Measles: NIMBY No More

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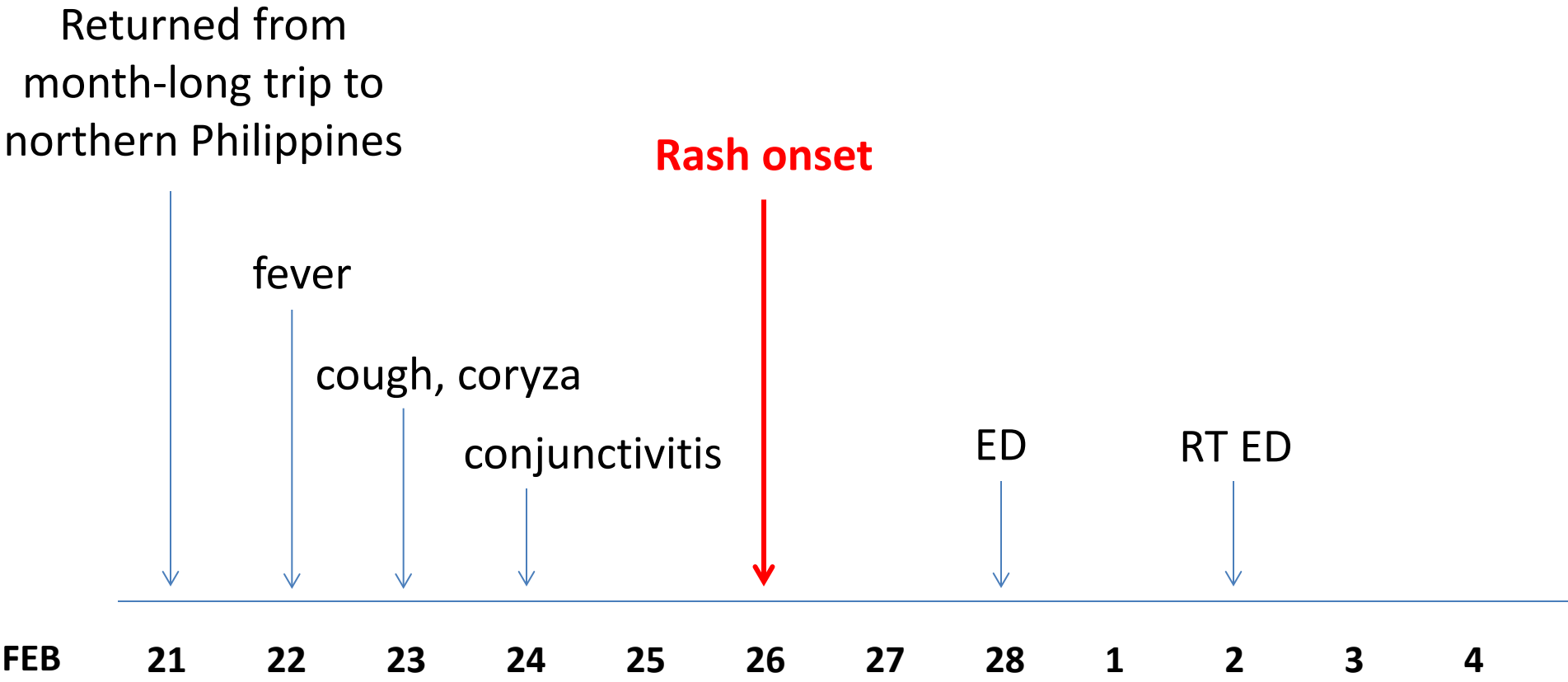
March 3, 2017

Objectives

- Provide an overview of the clinical presentation of measles, including complications and management
- Highlight key features of transmission that contribute to spread within the community
- Review epidemiology of measles since the introduction of the MMR vaccine
- Share strategies on how to communicate with:
  - Parents and community
  - Clinicians
  - Local public health unit

Case: 4-year old female



Case

- Born in Ontario
- Followed by GP, received all immunizations
- 10yo sister had 2 doses MMR as well
- No known sick contacts in Philippines

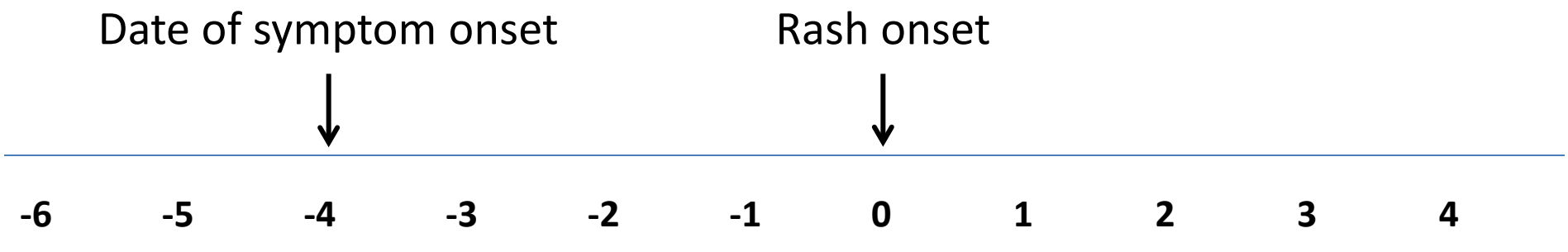
Could this be measles?

How to confirm and whom to notify?

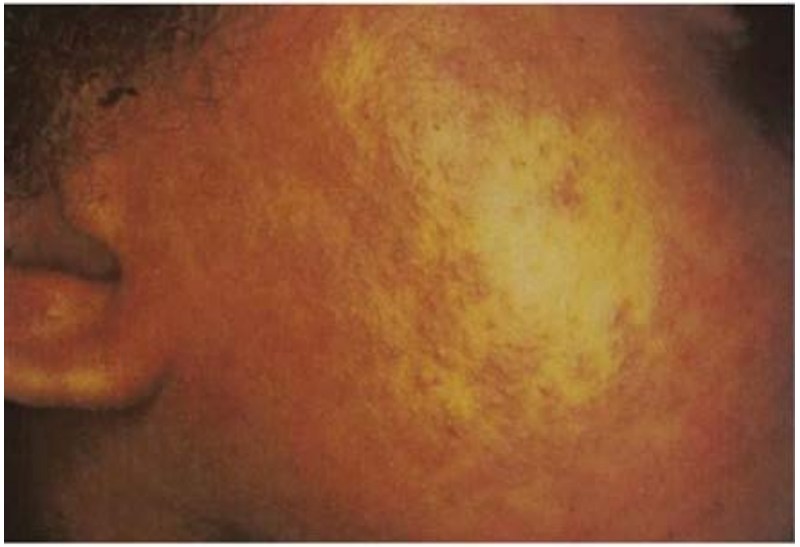
Clinical features of measles

- Prodrome
  - Fever, cough, coryza, conjunctivitis
- Koplik spots x 12-72h
  - Buccal mucosa, base of lower milk molars
  - reliably appear 3d before skin rash
- Generalised maculopapular rash
  - face → body → extremities

Nelson's Textbook of Pediatrics, 19th ed.



Measles Rash Distribution



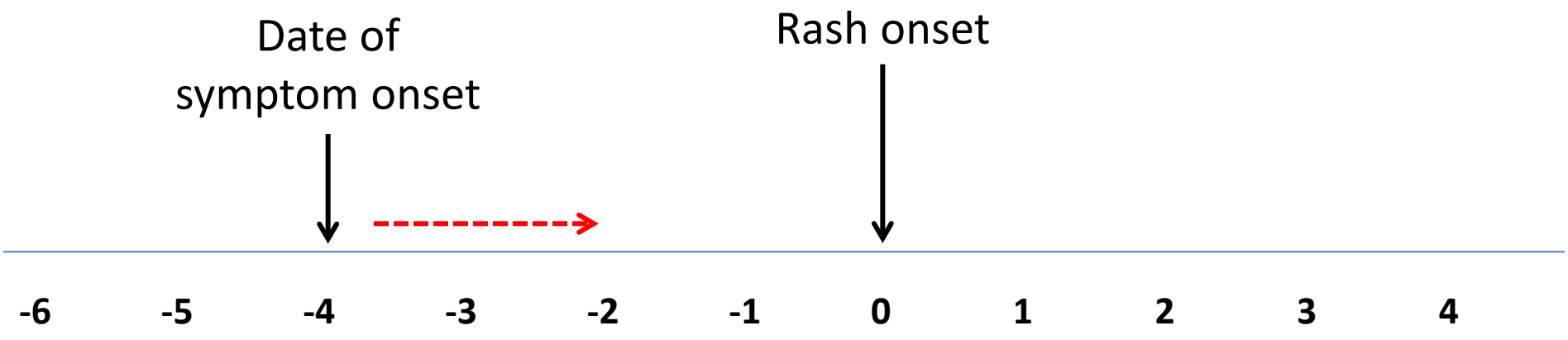
Measles Rash, Dark Skin

Measles Rash, Light Skin

http://nursekey.com/the-child-with-an-infectious-disease/

Clinical features if partially immunized

- Shorter prodromal period, may not see conjunctivitis
- Minimal symptoms
- Few or no Koplik spots
- Similar rash distribution and progression



Mitchell J Prim Health Care 2013

Differential

- Rash:
  - Roseola: afebrile, happy
  - Scarlet fever
  - Kawasaki disease: “morbiliform”
  - Drug eruption
- Conjunctivitis:
  - Adenovirus
  - *Mycoplasma pneumoniae* (LRTI symptoms)

Nelson’s Textbook of Pediatrics, 19th ed.

