Epidemiology of Pediatric Tuberculosis (TB) in North America

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The findings and conclusions in this presentation are those of the author(s) and do not necessarily represent the views of the Centers for Disease Control and Prevention.

National Center for HIV/AIDS, Viral Hepatitis, STD & TB Prevention
Division of Tuberculosis Elimination/International Research and Programs Branch

Overview and Objectives

- **Risk factors for TB**
  - TB in a child is a sentinel public health event
- **Recent pediatric TB data from Canada, Mexico, and the United States**
  - Similarities and differences compared with adult TB data
- **Programmatic and clinical implications**

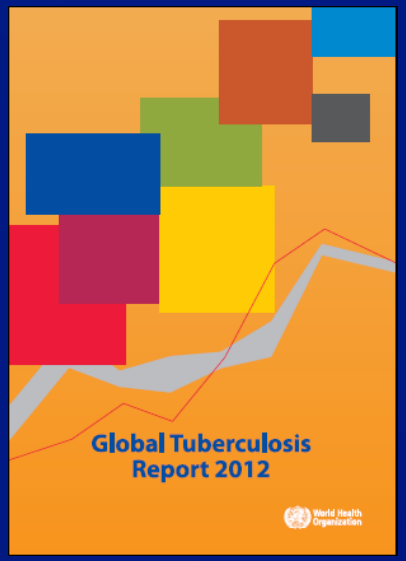
“Any program designed to control or eliminate tuberculosis must focus great effort on children, because they are the future reservoir for the disease…children are important public health markers…because they represent ongoing transmission”

Starke et al. Pediatrics 1989:28

EPIDEMIOLOGY OF PEDIATRIC TB

Global Epidemiology of Pediatric TB

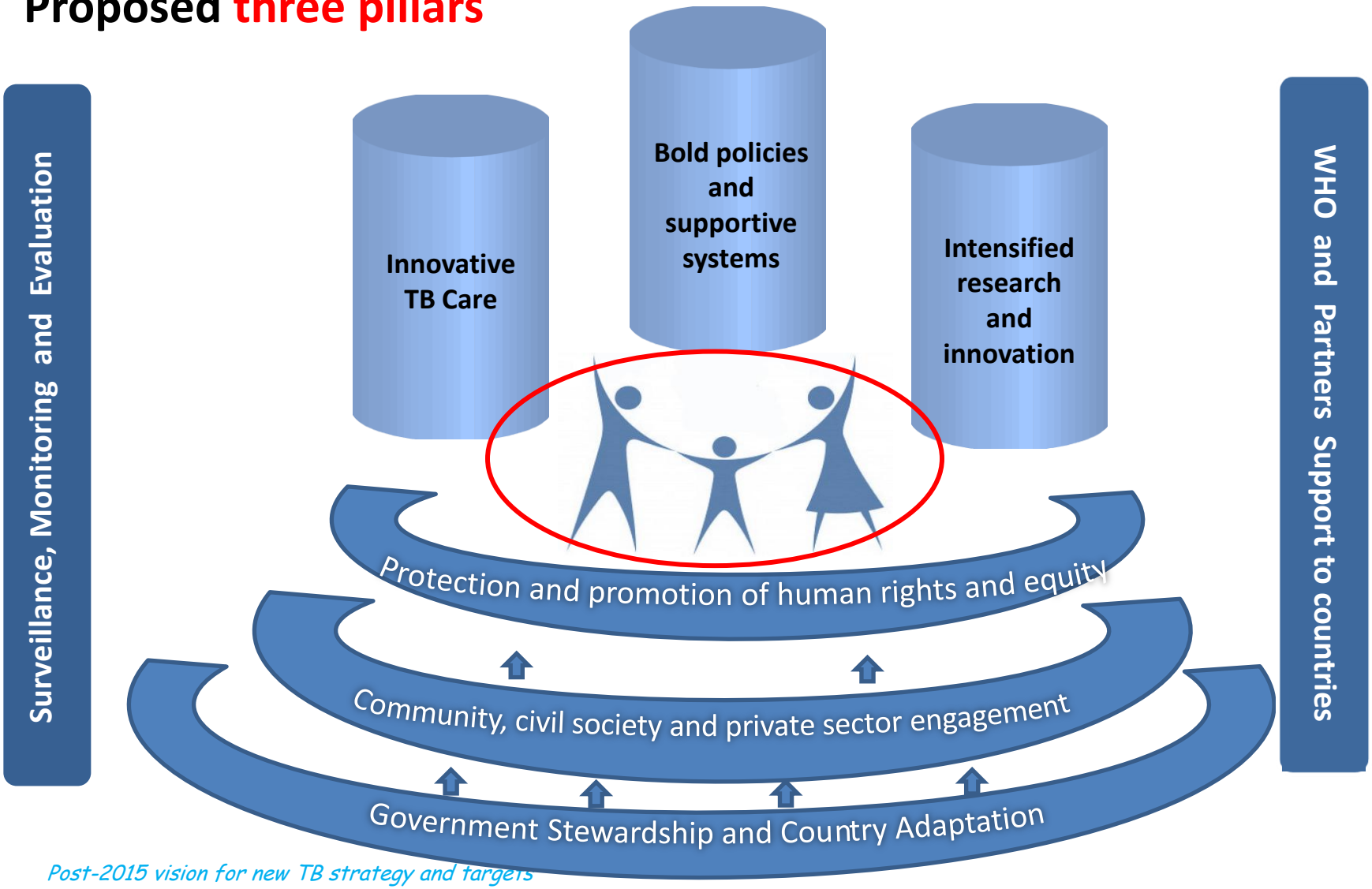
- **TB disease in a person < 15 years old**
- **Greater burden among children in low resource settings**
  - Low resource: children account for 15–20% of all TB cases
  - High resource: children account for 2–7% of all TB cases
- **Estimated 490,000 TB episodes in 2011**
  - 64,000 deaths



