Tuberculosis screening in South Africa

WHO expert consultation on TB screening

Gavin Churchyard
31st May 2011
Overview

• Background
• High risk groups
• Community based TB screening
• Conclusions
Background
SA has one of the worst TB epidemics in the world!

- Ranked 3rd globally
- 4th greatest number of MDR TB patients
- SA has the most number of HIV-infected TB patients in the world
- Case detection rate 62%
TB screening methods

• Screening high risk groups
  — Mines
  — Prisons
  — People living with HIV

• Community based TB screening
  — House hold contact tracing
  — Community meeting points
  — Kick TB
High risk groups

Mines
Prisons
People living with HIV
Active case finding among South African gold miners
ACF in SA mines: pre-HIV era

- Limited published data
- CXR screening in use from 1950s
- In 1981-2, 78% TB cases detected by CXR screening\(^1\)
- TB cases detected by CXR screening vs. self presentation had \(^1\)
  - fewer symptoms, less radiological extent of disease, lower risk of relapse
  - shorter hospital stay
  - similar proportion smear positive

1. R Cowie. MSc thesis
ACF in SA mines: HIV era

- Proportion of TB cases detected by CXR screening decreased to 30%
- Prevalence of TB detected by radiological screening remained relatively stable
ACF in SA mines: HIV era

- Adding CXR to symptom screening detects more TB cases
Performance of screening tools

<table>
<thead>
<tr>
<th>Screening method</th>
<th>Prevalence % (N=1905)</th>
<th>Sensitivity % (N=48)</th>
<th>Specificity % (N=1905)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom trio*</td>
<td>10.2</td>
<td>31.3</td>
<td>90.3</td>
</tr>
<tr>
<td>New CXR abnormality</td>
<td>2.0</td>
<td>27.1</td>
<td>98.7</td>
</tr>
<tr>
<td>Smear pos</td>
<td>1.6</td>
<td>25.0</td>
<td>99.0</td>
</tr>
<tr>
<td>Symptom trio or CXR</td>
<td>11.6</td>
<td>52.1</td>
<td>89.4</td>
</tr>
<tr>
<td>Symptom trio or smear +</td>
<td>11.5</td>
<td>47.9</td>
<td>89.4</td>
</tr>
</tbody>
</table>

* any of cough, night sweats, wt loss
Thibela TB study
TB screening

B/w July 2006 and December 2008, 23,299 participants completed screening
Minimum prevalence of TB: 1.4%
Detected 46% of TB during screening period
### Proportion of TB detected by symptom and CXR screening

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>All TB n (%)</th>
<th>Smear positive n (%)</th>
<th>Smear negative n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom trio *</td>
<td>113 (40.2)</td>
<td>64 (48.5)</td>
<td>49 (32.9)</td>
</tr>
<tr>
<td>Abnormal CXR</td>
<td>233 (82.9)</td>
<td>119 (90.2)</td>
<td>114 (76.5)</td>
</tr>
</tbody>
</table>

**Symptom trio and CXR**

The addition of CXR to symptom screening increased the number of TB cases detected by 2.5 fold (113 to 281)

* Cough>2 weeks, night sweats and weight loss
ACF in SA mines: HIV era

- TB cases detected by CXR screening vs self presentation, regardless of HIV status, are:
  - less likely to be HIV+ (47% vs. 76%)
  - less symptomatic (35% vs. 98%)
  - more likely to be pulmonary (81% vs. 65%)
  - more likely to be smear pos (76% vs. 59%)
  - more likely to have successful treatment outcomes (82% vs. 73%)
  - more likely to survive (mortality 3 vs. 21 /100 pyrs)
HIV does not alter the performance of TB screening tools

