report Prepared by the Influenza Division

Pneumonia and Influenza Mortality from the National Center for Health Statistics Mortality Surveillance System

Data through the week ending March 18, 2017, as of April 6, 2017

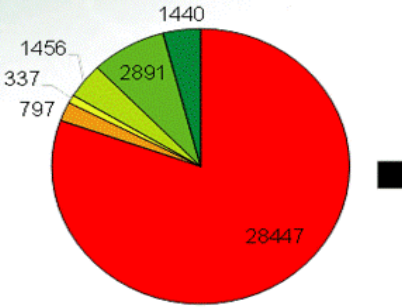


FLUVIEW

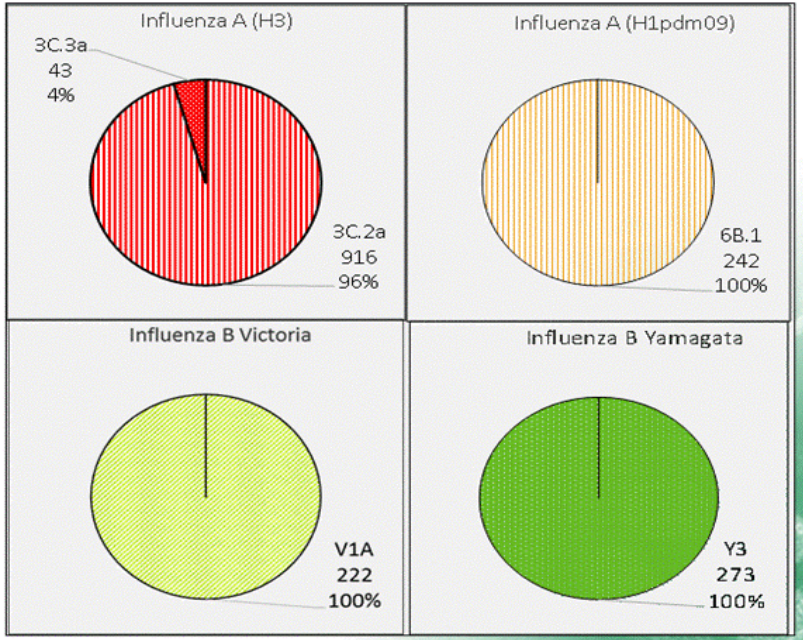
A Weekly Influenza Surveillance Report Prepared by the Influenza Division

CDC
Centers for Disease Control and Prevention

Influenza Positive Specimens Reported by U.S. Public Health Laboratories, Cumulative, 2016-2017 season



Sequence Results, by Genetic Group, of Specimens Submitted to CDC by U.S. Public Health Laboratories, Cumulative, 2016-2017 season

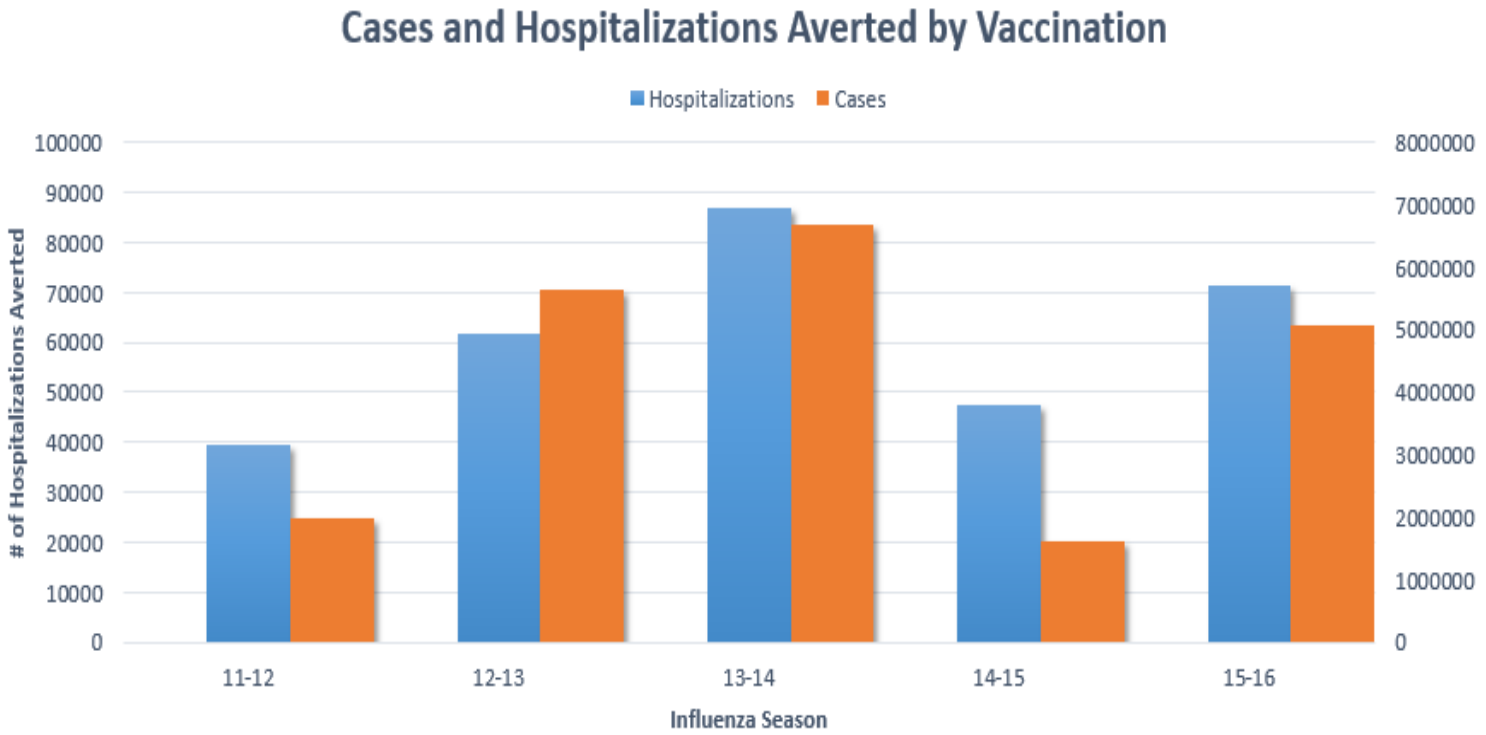


Impact of Vaccination - Influenza

- Vaccine Effectiveness (VE) varies based on antigenic match and age and health of person being vaccinated
  - ~30% VE in adults ≥65 years against medically attended influenza when good match[1]
  - Generally higher VE in younger adults and children compared to older adults when good match
    - Reduces antibiotic use, medical visits, loss work
- Preliminary VE estimate for 2016-17[2]
  - 48% (37 to 57) for all ages combined
  - 46% (4 to 70) among adults 65 years and older

1. CDC. Prevention and Control of Seasonal Influenza: Recommendations of the ACIP – U.S., 2016-17. MMWR 2016
2. www.cdc.gov/mmwr/volumes/66/wr/mm6606a3.htm

Impact of Influenza Vaccination, Illnesses and Hospitalizations Prevented, 2011-2016



