Disclosure: Session D2

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CDC did not accept commercial support for this continuing education activity.
Syndromic Surveillance as a Tool for Case-based Varicella Reporting in Georgia, 2016-2018

Presentation to: The National Immunization Conference, 2018
Presented by: Carolyn M. Adam, MPH
Date: May 15, 2018
BACKGROUND: VARICELLA REPORTING AND CASE INVESTIGATION
Varicella Overview

- Varicella (chickenpox) is a highly-contagious rash-illness caused by the varicella-zoster virus (VZV)

- Prior to the introduction of vaccine, varicella was common in the US, with approximately 4 million cases per year, including 100-150 deaths

- Since the introduction of routine two-dose vaccination for varicella, varicella incidence has decreased dramatically in the US
  - While less common than prior to the introduction of vaccine, varicella cases and outbreaks continue to occur

- Case-based surveillance for varicella allows jurisdictions to monitor disease trends, and also provide prevention and control recommendations to prevent varicella transmission

Varicella Reporting in Georgia

- Passive, case-based varicella reporting was implemented in Georgia during July 2011.

- Cases and outbreaks are reported via:
  - Phone
  - Fax
  - In the State Electronic Notifiable Disease Surveillance System (SendSS)
  - Electronic Laboratory Reporting (since Jan 2016)
  - **Syndromic Surveillance (since May 2016)**
    - Hospital discharge data has traditionally been used for early detection of unusual health events or disease patterns
    - This methodology can be incorporated into routine notifiable disease detection

- Reporters include:
  - Providers
  - Hospital infection prevention staff
  - School nurses
  - Laboratories
  - Community members
Varicella Case Investigations

• In response to suspect case reports, District Epidemiologists collect information about:
  – Patient demographics
  – Vaccine history
  – Clinical presentation
    • Estimated number of lesions
    • Fever
    • Hospitalizations
    • Complications
    • Etc..
  – Epidemiologic information
    • Information about case contacts
    • Call patient at 21 days post-rash onset to determine if any contacts developed disease

• Data sources include medical record reviews, physician interviews, and patient interviews

Photo: http://www.medicalnewstoday.com/articles/239450.php
SYNDROMIC SURVEILLANCE FOR VARICELLA
1) Detecting Suspect Cases
• Visit data are received electronically from 135 hospital emergency departments and urgent care facilities:
  – Chief complaint, discharge diagnosis, patient age, patient zip code, and patient ID or medical record number (MRN))
• The Syndromic Surveillance Coordinator queries for visits with a discharge diagnosis field containing the terms “varicella” or “chickenpox”

2) Follow-up on Suspect Cases
• Notification of suspect cases identified by this query are sent via email to state and District Epidemiologists
• District Epidemiologists follow-up on notifications by calling the reporting facility or through electronic medical record access
• Notifications from 5/1/2016-2/28/2018 were matched by MRN to reports entered into SendSS
Syndromic Surveillance for Varicella, 5/1/2016-2/28/2018

243 notifications from 62 reporting facilities

- 94 (38.7%) were varicella cases
  - 78 (83%) sporadic cases
  - 15 (16%) epi-linked to another varicella case
  - 3 outbreak-associated cases

- 149 (61.3%) were not varicella cases
  - 125 (84%) alternate diagnosis or LTF
  - 19 (13%) alternate diagnosis
  - 5 (3%) other reason
Varicella Reports in SendSS, Excluding Those Matched to SS Notifications (N=1015): 5/1/2016-2/28/2018

