Influenza and Pneumococcal Vaccination

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Objectives

Describe current trends in adult vaccination against influenza and pneumococci infection

To identify appropriate persons for vaccination

Explain role of immunosenescence, disease and vaccination

Contrast and update on PPSV23 and PCV13

Discuss ways in which to improve immunization rates
Figure 2.1 from Leo O, Cunningham A, Stern P. Vaccine immunology. Perspectives in Vaccinology. 2011;1(1):27.
Benefits of Vaccines

- Prevent symptoms and/or disease
- Reduce symptom severity
- Reduce disease complications
- Reduce disease transmission
- Can control and potentially eliminate or eradicate disease
Our Responsibilities

- Educate our patients
- Know contraindications and precautions to vaccinations
- Provide vaccines in a timely fashion, based on most current recommendations
- Report adverse events related to vaccine administration
Influenza and Pneumococcal vaccination

HealthyPeople 2020 Target

NOTES: Estimates are for noninstitutionalized adults. The pneumococcal high-risk group includes persons who reported diabetes; cancer; heart, lung, liver, or kidney disease; or cigarette smoking.

SOURCE: CDC/NCHS, Health, United States, 2014, Figure 12 and Tables 74 and 75. Data from the National Health Interview Survey (NHIS).
Influenza Vaccination Among Adults Aged 18 and Over, By Race

- Year:
  - 1989
  - 1995
  - 2005
  - 2010
  - 2013

- Percentage (%):
  - White only
  - Black only
  - Hispanic or Latino only

Derived from data from Table 74 of National Center for Health Statistics. Health, United States, 2014: With Special Feature on Adults Aged 55–64. Hyattsville, MD.
Influenza Vaccination Among Adults Aged 18 and Over, By Poverty Level

Percentage (%)

Year


Below 100%
100-199%
200-399%
400% or more

Derived from data from Table 74 of National Center for Health Statistics. *Health, United States, 2014: With Special Feature on Adults Aged 55–64. Hyattsville, MD.*
### Healthy People 2020: Goals and Progress for Influenza Vaccination

<table>
<thead>
<tr>
<th>Population</th>
<th>2011 (%)</th>
<th>2014 (%)</th>
<th>2020 Goal (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults aged ≥ 65 years</td>
<td>64.9</td>
<td>65</td>
<td>90</td>
</tr>
<tr>
<td>High-risk adults 18-64 years</td>
<td>45.2</td>
<td>46.3</td>
<td>90</td>
</tr>
<tr>
<td>HCP: All</td>
<td>63.5</td>
<td>75.2</td>
<td>90</td>
</tr>
<tr>
<td>LTC</td>
<td>64.4</td>
<td>63.0</td>
<td></td>
</tr>
<tr>
<td>Hospital</td>
<td>71.1</td>
<td>89.6</td>
<td></td>
</tr>
<tr>
<td>Office</td>
<td></td>
<td>73.7</td>
<td></td>
</tr>
</tbody>
</table>

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Healthy People 2020: Goals and Progress for Pneumococcal Vaccination

<table>
<thead>
<tr>
<th>Population</th>
<th>2011(^1) (%)</th>
<th>2013(^1) (%)</th>
<th>2020 Goal(^2) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults aged ≥ 65 years</td>
<td>62.3</td>
<td>59.7</td>
<td>90</td>
</tr>
<tr>
<td>High-risk adults 18-64 years</td>
<td>20.0</td>
<td>21.0</td>
<td>60</td>
</tr>
</tbody>
</table>

Preventable Diseases

Influenza and pneumococcal infection

• High morbidity and mortality and vaccine-preventable illnesses.

2015 Adult Immunization Schedule

Recommended Adult Immunization Schedule—United States - 2015

Note: These recommendations must be read with the footnotes that follow containing number of doses, intervals between doses, and other important information.