Nelson et al. IJTLD 2004;8:636, WHO Global TB Report 2012

Establishing a new post-2015 strategy

Proposed three pillars



Pediatric TB Risk Groups

- Contacts of a known TB case
- Recently infected
- Racial and ethnic minority populations
- Foreign-born
- Poverty; homelessness; congregate settings
- Immunosuppressed
- Younger age

Age Specific Risk for Developing TB Disease

Age	Risk of disease following primary infection	
<1 year	Pulmonary disease	30-40%
	TBM* or miliary disease	10-20%
1-2 years	Pulmonary disease	10-20%
	TBM or miliary disease	2-5%
2-5 years	Pulmonary disease	5%
	TBM or miliary disease	0.5%
5-10 years	Pulmonary disease	2%
	TBM or miliary disease	<0.5%
>10 years	Pulmonary disease	10-20%
	TBM or miliary disease	<0.5%

"Golden age"

*TBM = tuberculous meningitis

Marais et al. Int J TB Lung Dis 2004:392

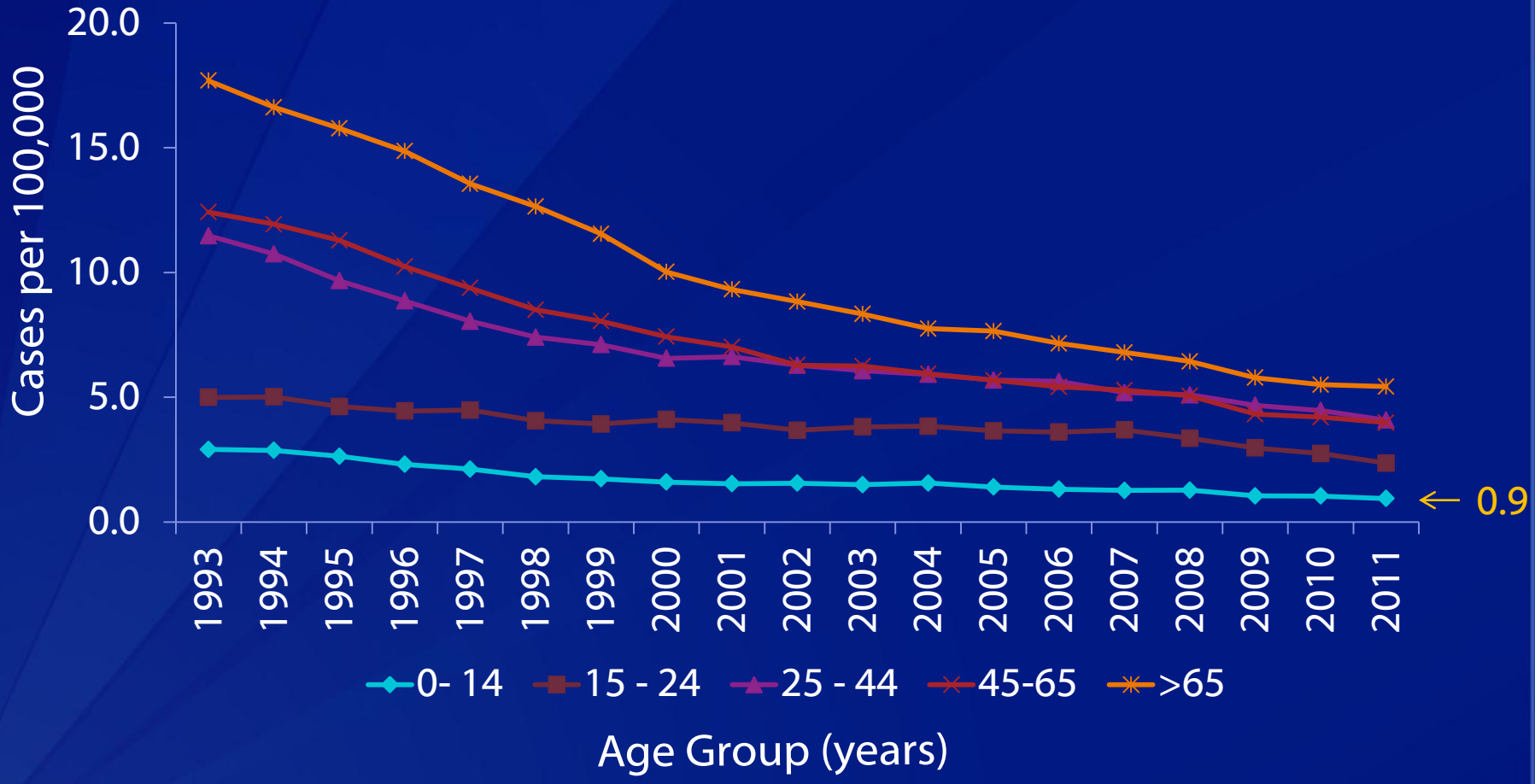
World Health Organization 2011 TB Data

	Canada	Mexico	United States (US)
Estimated incidence (per 100,000)	4.5	23.0	3.9
Incident new cases	1,332	18,986	10,521
Total cases < 15 years	74	886	572
Proportion pediatric TB	5.6%	4.7%	5.4%
Proportion of all children smear-positive	6.8%	29.8%	4.7%

WHO Global TB Report 2012

SIMILARITIES TO ADULT TB

TB Case Rates by Age Group — US, 1993–2011



CDC. Tuberculosis in the United States, 2011. http://www.cdc.gov/tb/statistics/surv/surv2011/default.htm

Top Five Countries of Origin for TB Cases with Foreign Birth — US, 2008–2010

Children < 18 N = 2,648 (%)	All persons N = 21,292 (%)
Mexico (19)	Mexico (23)
Philippines (9)	Philippines (11)
Ethiopia (6)	India (8)
Haiti (6)	Viet Nam (8)
Burma (5)	China (5)

