Vaccine-preventable diseases cause long-term illness, hospitalization, and even death

- Each year in the U.S.
  - 3,000–49,000 people die of influenza and its complications, mostly adults
  - HPV causes ~17,000 cancers in women, and ~9,000 in men
    - ~4,000 women die from cervical cancer
  - ~32,000 cases of invasive pneumococcal disease in 2012 and 3,300 deaths
  - 800,000–1.4M people suffer from chronic hepatitis B, with complications including liver cancer
Seasonal flu is a constant, though variable, threat to public health

<table>
<thead>
<tr>
<th>Influenza season</th>
<th>Estimated number of cases (in millions)</th>
<th>Estimated number of medically-attended cases (in millions)</th>
<th>Estimated number of hospitalizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005–06</td>
<td>10.9</td>
<td>4.6</td>
<td>84,500</td>
</tr>
<tr>
<td>2006–07</td>
<td>6.8</td>
<td>2.8</td>
<td>47,300</td>
</tr>
<tr>
<td>2007–08</td>
<td>13.0</td>
<td>5.5</td>
<td>118,700</td>
</tr>
<tr>
<td>2008–09</td>
<td>10.2</td>
<td>4.3</td>
<td>61,700</td>
</tr>
<tr>
<td>2009–10</td>
<td>52.0</td>
<td>24.2</td>
<td>290,200</td>
</tr>
<tr>
<td>2010–11</td>
<td>22.0</td>
<td>9.3</td>
<td>169,900</td>
</tr>
<tr>
<td>Season average</td>
<td>19.2</td>
<td>8.5</td>
<td>128,700</td>
</tr>
</tbody>
</table>


The benefits of flu vaccination

The estimated number of influenza-associated illnesses prevented by flu vaccination during the 2012-2013 season:

- **6.6 million**
  - or the population of the state of Arizona

The estimated number of flu-associated medical visits prevented by vaccination during the 2012-2013 season:

- **3.2 million**
  - or the passengers of 1,067 mega cruise ships

The estimated number of flu hospitalizations prevented during the 2012-2013 season:

- **79,000**
  - or all the fans in a FULL NFL stadium

get vaccinated

www.cdc.gov/flu
2009 H1N1 virus took a significant toll on the U.S. population

- **61M cases of flu**
  - Range: 43M–89M
- **274,000 hospitalizations**
  - Range: 195,000–403,000
- **12,500 deaths**
  - Range: 9,000–18,000
- **>1,000 pediatric deaths**
  - 8 times higher than average


**Major changes for ACIP influenza vaccination recommendations**

- Persons 65 years and older
- Persons of any age with chronic medical conditions conferring higher risk for flu-related complications
- Pregnant women in 2nd or 3rd trimester
- Contacts (household and out-of-home caregivers) of the above groups
- Health care workers

**Before 2000**
- + all adults (50–64 years)
- + pregnant women (any trimester)
- + all children (6–23 months)

**2001**
- + all children (6–23 months)

**2003**
- + all children (24–59 months)
- Annual vaccination recommended for all persons (6 months & older)

**2004**
- + all children (5–18 years)

**2006**
- + all children (5–18 years)

**2008**
- + all children (5–18 years)

**2010**
- + all children (5–18 years)
- + pregnant women (any trimester)
- + all children (6–23 months)
- + all children (24–59 months)
- + pregnant women (any trimester)
- + all children (5–18 years)
- Annual vaccination recommended for all persons (6 months & older)
### Influenza vaccines approved for use in the U.S., 2013–14

<table>
<thead>
<tr>
<th>Vaccine Type</th>
<th>Trade name</th>
<th>Age indications</th>
<th>Route</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inactivated influenza vaccine, trivalent (IIV3), standard dose</strong></td>
<td>Afluria</td>
<td>≥9 yrs.</td>
<td>IM</td>
</tr>
<tr>
<td></td>
<td>Fluarix</td>
<td>≥3 yrs.</td>
<td>IM</td>
</tr>
<tr>
<td></td>
<td>Flucelvax</td>
<td>≥18 yrs.</td>
<td>IM</td>
</tr>
<tr>
<td></td>
<td>FluLaval</td>
<td>≥3 yrs.</td>
<td>IM</td>
</tr>
<tr>
<td></td>
<td>Fluvirin</td>
<td>≥4 yrs.</td>
<td>IM</td>
</tr>
<tr>
<td></td>
<td>Fluzone</td>
<td>6 mos-64 yrs.</td>
<td>IM</td>
</tr>
<tr>
<td></td>
<td>Fluzone Intradermal</td>
<td>18–64 yrs.</td>
<td>Intradermal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Inactivated influenza vaccine, trivalent (IIV3), high dose</strong></th>
<th>Fluzone High-Dose</th>
<th>≥65 yrs.</th>
<th>IM</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Inactivated influenza vaccine, quadrivalent (IIV4), standard dose</strong></th>
<th>Fluarix Quadrivalent</th>
<th>≥3 yrs.</th>
<th>IM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flulaval Quadrivalent</td>
<td>≥3 yrs.</td>
<td>IM</td>
</tr>
<tr>
<td></td>
<td>Fluzone Quadrivalent</td>
<td>6-36 mos</td>
<td>IM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Recombinant influenza vaccine, trivalent (RIV3)</strong></th>
<th>FluBlok</th>
<th>18–49 yrs.</th>
<th>IM</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Live attenuated influenza vaccine, quadrivalent (LAIV4)</strong></th>
<th>FluMist Quadrivalent</th>
<th>2–49 yrs.</th>
<th>Intranasal</th>
</tr>
</thead>
</table>