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>AGE GROUP</th>
<th>19-26 years</th>
<th>22-26 years</th>
<th>27-49 years</th>
<th>50-59 years</th>
<th>60-64 years</th>
<th>≥ 65 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza²</td>
<td>1 dose annually</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tetanus, diphtheria, pertussis (Td/Tdap)³</td>
<td>Substitute 1-time dose of Tdap for Td booster; then boost with Td every 10 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Varicella⁴</td>
<td>2 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus (HPV) Female⁵</td>
<td>3 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus (HPV) Male⁶</td>
<td>3 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zoster⁷</td>
<td>1 dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measles, mumps, rubella (MMR)⁷</td>
<td>1 or 2 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumococcal 13-valent conjugate (PCV13)⁸</td>
<td>1-time dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumococcal polysaccharide (PPSV23)⁹</td>
<td>1 or 2 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meningococcal³</td>
<td>1 or more doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatitis A¹⁰</td>
<td>2 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatitis B¹¹</td>
<td>3 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemophilus influenzae type b (Hib)¹²</td>
<td>1 or 3 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Covered by the Vaccine Injury Compensation Program

For all persons in this category who meet the age requirements and who lack documentation of vaccination or who have evidence of previous infection: zoster vaccine recommended regardless of prior episode of zoster

Recommended if some other factor is present (e.g., on the basis of medical, occupational, lifestyle, or other indication)

No recommendation

### 2015 Adult Immunization Schedule Based on Medical Condition

**Figure 2. Vaccines that might be indicated for adults based on medical and other indications**

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>INDICATION</th>
<th>PREGNANCY</th>
<th>IMMUNOCOMPROMISING CONDITIONS (EXCLUDING HUMAN IMMUNODEFICIENCY VIRUS [HIV])</th>
<th>HIV INFECTION (CD4+ T Lymphocyte COUNT)</th>
<th>MEN WHO HAVE SEX WITH MEN (MSM)</th>
<th>END-STAGE RENAL DISEASE, RECIPIENT OF HEMODIALYSIS</th>
<th>CHRONIC HEART DISEASE, CHRONIC LUNG DISEASE, CHRONIC ALCOHOLISM</th>
<th>ASPLENIA (INCLUDING ELECTIVE SPLENECTOMY AND PERSISTENT COMPLEMENT COMPONENT DEFICIENCIES)</th>
<th>CHRONIC LIVER DISEASE</th>
<th>DIABETES</th>
<th>HEALTHCARE PERSONNEL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Influenza</strong></td>
<td></td>
<td></td>
<td>1 dose Tdap every Yrs</td>
<td>1 dose IV or IVF annually</td>
<td>1 dose IV annually</td>
<td>Substitute 1 time dose of Tdap for Td booster then boost with Td every 10 yrs</td>
<td>1 dose IV or IVF annually</td>
<td>1 dose IV or IVF annually</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tetanus, diphtheria, pertussis (Td/Tdap)</strong></td>
<td></td>
<td>1 dose Tdap every Yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Varicella</strong></td>
<td></td>
<td></td>
<td>Contraindicated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Human papillomavirus (HPV) Female</strong></td>
<td></td>
<td></td>
<td>3 doses through age 25 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Human papillomavirus (HPV) Male</strong></td>
<td></td>
<td></td>
<td>3 doses through age 26 yrs</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Zoster</strong></td>
<td></td>
<td></td>
<td>Contraindicated</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Measles, mumps, rubella (MMR)</strong></td>
<td></td>
<td></td>
<td>Contraindicated</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Pneumococcal 13-valent conjugate (PCv13)</strong></td>
<td></td>
<td></td>
<td>1 dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Pneumococcal polysaccharide (PPSV23)</strong></td>
<td></td>
<td></td>
<td>1 or 2 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Meningococcal</strong></td>
<td></td>
<td></td>
<td>1 or more doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td><strong>Hepatitis A</strong></td>
<td></td>
<td></td>
<td>2 doses</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hepatitis B</strong></td>
<td></td>
<td></td>
<td>3 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Haemophilus influenza type b (Hib)</strong></td>
<td></td>
<td></td>
<td>post-HSCT recipients only</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

*Covered by the Vaccine Injury Compensation Program:*

- For all persons in this category who meet the age requirements and who lack documentation of vaccination or have no evidence of previous infection; zoster vaccine recommended regardless of prior episode of zoster
- No recommendation

For more information, visit [CDC's Adult Immunization Schedule](http://www.cdc.gov/vaccines/schedules/downloads/adult/adult-combined-schedule.pdf).
Cases used during this presentation are adapted from the 2012 “Adult Vaccination” and 2011 “Influenza Prevention” teaching scenarios created by Dr. Richard K. Zimmerman, sponsored by the Association for Prevention Teaching and Research (APTR) and the CDC.

