Outbreak Investigation

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Outline

- Background information
- Apply epidemiological principles to outbreak management
- Detailed local examples:
  - Congregate living facilities
  - Community outbreaks:
    1. Pertussis 2009 outbreak
    2. Measles 2013

Epidemiology

- The study of the distribution, determinants and deterrents of morbidity and mortality in human populations

  (Oleckno, Essential Epidemiology 2002)
- Distribution – who, where, when
- Determinants – why, how, what
- Deterrents – prevent, control, reduce morbidity and mortality

Communicable Disease Control

- Base requirements
  - Public Health Act - paramountcy
  - Surveillance systems – various levels
  - Notification systems
  - Outbreak surveillance
  - Collaboration with internal and external stakeholders

Surveillance

- Local → Provincial → National → → →International
- Reporting of Notifiable diseases under the Public Health Act
- Public Health Act - authority given to Medical Officers of Health
- Notifiable Disease Guidelines
- Recognition of disease clusters at all levels

Notification and reporting systems

- Physician and Laboratory reporting of notifiable diseases
- Case follow-up by Public Health
- Contact tracing and management when indicated
- Mandatory reporting to Alberta Health:
  - Notifiable Diseases
  - Outbreaks
- National notification systems of cross jurisdictional outbreaks

Outbreak Management

- Apply epidemiological principles to outbreak investigation and management

Epidemiology

- The study of the distribution, determinants and deterrents of morbidity and mortality in human populations

  (Oleckno, Essential Epidemiology 2002)
- Distribution – who, where, when
- Determinants – why, how, what
- Deterrents – prevent, control, reduce morbidity and mortality

Outbreak

- A perceived or true occurrence of more cases of a **communicable disease** than expected in a given **area**, or among a specific **group of people** over a particular **period of time**. (Guidelines for Outbreak Prevention, Control and Management in Acute Care and Facility Living Sites, Alberta Health Services Dec 2010)
- Perspectives of:
  - Time - when
  - Place - where
  - Group of people – who
  - Disease type - what

Outbreak Management

- Verify diagnosis and establish a case definition;
- Confirm existence of an outbreak;
- Identify an outbreak control team;
- Define the at risk **population**;
- Investigate outbreak and formulate hypothesis as to its **source and spread**; Determine testing required;
- Determine necessary **control measures** to contain or mitigate the outbreak;

Outbreak management…

- Implementation, evaluation, and modification of the control measures that include environmental disinfection, isolation, closure of unit, prophylaxis, and early treatment, vaccination, etc.
- Evaluation of laboratory results;
- Daily review of outbreak and control measures;
- Regular communication;
- Ongoing disease surveillance and reporting;
- Reporting.

Outbreak management

- Multidisciplinary approach required, each with their specific roles and responsibilities in the Outbreak Management team:
  - MOH
  - Infection Prevention and Control;
  - Environmental Public Health
  - Facility administration;
  - Front Line Site or Unit Manager;
  - Occupational Health and Safety;
  - Provincial Laboratory;
  - Communications
  - Physicians

Outbreak definitions

- **Influenza-like-illness (ILI):**
  - Two or more cases of ILI within a 7 day period, with a common epidemiological link (eg. Same floor, unit, care giver and evidence of health care acquired transmission within a facility), and at least one laboratory confirmed case.

- **Gastrointestinal illness Outbreak:**
  - Two or more cases of GI illness with a common epidemiological link, with initial onset within one 48 hour period

Source: Alberta Health Services, Dec 2010, Guidelines for Outbreak Prevention, Control and Management in Acute Care and Facility Living Sites

GI Case definition

- At least one of the following, not attributable to another cause (ie. *Clostridium difficile,* medication, laxatives, etc):
  - ≥ 2 episodes of diarrhea in a 24 hour period, above what is normally expected for that individual; OR
  - ≥ 2 episodes of vomiting in a 24 hour period; OR
  - ≥ 1 episodes of vomiting and diarrhea in a 24 hour period; OR
  - Positive stool culture of a known enteric pathogen AND ≥ 1 symptom compatible with a GI infection

Source: Alberta Health Services, Dec 2010, Guidelines for Outbreak Prevention, Control and Management in Acute Care and Facility Living Sites

Tools used to manage outbreaks

- Outbreak management guidelines
- Investigation number to track and streamline laboratory samples
- Line lists
- Epidemiological curves
- Spider diagrams
- Social networking diagrams
- Laboratory diagnosis
- Symptomatology – physician diagnosis

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GASTROINTESTINAL

OUTBREAK TRACKING FORM

	Case #1	Case #2	Case #3	Case #4	Case #5	Case #6
Demographics						
Onset Date (yyyy/mm/dd)						
Last Name						
First Name						
PHN #						
Room #						
Age						
Sex						
Symptoms						
Day 0 (onset day)						
Day 1						
Day 2						
Day 3						
Day 4						
Day 5						
Day 6						
Day 7						
Day 8						
Other						
Comments						
Lab Tests						
Stool Specimen [1] (yyyy/mm/dd)						
Result [1]						
Stool Specimen [2] (yyyy/mm/dd)						
Result [2]						

EI#: OB#:

List For:

☐ Residents/Clients ☐ Staff

Facility:

Residence

Unit:

IPC Contact:

Phone #:

Fax:

# of Residents: Unit Facility:

# of Staff: Unit Facility

Symptoms Legend

V-Vomiting
N-Nausea
D-Diarrhea
Cr-Cramps
Ch-Chills
F-Fever
He-Headache
Bd-Bloody Diarrhea
Ho-Hospitalized due to GI illness
De-Deceased due to GI illness
O-Other (use comments area)
NS-No Symptoms

Please record NS for 48 hours or until outbreak declared over.

Fax to Public Health Office

Attn: Environmental Public Health

Regular Hours:

After-Hours:

Adapted from Provincial Outbreak Management Protocol January 2010

Epidemic Curves

- Effective tool for outbreak management:
  - Distribution of disease in a given location (where, who, when)
  - Transmission
  - Etiology
  - Index case
  - Incubation period
  - Effectiveness of control measures
  - Staff education
  - Resource management