Management Considerations

- Discuss with MD-on-call and Public Health Unit
  - HPI: course and duration of prodromal symptoms, associated pain, headache, vomiting
  - Sick contacts with similar signs and symptoms
  - Travel history
  - Immunization status (history of 2 MMR?)
- Prescribe Vitamin A to patient

Vitamin A

- Recommended by WHO for all children with acute measles regardless of country of residence
- Given once daily x 2 days:
  - 200,000 IU if ≥ 12 months
  - 100,000 IU if 6-12 months
  - 50,000 IU if < 6 months
- 3rd age-specific dose at 2-4 weeks to children with clinical signs and symptoms of Vitamin A deficiency
  - Poor growth, diarrhea, anemia, susceptibility to infections
  - Eye lesions, scaly layers of cells (xerophthalmia)

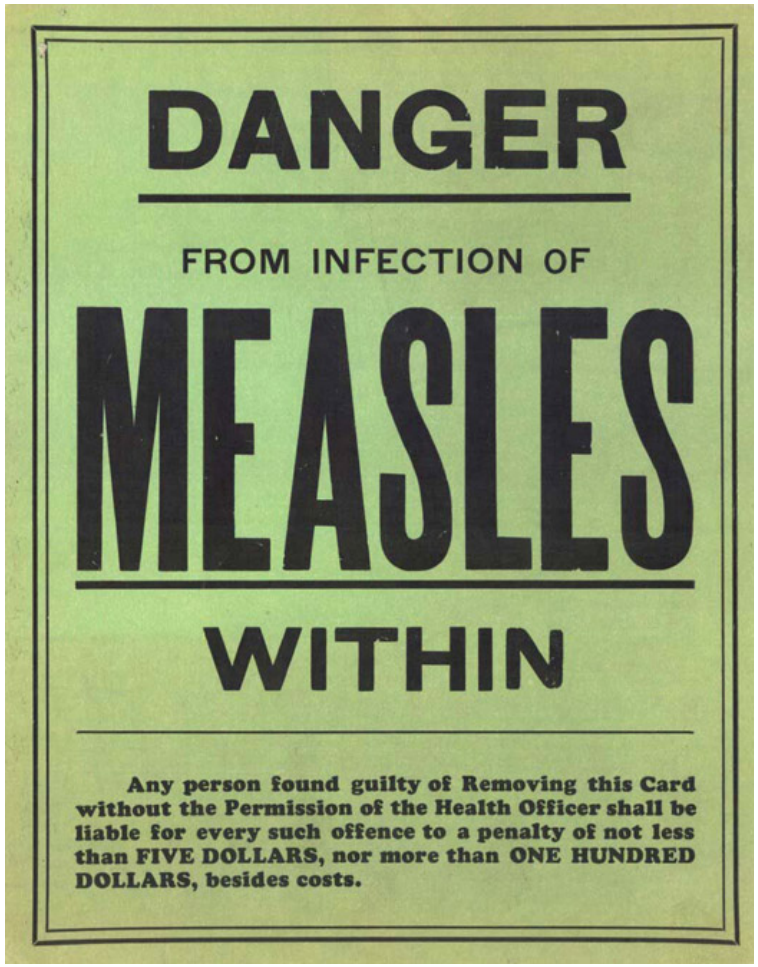
AAP Red Book: 2015 Report of the Committee on Infectious Diseases

Management Considerations

Teach family how to prevent transmission within home

- Hand hygiene
- Home isolation x 4 days after rash onset
- Mask use in shared spaces

Monitor for complications



Complications

Onset	Complication	Frequency
Early	Acute otitis media	Up to 1 in 10
	Bronchopneumonia (due to measles or bacterial super-infection)	1-6 in 100
	Transient hepatitis, ↓ platelets, GI (appendicitis, ileocolitis), SJS, TSS	Rare
2-6d after rash	Encephalitis	1-10 in 10,000 cases
< 20 yrs	Subacute sclerosing panencephalitis (persistent CNS infection)	1 in 100,000 cases

Up to 60% of mortality (70% in T-lymphocyte deficiencies)

15% fatal within 24h; ¼ with sequelae

Principles and Practices of Pediatric Infectious Diseases 3rd ed.

Complications

- Intense inflammatory response to viral replication
- Death in **1-3 per 1,000 cases**
  - Highest rate in 2nd year of life
- Black measles: severe hemorrhagic measles
  - Most common in infants from developing countries
  - sudden onset of high fever accompanied by seizures or altered mental status
  - Followed by pneumonia, hemorrhagic rash and conjunctivitis, bleeding from mouth, nose, and gastrointestinal tract, and disseminated intravascular coagulation

Severity of disease

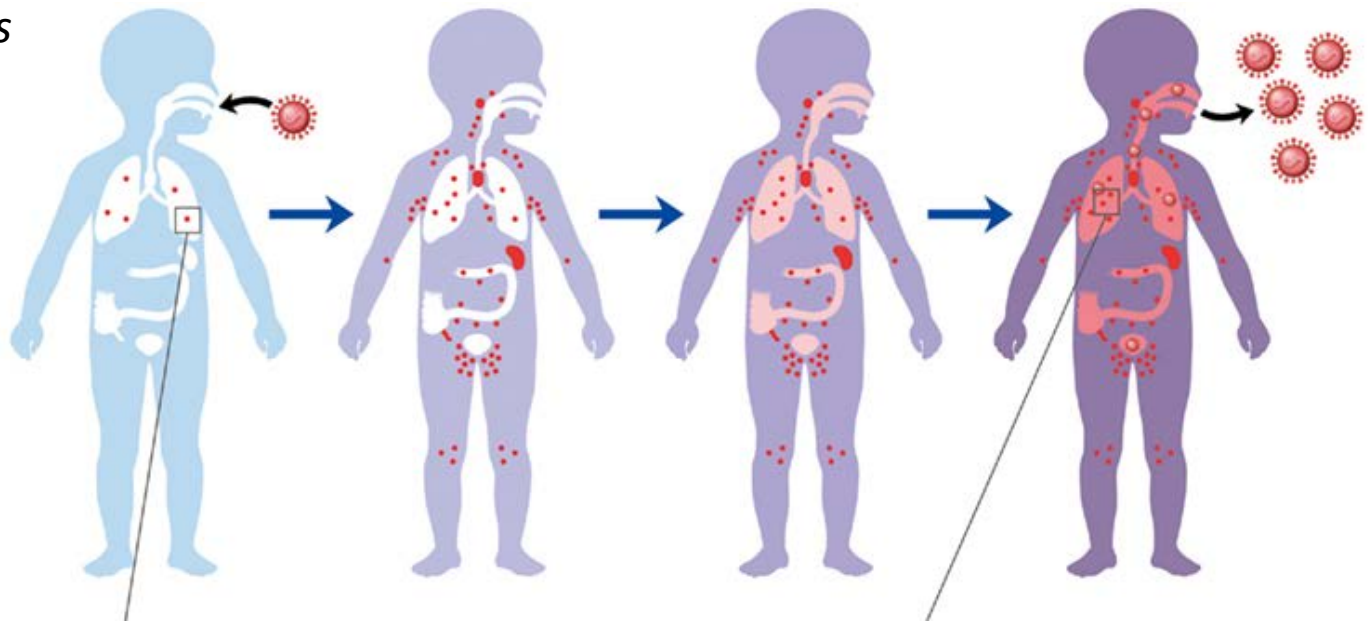
- Higher among:
  - Infants (highest secondary attack rates)
    - Up to 40% local cases occur < 16 months old
  - Pregnant women
  - Malnutrition
  - Immunocompromised (T-lymphocyte deficiencies)
  - ? Household contacts

How is measles spread?

Pathogenesis

aerosolized particles from respiratory secretions to susceptible hosts

Can persist in environment for >1h



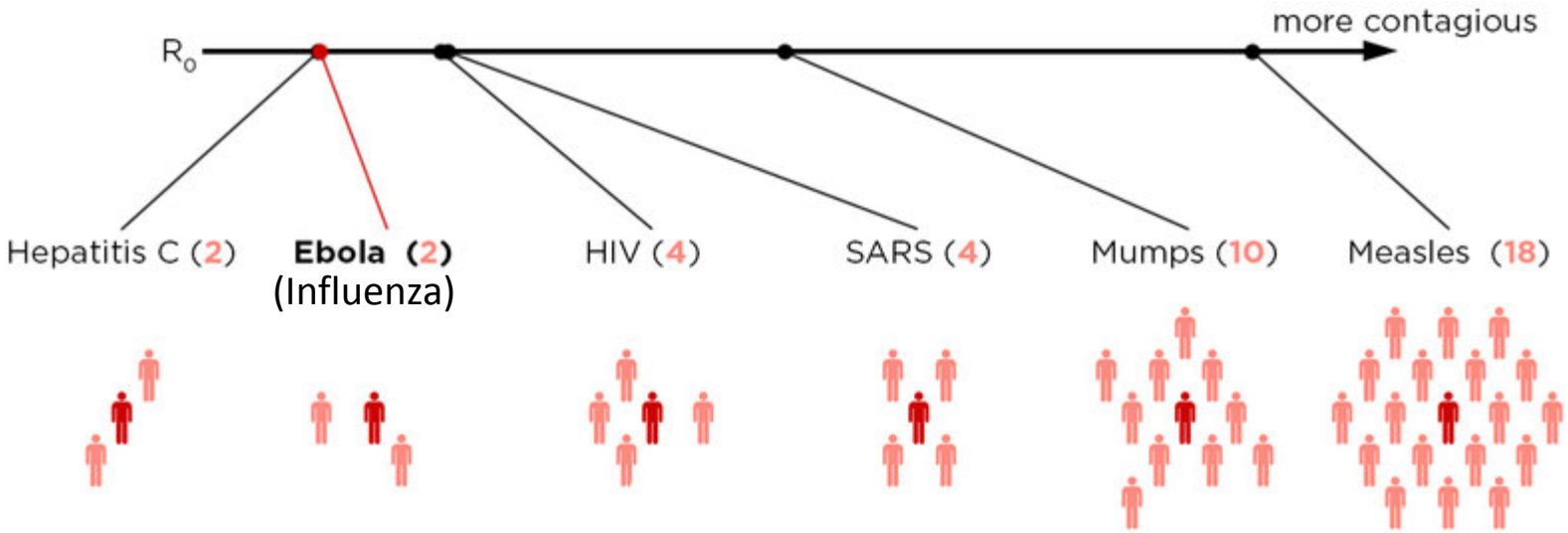
Measles virus enters the airways through the nasopharynx, and replicates in regional lymphatics before entering the bloodstream. Virus spreads to lymphoid organs and replicates.