Go To:  [http://www.aptrweb.org/?page=time](http://www.aptrweb.org/?page=time)
Mr. Smith, 65 year old, presents to the ED with a productive cough (yellow sputum), pleuritic chest pain, myalgia, chills and fever.

- Six days ago, when his symptoms began (cough, myalgia, fever, pharyngitis), his PCP diagnosed influenza.
- Influenza is circulating in the community.
- His symptoms first improved and now have worsened again.
- He has DM, CKD, is up-to-date on Td (five years ago)
- 39.2 °C and 30 breaths per minute; rales left lower lung field; hypoxia

**TRUE OR FALSE**

*Mr. Smith has at least three indications for influenza vaccination*

A) TRUE

B) FALSE
Risks for Influenza Complications

- Age > 50 years
- Residents of chronic care facilities
- People with chronic conditions
  - chronic pulmonary, metabolic, or CV disorders
  - renal dysfunction
  - hemoglobinopathies
  - immunosuppression, including HIV infection
- Pregnant women in second or third trimester during the influenza season
- Morbidly obese
- Children 6 mo–18 y receiving long-term aspirin therapy

Influenza Vaccines - Types

• Several types
  – **Trivalent inactivated influenza vaccine (TIV)**
    • Inactivated formulation (**IIV3**) – IM or intradermal
      – 2009 -> new, higher-dose formulation for persons >65 yo (Fluzone High Dose)
    • **Recombinant** formulation (**RIV**) – IM only
  – **Quadrivalent**
    • Inactivated formulation (**IIV4**) – IM only
    • Live attenuated vaccine (**LAIV**) – intranasal
      – Contains NO thimerosal or other preservative

• Only RIV has no egg protein (safe for egg allergy)
• Single dose/preservative free syringes and multi-dose vials

Influenza vaccine – indications

- **>6 months old should be vaccinated**
  - If > 6 months and healthy, including pregnant women and those with hives-only allergy to eggs → can give IIV
  - If 2-49 yo, healthy, and without high-risk medical conditions → LAIV can be given
  - If > 18 yo → can give RIV
    - Contains NO egg protein; can be given to people with egg allergy of any severity

- **Intradermal** vaccination approved only for persons age 18-64
- **High-dose** IIV approved only for adults > 65 yo

- Health care personnel should get IIV or RIV
  - If caring for immunocompromised, and LAIV given, avoid contact for 7 days post-vaccination
  - *Children can shed virus for up to 3 weeks

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ACIP Immunization Schedule for Adults: United States 2015

Changes/Additions -

• Contraindications/precautions for LAIV
  – Should not use if influenza antivirals used within 48 hours
  – CAD, renal disease, hepatic disease, diabetes, and chronic lung disease are now precautions, rather than contraindications

• Expand approved age for use of recombinant influenza vaccine
  – All adults 18+ (not 18-49) can receive RIV

Immunogenicity and vaccine efficacy

• Varies according to:
  – Match between circulating and vaccine strains
  – Remaining immunity from prior vaccine
  – Antigenic drift
  – Age
  – Overall health of person

• GOOD match, **60-75% effective**\(^2\) in preventing clinical influenza in healthy individuals; less so with age > 65 yo, still, though:
  – 50-60% reduction in influenza-related hospitalization in >65 yo\(^1\)
  – 80% effective in preventing death from influenza in persons > 65 yo\(^1\)

2. [http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6207a1.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6207a1.htm)
Immune Senescence

• More permissive for infection including pneumonia
  – More permissive for severe infection that can result in hospitalization

• Lowers vaccine response
  – Need better vaccines to overcome declining response

