Vaccine Preventable Disease (VPD)

Case studies: What would you do?

Kathy Sen, RN, BSN
VPD Surveillance
May 2017
Objectives

• Providers will:
  – Recognize the potential for a patient presenting with a vaccine preventable disease (VPD)
  – Take measures to minimize the risk of exposure and infection to staff and patients
  – Collect and submit appropriate specimens for testing to help rule out the VPD
  – Notify the local health department (LHD) of the suspect VPD
Vaccine Preventable Disease (VPD) Surveillance and Case Studies

• What would you do if you suspect a patient may have:
  • Pertussis
  • Mumps
  • Measles
  • Varicella
  • Tetanus
  • Congenital Rubella
Pertussis
Pertussis

• 14 year old adolescent, “Tony” presents to your office
  – Insidious onset of cough – non-productive, “spells” at night
  – Began 12 days ago with mild cold symptoms - cough began within a few days of runny nose
  – Denies chills or fever
  – Plays soccer year round and friends reported that he threw up outside today after coughing
  – Reports being tired
  – Appetite is okay but coughing has affected meals at times
Pertussis

- Up-to-date on all immunizations, including Tdap
- Vital signs are normal
  - Eyes slightly reddened - no drainage, no ear pain, tympanic membranes normal
  - No lymphadenopathy, no wheezing, no chest pain
  - Slightly congested breath sounds, no throat pain
  - No other remarkable findings
- Has not missed any school
Pertussis

• What are your actions once you decide the patient might have pertussis?
  • You don your earloop mask as this is a respiratory illness
  • Check NYSIIS
  • If you are ruling out pertussis you consider
    – PCR and/or culture
    – Ask about others ill in the family/friends/school
    – Educate family about pertussis
    – Notify the Local Health Department (LHD)
    – Treat and exclude from all activities until 5 days of an appropriated antibiotic are completed
Pertussis

- Classic symptoms include paroxysms, whoop, post-tussive vomiting; infants may experience apnea
- Patient does not appear ill between coughing spasms
- *Disease in vaccinated individuals may not be as severe as in unvaccinated and may not look like classic pertussis*
- Clinical case definition and control of pertussis:

Pertussis

- Infectious from onset of cold-like symptoms until 3 weeks after onset of paroxysms or until patient has completed 5 days of an effective antibiotic
  - Azithromycin, Clarithromycin, Erythromycin or Bactrim (TMP-SMZ)
  - Entire course of medication should be completed
- Antibiotic will not stop the cough - it is due to toxin produced by pertussis
- Household transmission is very common
Pertussis

- Immunity after vaccination wanes & infection does not confer lifelong immunity
- Milder infections can occur after vaccination
- Vaccination is the best way to prevent disease
- *Maternal immunization in the 3rd trimester of every pregnancy recommended to confer passive immunity to the newborn*

http://www.cdc.gov/pertussis/pregnant/research.html

http://www.museumofhealthcare.ca/explore/exhibits/vaccinations/pertussis.html
Testing for Pertussis

• Bacterial Specimens: **Nasopharynx (NP)**
  – **Bacterial Culture** using Dacron swabs (do not use cotton swabs)
    • Collect within 1-2 weeks of cough onset for optimal results
  – **Polymerase Chain Reaction (PCR) test** is less affected by antibiotic therapy
    • Collect within 3 weeks of cough onset for optimal sensitivity
    • Many commercial labs are doing PCR testing

• Serologic Testing
  – Standardized serologic tests are not available, making the results of commercially available tests difficult to interpret
    • Cannot confirm a case of pertussis with serology
Pertussis

• Control pertussis through:
  – Up-to-date immunization per ACIP recommendations
  – Early recognition of disease, treatment and isolation of the case until completion of 5 days of an effective antibiotic
  – Post-exposure prophylaxis (PEP) of high risk contacts:
    • Household, infants, women in their 3rd trimester of pregnancy, all persons with pre-existing health conditions that may be exacerbated by pertussis
    • Contacts who themselves have contact with: infants, women in their 3rd trimester of pregnancy, all persons with pre-existing health conditions that may be exacerbated by pertussis
    • All contacts in high risk settings that include infants < 12 months of age or women in their 3rd trimester of pregnancy
Mumps
Mumps

- Margaret is a 19 year old who has had all her childhood vaccines
- Onset of swelling - in front of her right ear today at angle of the jaw
- Presents at college health service and does not appear very ill
- Has not missed any school
- Complains about some muscle aches, jaw tenderness and maybe some chills but didn’t check her temperature
- Plays on the university’s varsity lacrosse team
Evaluation

