North Texas Measles Outbreak
Measles Background, Epidemiology and Response
Measles Symptoms

- Fever >101
- Rash
  - Starts after fever
  - Maculopapular
  - Starts on face, spreads downward
  - Becomes generalized
  - Lasts at least three days
- Cough
- Coryza
- Conjunctivitis
**Measles Epidemiology**

<table>
<thead>
<tr>
<th>Reservoir:</th>
<th>Humans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission:</td>
<td>Respiratory</td>
</tr>
<tr>
<td>Communicability:</td>
<td>4 days before rash onset to 4 days after rash appearance Highly infectious</td>
</tr>
<tr>
<td>Incubation Period:</td>
<td>14 days (range 7-21 days)</td>
</tr>
<tr>
<td>Prevention:</td>
<td>2 doses of MMR vaccine</td>
</tr>
</tbody>
</table>

As of 2000, measles is considered eliminated in the US and all of the Americas
Measles in Texas, 1993-2012

- Import-associated
- Indigenous
How Epi Responds to Measles

- Isolate patient
- Identify all contacts for entire 9 day infectious period
  - Alert all contacts of exposure
  - Assess vaccination history of all contacts
    - Can test for IgG response
  - Assess symptoms of all contacts
  - Offer vaccine or IG to all unvaccinated contacts
    - 72 hour window for vaccine after exposure
    - Six day window for IG after exposure
  - Quarantine unvaccinated contacts
    - Possibly up to 3 weeks!
Assessing Reported Measles

- Does patient have right symptoms?
  - Rash, no fever? No other symptoms? Rash not generalized?
- Is patient vaccinated? How recently?
  - Measles vaccination can cause measles-like symptoms
- Did patient travel? Where?
  - Measles is endemic in most of the world
  - Measles is not endemic in North, South and Central America
- Has lab testing been performed?
  - Who did it? What tests?
- Any sick contacts?
Measles Case Definition

- Fever >101, rash over 3 days and either cough, coryza, or conjunctivitis
  AND
- Measles antigen detected by PCR, OR
- Virus isolated, OR
- Measles IgM antibody + at public health lab, OR
- Measles IgG antibody acute-convalescent seroconversion or 4-fold increase, OR
- Epidemiologically linked to a lab-confirmed case
2013 Measles Outbreak
And so it begins...

- On 8/7/13, an MD reported 4 measles patients to Tarrant County Health Department (TCHD)
  - Pending laboratory testing
- Patients were all connected to a church
  - Physician affiliated with a staff clinic at the church
- Rash onset dates of 7/25 (source case), 7/30 (source case’s child), 8/4 and 8/5.
- Source case identified retroactively by MD that diagnosed child
  - Recently returned from Asia
  - Hospitalized 7/23-7/27, not diagnosed with measles
Evaluating the Church Exposure

ó Source case was only at the church on one Sunday while infectious
ó ~2000 members
ó Nursery offered during services
ó The church operated a daycare during the week
Response Activities

- The church allowed TCHD to provide prophylaxis on-site
  - TCHD vaccinated (or gave IG) to 220 people exposed at the church
- The church opened the staff clinic to all parishioners with measles symptoms
- TCHD, adjacent county health departments, the regional state health department in Arlington, and the state health department issued health alerts
  - Area health departments also sent measles information to local schools and daycares
The Outbreak Continues...

- 17 more cases identified
  - Five in Denton County, 12 in Tarrant
  - Last rash onset was 8/21/13

- Additional exposure sites identified
  - Inpatient and outpatient healthcare facilities
  - Healthcare facilities and TCHD assessed staff immunity and notified patients of exposure

- Increased reports of measles across the state
  - Concentrated in greater Fort Worth area
  - Dozens of additional suspects ruled out
## The Outbreak by the Numbers

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Number of Cases (%)</th>
<th>Number Vaccinated (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 year</td>
<td>2 (9.5%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>1-6 yrs</td>
<td>6 (28.6%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>7-19 yrs</td>
<td>6 (28.6%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>20-29 yrs</td>
<td>3 (14.3%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>40-49 yrs</td>
<td>4 (19.0%)</td>
<td>2 (50%)</td>
</tr>
<tr>
<td>Total</td>
<td>21 (100%)</td>
<td>2 (9.5%)</td>
</tr>
</tbody>
</table>
How the Outbreak Spread
The Laboratory Role in Measles Outbreaks
Laboratory Confirmation of Cases

- 21 cases
- 15 laboratory confirmed
  - 4 by IgM only
  - 2 by PCR only
  - 2 by PCR and viral isolation
  - 5 by IgM and PCR
  - 2 by IgM, PCR and viral isolation
- 6 confirmed by epidemiologic-link only
Measles Serology—Pros and Cons