• Slows recovery from infection

• Changes symptom presentation with age


Cytokine Response

- Influenza infection is localized within the respiratory tract, but the release of cytokines produces a systemic response.
- Systemic symptoms caused by cytokines include myalgia, malaise, and fever.
- People with less cytokine are less symptomatic.
Effects of Influenza Vaccine on Major Adverse Cardiovascular Events

<table>
<thead>
<tr>
<th>Endpoints</th>
<th>Vaccine (n=221)</th>
<th>Control (n=218)</th>
<th>Unadjusted HR (95% CI)</th>
<th>P-value (unadjusted HR)</th>
<th>Adjusted HR (95% CI)</th>
<th>P-value (adjusted HR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MACE, n (%)</td>
<td>21 (9.5)</td>
<td>42 (19.3)</td>
<td>0.70 (0.57 - 0.86)</td>
<td>0.004</td>
<td>0.67 (0.51 - 0.86)</td>
<td>0.005</td>
</tr>
<tr>
<td>Death, n (%)</td>
<td>6 (2.7)</td>
<td>12 (5.5)</td>
<td>0.73 (0.50 - 1.03)</td>
<td>0.156</td>
<td>0.62 (0.34 - 1.12)</td>
<td>0.113</td>
</tr>
<tr>
<td>Hospitalization for ACS, n (%)</td>
<td>10 (4.5)</td>
<td>23 (10.6)</td>
<td>0.73 (0.55 - 0.91)</td>
<td>0.032</td>
<td>0.68 (0.47 - 0.98)</td>
<td>0.039</td>
</tr>
<tr>
<td>Hospitalization for HF, n (%)</td>
<td>4 (1.8)</td>
<td>10 (4.6)</td>
<td>0.69 (0.49 - 1.01)</td>
<td>0.111</td>
<td>0.62 (0.19 - 2.04)</td>
<td>0.136</td>
</tr>
<tr>
<td>Hospitalization for stroke, n (%)</td>
<td>1 (0.5)</td>
<td>0</td>
<td>—</td>
<td>—</td>
<td>1.0</td>
<td>—</td>
</tr>
</tbody>
</table>

Hazard ratios were adjusted for age, sex, serum creatinine, treatment with angiotensin-converting enzyme inhibitors, and coronary revascularization. MACE, major adverse cardiovascular events; ACS, acute coronary syndrome; HF, heart failure.
Hospitalization from Influenza (1993-2008)

CDC Estimates of Influenza mortality

- 8.5% of all pneumonia and influenza deaths are estimated to be related to influenza\(^1\)
- 2.1% of all respiratory and circulatory deaths are estimated to be related to influenza\(^1\)
- Majority of deaths occur in persons > 65 years and often as a complication of secondary infection or other comorbid conditions (ie. CHF, COPD)

From 1976-2007, estimates of influenza-related deaths with **underlying pneumonia and influenza** causes, by age group¹:

*Graph showing rate of death per 100,000 person-years.*

1. [http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5933a1.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5933a1.htm) (Table 1)

From 1976-2007, estimates of influenza-related deaths with **underlying respiratory and circulatory causes**, by age group²:

*Graph showing rate of death per 100,000 person-years.*

2. [http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5933a1.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5933a1.htm) (Table 2)
CLINICAL IMPLICATIONS OF BASIC RESEARCH

Insights into Inflammation and Influenza
Cameron Simmons, Ph.D., and Jeremy Farrar, M.D., D.Phil.

• Referenced work by Zheng et al.
• Influenza virus burden in H5N1 infection determined degree of inflammatory response elicited through epithelial cells lining airways
  • TNF-alpha and COX2 produced by epithelial cells
• Giving COX-2 inhibitors (mesalamine + celecoxib) improved pathologic features of lung; lowered inflammatory cytokine concentrations; and produced less T-cell lymphopenia
20,486 persons with a first MI and 19,063 with first stroke who received influenza vaccine

No increased risk of MI or stroke after vaccination with influenza, tetanus, or pneumococcal vaccine

Increased risk of MI and stroke seen with active infection, especially within three days of onset of acute respiratory illness
• 31,989 volunteers at 126 centers in US/Canada
• Intent-to-treat, 50/50, 2011-2013
• Titers higher in HD group
• Relative efficacy, ILI 24.2%; (95% CI 9.7-36.5)
Retrospective Cohort Metadata Type Study: 22% more effective

