VACCINE PREVENTABLE DISEASE EPIDEMIOLOGY

The Twenty-Second Annual Massachusetts Immunization Action Partnership Pediatric Immunization Skills Building Conference
October 12, 2017

Marija PopStefanija, MPH, Epidemiologist
Division of Epidemiology & Immunization, MDPH

PRESENTER DISCLOSURE INFORMATION

☐ I, Marija PopStefanija, have been asked to disclose any significant relationships with commercial entities that are either providing financial support for this program or whose products or services are mentioned during my presentations.
  ☐ I have no relationships to disclose.
☐ I may discuss the use of vaccines in a manner not approved by the U.S. Food and Drug Administration.
  ☐ But in accordance with ACIP

Today's Topics

☐ Collaboration
  ☐ Initial steps and key concepts to prevent spread

☐ Vaccine-preventable disease (VPD) epidemiology in Massachusetts
  ☐ Overall trends
  ☐ Mumps
  ☐ Pertussis
  ☐ Congenital Rubella Syndrome (CRS)
  ☐ Influenza
  ☐ Chickenpox
Why Vaccinate? It Prevents Disease!

Vaccines for Children, 50 years of protecting America's children

Why Vaccinate? It Prevents Disease!

Vaccines for Children, 50 years of protecting America's children

Rates of Kindergarten Students with an Exemption, By County, 2016

Get Vaccinated! Yes, you!

Adult Occupational Immunizations

Recommendaed Immunizations For Health Care Personnel (HCP)

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Recommendations in Brief</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza</td>
<td>1 dose of the vaccine every 3-4 years</td>
</tr>
<tr>
<td>Tetanus</td>
<td>1 dose if Tdap was not received, then Td booster every 10 years</td>
</tr>
<tr>
<td>Measles, Mumps, Rubella</td>
<td>2 doses if &lt;12 years, last dose received before 7th birthday</td>
</tr>
<tr>
<td>Varicella</td>
<td>2 doses of varicella vaccine or serologic evidence of immunity or laboratory confirmation of prior varicella infection</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>First injection of a hepatitis B vaccine series</td>
</tr>
<tr>
<td>Pneumococcal</td>
<td>1 dose of pneumococcal conjugate vaccine (PCV) and 1 dose of pneumococcal polysaccharide vaccine (PPV)</td>
</tr>
</tbody>
</table>

Influenza: Why could more workers afford to receive the influenza vaccine?

HCPs working in settings that have a high risk of exposure to influenza patients or who work in intensive care units should receive the influenza vaccine. HCPs who work in settings that have a high risk of exposure to influenza patients should receive the influenza vaccine. HCPs who work in settings that have a high risk of exposure to influenza patients should receive the influenza vaccine. HCPs who work in settings that have a high risk of exposure to influenza patients should receive the influenza vaccine.
Collaborations in Disease Surveillance and Control

HEALTHCARE PROVIDER ROLE
- Notify patient of diagnosis
- Notify the LBOH or MDPH of an infectious reportable disease
- Inform patient that the LBOH may be calling
- Educate patient about protecting their family and close contacts
- Provide key information to the LBOH to complete the official "Case Report"
- Assist with notification and PEP
- Exclude susceptible staff?

Public Health – Initial Steps
- Confirming a case (may not be necessary)
  - Isolation of case while infectious
  - Determining the infectious period
  - Based on the mode of transmission, identifying those who were exposed
  - Facilitating notification of those who were exposed
  - Identification of susceptibles
  - Identification of high-risk susceptibles
  - Post-exposure vaccination or chemoprophylaxis

*per 105 CMR 300.000
WHAT IS REPORTABLE BY WHOM?

105 CMR 300.000

- Reportable Diseases Lists:
  - Healthcare providers
  - Clinical laboratories
  - Diseases in red are "immediate" diseases.
  - Diseases in black are reportable within 1-2 business days.


WHAT IS REPORTABLE BY WHOM?

