

# A comparison of the cost effectiveness of Interferon Gamma Release Assays with Tuberculin Skin Testing for screening contacts, or new immigrants to Canada

Dick Menzies



Respiratory Epidemiology Unit  
Montreal Chest Institute,  
McGill University  
Canada



# Background-TB in Foreign Born

- In Canada - TB among the foreign born accounted for 67% of all reported cases (2002).
  - (In US - 51% of all TB cases in 2002 were among foreign born)
- Each year about 250,000 new immigrants to Canada
  - Over 80% from countries with high/inter TB incidence
  - Prevalence LTBI: >50% in adults at entry
  - Prevalence Active TB: 0.1-0.2% in other surveys

# Background- Contacts

- After diagnosis and treatment of active TB, contact investigation is second highest priority of TB control programmes
  - High prevalence of new TB infection
    - 20-40% among close contacts
  - High risk of progression to active TB
    - 2-7% in next 2 years
  - High prevalence of active TB
    - 1-3% of all close contacts

# Objectives

## Objectives:

- Compare the cost-effectiveness of QFT vs TST for:
- Screening immigrants at time of entry to Canada
  - Investigation of close and casual Contacts

## Populations:

- Examined 3 Hypothetical cohorts of Foreign born
  - Different incidence of TB, and BCG vaccination

## Outcomes:

- TB related costs – Direct, or government only
- TB cases prevented – after screening

# Study populations - Immigrants

Parameter	High Inc	Inter	Low
BCG Vaccination	at birth	in late childhood	none
Incidence of smear + TB (per 100,000)	120	60	2
Annual risk Infection	2.4%	1.2%	0.1%
Mean Age (yrs)	35	35	35
LTBI prevalence at entry	52%	27%	1.5%

\* HIV seroprevalence for all entrants assumed 0 due to current entry policy

# Study populations - Contacts

- At time of screening:
- Prevalence of new LTBI
  - Close contacts – 40%
  - Casual contacts – 8%
- Prevalence of TB disease
  - Close contacts – 3%
  - Casual contacts – 0.6%

# Screening strategies modelled

- 4 strategies for Immigrant screening
    - 1) CXR
    - 2) TST
    - 3) QFT
    - 4) Sequential - TST then QFT
- 
- 2 Strategies for Contact screening
    - 1) TST
    - 2) QFT
  - Each compared to a “no screen” scenario

