Capture TB study in Pakistan 2011

Presented by
Dr Razia Fatima
MBBS, MSc Epi, LSHTM UK, MPH Pak
Epidemiologist / Research Coordinator
NTP Pakistan.
PI Capture TB Study
When routine surveillance does not effectively count incident cases there are broadly two approaches to estimate tuberculosis incidence:

(1) direct measurement through longitudinal cohort studies; and

(2) indirect estimation from (a) assessment of the completeness of registers of incident cases, e.g. through record-linkage and capture-recapture techniques, as well as from (b) measurements of prevalence (using assumptions on duration) or from (c) measurements of mortality (vital registration, using assumptions on case fatality)
Pilot Study

- A pilot phase of this study was conducted in Pakistan during the period January–March, 2008.

- The inventory method was used to evaluate the extent of underreporting, and capture recapture analysis was done using 2 data sources NTP and non-NTP.

- The underreporting rate accounted for 19%. However, this pilot had several limitations as follows:
Limitations

- The non-NTP sector enrolled in the study was confined to the private GPs and not all non-NTP providers.

- The linking of electronic registers (NTP and Non-NTP) to verify the status of registration of cases at NTP was not adequate as the names were entered in English and not in Urdu language.

- The diagnosis made by private GPs was not confirmed at NTP.

- The 3 source Capture recapture technique using log linear modeling was not applied because of the presence of 2 data sources only (NTPs and GP). Therefore, it was not possible to adjust for interaction between different data sources.
Objectives of Capture TB Study 2011

- To evaluate the extent of under-reporting of TB cases in a representative sample of non NTP facilities in the country
- To estimate TB Incidence using Capture Recapture Analysis
- To investigate where are the missing cases in the country.
- To describe the case management practices of Non NTP.
The study was carried out in all non-NTP facilities delivering care to TB patients in 12 randomly selected districts all over the country.

Inclusion criteria

Lab staff and physicians delivering care to TB patients in the non-NTP sectors in the selected districts who consented to participate in the study.

Intensive mapping of all health care providers in selected areas preceded the data collection.
Sources of Data

Public:
- Public hospitals
- University hospitals (governmental)
- Medical organizations (Petroleum companies, etc)
- Ministry of Interior (prisons)
- Ministry of Defense

Private:
- Private hospitals
- Private teaching hospitals (private universities)
- Private clinics
- Private polyclinics
- NGOs

Exclusion criteria
- Non-consented health workers.
All non-NTP physicians in the selected district were given a modified suspect register to register every TB suspect and record their case management.

Laboratory registers were introduced in each of the non-NTP labs including information about the full name of the patient, full contact address (with mobile number), age, sex, source of referral, number of specimens examined, results of DSM, final diagnosis, and treating physician.

data collection tools_modified_register (1).doc
Monitoring

NPO
- Engaging concerned DTC for Mapping of non NTP Private health care providers and non NTP Public health facilities
- Monitoring during implementation phase as part of routine monitoring of the district

DTC
- To Visit both sources of data every 2 weeks by the DTC in each district
- To cross-check the status of registration at NTP
- To contact all unregistered cases (pos and neg) at NTP registers to verify the diagnosis made by non-NTP.

Field officers
- To visit each health facility from each data source
- To coordinate with DTC for cross checking and to contact all unregistered cases.
- To compile and send final data
Stratified cluster random sampling was used to obtain a representative sample from 12 out of 131 districts of Pakistan in 2010, with strata defined by four equal-sized groups (quartiles) according to levels of smear positive notification rates.

The number of selected districts from each stratum was allocated proportionately based on its population size.

One district was obtained from stratum 1, five from stratum 2, three from stratum 3, and three from stratum 4. All the non-NTP facilities in the selected districts were mapped and consenting providers were enrolled.
## Characteristic of the selected districts and smear positive notification rates per 100,000 population.