**Figure 1:** Influenza outcome rates by vaccine type during the 2012–13 influenza season. Each plot displays the rate of influenza per 10,000 person-weeks. Data was smoothed using a weighted average, placing a weight of 0.5 on the current week and a weight of 0.25 on the previous and following weeks. (A) Rapid influenza test followed by treatment with oseltamivir. (B) Inpatient hospital admissions or emergency department visits with an influenza International Classification of Diseases, ninth revision, Clinical Modification code. RIT = rapid influenza diagnostic test.

Figure 1 reprinted from Izurieta HS et al. Lancet Infect Dis. 2015;15:293-300
Polling Question

68 yo BF, here because spouse hospitalized for influenza yesterday.

• CKD, is unvaccinated
• Had a friend with “bad flu” after vaccination
• H/O severe hypersensitivity reaction following exposure to duck feather, but does eat eggs
• Allergic rhinitis now
• Mother—h/o grand mal seizures

TRUE OR FALSE

Influenza can cause a heart attack or stroke in an older patient.

A) TRUE
B) FALSE
Polling Question

68 yo BF, here because spouse hospitalized for influenza yesterday.

- CKD, is unvaccinated
- Had a friend with “bad flu” after vaccination
- H/O severe hypersensitivity reaction following exposure to duck feather, but does eat eggs
- Allergic rhinitis now
- Mother—h/o grand mal seizures

TRUE OR FALSE

She should not get the vaccine due to her feather allergy.

A) TRUE
B) FALSE
Polling Question

68 yo BF, here because spouse hospitalized for influenza yesterday.

- CKD, is unvaccinated
- Had a friend with “bad flu” after vaccination
- H/O severe hypersensitivity reaction following exposure to duck feather, but does eat eggs
- Allergic rhinitis now
- Mother—h/o grand mal seizures

TRUE OR FALSE

The influenza vaccine can cause influenza.

A) TRUE  
B) FALSE
Recommendations for Patients Who Report Egg Allergy

Can the person eat lightly cooked egg (eg, scrambled) without reaction?
- Yes: Administer vaccine per usual protocol
- No:
  - After eating eggs or egg-containing foods, does the person experience ONLY hives?
    - Yes: Administer RIV3 if patient is ages 18 through 49 y OR Administer IIV
      Observe for reaction for at least 30 minutes after vaccination
    - No:
      - After eating eggs or egg-containing foods, does the person experience symptoms of anaphylaxis?
        - Yes: Administer RIV3 if patient is ages 18 through 49 y OR If RIV3 is not available, or patient is age < 18 y or > 49 y, IIV should be administered by a physician with experience in the recognition and management of severe allergic conditions
          Observe for reaction for at least 30 minutes after vaccination
        - No
To which components of vaccines are people most commonly allergic?

- **Egg** (if virus is grown in chicken eggs)
  - Influenza

- **Gelatin**
  - MMR
  - Zoster

- **Yeast** (recombinant vaccine)
  - HPV vaccine
  - Hepatitis B

- **Latex** (not actual component of vaccine; vaccine possibly exposed to natural rubber during storage)
  - Hepatitis and meningococcal vaccines
Adverse Effects

- Local injection-site reaction (15-20%\(^1\))
- Malaise, fevers, chills, myalgias (occur at same rate as placebo)
- **Allergic reaction (rare)**
  - Note thimerosol can potentiate hypersensitivity, but that this is usually a Type IV (delayed-type) hypersensitivity
- Guillain-Barré Syndrome
  - Prevalence is 1-2 cases per 100,000 so estimation of risk is difficult.\(^1\)
  - 1976 Swine Flu vaccine is the one most commonly associated with GBS\(^1\)
  - Do not give if person has developed GBS within 6 weeks of prior vaccination
- Flu???
  - Inactivated virus -> cannot cause the flu

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\(^1\) http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/flu.pdf
Vaccine Adverse Event Reporting System (VAERS)

