

# PIECES OF A PUZZLE: FOREIGN-BORN TUBERCULOSIS IN CANADA, 1986-2002

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# Background

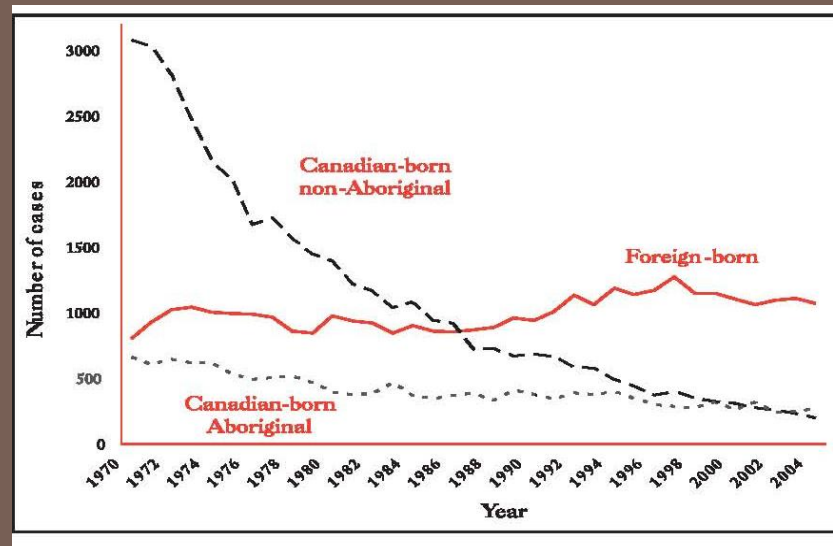
- ◎ Immigration is the single largest determinant of TB in high-income countries<sup>1</sup>
  - Foreign-born persons account for large proportion of TB cases (>65% in Canada)
  - National TB rates anticipated to decrease <2% annually when >70% of national caseload is foreign-born<sup>1</sup>
  - TB incidence is highest among recently arrived immigrants
- ◎ Canada has one of the highest immigration levels per capita
  - 80% of annual arrivals from high incidence countries<sup>2</sup>
  - Annual immigration levels are increasing

<sup>1</sup> WHO. Global tuberculosis control: surveillance, planning, and financing. Geneva, 2009

<sup>2</sup> Long R, Ellis E, editors . Canadian tuberculosis standards, 6<sup>th</sup> Edition. Ottawa, 2008.

# Background

- In Canada, no appreciable change in annual foreign-born TB cases and rate decreases reflect the increased size of the foreign-born population



Canadian Tuberculosis Standards. 6<sup>th</sup> edition. Ottawa: Canadian Lung Association and Public Health Agency of Canada

- A meaningful reduction in foreign-born TB incidence will not be achieved passively

# Objectives

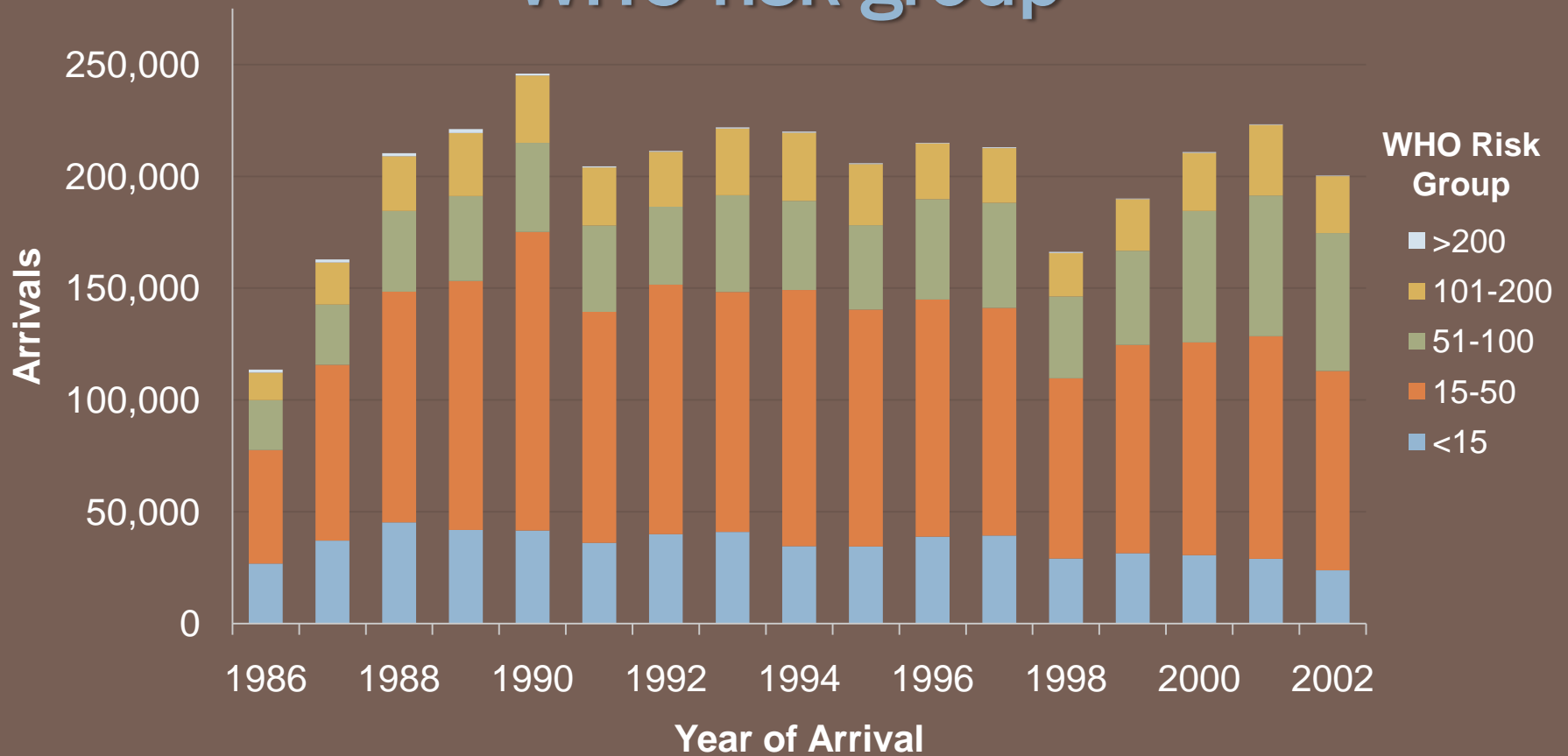
- To identify the key components of foreign-born TB incidence in Canada
- To identify appropriate targets for the screening of latent tuberculosis infection (LTBI) in Canada's foreign-born population
- To assess, with mathematical modelling, the potential impact of targeted screening for LTBI on foreign-born TB incidence