By Day 7-14 after exposure, see active replication in the tissues, and development of cough, coryza, conjunctivitis, fever, rash

Takeda Front Microbiol 2012

Infection and transmission

- Most contagious disease
  - R_0 15 (94% herd immunity to prevent epidemic)
  - 1 day before sx start → 4 days after rash onset
- Context:



http://www.bbc.com/news/health-29953765

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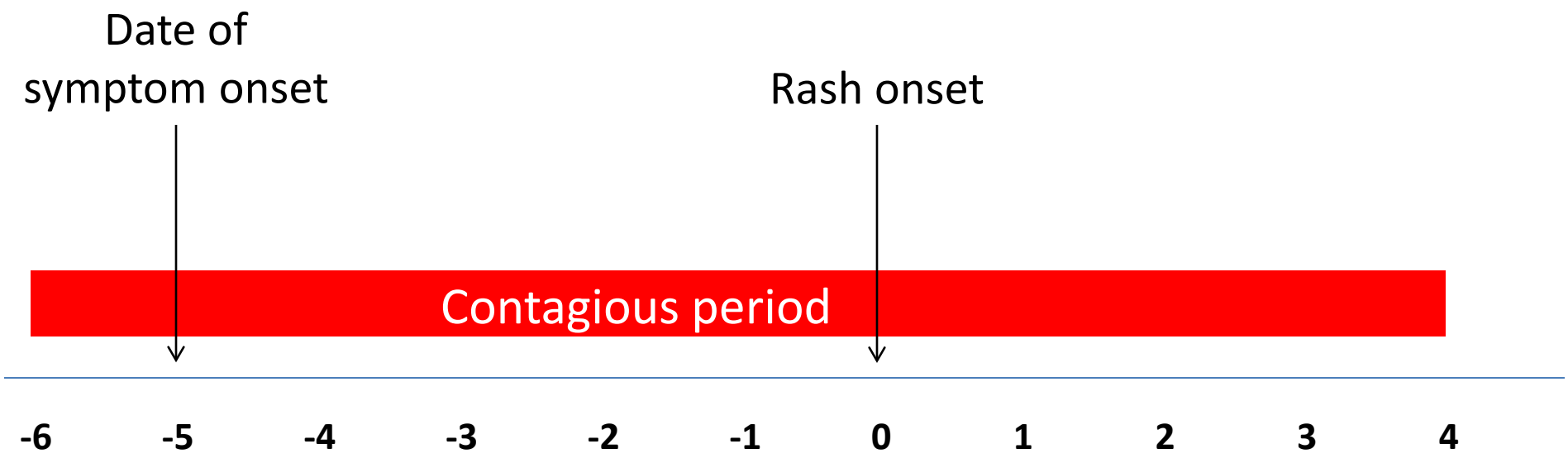


How to make the diagnosis?

Diagnosis

- Clinical assessment
- Travel history or contact with affected person
  - Need an epidemiological link
- Testing
  - Blood (5mL in serum tube)
  - Urine
  - Nasopharynx

https://www.publichealthontario.ca/en/eRepository/Measles_Update_for_Clinicians.pdf

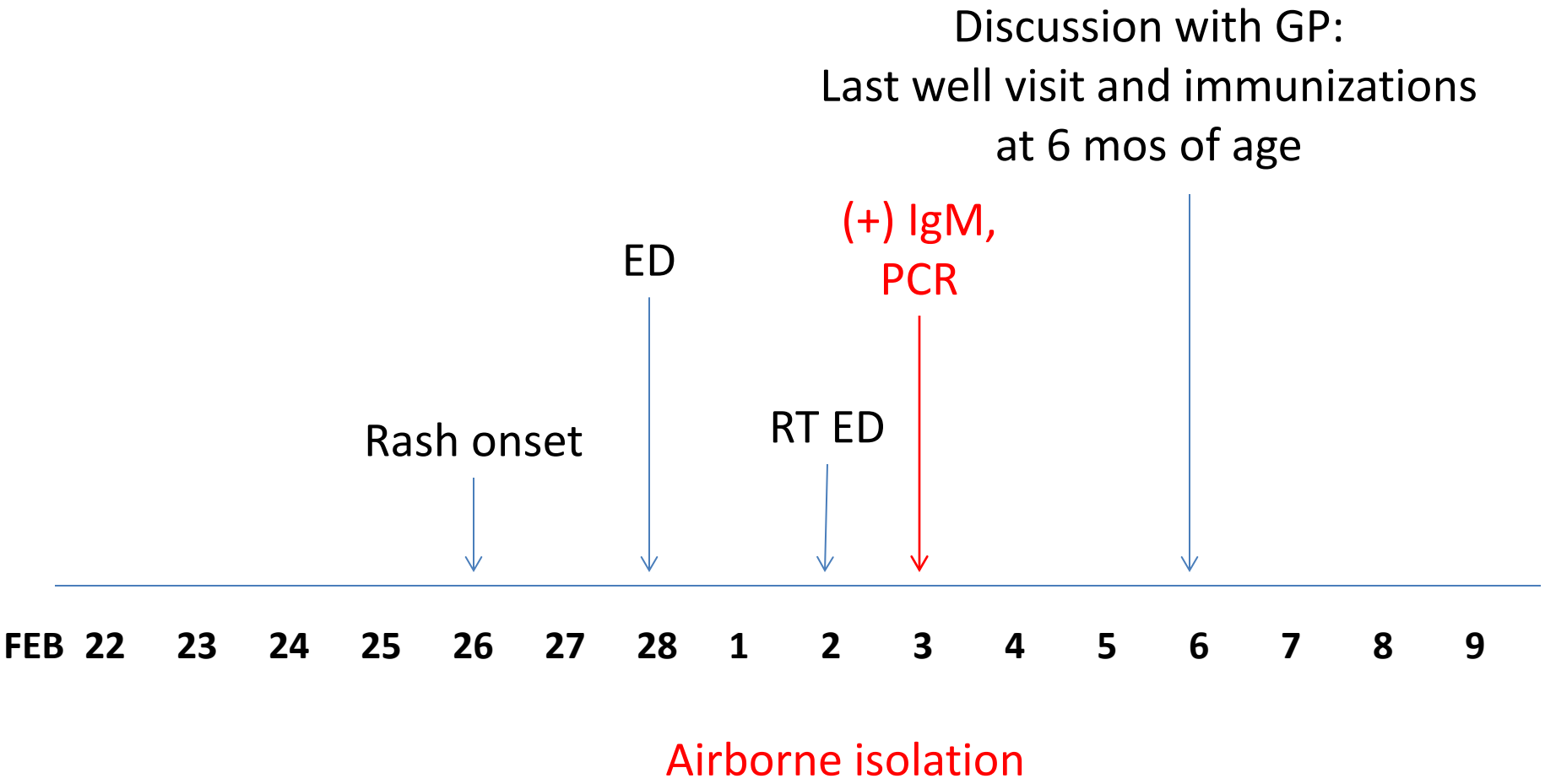
Diagnostic tests

- Acute serology for measles IgM and IgG
  - Blood (5mL serum tube) <7 days from rash onset
- Measles virus detection by PCR
  - Urine (50 mL) <7 days from rash onset
  - Nasopharyngeal or throat swab <5 days from rash onset
    - viral transport media – pink liquid medium
- Specimens stored and shipped <u>cold</u>

"Suspect case of measles": symptoms, date of onset, exposure history, travel history, vaccination history

Public Health Ontario April 2014. Infectious Diseases Protol, Appendix A: Measles

Anatomy of the outbreak



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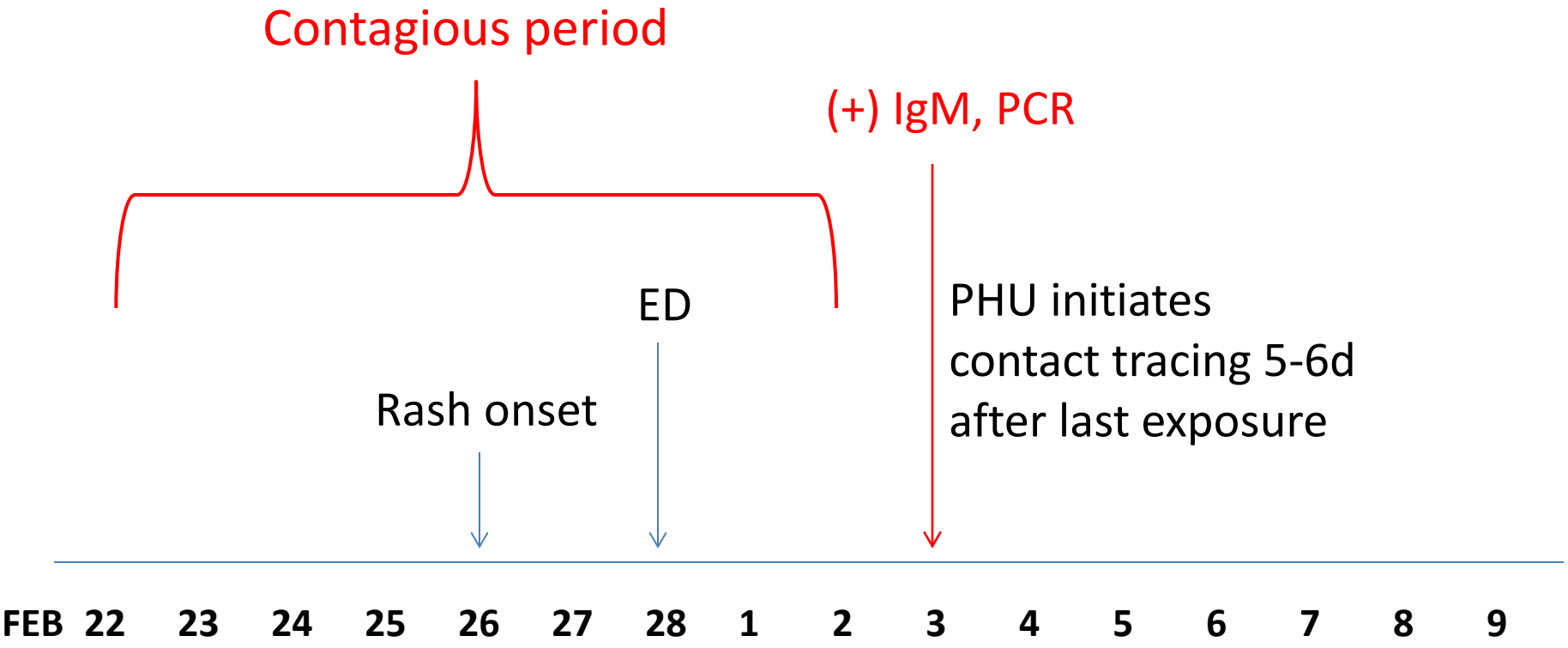


Management of Exposures

= Engage local public health unit early!

