Mass Screening for Tuberculosis Infection and Active Tuberculosis in Children < 16 years old in Nunavut, Canada

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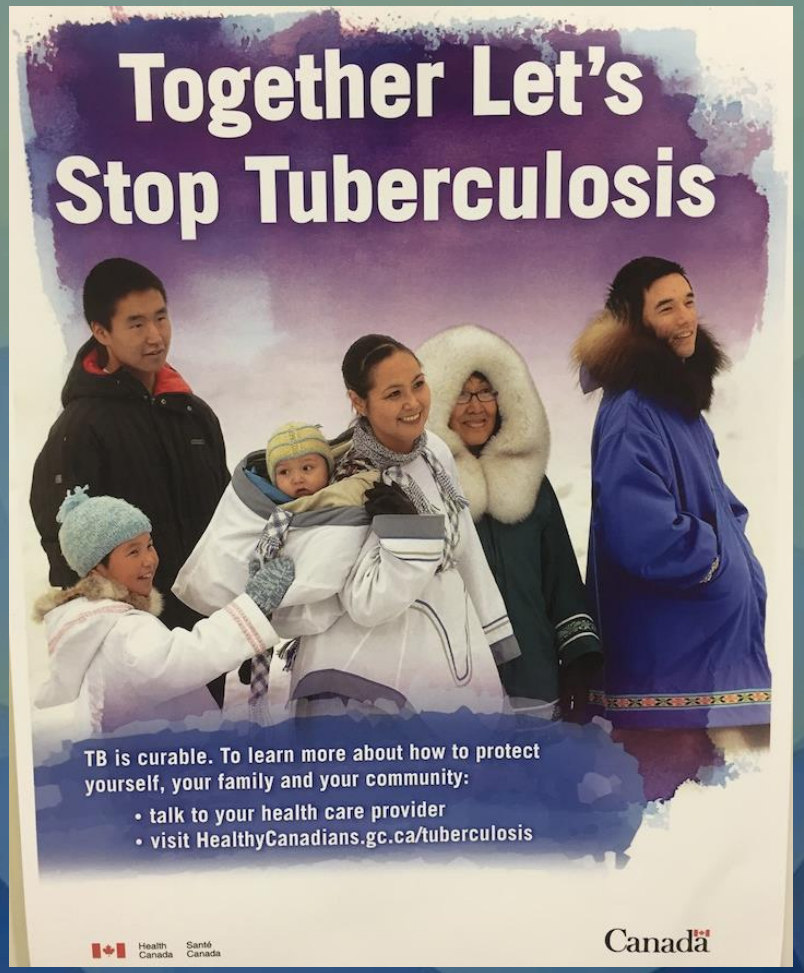


Land Acknowledgement

- The University of Manitoba campuses are located on original lands of Anishinaabeg, Cree, Oji-Cree, Dakota and Dene peoples, and on the homeland of the Métis Nation. We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of reconciliation and collaboration.

Objectives

- 1. Describe the demographic and epidemiologic characteristics of Inuit children < 16 years old who attending mass community-wide screening in Nunavut, Canada.

- 2. Describe the diagnostic results and clinical outcomes of Inuit children < 16 years old who attended mass community-wide screening in Nunavut, Canada.

- 3. Identify public health interventions that could reduce the risk of TB infection and disease in this population.

Conflict of Interest

- Nothing to disclose

*Ethics

- The data presented is considered to be owned by the Inuit persons/communities involved
- Community approval was required
- REB approval by: University of Manitoba, Johns Hopkins University, and the Nunavut Research Institute