Epidemic curves

- Attack rate – a cumulative incidence rate

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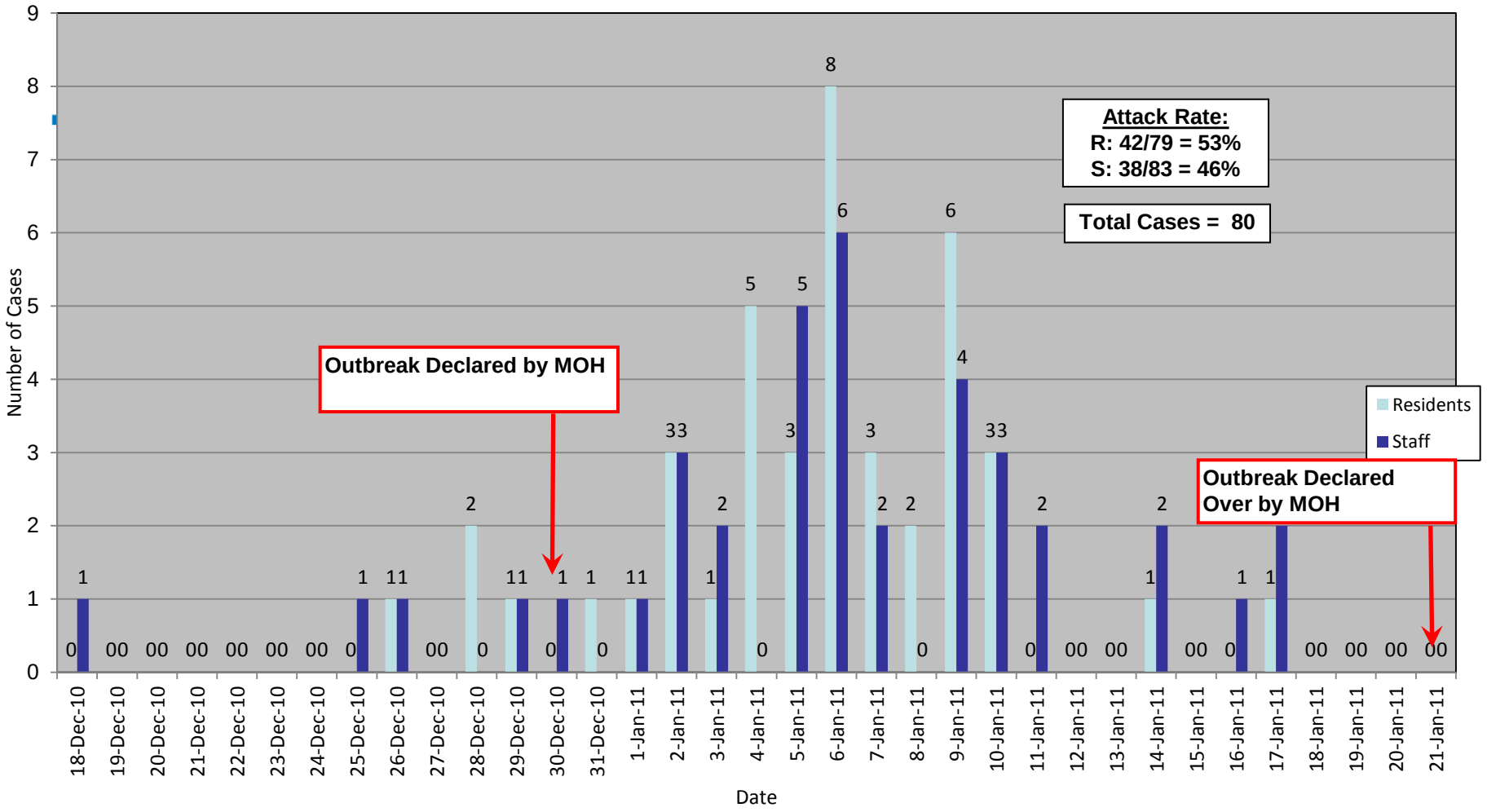
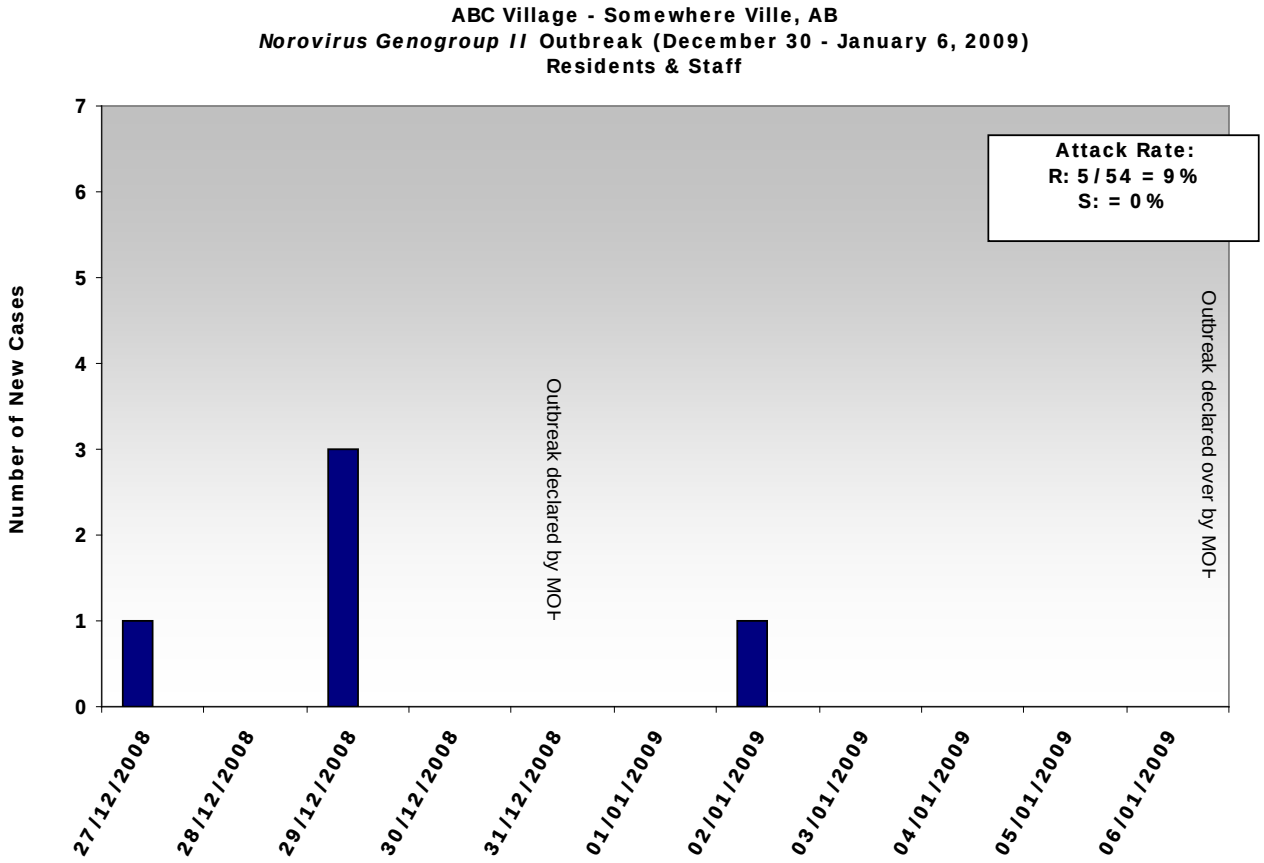
ABC Lodge- Somewhere Ville, AB - EI#000 - Norovirus G2 Outbreak (Dec.18, 2010 - Jan.21, 2011) Residents & Staff

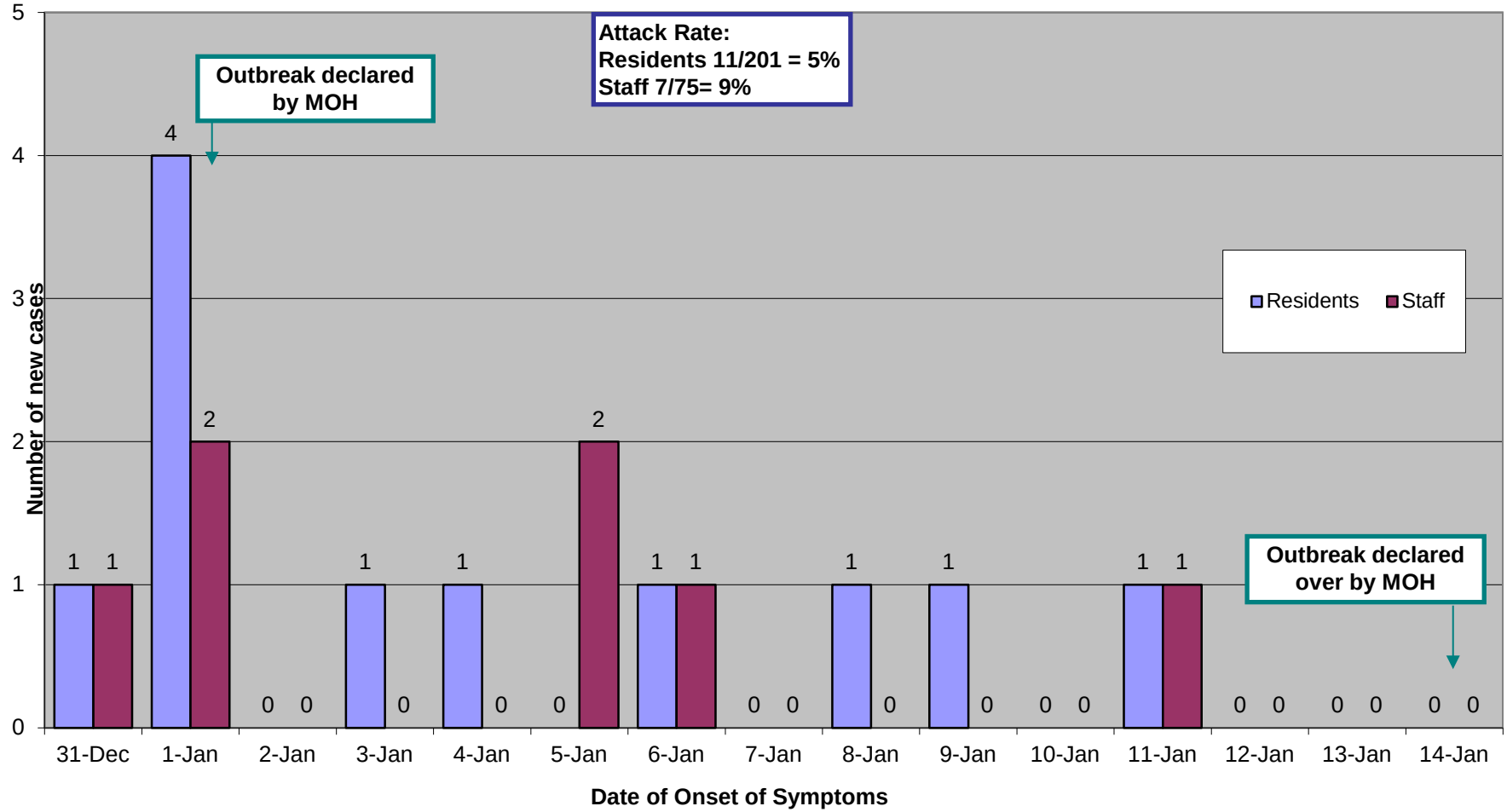


Epi Curve B - Norovirus



Alberta Health Services

EI#000 - XYZ Assisted Living Facility (CDE Town, AB)
Norovirus G2 Outbreak
December 31, 2010 - January 14, 2011