- Serum for measles IgM can be collected up to 30 days after onset
- Serum collected immediately after onset can be falsely IgM negative
- Antibody testing can be affected by vaccination
- Hard to collect serum on infants
- Obtaining acute and convalescent samples difficult
- Rapid turn around
Measles Serology—Private and Public

- IgM/IgG widely available at commercial/hospital laboratories
  - Commercial testing not always specific enough
- DSHS provides measles IgM/IgG testing
  - DSHS test preferred to commercial lab tests
- Epi tries to obtain serum from positive tests at private labs to retest at DSHS
  - Serum frequently discarded after seven days
  - Usually requires freezing serum and shipping on dry ice
## DSHS Serology Testing

<table>
<thead>
<tr>
<th>Laboratory Results</th>
<th>Number (%)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specimens received</td>
<td>34 (on 32 patients)</td>
<td></td>
</tr>
<tr>
<td>Unsatisfactory specimens</td>
<td>4 (12%)</td>
<td>Repeat specimens sent on 2 pts</td>
</tr>
<tr>
<td>Tested specimens</td>
<td>30 (88%)</td>
<td></td>
</tr>
<tr>
<td>Equivocal IgM results</td>
<td>2 (7%)</td>
<td>• Not confirmed as cases</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Due to MMR?</td>
</tr>
<tr>
<td>Positive IgM results</td>
<td>12 (40%)</td>
<td>• 10 confirmed as cases</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 2 ruled out by epi/clinical</td>
</tr>
<tr>
<td>Negative IgM results</td>
<td>16 (53%)</td>
<td>None confirmed as cases</td>
</tr>
</tbody>
</table>
IgM Positive Results

- Confirmed 3 patients that did not have PCR
  - Including the source case
- 4 had negative IgG results
  - Favorite result!
- 1 also had positive rubella IgM results
  - Cross-reactivity can be a problem
Measles Virology/Molecular Testing: Pros and Cons

- Easy specimen collection (throat swab)
- Viral isolation very difficult
- Vaccination can affect results, but less likely than serology
- Maximum of 10 days for specimen collection
  - Best collection within 5 days of rash onset
- Allows for typing to make epidemiologic connections
- PCR: rapid turn around
- Viral isolation: slow turn around
Measles Virology/Molecular Testing: Public and Private

- Measles PCR not available outside of public health.
- DSHS does not perform measles PCR.
- Viral isolation available at DSHS, some commercial laboratories.
- APHL started a vaccine preventable disease reference lab program in 2013.
- DSHS virology lab initiated PCR testing through APHL using the Minnesota PHL.
## DSHS-APHL Molecular/Viral Testing

<table>
<thead>
<tr>
<th>Laboratory Results</th>
<th>Number (%)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specimens received</td>
<td>48 (on 42 patients)</td>
<td></td>
</tr>
<tr>
<td>Unsatisfactory specimens</td>
<td>5 (10%)</td>
<td>Repeat specimens sent on 2 pts</td>
</tr>
<tr>
<td>Tested specimens</td>
<td>43 (90%)</td>
<td></td>
</tr>
<tr>
<td>Positive PCR results</td>
<td>11 (26%)</td>
<td>All confirmed as cases</td>
</tr>
<tr>
<td>Negative PCR results</td>
<td>31 (72%)</td>
<td>None confirmed as cases</td>
</tr>
<tr>
<td>Indeterminate by PCR</td>
<td>1 (2%)</td>
<td>Not confirmed as a case</td>
</tr>
<tr>
<td>Virus isolated</td>
<td>6 (14%)</td>
<td>• pH1N1 and HSV1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• both measles PCR-</td>
</tr>
<tr>
<td>Measles virus isolated</td>
<td>4 (9%)</td>
<td>• 100% measles PCR+</td>
</tr>
</tbody>
</table>
RNA Detected Results

- Confirmed 2 cases with negative IgM results (not at DSHS)
  - Vaccinated persons, serology collected early
- Genotype identified as D9
  - Confirmed import from Asia
  - Confirmed epi links between cases
Thanks to the DSHS Lab

- Serology
  - Eleanor, Shashi, Jing, Sharlan
- Virology
  - Crystal, Martha, Jennifer, Kniquezia, Peter, Charles
- Check-in
  - Walter, Kyle, Randy
- Container prep
  - Priscilla, Rick

I really appreciate all your effort, patience, and skill.
Measles Summary

- Measles is only a plane ride away
- Measles misdiagnosis is common, lab testing required
- Pockets of unvaccinated communities exist
  - Measles will transmit efficiently in these pockets
- Multiple healthcare exposures, only one secondary case in an outpatient setting
  - Indicates good community and healthcare vaccine coverage
- Maintaining high level of MMR vaccination is critical to measles control
  - Herd immunity works
THANK YOU!

RACHEL WISEMAN
512-776-2632
RACHEL.WISEMAN@DSHS.STATE.TX.US