# Methods

- ⦿ Population-based retrospective cohort study
- ⦿ National databases were used:
  - Citizenship and Immigration Canada
    - Study population was all permanent residents ('immigrants') arriving in Canada from 1986-2002
  - The Canadian Tuberculosis Reporting System
    - All TB cases reported from 1986-2002 in the foreign-born
  - Statistics Canada
    - Census data to determine size of pre-1986 population
    - Age-sex specific mortality data
- ⦿ Countries of birth categorized into WHO risk groups
  - Based on estimated rates of sputum smear positive pulmonary TB at mid-study period (3-year average)

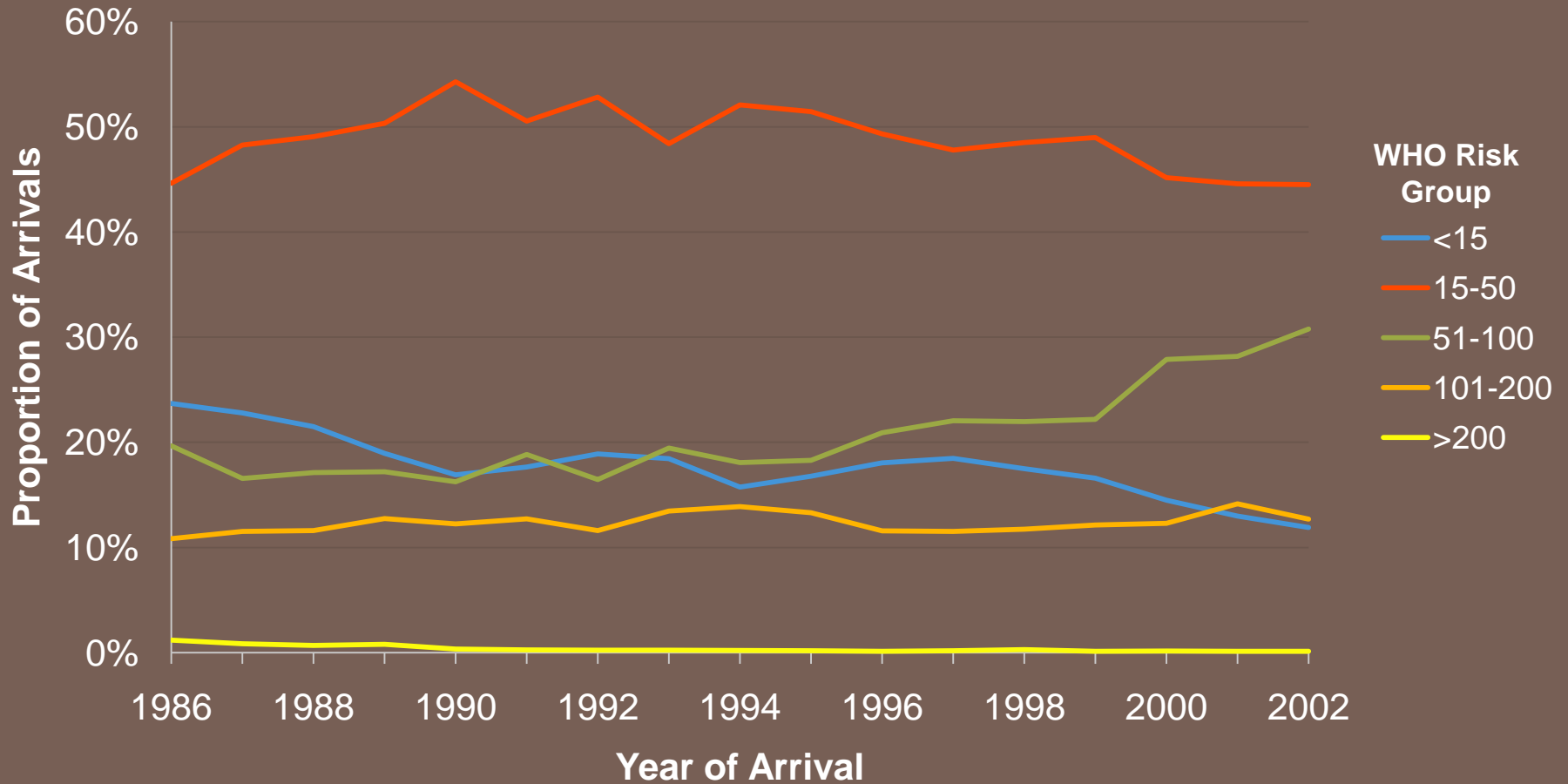
# Epidemiology of TB in the Foreign-born

