

# Modeling TB Control in the Inuit in Northern Canada : 1950- today

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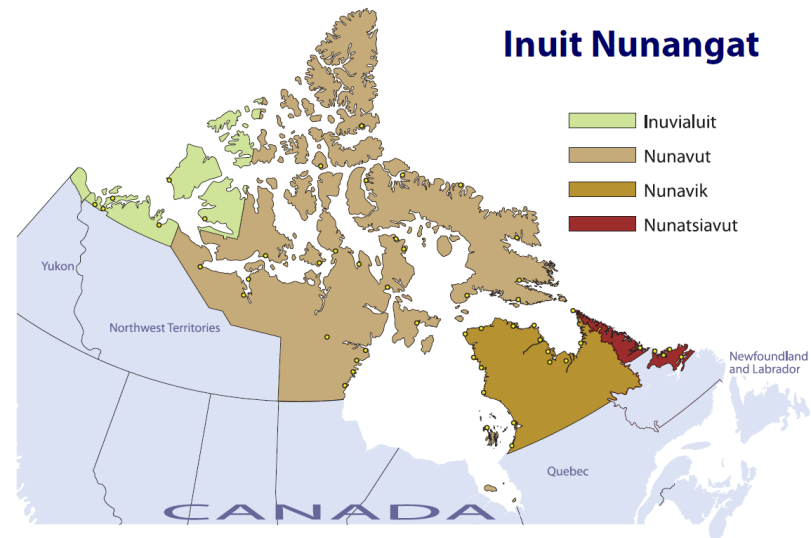
TB-MAC meeting

# Objectives

- Summarize the epidemiology of TB in the Inuit population in Northern Canada
- Describe some of the TB specific interventions/active case finding strategies that have been implemented in the Arctic over time
- Describe how this has been integrated into our models
  - From 1948-2000
  - From 2001-2015