Winston et al. Pediatrics 2012:e1425
CDC. Reported Tuberculosis in the United States, 2011

Epidemiology of Pediatric TB — Canada

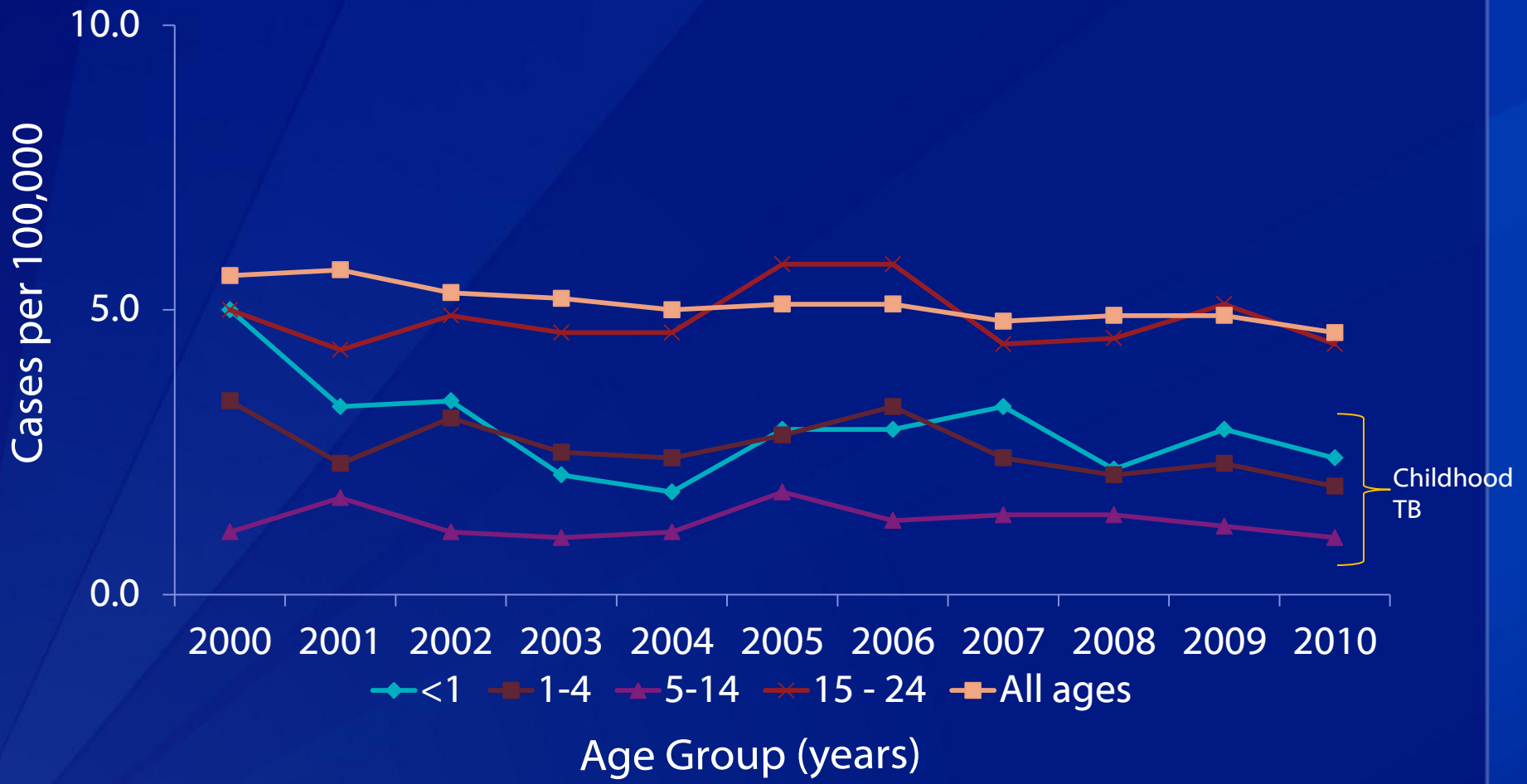
- **1,577 new and re-treatment TB cases in 2010**
  - 4.6 cases/100,000
  - Nunavut 304.0 cases/100,000

- **77 cases in children < 15 years (4.9% of total)**

2010	<1 year	1-4 years	5-14 years
Case rate per 100,000	2.4	1.9	1.0
Highest case rate per 100,000	875.0	140.8	29.3
Lowest case rate per 100,000	0	0	0