<table>
<thead>
<tr>
<th>Districts</th>
<th>Population</th>
<th>Smear positive case notification rate</th>
<th>All facilities</th>
<th>NTP facilities</th>
<th>Non-NTP facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rawalpindi</td>
<td>4,235,548</td>
<td>52</td>
<td>1986</td>
<td>25</td>
<td>1961</td>
</tr>
<tr>
<td>Khushab</td>
<td>1,141,196</td>
<td>92</td>
<td>139</td>
<td>13</td>
<td>126</td>
</tr>
<tr>
<td>Lodhran</td>
<td>1,475,118</td>
<td>59</td>
<td>513</td>
<td>9</td>
<td>504</td>
</tr>
<tr>
<td>Rajanpur</td>
<td>1,389,587</td>
<td>70</td>
<td>259</td>
<td>13</td>
<td>246</td>
</tr>
<tr>
<td>Larkana</td>
<td>1,220,718</td>
<td>71</td>
<td>203</td>
<td>9</td>
<td>194</td>
</tr>
<tr>
<td>Mirpurkhas</td>
<td>1,330,017</td>
<td>55</td>
<td>199</td>
<td>13</td>
<td>186</td>
</tr>
<tr>
<td>Swat</td>
<td>1,592,285</td>
<td>57</td>
<td>172</td>
<td>14</td>
<td>158</td>
</tr>
<tr>
<td>Buner</td>
<td>640,898</td>
<td>48</td>
<td>114</td>
<td>7</td>
<td>107</td>
</tr>
<tr>
<td>Battgram</td>
<td>388,991</td>
<td>48</td>
<td>52</td>
<td>5</td>
<td>47</td>
</tr>
<tr>
<td>Zhob</td>
<td>500,896</td>
<td>43</td>
<td>51</td>
<td>6</td>
<td>45</td>
</tr>
<tr>
<td>Lasbella</td>
<td>396,021</td>
<td>62</td>
<td>92</td>
<td>4</td>
<td>88</td>
</tr>
<tr>
<td>Washuk</td>
<td>1,31,871</td>
<td>66</td>
<td>14</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14,443,146</strong></td>
<td><strong>3794</strong></td>
<td><strong>120</strong></td>
<td><strong>3674</strong></td>
<td></td>
</tr>
</tbody>
</table>
Incident TB cases were defined as:
1) all TB patients registered with the NTP between 1\textsuperscript{st} January 2012 and 31\textsuperscript{st} March 2012.
2) all TB cases confirmed according to NTP criteria during the same time period for cases known to non-NTP providers.
Data quality assurance

- Four sources of information were used. The NTP TB Register was reviewed and data on all patients recorded.

- These facilities were visited weekly by field officers and District Tuberculosis Coordinators (DTCs) to check the records, collect the missing information and verify notification status of the TB cases. Non-NTP unregistered cases were contacted to verify diagnosis as per NTP criteria.
Four names were used as a unique identifier: first given name, father’s name, grandfather’s name and family name, when all four names were not recalled by the patient the National ID number was recorded.

The NTP register was examined two quarters before and one quarter after the study period (between July 2011 and June 2012) to check and correct any misclassification of patients not diagnosed during the study period or referred late for notification.
Record Linkage Contd

- The unregistered confirmed cases were added after the study period into the NTP register.
- Record linkage was done by using the combination of first, father’s and family name as unique identifiers
- After data cleaning and validation by double data entry of all records, completeness of registration was explored by adding records from all three sources and duplicates were removed (Inventory Method).
- By cross validation between data sources, data quality was improved.
Data from registers were analyzed using capture–recapture methods, which examines the extent of overlap between sources to estimate the total number of unobserved cases.

In particular, log–linear models were applied to four data registers, and dependencies between sources were accounted for via interaction terms.
Eight standard models (including 3 possible 2-way interactions) and 3 non-standard models (including three way interaction at the expense of one of the 2-way interactions) were applied.

The model with the lowest Akaike Information Criteria (AIC) value was chosen, with lower values indicating better models, which is a standard method for model selection in capture recapture studies.
Estimates of the number of unobserved TB cases (N) in the study area from the 8 standard models (M1–8) and 3 non-standard models (S1–3) that include a three-way interaction.

