

# Public health response to measles: An ounce of prevention is

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... a ton of work!

January 29 - February 9, 2009

San Francisco Department of Public Health  
Communicable Disease Control & Prevention

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August 4, 2009

# Index Case



- SF resident (Case A)
  - \*Believed previously vaccinated for measles
- Had contact with a known measles case on Jan. 17, 2009 while traveling in England
- Flew back to U.S. on Jan. 20, 2009
- On Jan. 25, 2009, 8 days after contact, developed measles symptoms:
  - *malaise & fever followed by descending rash*
  - *cough developed Jan. 26, 2009*

# First Response *January 27, 2009*

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- Case A called children's pediatrician and was diagnosed with ***measles*** over the phone.
- Pediatrician immediately called SFDPH
- That evening, Case A & family were interviewed/ examined by the Communicable Disease on-call MD.
- Specimens were obtained for laboratory testing:
  - Case A: NP swab and blood (serology)
  - Spouse: blood (serology)
  - Two Children: both unvaccinated, no specimens sent
- Case A isolated. Spouse & Children quarantined.
- Parents counseled to provide IgG and/or vaccination for children. Initially refused.

# Results & Response January 28, 2009

**Case A:** NP specimen: (+) measles  
Serology: IgM+ and IgG-

**Spouse:** Serology: immune IgG+

Preliminary case & contact investigation:  
multiple potential exposures of susceptible persons



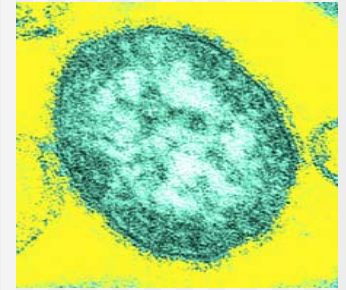
- IDER Activation & Notification Protocol initiated
- Criteria met for activation
  1. Large outbreak requiring more than routine HD resources.
  2. High profile situation involving an infectious disease.

# Symptoms of Measles

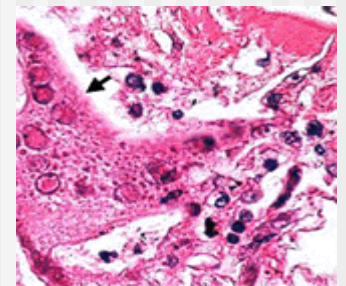
- Incubation Period: 7-18 days
- Prodrome onset: day 2-4
- Fever:  $\geq 101^{\circ}\text{F}$
- Cough
- Coryza
- Conjunctivitis
- Koplik spots
- Maculopapular rash
  - hairline to generalized
  - duration 5-6 days