Public Health Agency of Canada: Tuberculosis in Canada 2010 — Pre-Release

Pediatric TB — Canada, 2000–2010



Public Health Agency of Canada: Tuberculosis in Canada 2010 — Pre-Release

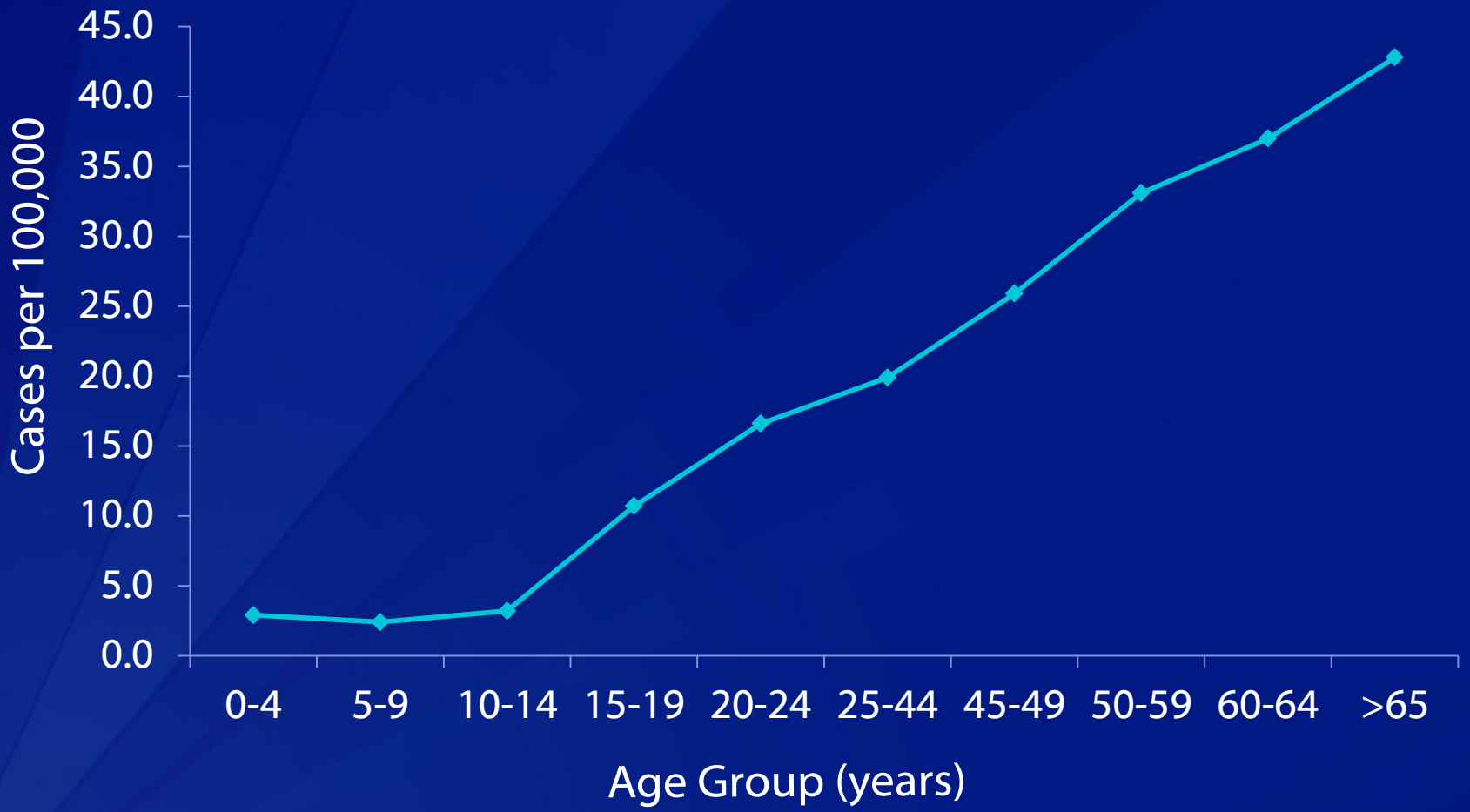
Epidemiology of Pediatric TB — Mexico

- **18,848 total cases in 2010**
  - 16.8 cases/100,000
- **917 cases in children <15 years (4.9% of total)**

2010	0-4 years	5-9 years	10-14 years
Case rate per 100,000	2.9	2.4	3.2

SINAVE/DGE/SALUD/Perfil Epidemiológico de Tuberculosis en México 2010

TB Case Rate by Age Group — Mexico, 2010

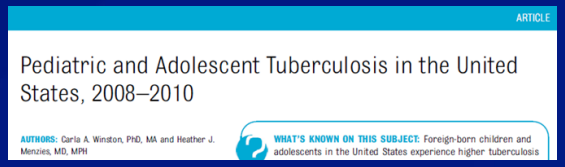


SINAVE/DGE/SALUD/Perfil Epidemiológico de Tuberculosis en México 2010

DIFFERENCES IN PEDIATRIC AND ADULT TB

Native Birth vs. Foreign Birth

- **31% foreign-born; 69% U.S.-born children (2008–2010)**

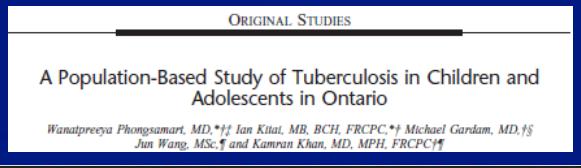

ARTICLE

Pediatric and Adolescent Tuberculosis in the United States, 2008–2010

AUTHORS: Carla A. Winston, PhD, MA and Heather J. Menzies, MD, MPH

WHAT'S KNOWN ON THIS SUBJECT: Foreign-born children and adolescents in the United States experience higher tuberculosis

- **66% of all Canadian TB cases in 2010 were foreign-born**
  - 69% of <17 with TB in Ontario (1999–2002)
  - 18% of <15 with TB in Canada (2001)
  - 45% of <18 with TB in Children's Hospital of Eastern Ontario (1998-2008)


ORIGINAL STUDIES

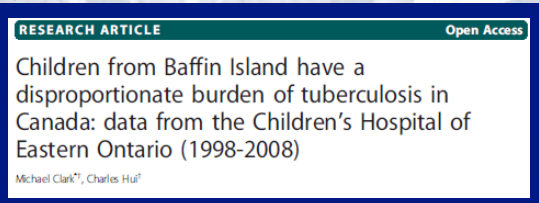
A Population-Based Study of Tuberculosis in Children and Adolescents in Ontario

Wanatpreeya Phongsamart, MD,†‡ Ian Kitai, MB, BCH, FRCPC,*† Michael Gardam, MD,†§ Jun Wang, MSc,¶ and Kamran Khan, MD, MPH, FRCPC†¶*

Canada Communicable Disease Report ◆ Relevé des maladies transmissibles au Canada