Infection and transmission

- Airborne (up to 2h)
- Incubation period 7-14 days (5-21)

Infection control considerations

- Airborne isolation:
  - Single room with negative air flow + door closed
  - Immunocompetent: 4 days after rash onset
  - Immunocompromised: duration of illness
- If no airborne infection isolation room:
  - patient should wear surgical mask
  - immediately placed in single room with door closed
- All staff wear personal protective equipment
  - N95 mask
  - Gowns and gloves if secretions

https://www.publichealthontario.ca/en/eRepository/Measles_Update_for_Clinicians.pdf

Infection prevention for susceptible contacts

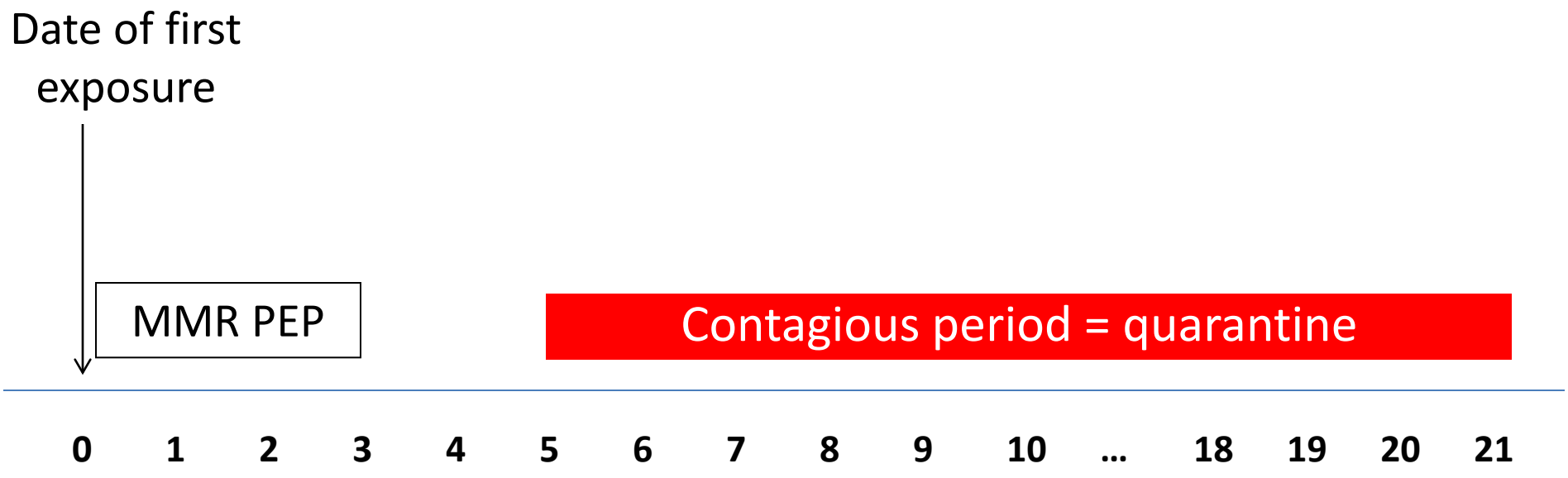
- Quarantined from Day 5 (first exposure) to Day 21 (last exposure)
- Post-exposure prophylaxis:
  - MMR within 72h of exposure
  - Immune globulin within 6 days of exposure*:
    - Pregnant women without measles immunity
    - Immunocompromised + HIV(+)
    - Infants < 12 months

* extends susceptibility period from 21 days to <u>28 days</u>

https://www.publichealthontario.ca/en/eRepository/Measles_Update_for_Clinicians.pdf

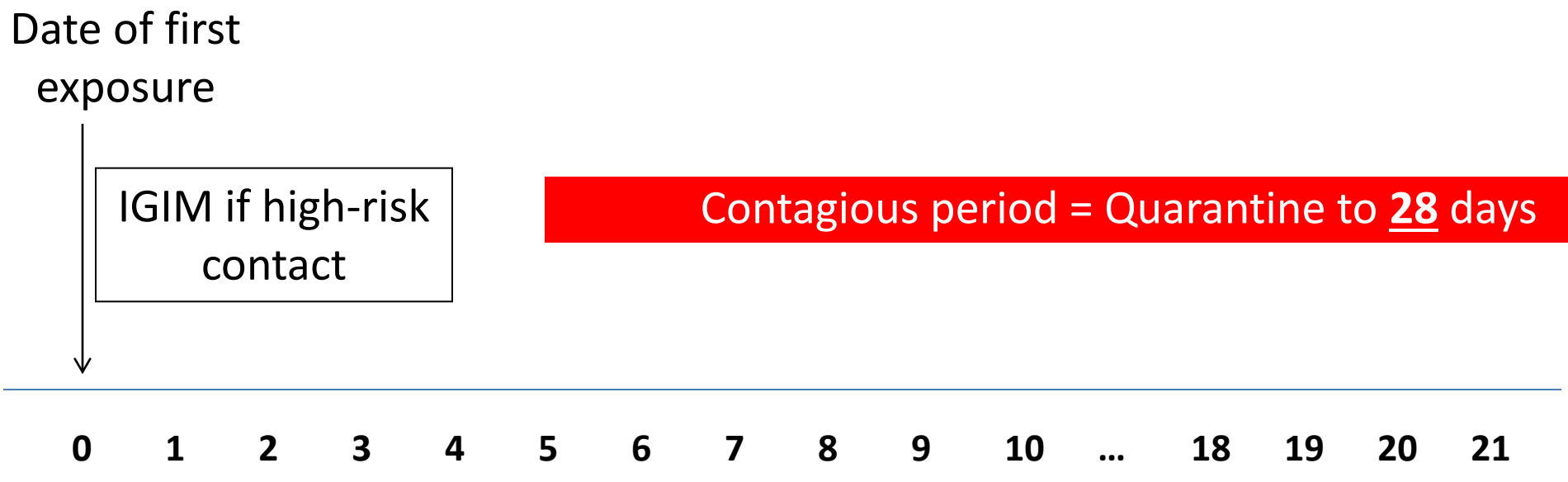
Infection prevention

- Incubation period 7-14 days (5-21)
- Susceptible contacts:



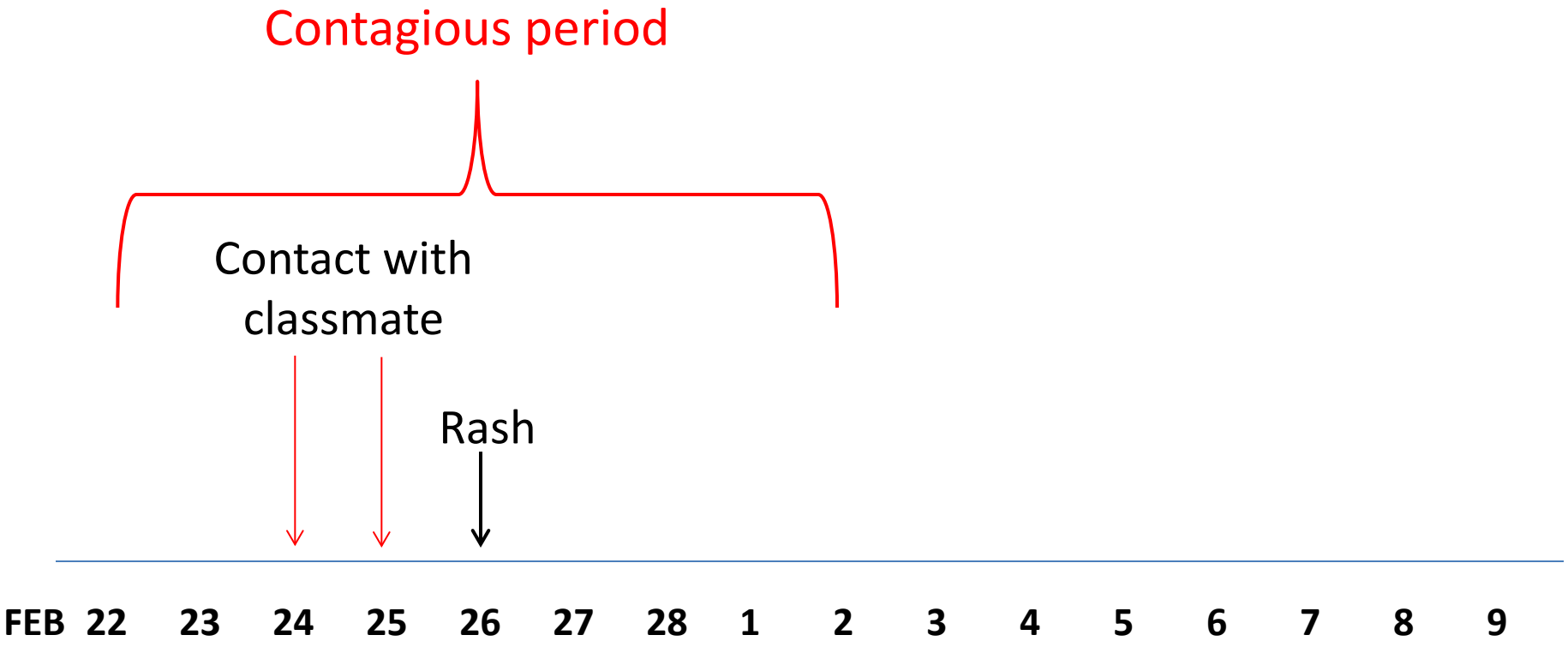
Infection prevention

- Incubation period 7-14 days (5-21)
- Susceptible contacts:

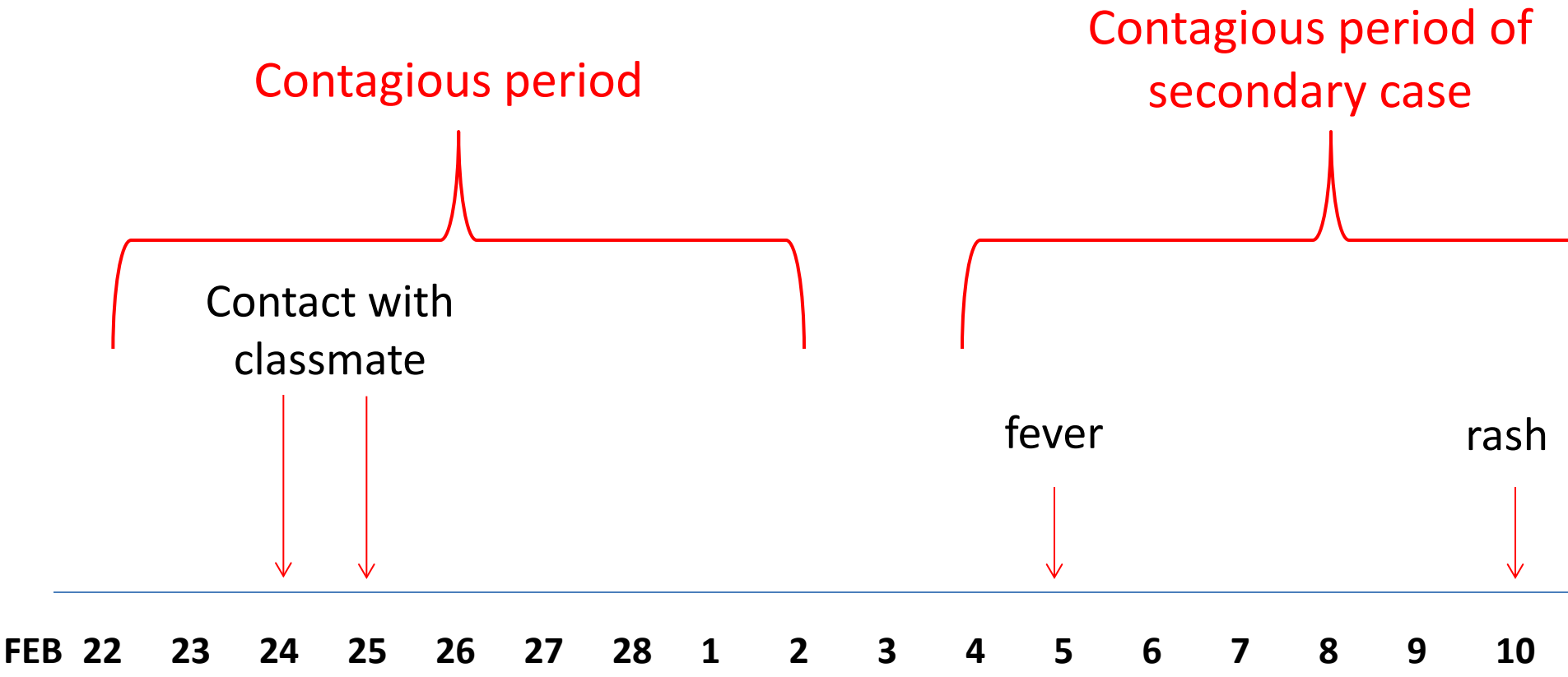


Returning to the outbreak

Anatomy of the outbreak



Anatomy of the outbreak



Outbreak

- Case 1: Rash onset February 26
  - ED February 28
  - 19 min at triage = 2 hrs 19 min exposure period
  - > 150 potential contacts through ED alone
  - 2 received immunoglobulin
- Case 2: Rash onset March 10 (14 days post-exposure)
  - ED March 10
  - 2 min at triage = 2 hrs exposure period
  - 4 received immunoglobulin

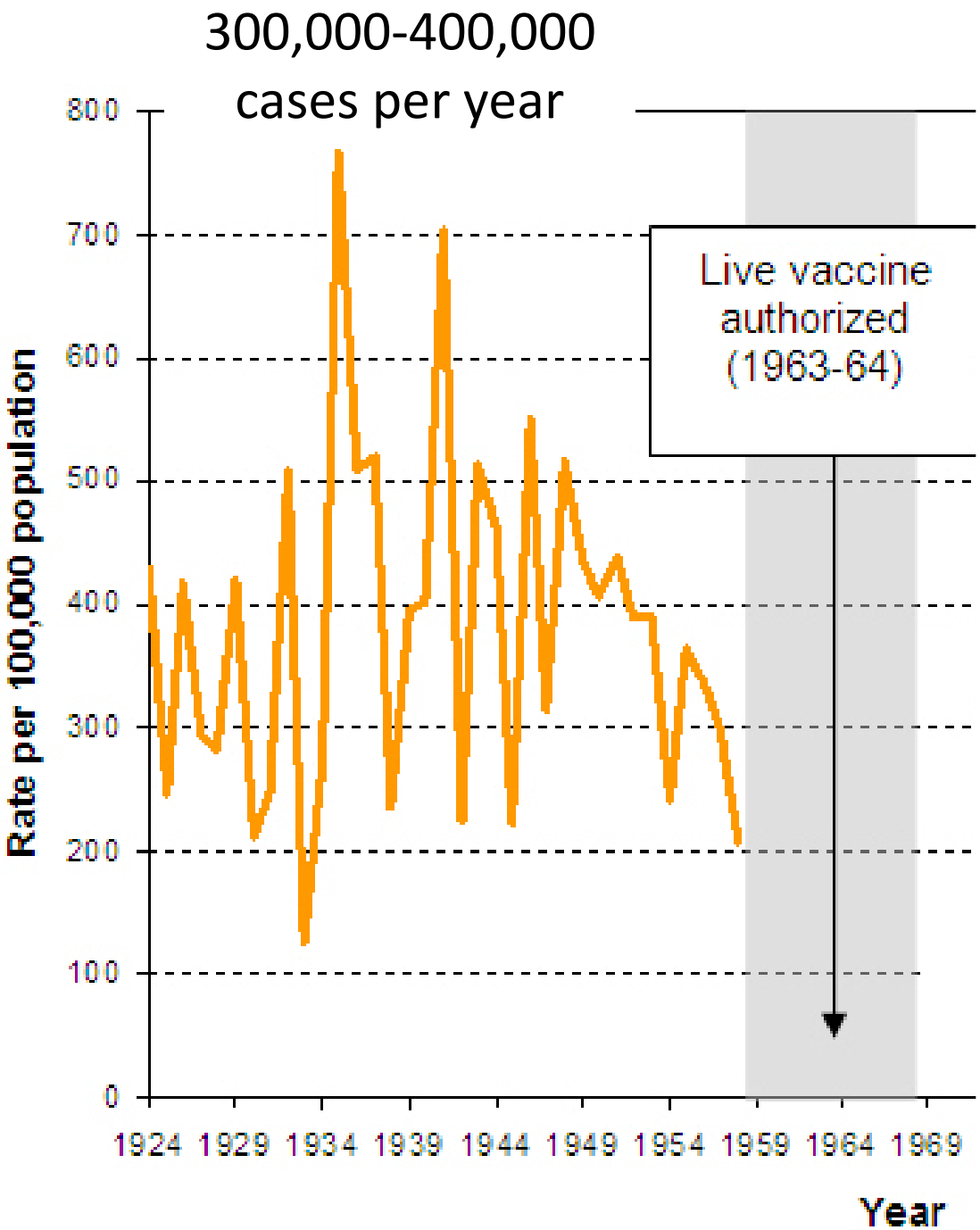
Outbreak

- Case 3: rash onset March 21 (16 days after exposure)
  - Household contact of Case 2
  - s/p IGIM March 10 (5 days after exposure)
  - On home isolation already
- Case 4: fever Mar 21, rash Mar 22 (17 days after)
  - Household contact of Case 2, 3
  - MMR x 1: IgG (+) IgM (-) PCR (+) urine
  - Had not been isolated
    - Susceptible contacts isolated x 21 days after known exposure

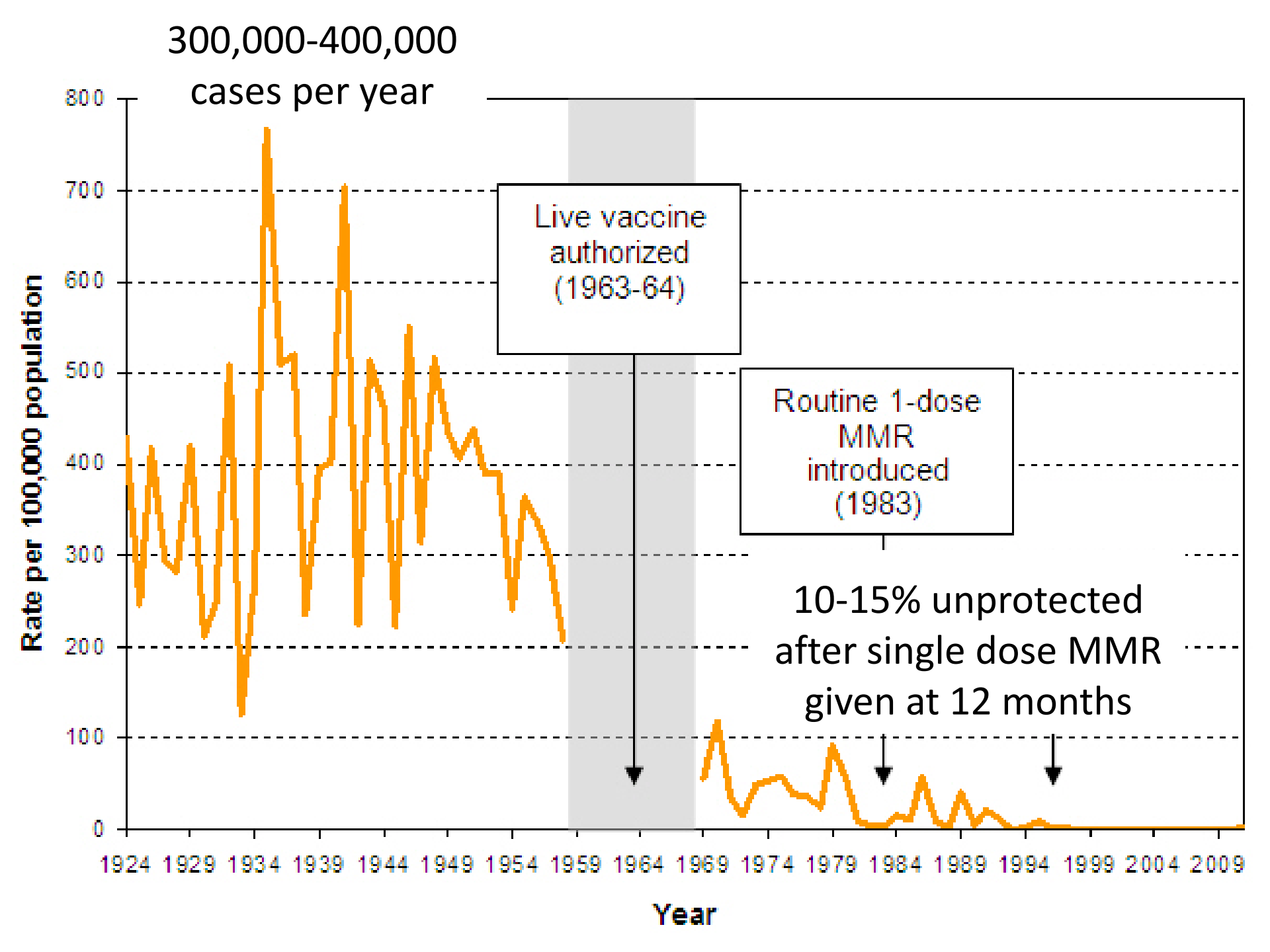
Primary Prevention: The Impact of MMR on the Epidemiology of Measles