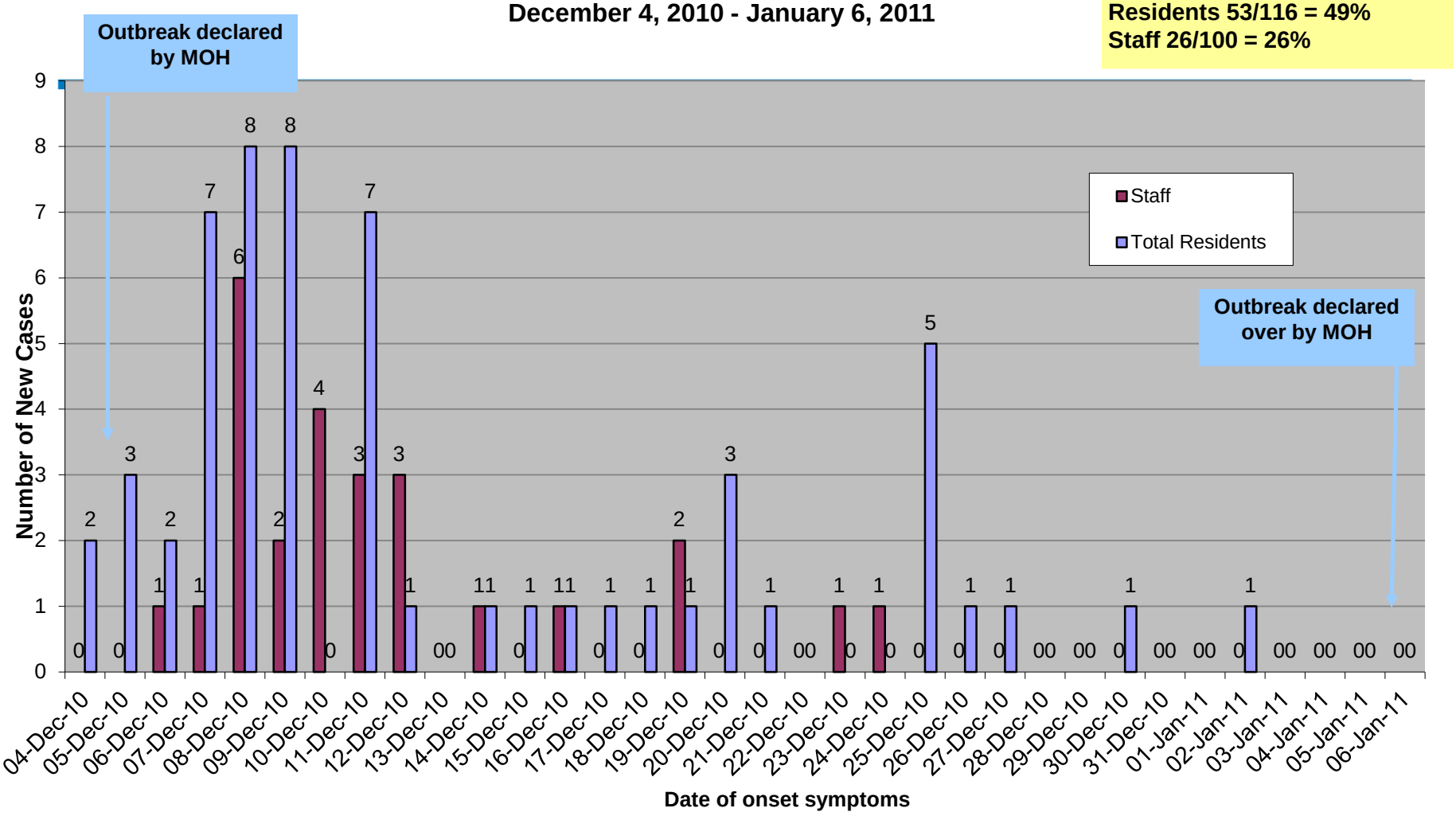


Alberta Health Services

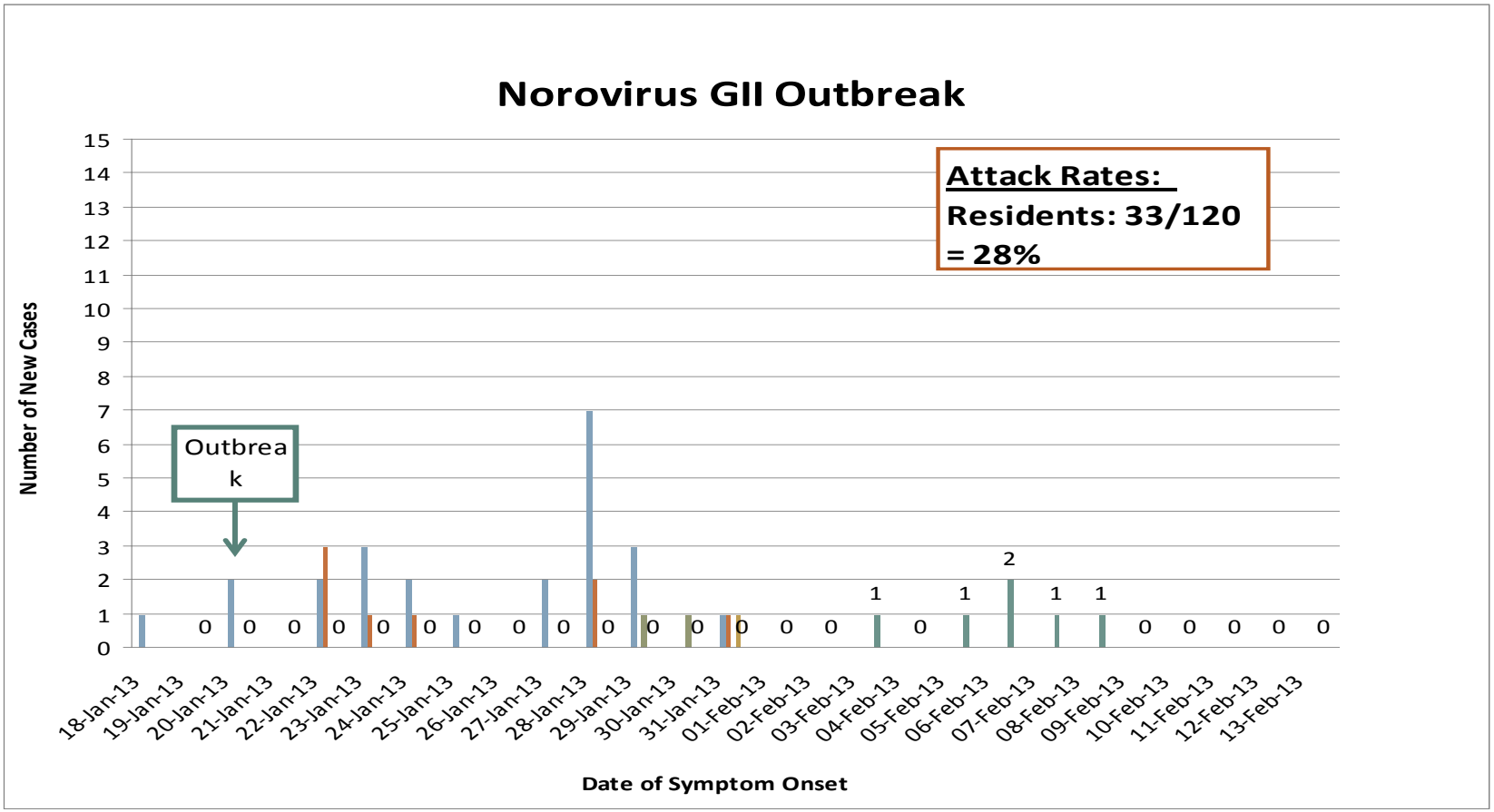
EI#000 - XYZ Facility (Emptytown, AB)
Norovirus G2 Outbreak
December 4, 2010 - January 6, 2011

