Epidemiology of Vaccine Preventable Diseases in Canadian First Nations

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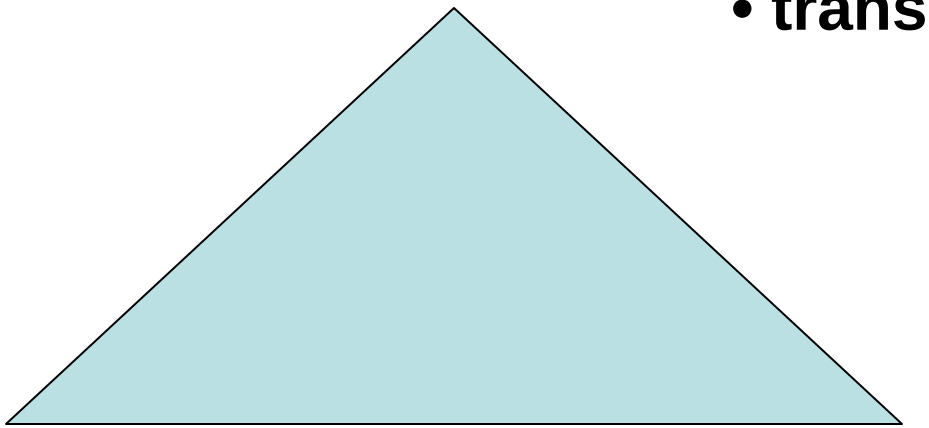
Vaccine Preventable Diseases in Canadian First Nations: Gaps/Needs

- **Epidemiologic Data: on infection, disease, vaccine and immunoglobulin use**

- **Vaccine trial network for Aboriginals: immune response, educational resources and methods, program delivery practices**

