Public Health Ontario | Santé publique Ontario

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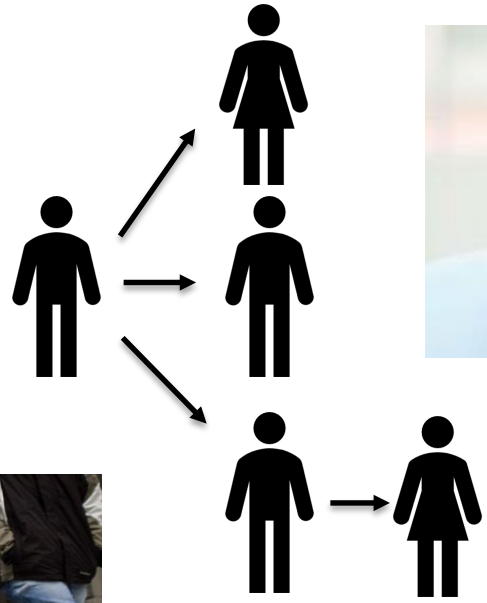
https://youtu.be/VmJfkLLtFio

Please scroll down this file to view a copy of the slides from the session.

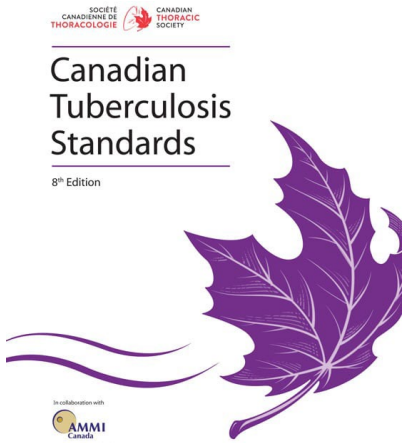
Tuberculosis: contact investigation 101



Dr Elizabeth Rea

Public Health Ontario rounds, Dec 5 2023

The plan



An overall framework

Exposure risk assessment

Approach to initial contact investigation

Practical issues

TB infection diagnostic and treatment updates from 2022 CTS (briefly!)

NOT a TB 101

But yes a TB contact investigation 101

A typical Ontario TB case

32 yr old man

Immigrated from India 5 years ago

Previously healthy

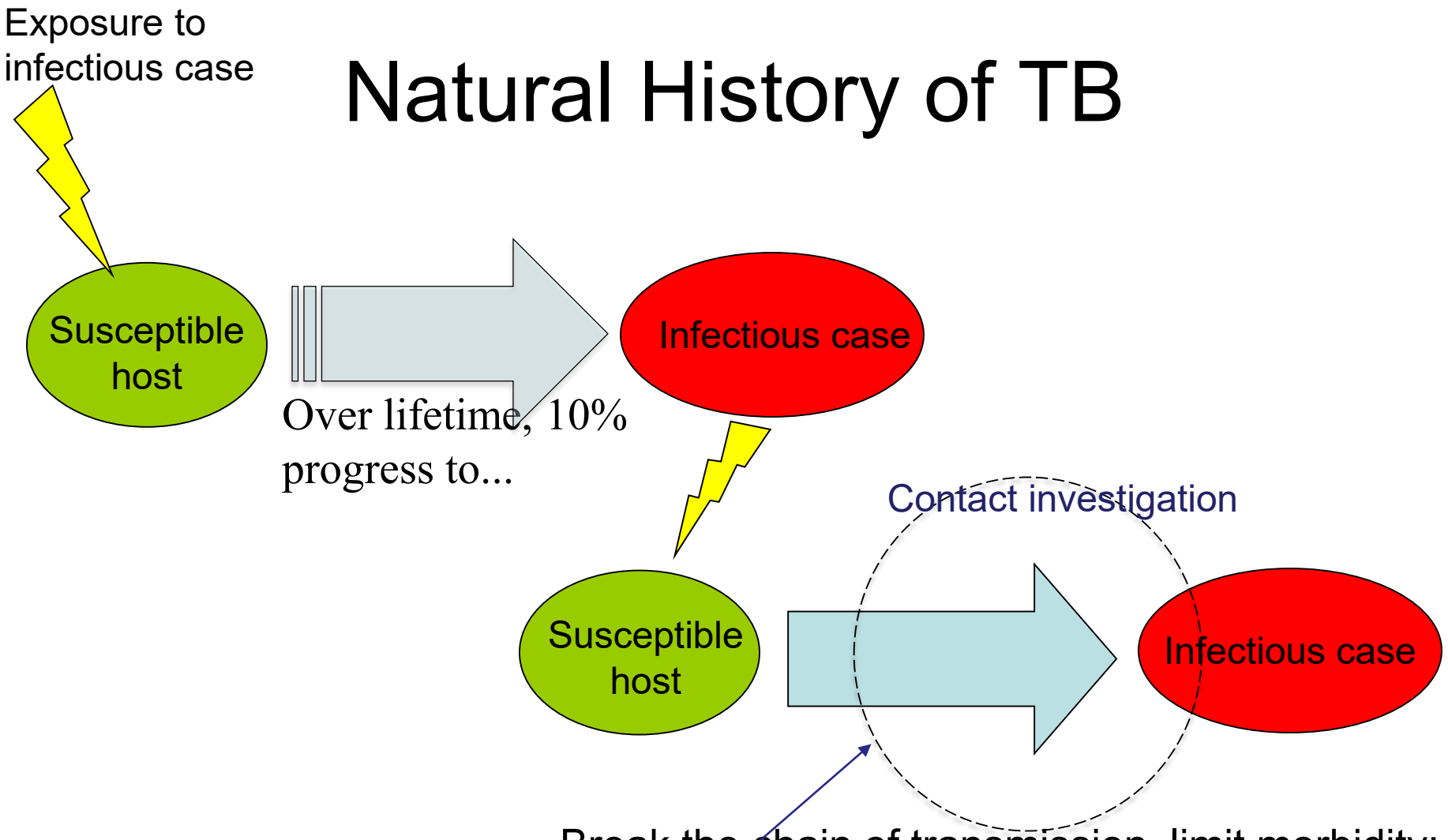
4 weeks progressive cough, fatigue, loss of appetite

1 week fever, night sweats

CXR = RUL infiltrates and opacities, no cavity

Sputum smear 3+ AFB, PCR +ve, culture positive @11 days, pan-sensitive

Natural History of TB



Break the chain of transmission, limit morbidity:

- Early detection of secondary cases (1%)
- Find source case (kids <5 only)
- Detection and treatment of (new) LTBI

Why do contact investigation?