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>24</td>
<td>0</td>
<td>1</td>
<td>8</td>
<td>0</td>
<td>1</td>
<td>2**</td>
</tr>
<tr>
<td>Mumps</td>
<td>6</td>
<td>7</td>
<td>15</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>71</td>
<td>5</td>
<td>6</td>
<td>258</td>
</tr>
<tr>
<td>Rubella</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CRS</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Meningococcal</td>
<td>21</td>
<td>22</td>
<td>14</td>
<td>8</td>
<td>14</td>
<td>6</td>
<td>11</td>
<td>11</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Pertussis</td>
<td>1187</td>
<td>761</td>
<td>862</td>
<td>296</td>
<td>280</td>
<td>655</td>
<td>348</td>
<td>258</td>
<td>253</td>
<td>197</td>
</tr>
<tr>
<td>HIB &lt; 5</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Tetanus</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Polio</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pneumococcal</td>
<td>89</td>
<td>83</td>
<td>81</td>
<td>72</td>
<td>40</td>
<td>51</td>
<td>24</td>
<td>27</td>
<td>20</td>
<td>31</td>
</tr>
<tr>
<td>Pertussis</td>
<td>1584</td>
<td>1515</td>
<td>770</td>
<td>606</td>
<td>628</td>
<td>475</td>
<td>469</td>
<td>356</td>
<td>290</td>
<td></td>
</tr>
</tbody>
</table>

Data are current as of 8/24/2017 and are subject to change.

*Both confirmed and probable cases are reported for measles, mumps, rubella, and varicella to better reflect the true burden of disease. All other diseases include confirmed cases only. **Includes one case in a visitor from Europe.

Investigations vs. Confirmed* Cases

<table>
<thead>
<tr>
<th>Disease</th>
<th>2015 Investigations</th>
<th>2015 Confirmed Cases</th>
<th>2016 Investigations</th>
<th>2016 Confirmed Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphtheria</td>
<td>5</td>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Measles*</td>
<td>267</td>
<td>0</td>
<td>272</td>
<td>2</td>
</tr>
<tr>
<td>Mumps*</td>
<td>154</td>
<td>6</td>
<td>789</td>
<td>258</td>
</tr>
<tr>
<td>Polio</td>
<td>28</td>
<td>0</td>
<td>37</td>
<td>0</td>
</tr>
<tr>
<td>Rubella*</td>
<td>23</td>
<td>0</td>
<td>65</td>
<td>0</td>
</tr>
<tr>
<td>Pertussis</td>
<td>345</td>
<td>253</td>
<td>338</td>
<td>197</td>
</tr>
<tr>
<td>Tetanus</td>
<td>822</td>
<td>259</td>
<td>1513</td>
<td>457</td>
</tr>
</tbody>
</table>

*Includes probable cases to more accurately reflect true burden of disease.

10/10/2017
Your clinical staff have had unprotected close contact to a confirmed case of mumps. Fortunately all are vaccinated. How protective is two doses of MMR in preventing mumps?

- 100% effective
- 75% effective
- 85% effective
- 88% effective

Your lifeline?

- Call MDPH epidemiologists at 617-983-6800
Mumps

A systemic disease characterized by:
- Non-specific prodrome consisting of myalgia, loss of appetite, malaise, headache, low-grade fever
- Swelling of one or more salivary glands, usually the parotid glands, often tender or painful, with orchitis commonly reported in males after puberty
- 1/3 of infections may be asymptomatic or manifest as respiratory illness
- Rare complications include arthritis, encephalitis, thyroiditis, mastitis, ataxia, oophoritis, hearing loss, and others
- Infectious 2 days before onset of swelling, and five days after

Mumps Cases and Outbreaks, United States - 2016-2017

**In 2016, over 6,000 cases reported to CDC, most cases in 10 years.**
- From January 1 to August 12, 2017, 47 states and the District of Columbia in the U.S. reported mumps infections in 4,240** people to CDC.
- In recent years outbreaks largely confined to universities and other close contact settings, including teams, schools, prisons and the Marshallese community.
- Large number have 2 doses of MMR

**Preliminary data reported to CDC.**

2016 Outbreak Summary - Massachusetts

Largest mumps outbreak in MA in 30+ years
- 789 total investigations from January – December 2016
- 253 confirmed or probable cases
- Age range 1-69 years (median 21 years)
- Largely contained within university settings, with little spread into surrounding communities
- Transmission interrupted due to:
  - Enforcement of existing school requirements for immunization
  - Implementation of control measures, including social distancing
  - End of school year (summer 2016) and school vacations

Data are preliminary and subject to change.
2017 Mumps to Date

- 546 mumps investigations from 1/1/17 – 10/10/17
- 87 confirmed cases
- Age range 15 - 50 years (median 25 years)
- 51 (59%) among Latinos in Greater Boston
- 58 (67%) no clear connection to colleges and universities

Mumps - What Should Providers Do?