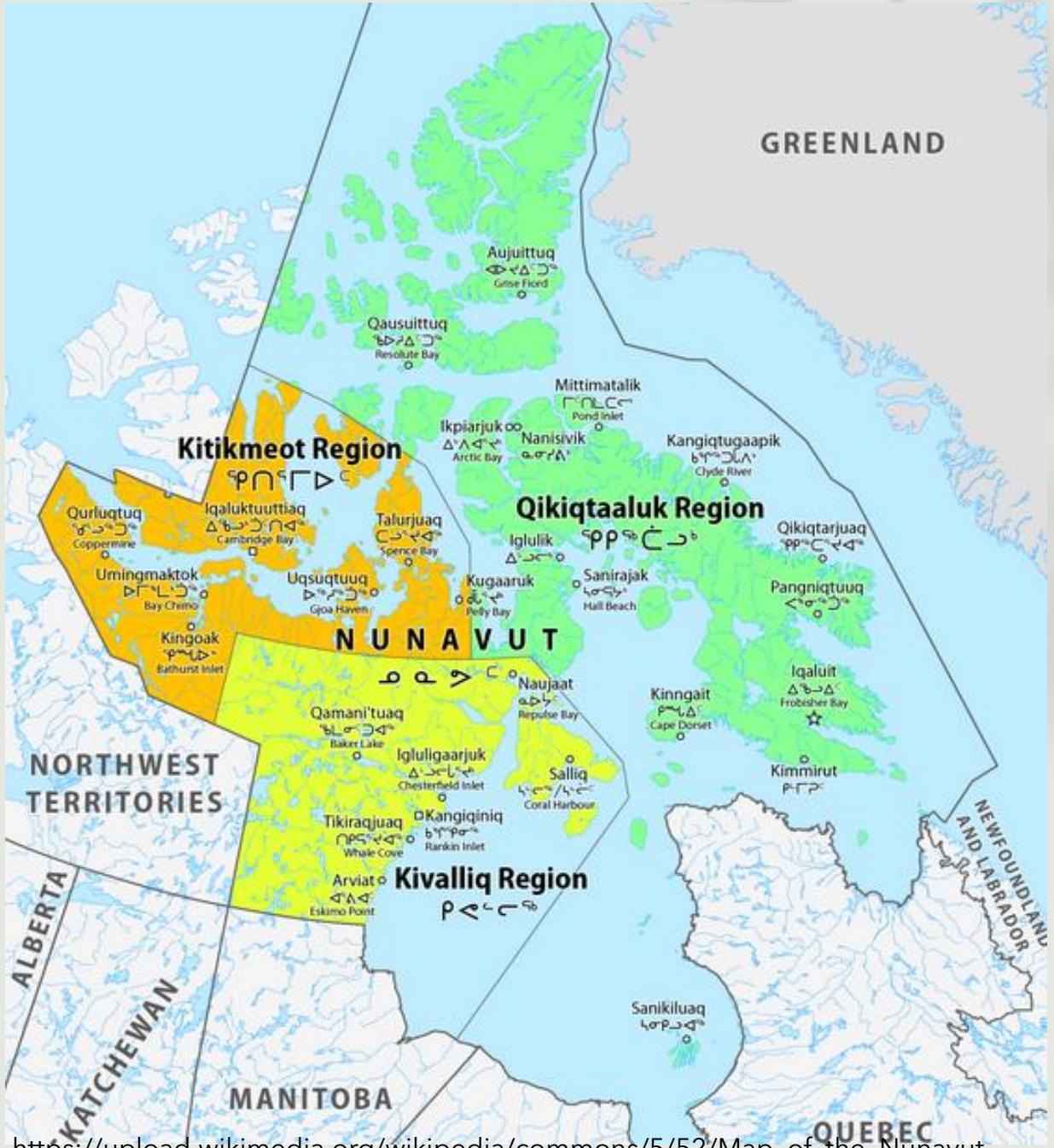
The Setting-Inuit Nunangat

- Homeland of the Inuit people
- Inuit are a group of Indigenous people that inhabit the Arctic regions of Canada
- Four regions
- Nunavut- region of TB screening activities

https://www.rcaanc-cirnac.gc.ca/eng/1623352635700/1623352671979

The Setting-Nunavut

- Nunavut is the largest territory in Canada (land mass)
- Pop. ~34-36,000
- Subdivided into three regions
- 25 communities
- Screening clinics took place in three communities
- Only way to access communities is by air or sea, no roads



https://upload.wikimedia.org/wikipedia/commons/5/52/Map_of_the_Nunavut_regions.png