CCDR·RMTC

15 August 2003 • Volume 29 • Number 16 — le 15 août 2003 • Volume 29 • Numéro 16


RESEARCH ARTICLE — Open Access

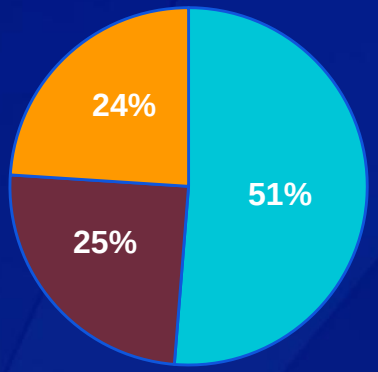
Children from Baffin Island have a disproportionate burden of tuberculosis in Canada: data from the Children's Hospital of Eastern Ontario (1998-2008)

Michael Clark[*†], Charles Hui[†]

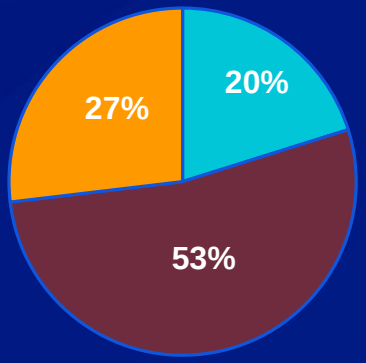
Winston et al. Pediatrics 2012:e1425, Public Health Agency of Canada: Tuberculosis in Canada 2010 — Pre-Release, Phongsamart et al. Pediatr Infect Dis J 2009:416, Phypers et al. Canada Communicable Disease Report 2003:139, Clark et al. BMC Pediatrics 2010:102