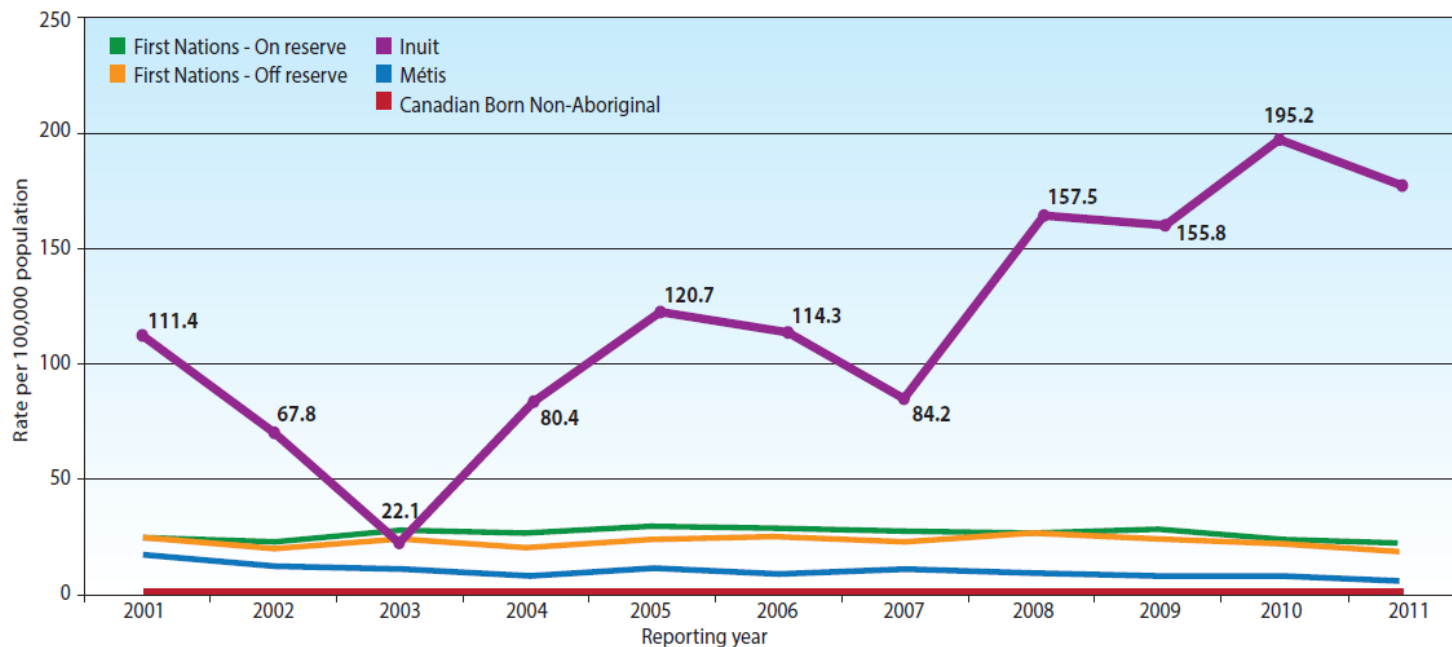
# Inuit Population and Land

- 2011 Inuit population: approx 60,000 people
  - 4.2 % of total Canadian Aboriginal population
  - 0.2% of total population of Canada
- Main territory is Nunavut (ᓄᓇᓂᓪ) (previously this land was part of the Northwest Territories (NWT))



# TB Epidemiology in the Inuit

Figure 1: Incidence rate of TB disease by Aboriginal group compared with Canadian-born non-Aboriginals, 2001 – 2011\*



\*Note: 2011 date provisional until release of Tuberculosis in Canada, 2011  
Source: Canadian Tuberculosis Reporting System, 2013 [4]

- In 2015, the Inuit population had a TB incidence rate of 166 per 100,000

# Historical perspective- TB incidence

S14 Grzybowski, Styblo and Dorken

200/100,000 

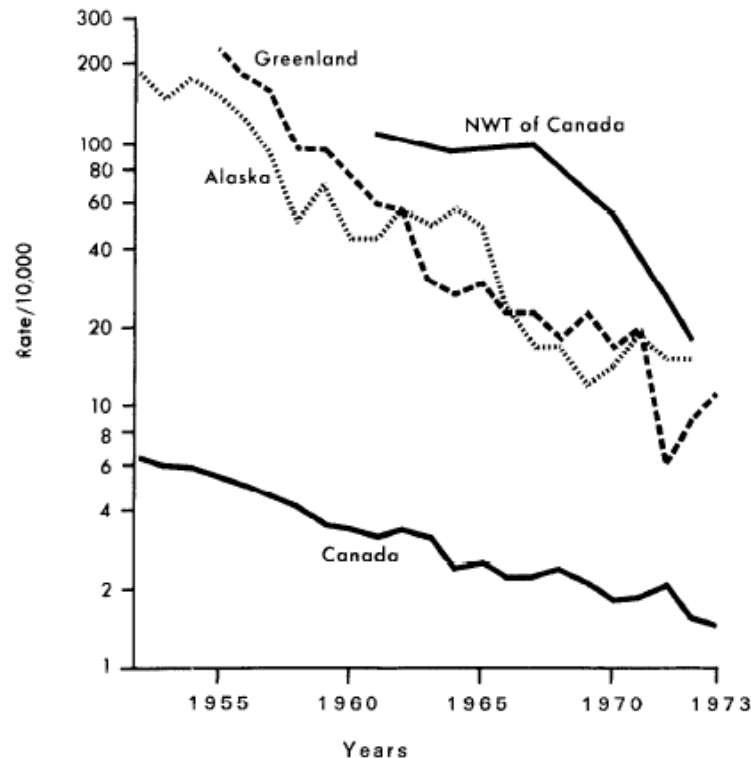


Figure 4 Incidence of new active tuberculosis (rates per 10 000) among the Eskimos of the Arctic : Greenland, Alaska and NWT of Canada ; and total population of Canada, 1952-73.

[Grzybowski S](#), [Styblo K](#), [Dorken E](#). Tuberculosis in Eskimos. [Tubercle](#). 1976 Dec;57(4 Suppl):S1-58.