# Epidemiology of Measles

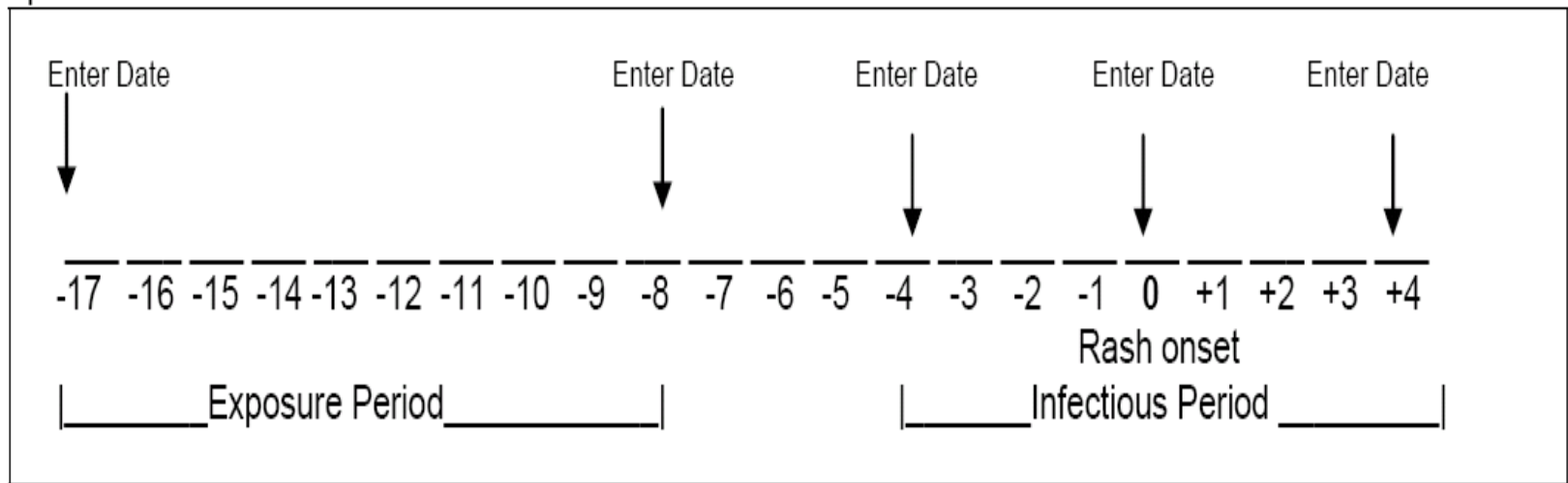


- Infectious Period: 4 days before & 4 days after rash onset
- Virus remains airborne for 2 hrs
  - Transmitted:
    1. Person-to-person via respiratory droplets
    2. Through the air via aerosolized droplet nuclei
- 90% attack rate
- >95% measles vaccine coverage required to stop outbreak



# Measles Timeline

The following time line depicts the clinical course of measles and may be useful in the investigation process:



- Chart utilized during measles investigation to determine potential & actual contacts.

# Defining who is at Risk



- A Contact: during the infectious period

1. Lived with the case **OR**
2. Shared air space for up to 2 hrs after the unmasked case was present

**AND** is:

- Susceptible to Measles

(i.e. answers “No” to *all* the following):

- \*Born before 1957
- \*Documentation of 2 doses of measles vaccine
- \*History of MD documented measles infection
- \*Laboratory evidence of measles immunity

# Timeline: Case A

**\*Infectious Period**

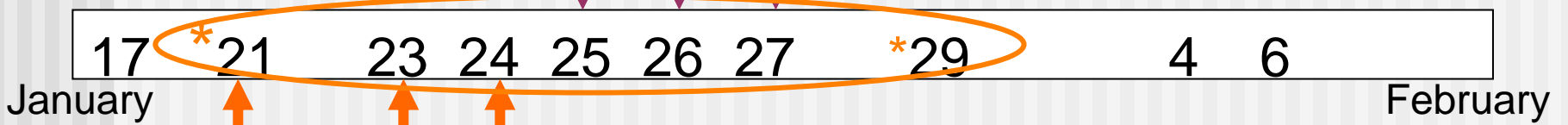
4 days before & 4 days after appearance of rash = 8 days total

Case A exposed

Case A develops rash

Case A develops cough

Case A isolated



Visited large office, 1 hr : 64 people  
Visited religious ceremony, 10 min: ~10 people

Tutored students in home, 1 hr: 3 people  
Contractor worked at home, 2 hrs: 1 person

Household, ongoing exposures: 5 people

**Exposures**

Infectious Period

4 days before & 4 days after appearance of rash = 8 days total

# Timeline: Case B & C

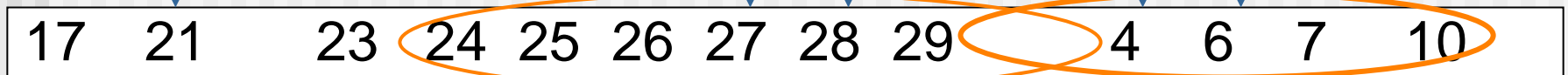
Case B & C's exposures start at beginning of Case A's infectious period

Case B & C quarantined in evening

Case B & C given IgG at home

Case B develops rash

Case C develops rash



January February

Party A, several hrs: 103 people

Sunday School, couple hrs: 25 people

Home visitors, < 1 hr : 3 people

Home visitor, 10 min: 1 person

School A Classmates & Staff, many hrs: 18 people

Children in After-school Program B, several hrs: 51 people

## Exposures

# Summary of Initial Info from Case & Contact Investigation

Case	Contact Group	Exposure Duration	# People	# Susceptible	Other information
→ A	Household	Ongoing	5	2	
→ A	Tutored students	1 hr	3	1	
→ A	Large office	1 hr + 2 hrs	64	Unknown	Mostly foreign born adults
A	Religious ceremony	10 min + ? 2 hrs ?	~10	Unknown	Large open space
→ B & C	Party A	Several hrs	103	Unknown	
→ B & C	Sunday school	Several hrs	25	Many kids unvaccinated	
→ B	School A	Many hrs	18	Many kids unvaccinated	
→ B & C	After school program	Several hrs	51	Many kids unvaccinated	
→ B & C	Home visitors	< 1 hour	4		Adults

# Response Activities



- Identification and verification of disease
  - Collection of specimens for diagnosis (Cases A, B & C)
- Case and contact investigation
  - Of 283 potential contacts, 62 determined to have been exposed (actual contacts).
- Assessment of contacts' immune status
  - Phone conversation
  - Collection of vaccination or medical records
  - Serology (collection, send to CDPH for testing)