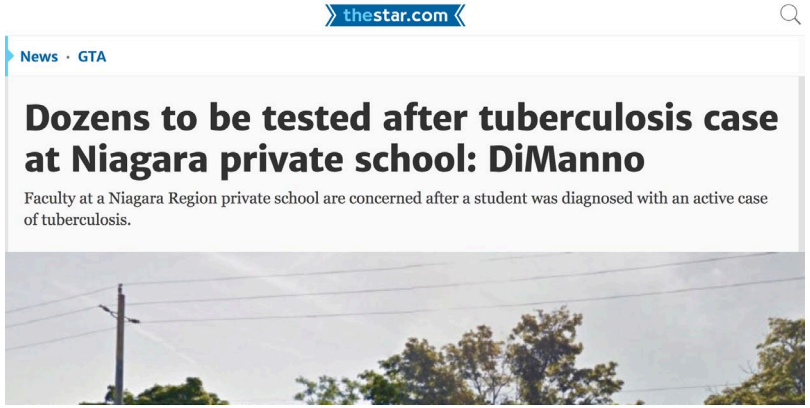
- Essential component of the WHO framework for TB elimination in high-income countries
- Highest yield group for case finding (prevalence of active TB 1000-2000/100,000)
- Contact tracing plus treatment of TB infection cost effective in multiple studies
- In modeling studies, household contact investigation with LTBI treatment may contribute as much as 18-27% to a decline in active TB incidence over 5-15 years, compared to no contact investigation and follow-up

Contact investigation for tuberculosis: a systematic review and meta-analysis | European Respiratory Society (ersjournals.com)

Timing of Tuberculosis Transmission and the Impact of Household Contact Tracing. An Agent-based Simulation Model | American Journal of Respiratory and Critical Care Medicine (atsjournals.org)

Systematic approach 101

1. **Risk assessment**
2. **Define and prioritize contacts**
3. Identify the specific contacts
4. Find contacts
5. Test/screen contacts →Treat those who are ill or infected
6. **Review results: expand contact follow-up?**
7. Identify and fix gaps in infection control, policy, practice



TB risk assessment framework

How infectious is index patient

Over what period of infectiousness (POI)

- 3 months back from earliest indication for cavitary
- 1 month back for smear neg, no cavity
- Ending when index patient was in isolation from others, or no longer infectious (whichever comes first)

In what setting(s)

→ exposure setting risk assessment

Pull it all together → prioritize contacts for follow-up

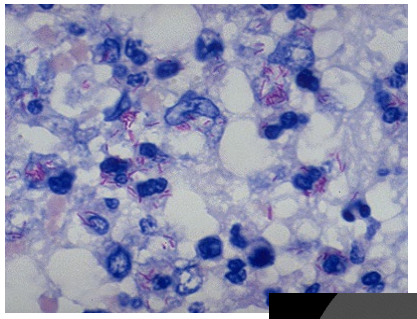
Poll #1

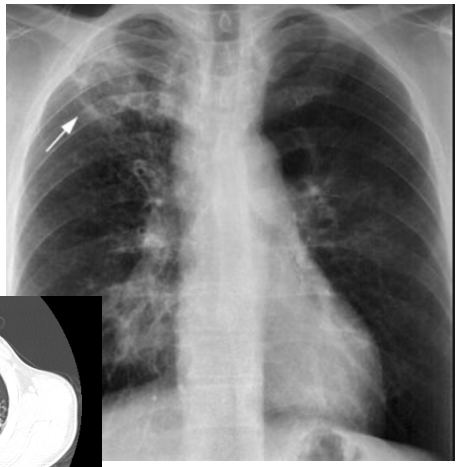
Is this patient infectious?

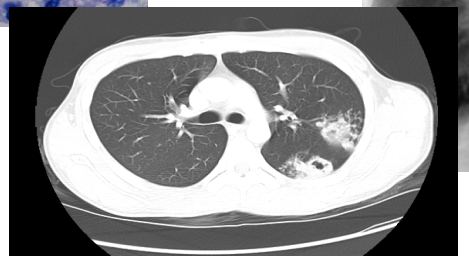
Yes/ No/ Don’t know

Infectiousness and TB

- Only respiratory TB contagious*
- Droplet nuclei = airborne
- Close, prolonged contact
- Smear AFB +ve (2-10x)
- Cavitary (2-3x)
- Coughing (variable)
- Young children rarely infectious