Iqaluit, Nunavut

= -33 Farenheit

The History

- Limited written information on rates of TB until mid-twentieth century
- As told by “European settlers”: Communities (coastal) which had contact with Europeans had higher rates of disease (i.e. “consumption”, typhoid, measles, pneumonia etc.)
- Estimates in 1940s, communities in the Northwest Territories, that the death rate from TB was 315/10,000 vs. 5.2/10,000 in non-Indigenous Canadians

Grzybowski S, Styblo K, Dorken E. Tuberculosis in Eskimos. Tubercle. 1976 Dec;57(

The History

- Late 1940s: Indian Health Services evacuated known active cases to sanitoria in southern Canada
  - Average length of stay in 1960s ~ 18 months
- BCG: Introduced in 1940s, not widely used until 1960s
- 1950s: Chest x-ray surveys
  - Eastern arctic: “C.D. Howe” ship > concerning CXR evacuated immediately
- 1950s: Estimated incidence 1500-2900/100,000

Grzybowski S, Styblo K, Dorken E. Tuberculosis in Eskimos. Tubercle. 1976 Dec;57(

CMAJ, March 5, 2013, 185(4)

The History

- With introduction of chemotherapy death rate and incidence declined
- 1960s: Mass testing, treatment (similar to Alaska) for TB infection > decline
- 1970s Inpatient hospitalization length of stay reducing to a few months
- Late 1970s Integration of TB program into routine health care programming at local health centres
- Decreasing incidence, periodic community outbreaks, with many case contacts
- 1997: Incidence 31/100,000