- National Childhood Vaccine Injury Act (NCVIA) of 1986
  - Must provide patients with vaccine information statement (VIS) for indicated vaccines
  - Report adverse events which may, or may not, be related to the vaccine
In RI, the Department of Health pre-orders influenza vaccine for providers

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Manufacturer / Distributor</th>
<th>NDC</th>
<th>Quadrivalent / Trivalent</th>
<th>Pkg</th>
<th>Preserve Free</th>
<th>Latex Free</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluzone PF 0.25ml (6-35 mos)</td>
<td>Sanofi Pasteur</td>
<td>42981-0515-25</td>
<td>Quad</td>
<td>SYR</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Fluzone PF 0.5ml (3-18 yrs)</td>
<td>Sanofi Pasteur</td>
<td>42981-0415-50</td>
<td>Quad</td>
<td>SYR</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Flumist (2-18 yrs)</td>
<td>MedImmunune</td>
<td>66019-0302-10</td>
<td>Quad</td>
<td>Spray</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Fluarix 0.5ml (19+ yrs)</td>
<td>GlaxoSmithKline</td>
<td>58160-0903-52</td>
<td>Quad</td>
<td>SYR</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Flumist (19-49 yrs)</td>
<td>FFF Enterprises</td>
<td>66019-0302-10</td>
<td>Quad</td>
<td>Spray</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Flulaval (19+ yrs)</td>
<td>GlaxoSmithKline</td>
<td>19515-0898-11</td>
<td>Quad</td>
<td>MDV</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Fluzone HD (65+ yrs)</td>
<td>Sanofi Pasteur</td>
<td>42981-0397-65</td>
<td>Tri</td>
<td>SYR</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Flumist is predicated on receiving a large enough order. If target is not reached it will be ordered with a substitution of single dose prefilled syringes.*
Polling Question

Janys is a 49 yo WF who just started HD for nephropathy from diabetes. Her last vaccines were when she had completed her DTP, MMR and polio vaccines as a child.

TRUE OR FALSE

*She should have her pneumococcal vaccine.*

A) TRUE

B) FALSE
Figure 2. Vaccines that might be indicated for adults based on medical and other indications1

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>INDICATION</th>
<th>Immuno-compromising conditions (excluding human immunodeficiency virus (HIV))4,6,7,8,13</th>
<th>HIV infection CD4+ T lymphocyte count</th>
<th>Men who have sex with men (MSM)</th>
<th>Kidney failure, end-stage renal disease, receipt of hemodialysis</th>
<th>Heart disease, chronic lung disease, chronic alcoholism</th>
<th>Asplenia (including elective splenectomy and persistent complement component deficiencies)4,6,12</th>
<th>Chronic liver disease</th>
<th>Diabetes</th>
<th>Healthcare personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza2,3</td>
<td>Pregnancy</td>
<td>1 dose IIV annually</td>
<td>1 dose IIV or LAIV annually</td>
<td>1 dose IIV annually</td>
<td>Substitute 1-time dose of Tdap for Td booster; then boost with Td every 10 yrs</td>
<td>2 doses</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>1 dose</td>
<td>1 dose IIV or LAIV annually</td>
</tr>
<tr>
<td>Tetanus, diphtheria, pertussis (Td/Tdap)4,5</td>
<td>1 dose Tdap each pregnancy</td>
<td>Contraindicated</td>
<td>1 or 2 doses</td>
<td>1 or 2 doses</td>
<td>1 or more doses</td>
<td>Recommended if some other risk factor is present (e.g., on the basis of medical, occupational, lifestyle, or other indications)</td>
<td>1 dose</td>
<td>2 doses</td>
<td>3 doses</td>
<td>1 or 3 doses</td>
</tr>
<tr>
<td>Varicella</td>
<td>Contraindicated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus (HPV) Female3,6</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>1 dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus (HPV) Male3,5</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 21 yrs</td>
<td>1 dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zoster4</td>
<td>Contraindicated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measles, mumps, rubella (MMR)4,7</td>
<td>Contraindicated</td>
<td></td>
<td>1 or 2 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumococcal 13-valent conjugate (PCV13)4,9</td>
<td></td>
<td></td>
<td>1 dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumococcal polysaccharide (PPSV23)4</td>
<td></td>
<td></td>
<td>1 or 2 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meningococcal9</td>
<td></td>
<td></td>
<td>1 or more doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatitis A3,10</td>
<td></td>
<td></td>
<td>2 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatitis B3,11</td>
<td></td>
<td></td>
<td>3 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemophilus influenzae type b (Hib)12</td>
<td></td>
<td></td>
<td>post-HSCT recipients only</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Covered by the Vaccine Injury Compensation Program