Agent
- virulence
- transmissibility



Host
- age, sex
- genetics
- behaviour

Environment
- physical
- socioeconomic
- cultural, political

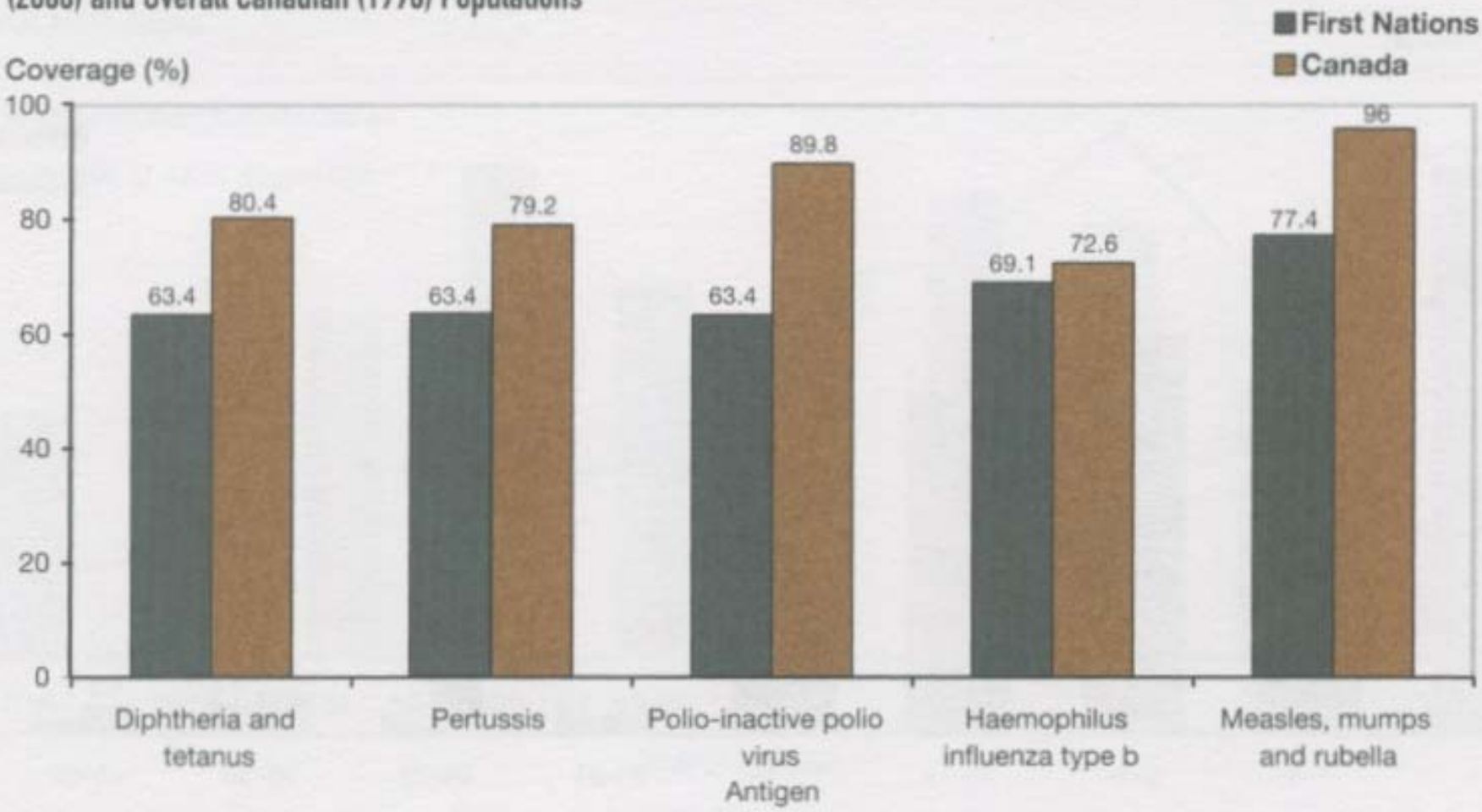
Vaccine Preventable Diseases

- **MMR, Pertussis**
- **IPD**
- ***H. influenzae***
- **RSV**
- **HPV**
- **Hep A**
- **TB**
- **Influenza**

Incidence rates (per 100,000) of Vaccine Preventable Diseases, 2000

	First Nations	Canada
Haemophilus influenza B	0	0.1
Measles	0	0.2
Mumps	0.3	0.3
Rubella	0.7	0.1
Pertussis	34.6	16.1

Figure 3.2
Comparison of Coverage (%) for Routine Immunizations Among Children Aged 2 Years in the First Nations[1] On-reserve (2000) and Overall Canadian (1998) Populations



[1] Excludes Atlantic Region.

Source: Health Canada, First Nations and Inuit Health Branch in-house statistics; Canadian Paediatric Society, *Paediatrics and Child Health*, 4, Supplement C, August 1999.

Estimates of Vaccine Coverage (the degree of Herd Immunity) required to eradicate specific diseases

Infectious Disease	Proportion of the Population to be immunized for eradication
Measles	90-95%
Mumps	85-90%
Rubella	82-87%
Pertussis	90-95%
Diphtheria	82-87%
Polio	82-87%