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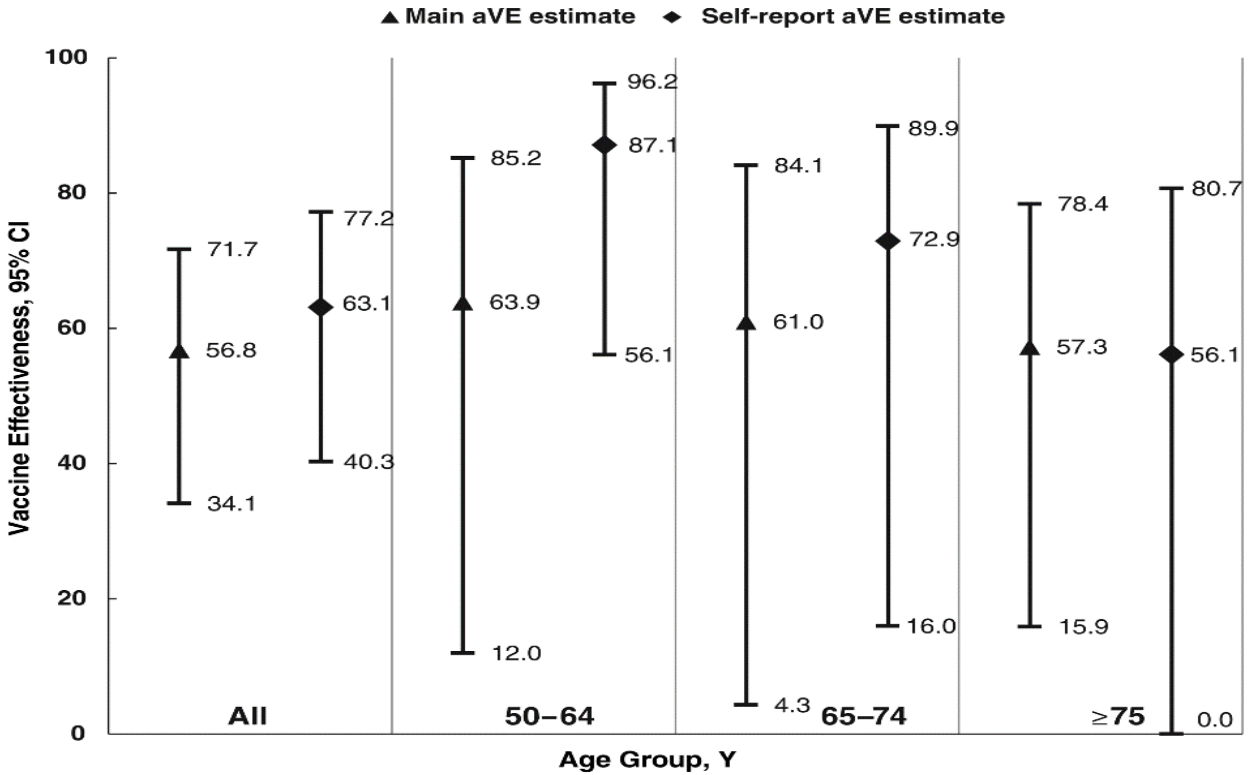
Case-Control Study of Vaccine Effectiveness in Preventing Laboratory-Confirmed Influenza Hospitalizations in Older Adults, United States, 2010–2011

Clin Infect Dis. 2016;63(10):1304-1311. doi:10.1093/cid/ciw512



Sensitivity analysis examining the effect of including self-reported influenza vaccination, without date and location, in adjusted estimates of influenza vaccine effectiveness (VE) in preventing hospitalization among adults aged ≥50 years in US Emerging Infections Program hospital surveillance sites, 2010–2011 influenza season.

Impact of Vaccination - Influenza

- Effective in preventing major cardiac events among persons with existing cardiovascular disease[1-4]
  - Meta-analysis of **case control studies**: [3]
    - Acute respiratory illness/ILI increases acute MI risk by 2-fold
    - Influenza vaccination efficacy (VE) 29% (95% CI=9-44%) against acute MI
  - Meta-analysis of **randomized studies** of persons with existing CVD:[4] influenza VE 36% (95% CI=14% to 53%)

1. CDC. Prevention and Control of Seasonal Influenza: Recommendations of the ACIP – U.S., 2014-15 Influenza Season. MMWR 2014; 63(32); 691-697.
2. American College of Cardiology recommendations for secondary prevention of atherosclerotic cardiovascular disease.
3. Barnes M, et al. Acute myocardial infarction and influenza: a meta-analysis of case–control studies. Heart 2015;101:1738–1747.
4. Udell JA, et al. Association between influenza vaccination and cardiovascular outcomes in high-risk patients: a meta-analysis. JAMA 2013;310:1711–20.

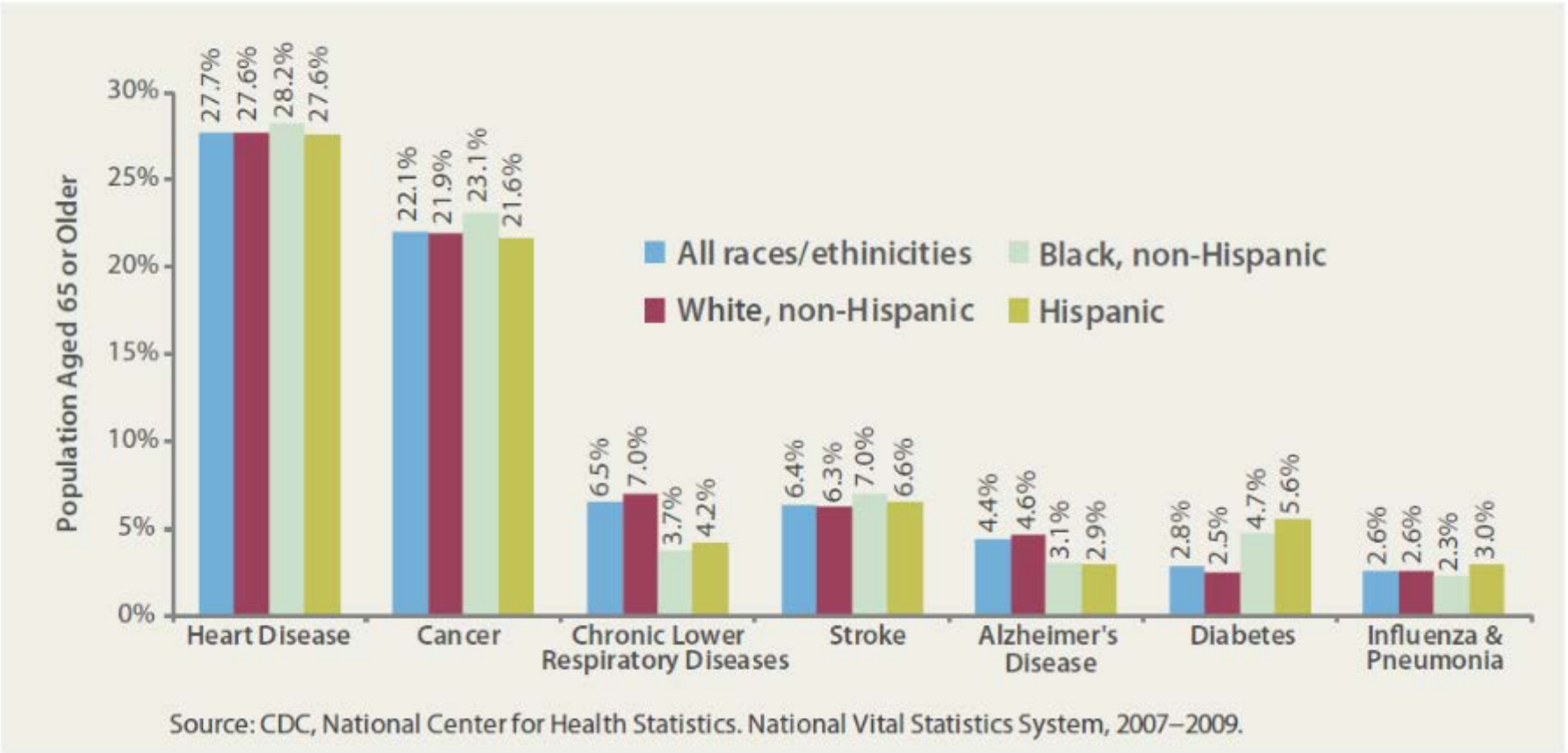
Impact of Vaccination - Influenza

- “We calculated a pooled VE of 29% (95% CI 9% to 44%) in preventing AMI, on a par with or better than accepted AMI preventive measures, with the estimates of the efficacy of statins for secondary prevention of 36%, anti-hypertensives of 15%–18% and smoking cessation interventions of 26%.”[1]