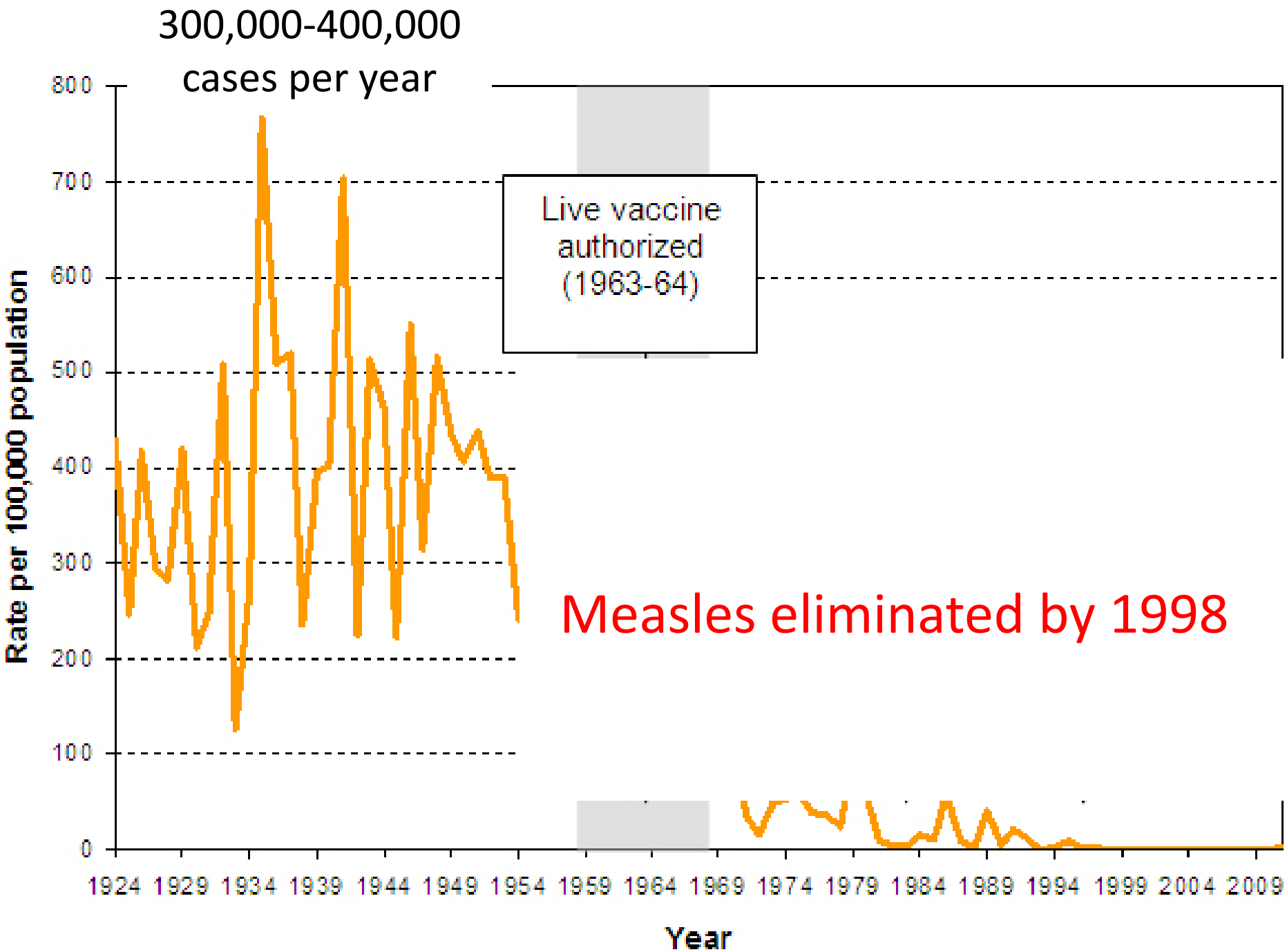
Epidemiology before vaccines

- Almost universal occurrence during childhood
- Large, cyclic epidemics
  - Changing pool of susceptible individuals in community
  - Most common age group affected: 5-9 years
  - Highest frequency of complications: under 2 years



Canadian Immunization Guide
www.phac-aspc.gc.ca


300,000-400,000
cases per year
Live vaccine
authorized
(1963-64)
Routine 1-dose
MMR
introduced
(1983)
10-15% unprotected
after single dose MMR
given at 12 months
Rate per 100,000 population
800
700
600
500
400
300
200
100
0
1924 1929 1934 1939 1944 1949 1954 1959 1964 1969 1974 1979 1984 1989 1994 1999 2004 2009
Year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Rate per 100,000 population
800
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0
1924 1929 1934 1939 1944 1949 1954 1959 1964 1969 1974 1979 1984 1989 1994 1999 2004 2009
Year

Epidemiology

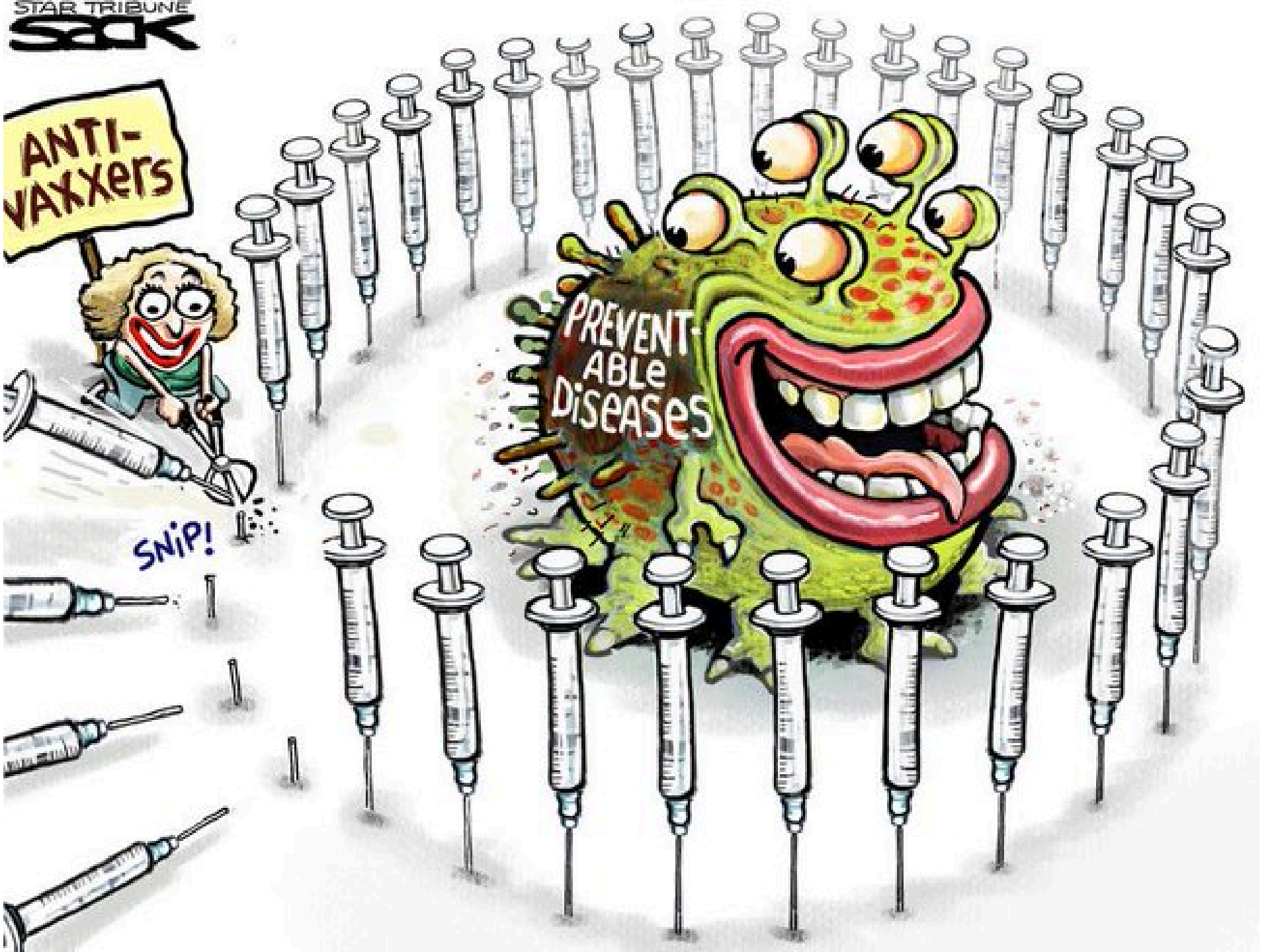
- Outbreaks:
  - Imported cases
  - Unimmunized / underimmunized communities
- 2007: Quebec
- 2008: Ontario
- 2010: BC: ~60% not immunized; 29% 1 MMR; 12% 2 MMR
- 2011: Quebec: teens; 80% not adequately immunized
- 2014: BC, Ontario, Quebec
- 2015: Southern Ontario
- 2017: Nova Scotia

Protection after MMR

- MMR effectiveness after 1 dose = 85%
- MMR effectiveness after 2 doses = 95%
  - 5 in 100 people not completely protected from measles during an outbreak
  - Decreased risk of acquiring disease
  - In immunized population, no sustained transmission of infection