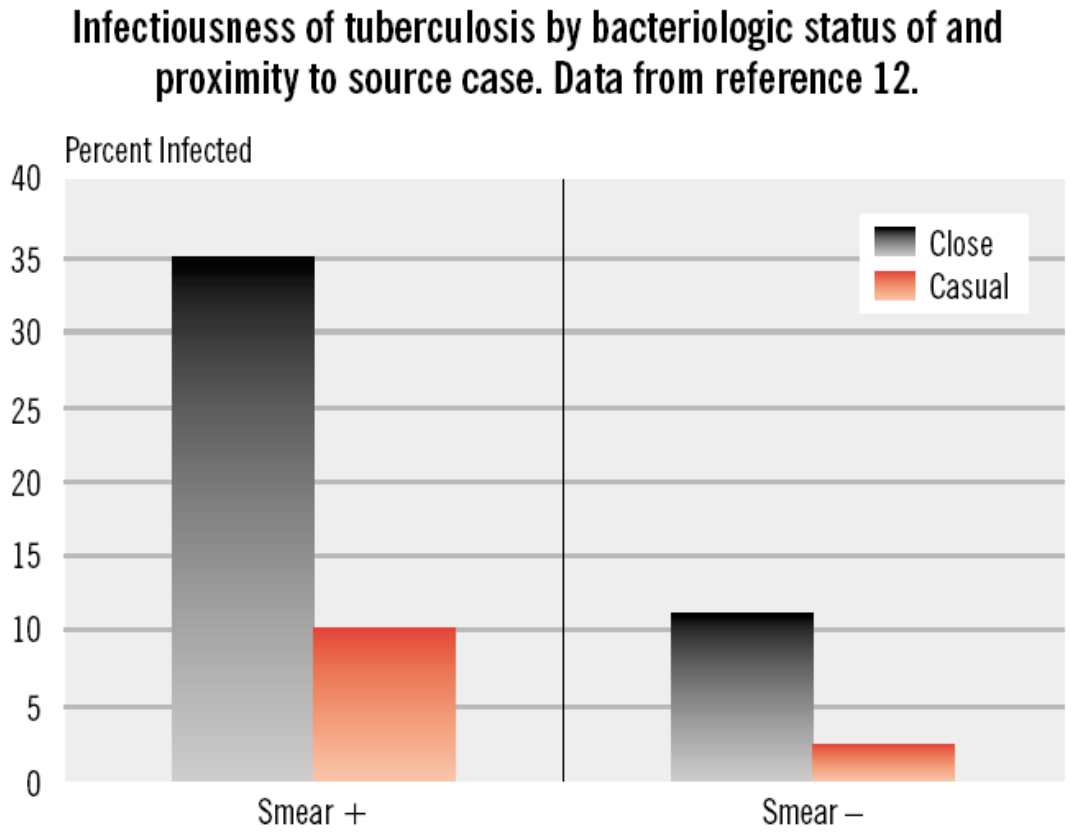






*rarely, procedures that aerosolize x-pulm TB can transmit (eg ortho surgery)

So how infectious is TB in real life?



"untreated case → 15 new infections/yr"

1-2% of contacts already have active TB

only 1/3 of respiratory TB patients are functionally infectious (Fennelly)

Cavitary 4+, ill for 4 m

- spouse, 5yr old, 18yr niece are secondary cases (3/5)
- No transmission to 10 m baby, husband (0/2)

Transmission: exposure times

In theory no exposure without risk

In practice 120-250 cumulative hours in most settings

Household contacts always highest risk

Hospital patient exposures: 8-24 hours??

ANY unprotected exposure @aerosolizing procedures

Reichler et al. *Clin Infect Dis*. 2020;71(7):1627–1634. doi:https://doi.org/10.1093/cid/ciz1044

Gerald et al. *Am J Respir Crit Care Med*. 2002;166(8):1122–1127. doi:https://doi.org/10.1164/rccm.200202-124OC

TB is airborne: ventilation matters

Crowding + not a lot of ventilation + lots of time sharing airspace = transmission risk

Plume effect – TB particles more concentrated closer to person with TB

Site visit is invaluable!

Poll #2

The risk of TB transmission in a room that has radiator heating (hot water radiator, or baseboard electric heating)

is HIGHER

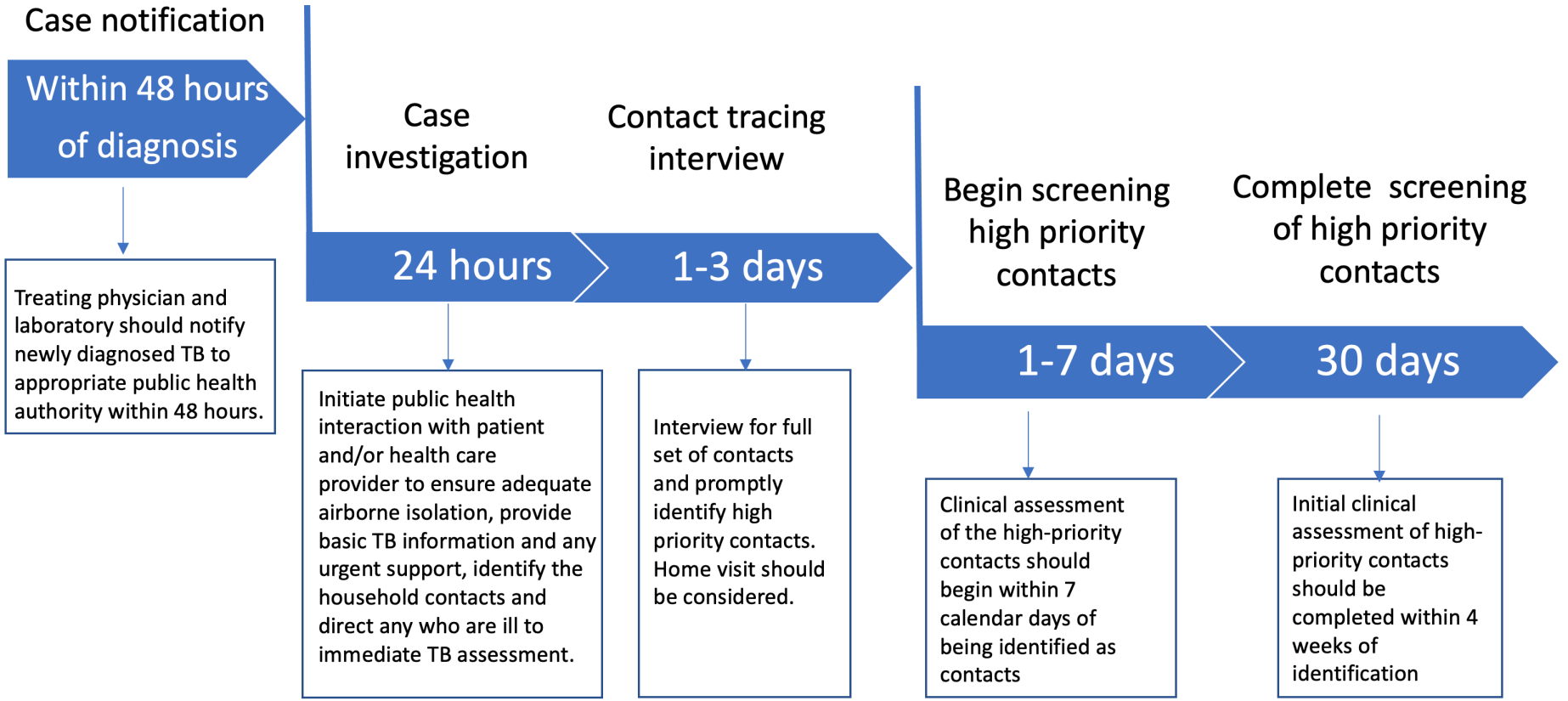
compared to a room with central heating (HVAC)