• You escort Margaret into an exam room and close the door
  – Don your earloop mask
    • Demographics – where does she reside?
    • History of present illness - onset date of parotitis
    • Any other recent symptoms or recent illness? (e.g. flu)
Evaluation

• Ask about her daily activities
• Did she have contact with someone with similar symptoms?
• Any recent travel history?
• Household and close contacts
  • Have they been well/ill/traveled recently?
  • Check age and vaccination status of contacts
  • Immunosuppressed contacts?
Margaret

- More information gathered:
  - Appetite diminished
  - Temperature is 99.2°F
  - Tenderness and swelling over the right parotid; her other salivary glands – not swollen nor tender
  - Lives with 3 roommates – they share one bathroom and a kitchen
  - You checked her vaccine status on NYSIIS – she has 2 MMRs documented
  - No recent travel except to friend’s parent’s cabin over spring break
Mumps

- Call the local health department (LHD) where she lives and ask to speak with the VPD nurse/epidemiologist immediately regarding a suspect case of mumps!

- The LHD will guide you through the specimen collection and submission process.
Mumps

• Mumps is a virus of the Paramyxoviridae family
• Droplet spread
• Two doses of a mumps-containing vaccine confer immunity on 88%
  – Note: Some individuals with 2 mumps-containing vaccines may still become infected with mumps
• For surveillance, a patient is considered infectious for 2 days before through 5 days after the onset of parotitis
• Other etiologies for parotitis include parainfluenza, EBV, Flu A, HIV, non-infectious causes – drugs, tumors, salivary duct obstruction, etc.
Mumps

• Clinical Description
  – Acute onset of *unilateral or bilateral* tender, self-limited swelling of the parotid and/or other salivary gland(s), lasting at least 2 days, and *without other apparent cause*
  – *Non-specific symptoms may include myalgia, anorexia, malaise, headache and low grade fever*
Mumps

• Complications are rare but do occur
  – Orchitis
  – Oophoritis and mastitis
  – Aseptic meningitis
  – Pancreatitis
  – Deafness
  – Encephalitis
  – Death is very rare (2 per 10,000 cases in outbreaks of 1967-1971)
Mumps Outbreaks

• Crowded environments favor prolonged close contact
  – Dormitories, student housing, sports teams
  – Certain behaviors increase spread of virus
    • Parties, kissing, sharing cups, water bottles, beer pong, eating utensils, cigarettes, vape pens, etc.
• Vaccine effectiveness: protects against most but not all cases
• Waning immunity?
  – Lower levels of neutralizing antibody (NA) observed among persons who received MMR #2 ≥15 years ago demonstrates antibody decay over time.¹

Mumps

• Discuss risk factors, provide education to Margaret
• Review testing plan with LHD and Margaret
  – Collect viral specimens: Buccal swab from Stensen’s duct
    • Use viral medium
  – Serology for mumps IgM and IgG
  – Overnight priority shipping to Wadsworth Center Lab
    • David Axelrod Institute
      120 New Scotland Ave. Albany, NY 12208
      518-474-4177
    • LHD must be involved
    • Do not send specimens for weekend arrival
Mumps

- Review Treatment plan with Margaret
  - ISOLATE through 5 full days after onset of parotitis
  - Easier said than done on a college campus
- LHD will begin the investigation and conduct contact tracing for suspect cases and increase surveillance for mumps cases
  - LHD will help to determine susceptible contacts
  - Notification of mumps will be sent to the students and staff – by university
- Results return:
  - Buccal swab was PCR positive
    - \( IgM \) was negative – why was the IgM negative??
    - IgG was positive
The percentage of positive results obtained from testing 296 confirmed mumps cases from New York City by day of sample collection after onset of symptoms. The serum samples were tested for presence of IgM using the CDC capture IgM EIA. The buccal swab samples were tested by rRT-PCR using the mumps nucleoprotein (N) gene as the target.
### Age Distribution of Mumps Cases**, New York State*, 2016

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Frequency</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;=1 Year</td>
<td>2</td>
<td>0.9%</td>
</tr>
<tr>
<td>2-10 Years</td>
<td>5</td>
<td>2.3%</td>
</tr>
<tr>
<td>11-17 Years</td>
<td>10</td>
<td>4.7%</td>
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<tr>
<td>18-24 Years</td>
<td>130</td>
<td>60.8%</td>
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<tr>
<td>25-30 Years</td>
<td>29</td>
<td>13.6%</td>
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<tr>
<td>31-40 Years</td>
<td>13</td>
<td>6.1%</td>
</tr>
<tr>
<td>41-50 Years</td>
<td>9</td>
<td>4.2%</td>
</tr>
<tr>
<td>51-64 Years</td>
<td>15</td>
<td>7.0%</td>
</tr>
<tr>
<td>65+ Years</td>
<td>1</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

**Total Cases = 214**

**Average Age**: 25 years  
**Median Age**: 21 years  
**Range**: 1 to 66 years

### Notes
- *Data represents New York State, excluding New York City.
- **Cases (Confirmed or Probable) 5/1/17.
  Case count is preliminary and subject to change.