# Figure 1: Annual immigration levels by WHO risk group



3.4 million new immigrants landed in Canada from 1986 through 2002

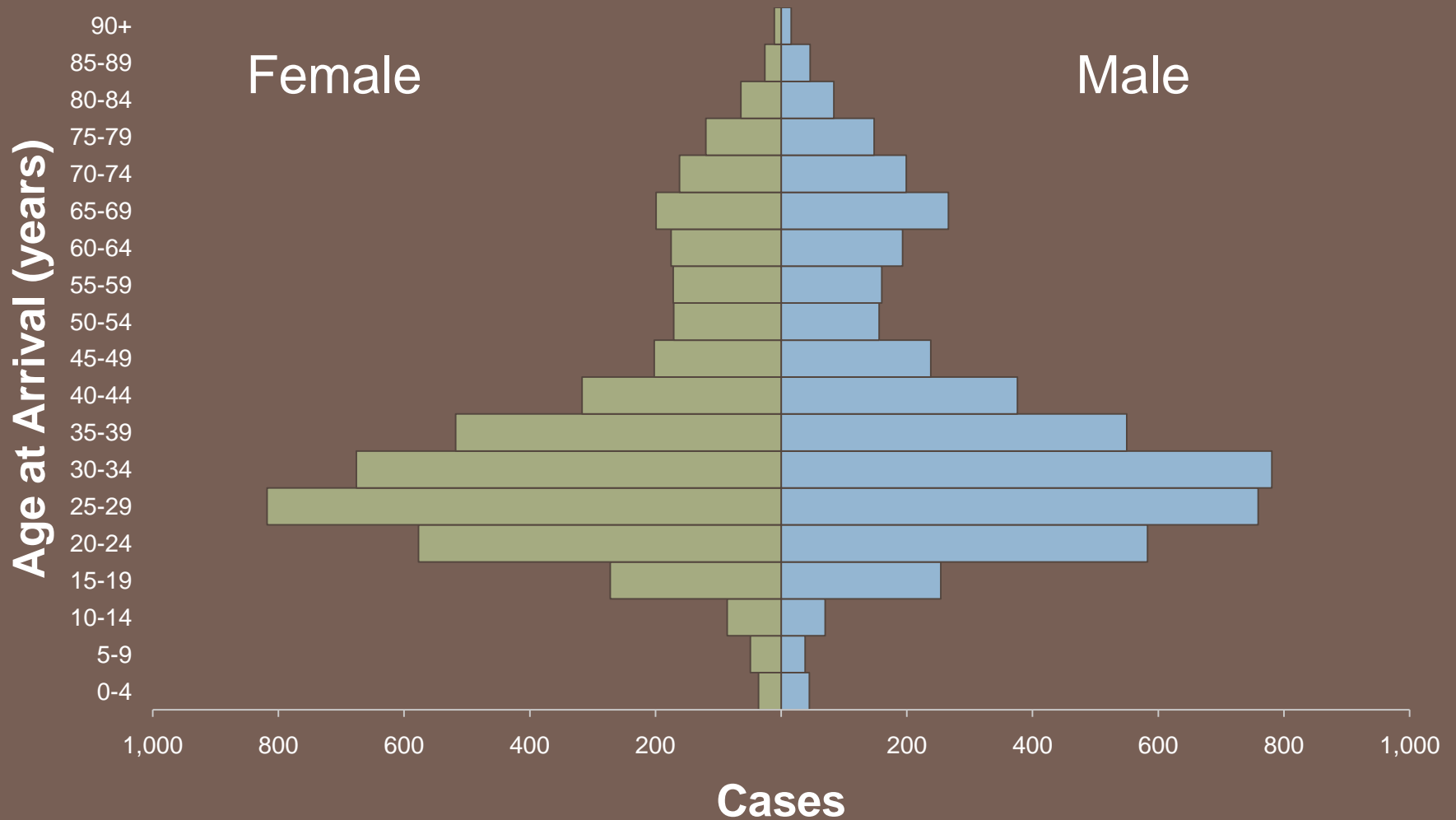
# Figure 2: Shifting immigration pattern