<table>
<thead>
<tr>
<th>symptom</th>
<th>sensitivity (%)</th>
<th>specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HIV- N=30</td>
<td>HIV+ N=18</td>
</tr>
<tr>
<td>Cough*: any</td>
<td>16.7</td>
<td>16.7</td>
</tr>
<tr>
<td>&gt;3w</td>
<td>6.7</td>
<td>5.6</td>
</tr>
<tr>
<td>Fever (any)</td>
<td>6.7</td>
<td>0</td>
</tr>
<tr>
<td>Weight loss &gt;5kg</td>
<td>20.0</td>
<td>11.1</td>
</tr>
<tr>
<td>Symptom trio**</td>
<td>30.0</td>
<td>33.3</td>
</tr>
<tr>
<td>New CXR abN</td>
<td>26.7</td>
<td>27.8</td>
</tr>
<tr>
<td>Smear pos (1 sp)</td>
<td>23.3</td>
<td>22.2</td>
</tr>
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* “new or worsening”; **any of cough, night sweats, wt loss

Lewis, ARRCCM, 2009
TB Incidence rates following screening

<table>
<thead>
<tr>
<th></th>
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<th>Rates/100py</th>
<th>95% CI</th>
</tr>
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<tbody>
<tr>
<td>HIV negative</td>
<td>&lt; 6 months</td>
<td>0.87</td>
<td>0.34 – 1.96</td>
</tr>
<tr>
<td></td>
<td>&gt;6 months</td>
<td>1.83</td>
<td>0.87 – 3.83</td>
</tr>
<tr>
<td>HIV positive</td>
<td>&lt; 6 months</td>
<td>5.68</td>
<td>3.36 – 9.58</td>
</tr>
<tr>
<td></td>
<td>&gt; 6 months</td>
<td>6.70</td>
<td>3.61 – 12.45</td>
</tr>
</tbody>
</table>
# 6 vs. 12 monthly radiological screening

<table>
<thead>
<tr>
<th>Study arm</th>
<th>N (%), Study arm</th>
<th>P value</th>
</tr>
</thead>
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<tr>
<td></td>
<td>12-monthly (n=11015)</td>
<td>6-monthly (n=10997)</td>
</tr>
<tr>
<td><strong>TB suspect</strong></td>
<td>1145/11,015 (10.4)</td>
<td>1433/10,997 (13.0)</td>
</tr>
<tr>
<td><strong>Ix for TB</strong></td>
<td>490/1,145 (42.8)</td>
<td>530/1,433 (37.0)</td>
</tr>
<tr>
<td><strong>Treated for TB</strong></td>
<td>216/490 (44.1)</td>
<td>232/530 (43.8)</td>
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Xpert MTB/RIF in ACF

- Thibela TB prevalence survey:
  - GXP has a low rate of test failure (2.4%)
  - GXP has a very low false+ rate
  - GXP is substantially more sensitive than smear (70.6% vs 29.4%)
  - GXP sensitivity good but imperfect:
    - Better for smear positive than smear negative TB (90% vs 62.5%)
TB screening in correctional facilities

- 981 prisoners
  - 526 already incarcerated
  - 455 newly sentenced
- HIV prevalence: 24.2%
- On TB treatment: 1.4%
- TB prevalence: 2.5%
  - 5.1% in HIV-positive
  - 1.6% in HIV-negative
## Performance of screening tools

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<th>Criteria</th>
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<th>Specificity (%)</th>
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<tr>
<td></td>
<td>(%, N=963)</td>
<td>(%, N=23)</td>
<td>(%, N=806)</td>
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<td>Cough &gt;2wks</td>
<td>9.4</td>
<td>34.8</td>
<td>91.3</td>
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<tr>
<td>Symptom trio*</td>
<td>27.9</td>
<td>43.5</td>
<td>72.6</td>
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<td>Sputum AFB positive</td>
<td>1.2</td>
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<td>7.6</td>
<td>60.9</td>
<td>93.9</td>
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<td>15.2</td>
<td>78.3</td>
<td>86.6</td>
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<td>32.6</td>
<td>78.3</td>
<td>68.7</td>
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* symptom trio: any of cough>2wks, night sweats, weight loss;
* wks weeks; CXR chest radiograph
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## Prevalence of undiagnosed active TB in PLHIV