For all persons in this category who meet the age requirements and who lack documentation of vaccination or have no evidence of previous infection; zoster vaccine recommended regardless of prior episode of zoster

Recommended if some other risk factor is present (e.g., on the basis of medical, occupational, lifestyle, or other indications)
S. Pneumoniae – How Common Is It?

- There is **invasive** and **non-invasive** pneumococcal disease
  - Invasive (IPD): **bacteremia, meningitis**
    - Up to 12,000 pneumococcal bacteremia hospitalizations annually
      - 20% mortality (**60% in elderly**)
      - ~3000-6000 meningitis
        » **8% mortality** – kids
        » **22% mortality** - adults
  - Noninvasive: **pneumonia, acute otitis media**
    - Up to 36% of adult CAP due to S. pneumoniae
      - 100,000-400,000 hospitalizations annually due to pneumococcal pneumonia, with **5-7% mortality** (higher in elderly)
      - In patients 18-64 yo with hematologic malignancies: 186/100,000 cases annually
      - In patients 18-64 yo with HIV: 173/100,000 cases annually

Polysaccharide vs. Conjugate Vaccines and Immunogenicity

- (Free) Polysaccharide vaccines induce **a B-cell-dependent immunity**
  - Helps prevent bacteremia (60-70% effective against invasive disease)\(^1\), less effective against pneumococcal pneumonia

- Conjugate vaccine gets **B- and T-cell immunity → memory response**
  - This involves mucosal surfaces, so helps with localized, non-bacteremic infection too (i.e., otitis media)

- PCV7 reduced invasive disease by 97%; reduced episodes of x-ray confirmed pneumonia, AOM, tympanostomy tube placement, and nasopharyngeal carriage\(^1\)

---

Percentage of Invasive Pneumococcal Disease Caused by Serotypes in 3 Pneumococcal Vaccines

- PCV7
- PCV13
- PPSV23

Age group (yrs):
- 18–49
- 50–64
- ≥65

Percentage
Efficacy of Pneumococcal Conjugate Vaccine

• In 2000, PCV7 licensed for use in kids
  – Good against IPD, somewhat effective against pneumonia and OM
  – Invasive pneumococcal disease in kids dropped from 80 to 1 case per 100,000 person years (by 2007)\(^1\)
  – **Indirect effects** reduced incidence of IPD in adults as well, from 2001 onward\(^1\)

---

Changes in Invasive Pneumococcal Disease (IPD) Incidence By Age Group 1996 – 2007. CDC Active Bacterial Core Surveillance
Changes in Invasive Pneumococcal Disease (IPD) Incidence By Serotype Group Among Children Aged <5 Years
Changes in Invasive Pneumococcal Disease (IPD) Incidence By Serotype Group Among Adults Aged >65 Years
Efficacy of Pneumococcal Conjugate Vaccine

- In 2010, PCV13 replaced PCV7
  - 7 serotypes of PCV7 + 6 more
    - Good for IPD against those 13 serotypes; and OM against 7 serotypes common to PCV7
- There has been decreased penicillin resistance as well!¹

- Compared with PCV7 alone, IPD in children < 5 years declined by 64%²

- IPD caused by PCV13 (excluding PCV7) serotypes decreased by 93% by summer 2013²

- In adults, IPD overall decreased by 12-32% and PCV13-PCV7 serotypes IPD decreased by 58-72% (depending on age)
  - ~30,000 cases of IPD and 3000 deaths prevented²