Attack Rate

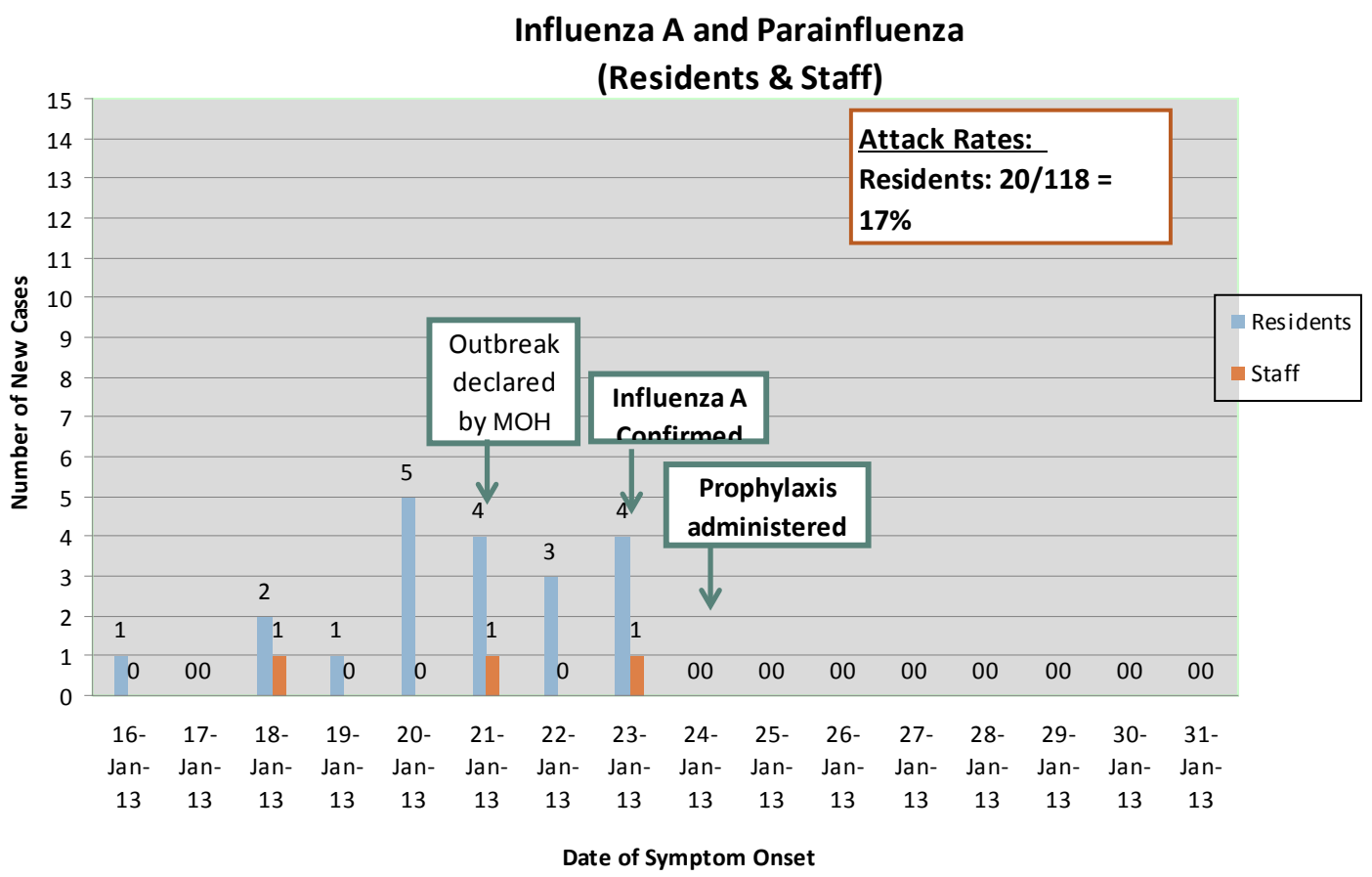
Residents 53/116 = 49%
Staff 26/100 = 26%



Norovirus outbreak example



Influenza A outbreak



Importance of Outbreak Management

- Early detection and notification
- Efficient implementation of outbreak management strategies/control measures to limit morbidity and mortality

Community outbreaks

- Typically more challenging
- Increased variables impacting transmission
- Autonomy of individuals/families
- Orders under the Public Health Act for:
  - isolation
  - quarantine
  - exclusion
  - treatment

Southern Alberta immunization rates

- **Southwest** (2008/2009)

  (4 doses of a Pertussis (whooping cough) containing vaccine by 2 years of age)

  – Overall rate = 74.3%

  – Range = 49.7 – 87.7% by geographic area

  – Lowest rates in County of Lethbridge

- **Southeast** (2009)

  – Overall rate = 86%

  – Range = 85.4 – 89.6

- Alberta target = 97%

Concept of Herd Immunity

- Protection of a population from the transmission of a vaccine preventable illness through immunization of this population (the “herd”, or group)
- Different vaccine preventable disease have different targets to achieve herd immunity

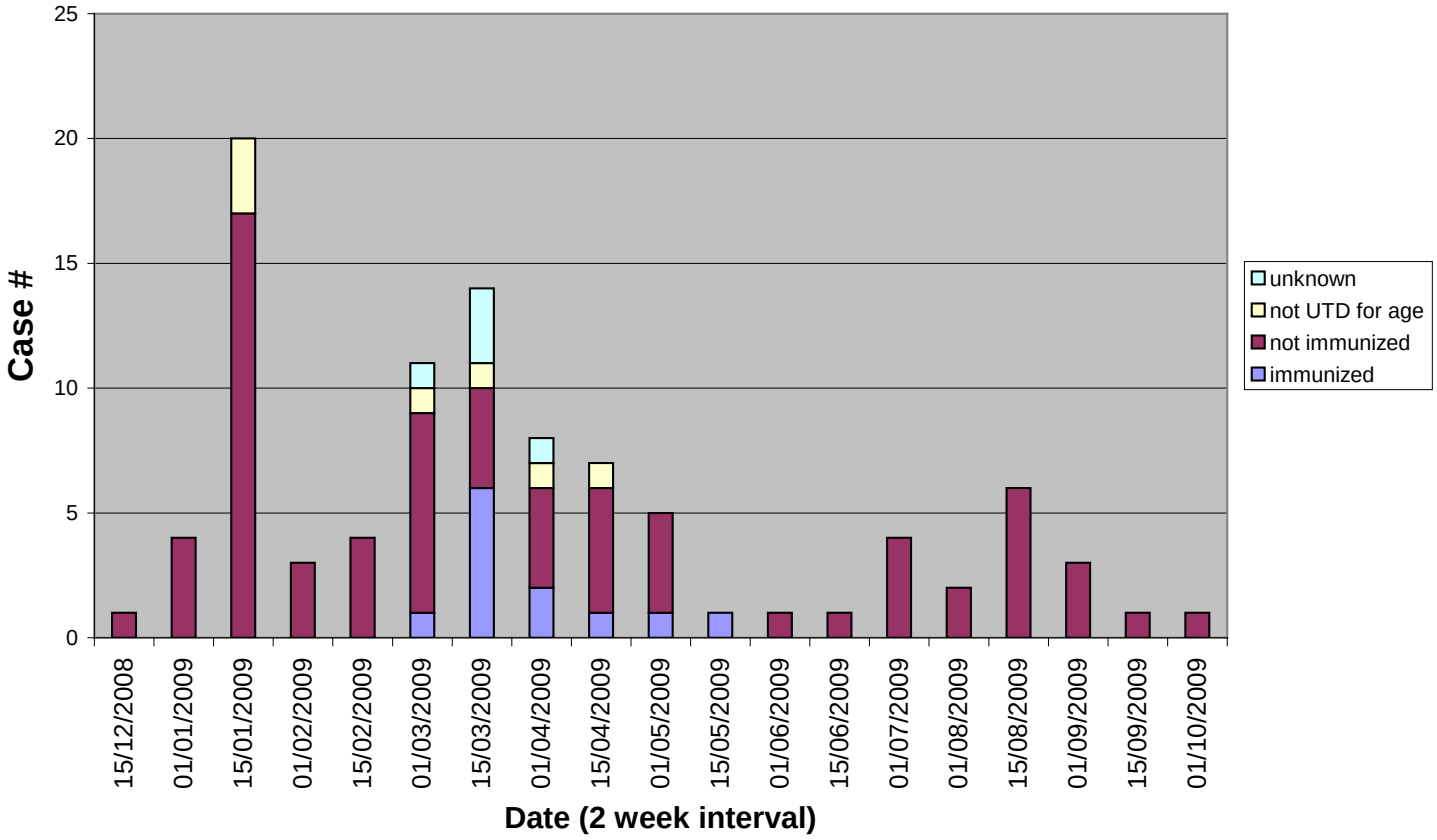
Concept of Herd Immunity

- Dependent on various assumptions:
  - Human to human transmission
  - Random mixing of the population
  - Presence of non-human hosts
  - Vaccine efficacy
  - Circulating communicable diseases
- Modelling approach

Vaccine Preventable Outbreaks in Southwest Alberta

- Measles 2013
- Pertussis 2012
- Pertussis 2009
- Mumps 2008
- Pertussis 2003/2004
- Pertussis 1999
- Measles 1999
- Measles 1997
- Rubella 1996
- Polio case approximately 20 years ago