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<th>Setting</th>
<th>% (range)</th>
<th>NNS</th>
</tr>
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<tr>
<td>In HIV care</td>
<td>2.2% (1.3-3.6)</td>
<td>46</td>
</tr>
<tr>
<td>Prior to ART</td>
<td>8.6% (3.6-24.7)</td>
<td>12</td>
</tr>
<tr>
<td>On ART</td>
<td>4.7%</td>
<td>21</td>
</tr>
</tbody>
</table>

Xpert has lower sensitivity in PLWH screened for TB prior to starting ART
- Overall: 73.3%
- S- TB: 43.4%

(Khan et al. CID. 2010, Churchyard et al. AIDS. 2010, Kufa, IAS 2011, Lawn 2011, Plos one)
TB screening in HIV-infected pregnant women in Matlosana

- 1500 HIV-infected pregnant women
- Sputum for smear, culture & DST on all

Results
- Age: 27 yrs, gest age: 24 wks, CD4 ~380
- ~1% already receiving TB treatment at visit
- ~8% reported previous TB treatment
- 25% had someone at home with TB in past 5 yrs
- TB prevalence: 2.8%
National HCT campaign

In 2010

- 8 million screened for TB, regardless of HIV status
Community based TB screening
Household contact tracing
Community gathering points
Kick TB
Household contact tracing
Rustenburg

- 3627 household contacts screened
- 28.7% consented to HIV testing
  - 22.1% HIV positive
- Prevalence on TB treatment
  - ≥ 5 years: 1.4%
  - < 5 years: 2.9%
- Prevalence of undiagnosed TB
  - ≥ 5 years: 3.0%
  - Culture picked up majority (76.5%) of cases
House hold contact tracing
Matlosana

- 2771 household contacts
- 56% consented to HIV test
  - 10% HIV positive
- 6.4% had undiagnosed TB
  - 96% S-/C+
House hold contacts of Kids with TB

Soweto

Chris Hani Baragwanath Academic Hospital

- Kids <7 yrs admitted to hosp with TB
- Rapid progression after infection so may be a good way to identify PTB transmitters at home
- N=250/400 already recruited
- HH contacts & caregiver
- High rates of previously undiagnosed TB & HIV
National roll out of Xpert
March - May 2011

NHLS GeneXpert Instrument Placement

<table>
<thead>
<tr>
<th>ICF Status</th>
<th>MTB Detected</th>
<th>MTB Not Detected</th>
<th>Test Unsuccessful</th>
<th>Total</th>
<th>% MTB Detected</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICF</td>
<td>694</td>
<td>4497</td>
<td>213</td>
<td>5404</td>
<td>12.84</td>
</tr>
<tr>
<td>Non-ICF</td>
<td>3035</td>
<td>11477</td>
<td>494</td>
<td>15006</td>
<td>20.23</td>
</tr>
<tr>
<td>Total</td>
<td>3729</td>
<td>15974</td>
<td>707</td>
<td>20410</td>
<td>18.27</td>
</tr>
</tbody>
</table>

% of Total 18.27 78.27 3.46 100.00
2289 community members screened for TB at pension pay points, municipal events, taxi ranks & schools
- Mean age 40.1 years
- 1540 females (67.3%), 749 males (32.7%)

465 (20.3%) TB suspects and sputum collected
- 2 smear positive (0.4%)
- 21 culture positive (4.5%)
  - 3 DS TB
  - 7 MDR TB
  - 1 XDR TB
  - 10 DST pending
Kick TB campaign

‘Let’s play, Let’s learn, Let’s save lives”
Conclusions

• A number of TB screening strategies are being used in South Africa
• Mines and prisons are high risk populations
• PLWH are at high risk of TB and should be screened for TB
  – including pregnant women and those on ART
• Screening household contacts of index TB cases is efficient at finding undiagnosed TB
• Xpert may have an important role to play in TB screening
Acknowledgements

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