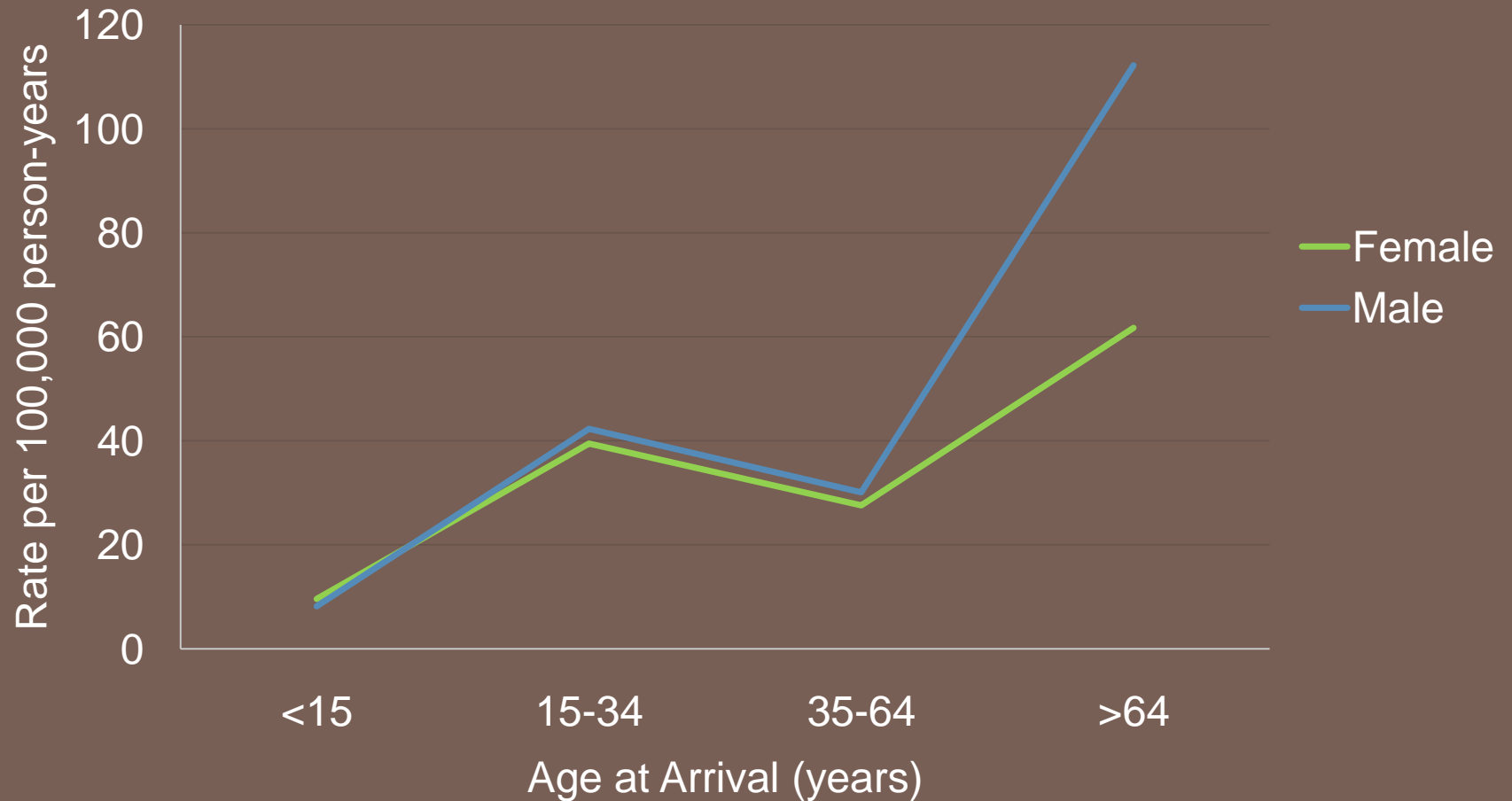
# Overall TB Incidence of Immigrants Arriving in 1986-2002

- Among immigrants who arrived in Canada from 1986 through 2002:
  - 9,613 TB cases were reported during the same 17-year period
  - Relatively high TB incidence rate:
    - 34.3/100,000 person-years
    - 16 times higher than that of Canadian-born non-Aboriginal persons and equal to the rate in Canadian-born Aboriginal persons