Pediatric TB Cases by Age and Case Verification Criterion — US, 1993–2008

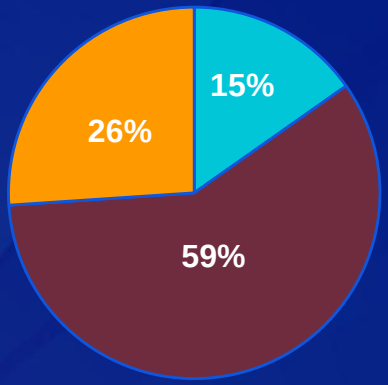
Age < 1 n=1,697



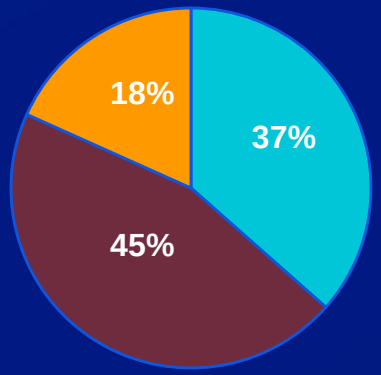
Age 1–4 n=8,616



Age 5–9 n=3,991



Age 10–14 n=3,198



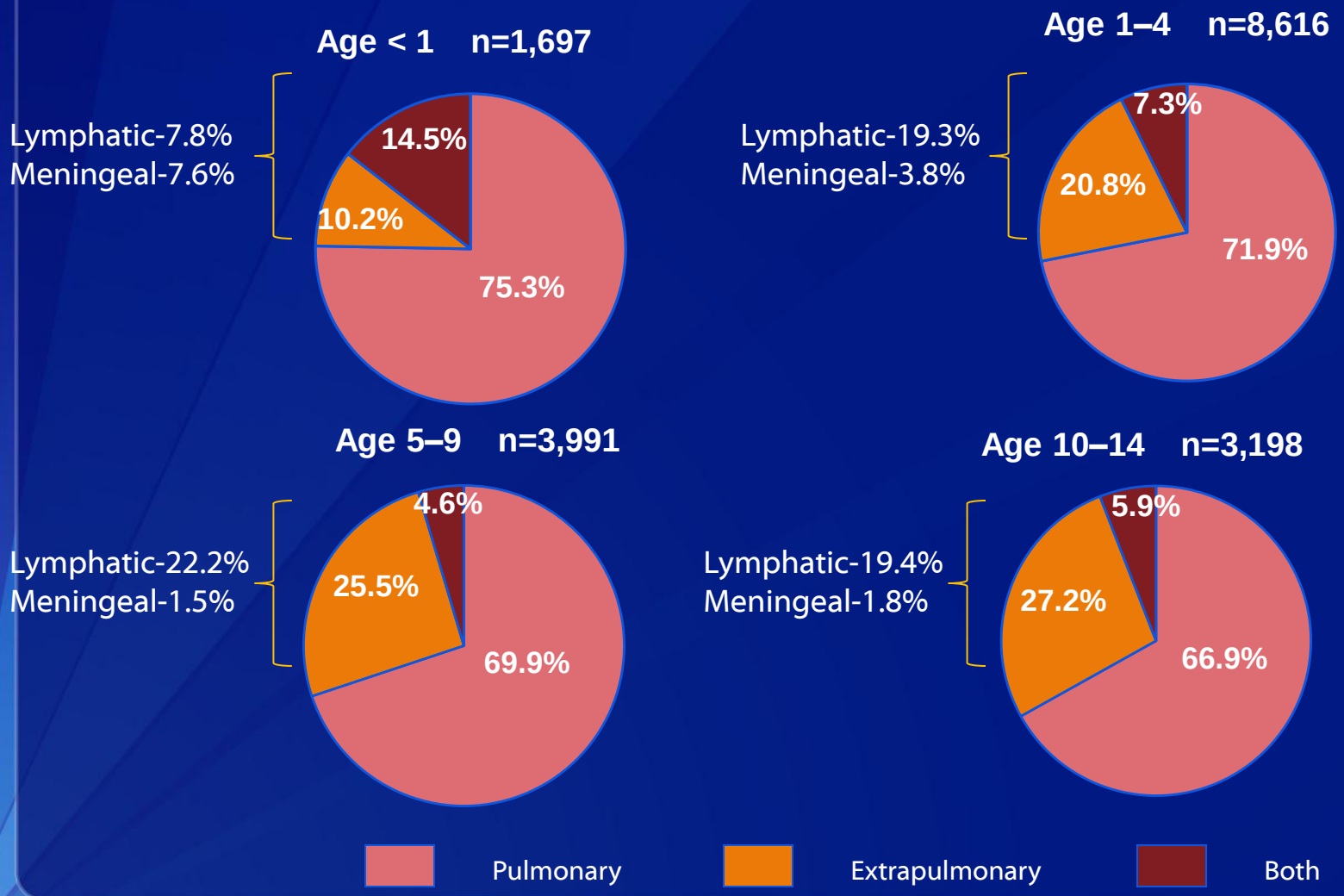
Laboratory Confirmed

Clinical Case

Provider Diagnosis

Pediatric Tuberculosis in the United States 1993-2008, http://www.cdc.gov/tb/publications/slidesets/pediatricTB/default.htm

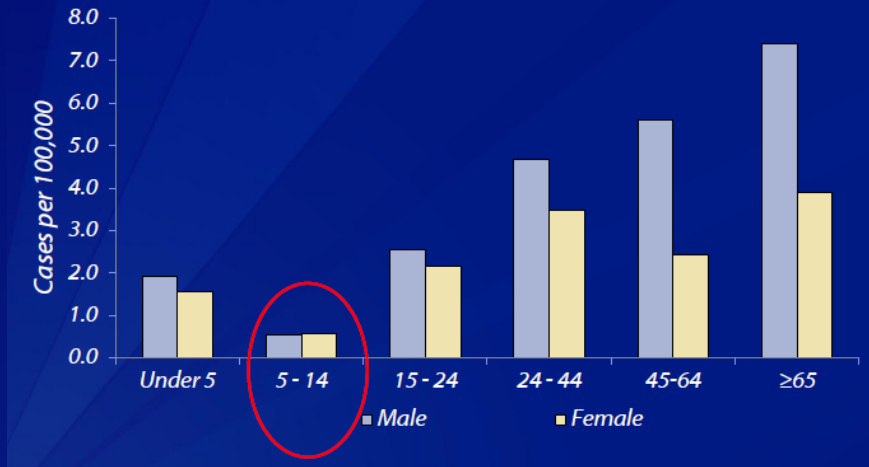
Percent of Pediatric TB Cases by Age and Site of Disease — US, 1993–2008



Pediatric Tuberculosis in the United States 1993-2008, http://www.cdc.gov/tb/publications/slidesets/pediatricTB/default.htm

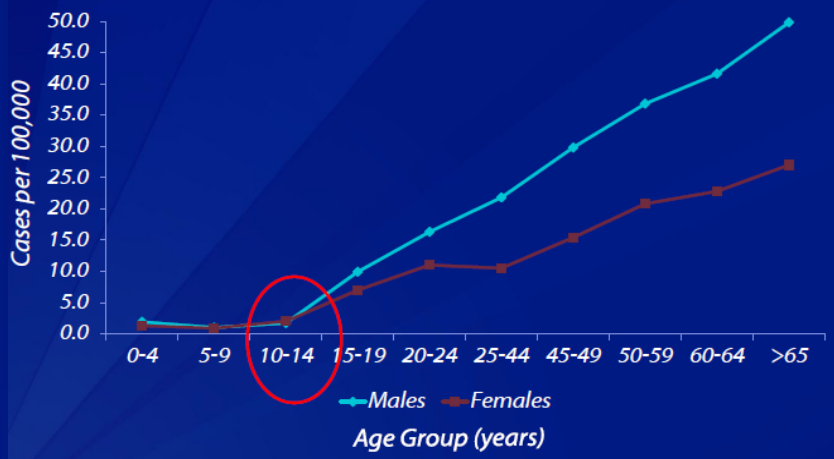
TB Case Rates by Age Group and Sex

US, 2011



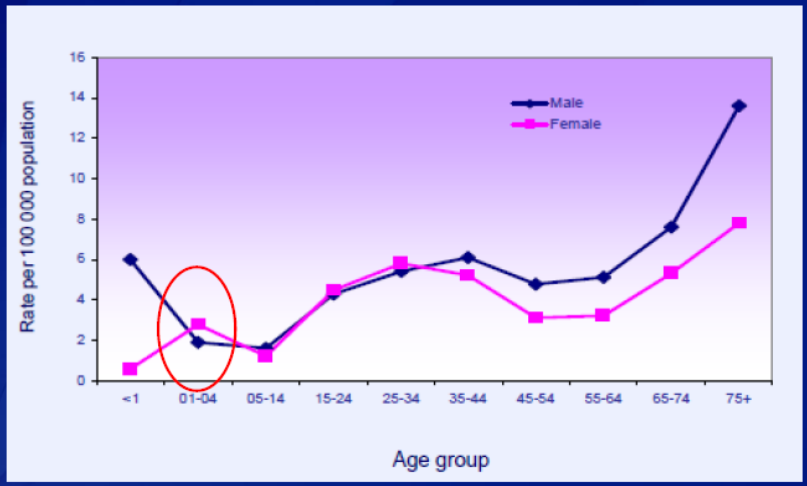
CDC. Tuberculosis in the United States, 2011. http://www.cdc.gov/tb/statistics/surv/surv2011/default.htm

Mexico, 2010



SINAVE/DGE/SALUD/Perfil Epidemiológico de Tuberculosis en México 2010

Canada, 2007



Public Health Agency of Canada: Tuberculosis in Canada 2007, http://www.phac-aspc.gc.ca/tbpc-latb/pdf/tb-2007-eng.pdf

