

# **Serological Testing versus Other Strategies for Diagnosis of Active Tuberculosis in India: A Cost-Effectiveness Analysis**

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# Background: TB Diagnosis in India

- 2 million cases of active TB per year in India
  - 39% of cases go undiagnosed.
- WHO-recommended diagnostic s include sputum smear microscopy and TB culture.
  - Sputum smear: Cheap, but low sensitivity
  - TB culture: Expensive, slow, but high sensitivity
- Serological testing is widely available through the private sector.
  - Cost-effectiveness of serological testing uncertain

WHO, Global Tuberculosis Control. Geneva: WHO, 2009.

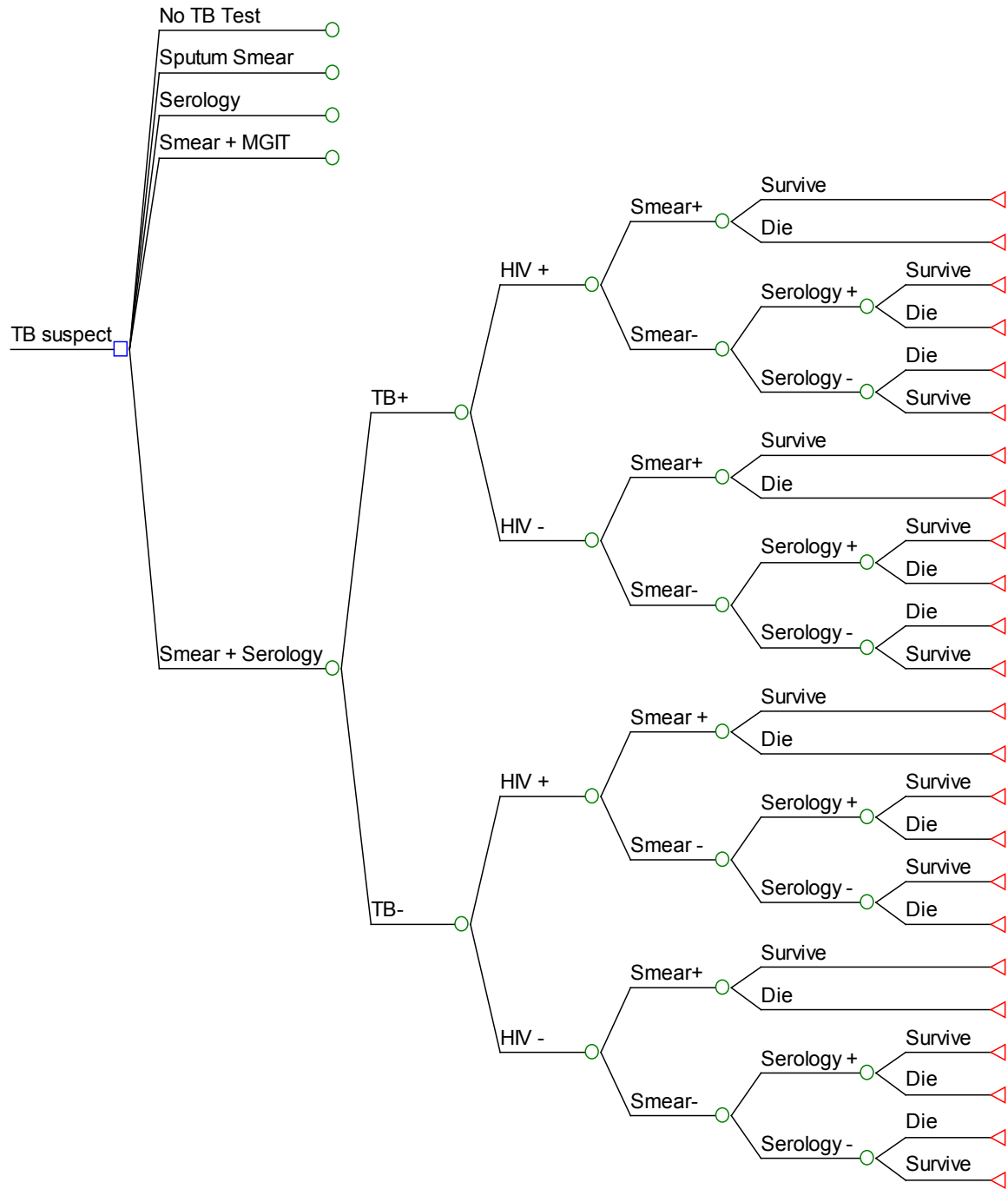
Grenier J et al. Widespread use of serological tests for tuberculosis. Eur Respir J, in press.