18 – 30 Years: 74%
Number of MMR Doses For Reported Mumps Cases New York State, 2016*

<table>
<thead>
<tr>
<th>#MMR Doses</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 or Unknown</td>
<td>25.7%</td>
</tr>
<tr>
<td>1</td>
<td>6.5%</td>
</tr>
<tr>
<td>2</td>
<td>64.5%</td>
</tr>
<tr>
<td>3</td>
<td>3.3%</td>
</tr>
</tbody>
</table>

*Cases (Confirmed or Probable) as of 2/24/2017. Case count is preliminary and subject to change. New York State, excluding New York City
Mumps

- Recommend vaccination with MMR ASAP to susceptibles
  - Give MMR #1 for those without any documented doses of MMR
  - Give #2 to those with one documented dose of MMR
- During an outbreak - recommendation for exclusion of susceptibles who are not immune until 26 days after the last case of mumps is diagnosed
  - MMR vaccine for mumps will not prevent mumps but will help protect from future exposures
- Administer 2nd MMR 28 days after the first dose to those who had originally received MMR #1
- Conduct active surveillance for mumps disease through two incubation periods
Use of a 3\textsuperscript{rd} dose of MMR

- ACIP has not recommended for or against
- Effectiveness of a 3\textsuperscript{rd} dose has not been established
- CDC has provided guidance for consideration of use of a 3\textsuperscript{rd} MMR for mumps outbreak control
  - Sustained transmission > 2 weeks despite outbreak control measures
  - Intense exposure setting (prolonged close contact)
  - Population with high 2-dose MMR vaccination coverage (>90%)
  - High attack rates (> 5 cases per 1,000 population)

- The state and local health departments should be consulted anytime the use of a 3\textsuperscript{rd} dose of MMR is being considered
DEAR LITTLE MUMPS CHILD

By Marguerite Rush Lerner, M.D. Illustrated by George Overlie
Measles

(Rubeola)
Measles

• 9 month old infant recently arrived in U.S. from overseas – parents have limited English language skills
• Unimmunized
• Presents to your emergency department with:
  • Fever of 102°, cough, URI symptoms & conjunctivitis
  • NO RASH
• Diagnosed with croup and sent home
Measles

- Rash onset 2 days after the emergency department visit
- No care sought initially
  - Followed up at local FQHC 4 days after rash onset
- Measles highly suspected
- LHD notified and public health response initiated
- Appropriate testing done
- Confirmed at Wadsworth the next day
Measles

- Measles is a virus of the Paramyxoviridae family
- Airborne and droplet spread
- Remains in the air for 2 hours after an infected person leaves a room
  - 90% of susceptibles will become infected after exposure
- Two doses of measles-containing vaccine confer immunity on 97% of those vaccinated (2\textsuperscript{nd} dose is an insurance dose, not a booster)
Measles

• Symptoms
  – Prodromal symptoms
    • Begin 10-12 days after exposure
    • Duration 2-4 days with a range of 1-7 days
    • Fever increases gradually up to 103° to 105° F
    • Symptoms include: cough, coryza, conjunctivitis
    • Malaise, diarrhea, anorexia, and lymphadenopathy
Measles

• Koplik's Spots:
  – White enanthem (rash) on mucous membranes, usually the buccal membrane
  – Scattered blue-white spots on a bright red background
  – Occur 1-2 days before rash to 1-2 days after rash

• Rash:
  – Maculopapular eruption that lasts 5-6 days
  – Occurs 2-4 days after prodrome (approximately 14 days after exposure)
  – Rash usually begins on face/head and spreads downward and outward, reaching the hands and feet
  – The rash fades in the same order that it appears
Koplik Spots
Coryza & Conjunctivitis
Day 3 of Rash
Measles