Pertussis Cases by Date and Immunization Status

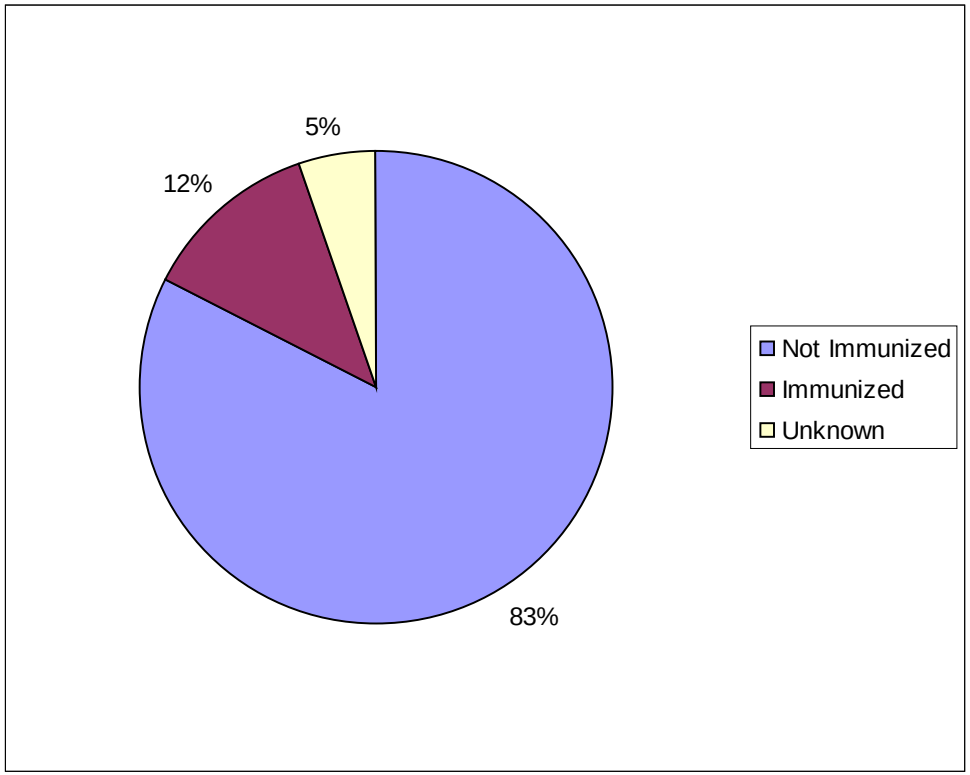


- December 29, 2008 until November 17, 2009

Pertussis outbreak Southern Alberta

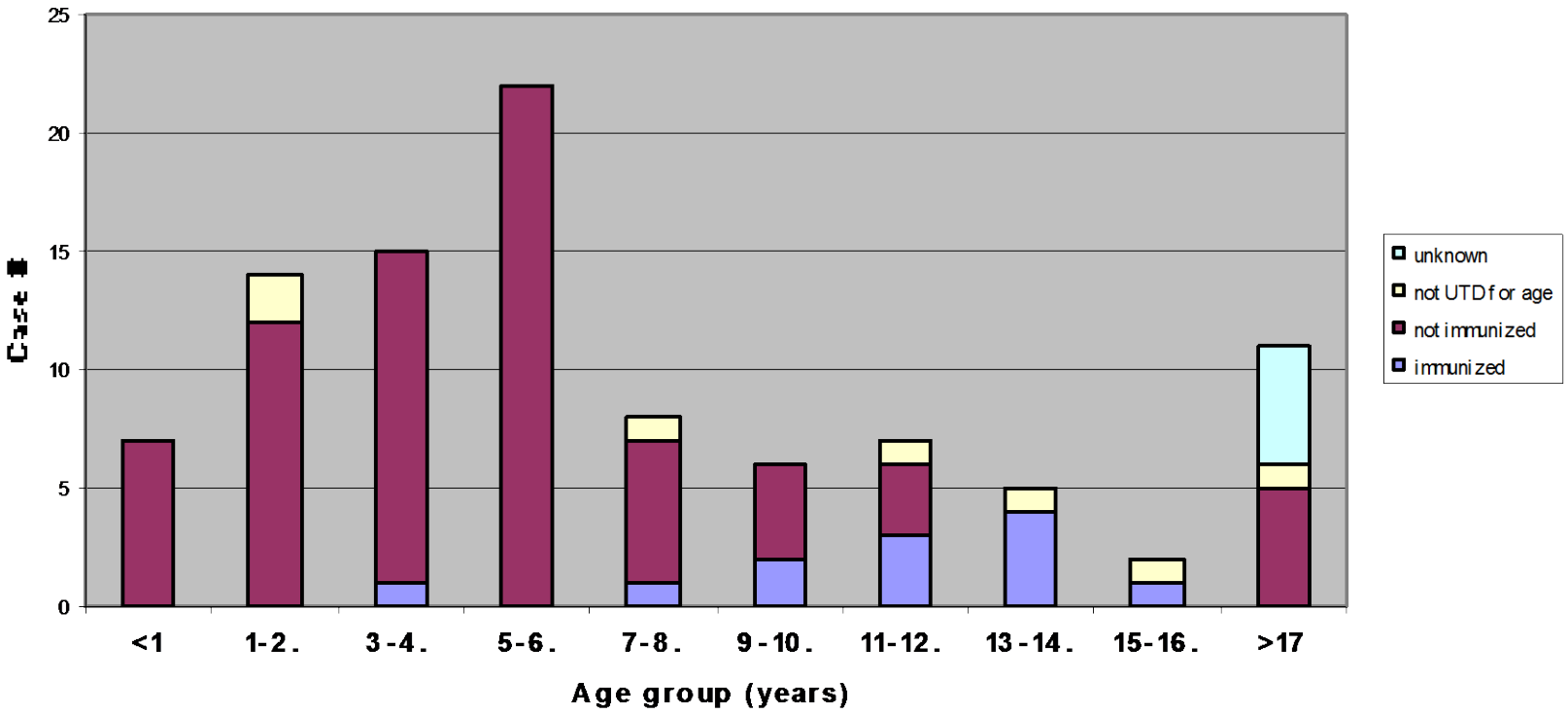
- Total of 97 cases of Pertussis reported by November 17, 2009 (one additional case on December 22)
- Most Pertussis cases were confirmed cases by NP swab
- **Under reporting of total Pertussis cases**
- **School based outbreak**