# Historical perspective- TB mortality

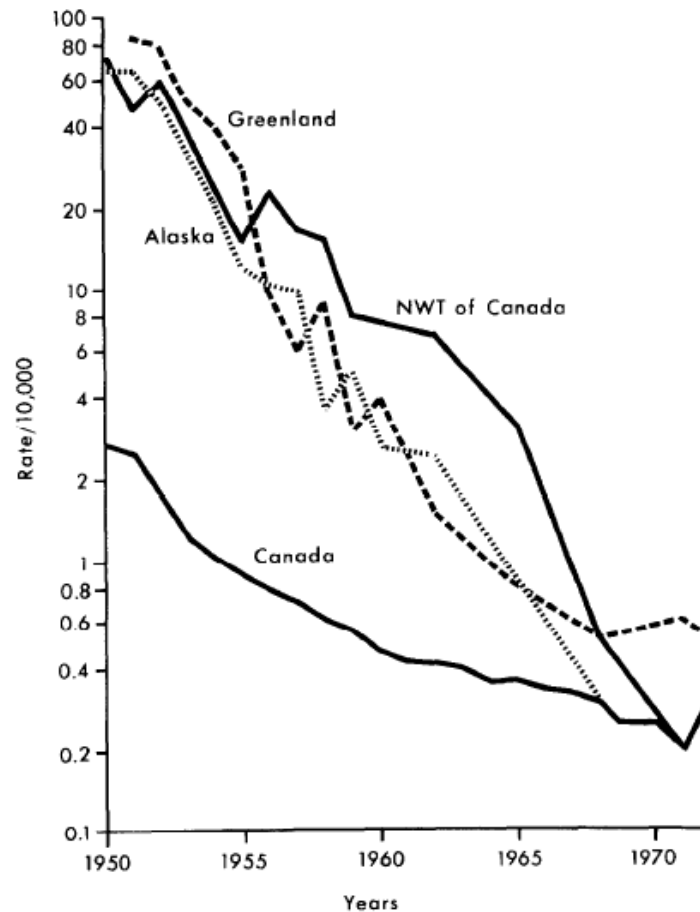


Figure 3 Tuberculosis death rates (per 10 000) among the Eskimos of the Arctic ; Greenland, Alaska and NWT of Canada ; and total population of Canada, 1950-72. Note: Alaska data includes Eskimos and Indians.

[Grzybowski S](#), [Styblo K](#), [Dorken E](#). Tuberculosis in Eskimos. [Tubercle](#). 1976 Dec;57(4 Suppl):S1-58.

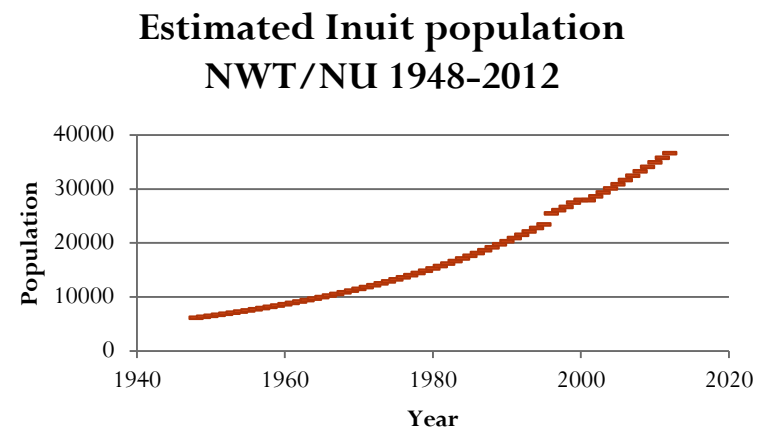
# TB Control Programs over time (NWT)

Table V. Tuberculosis control programme summary among Eskimos – Greenland, Alaska and NWT of Canada

<i>Eskimo population</i>	<i>Greenland</i> 22 700 (1951)	<i>Alaska</i> 22 300 (1960)	<i>NWT of Canada</i> 8000 (1961)
<i>Treatment</i>			
(a) In-patient	since 1951 (3745 persons treated between 1951 and 1968)	since 1953 (670 hospital beds for treatment of tb patients in 1953)	since 1955
(b) Out-patient	only recently	since 1954	only recently
<i>Diagnosis</i>			
(a) Indiscriminate case-finding by means of mass miniature radiography and the general hospital system	since 1955 (annually)	since 1954 (annually)	since 1955, but extensively since 1967 (annually or bi-annually)
(b) Bacteriological examination of sputum (by microscopy and on culture)	suspicious cases found at x-ray surveys	all individuals with x-ray evidence of tuberculosis	all individuals with active, inactive and presumably inactive tb. Since 1968, frequent bacteriological examination of individuals with productive cough used for diagnostic purposes. BCG rendered interpretation difficult. Larger reactions to 5 TU assumed due to tb infection
(c) Tuberculin test	not used for diagnostic purposes (BCG)	widely used (in children)	irregularly since the late 1940s; intradermal BCG on a large scale since 1965
<i>BCG</i>	since 1949; complete coverage by 1955	1949–1953 (2000–3000 persons vaccinated); no BCG since 1953	irregularly since the late 1940s; intradermal BCG on a large scale since 1965
<i>Chemoprophylaxis</i>	1956–57 (4000 non-tuberculous adults; 30 % protection)	extensive use since the mid-1950s	1967–73 (1794 persons)