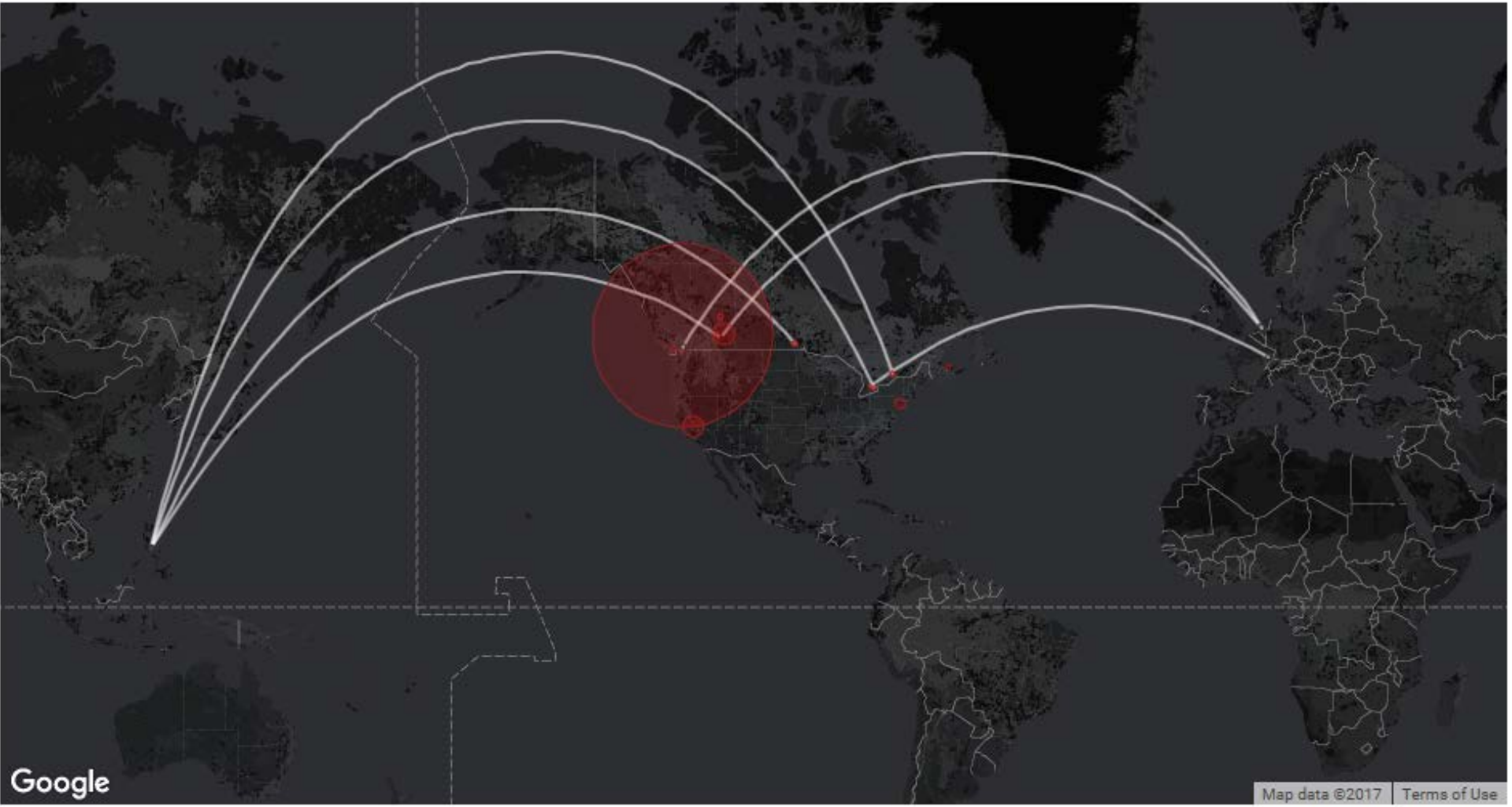
Rota J Inf Dis 2011;204: S559
De Serres et al. J Inf Dis 2013;207:990–8

STAR TRIBUNE
SACK
PREVENT-
ABLE
DISEASES

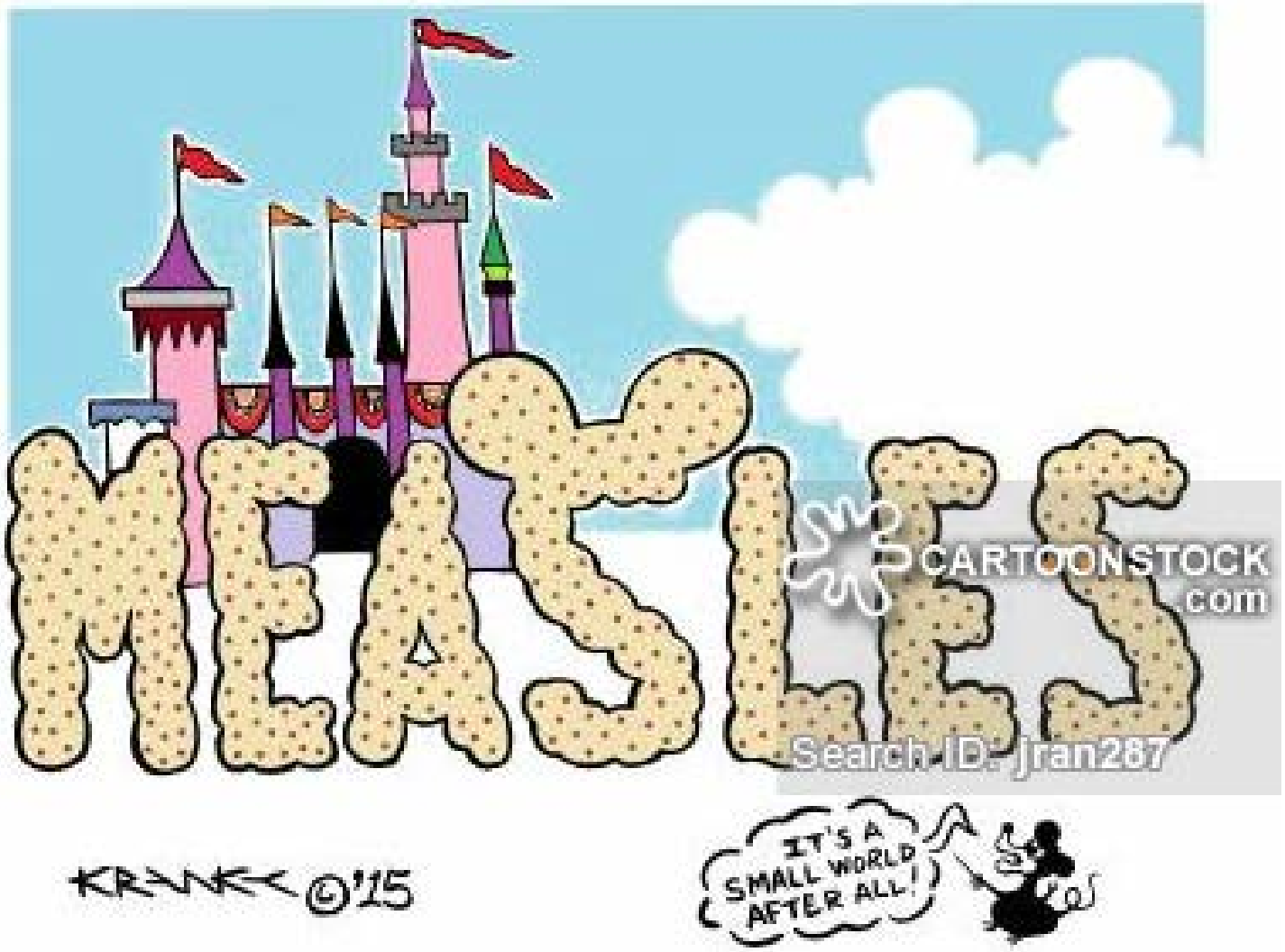

STAR TRIBUNE
SACK
ANTI-VAXXERS
SNIP!
PREVENT-ABLE DISEASES

PLANTE TULSA WORLD
2-3-2015
THANK YOUUUU, ANTI-VAXXERS!
EXTINCTION
POLIO
MEASLES
MUMPS

Origins of measles outbreaks in Canada



http://www.theglobeandmail.com/news/national/how-did-measles-get-to-canada-a-worldwide-guide/article17831620/?from=17866080



December 2014:
111 cases from US, Mexico, Canada

Communication Strategies

Within health care environment

- Personal protective equipment for all staff
- Contact physician-on-call and local Public Health Unit to notify of suspected case and testing
  - Do not wait for laboratory confirmation
- Instruct patient to return to ED if urgent clinical issue
  - Coordinate assessment / testing time in ED with charge nurse so that ED is prepared to receive patient in airborne isolation room with PPE for staff
  - Only immune staff should enter patient room

Within community setting

- If case in the office
  - PHU can assist with contact tracing
- CPS statement 2008: Infection prevention and control policies for the office setting

Communication with caregivers

Home » Life » Health & Fitness » Health

Measles in Canada: Why this infectious disease is spreading

ALLAN MAKI
Globe and Mail Update (correction included)
Published Monday, Apr. 07 2014, 8:46 PM EDT
Last updated Tuesday, Apr. 08 2014, 11:49 AM EDT