Proportion of cases not immunized

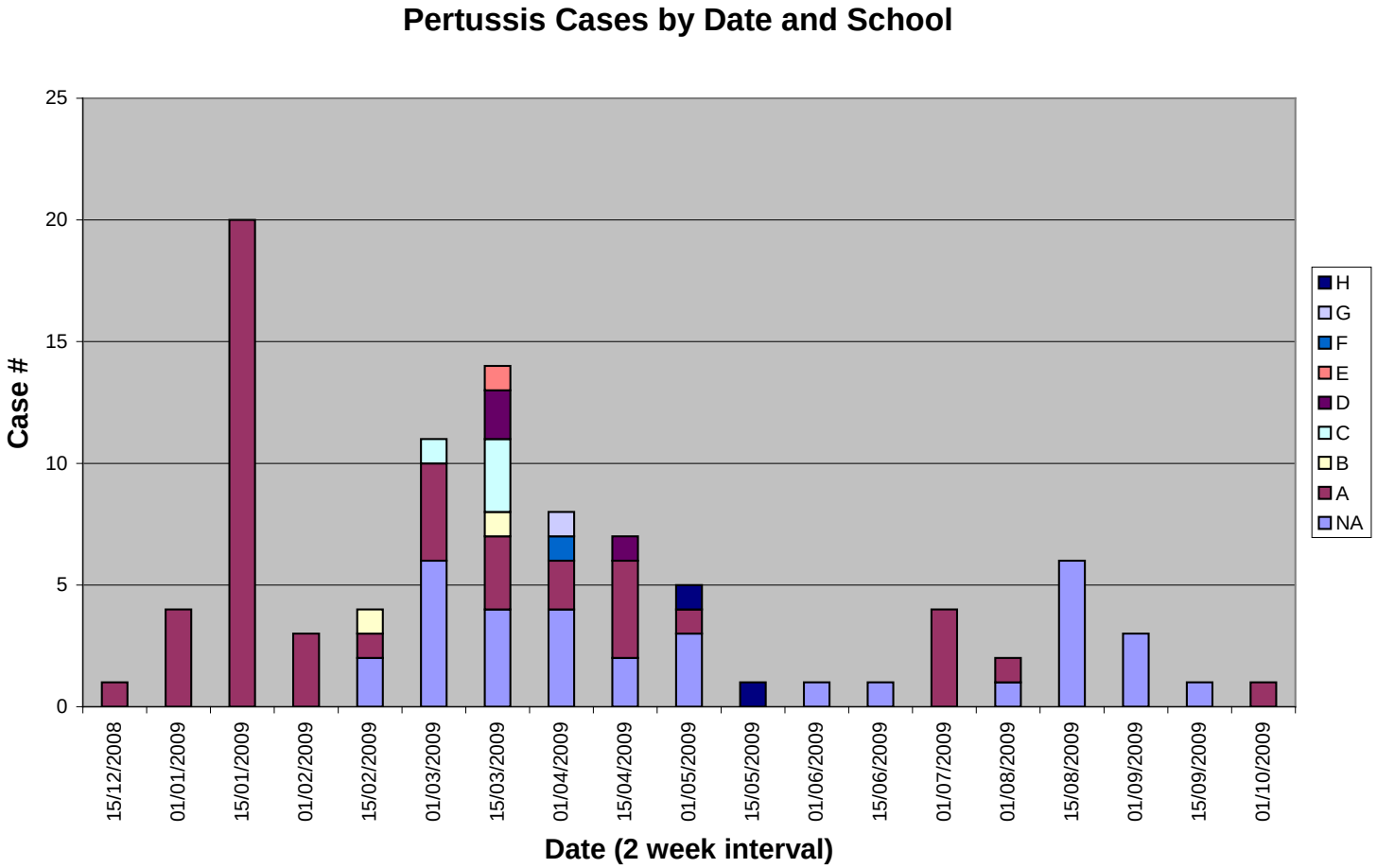


- Not immunized = unimmunized + those not up-to-date

Pertussis cases by age and immunization status

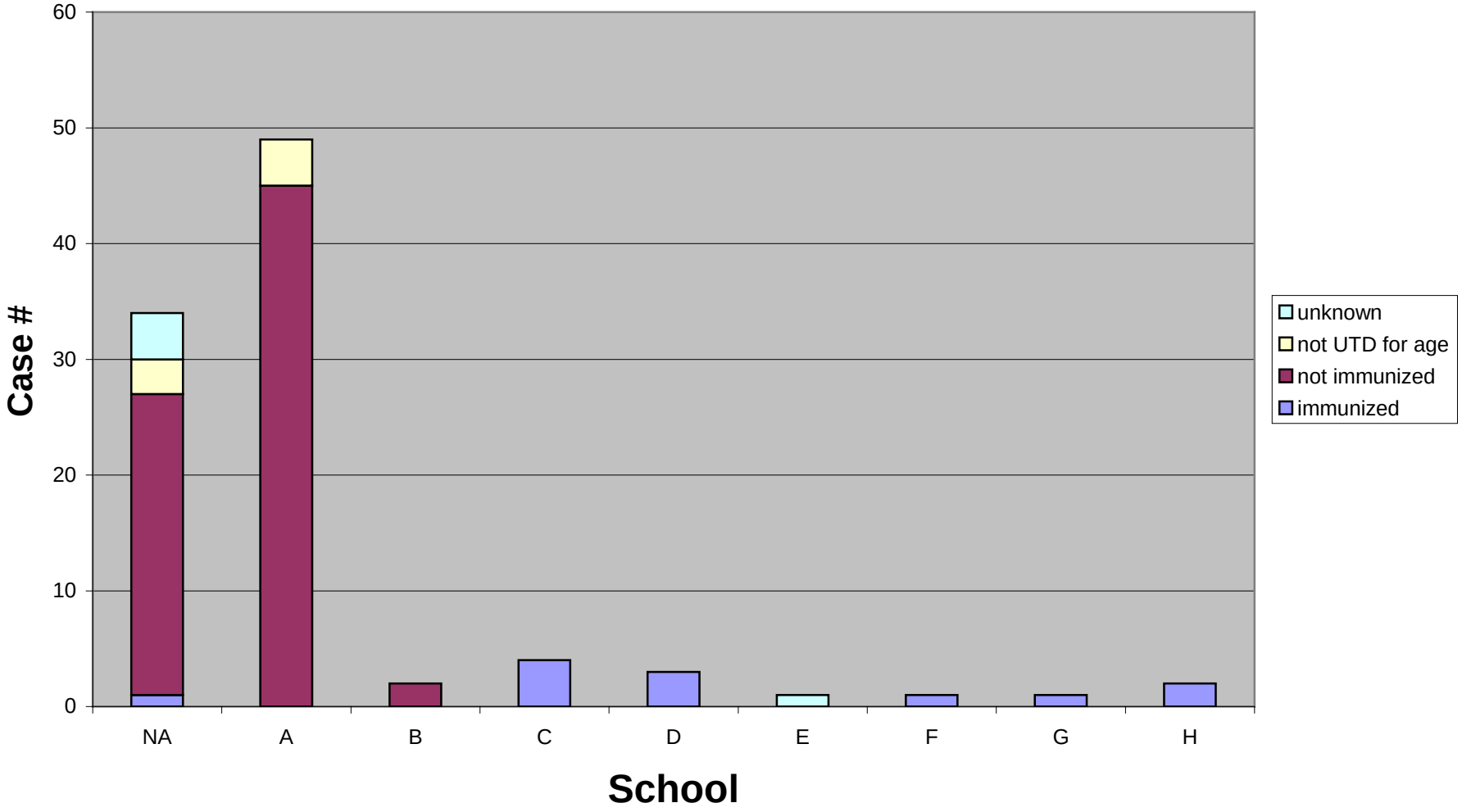


- Non-immunized children were primarily affected
- 60% of cases were children ≤ 6 years old
- 11% of cases were adults (≥ 17 years old)
- Last Pertussis outbreak in this community and school was in 2003/2004, most likely conferring immunity to the older children



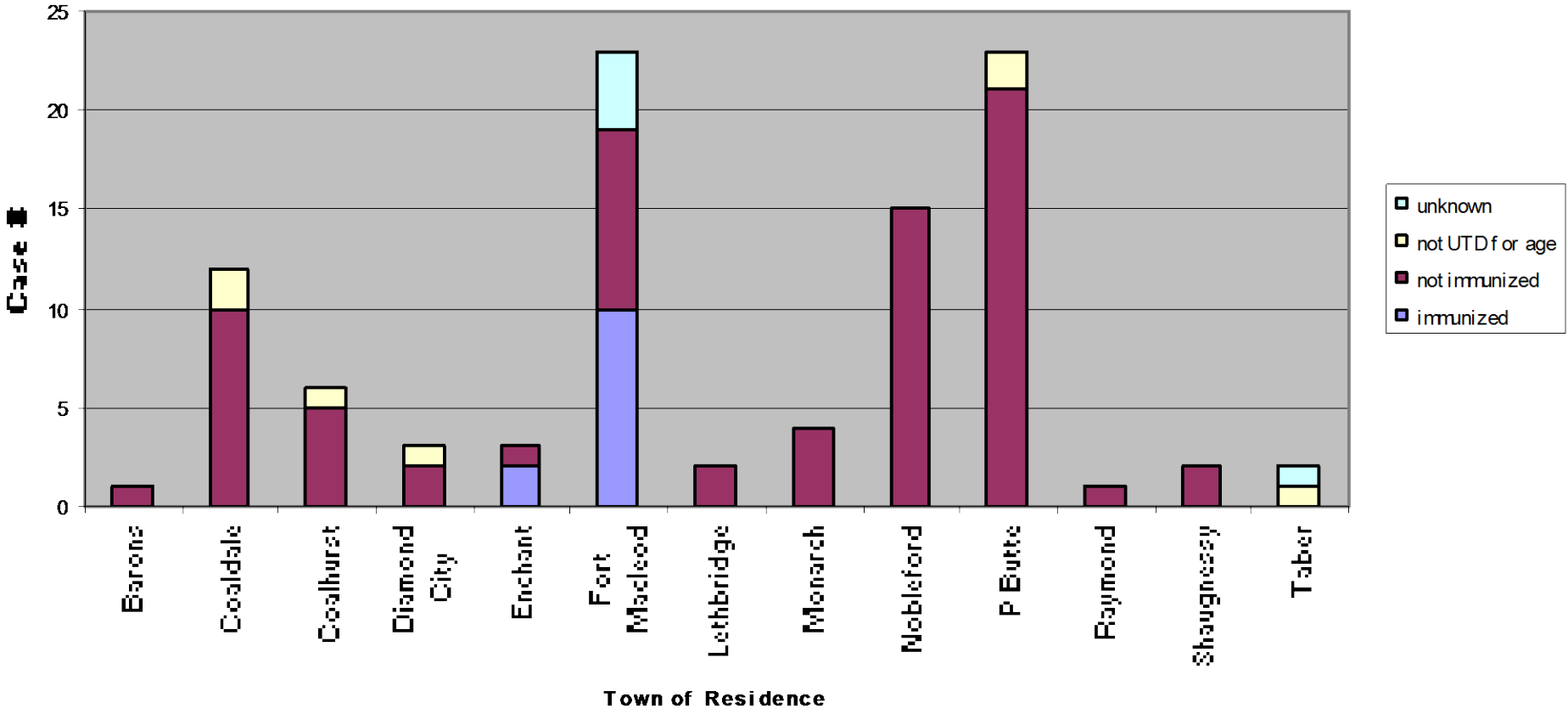
- All cases in the first 2 months attended School A, or were unimmunized preschool aged children (NA)
- March 10 and 16th were the first 2 confirmed cases in immunized children attending the a public school
- **Ongoing spread of Pertussis disease in School A**

Pertussis cases by school and immunization status



- Limited spread of disease in Schools where the majority of children are immunized, and where enhanced immunization campaign took place (dTap to grades 7, 8 and 9).

Pertussis cases by town of residence and immunization status



- School A has a large catchment area
- Many of these towns have known low immunization rates.
  - Eg. Picture Butte and Nobleford areas (2008/2009)
    49.7% of eligible children had received 4 doses of Pertussis containing vaccine by 2 years of age

Measles

- Caused by measles virus
- Humans are only host
- One of the most highly communicable infectious diseases
- Need high herd immunity rate to disrupt transmission (98%)
- Complications common → 30%
  - Most common in children <5 years of age and adults
  - dehydration, ear infection, pneumonia, encephalitis, seizures
  - death (1-2/1000) in developed world
  - Sub-acute sclerosing panencephalitis

Measles 2013

- **Cause and Symptoms**:
  - Highly contagious **airborne** viral infection which can remain in a room for up to 2 hours
  - Incubation period: 7 – 21 days; average 10 days
  - Person to Person contact is NOT required
  - Communicable one day PRIOR to onset of prodromal sxs
  - Most infectious period is 4-5 days before rash onset, up to 4-5 days after rash appearance
  - Prodrome before rash onset is cough, runny nose, red irritated eyes and fever… how common is this presentation?