True / False

Some high TB risk situations

- Choir practice (singing together in small spaces)
- Hotboxing – eg smoking weed or other drugs in a car together
- In the same room as brochoscopy of someone who has TB, without an N95 mask
- Long rural schoolbus route in winter
- Regular smoke breaks together, even outside if partially enclosed

Contact investigations - timeframe



Contact interviewing

- Contact interviewing is a skill – culture, language, local knowledge all essential
- Foundation for TB treatment support relationship
- In privacy
- In person – home visit ideal
- In language – use professional interpreter if needed
- Across multiple visits

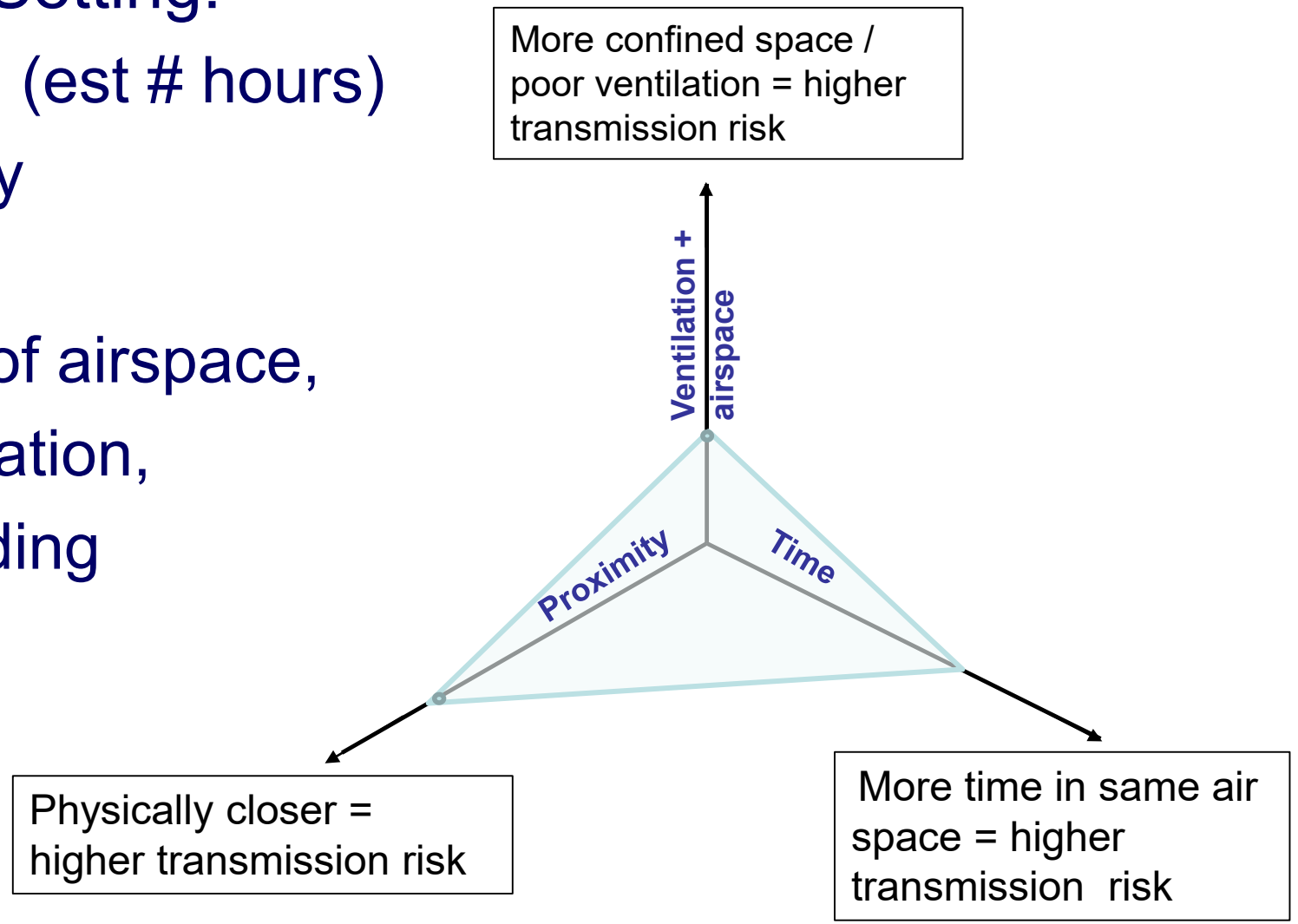
Systematic approach: contact interview

- Ask systematically about
  - live
  - play
  - work
  - pray
  - …and smoking, healthcare, transportation/travel, special events
- LIST based questions
- LOCATION based questions (social networking approach)
- Look at contacts/calendar on your phone, kitchen calendar, social media