# Screening Test Parameters

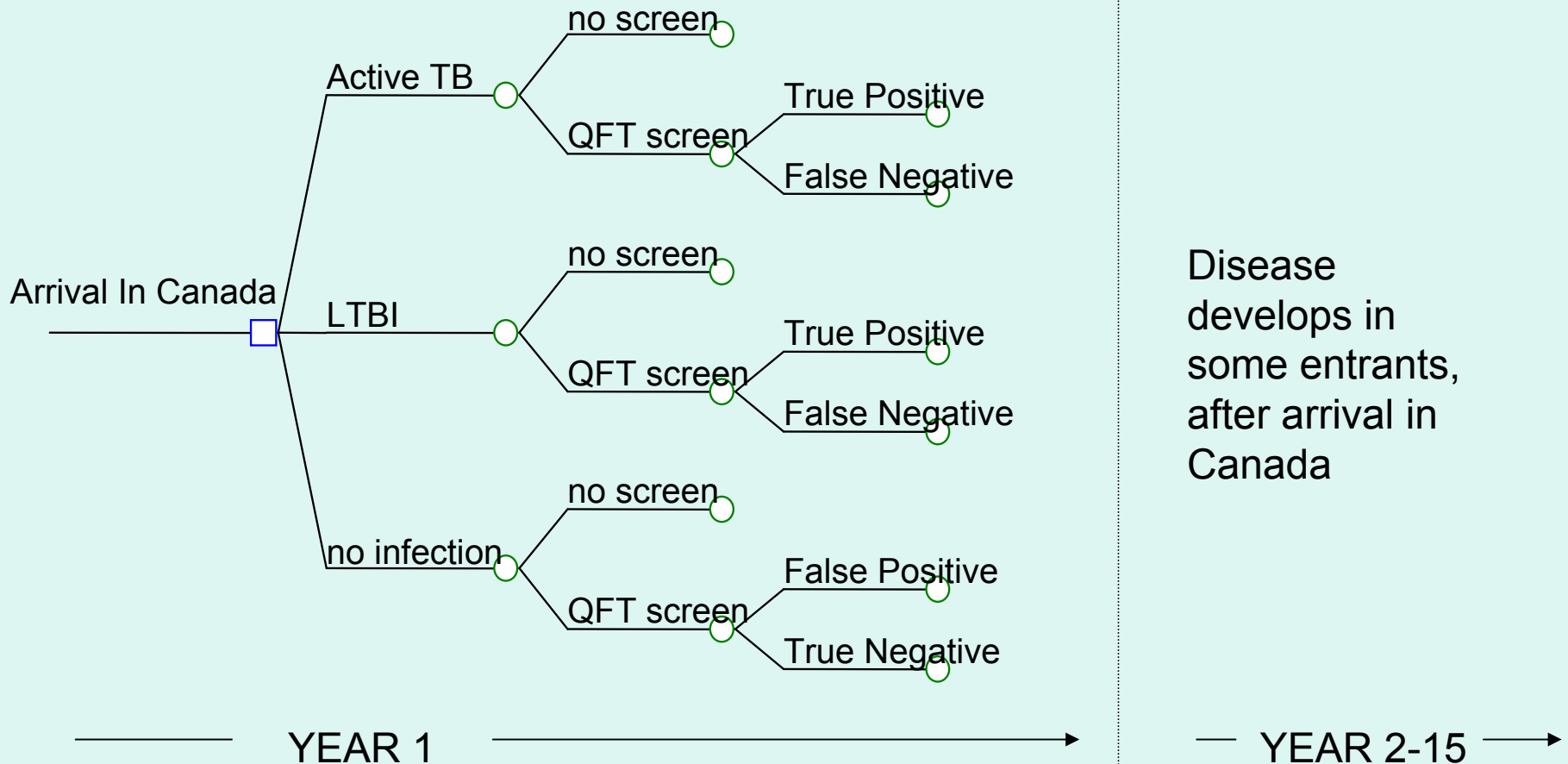
TEST	CXR	TST	QFT
Cost	\$26	\$13	\$49
Sensitivity Disease	100%	86%	86%
Sensitivity Infection	11%	95%	95%
Specificity	For disease: 98%	For infection: High: 96% Inter: 60% Low: 97%	For infection: High: 98% Inter: 98% Low: 98%

**NB: High-BCG infancy, Inter-BCG late childhood, Low-no BCG  
HIV negative population**

# Model

- Decision analysis model used (Treeage Pro 2005, Version 0.8)
- Used Markov modeling: allows for use of recurrent probabilities that change over time
- Follows cohorts over a 20 year time frame.
- 3% annual discounting

## Simplified Example showing QFT arms:



Model measures cumulative incidence over 20 year, after arrival, and total Costs associated with TB (screening and illness)

# **Results:**

# **Immigration screening**

# Cases expected

20 years after Entry (1,000 from each region)

Total New Cases: **NO SCREEN** strategy:

	High	Inter	Low
No Screen	15.7	9.8	0.4

Cases Prevented: **SCREENING** strategies:

CXR	0.8	0.5	0.02
TST or QFT	2.1	1.3	0.05
TST & QFT	2.0	1.25	0.05

NB. TST and QFT had the same sensitivity and therefore prevent the same number of cases

# Total cost difference

## Immigrant screening

	High	Inter	Low
CXR	\$700.	\$15,000	\$44,000
TST	\$103,500	\$128,000	\$21,500*
QFT	\$131,500	\$98,500	\$56,000

\*. The strategy of TST followed by QFT would be about 10% cheaper

# Cost per case prevented

## Immigrant screening

	High	Inter	Low
CXR	\$ 875*	\$ 31,000	\$2,187,000
TST	\$49,000	\$100,000	\$ 430,000
QFT	\$62,500	\$ 78,000	\$1,122,000