<table>
<thead>
<tr>
<th>Reporting Source</th>
<th>Report Was Varicella Case % (N)</th>
<th>Report Was Not a Varicella Case % (N)</th>
<th>Report Was Out of Jurisdiction % (N)</th>
<th>Total Number of Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic Laboratory Reporting (ELR)</td>
<td>6.7% (32)</td>
<td>92.3% (441)</td>
<td>1.0% (5)</td>
<td>478</td>
</tr>
<tr>
<td>Local or State Health Departments*</td>
<td>26.4% (65)</td>
<td>72.4% (178)</td>
<td>1.2% (3)</td>
<td>246</td>
</tr>
<tr>
<td>Hospitals or Doctor's office</td>
<td>58.5% (100)</td>
<td>38.0% (65)</td>
<td>3.5% (6)</td>
<td>171</td>
</tr>
<tr>
<td>Schools or Daycares</td>
<td>83.1% (59)</td>
<td>16.9% (12)</td>
<td>. (0)</td>
<td>71</td>
</tr>
<tr>
<td>Prisons</td>
<td>90.5% (19)</td>
<td>9.5% (2)</td>
<td>. (0)</td>
<td>21</td>
</tr>
<tr>
<td>Other</td>
<td>33.3% (1)</td>
<td>66.7% (2)</td>
<td>. (0)</td>
<td>3</td>
</tr>
<tr>
<td>Unknown</td>
<td>44.0% (11)</td>
<td>56.0% (14)</td>
<td>. (0)</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>28.3% (287)</td>
<td>70.3% (714)</td>
<td>1.4% (14)</td>
<td>1015</td>
</tr>
</tbody>
</table>

*May include cases reported by external partners through faxed labs or phone calls, in addition to cases diagnosed at health departments
Evaluating Syndromic Surveillance Notifications

- Syndromic surveillance varicella cases (SS cases) were compared to all other varicella cases reported during that time period (non-SS cases)

- 363 varicella cases had rash onset from 5/1/2016-2/28/2018
  - 93 (25.6%) SS cases
  - 270 (74.4%) non-SS cases
### Comparison of SS and non-SS Varicella Cases in Georgia, 5/1/2016-2/28/2018

<table>
<thead>
<tr>
<th>Case Characteristics</th>
<th>SS case (N=93)</th>
<th>Non-SS case (N=270)</th>
<th>Measures of Comparison</th>
<th>Significance Testing (α=.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Categorical Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Odds of reporting case characteristics(^2)</strong></td>
<td>Cases with Outcome(^1) % (n)</td>
<td>Cases with Outcome % (n)</td>
<td>Odds Ratio (95% Confidence Interval (CI))</td>
<td>2 sided p-value(^3)</td>
</tr>
<tr>
<td><strong>Clinical Information</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakthrough case</td>
<td>45.88 (39)</td>
<td>43.91 (101)</td>
<td>1.08 (0.66, 1.79)</td>
<td>0.7549</td>
</tr>
<tr>
<td>≥ 50 lesions</td>
<td>54.65 (47)</td>
<td>56.18 (141)</td>
<td>0.94 (0.57, 1.54)</td>
<td>0.806</td>
</tr>
<tr>
<td>Fever</td>
<td>57.78 (52)</td>
<td>44.31 (109)</td>
<td>1.72 (1.06, 2.80)</td>
<td>0.0286</td>
</tr>
<tr>
<td>Complications</td>
<td>7.61 (7)</td>
<td>6.42 (17)</td>
<td>1.20 (0.48, 3.00)</td>
<td>0.6937</td>
</tr>
<tr>
<td>Hospitalized</td>
<td>5.38 (5)</td>
<td>5.6 (15)</td>
<td>0.96 (0.34, 2.71)</td>
<td>0.9361</td>
</tr>
<tr>
<td>Co-morbid conditions</td>
<td>16.47 (14)</td>
<td>11.11 (27)</td>
<td>1.58 (0.78, 3.17)</td>
<td>0.1984</td>
</tr>
<tr>
<td>Immunocompromised</td>
<td>2.2 (2)</td>
<td>5.66 (15)</td>
<td>0.37 (0.08, 1.67)</td>
<td>0.2574</td>
</tr>
<tr>
<td>Lab testing done</td>
<td>15.05 (14)</td>
<td>34.57 (93)</td>
<td>0.33 (0.18, 0.62)</td>
<td>0.0004</td>
</tr>
<tr>
<td>Received antiviral treatment</td>
<td>31.46 (28)</td>
<td>29.73 (77)</td>
<td>1.08 (0.64, 1.83)</td>
<td>0.7589</td>
</tr>
<tr>
<td><strong>Epidemiologic Information</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epi-linked</td>
<td>16.13 (15)</td>
<td>32.09 (86)</td>
<td>0.41 (0.22, 0.75)</td>
<td>0.0031</td>
</tr>
<tr>
<td>Outbreak-associated</td>
<td>3.23 (3)</td>
<td>19.1 (51)</td>
<td>0.14 (0.04, 0.46)</td>
<td>0.0002</td>
</tr>
<tr>
<td><strong>Continuous Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-sample t-test</td>
<td></td>
<td></td>
<td>Mean Difference (95% CI)</td>
<td>2 sided p-value</td>
</tr>
<tr>
<td>Age</td>
<td>8.18 (0.14, 40.3)</td>
<td>14.0 (0.1, 85.12)</td>
<td>-5.82 (-9.47, -2.17)</td>
<td>0.0019</td>
</tr>
<tr>
<td>Days from rash onset to public health notification</td>
<td>5.28 (-3.25)</td>
<td>8.62 (0, 80.00)</td>
<td>-3.34 (-5.67, -1.01)</td>
<td>0.005</td>
</tr>
</tbody>
</table>
CONCLUSIONS AND NEXT STEPS
Lessons Learned