Measles 2013

- **No treatment; supportive treatment only**
- **Some complications treatable**
- **PREVENTION with vaccine**
  - Vaccine is effective and safe
  - One dose → 95% protection
  - Two doses → 99% protection
  - Note: no vaccine is 100% effective
  - Adults born prior to 1970 considered immune, with the exception of HCWs

MEASLES - Leading vaccine-preventable cause of death world-wide

- Prior to widespread immunization programs, world-wide estimates of disease impact:
  → estimated 100 million cases
  → estimated 6 million deaths
  → epidemics every 2 – 4 years
- 1963 – first vaccine licensed
- 1966 – killed measles vaccine introduced in Alberta
- 1970 – live vaccine, Alberta

Source: AH Notifiable Disease Guidelines November 2013

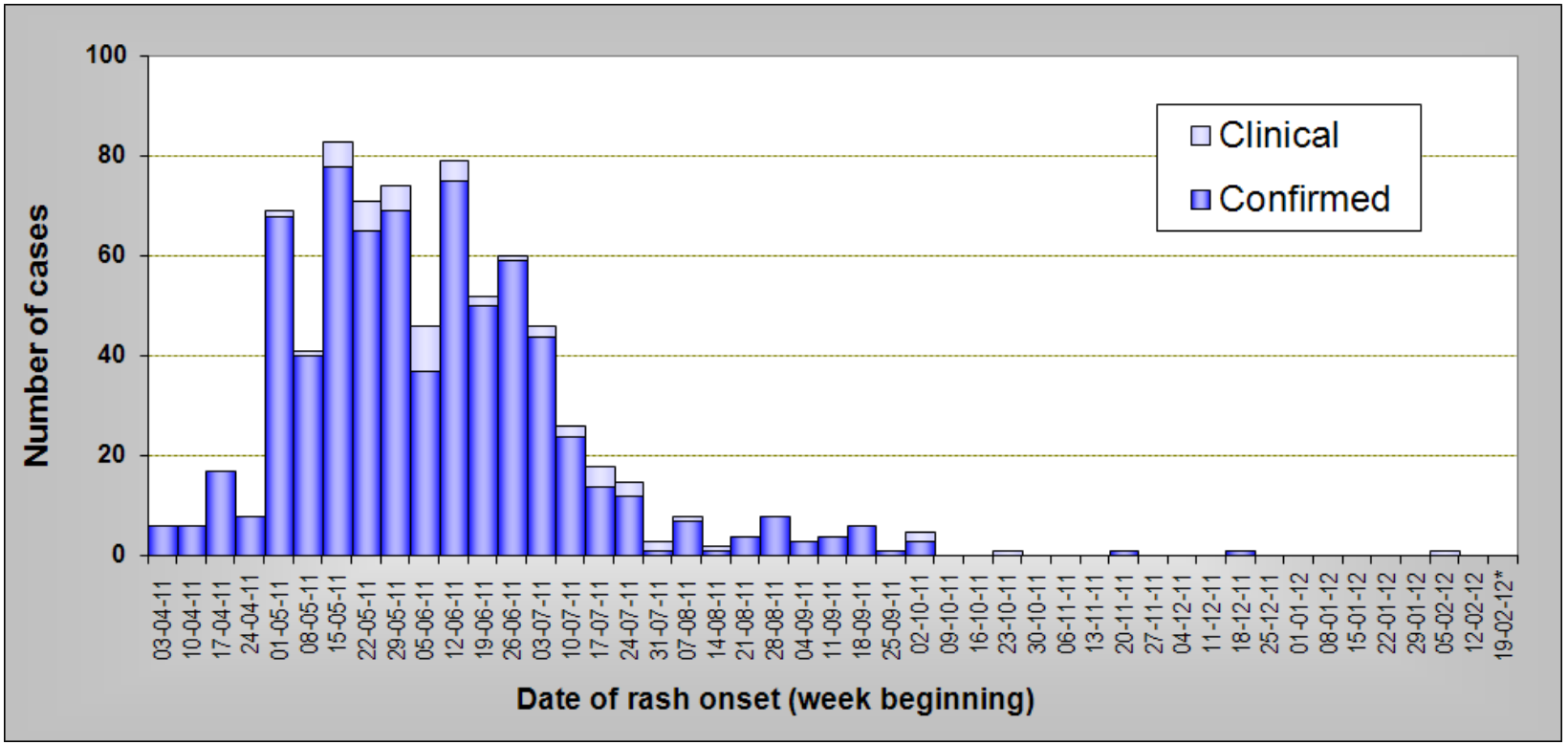
MEASLES - Leading vaccine-preventable cause of death world-wide

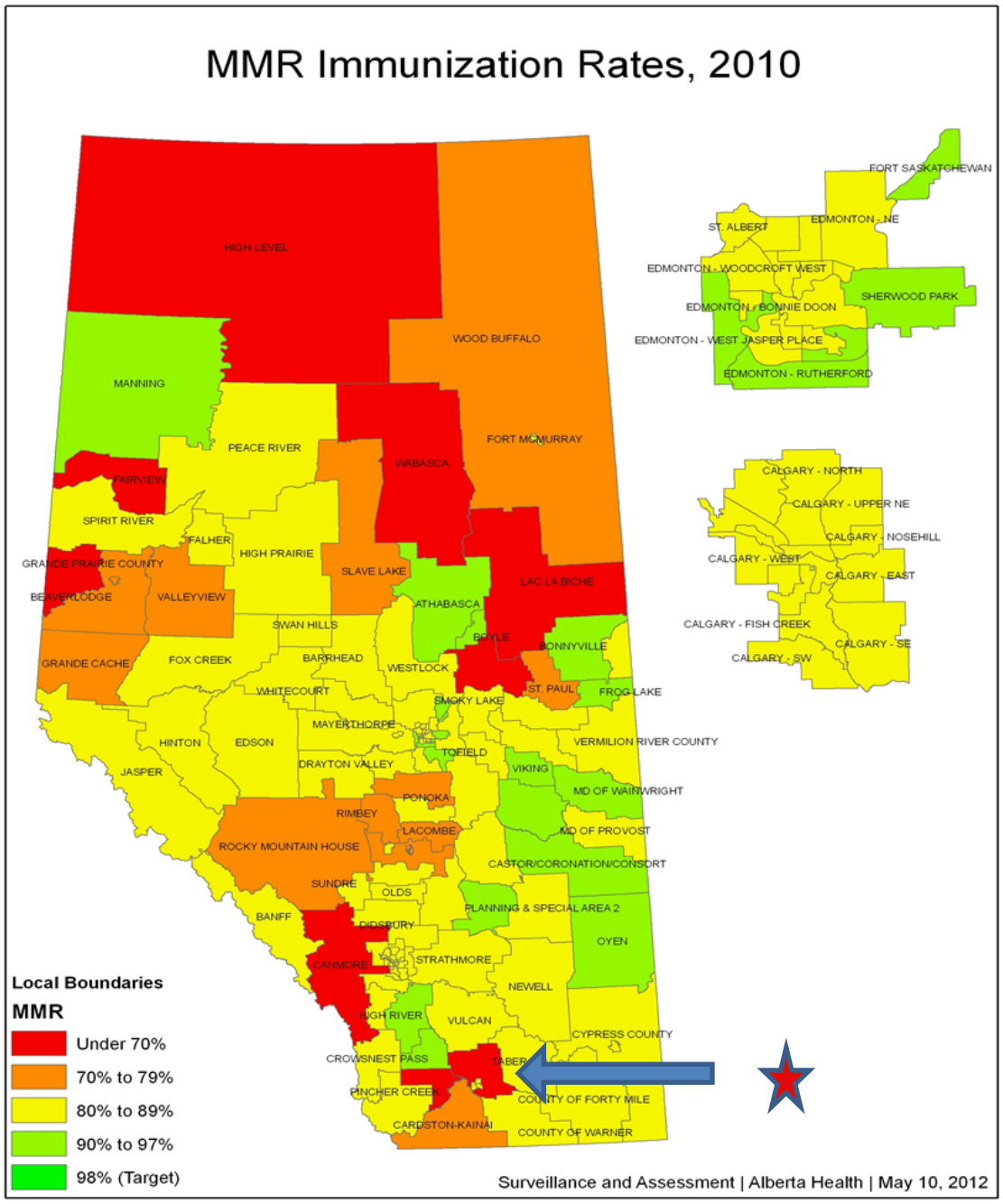
- 1999 → 873,000
- 2004 → 454,000 deaths; 30 million cases
- 2005 → 345,000
- 2008 → 164,000
- 2010 → 139, 300
- 2014 → 114,900

Source: WHO http://www.who.int/mediacentre/factsheets/fs286/en/

Measles outbreak in Quebec 2011

Source: Measles outbreak in Quebec: situation report for February 22, 2012





This coverage is for children at 2 years of age. The method used in these estimates use birth cohorts and account for migration into and out of the province, as well as migration between zones. Estimates exclude First Nations and Lloydminster residents.