Anderson RM, May RM. Infectious Diseases of Humans, 1992

Annual Incidence of IPD in Northern Canada, 1999-2007*

Age Group (yrs)	Incidence (per 100,000 pop.)
< 2	153
2-19	16
20-64	23
≥ 65	69

- International Circumpolar Surveillance (ICS) data courtesy of M. Bruce
  Northern Canada = Yukon, NWT, Nunavut, Nunavik, Labrador
  Implementation of 7-valent vaccine: 2002 in Nunavik and Nunavut; 2003 in Northern Labrador; 2005 in Yukon; 2006 in NWT

IPD in Indigenous Children < 2 years old Northern Canada, 2003-2005

Proportion of serotyped Isolates not covered by:

- **PCV 7 vaccine 79%**
- **PCV 13 vaccine 57%**

PCV7: Serotypes 4, 6B, 9V, 14, 18C, 19F, 23F

PCV10: PCV7 Serotypes plus 1, 5, 7F

PCV13: PCV7 Serotypes plus 1, 3, 5, 6A, 7F, 19A

Bruce M. et al, Emerging Infectious Diseases, January 2008

Current Issues with New PCVs

- **? Correlate of protection for IPD**
- **No correlate for pneumonia, otitis media and carriage (herd immunity)**
- **? Role of functional antibody activity (opsonophagocytic-OPA)**
- **Testing of PCV13 in Alaskan Natives but no testing in Canadian aboriginals?**

Characteristics of cases of invasive *Haemophilus influenzae* disease in Northern Canada: 2000-2005

