**Introduction**

Measles is a highly transmissible, vaccine-preventable viral disease.
- Characterized by rash, fever, cough, conjunctivitis, corona, and Koplik’s spots.
- Highly communicable through droplet spread; virus particles can remain on surfaces for up to 3 hours.
- Usual incubation period is 7-14 days after exposure.
- Persons with measles are infectious from 4 days before to 4 days after rash onset.

**Background**

- In Pennsylvania, persons are considered immune to measles if they:
  - Were born before 1957.
  - Had physician-diagnosed and documented measles.
  - Can document 1 dose of measles, mumps, rubella (MMR) vaccine.
- Have serologic evidence of measles immunity.
- Post-exposure prophylaxis (PEP) is recommended for exposed, non-immune persons, using either:
  - MMR vaccine within 72 hours of earliest exposure.
  - Immunoglobulin (IG) within 6 days of earliest exposure.
- In Pennsylvania, exposed susceptible persons who do not receive PEP are quarantined from day 8-21 post-exposure.

**Objective**

To review contact tracing, PEP administration and reported PEP failures during two measles outbreaks occurring in Pennsylvania during 2011.

**Methods**

**Contact Tracing**
- Locations where measles patients were present while infectious were identified.
- Immunization status was evaluated for all identified exposed contacts.
- Non-immune persons were offered MMR, IG or measles serology testing; susceptible persons not receiving PEP were quarantined.
- For exposures occurring in public venues, press releases were made to notify the public of possible exposure(s).

**PEP Timeliness and Failure**
- PEP timeliness was defined as persons who received timely PEP and subsequently developed measles.
- PEP failure rates were calculated by dividing reported failures by total administered doses.
- Transmission following PEP failure was assessed.

**Data Management and Analysis**
- Contact tracing databases were constructed and managed using Epi-Info version 3.5.3.
- Analysis was conducted using SAS 9.2.

**Results**

**Outbreak A: Southcentral PA**
- 6 confirmed cases occurred: 3 primary, 3 secondary.
- All cases were previously unvaccinated.
- Secondary cases occurred among two siblings and a playmate of the primary case.
- The primary case’s exposure was not identified, however, domestic travel through two international airports during the likely exposure period was reported.
- In total, 200 exposed contacts were identified.
- 54 exposed contacts received PEP (4 MMR, 50 IG).
- 80% of all administered doses were timely (MMR: 75%, IG: 98%).
- 2 people (2%) had previous evidence of measles immunity.

**Outbreak B: Southeastern PA**
- 4 confirmed cases occurred: 1 primary, 3 secondary.
- All cases were previously unvaccinated.
- Secondary cases occurred among two siblings and a playmate of the primary case.
- The primary case’s exposure was not identified, however, domestic travel through two international airports during the likely exposure period was reported.
- In total, 387 exposed contacts were identified.
- 43 exposed contacts received PEP (11 MMR, 32 IG).
- 93% of all administered doses were timely (MMR: 82%, IG: 97%).
- Only 1 MMR failure (9% failure rate) was reported, in a day 2 post-exposure recipient.

**Discussion**

- Two outbreaks involving many susceptible contacts were investigated in Pennsylvania during 2011.
- Among 677 persons exposed during both outbreaks, 97 (14%) received PEP (15 MMR, 82 IG).
- 93% of all administered PEP doses were given within the recommended timeframe.
- Two PEP failures were reported (2% failure); further transmission was not identified.

**Summary**

- Measles has been eliminated from the Western Hemisphere, however importations from other parts of the world continue.
- Due to ongoing importation and under immunization, the largest number of reported measles cases in the United States since 1996 occurred in 2011.
- Though several cases were reported in each outbreak, sustained community transmission was not identified, likely because of generally high community levels of measles immunity.
- Continued routine vaccination with MMR vaccine prevents measles disease and should be strongly encouraged.
- Each identified case requires significant public health agency efforts to reduce subsequent transmission potential.

**Limitations**

- Immunity status of exposed contacts was assessed by self-report.
- Limited information on non-household exposures was available.

**Conclusion**

- We acknowledge the contributions of Batty Hunt, Allison Longenberger, Maria Moli, Ramban, Arame Palumbo, Kimberly Warren, and Anie Switzer, from the Bureau of Epidemiology.
- We also acknowledge the contributions of many members of the PA Dept. of Health Bureau of Communicable Diseases, Laboratories and Community Health Services, as well as staff in the Southcentral, Southeast and Northeast District Offices.

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