TB Exposure Setting Risk Assessment

Exposure Setting:

- Duration (est # hours)
- Proximity
- Setting:
  - Size of airspace,
  - ventilation,
  - crowding



A typical Ontario TB case: the contacts

3+, non-cavitary

Infectious period Jun 2-Sept 23 (12 weeks)

At home: spouse, 2 kids (9m, 5 years), mother

Close family, in same building: sister and brother-in-law, 3 kids (18m, 5 yrs, 7 years)

Best friend – these days, 4 hrs/week

Weekend soccer

Mosque – about 2/month

Works … in IT for large bank

…as roofer for construction company

…as ECE in daycare

Poll #3

I want to do contact follow up for the weekend soccer group

Yes / No

TB transmission and kids

- <5 years – especially <1 year
- Easier to get infected (more rapid respiration, can be very close intense exposure)
- Easier to develop disease more quickly (immature immune system)
- Annual risk of active TB in first 2-3 years after infection is 15% for kids, 3% for adults

→Higher priority for contact investigation, with lower hours of exposure

→In Canada, most kids with TB diagnosed via contact follow up

Immunocompomising conditions

…and treatments

Decreased immune system with age
Diabetes
Dialysis clinics
Oncology clinics
HIV (4% of Toronto cases)
Rheumatology, GI clinics
(TNF alpha inhibitors)

→ Higher priority for contact investigation lower hours of exposure

Systematic, structured approach

Contact follow up is a program-scale activity

Prioritize! Easy to get unfocused quickly – time chasing lots of people with minimal exposure means not enough time to get good care to people most at risk

Screening alone is not the point – **intervention** is (successful treatment of active TB, LTBI tx for everyone who needs it)

Organized **documentation** to track contacts and outcomes is essential

Strategic, systematic approach: Prioritize!!!

Prioritize among TB patients for contact investigation by

- Infectiousness (sputum smear +ve, cavitary CXR)

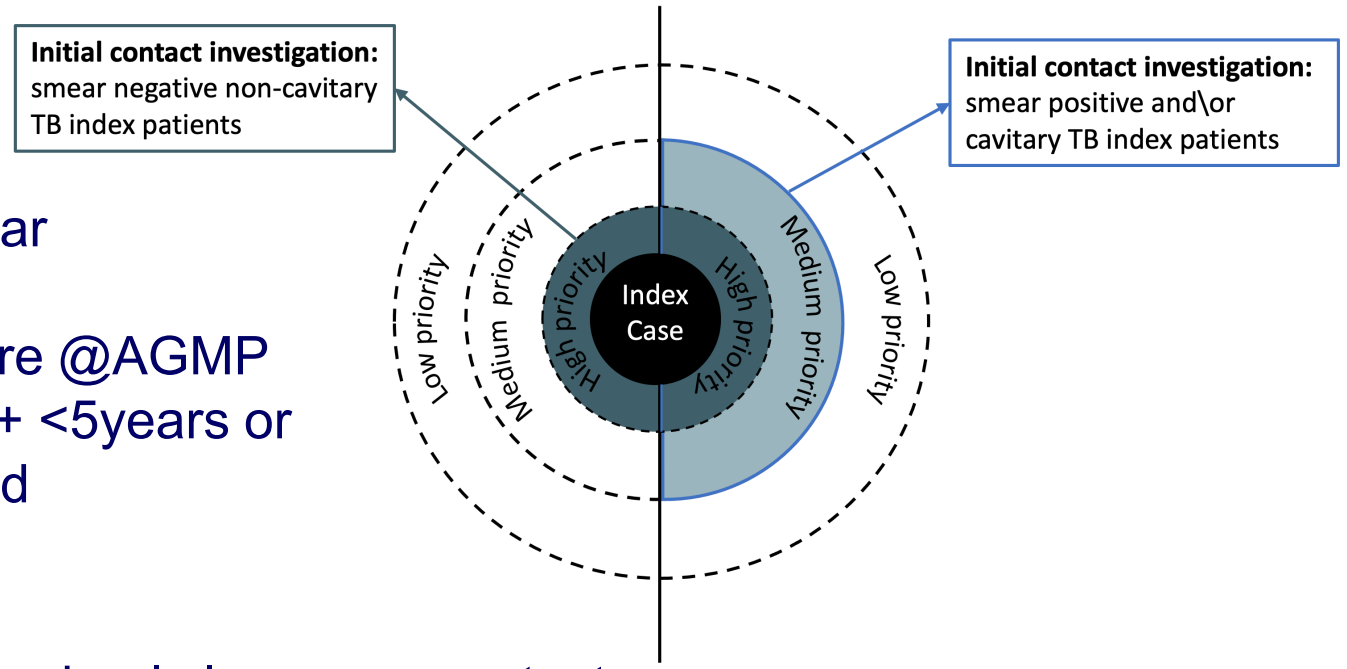
Prioritize among contacts by:

- Extent of exposure
- Immunologic vulnerability (children <5; immunocompromised)

Smear neg minimal CXR, 1 hr exposure, giant modern conference hall

Smear pos cavitary, 4 months exposure 40hrs/week in tiny office no HVAC

Contact prioritization



High priority:

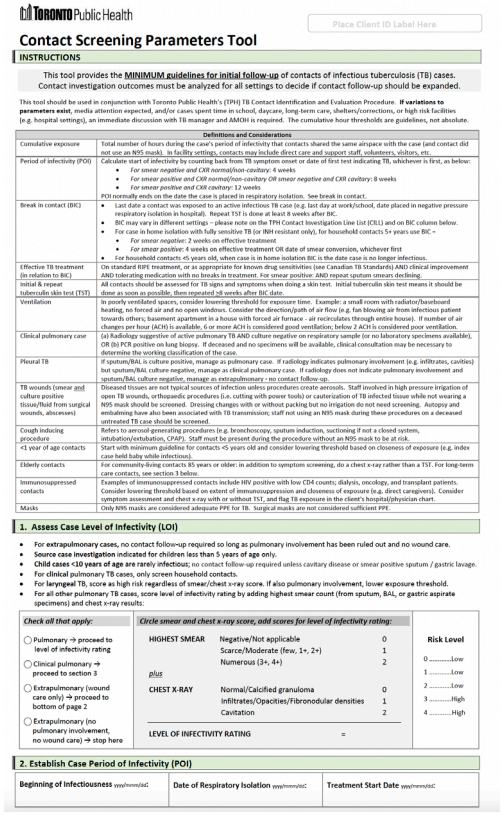
- Household and similar
- Daily caregivers
- Unprotected exposure @AGMP
- “Medium” exposure + <5years or immunocompromised

Medium priority:

- Most workplace and school classroom contacts
- Close friends, boyfriends/girlfriends
- Extended family

If transmission identified @initial contact investigation → expand

Systematic approach: a tool



Toronto Public Health

Place Client ID Label Here

Contact Screening Parameters Tool

INSTRUCTIONS

This tool provides the **MINIMUM guidelines for initial follow-up** of contacts of infectious tuberculosis (TB) cases. Contact investigation outcomes must be analyzed for all settings to decide if contact follow-up should be expanded.

This tool should be used in conjunction with Toronto Public Health's (TPH) TB Contact Identification and Evaluation Procedure. **If variations to parameters exist**, media attention expected, and/or cases spent time in school, daycare, long-term care, shelters/corrections, or high-risk facilities (e.g. hospital settings), an immediate discussion with TB manager and AMOH is required. The cumulative hour thresholds are guidelines, not absolute.

Definitions and Considerations	
Cumulative exposure	Total number of hours during the case's period of infectivity that contacts shared the same airspace with the case (and contact did not use an N95 mask). In facility settings, contacts may include direct care and support staff, volunteers, visitors, etc.
Period of infectivity (POI)	Calculate start of infectivity by counting back from TB symptom onset or date of first test indicating TB, whichever is first, as below: • *For smear negative and CXR normal/non-cavitary:* 4 weeks • *For smear positive and CXR normal/non-cavitary OR smear negative and CXR cavitary:* 8 weeks • *For smear positive and CXR cavitary:* 12 weeks POI normally ends on the date the case is placed in respiratory isolation. See break in contact.
Break in contact (BIC)	• Last date a contact was exposed to an active infectious TB case (e.g. last day at work/school, date placed in negative pressure respiratory isolation in hospital). Repeat TST is done at least 8 weeks after BIC. • BIC may vary in different settings – please note on the TPH Contact Investigation Line List (CILL) and on BIC column below. • For case in home isolation with fully sensitive TB (or INH resistant only), for household contacts 5+ years use BIC – • *For smear negative:* 2 weeks on effective treatment • *For smear positive:* 4 weeks on effective treatment OR date of smear conversion, whichever first • For household contacts <5 years old, when case is in home isolation BIC is the date case is no longer infectious.
Effective TB treatment (in relation to BIC)	On standard RIPE treatment, or as appropriate for known drug sensitivities (see Canadian TB Standards) AND clinical improvement AND tolerating medication with no breaks in treatment. For smear positive: AND repeat sputum smears declining.
Initial & repeat tuberculin skin test (TST)	All contacts should be assessed for TB signs and symptoms when doing a skin test. Initial tuberculin skin test means it should be done as soon as possible, then repeated ≥8 weeks after BIC date.
Ventilation	In poorly ventilated spaces, consider lowering threshold for exposure time. Example: a small room with radiator/baseboard heating, no forced air and no open windows. Consider the direction/path of air flow (e.g. fan blowing air from infectious patient towards others; basement apartment in a house with forced air furnace - air recirculates through entire house). If number of air changes per hour (ACH) is available, 6 or more ACH is considered good ventilation; below 2 ACH is considered poor ventilation.
Clinical pulmonary case	(a) Radiology suggestive of active pulmonary TB AND culture negative on respiratory sample (or no laboratory specimens available), OR (b) PCR positive on lung biopsy. If deceased and no specimens will be available, clinical consultation may be necessary to determine the working classification of the case.
Pleural TB	If sputum/BAL is culture positive, manage as pulmonary case. If radiology indicates pulmonary involvement (e.g. infiltrates, cavities) but sputum/BAL culture negative, manage as clinical pulmonary case. If radiology does not indicate pulmonary involvement and sputum/BAL culture negative, manage as extrapulmonary - no contact follow-up.
TB wounds (smear and culture positive tissue/fluid from surgical wounds, abscesses)	Diseased tissues are not typical sources of infection unless procedures create aerosols. Staff involved in high pressure irrigation of open TB wounds, orthopaedic procedures (i.e. cutting with power tools) or cauterization of TB infected tissue while not wearing a N95 mask should be screened. Dressing changes with or without packing but no irrigation do not need screening. Autopsy and embalming have also been associated with TB transmission; staff not using an N95 mask during these procedures on a deceased untreated TB case should be screened.
Cough inducing procedure	Refers to aerosol-generating procedures (e.g. bronchoscopy, sputum induction, suctioning if not a closed system, intubation/extubation, CPAP). Staff must be present during the procedure without an N95 mask to be at risk.
<1 year of age contacts	Start with minimum guideline for contacts <5 years old and consider lowering threshold based on closeness of exposure (e.g. index case held baby while infectious).
Elderly contacts	For community-living contacts 85 years or older: in addition to symptom screening, do a chest x-ray rather than a TST. For long-term care contacts, see section 3 below.
Immunosuppressed contacts	Examples of immunosuppressed contacts include HIV positive with low CD4 counts; dialysis, oncology, and transplant patients. Consider lowering threshold based on extent of immunosuppression and closeness of exposure (e.g. direct caregivers). Consider symptom assessment and chest x-ray with or without TST, and flag TB exposure in the client's hospital/physician chart.
Masks	Only N95 masks are considered adequate PPE for TB. Surgical masks are not considered sufficient PPE.