www.cdc.gov/mmwr/preview/mmwrhtml/rr6207a1.htm?s_cid=rr6207a1_w#Tab1

### Influenza vaccination has prevented millions of illnesses and medical visits, and thousands of hospitalizations

**Cumulative influenza illnesses and hospitalizations averted by influenza vaccination, 2005–2013, U.S.**

<table>
<thead>
<tr>
<th>Influenza seasons</th>
<th>Estimated number of cases averted</th>
<th>Estimated number of medically-attended cases averted</th>
<th>Estimated number of hospitalizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005–11*</td>
<td>13.6 M</td>
<td>5.8 M</td>
<td>112,900</td>
</tr>
<tr>
<td>2011–12†</td>
<td>1.5 M</td>
<td>720,000</td>
<td>18,900</td>
</tr>
<tr>
<td>2012–13†</td>
<td>6.6 M</td>
<td>3.2 M</td>
<td>79,300</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>21.7 M</strong></td>
<td><strong>9.8 M</strong></td>
<td><strong>211,100</strong></td>
</tr>
</tbody>
</table>

Seasonal influenza vaccine coverage increased among children and adults

![Graph showing increased vaccination coverage among children and adults]

*2009-10 estimates data are from Behavioral Risk Factor Surveillance System (BRFSS) (≥18 years) and the National 2009 H1N1 Flu Survey (≥ 6 months), www.cdc.gov/flu/fluvaxview/coverage_0910estimates.htm. 2012-13 estimates are from BRFSS (≥18 years) and National Immunization Survey (6 months-17 years), www.cdc.gov/flu/fluvaxview/coverage-1213estimates.htm

Vaccination coverage among health care personnel increased by 20%

![Graph showing increased vaccination coverage among health care personnel]

*National Health Interview Survey (NHIS) - Lu et al. AJE. NHIS is data source for HP2020 objective
Internet Panel Surveys - MMWR 2013;62(38); *Preliminary results
Coverage among Hispanic, black, and Asian children was higher compared to non-Hispanic whites

Other racial/ethnic groups exclude Hispanics
Sources: National Immunization Survey (NIS) (6 months-17 years) and Behavioral Risk Factor Surveillance System (BRFSS) (≥18 years)

Progress in influenza diagnostics: CDC’s molecular detection kits

- Produce fast, accurate information from flu samples
- Lead to rapid public health response in the case of emerging novel virus infections
- Distributed to all states and National Influenza Centers globally
- Can determine type and subtype of a flu virus in hours, not days
- Lead to cost-savings at the state level

Other racial/ethnic groups exclude Hispanics
Sources: National Immunization Survey (NIS) (6 months-17 years) and Behavioral Risk Factor Surveillance System (BRFSS) (≥18 years)
Global Health Security

3 Risks
• Emerging organisms
• Drug resistance
• Intentional creation

3 Opportunities
• Societal commitment
• New technologies
• Success leads to success

3 Priorities
• Prevent wherever possible
• Detect rapidly
• Respond effectively

More Americans died from the 1918–1919 influenza pandemic than died in World War I

New influenza viruses have the potential to emerge as pandemic

- Avian Influenza A (H5N1)
- Influenza A (H1N1)
- Influenza A (H3N2) variant
- Avian Influenza A (H7N9)

www.sciencedirect.com/science/article/pii/S0140673612611519
Note: Air traffic to most places in Africa, regions of South America, and parts of central Asia is low. If travel increases in these regions, additional introductions of vector-borne pathogens are probable

A health threat anywhere is a health threat everywhere

Global aviation network
Outbreaks can start anywhere

Outbreaks reported by WHO, 1996-2009

Note: Points mark reported origin of outbreak or, if unknown, where highest reported morbidity/mortality rates were recorded.

Confirmed cases of MERS (N = 536) as of May 9, 2014,* and history of travel from in or near the Arabian peninsula within 14 days of illness onset

Points of entry and volume of travelers on flights to the U.S. from Saudi Arabia and the United Arab Emirates, May-June 2014

*Reported by WHO
Advanced Molecular Detection saves lives, time, and money

- AMD includes new lab technologies that revolutionize how CDC investigates and controls outbreaks
- Enables CDC to detect outbreaks sooner and respond more effectively, saving lives, time, and money

Detects pathogens in just hours or days

Improving public health through AMD technologies

<table>
<thead>
<tr>
<th>Year</th>
<th>Basal Pairs/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>500</td>
</tr>
<tr>
<td>2003</td>
<td>50,000</td>
</tr>
<tr>
<td>2013</td>
<td>50,000,000,000</td>
</tr>
</tbody>
</table>

Human genome: 3,000,000,000bp
Advanced Molecular Detection combines cutting-edge approaches

Key directions

- Improve vaccine coverage
- Improve influenza vaccines
- Enhance bioinformatics infrastructure
- Improve influenza surveillance in animal populations
CDC works 24/7 to save lives & protect people from health threats