Children Have Better Treatment Outcomes

- **Treatment completion**
  90% vs. 76%

- **Lower mortality**
  - 1% vs. 13% US-born
  - <1% vs. 5% foreign-born

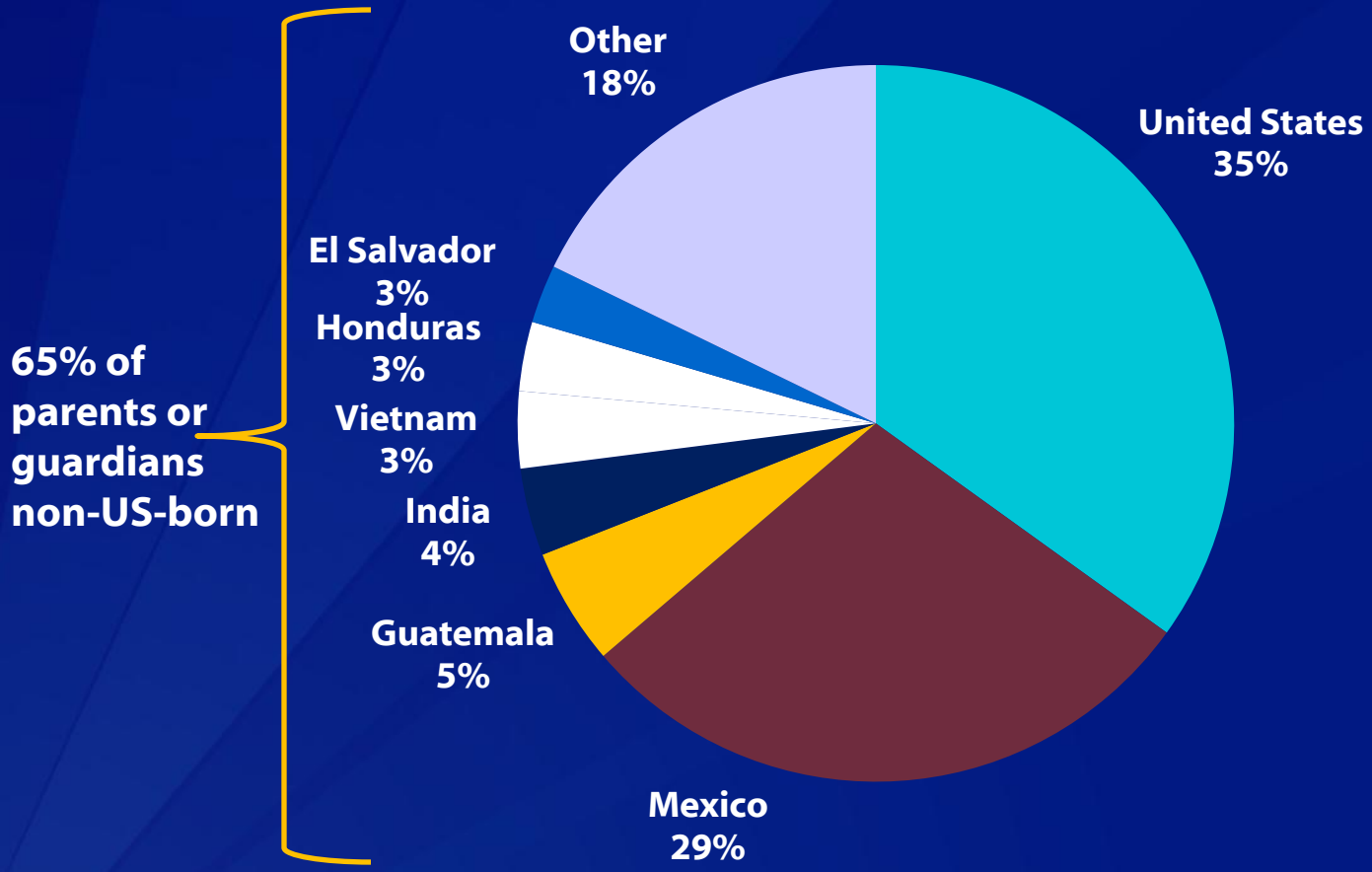
Epidemiology of Tuberculosis Among US- and Foreign-Born Children and Adolescents in the United States, 1994–2007

Heather J. Menzies, MD, MPH, Carla A. Winston, PhD, MA, Timothy H. Holtz, MD, MPH, Kevin P. Cain, MD, and William R. Mac Kenzie, MD

Menzies et al. Am J Public Health 2012:1724

PROGRAMMATIC AND CLINICAL IMPLICATIONS

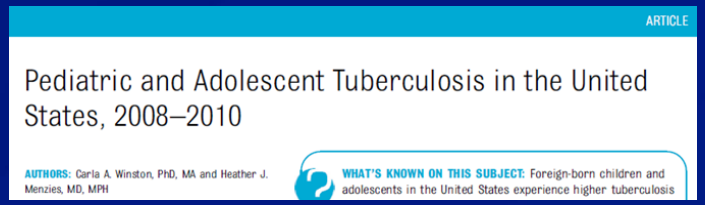
Parent or Guardian Country of Birth for US-Born Pediatric TB Patients <18, 2009–2010



Winston et al. Pediatrics 2012:e1425

Opportunities to Recognize Pediatric TB

- **25% (188 of 765) US-born children**
  - Did NOT have foreign-born parent AND
  - Did NOT live outside US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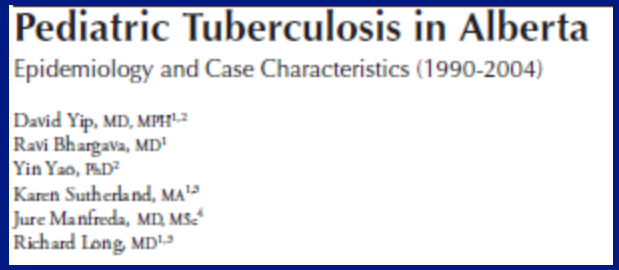
AUTHORS: Carla A. Winston, PhD, MA and Heather J. Menzies, MD, MPH