# Serological Testing for TB

- Based on detection of TB antibodies in serum
  - Should not be specific for active (vs. latent) TB
- Not approved for use in the U.S. or Europe
  - Often produced in Europe for export to countries where regulatory framework is weaker.
- Quality of supporting evidence is very poor.
  - Small studies, industry-funded, hand-selected populations, inconsistent results
  - No randomized data

# Methods

- Decision-analytic cost-effectiveness model
- Two analyses:
  - Analysis I: Smear vs. serology as initial test
  - Analysis II: Serology vs. culture as add-on to smear
- Population: 1.5 million TB suspects in India
  - Current annual volume of TB serological tests
  - 10-15% of total TB suspects in India



# Key Assumptions

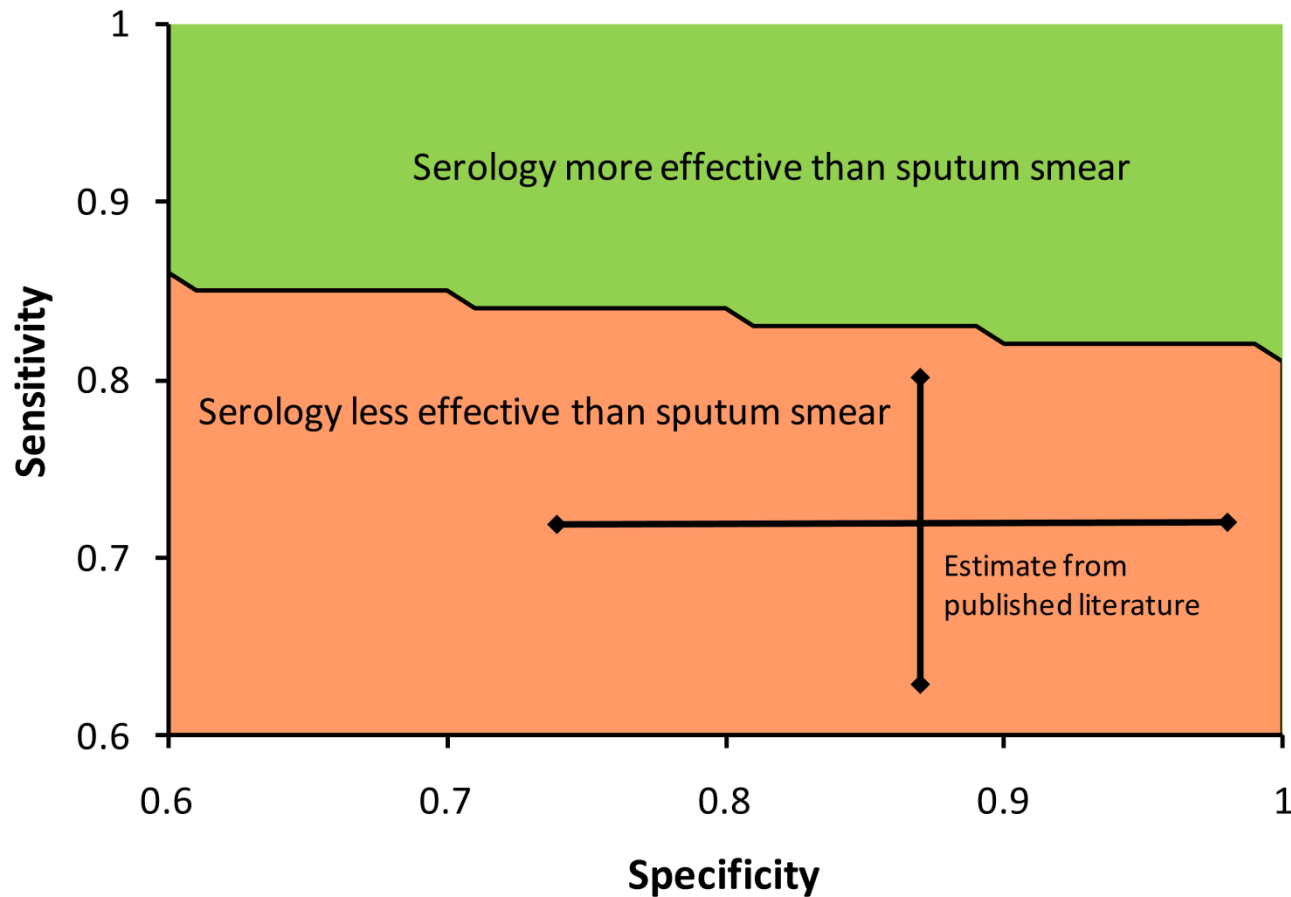
Parameter	Value
Sensitivity/Specificity: Sputum smear Serology TB Culture	0.53/0.97 0.68/0.87 0.87/0.99
Time to diagnosis: Smear or Serology TB Culture	1 week 8 weeks
Cost: Sputum smear x2 Serology or TB Culture	\$3.62 \$20
Prevalence of TB Among TB Suspects	14%
Cost to Treat One TB Case	\$82