1. Assess Case Level of Infectivity (LOI)

- **For extrapulmonary cases,** no contact follow-up required so long as pulmonary involvement has been ruled out and no wound care.
- **Source case investigation indicated for children less than 5 years of age only.**
- **Child cases <10 years of age are rarely infectious;** no contact follow-up required unless cavitary disease or smear positive sputum / gastric lavage.
- **For clinical pulmonary TB cases, only screen household contacts.**
- **For laryngeal TB,** score as high risk regardless of smear/chest x-ray score. If also pulmonary involvement, lower exposure threshold.
- **For all other pulmonary TB cases, score level of infectivity rating by adding highest smear count (from sputum, BAL, or gastric aspirate specimens) and chest x-ray results:**

Check all that apply:	*Circle smear and chest x-ray score, add scores for level of infectivity rating:*			Risk Level
◯ Pulmonary → proceed to level of infectivity rating	**HIGHEST SMEAR**	Negative/Not applicable	0	0 .....Low
◯ Clinical pulmonary → proceed to section 3		Scarce/Moderate (few, 1+, 2+)	1	1 .....Low
◯ Extrapulmonary (wound care only) → proceed to bottom of page 2		Numerous (3+, 4+)	2	2 .....Low
◯ Extrapulmonary (no pulmonary involvement, no wound care) → stop here	*plus*			3 .....High
	CHEST X-RAY	Normal/Calcified granuloma	0	4 .....High
		Infiltrates/Opacities/Fibronodular densities	1	
		Cavitation	2	
	LEVEL OF INFECTIVITY RATING		=	

2. Establish Case Period of Infectivity (POI)

Beginning of Infectiousness yyyy/mmm/dd:	Date of Respiratory Isolation yyyy/mmm/dd:	Treatment Start Date yyyy/mmm/dd:

Link in Ch 11 Can TB Standards, appendix 1:
Canadian Journal of Respiratory, Critical Care, and Sleep Medicine: Vol 6, No sup1 (tandfonline.com)

Check all that apply:	*Circle smear and chest x-ray score, add scores for level of infectivity rating:*			Risk Level
◯ Pulmonary → proceed to level of infectivity rating	**HIGHEST SMEAR**	Negative/Not applicable	0	0 .....Low
◯ Clinical pulmonary → proceed to section 3		Scarce/Moderate (few, 1+, 2+)	1	1 .....Low
◯ Extrapulmonary (wound care only) → proceed to bottom of page 2		Numerous (3+, 4+)	2	2 .....Low
◯ Extrapulmonary (no pulmonary involvement, no wound care) → stop here	*plus*			3 .....High
	CHEST X-RAY	Normal/Calcified granuloma	0	4 .....High
		Infiltrates/Opacities/Fibronodular densities	1	
		Cavitation	2	
	LEVEL OF INFECTIVITY RATING		=	

3. Identify Contacts Requiring Follow-up and Establish Break In Contact – *please complete the following:*

Location of Exposure	Low Risk (0 – 2)	High Risk (3 – 4)	Contacts meeting criteria? (complete CILL for each "yes")		Name of Facility	BIC
Household	• Everyone in household – *initial & repeat TST* • For rooming houses/basement apartments, consider those on the same floor as "household"	• Everyone in household – *initial & repeat TST* • For rooming houses/basement apartments with forced air, consider all floors as "household"	No	Yes		
Close non-household (e.g. family, friends)	• Contacts ≥ 5 years old with **≥ 120 hours** cumulative exposure – *initial & repeat TST* • Contacts < 5 years old or immunosuppressed contacts with **≥ 60 hours** cumulative exposure – *initial & repeat TST*	• Contacts ≥ 5 years old with **≥ 96 hours** cumulative exposure – *initial & repeat TST* • Contacts < 5 years old or immunosuppressed contacts with **≥ 36 hours** cumulative exposure – *initial & repeat TST*	No	Yes		
Worksites / Universities / Colleges	• Smear negative index case – *no screening* • Smear positive index case – follow-up contacts with **≥ 120 hours** of cumulative exposure in a poorly ventilated or small space (e.g. approximately 150 square feet) – *TST > 8 weeks BIC*	• Contacts with **≥ 96 hours** of cumulative exposure in a medium space (e.g. classroom or smaller size space), or within 8 feet of index case in a large space (e.g. lecture hall, large open warehouse or open office floor) – *TST > 8 weeks BIC* • Lower threshold for poorly ventilated or small space (e.g. lunch room, approximately 150 square feet)	No	Yes		
School Contacts ≥ 5 years of age (excludes universities/ colleges)	• Smear negative index case – *no screening* • Smear positive index case – follow-up contacts with **≥ 120 hours** of cumulative exposure in classroom and group activities – *initial & repeat TST*	• Contacts with **≥ 96 hours** of cumulative exposure in classroom and group activities – *initial & repeat TST*	No	Yes		

A typical TB case: at work

POI Jun 2-Sept 23 (12 weeks)

… in IT for large bank.