PCV13: CAPiTA Trial

- 84,496 adults >65 yo
- Double-blind, placebo RCT
- Netherlands

Primary endpoint:
- 45.5% reduction (P < 0.0001) in vaccine type (VT) CAP

Secondary endpoint
- 45% reduction (P < 0.001) in nonbacteremic non VT CAP
- 75% reduction in invasive VT pneumococcal disease
Herd Immunity

http://www.vaccines.gov/basics/protection/
Image credited to NIAID
Pneumococcal Vaccine Timing Flow Chart (age 65+ and high-risk adults)
SUMMARY

• If pneumococcal vaccine naïve, **PCV13 first**
  – Follow with PPSV23 at least 8 weeks afterward
• **If already had PPSV23, then PCV13 next, at least 1 year out**

• If already had both PPSV23 and PCV13, then give 2nd PPSV23
  – 8 weeks after PCV13 AND 2.5 years after first PPSV23 dose

**ALSO**
• ONLY 1 lifetime dose of PCV13
• No more than 2 doses of PPSV23 before age 65 (in select groups)
• Expect most will get one dose of PCV13 and one dose of PPSV23 after age 65
Polling Question

Joan is an 89 yo BF who had received PPSV23 four years ago.

**TRUE OR FALSE**

*She should receive the PCV-13 now.*

A) TRUE  
B) FALSE
Low Vaccination Rates

Provider-oriented Reasons
• Indications based on environment, lifestyle, and chronic medi-cal conditions are overlooked
• Missed opportunities
• Incorrect contraindications
• No system to identify people due for vaccination
• No standing orders

Patient-oriented Reasons
• Patients don’t know they are due
• Fear of adverse events, needles
• Lack of routine appointment

System Reasons
• Shortage
• Lack of vaccine tracking systems
• Reimbursement issues (<65 yo)
• Access difficulties

How can WE improve vaccination rates?

- Protocol to screen patient and **standing orders** to vaccinate
  - Use coding systems to ID patients who need vaccine based on age and high-risk conditions
  - Devise a reminder system (for patient and EMR alert or chart sticker)
- Incorporate vaccination discussion into **routine** office intake
- Maintain accurate **documentation** of vaccination history and help patient keep vaccination list which they can keep updated
- Develop a **QI initiative** for performance feedback, competition
- **Improve access**: reimbursements, health-care coverage, multiple sites, home visits for home-bound, call less-literate “reserving your flu shot”, “no appointment necessary”
- Improve provider access to records: **vaccine registries**

How can you improve vaccination rates?

Patient education, dispelling myths, staff vaccination rates…

Effect of Health Care Provider Recommendation on Vaccine Receipt in Those with Negative Thoughts about Vaccination

- Received vaccine if provider recommended
- Received vaccine if provider did not recommend

Influenza

Pneumococcal

Percentage

80
70
60
50
40
30
20
10
0

FLU VACCINE CATEGORIES

H1N1 FLU
NASAL FLU MIST
HIGH RISK
OVER AGE 65
UNDER AGE 2

REGULAR FLU
LOW DOSE
HIGH DOSE

LOW RISK
HIGH RISK

AGE 2-49
PREGNANT
LOW RISK
PRIORITY JOBS
HEALTH STAFF

ANY QUESTIONS?

DAVE GRANLUND © www.davegranlund.com
Aligning Quality Reporting

- Meaningful Use electronic Clinical Quality Measures (e-CQMs) -> PQRS
- Physician Quality Reporting System (PQRS) Measures
  - Preventative Care and Screening: Influenza (110)
  - Pneumonia Vaccination Status for Older Adults (111)
- PQRS-> Value-Based Payment Modifier
- Patient Centered Medical Homes
- ACO Shared Savings Programs
Summary

- None of the current adult vaccines have uptake anywhere near the HealthyPeople 2020 goals of 90%

- Influenza and pneumococcal vaccines reduce or prevent disease, and are covered by insurance
  - Older adults present differently, and have consequences affecting cardiovascular outcomes, too

- Other vaccines effective in adults, too, with variable coverage
  - Shingles (Herpes Zoster), hepatitis and TdaP vaccines

- Develop systematic approach to getting vaccination status tracked, reminders, and standing orders to meet HP2020 goals and align with meaningful use