- Complications:
  - Diarrhea
  - Otitis media
  - Pneumonia
  - Seizures
  - Acute encephalitis
  - Pregnancy: spontaneous abortion, low birth weight infants, birth defects
  - Death (2-3 per 1,000 cases; higher fatality in 3rd world)
  - Subacute sclerosing panencephalitis – SSPE (average onset is ~ 7 years after infection)
# Measles Timeline

<table>
<thead>
<tr>
<th>Incubation Period</th>
<th>Prodrome</th>
<th>Rash Onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>-14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8</td>
<td>V</td>
<td>V</td>
</tr>
</tbody>
</table>

**Period of Communicability**

- Exposure to prodrome: 10-12 days
- Exposure to rash 14 days (7-18 days)
- Communicable 4 days before to 4 days after rash onset
- Secondary attack rate is 90% in susceptibles
Measles - Clinical Case Definition

• **Measles Clinical Case Definition:**
  – An acute illness characterized by:
    • Generalized, maculopapular rash lasting ≥3 days; **and**
    • Temperature ≥101°F or 38.3°C; **and**
    • Cough, coryza, or conjunctivitis
Measles Specimen Collection

• Discuss plan with LHD and family
  – Viral specimens: throat or nasopharyngeal swab plus urine
    • Use viral medium
  – Serology for measles IgM and IgG
  – Overnight to Wadsworth Center Lab
    • David Axelrod Institute
      120 New Scotland Ave. Albany, NY 12208
      518-474-4177
    • LHD must be involved – for weekend shipping consult with the Bureau of Immunization
Measles presumptive evidence of immunity

- Birth before 1957; OR
- Vaccination:
  - One or more doses of a measles-containing vaccine given on or after the first birthday for preschool-age children and adults not at high risk, and
  - Two doses of measles-containing vaccine for school-age children and adults at high risk for exposure transmission (i.e., health care personnel, international travelers, and students at post-high school educational institutions); OR

http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm
Measles presumptive evidence of immunity (continued)

- Lab Evidence of Immunity
  - Laboratory evidence of immunity (serology = IgG+), or
  - Laboratory confirmation of disease (PCR+ or viral culture +)

- Persons who do not meet the above criteria are considered susceptible and should be vaccinated unless contraindicated

http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm
What next?

• Isolation of patient for 4 days after rash onset
  – Patient is on the 4th day of rash upon presentation
• Ensure that specimens are expedited to Wadsworth – overnight priority
• Investigation and contact tracing done by LHD to determine who might need post-exposure prophylaxis (PEP)
• What happens at the exposed healthcare facilities?
  – Take a deep breath and pull out your exposure control policy and procedure
What next?

- Determine who was exposed
  - Who was at facility when exposure to measles was a risk
    - Create a line list of those exposed for the entire time the patient was present and 2 hours after they left
    - Determine who is immune vs. susceptible
    - Contact exposed: phone and send follow-up letter with a fact sheet
      - Interpretation and Translation may be needed
    - Surveillance for one incubation period, up to 21 days

https://www.health.ny.gov/publications/2170/
Post-Exposure Prophylaxis (PEP)

- To prevent or limit severity of measles infection

- **MMR vaccine**
  
  **Who:** Persons age ≥6 months
  
  **When:** ≤72 hours of initial exposure

- **Immunoglobulin (IG)**
  
  **Who:** Infants age <12 months (IGIM)
  
  Immunocompromised
  
  Pregnant women without evidence of immunity (IGIV)
  
  **When:** ≤6 days of initial exposure

*Advisory Committee on Immunization Practices (ACIP)*
If PEP is needed…

• If PEP is administered within the appropriate time frames, *most but not all* individuals can return to work or school
• LHD will help determine who should be restricted from returning to normal activities
• Those receiving PEP will be under surveillance for measles symptoms for 21 days

*Note:* Quarantine (and exclusion for 21 days after last measles case) for susceptibles if no PEP & exposed to measles

https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm#Tab3
Healthcare Personnel

• If susceptible (non-immune) healthcare personnel are exposed to measles, whether they receive or do not receive PEP, they are excluded from activities and work from:
  – the 5th day after their exposure through
  – the 21st day after the last potential exposure to measles (e.g. in an outbreak setting with ongoing cases)

• Huge burden on the healthcare system

• Note: IG prolongs the incubation of measles and those receiving it should be excluded for 28 days
Measles diagnostic serology

- Difficult to interpret serology in the face of vaccination – recent or remote
- Consult with the LHD, regional or state health department for interpretation of serology
- False negatives and false positives may occur
- Convalescent sera may need to be run
- Note: 23% of unvaccinated will have false negative IgM if serology is collected within 72 hours of rash onset – may need to repeat
- If vaccinated, there may be a transient or blunted production of IgM antibodies
- Always consult with LHD for guidance!
Fever and rash after vaccination