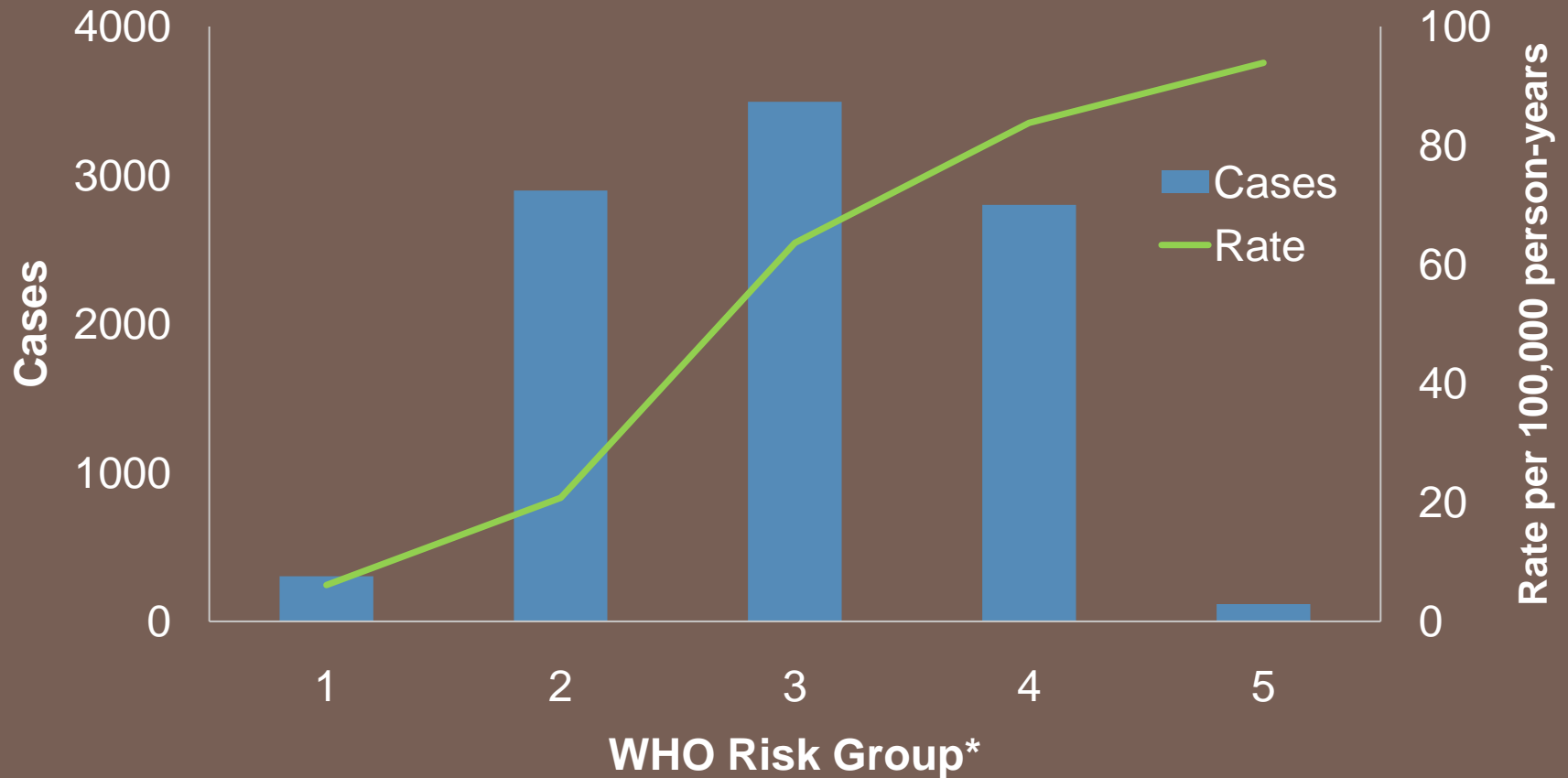
# Figure 3: Age-sex specific TB cases



# Figure 4: Age-Sex specific TB rates

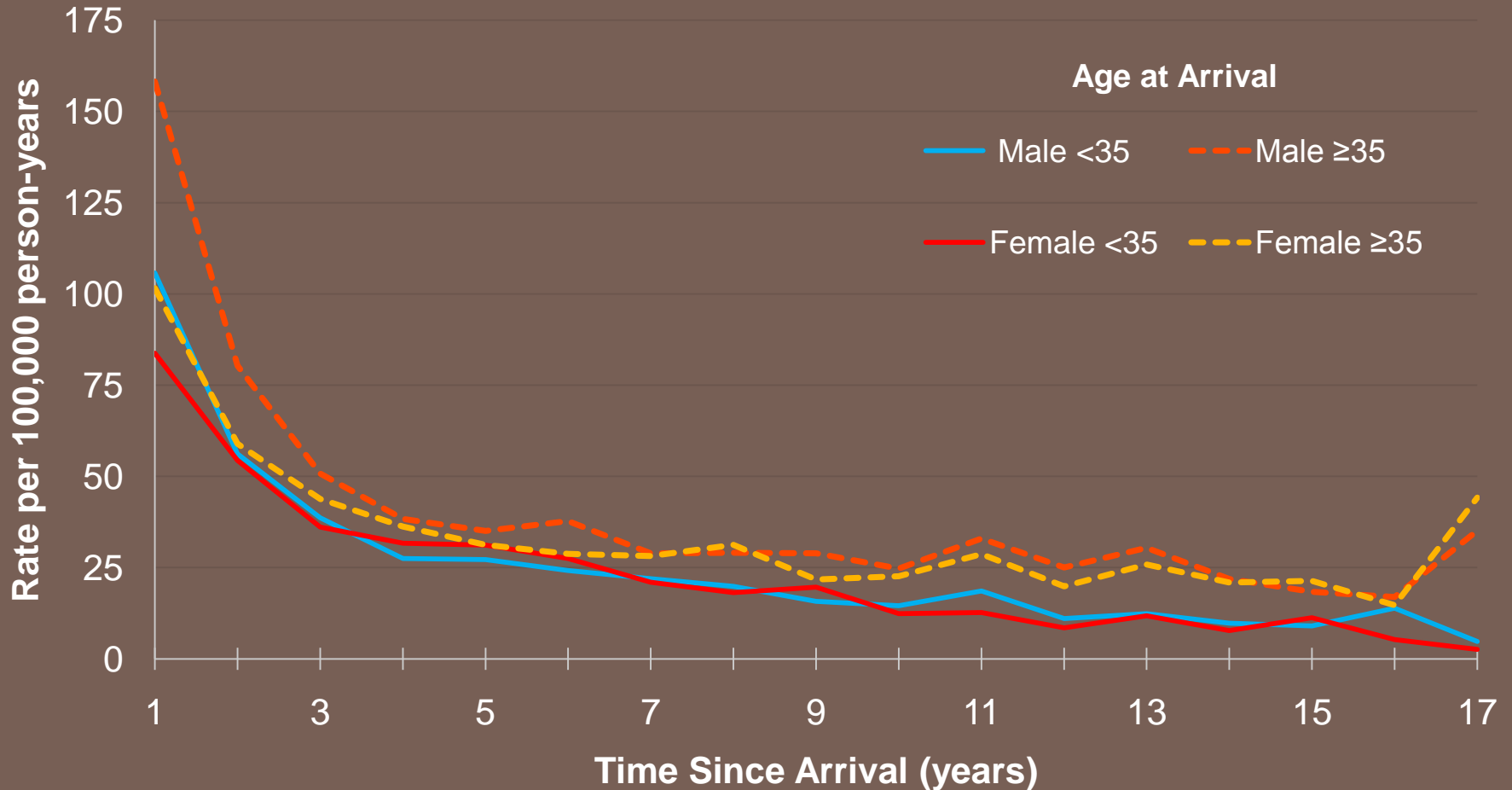


# Figure 5: TB Incidence by WHO risk group

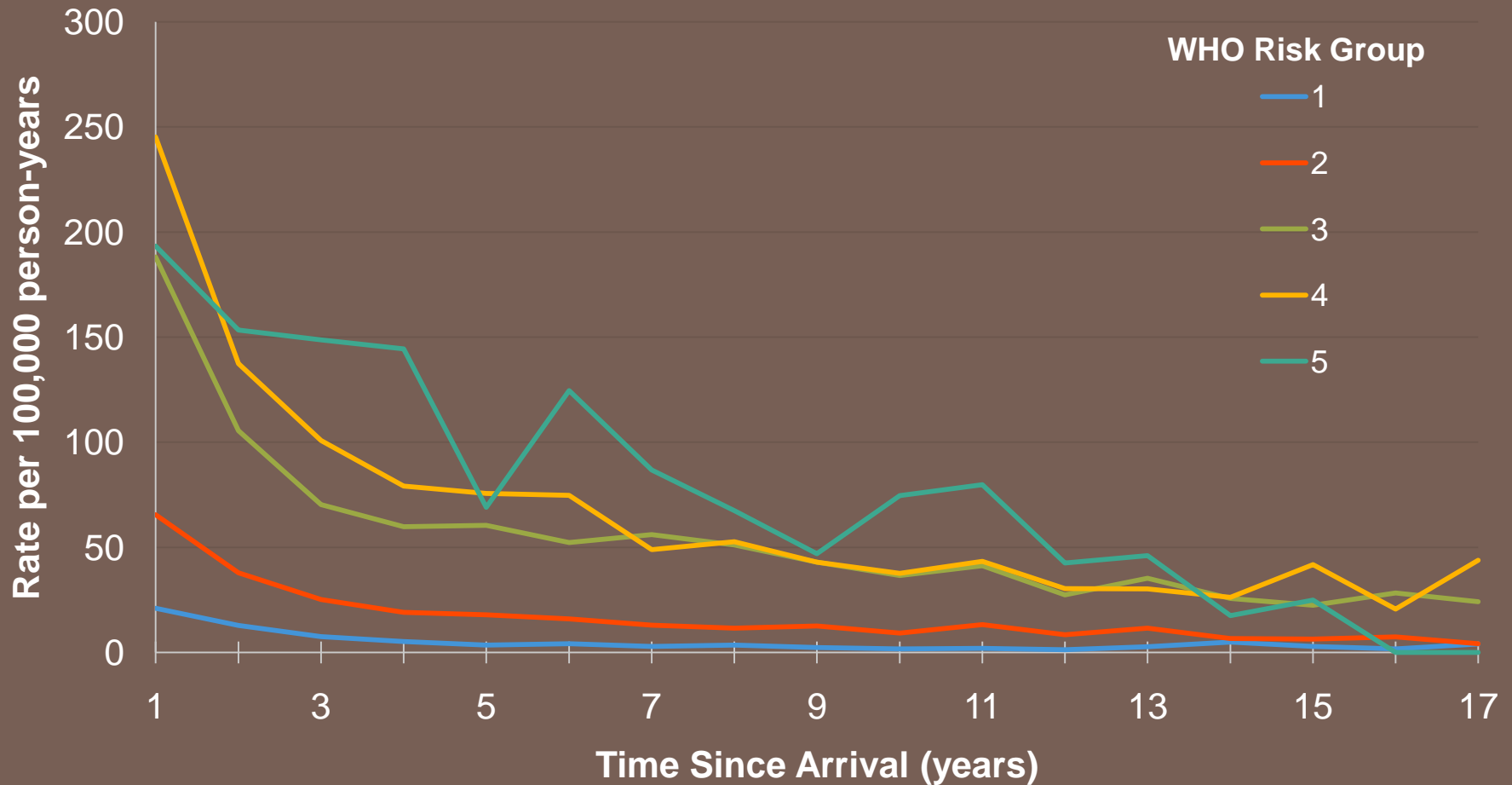


\*Countries of birth were categorized into WHO Risk Groups