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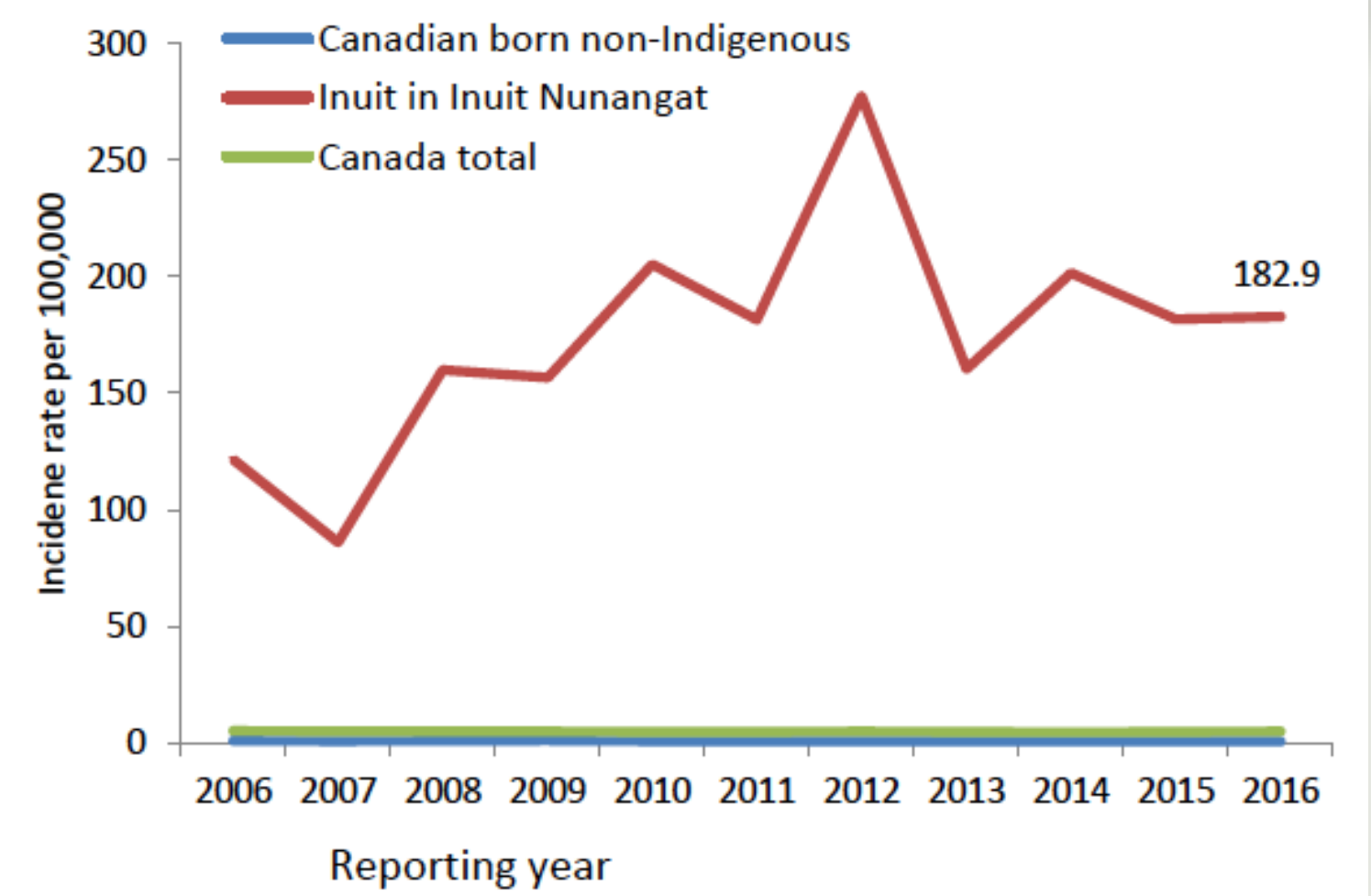
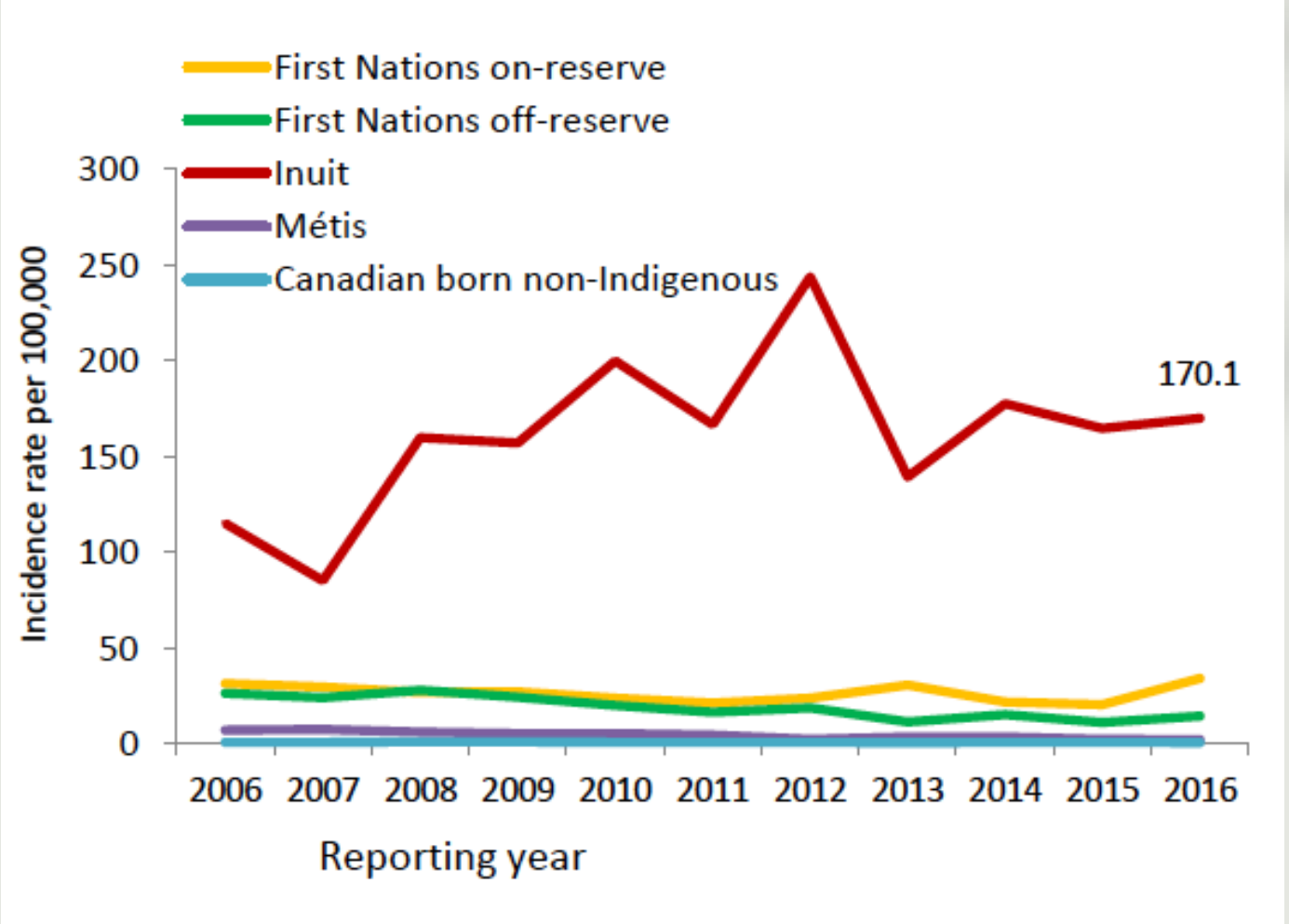
The History



