Measles: It’s a Small World After All

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Measles Outbreaks Around the World

- **China** is reporting > 50,000 suspect and confirmed measles cases in 2015
- **Germany** has reported > 950 cases of measles in 2015. One child has died
- **Kyrgyzstan** is experiencing an ongoing measles outbreak with > 7,400 measles cases. Two children have died.
- **Ethiopia** is experiencing an ongoing measles outbreak with > 14,000 confirmed cases in 2014; cases continue to occur in 2015.
- **Angola** is experiencing an ongoing measles outbreak. With > 12,036 in 2014; cases continue to occur in 2015.
- **The Federation of Bosnia and Herzegovina** has reported > 3,800 measles cases since January 2014
- **Vietnam** > 18,597 suspected measles cases, including 6,498 confirmed cases, and no deaths during 2014
- **Philippines** > 58,010 suspected cases of measles, including 21,420 confirmed cases and 110 deaths during 2014
Risk of Measles Importations Ongoing

• Since measles is still endemic in all countries outside of North and South America, the US is at continued risk of imported measles cases from foreign tourists and US travelers returning from abroad

• In 2014, there were 34 million travelers to the US from other countries other than Canada or Mexico; 7 million of these travelers visited California

• In 2014, 30 million US citizens traveled outside of the US, Canada or Mexico

Data Sources:
http://industry.visitcalifornia.com/find-research/california-statistics-trends/
Confirmed Measles Cases, California 2000 - 2014

- 2000: 19 cases
- 2001: 40 cases
- 2002: 5 cases
- 2003: 5 cases
- 2004: 6 cases
- 2005: 4 cases
- 2006: 6 cases
- 2007: 4 cases
- 2008: 17 cases
- 2009: 9 cases
- 2010: 27 cases
- 2011: 31 cases
- 2012: 8 cases
- 2013: 18 cases
- 2014: 75 cases

California Department of Public Health
Identifying the Outbreak

• January 5\textsuperscript{th}, CDPH was notified of a suspect measles case in an unvaccinated 11 yo whose only notable travel was to Disneyland

• On the same day CDPH was notified of two measles suspects from Utah, and four additional suspect cases with travel to Disneyland or California Adventure Park during their exposure period

• By January 7\textsuperscript{th}, 7 cases had been confirmed and CDPH initiated notifications to other states
California Measles Cases, December 2014 – April 17th, 2015

Outside of CA:
- AZ    7
- UT    3
- NE    2
- WA    2
- CO    1
- OR    1
- Mexico 1
- Canada 159

131 outbreak-associated measles cases in California

88% of outbreak cases in SoCal
Confirmed Measles Cases* by Rash Onset Date and Transmission Setting, California, December 2014 - April 17th, 2015

- Unknown source
- Community contact to a case
- Household or close contact of a case
- Exposed at Disneyland Dec 17th-Dec 20th

*Outbreak declared over on 4/17/2015
Measles Testing

- PCR testing for measles was the primary diagnostic tool in this outbreak
  - Viral and Rickettsial Disease Laboratory (VRDL) and 17 local public health laboratories offer PCR testing
- VRDL performed > 1500 PCR tests; local public health laboratories performed > 900 PCR tests
- VRDL performed genotyping
  - 73 genotype B3
  - Other genotypes that occurred during the outbreak (but not associated): D4 (1), D8 (2), H1 (2), A (31)
Information flow

Specimens collected
• Provider contacts LHJ regarding a suspect measles case
• Epidemiologists tracked ARNOLD alerts in CalREDIE and reach out to jurisdictions to find out if specimens would be sent
• LHJ assess likelihood of measles, collects specimens and notifies the state and/or their local public health lab that specimens are coming
• LHJ or CDPH epidemiologist prioritize specimens for testing

Specimens tested
• Epidemiologists at the state communicate with the lab to notify them that specimens are coming
• Medical Records Unit tracks specimens when courier information is available
• Specimen Receiving Logs in specimens when they arrive, and Medical Records Unit routes specimens for testing
• Microbiologists perform laboratory testing

Specimens resulted
• Results are typically available by COB depending on what testing was done and when testing was started
• After results are approved by a microbiologist they are faxed out to the submitting laboratory
• Epidemiologists at the state are notified of the results and update databases

Confirmed cases Reported
• Epidemiologists track relevant clinical and exposure details and prepare summary reports for upper management as needed
• Epidemiologists ensure that confirmed cases are reported to CDC
• Epidemiologists provide consultation and technical assistance to LHJs
Epidemiology Daily Schedule During the Outbreak

Three times daily

• Check ‘measlesreport’ inbox and add all new suspect cases with specimens coming to CDPH to the outbreak database. If any info is missing follow up with jurisdiction

• Download CalREDIE data and merge with outbreak database to identify newly entered suspect or confirmed cases that we had not been notified of previously; Determine whether specimens are being sent to CDPH for testing on these cases

• Data entry!
Epidemiology Daily Schedule During the Outbreak

Two times daily
- Submit the list of expected specimens with priority status to VRDL

One time daily
- Review results from VRDL and notify local PHNs/epis of results

Alternate days
- Prepare epidemiology reports for distribution to CDPH Administration, to LHJ partners, CDC and the public
Epidemiology Daily Schedule During the Outbreak

Continuous

• Provide technical support to ongoing investigations
• Draft health alerts, press releases, improve available guidances
• Respond to media inquiries
• Provide updates and respond to inquiries from CDC
• Coordinate between multiple groups – the laboratory, Information and Education Section/IZB, CAIR, CalREDIE, OPA
Outbreak Challenges

- Specimens were shipped to CDPH without notification
- Specimens would arrive without completed submittal forms or illegible forms
- Due to the volume of specimens PCR runs were started later than normal and resulted later
- Maintaining multiple data systems
- Determining which exposed “immunocompromised” people needed IVIG; ACIP guidance insufficient, treatment expensive and timeliness critical
Outbreak Challenges

• Surge capacity in local health jurisdictions
  – Dedicated staff worked evenings and weekends

• Prioritization of large contact investigations in the setting of an outbreak; one case may have hundreds of contacts

• Providers initially missed cases; first identified cases originally diagnosed with Kawasaki Disease

• Many exposed healthcare personnel had no record of measles immunity; assessing immunity after exposure took time and resources
Outbreak Successes

• Prompt identification of outbreak and notification of local health jurisdictions and providers

• Excellent work by local health departments in case and contact investigations
  – Follow-up on thousands of contacts

• Laboratory capacity
  – Quick turnaround times led to timely intervention
  – 16 local public health laboratories have capacity for measles testing

• Communications
  – Health advisories directed toward providers
  – Statewide calls with local health departments
  – Publicly available data and regular press releases

Outbreak was declared over on April 17th
Final Thoughts

• How to best balance resources used for contact investigations with the possibility of additional measles cases in a setting of high population immunity?
  – What are the risk factors for transmission, can these inform contact investigation protocols?

• Are there technology fixes that might address some of the identified challenges?
  – ELR
  – Electronic specimen submittal forms
  – Other communication between LIMS and CalREDIE
  – Broader use of CalREDIE
  – Others?
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