based on the estimated rate of sputum smear positive pulmonary TB at mid-study period: (1) <15/100,000 pop ; (2) 15-50/100,000 pop; (3) 51-100/100,000 pop; (4) 101-200/100,000 pop; (5) >200/100,000 pop

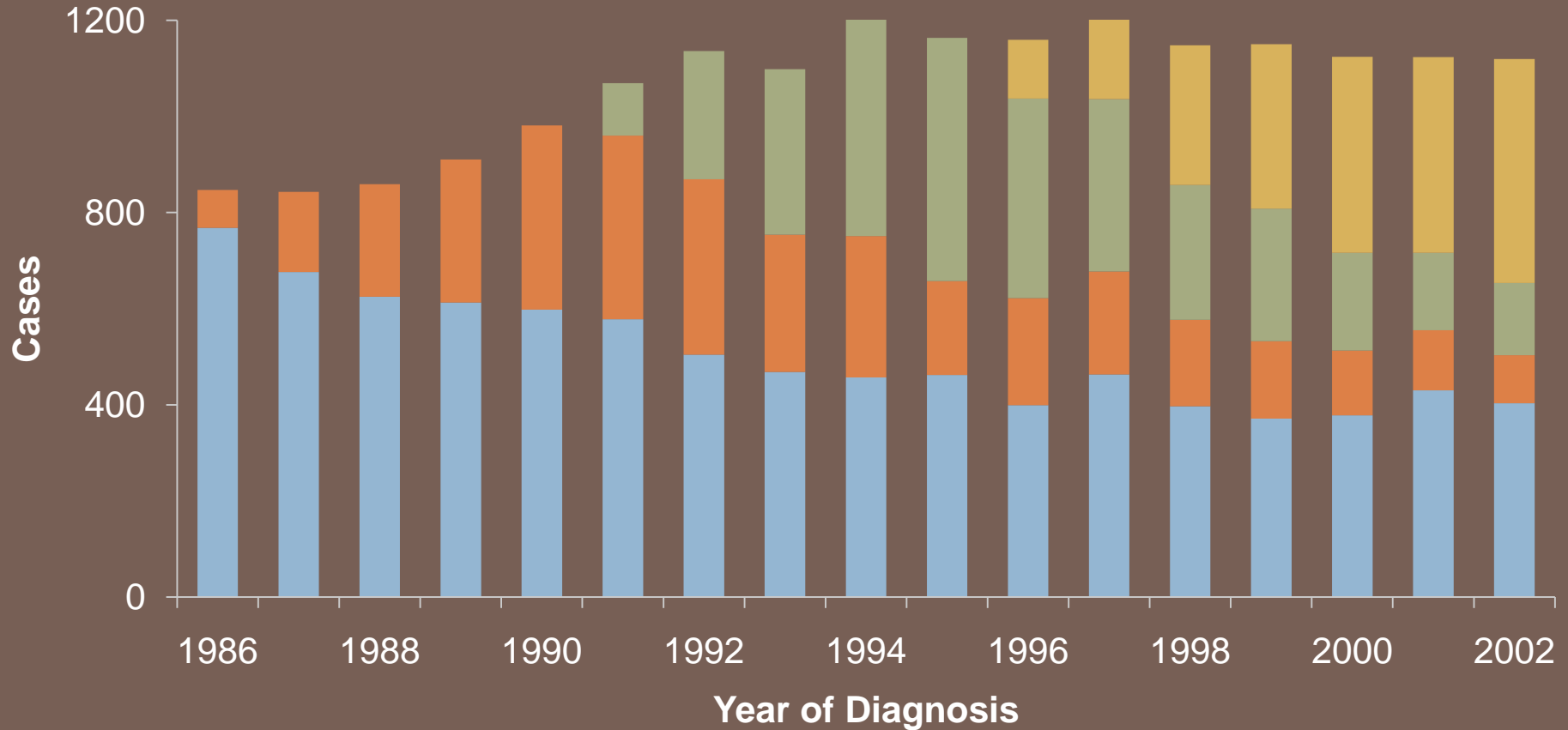
# Figure 6: Age-sex specific TB rates by time since arrival