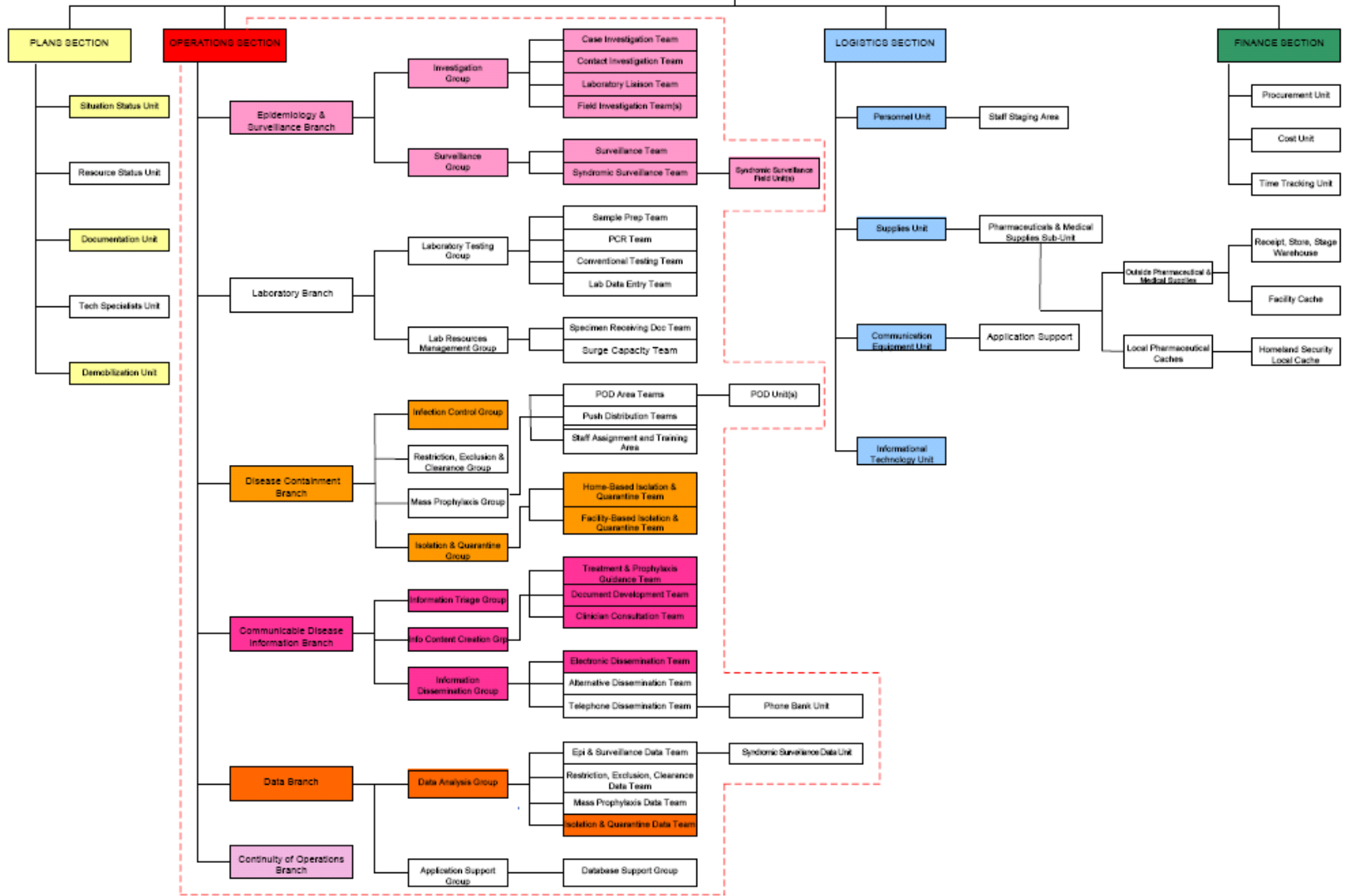
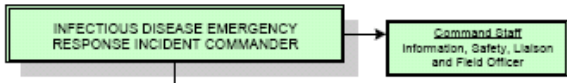
# Response Activities - 2



- Isolation and Quarantine
  - Orders served in person from Jan. 29- Feb. 1, 2009
  - Issued to individuals meeting case or susceptible contact definitions
- Active symptom surveillance of persons in quarantine
- Enhanced passive surveillance with Health Alert to clinicians
- Phone information line
- Data Collection

**SFDPH  
Infectious Disease Emergency  
Response ICS Chart**

4/2008



# Looking at the Final Numbers

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# Confirmed Cases	3 (1 adult, 2 children)
# Potentially Exposed	283
# Confirmed Exposed	62
# Individuals Tested	20
# Placed in Isolation	3
# Placed in Quarantine	27
# Placed under Active Surveillance	13

# Effective Actions & Successes

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- Immediate notification by pediatrician!!!
- Immediate isolation of Case A and quarantine of children (Cases B & C) by SFDPH.
- Rapid testing by VRDL at CDPH.
- Administration of IgG likely ameliorated disease in Case B & C and may have prolonged their incubation period.
- Only 3 cases!!!