Total # cases	**63**
Typeable	**46**
Non-typeable	**17**
Of typeable serotypes:	
Type B	**19%**
Type A	**74%**
Non-A/B	**7%**

Bruce M et al. Emerging Infectious Diseases, January 2008

Incidence of Invasive *Haemophilus influenzae* Type A in Northern Canada: 2000-2005

	Incidence (per 100,000)
Total Population, all ages	3.9
< 2 yrs age	79.1
Indigenous, all ages	5.9
< 2 yrs	101.9

RSV Prevention in First Nations Communities

General Preventive Measures

- **eliminate exposure to smoke**
- **handwashing**
- **improved housing (decreased crowding)**
- **promote breastfeeding**

Palivizumals (humanized monoclonal IgG against the F glycoprotein of RSV)

- **? for children of isolated northern communities who are born before 36 weeks gestation if they are less than 6 months at onset of RSV season**

Singleton et al. IJCH 65:1, 2006

HPV : CA Cervix

Cervical Cancer

Aboriginal women have higher age-standardized incidence rate of in-situ and invasive cervical CA

- **MB (Young, 2000) – 1.8 x in-situ CA**
  – 3.6 x invasive CA
- **Baffin (Healey, 2001) – 11% screened Inuit females age 13-20 have squamous intra-epithelial lesions**
- **Nunavik (Hamlin, 2008) – 7% of women screened have abnormal cytology (atypia, low grade, high grade)**

HPV : CA Cervix

HPV Infection

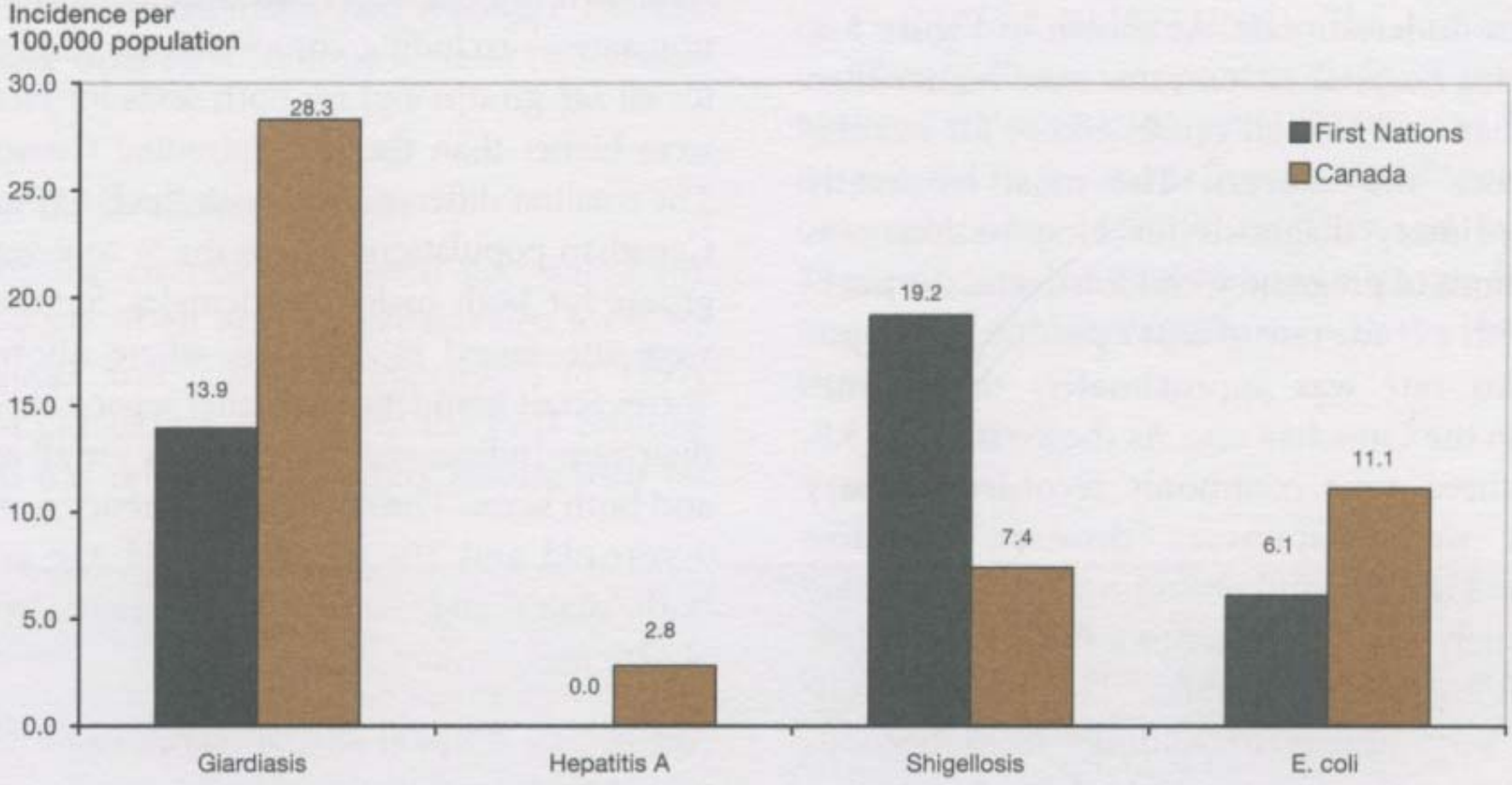
Aboriginal women have higher prevalence of oncogenic HPV