- Ensure all patients and staff are UTD with MMRs
- If mumps is suspected, isolate patient for 5 days, even if test results come back negative
- Encourage good infection control practices
- Remember, there are many causes of parotitis! Consider testing for other etiologies
  - (e.g., influenza, blocked salivary ducts, etc.)
- Testing – “rule out testing” does not exist
  - Buccal swabs for PCR testing are best, but not perfect
  - IgM testing of limited value in vaccinated population
- 2 doses of MMR is 88% effective

Pertussis Million Dollar Question

Your clinical staff have had unprotected close contact to a confirmed case of pertussis, who made four office visits while infectious. How long is the pertussis infectious period if untreated?

- Three weeks before cough onset
- Two weeks after cough onset
- About 21 days
- Two weeks before and three weeks after cough onset
Your clinical staff have had unprotected close contact to a confirmed case of pertussis, who made four office visits while infectious. How long is the pertussis infectious period if untreated?

- Three weeks before cough onset
- Two weeks after cough onset
- About 21 days
- Two weeks before and three weeks after cough onset, if untreated

Phone a friend

- Call MDPH epidemiologists at 617-983-6800

Make sure all healthcare staff are up to date with Tdap.

12/197 confirmed cases in 2016 were in infants < 1 year.
Pertussis - Whooping Cough

- Can start like a common cold – runny nose, low-grade fever, and coughing – some people might not know they have it.
- Infants suffer the most serious consequences.
  - Infants younger than 1 year old who get whooping cough, ½ are hospitalized.
  - Of those hospitalized, 1 out of 4 get pneumonia.
  - Of those hospitalized, 1 to 2 out of 100 dies.
- Peak in 2012 in US:
  - More than 48,000 cases of whooping cough reported.
  - 15 infants younger than 3 months died.

Tdap for Mother Protects Infant

- Pregnant women should receive 1 dose of Tdap during each pregnancy, preferably during the early part of gestational weeks 27–36, regardless of prior history of receiving Tdap.
- Infants of Tdap vaccinated mothers were born with significantly higher anti-pertussis antibodies compared to infants of unvaccinated mothers.
- Within the 27-36 weeks administration “window”:
  - Concentration of anti-pertussis antibodies in infant cord blood were higher when mothers were vaccinated earlier.
  - Longer exposure to vaccine allows for higher vaccine induced antibody levels produced by other and transferred to infant.

PERTUSSIS TESTING

- Acceptable diagnostic tests include:
  - Culture at HSLI or any commercial lab
  - PCR from any commercial lab
  - Serology performed at MA SPHL (Serology from commercial labs are not acceptable due to inability to interpret results).

<table>
<thead>
<tr>
<th>Diagnostic Method</th>
<th>Duration of Cough</th>
<th>Children (≤11 yrs)</th>
<th>Adults (≥11 yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤14 Days</td>
<td>NP Swab(s)</td>
<td>NP Swab(s)</td>
</tr>
<tr>
<td></td>
<td>14-28 Days</td>
<td>Serology at HSLI</td>
<td>Serology at HSLI</td>
</tr>
<tr>
<td></td>
<td>29-56 Days</td>
<td>Serology at HSLI</td>
<td>Serology at HSLI</td>
</tr>
</tbody>
</table>

MIAP Conference, 2017
Pertussis Notifications

- Schools/teams/camps may send out notifications when there has been an exposure.
- Read the advisory closely to determine if this is a general notification, or if the patient has been identified as a close contact.

CRS Million Dollar Question

A baby with congenital rubella syndrome (CRS) is born in your community. This is an unusual event in the U.S. How long could this baby be infectious with rubella?

- Until treated with antiviral medication
- For seven days before and seven days after rash onset
- Virus usually cleared by three months
- Until two negative PCR results 30 days apart (up to a year or more)
Who you gonna call?

- Call MDPH epidemiologists at 617-983-6800

Congenital Rubella Syndrome (CRS)

Maternal rubella infection, especially during the first trimester can cause multiple serious birth defects in the fetus. Baby can remain infectious for one year or longer.