Percent of children at 2 years of age who have received one dose of Measles containing vaccine

Alberta Health, May 2012

Measles 2013 - background

- Last outbreak in Southern Alberta 1997
  - Thus, 17 year cohort of kids who are unimmunized and at risk.
  - Last outbreak was also identified early, potentially leaving a larger unimmunized demographic at risk.
- Biggest risk is unimmunized, and partially immunized
- Low immunization rates in Southwest Alberta

Measles 2013

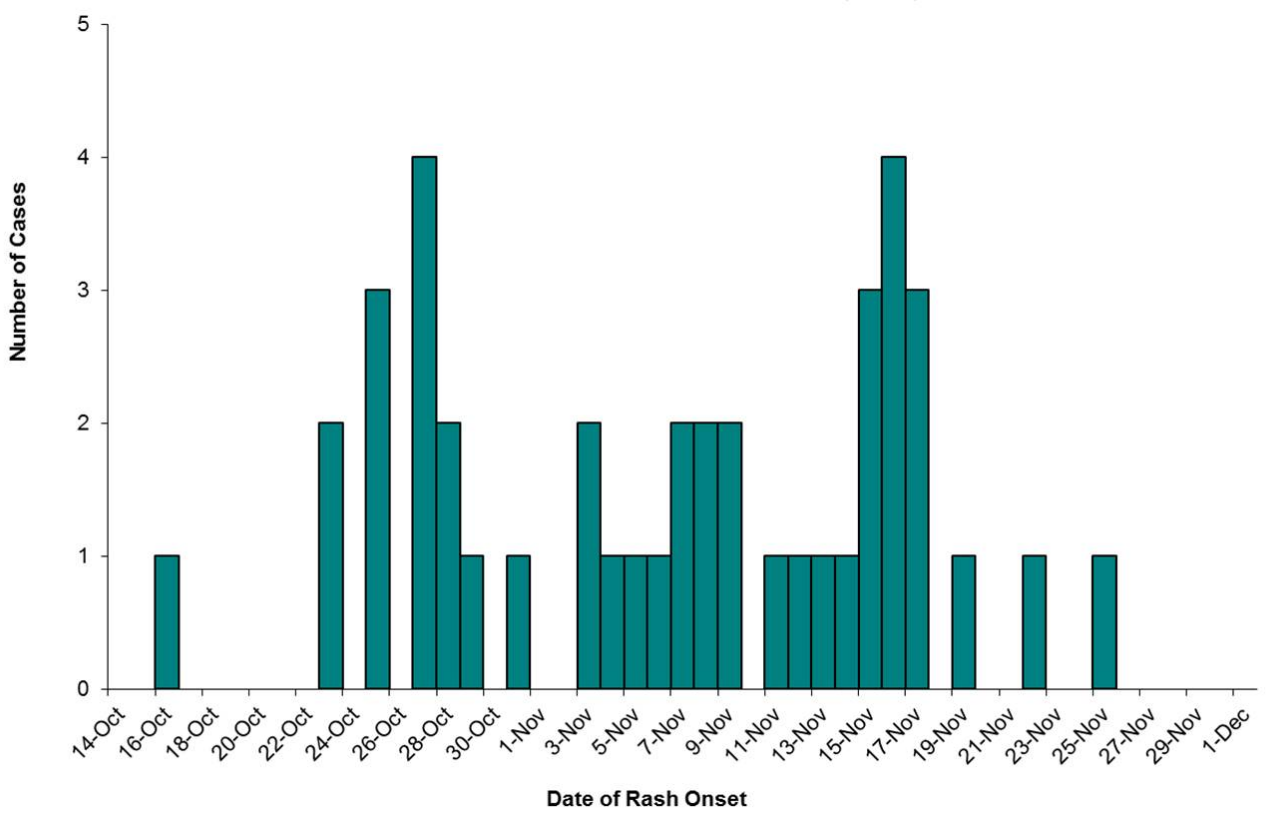
Background:

- Measles outbreak in the Netherlands (May to current) with over 2,000 cases reported to date.
- Under-reporting
- Importation of same D8 strain this year to Ontario and BC
- Historically, these 3 Canadian locations have shared vaccine preventable illness (e.g.. Mumps in 2008, Pertussis 2009).

South Zone Measles Preparedness

- Commence August 2013
- Engagement with community stakeholders
- Immunization to children (1 and 4 years of age)
- Immunization of Healthcare workers
- Hospital readiness – Negative pressure room capacity
- Development of a Measles Assessment Centre plan

Confirmed Measles Cases in Alberta by Date of Rash Onset, October 16-November 25, 2013 (N=42)



Measles 2013 – Outbreak Strategies

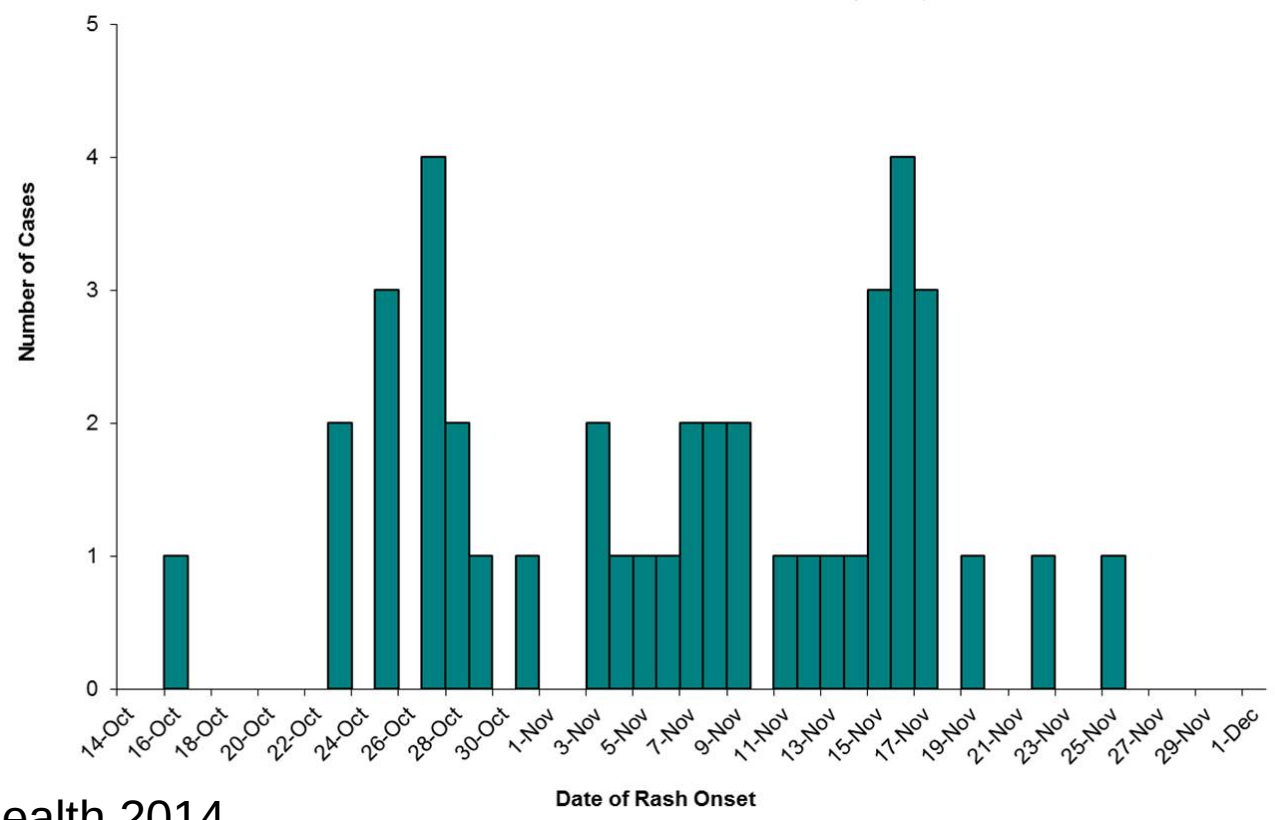
- South Zone Emergency Operating Centre opened – Oct 19th
- Immunization - Children, Health care workers, physicians
  - Outbreak dose for infants 6 – 12 months
- Measles Hotline – collaboration with Health Link Alberta
- Mobile Measles Assessment Team
- Measles Assessment Centre at Chinook Regional Hospital
- Capacity at some rural and the 2 regional hospitals for negative pressure rooms in case admission required

Measles Assessment Centre

Measles Assessment Centre

Measles Assessment Centre

Confirmed Measles Cases in Alberta by Date of Rash Onset, October 16-November 25, 2013 (N=42)



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Summary

- Legislative requirements
- Prevention – capacity building, community engagement
- Use of epidemiologic principles to guide outbreak management
- Outbreak management is a Systematic and dynamic process with multidisciplinary team

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Measles Alert

Do you have a FEVER, COUGH, RUNNY NOSE or a RASH?

Bringing measles inside could put other people at risk!

Questions