- **Nunavik (Hamlin, 2008)**
  - **47%, females age 15-19, +ve oncogenic HPV**
  - **HPV-16 most common, then HPV-31, 58, 52**
- **Nunavut (Healey, 2001)**
  - **26% +ve oncogenic HPV**
  - **43% +ve, females age 13-20 in Baffin**
  - **HPV acquired at earlier age in Inuit**
- **MB (Young, 1997)**
  - **same prevalence of oncogenic HPV, but more type 18**

HPV and Cervical Cancer Questions in First Nations

- **What HPV strains are prevalent in First Nations populations in the provinces? Are these strains covered by the current vaccine?**
- **Is the vaccine effective in FN women?**
- **What is the uptake of PAP smear in FN women?**

Figure 3.7
Enteric, Food and Waterborne Diseases Among Children Aged 0 to 14 years, First Nations (2000) and Canada (1999)



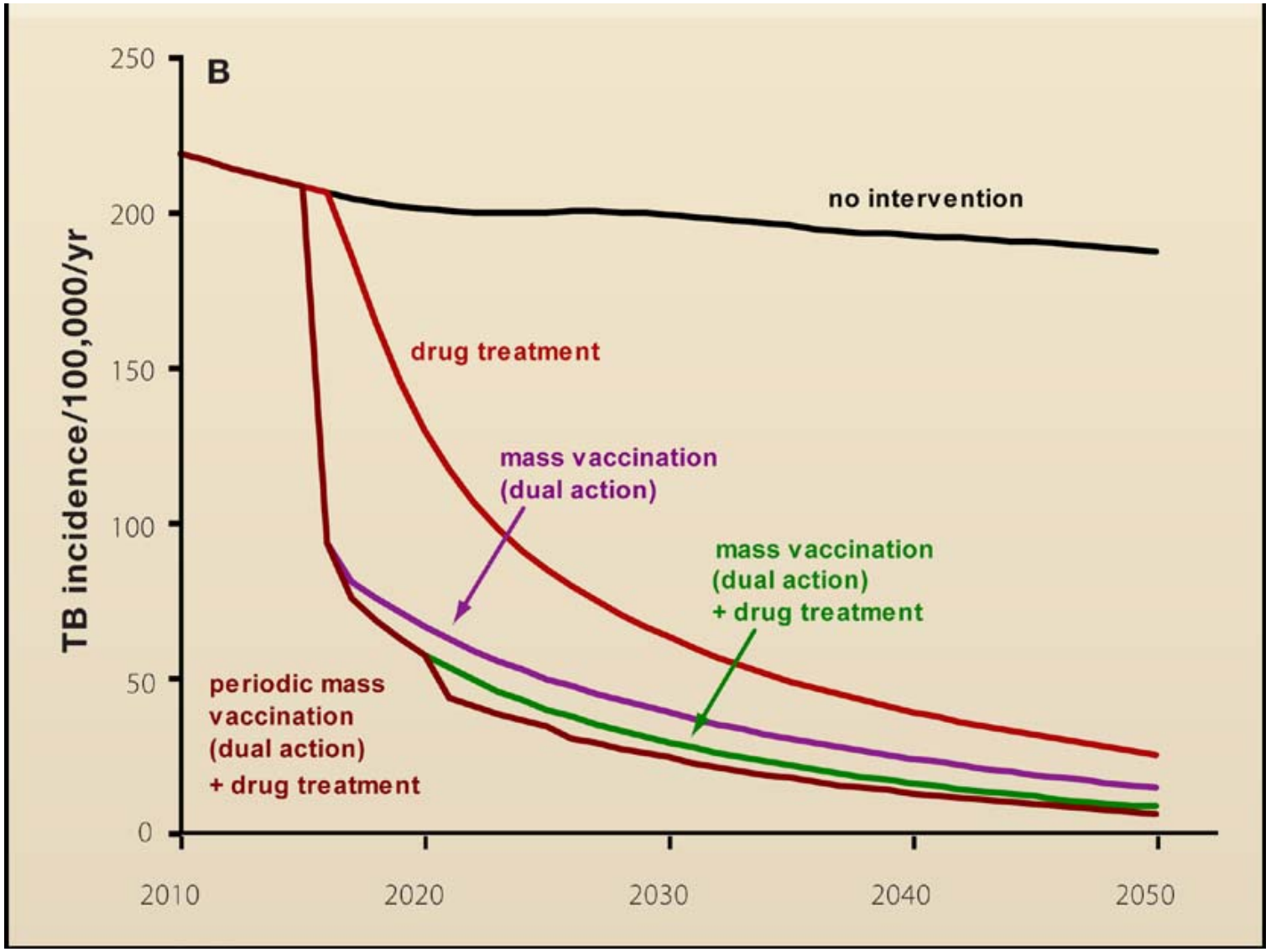
Source: Health Canada, First Nations and Inuit Health Branch in-house statistics; Health Canada, Notifiable Diseases Annual Summary, Canada Communicable Disease Report, Vol. 27S6.