Non-vaccinating mother prefers immunity through disease exposure

Donald J. Trump
@realDonaldTrump

Follow

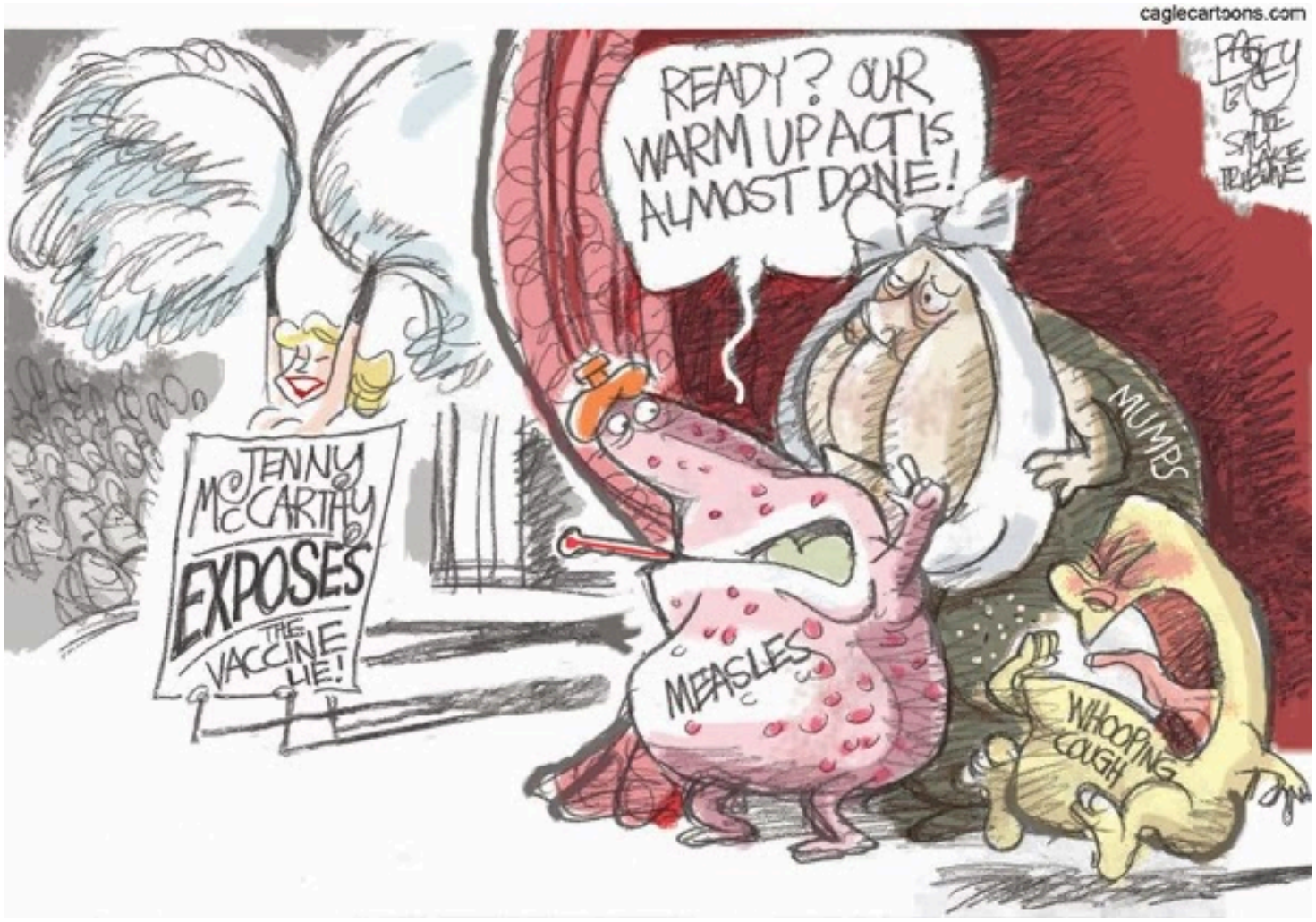
I am being proven right about massive vaccinations—the doctors lied. Save our children & their future.

9:30 AM - 3 Sep 2014

1,263 1,089

Anti-vaccination parents are risking my toddler's life, mother says

'We are just at their mercy,' says woman whose young son had a heart transplant


caglecartoons.com
READY? OUR WARM UP ACT IS ALMOST DONE!
JENNY McCARTHY EXPOSES THE VACCINE LIE!
MEASLES
MUMPS
WHOOPING COUGH

Early report

Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children

A J Wakefield, S H Murch, A Anthony, J Linnell, D M Casson, M Malik, M Berelowitz, A P Dhillon, M A Thomson, P Harvey, A Valentine, S E Davies, J A Walker-Smith

Summary

Background We investigated a consecutive series of children with chronic enterocolitis and regressive developmental disorder.

Methods 12 children (mean age 6 years [range 3–10], 11 boys) were referred to a paediatric gastroenterology unit with a history of normal development followed by loss of acquired skills, including language, together with diarrhoea and abdominal pain. Children underwent gastroenterological, neurological, and developmental assessment and review of developmental records. Ileocolonoscopy and biopsy sampling, magnetic-resonance imaging (MRI), electroencephalography (EEG), and lumbar puncture were done under sedation. Barium follow-through radiography was done where possible. Biochemical, haematological, and immunological profiles were examined.

Findings Onset of behavioural symptoms was associated by the parents, with measles, mumps, and rubella vaccination in eight of the 12 children, with measles infection in one child, and otitis media in [illegible]. All 12 children had intestinal abnormalities, ranging from lymphoid nodular hyperplasia to [illegible] ulceration. Histology showed patchy chronic inflammation in 11 children and reactive lymphoid hyperplasia in seven, but no granulomas. Developmental disorders included autism (nine), disintegrative psychosis (one), and possible postviral or vaccinal encephalitis (one). There were no focal neurological abnormalities and MRI and EEG tests were normal. Abnormal laboratory results were significantly raised urinary methylmalonic acid compared with age-matched controls ([illegible]), low haemoglobin in four children, and low serum IgA in [illegible] children.

Interpretation We identified associated gastrointestinal disease and developmental regression in a group of previously healthy children, which was generally associated in time with possible environmental triggers.

Lancet 1998; [illegible]: 637–41
See Commentary page

Inflammatory Bowel Disease Study Group, University Departments of Medicine and Histopathology (A J Wakefield FRCS, A Anthony MD, J Linnell PhD, A P Dhillon MChBchir, S E Davies MChBchir) **and the**

Introduction

We saw several children who, after a period of apparent normality, lost acquired skills, including speech and vocabulary. They all had gastrointestinal symptoms, including abdominal pain, diarrhoea, and bleeding and, in some cases, food intolerance. We describe the clinical findings and gastrointestinal features of these children.

Patients and methods

12 children, consecutively referred to a department of paediatric gastroenterology with a history of a pervasive developmental disorder with loss of acquired skills and intestinal symptoms (diarrhoea, abdominal pain, bleeding and food intolerance), were investigated. All children were admitted to the ward for assessment, accompanied by their parents.

Clinical investigations

We took histories, including details of immunisations and exposure to infectious diseases, and assessed the children. In 11 cases the histories were obtained by the senior clinician (JW-S). Neurological and psychiatric assessments were done by consultant staff (PH, MD) with ICMS-4 criteria. Developmental data included a review of prospective developmental records from parents, health visitors, and general practitioners. Four children did not undergo psychiatric assessment in hospital, all had been assessed professionally elsewhere, so these assessments were used as the basis for their behavioural diagnosis.

After bowel preparation, ileocolonoscopy was performed by SEM or MAT under sedation with midazolam and pethidine. Paired biopsies and formalin-fixed mucosal biopsy samples were taken from the terminal ileum, ascending, transverse, descending, and sigmoid colons, and from the rectum. The procedure was recorded by video or still images, and were compared with images of the previous seven consecutive paediatric colonoscopies (four normal colonoscopies and three on children with ulcerative colitis), in which the physician reported normal appearances in the terminal ileum. Barium follow-through radiography was possible in some cases.

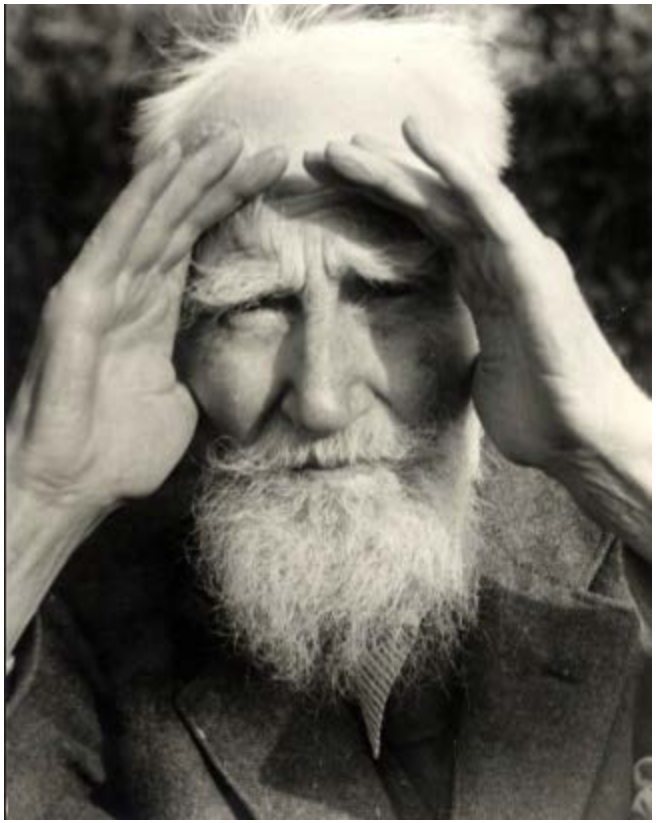
Also under sedation, cerebral magnetic resonance imaging (MRI), electroencephalography (EEG) including visual, brain stem auditory, and sensory evoked potentials (where compliance made these possible), and lumbar punctures were done.

Laboratory investigations

Thyroid function, serum long-chain fatty acids, and cerebrospinal-fluid lactate were measured to exclude known causes of childhood neurodegenerative disease. Urinary methylmalonic acid was measured in random urine samples from eight of the 12 children and 14 age-matched and sex-matched normal controls, by a modification of a technique described previously.[7] Chromatograms were scanned digitally on

RETRACTED

THE LANCET



At present, intelligent people do not have their children vaccinated… more people are now killed by vaccination than by smallpox."

- George Bernard Shaw, 1944

They say that the measles vaccine is effective but the truth is that outbreaks happen in populations of 99.7% vaccination with no easy explanation.

- 2014, gianelloni.wordpress.com

Take-home messages

- Measles is rare
  - Cases in Canada are mostly from affected travelers
- Diagnosis: clinical + epidemiological link
  - Confirmed by serology + PCR
  - Look for complications especially in children under 18 months: acute otitis media, bronchopneumonia, rarely encephalitis

Take-home messages

- Management:
  1. Supportive + Vitamin A; airborne precautions
  2. Call Public Health <u>as soon as measles suspected</u>
     - Diagnostic testing
     - Resources for contact tracing, quarantining, surveillance
     - Post-exposure prophylaxis to protect the most vulnerable and prevent spread in community

- Prevention:
  - Ensure all patients are up-to-date (2 doses MMR)
  - Communicate benefits and address concerns about MMR with vaccine-hesitant families