# Figure 7: TB rates within WHO risk groups based on time since arrival



# Figure 8: National foreign-born TB caseload by arrival-year cohort



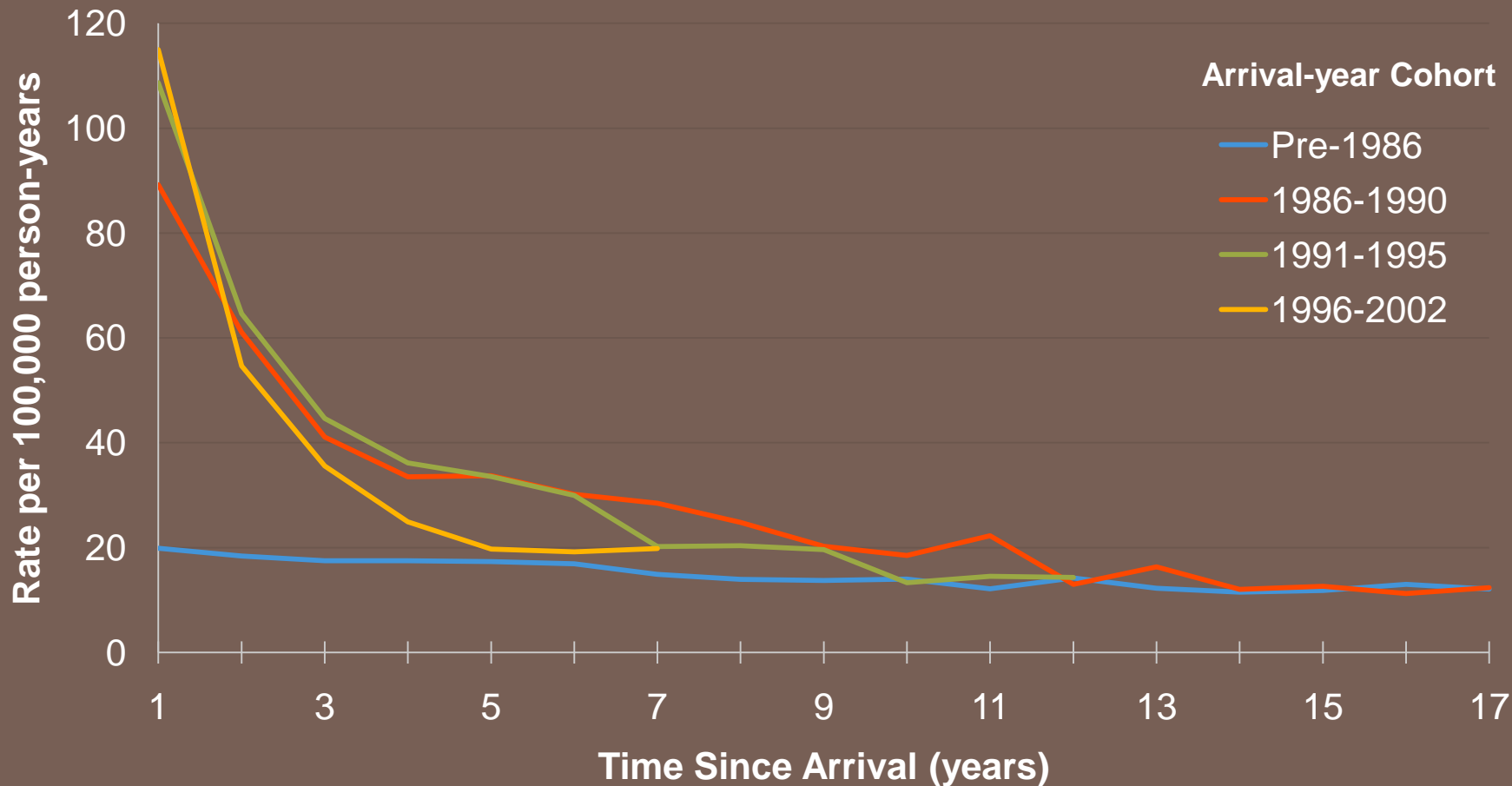
■ Pre-1986 Arrivals

■ 1986-1990 Arrivals

■ 1991-1995 Arrivals

■ 1996-2002 Arrivals

# Figure 9: TB rates of arrival-year cohorts based on time since arrival



# Epidemiologic Findings: Key Points

- Sex-specific TB incidence highly similar
- Period of highest TB risk is  $\leq 5$  years – and especially  $\leq 2$  years – post-arrival
- Shifting immigration pattern to higher risk countries of birth (smear positive pulmonary TB  $>50/100,000$  pop)
  - Progressive increase in rates  $\leq 2$  years post-arrival
  - Associated with rates of  $>20/100,000$  person-years for at least 17 years post-arrival
- There is remarkable resiliency and predictability in number of TB cases contributed by arrival-year cohorts