- Influenza vaccination recommended as secondary prevention by American College of Cardiology and American Heart Association

1. Udell JA, et al. Association between influenza vaccination and cardiovascular outcomes in high-risk patients: a meta-analysis. JAMA 2013;310:1711–20.

Figure 2. Chronic conditions were the leading causes of death among U.S. adults aged 65 or older in 2007–2009



CDC. The State of Aging and Health in America (SAHA), 2013 report

Vaccination of Adults 65 Years and Older

- High dose influenza vaccine
  - Inactivated trivalent vaccine – 4 times the antigen as standard dose (60 µg antigen per vaccine strain vs 15 µg in standard dose)
  - Licensed 2009 based on improved immunogenicity compared to standard dose for influenza A (H1N1) and A (H3N2) and non-inferior immune response for influenza B.
  - RCT found efficacy of high-dose relative to standard dose vaccine of 24% (CI 9.7-36.5) against **laboratory confirmed influenza**
  - Cohort study by CMS comparing persons with a **claim** for standard versus high dose vaccine found 22% (CI 16-27%) reduction in **influenza-related hospitalization**

Falsey, et al. J Infect Dis 2009
DiazGranados, et al. NEJM 2015.
Izurieta, et al Lancet Infect Dis 2015.

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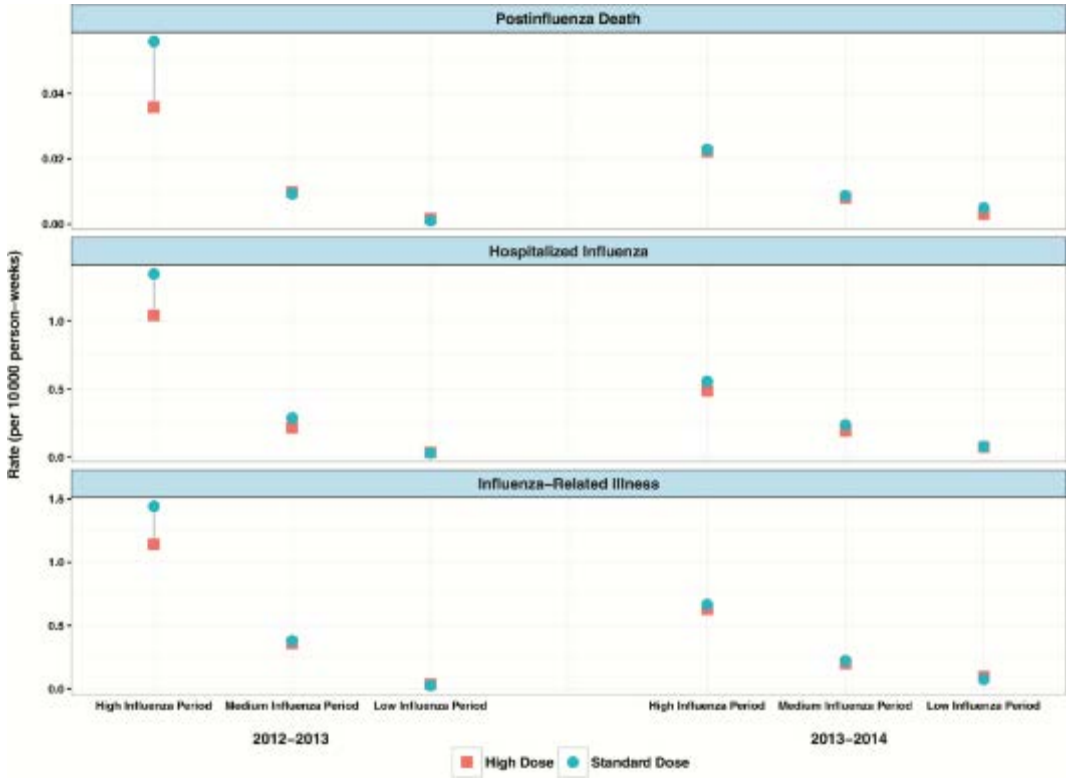
From: **Comparative Effectiveness of High-Dose Versus Standard-Dose Influenza Vaccines Among US Medicare Beneficiaries in Preventing Post-influenza Deaths During 2012–2013 and 2013–2014** Shay et al. J Infect Dis. Published online March 02, 2017.



Outcome rates (per 10000 person-weeks) for each of 3 influenza outcomes, by influenza season and during periods of high, medium, and low influenza activity.

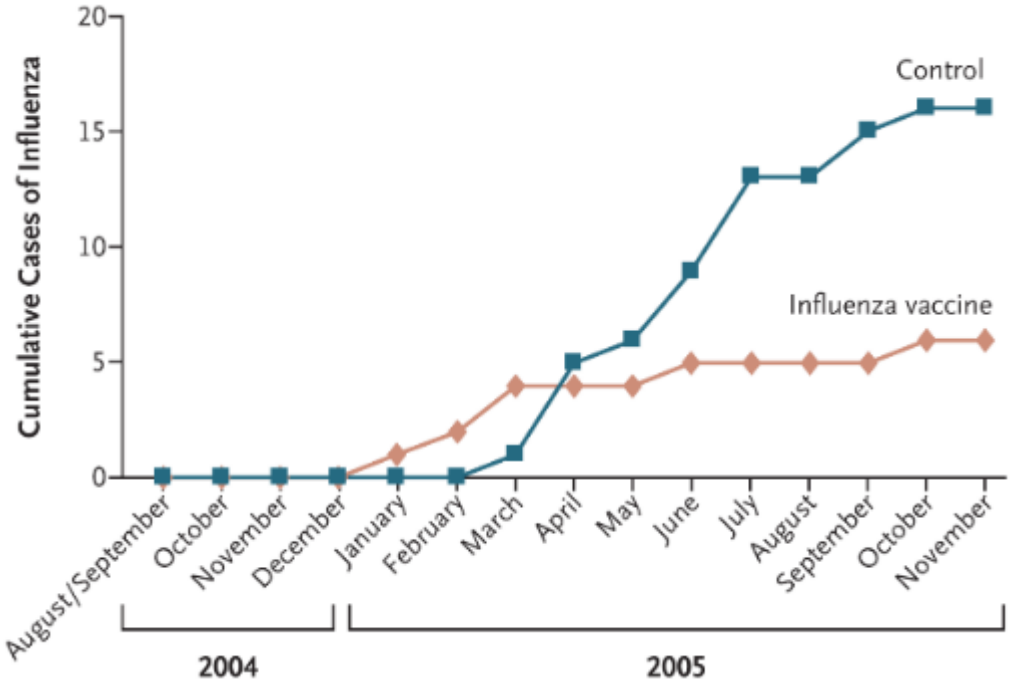
Vaccination of Adults 65 Years and Older