# From Measles to Money: The Cost of a Small Response

**Total Person Hours = 1,657**

## **Participating Organizations:**

SF Department of Public Health (CDCP, Community Health Programs, Sexually Transmitted Diseases and SF General Hospital)

## **Cost**

- Personnel 91,059
  - Supplies 7,042
- \$ 98,101!!!**



# How did CDPH/CDC Policies and Recommendations impact the Scope of our Response?

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- In the setting of limited resources, is there a way to prioritize follow-up of contacts?
  - Is the presence or absence of cough in the case predictive?
  - Is the quality of ventilation in the space where exposure occurred predictive?
  - Is the country of birth of the contact predicted of immunity?
- Recommendation for duration of quarantine period varied for single cases versus outbreaks:
  - 18 days (single case guidance) vs.. 21 days (outbreak guidance)
- Effect of IgG on disease course
  - Does it prolong incubation period? Should it extend quarantine?
    - We extended quarantine period to 28 days as per CDPH guidance.

# What does the data show?

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- Cough as predictor of infectiousness
- Ventilated space as predictor of disease spread
- Country of birth: are individuals born in countries where measles is endemic likely to be immune?
- Duration of quarantine period: 21 vs. 18 days
- Effects of IgG on infectious and incubation period



# Does Having a Cough Matter?

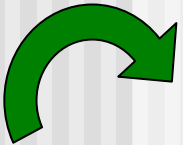
- Despite being infectious, Case A did not have a cough while at Office A on 1/24/09.
    - \* No further cases developed from that exposure.
  - Data suggests that the presence of a ***cough*** is associated with an increased risk of spreading measles virus.
1. Remington, et. al (1985) investigated a pediatric office outbreak. Interesting observation:  
Index case was seen for otitis media and rash on  
**11/15** without cough → NO cases developed.  
Seen again  
**11/16** with cough → 4 cases developed despite lack of direct contact.

# Does Having a Cough Matter? (cont'd)

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2. Chen, et. al (1989) investigated a high school outbreak where 69 cases occurred among a highly vaccinated population.

Interesting observation:



Epidemiologic curve suggest effective transmission of measles virus occurred once forceful hacking cough developed (despite earlier prodrome symptoms).

- Results indicate:

Most efficient conditions for mass exposure was

a. Presence of frequent/ forceful cough

b. Poorly ventilated areas (hallway & cafeteria)

# Considering Ventilation Status

- Measles virus has been shown to be more concentrated and survive longer in areas with poor ventilation.
- 1. Remington, et. al (1985) demonstrated the rate of fresh air ventilation has a marked effect on the amount of time to clear measles virus.
  - If rate is 2.5cu m/min = 3 hrs to clear
  - If rate is 10cu m/min = 30 min to clear
- 2. Bloch, et. al (1985) investigated an outbreak (7 cases) in a pediatric office with detailed hx of location/transit of office and airflow studies.
  - Results indicate:  
Highest concentration of measles virus in the hallway & at the weight scale where ventilation was minimal.  
Exposures/transmissions correlated (altho #'s lo)

## Country of Birth:

Are individuals born in measles endemic countries likely to be immune?

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- No studies have addressed
- SF data suggests this may be a useful consideration in settings with limited response resources

# Duration of Quarantine

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- Why recommendation for quarantine is 18 days for single case vs. 21 days for outbreak?
  - Initially, followed the 21 day recommendation, but dropped to 18 days due to resource limitations.

# Effects of IgG on incubation period

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- No data indentified in the literature.
- From Control of Communicable Diseases Manual – Heymann, 18<sup>th</sup> edition: “IG given for passive protection [of measles] early in the incubation period may extend this period.”
- Old and limited data on varicella (reference?).

# What's in store for our next response to a measles case?

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- In the setting of a well confined outbreak, with no new cases, use 18 day quarantine period, rather than 21.
- Promote IgG when indicated, in the setting of pros/cons of extended quarantine period.
- Create “Tiered-Response” to follow-up of contacts.

# Tiered-response: contacts to a case of Measles

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- **DRAFT PROPOSAL for extensive follow-up**
- Tier One:
  - High risk contacts: non-immune w/significant exposure
- Tier Two:
  - Medium risk contacts: no known non-immune, moderate exposure
- Tier Three:
  - Low risk contacts: likely immune, low risk of exposure

# Thank you!

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- Mariah Bianchi, RN: Intern at SFDPH, Masters Program in Health Policy, School of Nursing, UCSF
- Karen Holbrook, MD: CDCP/SDPH
- CDCP and other DPH Staff who participated in the response

# References

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