\*CHEAPEST STRATEGY IN GREEN. All costs are in CANADIAN \$

# **Results:**

# **Contact screening**

# Cases Expected or Prevented

Contact screening (1,000 from each region)

CLOSE CONTACTS: HIGH INTER LOW

No Screen	51.9	52.2	52.7
TST or QFT	3.7	3.8	4.0

Cases  
Expected

Cases  
Prevented

CASUAL CONTACTS	HIGH	INTER	LOW
No Screen	18.9	14.9	10.8
TST or QFT	2.1	1.5	0.8

Cases  
Expected

Cases  
Prevented

NB. TST and QFT had the same sensitivity and therefore prevent the same number of cases

# Total cost difference

CLOSE Contacts ( in 1,000 from each region)

	High	Inter	Low
TST	\$(256,000)	\$(266,000)	\$(357,000)
QFT	\$(228,000)	\$(273,000)	\$(322,000)

\* . CHEAPEST STRATEGY IN GREEN. All strategies would result in Savings

# Total cost difference

CASUAL Contacts (1,000 from each region)

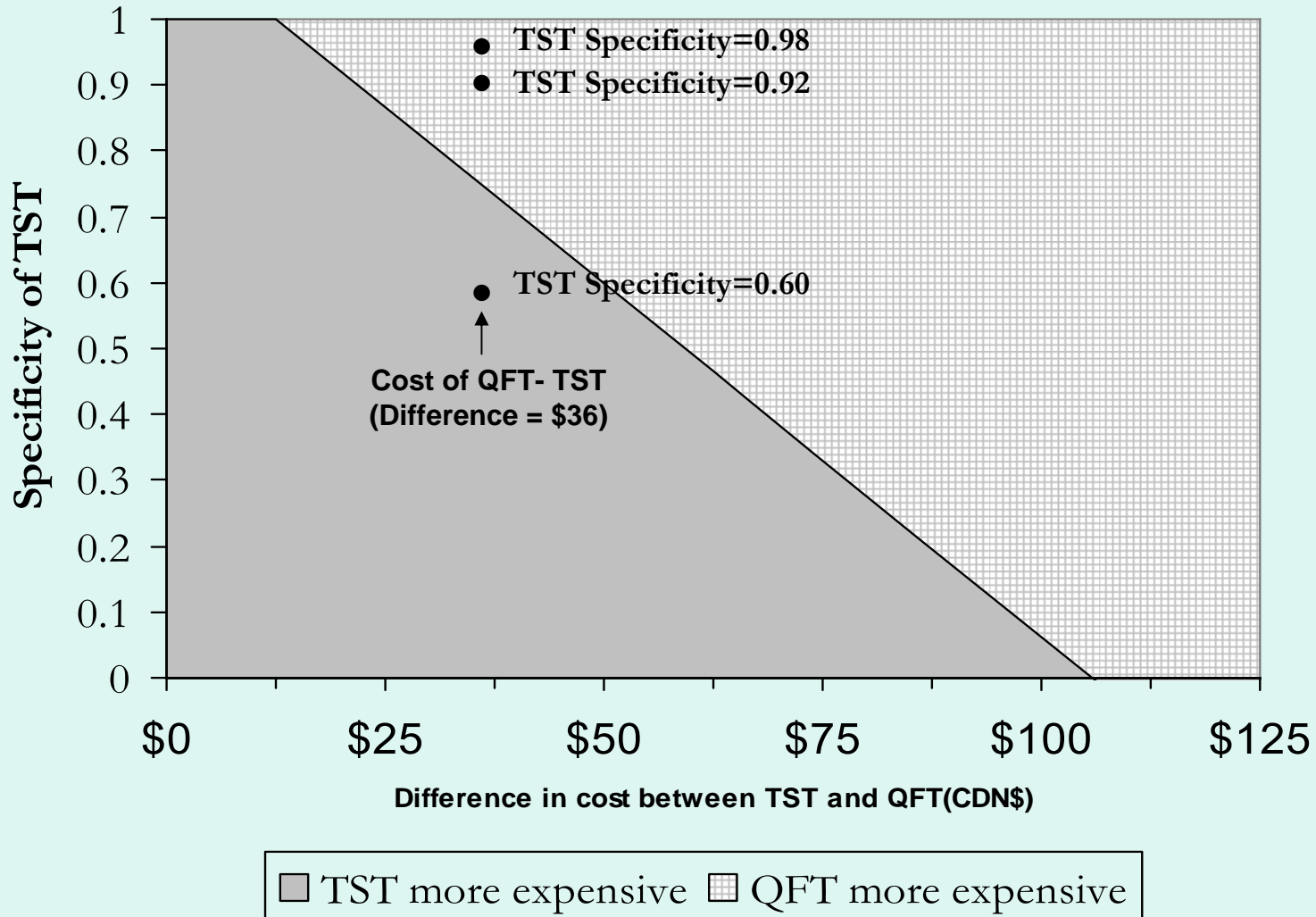
	High	Inter	Low
TST	\$57,000	\$66,000	\$(53,000)
QFT	\$84,000	\$35,000	\$(18,000)