# Cost-Effectiveness

<b>Diagnostic Test</b>	<b>Cost (US\$)</b>	<b>Additional TB Cases</b>	<b>Additional False-Positives</b>	<b>DALYs Averted</b>	<b>Incremental Cost per DALY Averted</b>
<i>Performed Alone, Relative to No Microbiological Testing</i>					
<b>Sputum smear microscopy</b>	\$11.9 million	44,000	36,000	623,000	\$19
<b>Serology</b>	\$47.5 million	58,000	157,000	520,000	(dominated)
<i>Performed on Smear-Negative Specimens Only, Relative to Sputum Smear Alone</i>					
<b>TB culture</b>	\$27.6 million	26,000	12,000	130,000	\$213
<b>Serology</b>	\$39.0 million	24,000	152,000	110,000	(dominated)

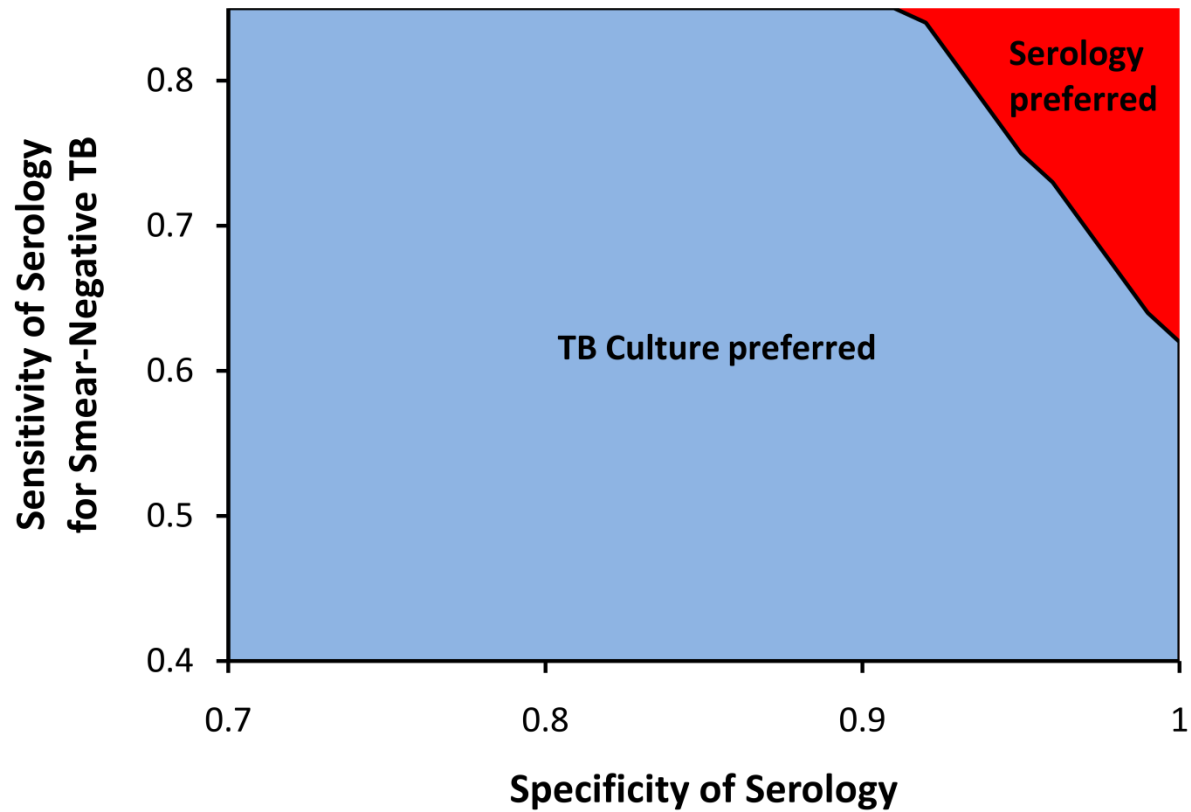
DALY = disability-adjusted life year; dominated = more costly and less effective

# Sensitivity Analysis: Smear vs. Serology





# Sensitivity Analysis: TB Culture vs. Serology



# Discussion

- Sputum smear is preferred to serology as an initial test.
- TB culture is preferred to serology as an “add-on” test to sputum smear.
- This is true despite conducting an analysis that is the “best-case scenario” for serology.
  - Published estimates overestimate actual accuracy.
  - Minimal “cost” for false-positives
  - High TB prevalence biases in favor of serology.

# Limitations

- Unable to adopt societal perspective
- No accounting for drug resistance testing
- Urban population with access to serology not representative of entire Indian population
- Does not fully account for secondary TB transmission

# Conclusions

These data were presented to the WHO Expert Group on TB Serodiagnosis (Geneva, 2010).

Strategic & Technical Advisory Group on TB and WHO have factored these data into their recent decision to make a negative recommendation on serological tests for TB (July 19, 2011)