https://www.itk.ca/wp-content/uploads/2018/12/FINAL-ElectronicEN-Inuit-TB-Elimination-Framework.pdf

The History



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Healthcare

- Baseline challenges: small population, great distances between communities, weather, reliance on air travel
- Each community is served by a Health Centre
- Each Health Centre (ideally) is staffed by nurses all the time, and a doctor intermittently
- Basic testing (i.e. chest x-ray, sputum collection, bloodwork) can be performed in community
- Send samples by air to larger centres

https://www.oag-bvg.gc.ca/internet/english/nun_201703_e_41998.html

Healthcare

Exhibit 2—For selected indicators, the population of Nunavut has a lower health status than the Canadian average

Health indicator	Nunavut	Canada
Life expectancy at birth (years) (2007–2009)	71.6	81.1
Infant mortality (per 1,000 live births) (2012)	21.4	4.8
Smoking rate (population aged 12 and over who reported being a current daily smoker) (2013–2014)	60.6%	18.7%
Respiratory diseases, deaths (such as pneumonia, influenza, and bronchitis) (age-standardized rate of death per 100,000 population) (2005–2007)	182.9	45.0
Suicides and self-inflicted injuries, deaths (age-standardized rate of death per 100,000 population) (2012)	63.5	10.4

Source: Health Profile Nunavut: Information to 2014, Department of Health, Nunavut (2016). The numbers have not been audited.

https://www.oag-bvg.gc.ca/internet/english/nun_201703_e_41998.html

Healthcare

- Most healthcare personnel are not from Nunavut
- Difficulties in healthcare worker retention
- Currently very short staffed (with some centres closed) due to COVID

https://www.oag-bvg.gc.ca/internet/english/nun_201703_e_41998.html

TB in Inuit Children

- 2017: Incidence rate of active TB ~ 200/100,000 persons
- Highly exposed population of children
- No separate analyses available to describe this population, their TB related outcomes