TABLE II

Hepatitis A Cases on Reserves in BC, Jan 1991 to Oct 1996

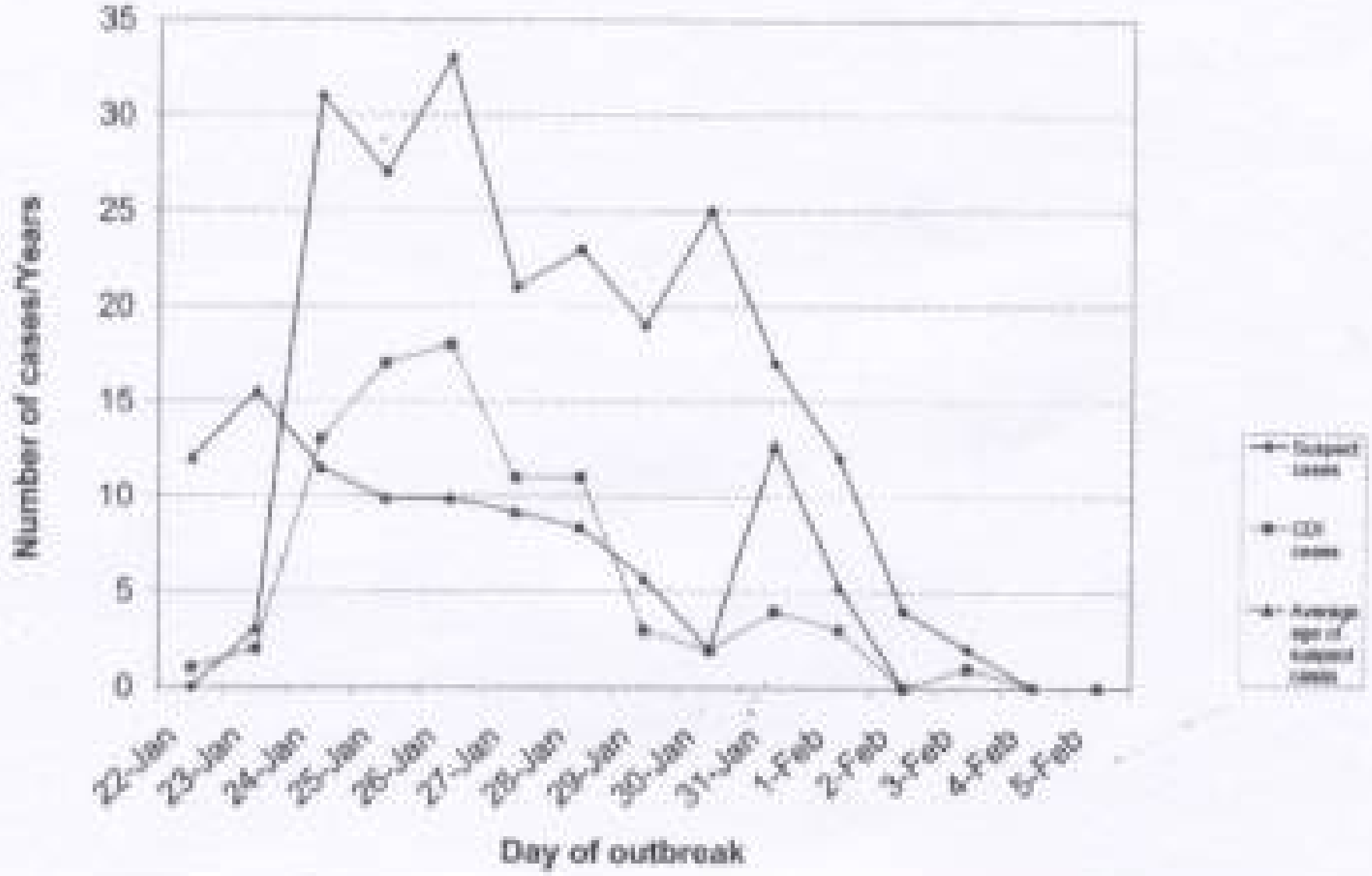
	Population*	Cases†		Rate‡	95% CI§		
		No.	%				
Total	49,756	90	100%	31	25	to	37
Gender							
Male	25,896	50	56%	33	24	to	42
Female	23,860	40	44%	29	20	to	38
Age in years ‖							
0-4	4,520	11	14%	42	17	to	66
5-9	5,667	20	25%	61	34	to	87
10-14	5,266	10	13%	33	12	to	53
15-19	4,696	11	14%	40	16	to	64
20-24	4,493	11	14%	42	17	to	67
25-29	4,508	7	9%	27	7	to	46
30-39	8,727	4	5%	8	2	to	16
40-49	5,202	3	4%	10	0	to	23
50-89	6,677	3	4%	8	0	to	18

* on-reserve Status Indian population, 31-Dec-1993, INAC population file
† cases reported to Pacific Region, First Nations & Inuit Health Branch, Health Canada; 83% of cases confirmed by IgM
‡ cases per 100,000 persons in the population per year
§ 95% confidence interval for incidence rate
‖ not included: 10 cases of unknown age



See : Young D, Dye C. Cell, February 2006

: Aeras Global TB Vaccine Foundation


Number of cases/Years
35
30
25
20
15
10
5
0
22-Jan
23-Jan
24-Jan
25-Jan
26-Jan
27-Jan
28-Jan
29-Jan
30-Jan
31-Jan
1-Feb
2-Feb
3-Feb
4-Feb
5-Feb
Day of outbreak

Influenza

1. **Seasonal influenza**
   - **Need for yearly influenza vaccine– universal coverage makes sense in remote communities**

2. **Pandemic influenza**
   - **Need for antibody testing**
   - **Need for vaccine testing**
   - **Need to discuss/prepare immediately**

Reference Regarding Immune Response to Infections and Vaccines in Aboriginals

1. Larcombe L et al. JID 2008;198(October 15)
2. Siber G et al. NEJM 1990;323(20):1387
3. Guenter D et al. Arctic Med Res 1991;Suppl. 344
4. Meissner HC. Pediatr Infect Dis J 2003;22(2):S40-44
5. Wilbur AK et al. Tuberculosis 2007;87(4):329
6. Santosham M et al. J Infect Dis 1992;165(Suppl. 1):S144
7. O'Brien KL. J Infect Dis 2007;196(1):104