# During the same time period...

- Rapid population growth
- Transition from a nomadic lifestyle and reliance on “country food”
- Very high levels of behaviour mediated risk factors (ex. 91% adult population “smokers” in 1960)





# Models

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# Model 1 (1948-2000)

- Dynamic model that accounts for natural history of TB, TB specific interventions and changing prevalence of behaviour related risk factors (here smoking only)

## Phase 1: 1948-1966- Period of “Natural decline”

- No widespread TB specific intervention in place
- Unchanging smoking prevalence
- Assume that all change in TB epidemiology comes from improvements in standard of living

## Phase 2: 1967-2000

- “Natural decline” in TB continues
- Sequential introduction of TB interventions (BCG, active case finding +tx, & IPT)
- Smoking prevalence starts to decline according to observed data

# Active Case Finding activities

- 1946- “obvious” active cases were evacuated South to sanatoria.
- Treatment started in late 40s
- No on-site plan for “TB control”

Eastern/ Western Arctic:

- Early 1950s- Chest X ray Surveys: C. D Howe “hospital ship” started to tour every summer with onsite X-ray equipment
- Once diagnosed, many Inuit were not permitted to leave the ship
- Active cases sent to Ontario (2,500 Km away) for TB treatment



*“During our time in both Iqaluit and Igloolik, many of the Elders spoke with piercing, eviscerating intensity, about their own trips to Hamilton [Ontario]...when they were children, or the trips made by family members. In every case, they wept unashamedly. It was hard for everyone present to retain emotional control. The stories were truly the narratives of nightmares. Mothers, fathers, grandparents were wrenched, abruptly, suddenly, heartlessly from their families. They disappeared for years, some never to return. Children were pulled from the arms of their parents and taken south, treated cruelly, were uncomprehending, lost their language — I repeat, lost their language — and returned home unable to communicate...”*

Stephen Lewis, September 9<sup>th</sup> 2017

<https://aidsfreeworld.org/commentary/2017/9/9/statement>



The Necessities of Life/ Ce qu'il faut pour Vivre

# ACF and other interventions

Central Arctic: pursued ACF in the early 1960's and expanded gradually

- increasing the frequency of mass community surveys
- installing X-ray equipment in nursing stations located in practically every Inuit settlement
- Late 1960's: Sputum exams began to be used as a primary diagnostic tool
- sputum specimens collected from any patients presenting with a chronic productive cough
- Examination of "household contacts"
- By 1970s local general hospitals started treating patients in the North
- BCG and IPT also applied extensively starting in the mid to late 1960s

# Key Model assumptions- TB control activities

## Case detection

- Prior to 1968: Very few TB cases diagnosed and treated
- Starting in 1968: 10% TB cases diagnosed and treated
- 1969-1980: 8% (absolute) increase per year until 90% case detection
- 1980 onwards: 90% case detection

## IPT:

- 1969: 1% LTBI cases treated
- 1970- 1993: 1% (absolute) increase per year until it reaches 25%
- 1993 onward: 25% LTBI cases treated

Data Adapted from: [Grzybowski S, et al.](#)

# Key Model assumptions- Smoking

## Prevalence of risk factor

- Initially fixed smoking prevalence of 90%
- Declines by 1.2% per year, according to observed data
- No specific intervention to reduce smoking included in this model

## Impact of smoking on TB

- As described in Lin et al.
- Smoking increases risk of infection, progression/reactivation and mortality

[OPEN ACCESS](#) Freely available online

PLOS MEDICINE

### Tobacco Smoke, Indoor Air Pollution and Tuberculosis: A Systematic Review and Meta-Analysis

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# Model 1 (1948-2000): Results