• The percentage of syndromic surveillance reports that ended up being true varicella cases was higher compared to other reporting methods during that time period, particularly ELR.

• Syndromic surveillance data are valuable in varicella case and outbreak detection.

• The only significant difference in reported measures of clinical severity of varicella infection between SS and non-SS cases was reported fever; possible explanations include:
  – Perceived urgency of having a fever accompanied by a rash; Patients might be more inclined to visit Emergency Departments or Urgent Care facilities for these symptoms.

Photo: https://precom.nu/lessons-learned-from-migrating-windows-mobile/
Lessons Learned

• SS cases were less likely to be laboratory tested than non-SS cases, indicating that emergency room and urgent care settings likely diagnose patients with varicella based solely on clinical presentation
  – This could indicate a need for setting-specific provider outreach about varicella diagnostic testing

• Using syndromic surveillance to detect varicella cases might also lead to timelier public health response
  – If prevention recommendations can be shared sooner, there are more opportunities available to prevent disease transmission
Ongoing Challenges

• Varicella surveillance in Georgia is passive, thus cases are likely underreported

• Data collected during case investigation is largely based on self-report, leading to potential case misclassification

• Determining if syndromic surveillance resulted in early notification

• Reducing false-positive SS notifications statewide
  – Ability to follow-up on suspect case reports is affected by variability of resources
  – Are hospitals in some health districts less likely to diagnose varicella?
Acknowledgements

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  – Rene Borroto, Syndromic Surveillance Coordinator

  – Ebony Thomas, Vaccine Preventable Disease Epidemiologist

  – Dr. Jessica Tuttle, Medical Epidemiologist

• District Epidemiologists and Case Investigators
Questions?

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Photo: http://webpages.shepherd.edu/jbrock02/chickenpox%20webpage%20new.html
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Healthcare Personnel Influenza Vaccine Coverage after Implementation of a Mandatory Influenza Vaccine Policy

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CDC Contractor - IHRC, Inc.

Disclaimer
The findings and opinions expressed in this presentation are those of the author and do not necessarily reflect the view of the Indian Health Service.
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Indian Health Service (IHS)

- Part of the Department of Health and Human Services since 1955
- Federal health care provider for **eligible** American Indian/Alaska Native (AI/AN) people
  - Member of federally recognized tribe (573 tribes)
  - Not an entitlement program
- Healthcare to 2.2 million AI/AN people
- Network of IHS, Tribal and Urban Indian (I/T/U) health care facilities in 35 states
  - IHS – managed and staffed by IHS employees
  - Tribal – managed by tribe, staffed by tribal employees or contracted IHS staff
  - Urban programs – located in 34 urban areas, limited care services
Indian Health Service

Service Population: 2.2 Million
IHS and Tribal Facilities

- **~15,000 IHS Federal Employees**
  - Mixture of Civil Service and United States Public Health Services (USPHS) Commissioned Officers.