- Fever and rash can occur 6-12 days post-vaccination
  - Side effect of vaccine
- Measles IgM cannot confirm diagnosis of measles in persons who have received vaccine within the last 6-45 days before rash onset
- Viral specimens can be run – but may be positive too
  - Wadsworth will have to run additional tests to determine if virus is wild-type measles or vaccine strain
  - Decisions about testing should be made in conjunction with the LHD based on risk history and severity of symptoms

https://www.health.ny.gov/prevention/immunization/providers/outbreak_control_guidelines.htm
Measles exposures at the healthcare facilities

- 340 potential exposures identified at 2 healthcare facilities
- All were contacted by phone and/or received a letter and fact sheet
- Susceptible contacts identified: infants or pregnant
- IG administered
- One of the exposed infants – parent refused IG: became symptomatic and was isolated; not measles
- Household members: Unvaccinated received vaccine and were quarantined
- No secondary cases

Varicella
Varicella

• Varicella is thought, by many, to be a benign disease
• A myth exists that it is “better” for your child to become infected with chickenpox than to receive vaccination
• In the early 1990s (prevaccine) there were approximately 4 million cases annually (# approximated the birth cohort)
  – 10,500-13,000 hospitalizations
  – 100-150 deaths
• Since implementation of vaccine there has been a 96% decline in cases

CDC varicella date (unpublished). Based on the % decline from 4 states that have continuously reported cases to CDC.
Varicella

- **Common Symptoms:** malaise, fever, headache, anorexia, discomfort from itching
- **Complications:** more likely in infants, adolescents and adults, pregnant women and immunosuppressed
- **Serious complications seen:**
  - Secondary bacterial infections
  - Pneumonia
  - Encephalitis
  - Sepsis
  - Dehydration
- **Recent cases in New York State:**
  - Infant with osteomyelitis of left femur
  - Infant with lymphangitis and cellulitis
  - Pregnant mother with varicella exposes infant at birth
- **Lost time from work/school/activities**
PETER GETS THE CHICKENPOX

By Marguerite Rush Lerner, M.D. Illustrated by George Overlie
Summary

• VPDs can be challenging to diagnose
• Thorough history of present illness and risk factor ascertainment is critical
• Remember to assess for clinically compatible symptoms
• Determine vaccination status (valid documentation)
• Assess for a sensitive setting
• Contact your local health department early - for consultation and guidance: DON’T WAIT
• Collect appropriate specimens – use viral media for viral diseases and remember to collect serology for IgM and IgG testing
• Ensure that your staff is immune to VPDs
Resources

- Immunization Action Coalition: http://www.immunize.org/
- Ask the Experts: http://www.immunize.org/askexperts/
Tetanus
Tetanus

• Unvaccinated 6 year old arrives at health center - history of stepping on a nail 14 days ago – wound is healed
• Developed fever, chills, muscle stiffness and worsening back and neck spasms overnight
• Could not walk upon awakening
• Upon arrival child noted to have trismus plus torticollis
• Child is in crisis, is tachycardic and airway is compromised
Tetanus

- Child was intubated
- Immediately administered 500 units of Tetanus Immune Globulin (TIG), ceftriaxone, metronidazole, valium
- Airlifted to tertiary care center
- Treating facility chose to administer an additional 750 units of TIG – first infiltrating wound site with 250 units and 500 units IM at a remote site
- Lumbar puncture performed, CT done
- Scab on foot removed, ensured that site was clean and no remnants of foreign object present
Tetanus

- Hospitalization:
  - Fever developed
  - Multiple desaturations
  - Required increased suctioning
  - Intubated and sedated for prolonged period
  - Increasing pain, arching and crying
  - TPN, tracheostomy required – dislodged due to thrashing
  - Weaning sedation, multiple attempts to wean from vent
  - NG tube finally pulled as patient tolerated PO feeds
  - Hospitalized for 38 days before being discharged to home
Tetanus

• Parents want to do what is best for their children
• Listen to a parent who is vaccine hesitant and allow them to express their concerns or fears
• Discuss benefits of vaccinating and the potential for side effects
• Clarify concerns and correct misinformation
• Personalize education to the parents
• Explain the benefits of herd immunity
• Let them know what you do to stay up to date on vaccine research
• Stress the number of lives saved by immunization
• Tell this personal story