## Annual Risk of TB Infection in Nunavut

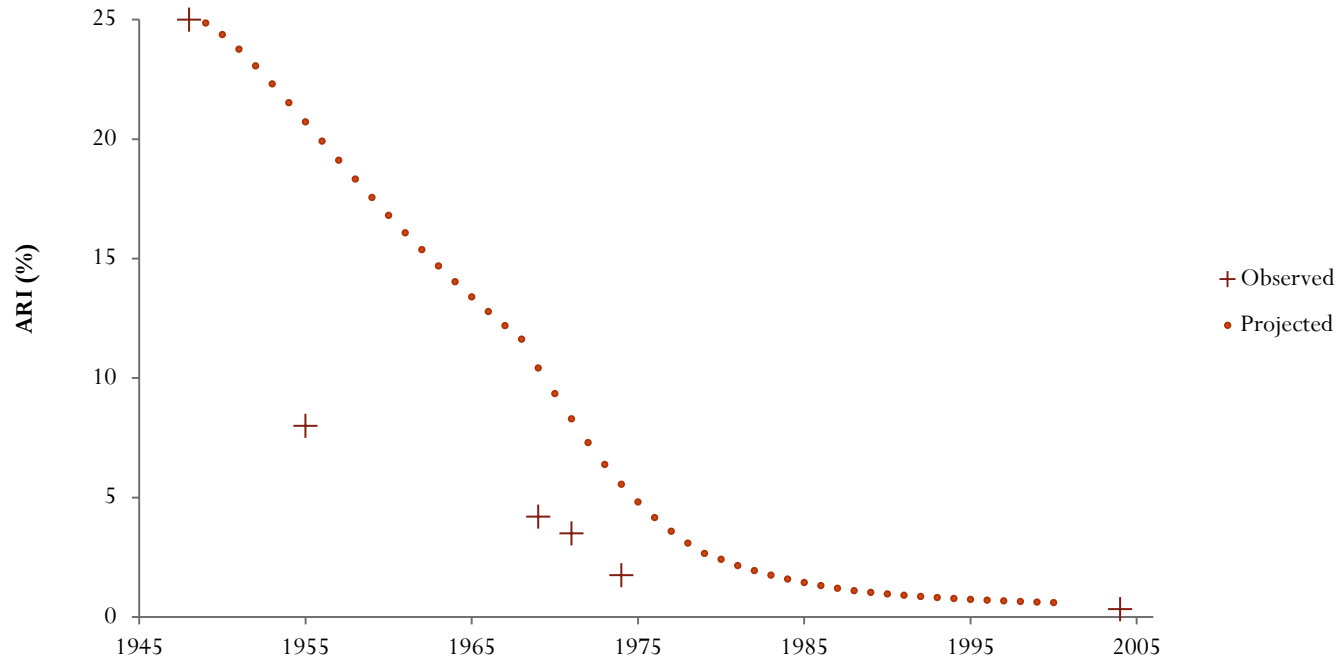


Figure 1a: Observed and projected ARI, 1948- 2000

# Model 1 (1948-2000): Results

## TB incidence in Nunavut

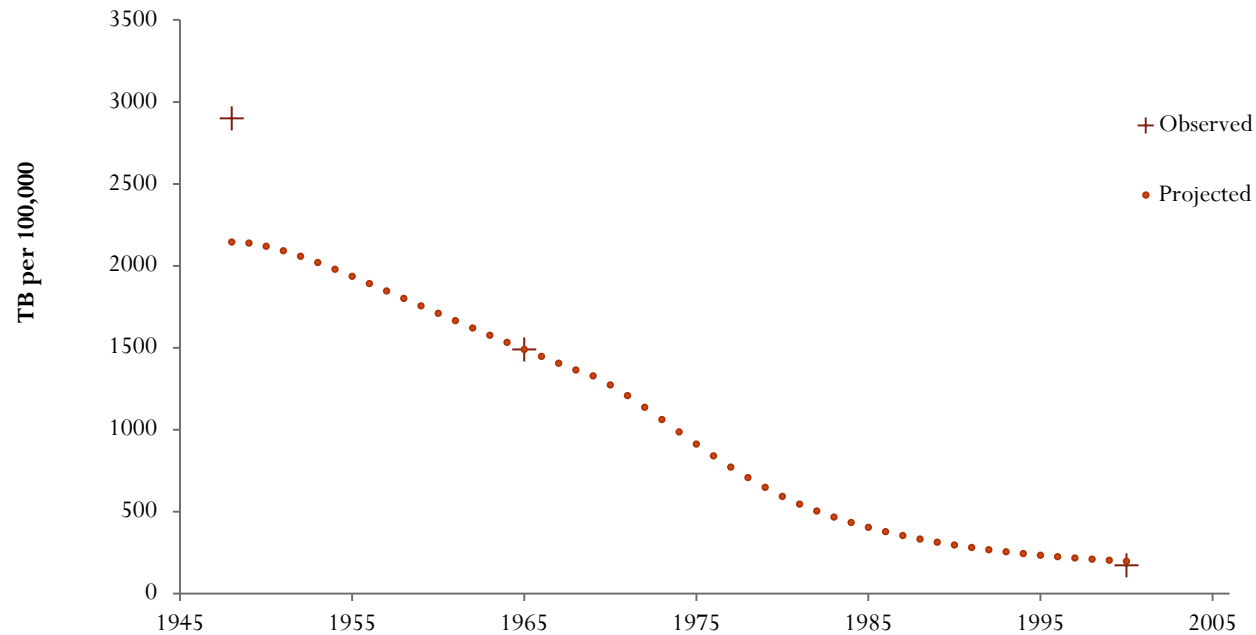


Figure 1b: Observed and projected incidence, 1948- 2000

# Model 2 (2001-2015)

- Transition from active case finding to passive case detection through 80's and 90s (better local health services – detection and follow up tends to be high)
- Despite this consistent increases in TB rates observed from early 2000 onwards
- In our model this has been attributed to increases in behaviour mediated related risk factors

# Model 2 (2001-2015): Results

## TB incidence in Nunavut

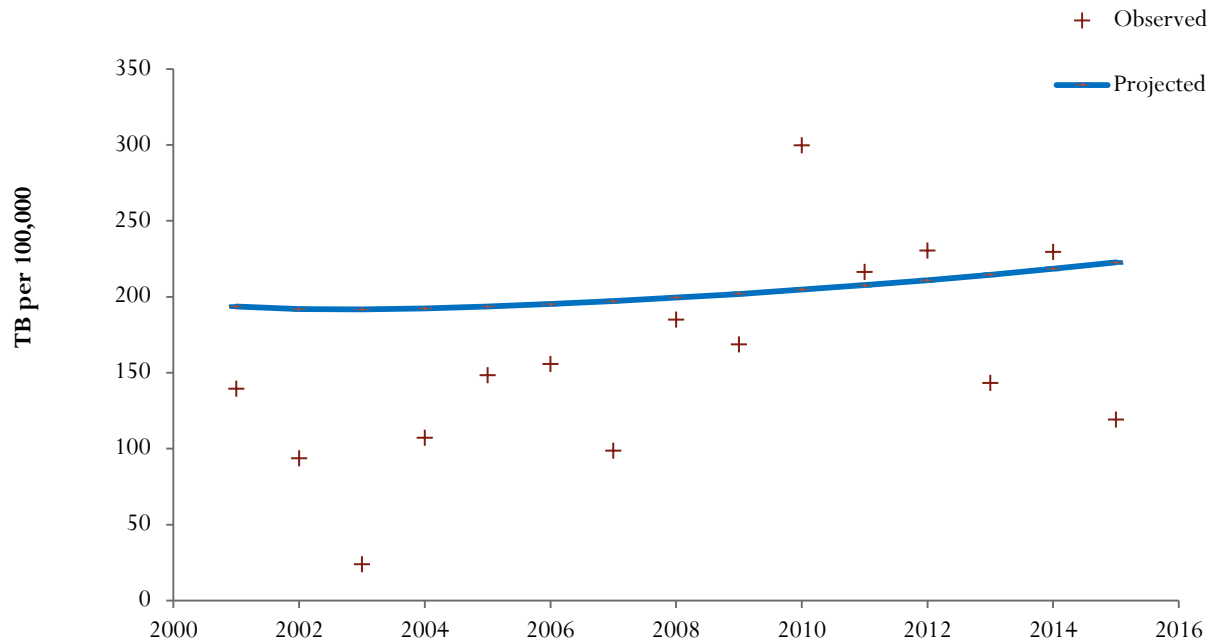


Figure 2: Observed and projected TB incidence , 2001-2015

# Conclusions

- TB situation in the Inuit remains a serious problem
- The epidemiology and control response is unique and complex
- Active case finding was just one response among many, over different time periods
- Have to think carefully as to how it all fits together and is incorporated into the model
- Always have to be mindful with respect to what is both acceptable and a priority for the Inuit themselves
- Recently, have seen renewed efforts to reach out....

# TAIMA (Stop) TB: The Impact of a Multifaceted TB Awareness and Door-to-Door Campaign in Residential Areas of High Risk for TB in Iqaluit, Nunavut

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