- **~19,000 Tribal employees**

<table>
<thead>
<tr>
<th></th>
<th>Hospitals</th>
<th>Health Centers</th>
<th>Alaska Village Clinics</th>
<th>Health Stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>IHS</td>
<td>26</td>
<td>59</td>
<td>N/A</td>
<td>32</td>
</tr>
<tr>
<td>Tribal</td>
<td>19</td>
<td>284</td>
<td>163</td>
<td>79</td>
</tr>
</tbody>
</table>
IHS Employee Immunization Policy
Current Policy

• Chapter 12, IHS Employee Immunization Program (1991)
  • Requires Measles and Rubella vaccine
    • Exemptions for medical contraindications
  • Recommends Influenza, Hepatitis B

• Reporting requirement initiated in 2008 for all IHS facilities

2008 – 2015
IHS and U.S. Health Care Personnel
Influenza Vaccine Coverage

HP 2020 Goal

IHS Influenza Vaccine Coverage reports available at: www.ihs.gov/flu
Mandatory Seasonal Influenza Immunization for Civilian Health Care Personnel

• Special General Memorandum (SGM)
  • Approved and Signed: Sept. 3, 2015
  • Mandatory Seasonal Influenza Immunizations for Civilian Health Care Personnel Working in Indian Health Service Health Care Facilities
    • Medical exemptions
    • Masks for unvaccinated employees

• IHS Circular
  • Approved and Signed: July 28, 2016
    • Revised policy to include Religious exemptions
Policy Timeline

• Draft Special General Memorandum (SGM): Jan – May 2015
• Internal Review: May 2015
• Agency Public Comment: June 2015
• Response to Comments: July 2015
• Internal Review: August 2015
• SGM Approved and Signed: Sept. 3, 2015
• Circular Approved and Signed: July 28, 2016

• Partial implementation: 2015-2016 influenza season
• Full implementation: 2016-2017 influenza season
IHS Influenza Working Group

- Interdisciplinary
- Clinical
  - Epidemiology/Infectious Disease
  - Immunizations
  - Nursing
  - Area Chief Medical Officer
- Administrative
  - Facility CEO
  - Labor Relations
- Human Resources
- Legal
  - Office of General Counsel
Challenges

• Definition of Health Care Personnel
  • Those with patient contact?
• Exemptions – Philosophical? Religious?
• Responsibility for ensuring compliance
  • Masks?
• Consequences for lack of compliance
• Union bargaining process
  • Bargaining with one union not completed
IHS Influenza Vaccine Coverage reports available at: www.ihs.gov/flu
IHS Healthcare Personnel (HCP) Influenza Vaccine Coverage IHS vs. Tribal Facilities

Data as of March 31st, 2018. IHS National Immunization Reporting System
Current/new challenges

• Updating the IHS Employee Handbook
  • Requires only Measles and Rubella

• Does the policy apply to contractors working at the facility?
  • i.e. Construction, cleaning, cafeteria workers
Conclusions

• Preventing the transmission of influenza is an important patient safety and patient care issue for IHS, and influenza vaccine is one of the most effective tools we have to prevent influenza.