→ 8 hrs/day x 5 days/wk x 12 weeks = 480 hours

remote vs in person?

open cubicle office vs small room? Define closest group

…as roofer for construction company

→ outside, much lower risk…carpooling? Smoking?

…as ECE in toddler daycare

→ 8 hrs/day x 5 days/wk x 12 weeks = 480 hours

High risk contacts <5 yrs, work in close proximity

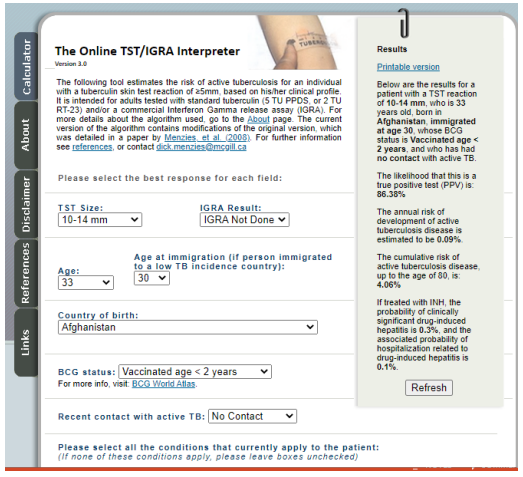
In practical terms

- “Household” most at risk (50% of transmission)…includes shelter sleeping rooms, jail, any congregate settings
- Transmission definitely possible in small enclosed rooms with low ventilation – eg “party houses”
- Smoking groups high risk, even outdoors if partly enclosed
- Transmission in most adult workplaces uncommon, but ventilation and room size matter
- Transmission in school classrooms possible, especially grades 6-12
- Airplanes low risk – HEPA filters and laminar ventilation
- Generally >100 hours cumulative exposure
- **Community knowledge and site visits invaluable**

Systematic approach: contact testing

Standardized follow-up

- Assess for symptoms →CXR, sputum x3, isolate pending smear results
  - → tx active TB disease
- If asymptomatic (+/or TB disease r/o), TST or IGRA
  - → CXR +/- sputum x3
  - → offer TPT (TB Preventive Treatment)



Systematic approach: timing of tests

Up to 8 weeks to develop immune response following exposure – test too early doesn't count!

Break in contact = when exposure to this specific contact stopped (for household: when non-infectious)

Household / high risk: immediate and 8 weeks post BIC

Medium risk (workplace, school): only 8 weeks post BIC?

TB is a high stakes diagnosis

Severe, fatal reputation – TB in other times and places

Societal response to TB has often been harsh

TB stigma is real - many cultures link TB and being dirty, or alcoholic, or poor, or bad

Equity, person-centred care

Make it easier to do the right thing:

Testing at home visit or on-site clinic for school / workplace better uptake than referral to MD for testing

Consider day of week, time of day

Out of pocket costs – TB-UP if no OHIP for follow-up of +ve TST

Clear, consistent communication about level of risk and plan for follow-up

Systematic approach: line lists

- One contact line list for each case
- To organize key information
- Update as new info / results available

**review aggregate results of contact follow-up for each case – expand??

Tuberculosis Contact Investigation Line List for CASE #2

Contact ID	Setting / Type	Relationship	Birth country	Previous TST	TST < 8 Weeks	TST > 8 weeks	Chest x-ray
201	Household	Roommate	Canada	Not tested	Negative	Positive	Abnormal
202	Close non-household	Friend	Philippines	Not tested	Positive		Normal
203	Close non-household	Friend	Australia	Not tested		Lost to f/u	
204	Worksite	Co-worker	Canada	Not tested		Negative	
205	Worksite	Co-worker	Nigeria	Not tested		Positive	Pending
206	Church	Friend	South Africa	Positive			Normal

NEW from CTS: TB Infection diagnostics

IGRA – Quantiferon (QFT) – blood test for TB infection

- preferred for <10yrs with BCG and >=10 years with BCG after infancy
- or to clarify unexpected TST result

***NOT to diagnose active TB disease!

- Not covered by OHIP (yet?!), though HUs can choose to cover the cost
- $95

NEW from CTS: TPT recommendation

TPT = TB Preventative Treatment

***guided by DS result for index case**

1. Either 600mg **daily rifampin for 4 months (4R)**, or **once-weekly rifapentine* and isoniazid for 3 months (3HP)**
2. When rifamycin based regimens cannot be used because they are not tolerated, not feasible or are contraindicated: 9-month daily isoniazid (9H)

*still not licensed in Canada! Available to HUs through OCMOH via “urgent public health need” regulation. Generally given by DOPT.

Systematic, programmatic approach

- **for each index case, always review aggregate contact outcomes, to decide if expanded contact investigation needed**
- Genotyping useful to confirm/refute transmission for secondary cases, and identify potential clusters
- Pattern of transmission, co-ordination of response, resources → program policies, field epidemiology
- “Local transmission” potential metric for TB

Source case investigation

- Young child with TB disease = red flag for functionally infectious case
- Source case investigation looks around a young child case to find “missing” adult case who infected them – almost always a household member/caregiver
- Only 40% success even for child cases under 5 years
- NOT indicated for kids with LTBI, or new TB cases >5yrs

Questions?

World TB Day flash mob March 24

elizabeth.rea@toronto.ca
Tel 416-525-3794

www.toronto.ca/health/
Tel 416-338-7600

UNITE TO END TB