Community-Wide Screening Clinics

- 2018-2019: Three entire communities in Nunavut were screened for TB infection and disease
  - Qikitarjuaq, Whale Cove, Kinngait
  - Population size: ~ 150- 500 persons/community
- Included children (often left out of mass screening campaigns)
- Screening method: symptoms, exposure, past TB history, TST (if eligible), CXR, sputum (if possible) for PCR/smear/culture
  - TST positive: >= 5 mm with contact, >= 10 mm no contact known
- Participants: any child < 16 yo that registered for a screening clinic
  - Retrospective database review using data collected from these clinics

Community-Wide Screening Clinics

Overarching goal: Provide "gold-standard" care to residents in their own community

Demographic Characteristics

	Clinic Location							
	Community 1		Community 2		Community 3		Total (n=791)	
	Median	IQR	Median	IQR	Median	IQR	Median	IQR
Age (months)	84	(41,132)	84	(36,129)	84	(40,132)	84	(40,132)
Weight (kgs)	25.8	(17.4,39.5)	27	(17,40)	26.9	(16.7,44.1)	26.5	(17.1,40.6)
Height (cms)	122	(100,142.8)	124.5	(102,143.5)	115.1	(58,172.2)	122	(100.5,143)
Body Mass Index (kg/m^2)	18.5	(17,20.8)	19.4	(17.5,23.3)	23.4	(17.9,28.9)	18.6	(17.1,21.2)
Residents/household	5	(4,7)	5	(4,6)	6	(4,7)	5	(4,7)
Rooms/household	3	(2,3)	3	(2,3)	3	(2,4)	3	(2,4)
Number of Previous TB Contacts	1	(0,1)	2	(1,3)	0	(0,0)	1	(0,1)

Demographic Characteristics

	Clinic Location							
	Community 1		Community 2		Community 3		Total (n=791)	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Female sex							365	46.1%
BCG vaccinated							723	97.4%
Current Smoker							52	6.6%
Current Alcohol Use							2	0.3%
Contact with Corrections							1	0.2%
Currently Pregnant							2	0.5%
Current Rec Drug Use							40	5.1%
Currently Breastfeeding							1	0.3%
Smoking in Household	Percentage: Low 4.5%, High 45.9%						128	18.9%

TB History

	Clinic Location							
	Community 1		Community 2		Community 3		Total (n=791)	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Reported Previous TB Contact	Percentage: Low- 21.7%, High-81.6%						382	59.8%
Prev TST ≥ 5 mm							164	30.9%
Prev TST ≥ 10 mm	Percentage: Low- 8.9%, High- 28%						126	23.7%
Previous Active TB Diagnosis							15	1.9%
Completed Active TB Treatment							14	93.3%
Previous LTBI Diagnosis	Percentage: Low- 5.5%, High- 34%						180	22.8%
Completed Previous LTBI Treatment							147	96.1%

Symptom Summary

	Clinic Location							
	Community 1		Community 2		Community 3		Total (n=791)	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Cough	Percentage: Low= 4.2%, High= 22.7%						135	17.1%
Fever							44	5.6%
Weight Loss							15	1.9%
Fatigue							20	2.5%
Night Sweats							18	2.3%
Hemoptysis							4	0.5%
Shortness of Breath							15	1.9%

Testing Outcome, Diagnosis

	Clinic Location							
	Community 1		Community 2		Community 3		Total (n=791)	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
New Pos. TST Result	Percentage: Low- 5%, High- 10.3%						62	7.8%
Sputum GeneX Positive							1	0.7%
Negative Sputum Smear Result							242	100.0%
Any Positive Sputum Culture							5	4.4%
Abnormal CXR	Percentage: Low- 13.4%, High- 30%						188	24.8%
New LTBI	Percentage: Low- 5%, High-10%						57	7.2%
New Active TB							12	1.5%