- Adjuvanted inactivated trivalent influenza vaccine
  - MF-59 adjuvant is oil-in-water emulsion
  - Licensed in Europe for many years
  - Licensed in US in November 2015 based on immunogenicity $\geq$ 65 yrs
  - No RCT in older adults, however clinical efficacy trial of quadrivalent MF-59 vaccine post-licensure required

- Cohort study in Italy using administrative database estimated 25% (CI 2-43) lower risk influenza-related hospitalization for MF-59 adjuvanted vaccine vs non-adjuvanted influenza vaccine

FDA accelerated approval letter http://www.fda.gov/BiologicsBloodVaccines/SafetyAvailability/VaccineSafety/ucm473989.htm.
Black S. Safety and effectiveness of MF-59 adjuvanted influenza vaccines in children and adults. Vaccine 2015;335:B3-B5.
Mannino S, et al. Effectiveness of adjuvanted influenza vaccination in elderly subjects in northern Italy. Am J Epidemiol. 2012;176(6):527-33.

Influenza Vaccine during Pregnancy Protects Infants < 6 Months of Age from Laboratory-Proven Influenza



Zaman et al., N Engl J Med 359:1555-64, 2008

Maternal Influenza Vaccination Effects on Fetus/Newborn

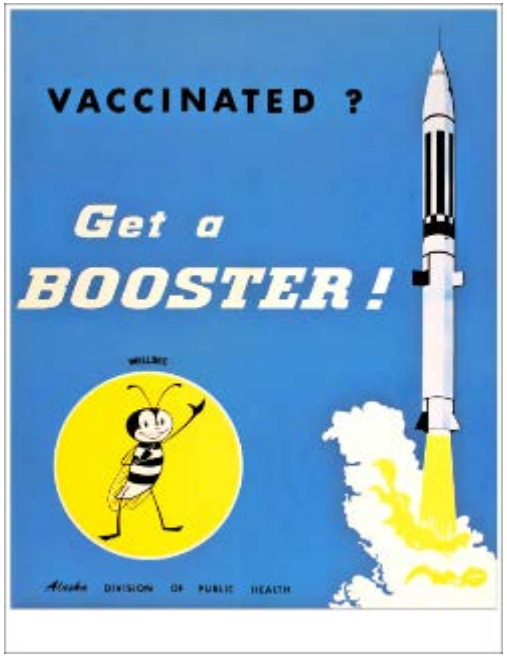
- **Observational study from Georgia PRAMS[1]**
  - **Infants whose mothers who received influenza vaccine prenatally were less likely to be preterm (aOR=0.60, 95% CI 0.38-0.94) and SGA (aOR= 0.31, 95% CI 0.13-0.75).**

- **Observational study from Ontario[2]**
  - **Infants whose mothers received H1N1 vaccine prenatally less likely to be SGA (aRR=0.90; 95% CI 0.85, 0.96) or preterm (<32 weeks) (aRR = 0.73; 95% CI = 0.58, 0.91). Fetal loss aRR = 0.66; 95% CI = 0.47, 0.91.**

- **Observational study: Kaiser Permanente[3]**
  - **Infants whose mothers who received H1N1 vaccine prenatally had 37% lower odds of being born preterm (aOR 0.63; 95%CI 0.47-0.84).**

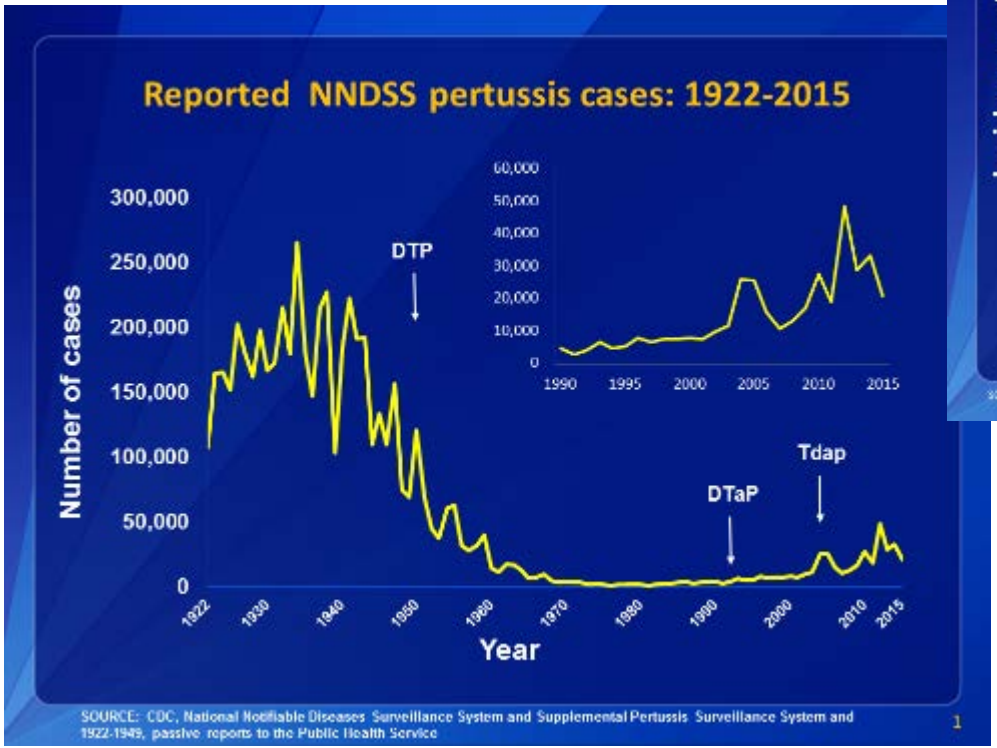
SGA=small for gestational age; aOR=adjusted odds ratio; aRR=adjusted relative risk.

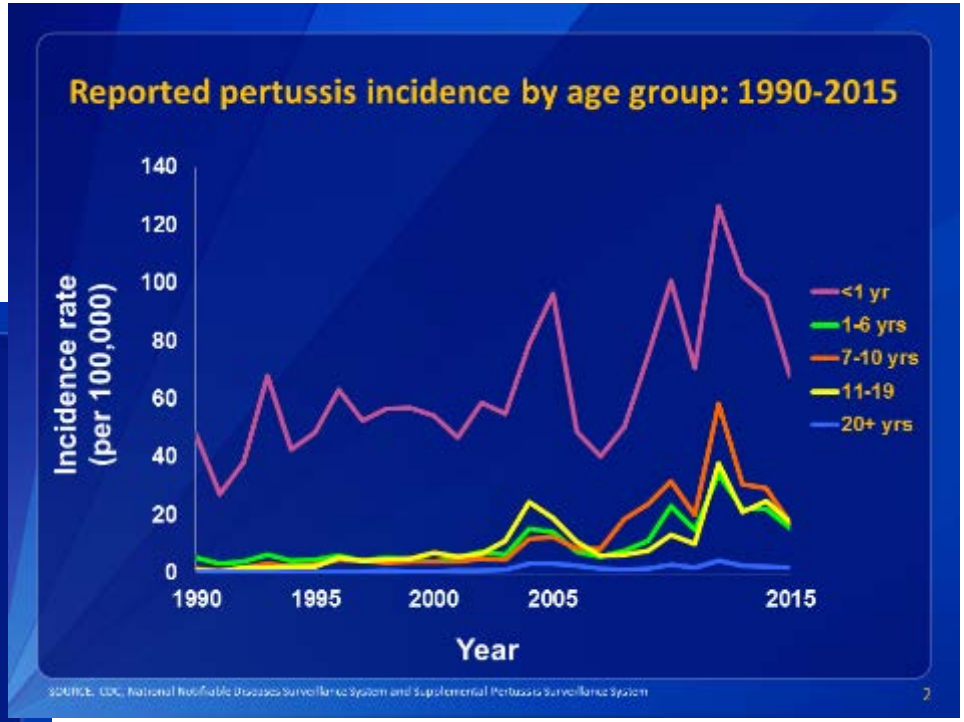
Pertussis (Whooping Cough)



- Caused by *Bordetella pertussis*
- Infection leads to respiratory tract inflammation and difficulty clearing pulmonary secretions
- ~21,000 cases reported in 2015, 22% in adults
- Most severe cases among infants – complications among hospitalized infants: apnea (61%), pneumonia (23%), seizures (1.1%), death (1%), and encephalopathy (0.3%)
- Complications in adults: pneumonia (2%), weight loss (33%), urinary incontinence (28%), syncope (6%), and rib fractures from severe coughing (4%)
- Pregnant women recommended to get Tdap vaccine 3rd trimester *each pregnancy* to protect infants
    - Other adults should have a single dose of Tdap vaccine

Pertussis cases reported in US by year and age group, 1990-2015





- Source: National Notifiable Disease Surveillance System (NNDSS)

www.cdc.gov/pertussis/surv-reporting.html

Effectiveness of Maternal Pertussis Vaccination -- United Kingdom

- Observational study
- Vaccine effectiveness (VE) calculated by comparing vaccination status for mothers of confirmed cases with estimates of vaccine coverage for national population of pregnant women

Effectiveness of maternal pertussis vaccine for infants <3 months of age at onset

Vaccine effectiveness		Timing of maternal vaccination
91%	(83-95)	At least 28 days before birth
38%	(-95-80)	0-6 days before or 1-13 days after birth

Amirthalingam, et al. Lancet. 2014, 384(9953):1521-8

U.S. Tetanus Surveillance 2001-2008

TABLE 1. Number and rate* of tetanus cases, number of known deaths, and case-fatality rate (CFR), by tetanus toxoid--containing vaccination status and age group --- United States, 2001--2008

Age group (yrs)	Previous vaccination with tetanus toxoid--containing vaccine										Total		Average annual rate	No. known deaths	CFR† (%)
	Unknown		0 dose		1 dose		3 doses		≥4 doses						
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.§	(%)			
5--19	6	(27.3)	10	(45.5)	1	(4.6)	1	(4.6)	4	(18.2)	**22**	**(9.4)**	0.04	0	---
20--34	20	(58.8)	3	(8.8)	3	(8.8)	1	(2.9)	7	(20.6)	**34**	**(14.6)**	0.07	0	---
35--49	37	(59.7)	5	(8.1)	9	(14.5)	2	(3.2)	9	(14.5)	**62**	**(26.6)**	0.12	4	(7.5)
50--64	30	(69.8)	4	(9.3)	6	(14.0)	0	---	3	(7.0)	**43**	**(18.5)**	0.11	2	(5.4)
≥65	48	(67.6)	14	(19.7)	7	(9.9)	1	(1.4)	1	(1.4)	**71**	**(30.5)**	0.23	20	(31.3)
Total	**141**	**(60.5)**	**37**	**(15.9)**	**26**	**(11.2)**	**5**	**(2.2)**	**24**	**(10.3)**	**233**	**(100.0)**	**0.10**	**26**	**(13.2)**

* Per 1 million population.

† Based on 197 cases with known outcomes.

§ Includes one nonfatal case in a neonatal patient who received no vaccine doses.

www.cdc.gov/mmwr/preview/mmwrhtml/mm6012a1.htm

Measles

- Although year-round transmission eliminated from US, cases still reported in U.S., including among adults.
  - Most cases importation-related
- January 1 to March 25, 2017, 28 cases reported from 10 states (CA, CO, FL, MI, NE, NJ, NY, PA, UT, WA)

Number of measles cases by year since 2010

Year	Cases
2010	63
2011	220
2012	55
2013	187
2014	667
2015	188
2016*	70
2017**	28

*Cases as of December 31, 2016. Case count is preliminary and subject to change.

Cases as of March 25, 2017. Case count is preliminary and subject to change. **Data are updated monthly.

Source: Morbidity and Mortality Weekly Report (MMWR), Notifiable Diseases and Mortality Tables

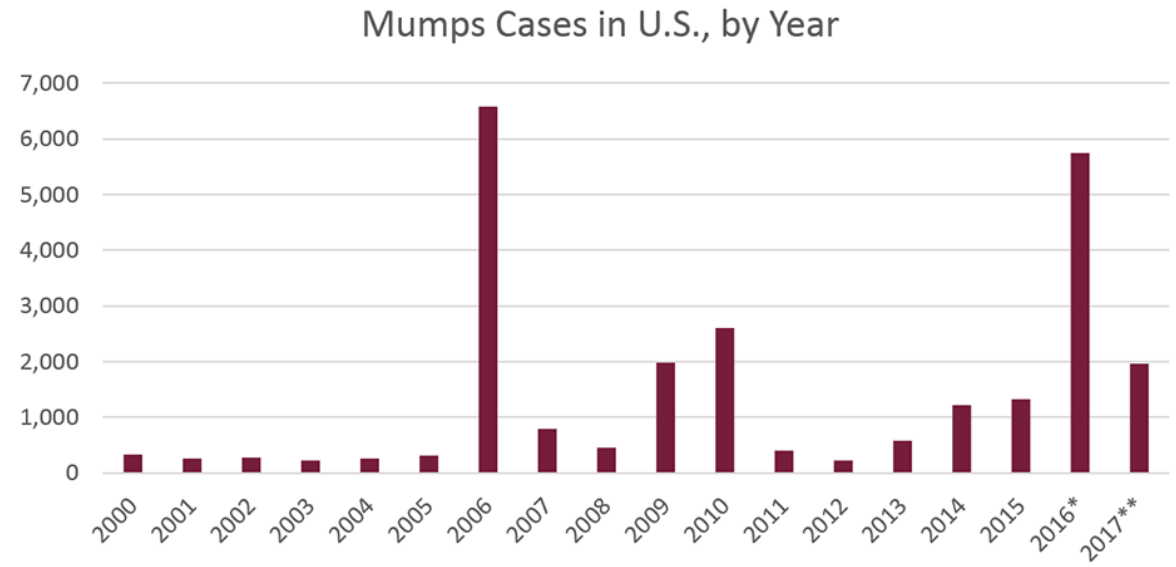
Measles

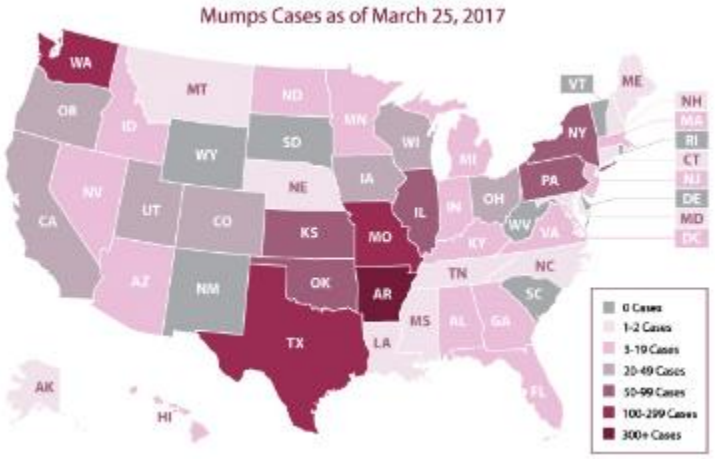
- Important to be able to recognize quickly since highly transmissible
- Incubation period 7-21 days,
- Clinical features: fever, cough, coryza, conjunctivitis
  - Koplick spots (small, red, irregularly-shaped spots with blue-white centers on the mucosal) followed by maculopapular rash.
- Complications can include pneumonia (1 in 20), encephalitis (1 in 1,000)
  - Most often in children <5 and adults ≥20 years

Mumps

- Most common symptoms include: fever, headache, muscle aches, fatigue, and swollen and tender salivary glands on one or both sides (parotitis)
- Symptoms typically 16-18 days after infection, range from 12-25 days
- Some people who get mumps have very mild or no symptoms
- Most people with mumps recover completely in a few weeks.
- Complications: orchitis in 3.3-10% of adolescent and adult males
  - Very rare complications (≤1%): mastitis, oophoritis, pancreatitis, deafness, meningitis, and encephalitis
  - Death exceedingly rare
- Recent outbreaks often among college students

Mumps





- Recent outbreaks often among college students
- Factors contributing to transmission included crowded settings like dormitories, and exposure to saliva from an infected person

Cancers Caused by HPV per Year, U.S., 2009-2013

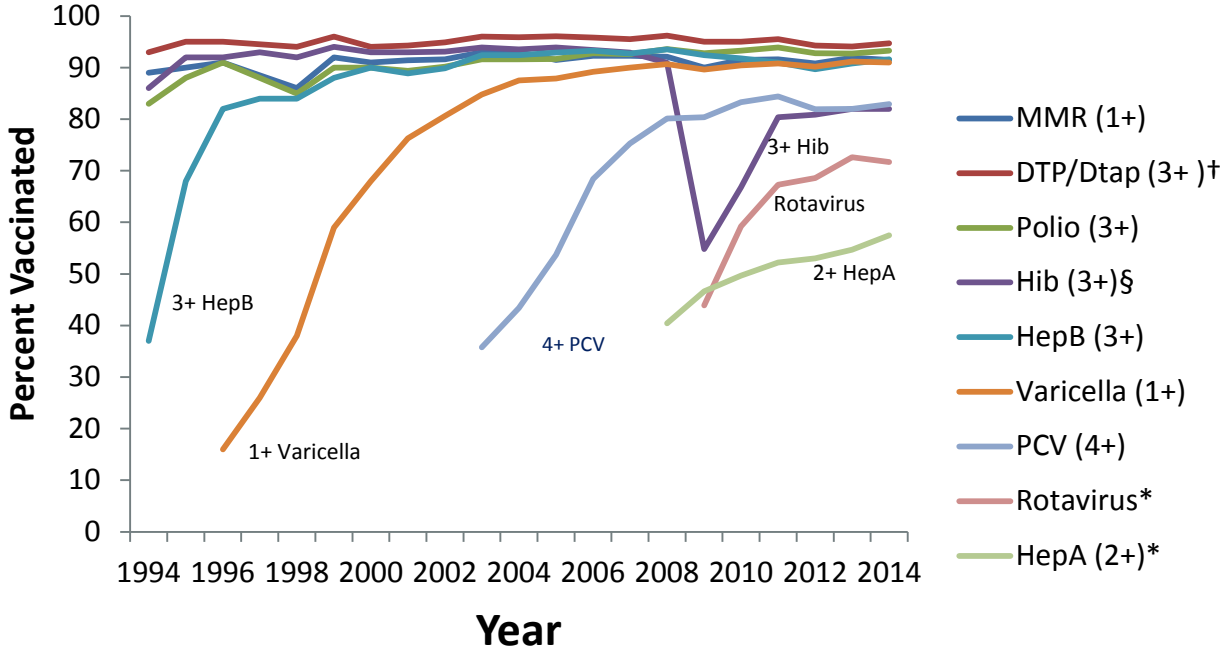
Cancer site	Number probably caused by any HPV type			Percentage probably caused by any HPV type
	Male	Female	Both Sexes	
Anus	1,600	3,200	4,800	**91%**
Cervix	0	10,600	10,600	**91%**
Oropharynx	9,600	2,000	11,600	**70%**
Penis	700	0	700	**63%**
Rectum	200	500	700	**91%**
Vagina	0	600	600	**75%**
Vulva	0	2,500	2,500	**69%**
TOTAL	**12,100**	**19,400**	**31,500**	

HPV Vaccine Impact

- HPV Vaccine Effectiveness
  - Clinical trials showed HPV vaccine provided close to 100% protection against pre-cancers of cervix
  - HPV vaccination decreases HPV infection and genital warts
- HPV Vaccine Duration of Protection
  - Protection lasts at least 10 years
  - No sign that protection will decrease
  - Similar to Hepatitis B vaccine which gives lifelong protection

Vaccination Coverage Rates

Vaccine-specific Coverage* among Children 19-35 Months, National Immunization Survey, United States, 1994-2014



* The *Healthy People* 2020 target for coverage is 90% for all vaccines with the exception of rotavirus (80%) and HepA (85%).

† DTP (3+) is not a Healthy People 2020 objective. DTaP (4+) is used to assess Healthy People 2020 objectives.

§ Reflects 3+ doses through 2008, and Full Series (3 or 4 doses depending on type of vaccine received) 2009 and later.

U.S. Adult Vaccination Coverage, NHIS 2015

- Brief update published online Feb 7 (full article pending publication in MMWR)
  - Non-influenza vaccination coverage – National Health Interview Survey (NHIS)
- Influenza vaccination coverage – Behavioral Risk Factor Surveillance System (BRFSS)
- Key findings
  - Pneumococcal vaccination for 19–64y high risk: **23.0**% (↑2.8%)
  - Tdap vaccination for ≥19y: 23.1% (↑3.1%); adults living with infants <1y: 41.9% (↑10.0%)
  - Shingles vaccination for ≥60y: **30.6%** (↑2.7%)
  - Otherwise similar to 2014 estimates:
    - Pneumococcal vaccination for ≥65y: **63.6%**
    - Hepatitis B vaccination for 19–59 years among persons with diabetes: **24.4%**
  - Disparities by race and ethnicity, insurance (highest for private), education, and income

www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/coverage-estimates/2015.html
www.cdc.gov/flu/fluvaxview/coverage-1516estimates.htm

Adult Vaccination Coverage for Selected Vaccines and Age Groups, National Health Interview Survey, 2010-15, and BRFSS survey for influenza vaccine 2010-16 seasons

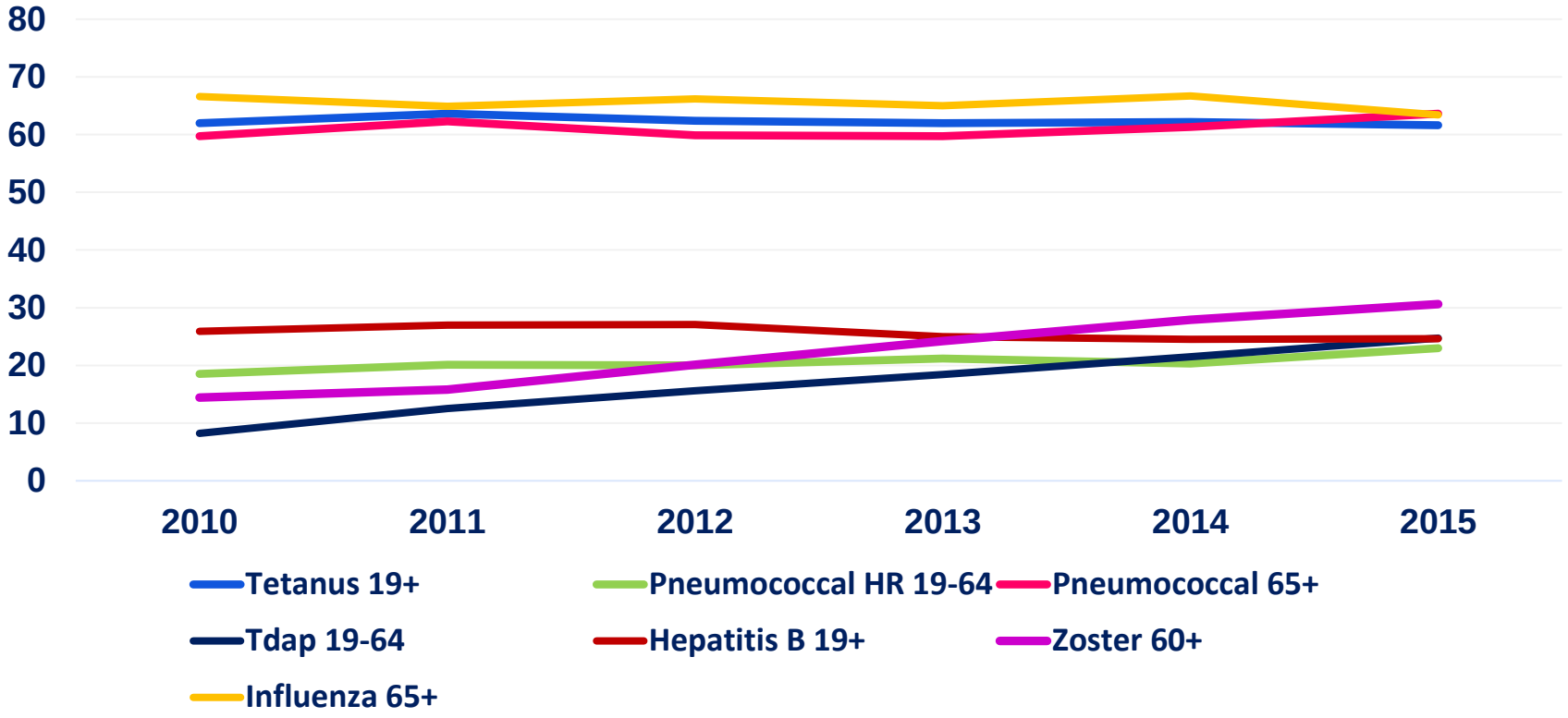
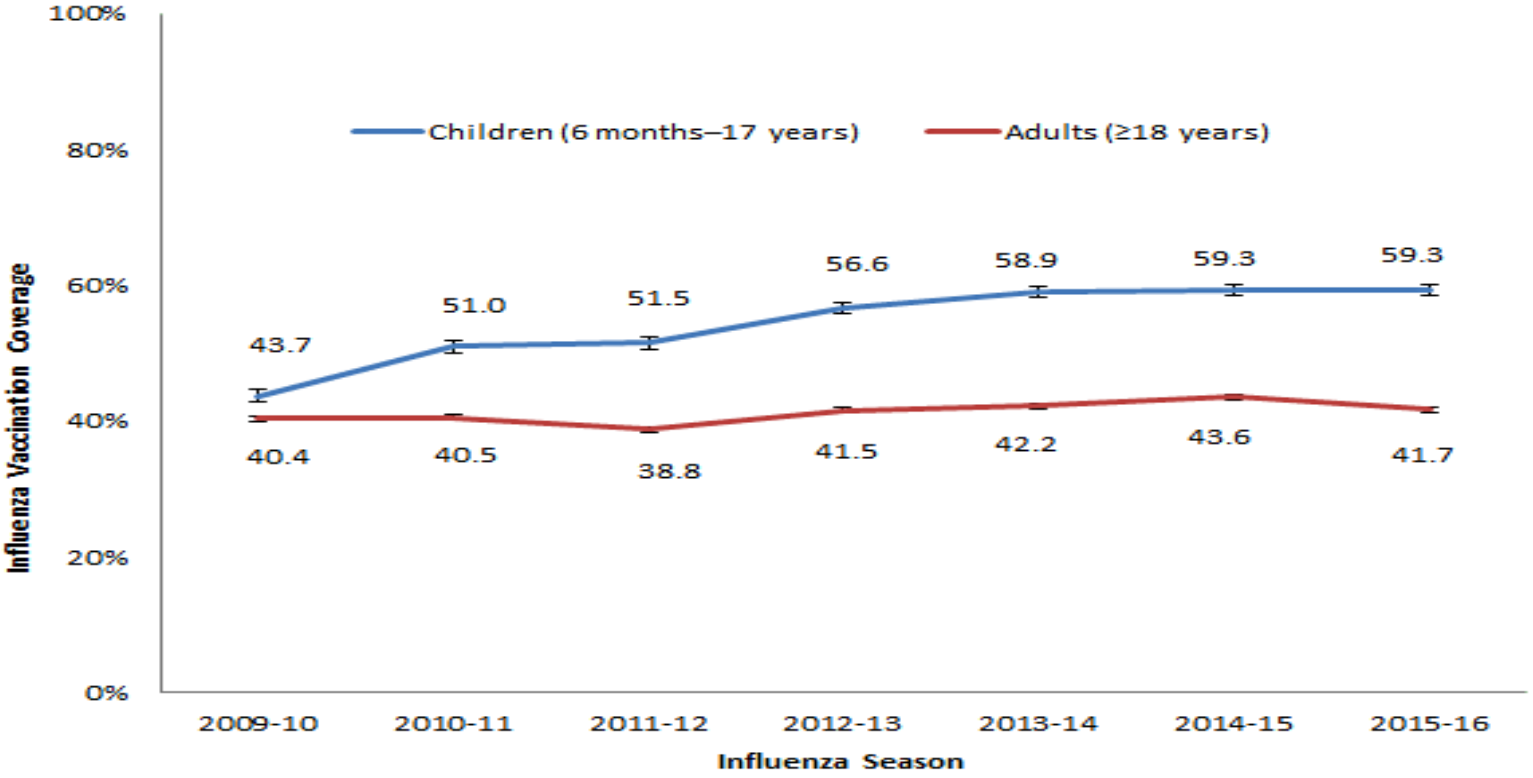


Figure 1. Seasonal Flu Vaccination Coverage by Age Group and Season, United States, 2009–2016

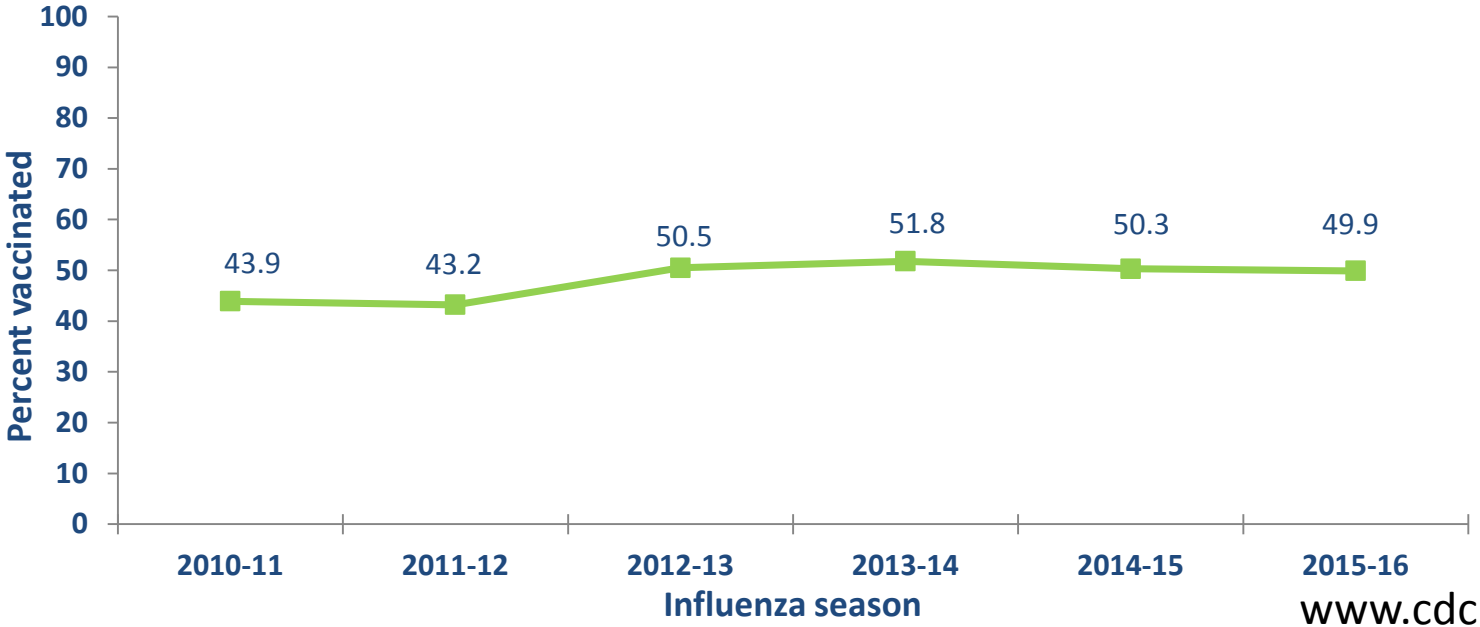


www.cdc.gov/flu

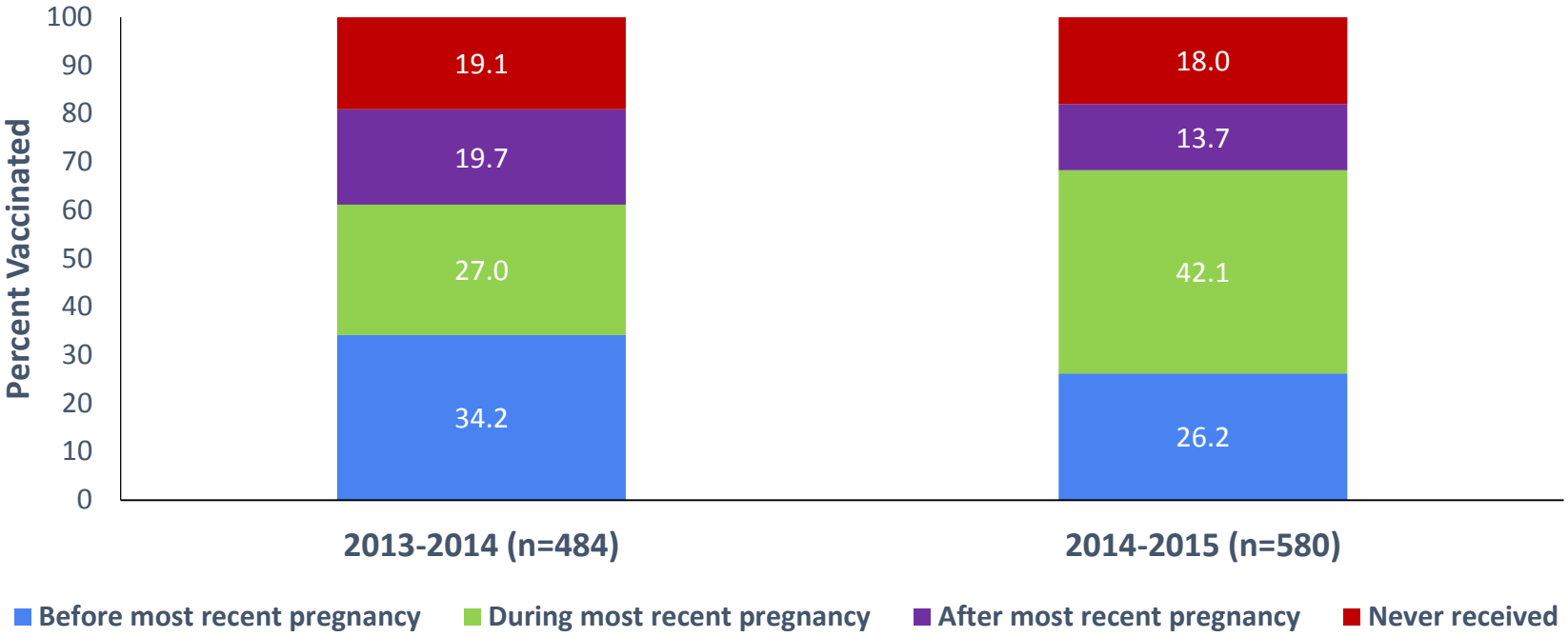
Error bars represent 95% confidence intervals around the estimates.
The 2009-10 estimates do not include the influenza A (H1N1) pdm09 monovalent vaccine.
Starting with the 2011-12 season, adult estimates reflect changes in BRFSS survey methods: the addition of cellular telephone samples and a new weighting method.

Influenza Vaccination Coverage among Pregnant Women, 2010-11 through 2014-15 seasons, Internet Panel Survey, United States

Influenza vaccination coverage* before and during pregnancy among women pregnant during October-January of each influenza season, Internet panel survey, United States



Tdap Coverage among Pregnant Women* by Timing of Vaccination, 2013-2014 through 2014-2015, Internet Panel Survey, United States



Conclusions

Conclusions

- Infections that can be prevented through vaccination impact persons of all ages
  - Adults and especially older adults often disproportionately impacted
- Vaccines are available but are underutilized especially for adults, including
  - Vaccination of pregnant women to prevent influenza and pertussis in infants younger than 6 months
  - Adults 19 and older with high risk conditions, e.g. diabetes
- Ensuring that adults are up-to-date on recommended vaccines, including vaccines they may not have received as a child or adolescent, is key to helping adults stay healthy and preventing hospitalizations, disability and premature deaths

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