- 2017: First Massachusetts case in over 20 years.
  - Born in February in an outlying hospital.
  - Mother from Africa: one US prenatal visit prior to delivery.
  - Came to MA for delivery.
  - Born with many serious health effects.
  - Mother was tested for rubella immunity and had a very high positive IgG. Most likely had rubella in first trimester.
  - Baby had positive PCR results for five months; first
**CRS In the US and Worldwide**

- More than 100,000 children are born every year with CRS, mainly in Africa, South-East Asia, and the Western Pacific.
- There were 41 cases of CRS reported in the US from 1998 – 2016 (18 year period). 88% of mothers were born outside the US.

**CRS Recommendations**

- Immunity to rubella should be documented in ALL pregnant women.
- If not immune, or status unknown, vaccinate.
  - Before pregnancy
  - Or before discharge after delivery
  - Or at the first post-partum visit
- High index of suspicion with recent arrivals to US who were born outside of US.
- Ask about exposure to rash illness during pregnancy
- Consider CRS in infants with symptoms consistent with CRS, especially in foreign-born or recently-arrived mothers, and place on contact precautions.
- Infection Control is Critical: Infants can shed the virus for prolonged periods (up to 1 year of age or longer)
- Presumptive evidence of immunity for HCW: 1 dose of MMR, or serologic evidence of immunity to rubella, or lab evidence of disease.

**Flu Million Dollar Question**

A 9 month old baby with no previous history of flu vaccine needs two doses this season. What are the possible acceptable scenarios?

- Two 0.25mL doses of Fluzone
- Two 0.5mL doses of FluLaval
- A correct dose volume of one formulation, followed by the correct dose volume of another formulation
- All three scenarios are correct
Flu Million Dollar Question

A 9 month old baby with no previous history of flu vaccine needs two doses this season. What are the possible acceptable scenarios?

- Two 0.25mL doses of Fluzone
- Two 0.5mL doses of FluLaval
- A correct dose volume of one formulation, followed by the correct dose volume of another formulation
- All three scenarios are correct

One key resource

- Call MDPH epidemiologists at 617-983-6800

Influenza
2016-2017 Influenza Season

- Moderate season – Influenza A (H3N2) predominated this season.
- Circulating strains were a good match with the vaccine. Overall vaccine effectiveness (VE) against influenza A and influenza B virus infection associated with medically attended acute respiratory illness (ARI) was 42%.
- Influenza activity in Massachusetts peaked in February.
- Two pediatric flu-related deaths in Massachusetts.

What to Report to MDPH

- Labs report results of flu testing
- Teleform reports of rapid test results no longer necessary
- **Please report any pediatric flu-related deaths immediately**
- Please report any unusual clusters of influenza-like illness
- Please report any suspected cases of novel flu, avian flu, or flu associated with contact with swine

Varicella Million Dollar Question

A 9 month old baby comes to your office and is diagnosed with varicella. Which of your staff who had close contact will need to be excluded?

- A has two doses of varicella vaccine
- B has a positive titer
- C was born in the US before 1980
- D had shingles last year
- E none of these staff need be excluded
Varicella Million Dollar Question

A 9 month old baby comes to your office and is diagnosed with varicella. Which of your staff who had close contact will need to be excluded?

- A has two doses of varicella vaccine
- B has a positive titer
- C was born in the US before 1980
- D had shingles last year
- E none of these staff need be excluded

Varicella

- Elementary school with very high exemption rates.
- Many unvaccinated siblings in various grades.
- Unvaccinated kids who travel in the same “social circles” outside of school.
- Children who attended school and social events while infectious.
- Reluctance of parents to seek medical care for mildly ill children.
- Reluctance of providers to see and diagnose mildly ill children.

Varicella Outbreak, 2016
Varicella Control Measures

- Identify sites of exposure:
  - Classrooms
  - Buses
  - Within families/households
- Identify susceptible children
- Exclude susceptible children
  - Because of this, there were no additional exposures at school
- Remember to Report
  - Use the MDPH Varicella Teleform
  - MDPH is particularly interested in clusters of 3 or more related/connected cases.

Resources

Massachusetts Immunization Program
- 1-617-983-6800
- 1-888-658-2850
- Website
  - http://www.mass.gov/dph/imm

CDC/NIP
- English and Spanish
- 1-800-232-INFO
- TTY 888-232-6348
- Website
  - http://www.cdc.gov/vaccines

Questions?