• IHS data suggest a mandate can increase coverage.
  • ~17% increase in flu vaccine coverage for employees working at an IHS facility with full implementation.
  • Achieved the HP 2020 goal for Health Care Personnel for last 2 years.
Next Steps

• To maintain and increase influenza coverage among HCP:
  • Offer influenza vaccine free of charge, easily accessible.
  • Offer agency wide education including sharing best practices, policy information, and coverage data.
• IHS:
  • Update IHS Employee Handbook to include all ACIP recommended vaccines.
  • Continue collaborations with clinical, administrative, and human resources.
• Tribal:
  • Share IHS and tribal facility policies to encourage other tribal facilities to implement their own policy.
  • Encourage tribal facilities to continue submitting their coverage data.
Thank you

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505-803-8548
Laboratory Testing Algorithm for Asymptomatic Rubella Contacts

Beth Isaac
New York City Department of Health and Mental Hygiene
48th National Immunization Conference
May 15, 2018
Rubella

- Viral illness
- Characterized by:
  - Rash
  - Fever
  - Arthralgia, arthritis, conjunctivitis, or lymphadenopathy
- Up to 50% of cases may be asymptomatic*
- Declared eliminated in the United States in 2004, but possibility of importation remains
- Infection during pregnancy can lead to congenital rubella, a condition associated with serious birth defects

Photo: http://www.cdc.gov/rubella/about/photos.html
Rubella Transmission

- Infectious period: 7 days before rash onset through 7 days after
- Incubation period: 12 –23 days
Case of Congenital Rubella Syndrome (CRS) in New York City (NYC) in 2015*

- Positive maternal rubella IgG titers during routine prenatal screening
  - Mother was considered immune to rubella
    - Unknown vaccination status
    - No rubella symptoms
    - Travel to Yemen during pregnancy
- Child born with symptoms of CRS but diagnosis delayed
  - Resulted in exposures to CRS case

Concerns with Use of IgG Titers Alone to Determine Immunity Status

• Asymptomatic infection
• IgG positive titers:
  – Can indicate evidence of immunity or recent infection
  – Do not preclude re-infection or waning immunity
    • Rare but have been documented*

### Rubella in NYC

<table>
<thead>
<tr>
<th>Year</th>
<th>Rubella Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1</td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>0</td>
</tr>
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<tr>
<td>2014</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>2</td>
</tr>
</tbody>
</table>
Laboratory Testing Algorithm for Asymptomatic Rubella Contacts

• Developed algorithm to determine which contacts should have lab testing
  – Does not rely solely on IgG titers
  – Identifies asymptomatic infection
  – Takes into account re-infection or waning immunity for pregnant women

• Builds on 2001 CDC/MMWR guidance*

Laboratory Tests Used in Algorithm

- IgG titers
- IgM titers
- IgG avidity
Antibody Response After Rubella Infection

Concentration

IgM

Time Since Symptom Onset

5 days 6 weeks 3 months
Antibody Response After Rubella Infection

Concentration

Time Since Symptom Onset

- 5 days
- 6 weeks
- 3 months

IgM
Antibody Response After Rubella Infection

Concentration

IgM

IgG

Low IgG avidity

High IgG avidity

Time Since Symptom Onset

5 days

6 weeks

3 months
Antibody Response After Rubella Infection

Concentration

IgM

IgG

Low IgG avidity

High IgG avidity

Time Since Symptom Onset

5 days
6 weeks
3 months
Antibody Response After Rubella Infection

Concentration

5 days 6 weeks 3 months

Time Since Symptom Onset

IgM

IgG

Low IgG avidity

High IgG avidity
Algorithm for Asymptomatic Rubella Contacts
Algorithm for Asymptomatic Rubella Contacts

Asymptomatic Rubella Contact

- Pregnant
- Non-pregnant
Algorithm for Asymptomatic Rubella Contacts

Asymptomatic Rubella Contact

- Pregnant
  - Regardless of immunity status
- Non-pregnant
  - Non-immune prior to exposure
  - Unknown immunity
  - Immune prior to exposure

- IgG positive titers
- Documented 1 dose rubella-containing vaccine
- Birth before 1957
Algorithm for Asymptomatic Rubella Contacts

- Pregnant
  - Regardless of immunity status
- Non-pregnant
  - Non-immune prior to exposure
  - Unknown immunity
  - Immune prior to exposure