Demographics and TB Infection

	TB Infection			
	Not TB Infection (n=542)		New TB Infection (n=66)	
	Median	IQR	Median	IQR
Age (months)	75.5	(33, 125)	55.5	(37,95)
Weight (kgs)	24.6	(39,21.1)	21.1	(15.2,31.6)
Height (cms)	118	(94,138.4)	107	(94,132.5)
Body Mass Index (kg/m^2)	18.5	(17,20.7)	18.5	(17.5,20.9)
Residents/household	5	(4,7)	5	(4,6)
Rooms/household	3	(2,4)	3	(2,3)
Number of Previous TB Contacts	0	(0,1)	0	(0,1)

OR: 3.1
P-value: .002
95% CI: (1.49, 6.44)

Demographics and TB Infection

	New LTBI Diagnosis			
	Not TB Infection (n=542)		New TB Infection (n=66)	
	Freq	Percent	Freq	Percent
Female sex	253	46.7%	28	42.4%
BCG vaccinated	487	96.4%	60	98.4%
Current Smoker	23	4.3%	1	1.5%
Current Alcohol Use	0	0.0%	0	0.0%
Contact with Corrections	1	0.2%	0	0.0%
Currently Pregnant	2	0.8%	0	0.0%
Current Rec Drug Use	18	3.3%	1	1.5%
Currently Breastfeeding	1	0.4%	0	0.0%
Smoking in Household	80	17%	12	20.7%

OR: 1.63
P-value: 0.93
95% CI: (0.75, 3.55)

Previous TB History, Symptom Screen, and Testing Summary by Active TB Outcome

	New Active TB Diagnosis			
	Not Active TB (n=779)		Active TB (n=12)	
	Freq	Percent	Freq	Percent
Previous Active TB Diagnosis	14	1.8%	1	8.3%
Completed Active TB Treatment	13	92.9%	1	100.0%
Previous LTBI Diagnosis	177	22.7%	3	25.0%
Completed Previous LTBI Treatment	145	96.0%	2	100.0%
Reported Previous TB Contact	374	59.5%	8	80.0%
Prev TST ≥ 5 mm	161	30.9%	3	30.0%
Prev TST ≥ 10 mm	123	23.6%	3	30.0%
Cough	131	16.8%	4	33.3%
Fever	43	5.5%	1	8.3%
Weight Loss	14	1.8%	1	8.3%
Fatigue	20	2.6%	0	0.0%
Night Sweats	18	2.3%	0	0.0%
Hemoptysis	3	0.4%	1	8.3%
Shortness of Breath	15	1.9%	0	0.0%
New Pos. TST Result	59	7.6%	3	25.0%
Any Sputum GeneX Positive	NA	NA	1	14.3%
Any Positive Sputum Culture Result	NA	NA	5	62.5%
Abnormal CXR	182	24.4%	6	50.0%

Public Health Implications

- High proportion of children < 16 yo previously exposed
  - 60% of those who registered
- High proportion of children with previous TB infection
  - ~ 25%
- Late diagnosis of index case?
- Subset of children with multiple exposures

Public Health Implications

- Increased odd of diagnosis of TB infection with exposure to indoor smoking (not statistically significant)
- Seen in other pediatric populations
  - South Africa, Peru
- Study from Peru showing reduction in risk if the index case quits smoking

Public Health Implications

- Increased risk of TB infection if < 5 yo
  - No difference between number of known contacts
- High risk of developing active disease
- Where are these children being infected?
  - Household? Community?

Public Health Implications

- Large number of children with cough, abnormal CXRs
- High burden of viral respiratory tract infections
  - Annual incidence rate of hospitalizations for viral bronchiolitis is 484/100,000 in children < 6 months old
- Difficult to apply symptom screening tools
- Shared risk factors

Next Steps

- Sharing the results with each community
  - Deferred due to COVID lockdowns
- Sharing the results with the TB Program
- Collaborations in the future based on community feedback

Acknowledgements

- Communities of Qikitarjuaq, Kinngait, and Whale Cove, Nunavut
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