<table>
<thead>
<tr>
<th>Model</th>
<th>NTP x Lab Private</th>
<th>NTP x Lab Private</th>
<th>NTP x Lab Private</th>
<th>N</th>
<th>95% confidence interval</th>
<th>Detect ed</th>
<th>Notifie d</th>
<th>AIC*</th>
<th>Model weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>10,030</td>
<td>7,800 – 12,910</td>
<td>45.4%</td>
<td>33.0%</td>
<td>78.3</td>
<td>48.7%</td>
</tr>
<tr>
<td>M8</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>18,500</td>
<td>10,890 – 31,420</td>
<td>31.1%</td>
<td>22.6%</td>
<td>78.9</td>
<td>36.4%</td>
</tr>
<tr>
<td>M6</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>33,930</td>
<td>30,090 – 38,260</td>
<td>19.7%</td>
<td>14.3%</td>
<td>81.8</td>
<td>8.5%</td>
</tr>
<tr>
<td>S2</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>33,930</td>
<td>30,090 – 38,260</td>
<td>19.7%</td>
<td>14.3%</td>
<td>83.4</td>
<td>3.8%</td>
</tr>
<tr>
<td>M5</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>10,030</td>
<td>7,800 – 12,910</td>
<td>45.4%</td>
<td>33.0%</td>
<td>84.2</td>
<td>2.6%</td>
</tr>
<tr>
<td>S3</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>54,680</td>
<td>38,570 – 77,530</td>
<td>13.2%</td>
<td>9.6%</td>
<td>99.2</td>
<td>0.0%</td>
</tr>
<tr>
<td>M7</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>54,680</td>
<td>38,570 – 77,530</td>
<td>13.2%</td>
<td>9.6%</td>
<td>99.8</td>
<td>0.0%</td>
</tr>
<tr>
<td>M4</td>
<td></td>
<td>Y</td>
<td></td>
<td>37,510</td>
<td>33,410 – 42,110</td>
<td>18.2%</td>
<td>13.2%</td>
<td>103.5</td>
<td>0.0%</td>
</tr>
<tr>
<td>M2</td>
<td></td>
<td></td>
<td></td>
<td>29,670</td>
<td>26,540 – 33,170</td>
<td>22.0%</td>
<td>15.9%</td>
<td>147.9</td>
<td>0.0%</td>
</tr>
<tr>
<td>M3</td>
<td></td>
<td></td>
<td></td>
<td>25,060</td>
<td>20,040 – 31,350</td>
<td>25.0%</td>
<td>18.1%</td>
<td>172.8</td>
<td>0.0%</td>
</tr>
<tr>
<td>M1</td>
<td></td>
<td></td>
<td></td>
<td>32,900</td>
<td>29,540 – 36,640</td>
<td>20.2%</td>
<td>14.7%</td>
<td>177.6</td>
<td>0.0%</td>
</tr>
</tbody>
</table>
Results:

- Total 8346 TB cases were identified.
- Of them 6061 registered with the NTP.
- The estimated number of unobserved TB cases was 10030 (95% CI 7800–12910),
- Wide confidence interval shows model uncertainty.
- Proportion of notified cases was 32% (95% CI 17–49) and under-reporting was 28%.

The results need to be matched with National disease prevalence surveys.
Venn diagram showing study participants (n=8346) by source of identification.
Distribution of TB Suspects Identified in the different Non–NTP health care facilities in 12 District of Pakistan, January–March 2012

Private: 2961
- General Lab: 614
- Parastal: 36
- Military: 4
- University: 2
- Hospital: 28

Public: 115
- General Lab: 614
- Parastal: 36
- Military: 4
- University: 2
- Hospital: 87

Grant Total: 3116
- General Lab: 614
- Parastal: 36
- Military: 4
- University: 2
- Hospital: 87

Legend:
- General Lab
- Parastal
- Military
- University
- Private Clinic
- Hospital
Age distribution in the survey compared to the NTP notification data for new smear positive PTB

Proportion of age categories (%)
Gender Wise Distribution of Confirm Cases

- Rawalpindi: 51% Male, 49% Female
- Lodhran: 49% Male, 51% Female
- