Immunization Update; 2018

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Background Statements:
about me …
I have nothing to disclose

Discussion Objectives

- Recognize that immunizations save lives & prevent human suffering
- Immunization schedules & recommendations are complicated; changes do occur
- Review vaccinations: influenza, pneumococcal, Zoster, HBV

Vaccinations Save Lives

- Preventing infection in persons receiving the vaccine
- Preventing infections in persons who cannot receive vaccines
- Influenza vaccination in pregnancy = give it
- Inflammation = hypercoagulable state = vascular events

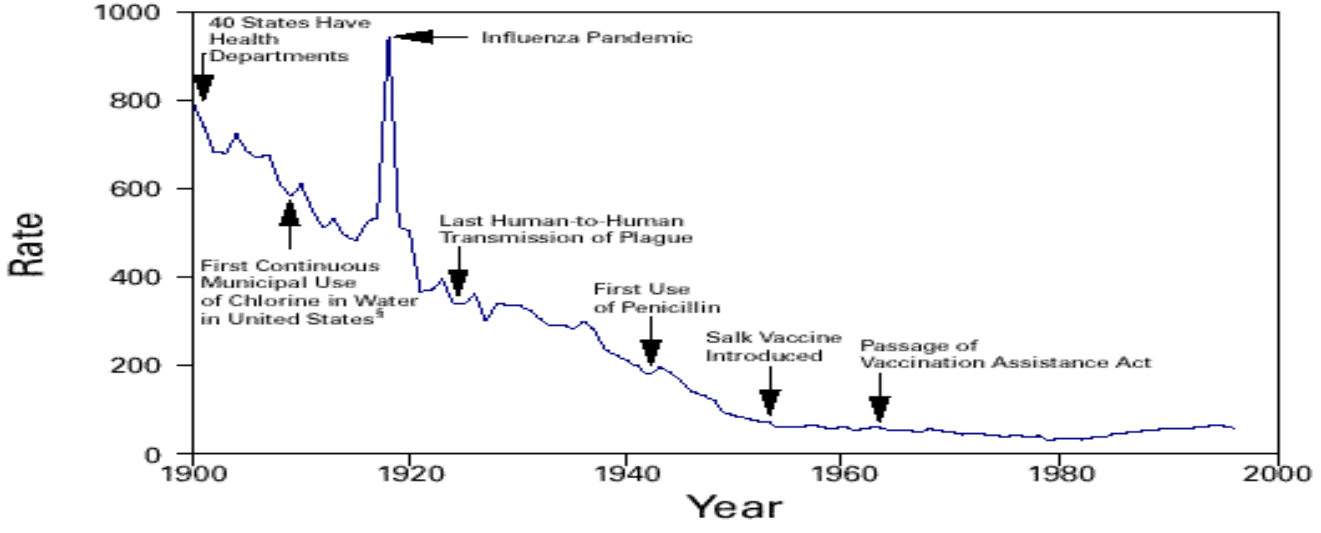
Immunization references:

- Advisory Committee on Immunization Practices (ACIP); cdc.gov
- Immunization Action Coalition; immunize.org
- Apps (all free): CDC Vaccine Schedule, ReadyVax (from Emory University, The Vaccine Handbook

Saving Lives the last 100 years

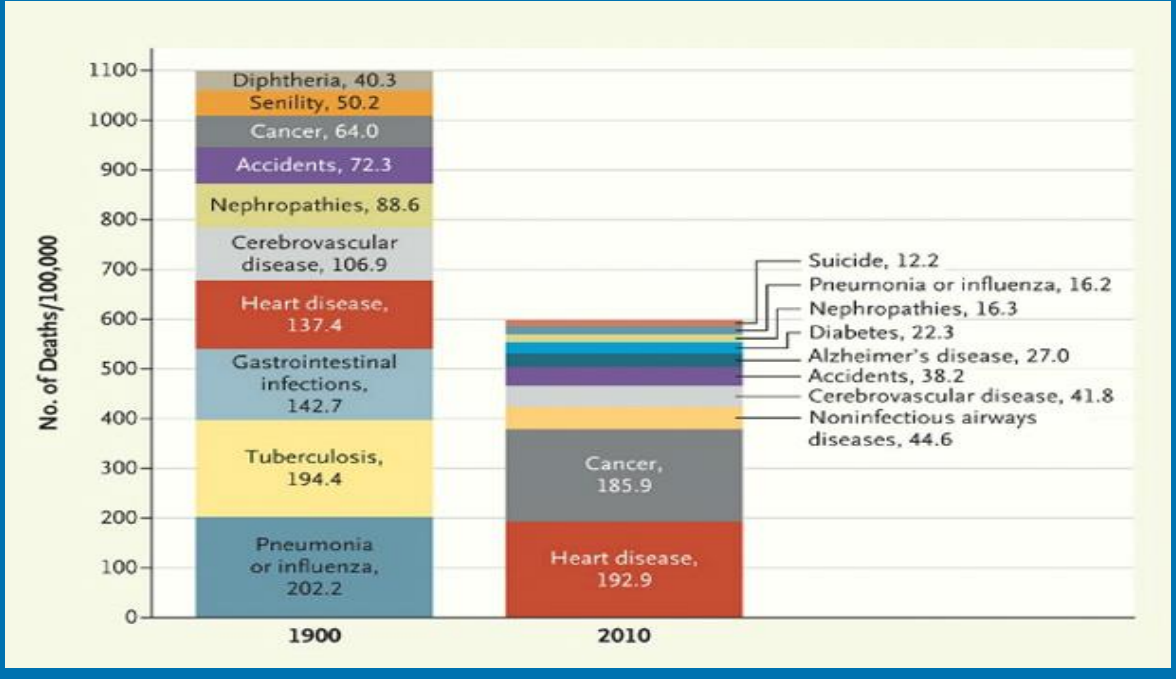
- Clean water / sanitization
- Aseptic technique / sterilization
- Antibiotics
- Vaccines

FIGURE 1. Crude death rate* for infectious diseases — United States, 1900–1996†



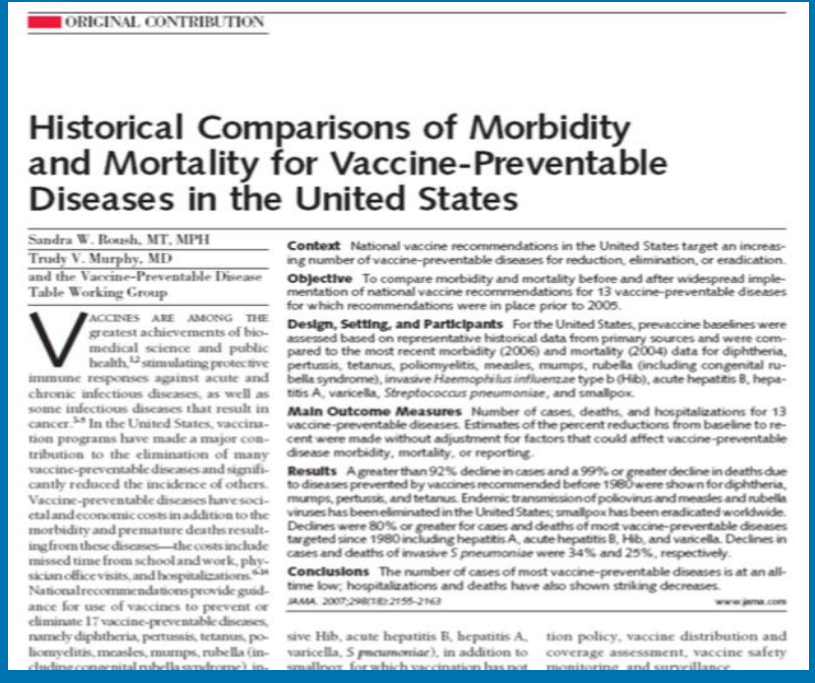
*Per 100,000 population per year.
†Adapted from Armstrong GL, Conn LA, Pinner RW. Trends in infectious disease mortality in the United States during the 20th century. JAMA 1999:281;61–6.
§American Water Works Association. Water chlorination principles and practices: AWWA manual M20. Denver, Colorado: American Water Works Association, 1973.

N Engl J Med 2012; 366:2333-2338



What about Vaccine Preventable Diseases ?

JAMA. 2007;298(18):2155-2163 (doi:10.1001/jama.298.18.2155)



ORIGINAL CONTRIBUTION

Historical Comparisons of Morbidity and Mortality for Vaccine-Preventable Diseases in the United States

Sandra W. Roush, MT, MPH
Trudy V. Murphy, MD
and the Vaccine-Preventable Disease Table Working Group

Context National vaccine recommendations in the United States target an increasing number of vaccine-preventable diseases for reduction, elimination, or eradication.

Objective To compare morbidity and mortality before and after widespread implementation of national vaccine recommendations for 13 vaccine-preventable diseases for which recommendations were in place prior to 2005.

Design, Setting, and Participants For the United States, prevaccine baselines were assessed based on representative historical data from primary sources and were compared to the most recent morbidity (2006) and mortality (2004) data for diphtheria, pertussis, tetanus, poliomyelitis, measles, mumps, rubella (including congenital rubella syndrome), invasive *Haemophilus influenzae* type b (Hib), acute hepatitis B, hepatitis A, varicella, *Streptococcus pneumoniae*, and smallpox.

Main Outcome Measures Number of cases, deaths, and hospitalizations for 13 vaccine-preventable diseases. Estimates of the percent reductions from baseline to recent were made without adjustment for factors that could affect vaccine-preventable disease morbidity, mortality, or reporting.

Results A greater than 92% decline in cases and a 99% or greater decline in deaths due to diseases prevented by vaccines recommended before 1980 were shown for diphtheria, mumps, pertussis, and tetanus. Endemic transmission of poliovirus and measles and rubella viruses has been eliminated in the United States; smallpox has been eradicated worldwide. Declines were 80% or greater for cases and deaths of most vaccine-preventable diseases targeted since 1980 including hepatitis A, acute hepatitis B, Hib, and varicella. Declines in cases and deaths of invasive *S pneumoniae* were 34% and 25%, respectively.

Conclusions The number of cases of most vaccine-preventable diseases is at an all-time low; hospitalizations and deaths have also shown striking decreases.

JAMA. 2007;298(18):2155-2163 www.jama.com

VACCINES ARE AMONG THE greatest achievements of biomedical science and public health,[1,2] stimulating protective immune responses against acute and chronic infectious diseases, as well as some infectious diseases that result in cancer.[3-5] In the United States, vaccination programs have made a major contribution to the elimination of many vaccine-preventable diseases and significantly reduced the incidence of others. Vaccine-preventable diseases have societal and economic costs in addition to the morbidity and premature deaths resulting from these diseases—the costs include missed time from school and work, physician office visits, and hospitalizations.[6-14] National recommendations provide guidance for use of vaccines to prevent or eliminate 17 vaccine-preventable diseases, namely diphtheria, pertussis, tetanus, poliomyelitis, measles, mumps, rubella (including congenital rubella syndrome), invasive Hib, acute hepatitis B, hepatitis A, varicella, *S pneumoniae*), in addition to smallpox, for which vaccination has not tion policy, vaccine distribution and coverage assessment, vaccine safety monitoring, and surveillance

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JAMA. 2007;298(18):2155-2163 (doi:10.1001/jama.298.18.2155)

Table 1. Historical Comparison of Morbidity and Mortality for Vaccine-Preventable Diseases With Vaccines Licensed or Recommended Before 1980: Diphtheria, Measles, Mumps, Pertussis, Poliomyelitis, Rubella, Smallpox, Tetanus[a]

Vaccine-Preventable Disease	Prevaccine No. (y)				Vaccine Date(s), y[f]	Most Recent Postvaccine Reported No.		Prevaccine Estimated Annual No. vs Most Recent Reported No. (% Reduction)	
	Estimated Annual Average		Peak						
	Cases[b]	Deaths[c]	Cases[d]	Deaths[e]		Cases, 2006[g]	Deaths, 2004[h]	Cases	Deaths
Diphtheria	21 053 (1936-1945)	1822 (1936-1945)	30 508 (1938)	3065 (1936)	1928-1943	0	0	21 053 (100)	1822 (100)
Measles	530 217 (1953-1962)	440 (1953-1962)	763 094 (1958)	552 (1958)	1963, 1967, 1968	55	0	530 162 (99.9)	440 (100)
Mumps	162 344 (1963-1968)	39 (1963-1968)	212 932 (1964)	50 (1964)	1940s, 1967	6584	0	155 760 (95.9)	39 (100)
Pertussis	200 752 (1934-1943)	4034 (1934-1943)	265 269 (1934)	7518 (1934)	1914-1941	15 632	27	185 120 (92.2)	4007 (99.3)
Poliomyelitis, acute	19 794 (1941-1950)	1393 (1941-1950)	42 033 (1949)	2720 (1949)	1955, 1961-1963, 1987	0	0	19 794 (100)	1393 (100)
Poliomyelitis, paralytic	16 316 (1951-1954)	1879 (1951-1954)	21 269 (1952)	3145 (1952)	1955, 1961-1963, 1987	0	0	16 316 (100)	1879 (100)
Rubella	47 745 (1966-1968)	17 (1966-1968)	488 796 (1964)	24 (1968)	1969	11	0	47 734 (99.9)	17 (100)
Congenital rubella syndrome	152 (1966-1969)	Not available	20 000 (1964-1965)	2160 (1964-1965)	1969	1	0	151 (99.3)	Not available
Smallpox	29 005 (1900-1949)	337 (1900-1949)	110 672 (1920)	2510 (1902)	1798	0	0	29 005 (100)	337 (100)
Tetanus	580 (1947-1949)	472 (1947-1949)	601 (1948)	511 (1947)	1933-1949	41	4	539 (92.9)	468 (99.2)

[a] Footnote letters correspond to Box 1.

JAMA. 2007;298(18):2155-2163 (doi:10.1001/jama.298.18.2155)

Table 2. Historical Comparison of Morbidity, Mortality, and Hospitalizations for Vaccine-Preventable Diseases With Vaccines Licensed or Recommended Between 1980 and 2005: Hepatitis A, Acute Hepatitis B, *Haemophilus influenzae* Type b, Pneumococcal Disease, Varicella[a]

Vaccine-Preventable Disease	Prevaccine No. (y)					Vaccine Date(s), y[g]	Most Recent Postvaccine No., 2006				Prevaccine Estimated Annual No. vs Most Recent Estimated No. (% Reduction)		
	Estimated Annual Average			Estimated Peak			Reported Cases[h]	Estimated Cases[i]	Estimated Hospitalizations[j]	Deaths[k]			
	Cases[b]	Hospitalizations[c]	Deaths[d]	Cases[e]	Deaths[f]						Cases	Hospitalizations	Deaths
Hepatitis A	117 333 (1986-1995)	6863 (1986-1995)	137 (1986-1995)	254 518 (1971)	298 (1971)	1995	3579	15 298	895	18	102 035 (87.0)	5968 (87.0)	119 (86.9)
Acute hepatitis B	66 232 (1982-1991)	7348 (1982-1991)	237 (1982-1991)	74 361 (1985)	267 (1985)	1981, 1986	4713	13 169	1461	47	53 063 (80.1)	5887 (80.1)	190 (80.2)
Invasive *Haemophilus influenzae* type b	20 000 (1980s)	Not available	1000 (1980s)	Not available	Not available	1985, 1987, 1990	208 (29 type b; 179 type unknown)	< 50 (2005)	Not available	<5 (2005)	19 950 (≥ 99.8)	Not available	995 (≥ 99.5)
Invasive pneumococcal disease	63 067 (1997-1999)	Not available	6500 (1997-1999)	64 400 (1999)	7300 (1999)	2000	5169	41 550 (2005)	Not available	4850 (2005)	21 517 (34.1)	Not available	1650 (25.4)
Varicella	4 085 120 (1990-1994)	10 632 (1988-1995)	105 (1990-1994)	5 358 595 (1988)	138 (1973)	1995	48 445	612 768	1276	19 (2004)	3 472 352 (85.0)	9356 (88.0)	86 (81.9)

[a] Footnote letters correspond to Box 2.

Recommended Adult Vaccines: Age-Based

Figure 1. Recommended immunization schedule for adults aged 19 years or older by age group, United States, 2018

This figure should be reviewed with the accompanying footnotes. This figure and the footnotes describe indications for which vaccines, if not previously administered, should be administered unless noted otherwise.

Vaccine	19–21 years	22–26 years	27–49 years	50–64 years	≥65 years
Influenza[1]	1 dose annually				
Tdap[2] or Td[2]	1 dose Tdap, then Td booster every 10 yrs				
MMR[3]	1 or 2 doses depending on indication (if born in 1957 or later)				
VAR[4]	2 doses				
RZV[5] (preferred) or ZVL[5]				2 doses RZV (preferred) or 1 dose ZVL	
HPV–Female[6]	2 or 3 doses depending on age at series initiation				
HPV–Male[6]	2 or 3 doses depending on age at series initiation				
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[10]	1 or 2 doses depending on indication, then booster every 5 yrs if risk remains				
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 other indications

No recommendation

www.cdc.gov/vaccines/schedules/hcp/adult.htm

immunization action coalition
IAC
immunize.org

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Adult Vaccines: Footnotes; www.cdc.gov/vaccines/schedules/hcp/adult.htm

Footnotes. Recommended immunization schedule for adults aged 19 years or older, United States, 2018

1. Influenza vaccination
www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/flu.html

General information
- Administer 1 dose of age-appropriate inactivated influenza vaccine (IIV) or recombinant influenza vaccine (RIV) annually
- Live attenuated influenza vaccine (LAIV) is not recommended for the 2017–2018 influenza season
- A list of currently available influenza vaccines is available at www.cdc.gov/flu/protect/vaccine/vaccines.htm

Special populations
- Administer age-appropriate IIV or RIV to:
  - **Pregnant women**
  - Adults with **hives-only egg allergy**
  - Adults with **egg allergy other than hives** (e.g., angioedema or respiratory distress): Administer IIV or RIV in a medical setting under supervision of a health care provider who can recognize and manage severe allergic conditions

2. Tetanus, diphtheria, and pertussis vaccination
www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/tdap-td.html

General information
- Administer to adults who previously did not receive a dose of tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine (Tdap) as an adult or child (routinely recommended at age 11–12 years) 1 dose of Tdap, followed by a dose of tetanus and diphtheria toxoids (Td) booster every 10 years
- Information on the use of Tdap or Td as tetanus prophylaxis in wound management is available at www.cdc.gov/mmwr/preview/mmwrhtml/rr5517a1.htm

Special populations
- **Pregnant women**: Administer 1 dose of Tdap during each pregnancy, preferably in the early part of gestational weeks 27–36

3. Measles, mumps, and rubella vaccination
www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/mmr.html

General information
- Administer 1 dose of measles, mumps, and rubella vaccine (MMR) to adults with no evidence of immunity to measles, mumps, or rubella
- Evidence of immunity is:
  - Born before 1957 (except for health care personnel, see below)
  - Documentation of receipt of MMR
  - Laboratory evidence of immunity or disease
- Documentation of a health care provider-diagnosed disease without laboratory confirmation is not considered evidence of immunity

Special populations
- **Pregnant women and nonpregnant women of childbearing age** with no evidence of immunity to rubella: Administer 1 dose of MMR (if pregnant, administer MMR after pregnancy and before discharge from health care facility)
- **HIV infection and CD4 cell count ≥200 cells/μL for at least 6 months** and no evidence of immunity to measles, mumps, or rubella: Administer 2 doses of MMR at least 28 days apart
- **Students in postsecondary educational institutions, international travelers**, and **household contacts of immunocompromised persons**: Administer 2 doses of MMR at least 28 days apart (or 1 dose of MMR if previously administered 1 dose of MMR)
- **Health care personnel born in 1957 or later** with no evidence of immunity: Administer 2 doses of MMR at least 28 days apart for measles or mumps, or 1 dose of MMR for rubella (if born before 1957, consider MMR vaccination)
- Adults who **previously received ≤2 doses of mumps-containing vaccine and are identified by public health authority to be at increased risk for mumps in an outbreak**: Administer 1 dose of MMR
- MMR is contraindicated for pregnant women and adults with severe immunodeficiency

4. Varicella vaccination
www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/varicella.html

General information
- Administer to adults without evidence of immunity to varicella 2 doses of varicella vaccine (VAR) 4–8 weeks apart if previously received no varicella-containing vaccine (if previously received 1 dose of varicella-containing vaccine, administer 1 dose of VAR at least 4 weeks after the first dose)
- Evidence of immunity to varicella is:
  - U.S.-born before 1980 (except for pregnant women and health care personnel, see below)
  - Documentation of receipt of 2 doses of varicella or varicella-containing vaccine at least 4 weeks apart
  - Diagnosis or verification of history of varicella or herpes zoster by a health care provider
  - Laboratory evidence of immunity or disease

Special populations
- Administer 2 doses of VAR 4–8 weeks apart if previously received no varicella-containing vaccine (if previously received 1 dose of varicella-containing vaccine, administer 1 dose of VAR at least 4 weeks after the first dose) to:
  - **Pregnant women without evidence of immunity**: Administer the first of the 2 doses or the second dose after pregnancy and before discharge from health care facility
  - **Health care personnel without evidence of immunity**
- Adults with **HIV infection and CD4 cell count ≥200 cells/μL**: May administer, based on individual clinical decision, 2 doses of VAR 3 months apart
- VAR is contraindicated for pregnant women and adults with severe immunodeficiency

5. Zoster vaccination
www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/shingles.html

General information
- Administer 2 doses of recombinant zoster vaccine (RZV) 2–6 months apart to adults aged 50 years or older regardless of past episode of herpes zoster or receipt of zoster vaccine live (ZVL)
- Administer 2 doses of RZV 2–6 months apart to adults who previously received ZVL at least 2 months after ZVL
- For adults aged 60 years or older, administer either RZV or ZVL (RZV is preferred)

Special populations
- ZVL is contraindicated for pregnant women and adults with severe immunodeficiency

6. Human papillomavirus vaccination
www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/hpv.html

General information
- Administer human papillomavirus (HPV) vaccine to **females through age 26 years** and **males through age 21 years** (males aged 22 through 26 years may be vaccinated based on individual clinical decision)
- The number of doses of HPV vaccine to be administered depends on age at initial HPV vaccination
  - **No previous dose of HPV vaccine**: Administer 3-dose series at 0, 1–2, and 6 months (minimum intervals: 4 weeks between doses 1 and 2, 12 weeks between doses 2 and 3, and 5 months between doses 1 and 3; repeat doses if given too soon)
  - **Aged 9–14 years at HPV vaccine series initiation and received 1 dose or 2 doses less than 5 months apart**: Administer 1 dose
  - **Aged 9–14 years at HPV vaccine series initiation and received 2 doses at least 5 months apart**: No additional dose is needed

Special populations
- Adults with **immunocompromising conditions (including HIV infection)** through age 26 years: Administer 3-dose series at 0, 1–2, and 6 months
- **Men who have sex with men** through age 26 years: Administer 2- or 3-dose series depending on age at initial vaccination (see above); if no history of HPV vaccine, administer 3-dose series at 0, 1–2, and 6 months
- **Pregnant women** through age 26 years: HPV vaccination is not recommended during pregnancy, but there is no evidence that the vaccine is harmful and no intervention needed for women who inadvertently receive HPV vaccine while pregnant; delay remaining doses until after pregnancy; pregnancy testing is not needed before vaccination

7. Pneumococcal vaccination
www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/pneumo.html

General information
- Administer to immunocompetent adults aged 65 years or older 1 dose of 13-valent pneumococcal conjugate vaccine (PCV13), if not previously administered, followed by 1 dose of 23-valent pneumococcal polysaccharide vaccine (PPSV23) at least 1 year after PCV13; if PPSV23 was previously administered but not PCV13, administer PCV13 at least 1 year after PPSV23
- When both PCV13 and PPSV23 are indicated, administer PCV13 first (PCV13 and PPSV23 should not be administered during the same visit); additional information on vaccine timing is available at www.cdc.gov/vaccines/vpd/pneumo/downloads/pneumo-vaccine-timing.pdf

Adult Vaccines: Footnotes; cdc.gov/vaccines/schedules/hcp/adult.htm

Special populations

- Administer to adults aged 19 through 64 years with the following chronic conditions 1 dose of PPSV23 (at age 65 years or older, administer 1 dose of PCV13, if not previously received, and another dose of PPSV23 at least 1 year after PCV13 and at least 5 years after PPSV23):
  - **Chronic heart disease** (excluding hypertension)
  - **Chronic lung disease**
  - **Chronic liver disease**
  - **Alcoholism**
  - **Diabetes mellitus**
  - **Cigarette smoking**
- Administer to adults aged 19 years or older with the following indications 1 dose of PCV13 followed by 1 dose of PPSV23 at least 8 weeks after PCV13, and a second dose of PPSV23 at least 5 years after the first dose of PPSV23 (if the most recent dose of PPSV23 was administered before age 65 years, at age 65 years or older, administer another dose of PPSV23 at least 5 years after the last dose of PPSV23):
  - **Immunodeficiency disorders** (including B- and T-lymphocyte deficiency, complement deficiencies, and phagocytic disorders)
  - **HIV infection**
  - **Anatomical or functional asplenia** (including sickle cell disease and other hemoglobinopathies)
  - **Chronic renal failure and nephrotic syndrome**
- Administer to adults aged 19 years or older with the following indications 1 dose of PCV13 followed by 1 dose of PPSV23 at least 8 weeks after PCV13 (if the dose of PPSV23 was administered before age 65 years, at age 65 years or older, administer another dose of PPSV23 at least 5 years after the last dose of PPSV23):
  - **Cerebrospinal fluid leak**
  - **Cochlear implant**

8. Hepatitis A vaccination

www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/hepa.html

General information

- Administer to adults who have a specific risk (see below), or lack a risk factor but want protection, 2-dose series of single antigen hepatitis A vaccine (HepA; Havrix at 0 and 6–12 months or Vaqta at 0 and 6–18 months; minimum interval: 6 months) or a 3-dose series of combined hepatitis A and hepatitis B vaccine (HepA-HepB) at 0, 1, and 6 months; minimum intervals: 4 weeks between first and second doses, 5 months between second and third doses

Special populations

- Administer HepA or HepA-HepB to adults with the following indications:
  - **Travel** to or work in countries with high or intermediate hepatitis A endemicity
  - **Men who have sex with men**
  - **Injection or noninjection drug use**
  - **Work with hepatitis A virus in a research laboratory or with nonhuman primates infected with hepatitis A virus**
  - **Clotting factor disorders**
  - **Chronic liver disease**
  - Close, personal **contact with an international adoptee** (e.g., household or regular babysitting) during the first 60 days after arrival in the United States from a country with high or intermediate endemicity (administer the first dose as soon as the adoption is planned)
  - Healthy adults **through age 40 years who have recently been exposed to hepatitis A virus**; adults older than age 40 years may receive HepA or HepA-HepB if hepatitis A immunoglobulin cannot be obtained

9. Hepatitis B vaccination

www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/hepb.html

General information

- Administer to adults who have a specific risk (see below), or lack a risk factor but want protection, 3-dose series of single antigen hepatitis B vaccine (HepB) or combined hepatitis A and hepatitis B vaccine (HepA-HepB) at 0, 1, and 6 months (minimum intervals: 4 weeks between doses 1 and 2 for HepB and HepA-HepB; between doses 2 and 3, 8 weeks for HepB and 5 months for HepA-HepB)

Special populations

- Administer HepB or HepA-HepB to adults with the following indications:
  - **Chronic liver disease** (e.g., hepatitis C infection, cirrhosis, fatty liver disease, alcoholic liver disease, autoimmune hepatitis, alanine aminotransferase [ALT] or aspartate aminotransferase [AST] level greater than twice the upper limit of normal)
  - **HIV infection**
  - **Percutaneous or mucosal risk of exposure to blood** (e.g., **household contacts** of hepatitis B surface antigen [HBsAg]-positive persons; adults younger than age 60 years with **diabetes mellitus** or aged 60 years or older with diabetes mellitus based on individual clinical decision; adults in predialysis care or receiving **hemodialysis or peritoneal dialysis**; recent or current **injection drug users**; **health care and public safety workers** at risk for exposure to blood or blood-contaminated body fluids)
  - **Sexual exposure risk** (e.g., sex partners of HBsAg-positive persons; sexually active persons not in a mutually monogamous relationship; persons seeking evaluation or treatment for a sexually transmitted infection; and **men who have sex with men** [MSM])
  - Receive care in **settings where a high proportion of adults have risks for hepatitis B infection** (e.g., facilities providing sexually transmitted disease treatment, drug-abuse treatment and prevention services, hemodialysis and end-stage renal disease programs, institutions for developmentally disabled persons, health care settings targeting services to injection drug users or MSM, HIV testing and treatment facilities, and correctional facilities)
  - **Travel** to countries with high or intermediate hepatitis B endemicity

10. Meningococcal vaccination

www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/mening.html

Special populations: Serogroups A, C, W, and Y meningococcal vaccine (MenACWY)

- Administer 2 doses of MenACWY at least 8 weeks apart and revaccinate with 1 dose of MenACWY every 5 years, if the risk remains, to adults with the following indications:
  - **Anatomical or functional asplenia** (including sickle cell disease and other hemoglobinopathies)
  - **HIV infection**
  - **Persistent complement component deficiency**
  - **Eculizumab use**
- Administer 1 dose of MenACWY and revaccinate with 1 dose of MenACWY every 5 years, if the risk remains, to adults with the following indications:
  - **Travel to or live in countries where meningococcal disease is hyperendemic or epidemic**, including countries in the African meningitis belt or during the Hajj
  - At risk from a **meningococcal disease outbreak attributed to serogroup A, C, W, or Y**
  - **Microbiologists** routinely exposed to *Neisseria meningitidis*
  - **Military recruits**
  - **First-year college students who live in residential housing** (if they did not receive MenACWY at age 16 years or older)

General Information: Serogroup B meningococcal vaccine (MenB)

- May administer, based on individual clinical decision, to young adults and adolescents aged 16–23 years (preferred age is 16–18 years) who are not at increased risk 2-dose series of MenB-4C (Bexsero) at least 1 month apart or 2-dose series of MenB-FHbp (Trumenba) at least 6 months apart
- MenB-4C and MenB-FHbp are not interchangeable

Special populations: MenB

- Administer 2-dose series of MenB-4C at least 1 month apart or 3-dose series of MenB-FHbp at 0, 1–2, and 6 months to adults with the following indications:
  - **Anatomical or functional asplenia** (including sickle cell disease)
  - **Persistent complement component deficiency**
  - **Eculizumab use**
  - At risk from a **meningococcal disease outbreak attributed to serogroup B**
  - **Microbiologists** routinely exposed to *Neisseria meningitidis*

11. *Haemophilus influenzae* type b vaccination

www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/hib.html

Special populations

- Administer *Haemophilus influenzae* type b vaccine (Hib) to adults with the following indications:
  - **Anatomical or functional asplenia** (including sickle cell disease) or undergoing elective splenectomy: Administer 1 dose if not previously vaccinated (preferably at least 14 days before elective splenectomy)
  - **Hematopoietic stem cell transplant** (HSCT): Administer 3-dose series with doses 4 weeks apart starting 6 to 12 months after successful transplant regardless of Hib vaccination history

Recommended Adult Vaccines: Risk-Based

Figure 2. Recommended immunization schedule for adults aged 19 years or older by medical condition and other indications, United States, 2018

This figure should be reviewed with the accompanying footnotes. This figure and the footnotes describe indications for which vaccines, if not previously administered, should be administered unless noted otherwise.

Vaccine	Pregnancy[1-6]	Immuno-compromised (excluding HIV infection)[3-7,11]	HIV infection CD4+ count (cells/μL)[3-7,9-10] <200	HIV infection CD4+ count (cells/μL)[3-7,9-10] ≥200	Asplenia, complement deficiencies[7-10,11]	End-stage renal disease, on hemodialysis[7-9]	Heart or lung disease, alcoholism[7]	Chronic liver disease[7-9]	Diabetes[7,9]	Health care personnel[3,4,9]	Men who have sex with men[6,8,9]
Influenza[1]	1 dose annually										
Tdap[2] or Td[2]	1 dose Tdap each pregnancy	1 dose Tdap, then Td booster every 10 yrs									
MMR[3]	contraindicated	1 or 2 doses depending on indication									
VAR[4]	contraindicated	2 doses									
RZV[5] (preferred)					2 doses RZV at age ≥50 yrs (preferred)						
or					or						
ZVL[5]	contraindicated				1 dose ZVL at age ≥60 yrs						
HPV–Female[6]		3 doses through age 26 yrs			2 or 3 doses through age 26 yrs						
HPV–Male[6]		3 doses through age 26 yrs			2 or 3 doses through age 21 yrs						2 or 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[10]		1 or 2 doses depending on indication , then booster every 5 yrs if risk remains									
MenB[10]		2 or 3 doses depending on vaccine									
Hib[11]		3 doses 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 other indications

Contraindicated

No recommendation

www.cdc.gov/vaccines/schedules/hcp/adult.htm

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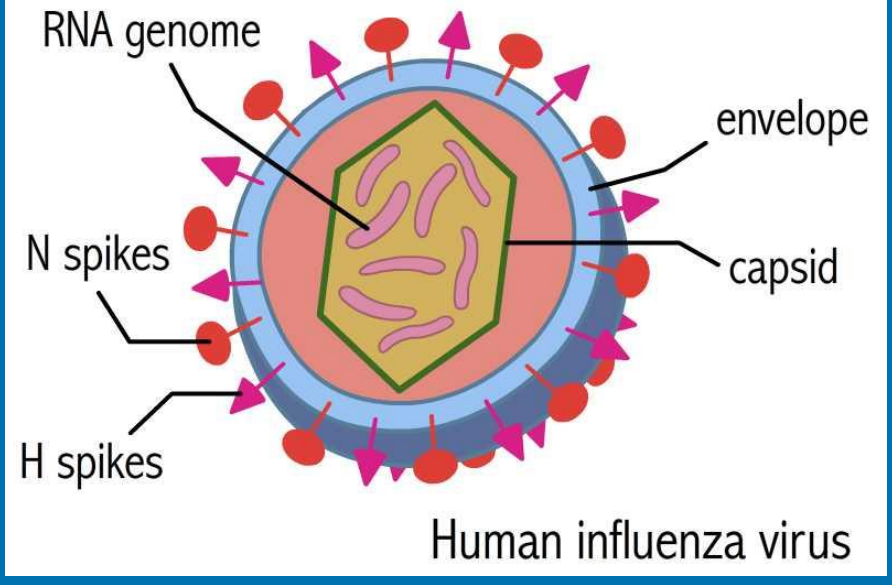
Influenza


RNA genome
envelope
N spikes
capsid
H spikes
Human influenza virus

Influenza: most vulnerable infants, elderly, hospitalized, pregnancy, compromised host

Typical uncomplicated Sx: abrupt onset fever with dry cough; myalgia, HA, malaise, sore throat, GI effects

Complications: bacterial sinusitis & pneumonia, OM, COPD exacerbations, chronic disease worsening

Prevention: keep>6 feet from infected, cover sneezing, stay home; surgical masks adequate; CDC-use N95 for high risk procedures

Influenza: infectivity

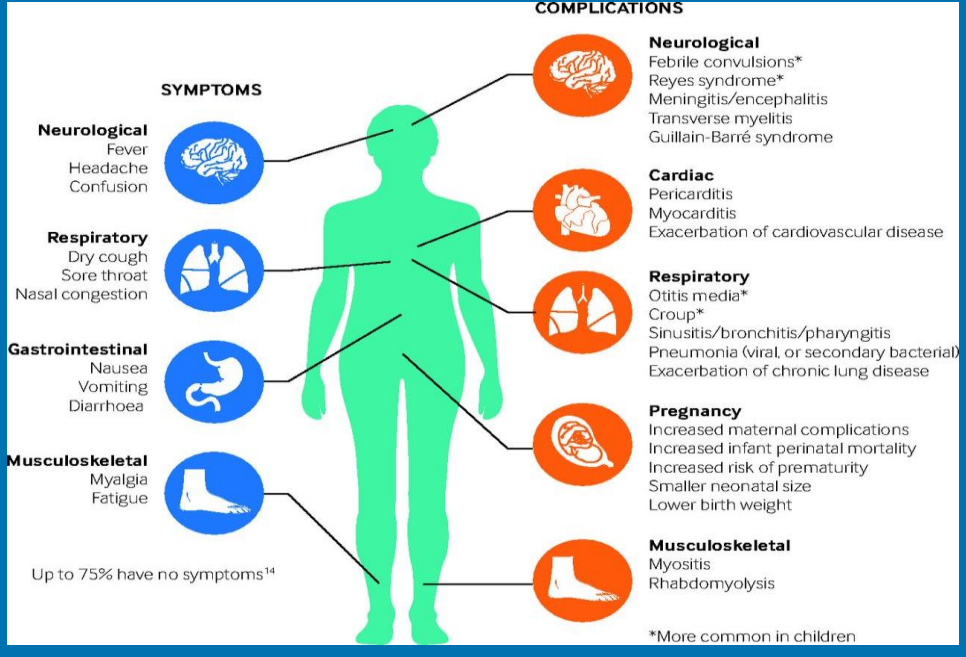
From shedding & fomite transmittion

Adults: shed virus (-) day 1 until day 7

Viral shedding may be prolonged (weeks – months) in immunosuppressed patients

Diagnosis: PCR testing; be careful with antigen testing

Influenza



Influenza

Globally,

- 3-5x10^6 severe cases/year
- 250,000-500,000 deaths/year

In US, 10,000-60,000 deaths/yr

>90% deaths in industrialized world in individuals >65 years of age

In elderly, vaccine provides:

- 30-40% reduction in illness
- 50-60% reduction in hospitalization
- 80% reduction in death

In US, only 60-70% individuals >65 yoa immunized, and 20-45% of high risk younger individuals;

40% overall

Many options

Trivalent flu vaccines include:

- **Standard-dose trivalent shots (IIV3) that are manufactured using virus grown in eggs. Different flu shots are approved for different age groups. Most flu shots are given in the arm (muscle) with a needle. One trivalent vaccine formulation can be given with a jet injector, for persons aged 18 through 64 years.**
- **A high-dose trivalent shot, approved for people 65 and older.**
- **A recombinant trivalent shot that is egg-free, approved for people 18 years and older, including pregnant women.**
- **A trivalent flu shot made with adjuvant (an ingredient of a vaccine that helps create a stronger immune response in the patient's body), approved for people 65 years of age and older (new this season).**

Quadrivalent flu vaccines include:

- **Quadrivalent flu shots approved for use in different age groups, including children as young as 6 months.**
- **An intradermal quadrivalent flu shot, which is injected into the skin instead of the muscle and uses a much smaller needle than the regular flu shot. It is approved for people 18 through 64 years of age.**
- **A quadrivalent flu shot containing virus grown in cell culture, which is approved for people 4 years of age and older.**
- **A recombinant quadrivalent flu shot approved for people 18 years of age and older, including pregnant women (new this season).**

Influenza vaccine efficacy

Table. Adjusted vaccine effectiveness estimates for influenza seasons from 2005-2017

Influenza Season†	Reference	Study Site(s)	No. of Patients‡	Adjusted Overall VE (%)	95% CI
2004-05	Belongia 2009	WI	762	10	-36, 40
2005-06	Belongia 2009	WI	346	21	-52, 59
2006-07	Belongia 2009	WI	871	52	22 ,70
2007-08	Belongia 2011	WI	1914	37	22, 49
2008-09	Unpublished	WI, MI, NY, TN	6713	41	30, 50
2009-10	Griffin 2011	WI, MI, NY, TN	6757	56	23, 75
2010-11	Treanor 2011	WI, MI, NY, TN	4757	60	53, 66
2011-12	Ohmit 2014	WI, MI, PA, TX, WA	4771	47	36, 56
2012-13	McLean 2014	WI, MI, PA, TX, WA	6452	49	43, 55
2013-14	Gaglani 2016	WI, MI, PA, TX, WA	5999	52	44, 59
2014-15	Zimmerman 2016	WI, MI, PA, TX, WA	9311	19	10, 27
2015-16*	Jackson 2017	WI, MI, PA, TX, WA	6879	48*	41, 55*
2016-17**	Unpublished final estimates.	WI, MI, PA, TX, WA	7410	40**	32, 46

*Estimate from Nov 2, 2015–April 15, 2016.

CDC

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Influenza Vaccination Coverage Among U.S. Adults, Past Four Seasons

Group	2013–14 (%)	2014–15 (%)	2015–16 (%)	2016–17 (%)
Persons ≥ 18 yrs	**42.4**	**43.6**	**41.7***	**43.3 ± 0.6***
Persons 18-49 yrs, all	32.3	33.5	32.7	33.6 ± 0.8
Persons 18-49 yrs, high risk	38.7	39.3	39.5	39.3 ± 1.8
Persons 50-64 yrs	45.3	47.0	43.6*	45.4 ± 1.0*
Persons ≥ 65 yrs	65.0	66.7	63.4*	65.3 ± 1.0*

* Statistically significant declines/increases from the previous season

www.cdc.gov/flu/fluvaxview/index.htm

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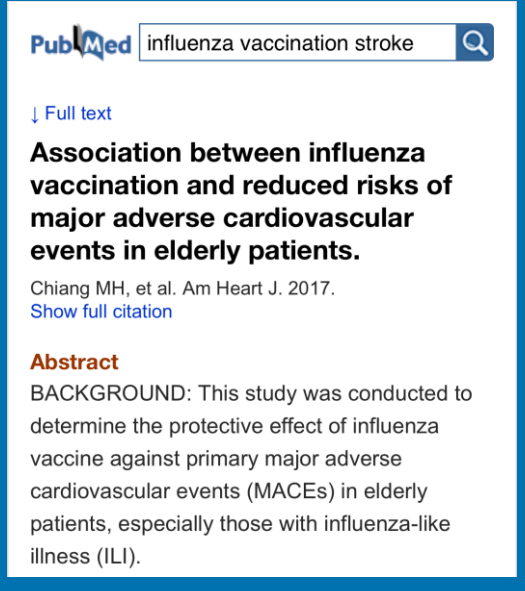
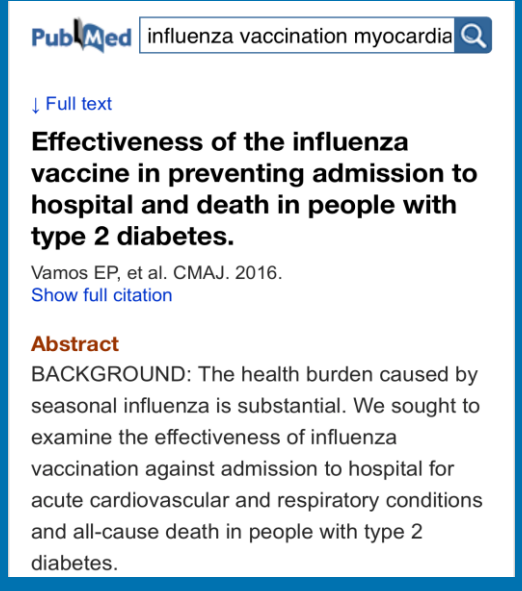
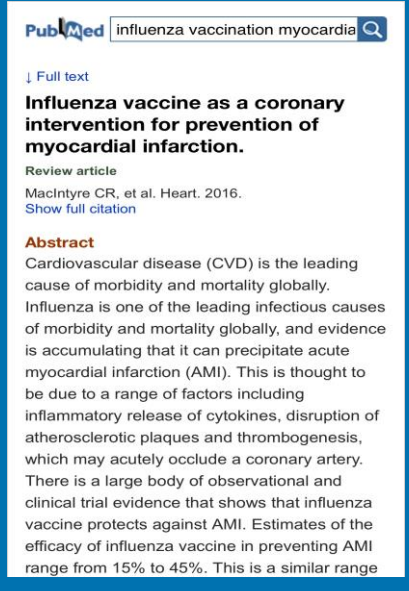
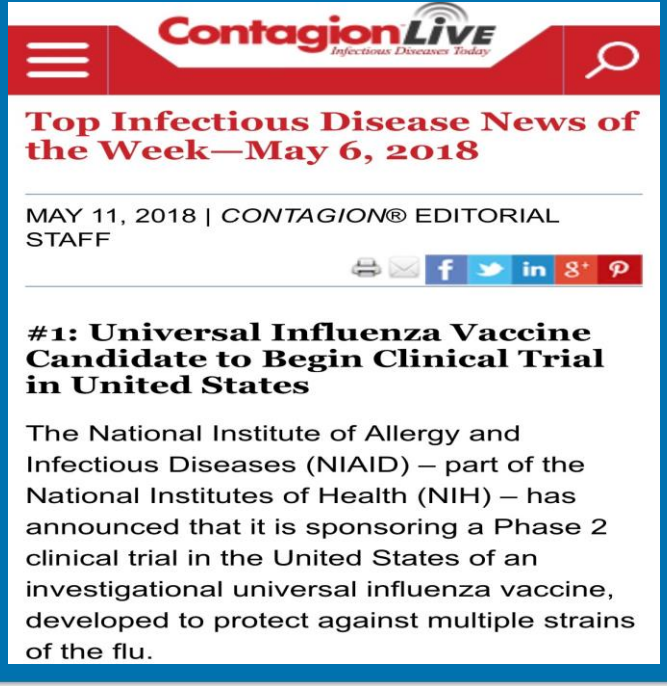
Influenza → inflammation







Influenza Vaccination Research



ContagionLive
Infectious Diseases Today

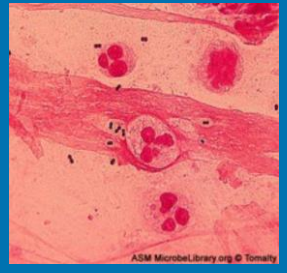
Top Infectious Disease News of the Week—May 6, 2018

MAY 11, 2018 | *CONTAGION*® EDITORIAL STAFF

#1: Universal Influenza Vaccine Candidate to Begin Clinical Trial in United States

The National Institute of Allergy and Infectious Diseases (NIAID) – part of the National Institutes of Health (NIH) – has announced that it is sponsoring a Phase 2 clinical trial in the United States of an investigational universal influenza vaccine, developed to protect against multiple strains of the flu.

Pneumococcal Vaccination; *Streptococcus pneumoniae*



- Virulence factor: polysaccharide capsule that releases pneumococci from the host by preventing phagocytosis
- >90 serotypes of pneumococcus bacteria; not all strains cause disease; immunity is serotype specific; serotype 19A
- Ecologic Niche: nasopharynx; adults with 5-10% colonization rates (higher in smoker), children with 20-40% colonization rates
- Disease: CAP, sinusitis, OM, bacterial meningitis

Burden of Pneumococcal disease

- Invasive pneumococcal disease (IPD)
  - 29,500 total cases/ 3,350 total deaths (in 2015)
  - 90% of IPD and nearly all IPD deaths among adults > 65 years

CDC. 2015. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, Streptococcus pneumoniae, 2015

Pneumococcal

PPV23: (pneumococcal polysaccharide vaccine 23)

- Adult vaccine
- 60-80% protective against invasive disease;
  - no effect on mortality?
- Only ~65% individuals >65 yoa immunized, and <20% of high risk younger individuals

PCV13: (pneumococcal conjugate vaccine 13) (Childhood and FDA approved for use in adults in 2011; ACIP recommendation for adults 2012; broadened to all ≥65 in 2014)

Pneumococcal

PCV13 and PPSV23 now recommended for all adults 65 years or older

- **If not previously vaccinated, administer PCV13 first; give PPSV23 "at least one year later" (6-12 months)**
- **If previously received PPSV23, administer PCV13 ≥12 months after**

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 Chronic heart disease† Chronic liver disease Chronic lung disease§ Cigarette smoking Diabetes mellitus		✓		✓	✓ ≥ 1 year after PCV13 ≥ 5 years after any PPSV23 at < 65 years
	Cochlear implants CSF leaks	✓	✓ ≥ 8 weeks after PCV13		✓ If no previous PCV13 vaccination	✓ ≥ 8 weeks after PCV13 ≥ 5 years after any PPSV23 at < 65 years
Persons with functional or anatomic asplenia	Congenital or acquired asplenia Sickle cell disease/other hemoglobinopathies	✓	✓ ≥ 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
Immunocompromised persons	Chronic renal failure Congenital or acquired immunodeficiencies¶ Generalized malignancy HIV infection Hodgkin disease Iatrogenic immunosuppression‡ Leukemia Lymphoma Multiple myeloma Nephrotic syndrome Solid organ transplant	✓	✓ ≥ 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

*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

Revaccination with PPSV23

- One-time revaccination 5 years after the first dose of PPSV23 is recommended for persons aged 19 through 64 years with chronic renal failure or nephrotic syndrome, functional or anatomic asplenia (e.g., sickle cell disease or splenectomy), or immunocompromising conditions.
- Persons who received 1 or 2 doses of PPSV23 before age 65 years for any indication should receive another dose of the vaccine at age 65 years or later if at least 5 years have passed since their previous dose.
- No further doses of PPSV23 are needed for persons vaccinated with PPSV23 at or after age 65 years.

- RESTATEMENT: At present, max # of times someone should receive PPSV23 is THREE.

Varicella Zoster Virus

- DNA, herpes virus; humans only reservoir
- Primary infection spread by respiratory route with viral latency established in doral root ganglia & cranial nerve ganglia
- In pre-vaccine era, 90-95% infected by adulthood

Reactivation = Zoster = Shingles

~ 1 million cases annually in USA

- 30% lifetime risk; mostly >60 yo; can occur any age; increased rates in immunosuppressed
- Classic presentation: dermatomally based, unilateral eruption; thoracolumbar most common; facial/ocular involvement → bad; pain / paresthesia first
- Vesicles may transmit infection

Postherpetic Neuralgia (PHN)

- –Pain ≥ 30 days occurs in 18-30% of zoster cases – mild to excruciating pain after resolution of rash –Constant, intermittent, or triggered by trivial
- stimuli
- –May persist weeks, months or occasionally years
- –Can disrupt sleep, mood, work, and activities of daily living and lead to social withdrawal and depression
- –Risk factors for PHN include age ≥ 50, severe pain before or after onset of rash, extensive rash, and trigeminal or ophthalmic distribution of rash

Other Zoster Complications

- • Herpes Zoster Ophthalmicus – ~15% of HZ cases
- – Can occur when ophthalmic division of trigeminal nerve is involved
  – Untreated, 50-70% develop acute ocular complications
  – Can lead to chronic ocular complications, reduced vision, even blindness

- • Neurologic complications
  – Myelitis, encephalitis, ventriculitis, meningoencephalitis, cranial nerve
- palsies, ischemic stroke syndrome • CSF PCR testing

- – Cutaneous dissemination, pneumonia, hepatitis, disseminated intravascular coagulation

- • Dermatologic complications
  – Secondary infections of rash
  – Permanent scarring and changes in pigmentation

Shingles (Zostavax)

- Zostavax
- Single immunization
- Live attenuated
- 50% reduction in incidence of shingles (in 60-69 year olds, 64% reduction)

Shingrix: recombinant; 2 dose (0 and 2-6 months later)

- Two doses of Shingrix provides strong protection against shingles and postherpetic neuralgia (PHN)
- In adults 50 to 69 years old who got two doses, Shingrix was 97% effective in preventing shingles; among adults 70 years and older, Shingrix was 91% effective.
- In adults 50 to 69 years old who got two doses, Shingrix was 91% effective in preventing PHN; among adults 70 years and older, Shingrix was 89% effective.
- Shingrix protection remained high (more than 85%) in people 70 years and older throughout the four years following vaccination.

CDC ACIP

Recommendations

- Recombinant zoster vaccine (RZV) is recommended for the prevention of herpes zoster and related complications for immunocompetent adults ≥50 years.

- RZV is recommended for the prevention of herpes zoster and related complications for immunocompetent adults who previously received zoster vaccine live (ZVL).

- RZV is preferred over ZVL for the prevention of herpes zoster and related complications.

CDC ACIP

•Care should be taken not to confuse the two different zoster vaccine formulations. RZV (Shingrix) is stored in the refrigerator and administered intramuscularly (IM). ZVL (Zostavax) is stored in the freezer and administered subcutaneously (SC).

•Reconstitution. Shingrix consists of a lyophilized vaccine which needs to be reconstituted with the liquid adjuvant.

•Schedule. 2 doses should be administered IM at 0 and 2-6 months. The vaccine series need not be restarted if more than 6 months have elapsed since the first dose. The minimum interval between doses is 4 weeks and doses given at shorter intervals should be repeated.
Shingrix can be given regardless of: 1) prior receipt of varicella vaccine; 2) prior receipt of ZVL; and 3) prior history of herpes zoster. Do not screen for a history of varicella (verbally or via laboratory serology).

•Based on expert opinion, RZV should not be given <2 months after receipt of ZVL

•Reactions. Studies show Shingrix is safe. Shingrix contains an adjuvant to improve immune response, so it can be associated with more temporary side effects than some other vaccines. About 16% of those vaccinated reported reactions that might prevent them from doing regular activities. Local reactions were reported in about 9% of recipients and systemic reactions in 11%, which included fatigue, fever, nausea, vomiting, diarrhea, shivering. The most common symptoms were pain (78%), myalgia (45%) and fatigue (45%). However, they resolve in 2-3 days.

•Counseling for Reactogenicity. Before vaccination, providers should counsel RZV recipients about expected systemic and local reactogenicity. Reactions to the first dose did not strongly predict reactions to the second dose; vaccine recipients should be encouraged to complete the series even if they experienced a reaction to the first dose of RZV.

Storage and Handling

•Shingrix should be stored in the refrigerator at 2-8^{0}C (not in the freezer). After reconstitution, it must be used within 6 hours or be discarded.

Zoster vaccine summary:

- Use recombinant non-live vaccine (Shingrix)
- Safety in immunocompromised persons …
- Superior efficacy over live vaccine
- No recommendations for booster; immune response had been studied ~ 9 years out
- “AWP” of Shingrix: ~ $170.00 per dose

Vaccines: Economic Considerations: Cost Burden of 4 Adult Vaccine-preventable Diseases to the U.S (65 yrs and older), 2013

Vaccine-Preventable Disease	Estimated # of CASES	Estimated COSTS (Medical & Indirect) *(in millions)*
Influenza	4,019,759	8,312.8
Pneumococcal	440,187	3,787.1
Zoster	555,989	3,017.4
Pertussis	207,241	212.5
TOTAL	**5,223,176**	**$15,329.8**

~$11 billion more annually if population 50–64 yrs of age included

McLaughlin, JM., Tan, L., et al. 2015 J Prim Prev. 2015 Aug;36(4):259–73.

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Ramifications Exist When We Fail to Vaccinate Adults

- Beyond the impact to the health of the public, our ineffectiveness in immunizing adults:
  - Creates disincentive for manufacturers to enter the market
  - Leave the chronically ill vulnerable
  - Creates disparities in access to care
    - Absence of commitment exacerbates existing barriers to immunization for those in the lower socio-economic strata and for racial and ethnic minorities

Other Ramifications …

"By failing to prepare, we are preparing to fail"

- Benjamin Franklin

- Leaves us vulnerable during times of crisis when the ability to reach 250 million adults with vaccines/medications is crucial
  - Pandemic influenza
- Our failure to successfully immunize adults in healthy times predicts our failure to immunize them in times of crisis

Conclusion

- Substantial burden of disease in adults for which vaccines are available
- Vaccines are effective in the adult population. Effectiveness varies by:
  - Vaccine type
  - Disease outcome
  - Age or health of person vaccinated
- Vaccination rates low among adults in U.S.
- Ramifications for failing to vaccinate

Thank you

- Joseph.Gastaldo@OhioHealth.com

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Up to 50% of antibiotic Rx is Inappropriate

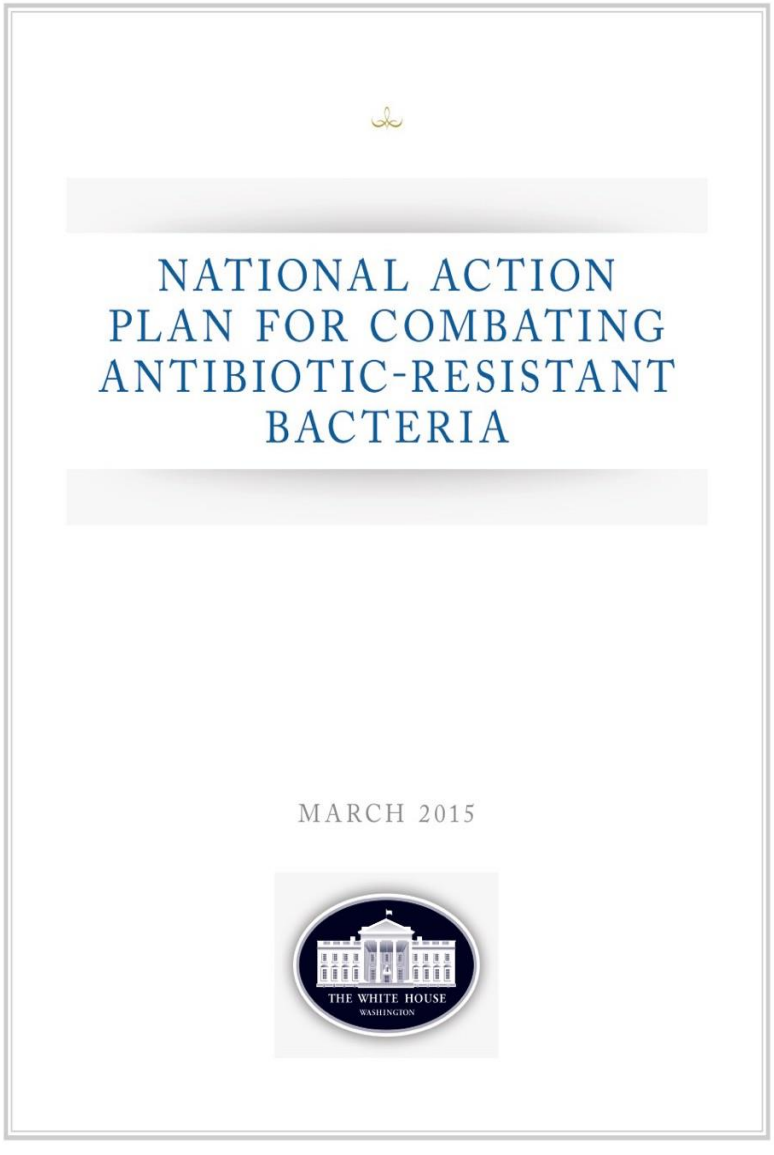
***J of Qual Imp*; Aug 2001; 27(8)**
cdc.gov

- Antibiotic Rx for treatment of syndromes not caused by bacteria
- Antibiotic Rx for treatment of culture results that represent colonization rather in infection
- Administration of broad spectrum antibiotics where narrow spectrum antibiotics are effective
- Antibiotic courses that are longer than necessary
- Antibiotic doses that are too high (toxic) or low

Antimicrobial Stewardship

***CID* (Jan. 2007)44: 159-77**

- A rational, systemic approach using antimicrobial agents in order to achieve optimal outcomes
- Patient outcomes: treatment cure, avoidance of toxicity, & other adverse effects
- Public health outcomes: avoidance of emergence or propagation of antimicrobial resistance
- ASPs: improve patient outcomes, reduce the emergence of antibiotic resistance, reduce *C. difficile* infection rates, improved value: save hospitals money



2020 Goals:

***Establishment of antibiotic stewardship programs in all acute care hospitals and improved antibiotic stewardship across all healthcare settings**

*** Reduction of inappropriate antibiotic use by 50% in outpatient settings and by 20% in inpatient settings**

***Establishment of State Antibiotic Resistance (AR) Prevention (Protect) Programs in all 50 states to monitor regionally important multidrug resistant organisms**

obamawhitehouse.archives.gov

CMS, JC

June, 2016: CMS releases proposed rule change to its Conditions of Participation; require hospitals to implement antibiotic stewardship programs in order to participate in Medicare and Medicaid; approved: **New Antimicrobial Stewardship Standard**

July, 2016: Joint Commission recently announced a new Medication Management (MM) standard for **hospitals**, **critical access hospitals**, and **nursing care centers**; addresses antimicrobial stewardship and becomes **effective January 1, 2017; see jointcommision.org**.

Seven Core Elements of Antimicrobial Stewardship

1. **Leadership Commitment**
   Dedicating necessary human, financial, technological resources
2. **Accountability**
   Appointing a single leader (physician or pharmacist) responsible for program outcomes
3. **Drug Expertise**
   A single dedicated (physician or pharmacist) with responsibility to improve antibiotic use
4. **Tracking**
   Monitoring antibiotic prescribing and resistance patterns
5. **Reporting**
   Feedback of information on antibiotic use and resistance to frontline providers
6. **Education**
   Ongoing education of clinicians about resistance and optimal prescribing
7. **Action**
   Implementing at least one recommended action

http://www.cdc.gov/getsmart/healthcare/implementation/core-elements.html

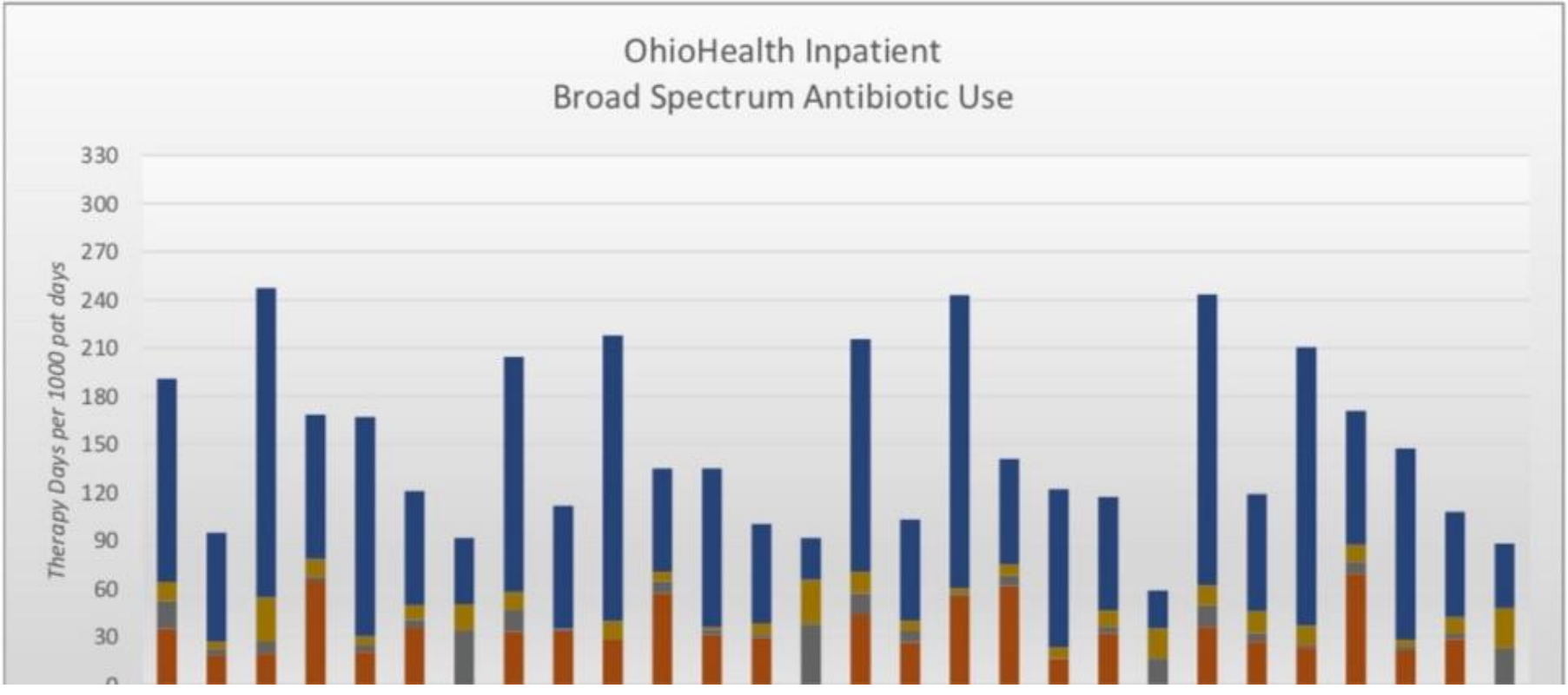
ID CGC

- First meeting: September, 2016; rotated monthly meetings to different campuses
- Participants: ID physicians, representation from other CGCs, pharmacists, lab representation, infection prevention

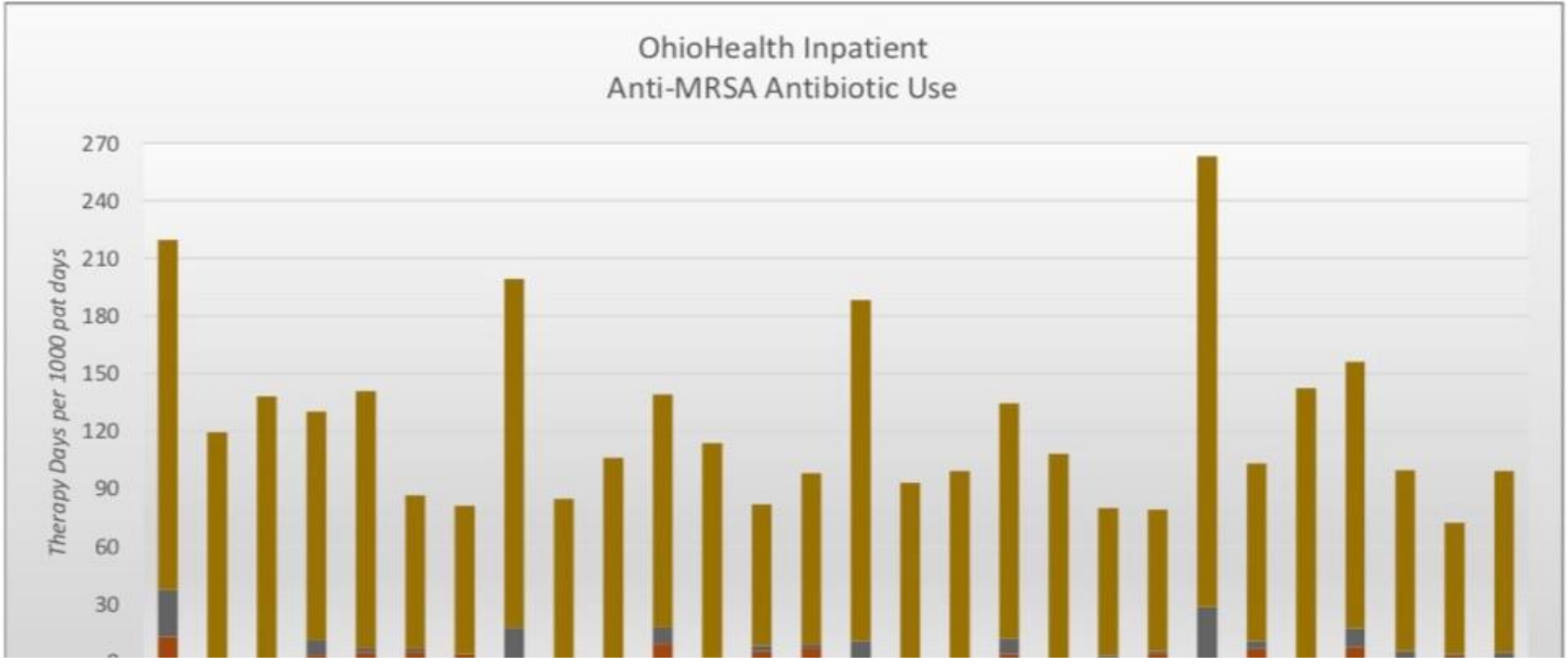
Action topics

- Implementing AMS core measures
- Adding specialized/restricted/timely antimicrobial agents for provider use; having Alinia available for cryptosporidium outbreak
- PCR testing / lab tests: blood, CSF, upper respiratory tract, stool; medical staff education
- Guidelines; HAP, guidelines change

OhioHealth Broad Spectrum Antibiotic Use



OhioHealth Anti-MRSA Antibiotic Use



Future Goals

- Raising the bar for ASM; each campus with a lead AMS pharmacist continued evolution
- Provide real time feed back to providers on antibiotic use & use a 48 hour antibiotic time out
- Lab stewardship: appropriate use of labs, cultures, PCRs, etc

Get Smart About Antibiotics Week
November 12-18, 2017

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