# Mathematical Modelling...in progress

Potential Impact of Targeted Screening and Treatment for Latent Tuberculosis Infection (LTBI)

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# Modelling Methodology

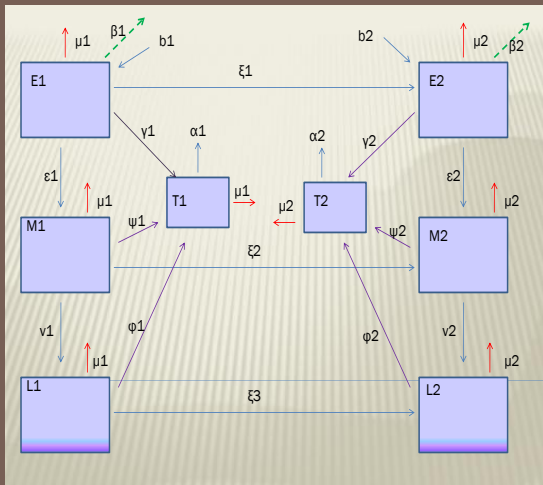
## ◎ Targeted screening

- Newly arrived immigrants ( $\leq 2$  years post-arrival) who were:
  - $< 35$  years old at arrival
    - Lowest risk group in terms of side effects of treatment of LTBI
  - Born within high risk countries of birth
    - Countries of birth associated with WHO estimated rates of sputum smear positive pulmonary TB  $> 15/100,000$  population
- Use of interferon-gamma releases assays
  - Average sensitivity (80%) and specificity (97.5%)

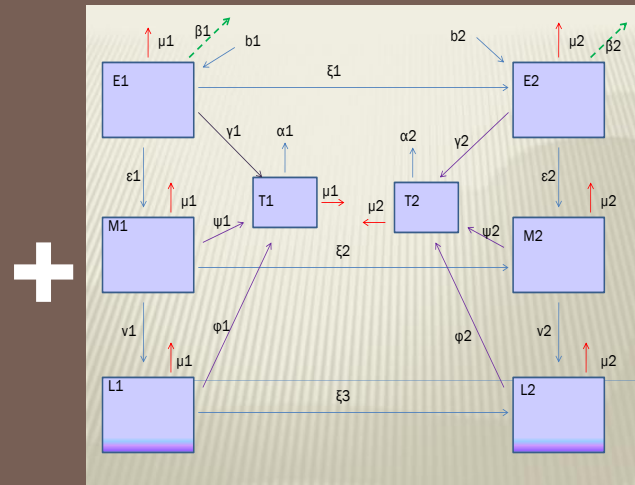
## ◎ 90% treatment efficacy

# The Model

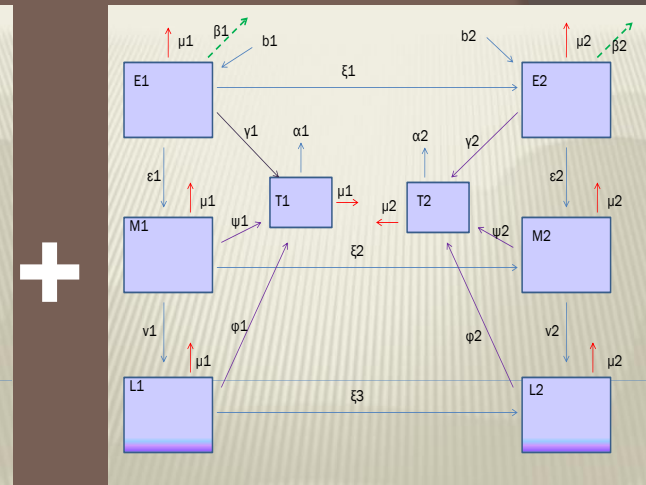
WHO Risk Group  
<15/100,000 pop



WHO Risk Group  
15-50/100,000 pop



WHO Risk Group  
>50/100,000 pop



# Preliminary models suggest:

Estimated Reductions in Foreign-born Tuberculosis Incidence Rates				
WHO Risk Groups	<35 yrs old at arrival		All arrival ages	
	50% screened	100% screened	50% screened	100% screened
15-50/100,000 pop	9%	← 12% →		26%
>50/100,000 pop	16%	← 26% →		37%
>15/100,000 pop	25%	← 37% →		51%

# Screening and Treatment of LTBI: Key Points

- The feasibility of screening\* for LTBI is expected to improve dramatically:
  - interferon-gamma release assays (IGRAs)
  - shorter course LTBI treatment regimens
- Targeted screening of new immigrants over a prolonged period of time could appreciably decrease foreign-born TB incidence
- It is anticipated that screening for LTBI among selected new immigrants will become a major component of the Canadian TB strategy

\*The term “screening” also implies the provision of treatment to those found to be positive

# Conclusions

- ◎ Foreign-born TB incidence is unlikely to decrease
  - Increases in annual immigration levels
  - Unchanging immigration patterns or even possible shift to even higher WHO risk group countries of birth
    - sub-Saharan Africa, Haiti, etc.
- ◎ Will significantly hamper efforts to reduce national TB incidence rate

# Acknowledgements

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  - Citizenship and Immigration Canada

# Questions

Thank you!