\* . CHEAPEST STRATEGY IN GREEN. (Strategies with Savings in Parentheses)

# Sensitivity analyses

- Varying Specificity –
  - Main advantage of QFT is better specificity
  - What if difference more, or less?
- Sensitivity – TST same as QFT
  - What is effect if TST less sensitive?
- Cost – QFT is more expensive
  - And cost for T-\$pot is even higher
  - What if cheaper, or TST more?

# Cost minimization analysis – Varying TST specificity and the TST-QFT cost difference.



# Sensitivity analysis

- Changing programme efficiency
  - Usual programme conditions – 21% of all eligible actually complete 9INH
  - Efficient – 78% complete

# Costs and Cases prevented with Improved Immigrant entry screening program: 78% with LTBI complete treatment

	Routine (21%)	Improved (78%)
No Screen - Cases	9.8	9.8
CXR – Cases prevented	0.5	1.8
- Cost/case prevented	\$31,000	\$322
TST – Cases prevented	1.3	4.7
- Cost/case prevented	\$48,000	\$22,000
QFT – Cases prevented	1.3	4.7
- Cost/case prevented	\$76,000	\$30,000

# Costs and Cases prevented with Improved Close contact screening program: 78% with LTBI complete treatment

	Routine (21%)	Improved (78%)
No Screen - Cases	52.1	52.1
TST – Cases prevented	3.8	14
- Cost/case prevented	<b>SAVINGS</b>	<b>SAVINGS</b>
- Total SAVINGS*	(\$298,000)	(\$327,000)
QFT - Cases prevented	3.8	14
– Cost/case prevented	<b>SAVINGS</b>	<b>SAVINGS</b>
- Total SAVINGS*	(\$262,000)	(\$290,000)
* Relative to no screen		

# Conclusions (1)

- Immigrant screening programs are very expensive, and prevent few incident cases
- CXR performs better in Haiti and Russian cohorts and TST in US cohort
- QFT performs better than TST in specific populations (ie. where BCG has been given in late childhood), but it is not the best strategy for Immigration screening in any group
- TST then QFT, better than QFT alone – in all situations, and better than TST alone in a few.

# Conclusions (2)

- Contact screening programs are much more cost-effective, and have greater impact.
- Close contacts much better than Casual
- QFT performs better than TST in populations with BCG in late childhood.

# Conclusions (3)

- Trade-off between TST and QFT
  - At TST specificity of 75% - total costs are the same
  - If QFT costs are lowered, or TST costs higher then equivalence at higher TST specificity
- Minor differences in sensitivity will not affect relative cost-effectiveness much.

# Conclusions (4)

- Sensitivity analysis shows that improving program performance would be more cost effective, and have much greater impact, rather than the introduction of a new diagnostic test

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