- IgG negative titers
- 0 doses rubella-containing vaccine
Algorithm for Asymptomatic Rubella Contacts

1. **Asymptomatic Rubella Contact**
   - **Pregnant**
     - Regardless of immunity status
   - **Non-pregnant**
     - Non-immune prior to exposure
     - Unknown immunity
     - Immune prior to exposure

2. **Testing**
   - **Pregnant**
     - None
   - **Non-pregnant**
     - Day 29 post-exposure: IgM OR
     - >6 weeks post-exposure: IgM and IgG avidity
     - IgM and IgG
Algorithm for Asymptomatic Rubella Contacts

- **Asymptomatic Rubella Contact**
  - **Pregnant**
    - Regardless of immunity status
  - **Non-pregnant**
    - Non-immune prior to exposure
      - Testing
        - Day 29 post-exposure: IgM OR
        - >6 weeks post-exposure: IgM and IgG avidity
      - Unknown immunity
      - Immune prior to exposure
        - Testing
          - IgM and IgG
          - None
Unknown immunity

Testing

• IgM and IgG

Non-pregnant
Unknown immunity

Testing

• IgM and IgG

IgM positive = Infection
Unknown immunity

Testing

- IgM and IgG

- IgM Negative
- IgG Negative

Non-immune

Non-pregnant
Unknown immunity

Testing
- IgM and IgG

Non-pregnant

IgM Negative
IgG Positive

Immune
Non-pregnant

Unknown immunity
- Testing
  - IgM and IgG

Immune prior to exposure
- Testing
  - None
Algorithm for Asymptomatic Rubella Contacts

Asymptomatic Rubella Contact

- Pregnant
  - Regardless of immunity status
    - Testing:
      - Day 29 post-exposure: IgM OR
      - >6 weeks post-exposure: IgM and IgG avidity

- Non-pregnant
  - Non-immune prior to exposure
    - Testing: IgM and IgG
  - Unknown immunity
  - Immune prior to exposure
    - Testing: None
Non-immune prior to exposure

Regardless of Immunity Status

Non-pregnant

Testing

- Day 29 post-exposure: IgM

OR

- >6 weeks post-exposure: IgM and IgG avidity
Non-immune prior to exposure

Non-pregnant

Regardless of Immunity Status

Pregnant

Testing

• Day 29 post-exposure: IgM

OR

• >6 weeks post-exposure: IgM and IgG avidity
Non-immune prior to exposure

Regardless of Immunity Status

Testing

- Day 29 post-exposure: IgM

OR

- >6 weeks post-exposure: IgM and IgG avidity

IgM Positive = Infection
Non-immune prior to exposure

Regardless of Immunity Status

Non-pregnant

Testing

• Day 29 post-exposure: IgM

OR

• >6 weeks post-exposure: IgM and IgG avidity

Pregnant
Non-immune prior to exposure:

- Regarding of Immunity Status

Non-pregnant:

- Testing
  - Day 29 post-exposure: IgM
  - OR
  - >6 weeks post-exposure: IgM and IgG avidity

Pregnant:

- Low IgG Avidity = Infection
Timing of Testing

- Testing IgM before day 29 may result in a false-negative result
  - IgM may take 5 days to become detectable after infection develops
    - Could occur as late as day 23 (final day of incubation)
  - Negative IgM results should be repeated on/after day 29

Days Since Exposure

Incubation period 12-23 days
Day 29

0 10 20 30 40 50 60 70 80 90 100
Timing of Testing

- May consider IgM/IgG testing earlier to more quickly identify:
  - Infection (IgM positive)
  - Need for quarantine at home (IgG negative)
Timing of Testing

- After 3 months, IgG avidity cannot distinguish between recent and prior infection or vaccination.
Summary

• Asymptomatic infection should be considered in management of rubella contacts

• IgG titers alone may not give the whole picture in determining evidence of rubella immunity

• IgM and IgG avidity testing may be warranted
Acknowledgements

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