WHAT'S KNOWN ON THIS SUBJECT: Foreign-born children and adolescents in the United States experience higher tuberculosis

- **7% (7 of 95) Canadian-born children**
  - Did NOT have foreign-born parent AND
  - Were not Status Indian or Métis


Pediatric Tuberculosis in Alberta

Epidemiology and Case Characteristics (1990-2004)

David Yip, MD, MPH[1,2]
Ravi Bhargava, MD[1]
Yin Yao, PhD[2]
Karen Sutherland, MA[1,3]
Jure Manfreda, MD, MSc[4]
Richard Long, MD[1,3]

Winston et al. Pediatrics 2012:e1425
Yip et al. Can J Public Health 2007:276

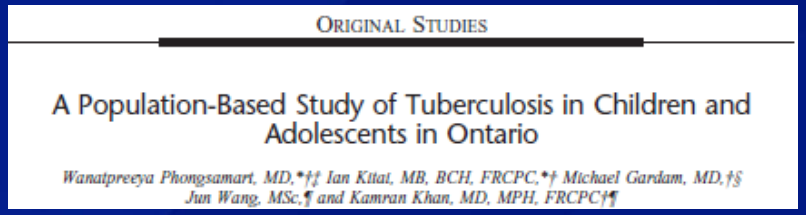
Reasons Evaluated for TB Disease among Children < 18 years by Nativity — US, 2009–2010

	US-born (n = 1,162)	Foreign-born (n = 518)
TB Symptoms	29%	33%
Contact Investigation	32%	8%
Targeted Testing (if other reason not appropriate)	3%	6%
Immigration Exam	Not applicable	8%
Abnormal Chest Radiograph (incidental)	15%	22%
Other*	2%	3%
Missing/Unknown	19%	20%

*Other = Incidental laboratory result for evaluation other than TB, employment/administrative testing

Winston et al. Pediatrics 2012:e1425

Reasons Evaluated for TB Disease among Children < 17 years — Ontario, 1999–2002



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	N = 121 n (%)
TB Symptoms	78 (64.5)
Contact Investigation	25 (20.7)
Immigration Screening	5 (4.1)
Postmortem	1 (0.8)
Other	5 (4.1)
Unknown	7 (5.8)

Phongsamart et al. Pediatr Infect Dis J 2009:416

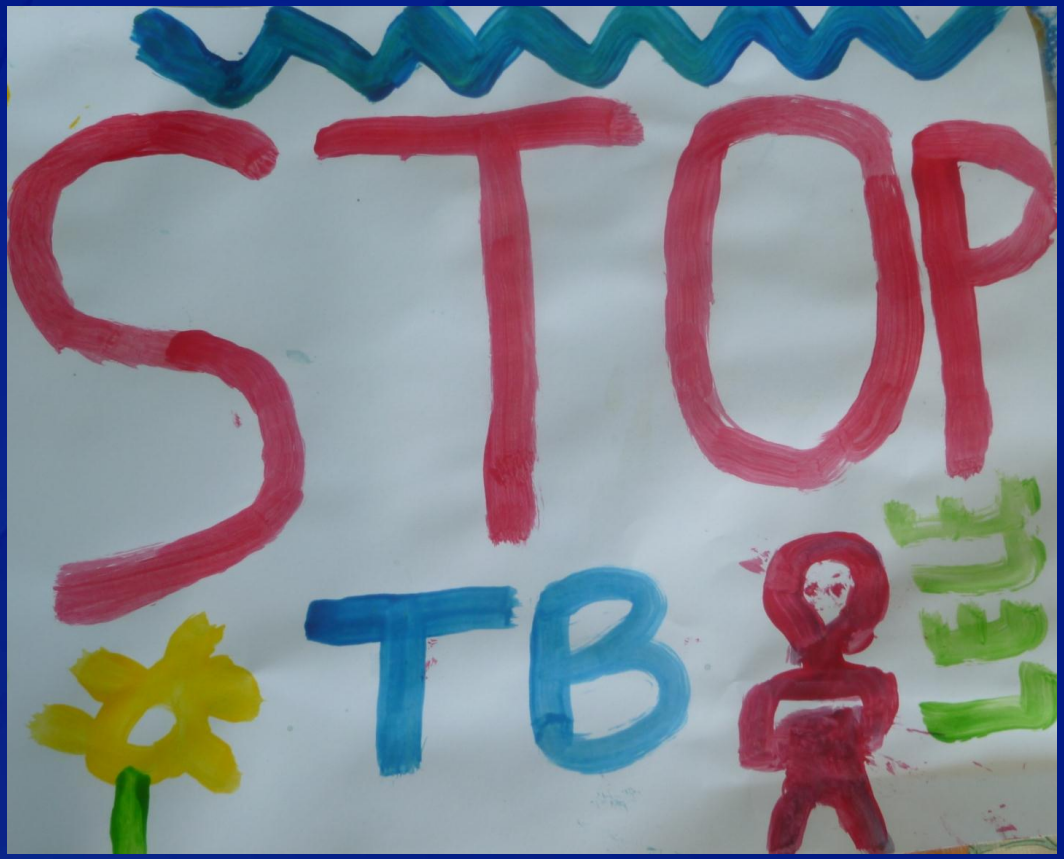
Think TB!

^ Pediatric

Summary

- **Think about pediatric TB as a sentinel event**
- **Think about TB in context of local epidemiology**
  - Think about TB in high-risk children
  - Think about TB in seemingly "low-risk" children

Acknowledgements

- **US Centers for Disease Control and Prevention**
  - Heather Menzies
  - Eric Pevzner
  - Carla Winston
- **Public Health Agency of Canada**
  - Carole Scott
- **National Tuberculosis Program, Mexico**
  - Martha Angélica García Avilés

Thank you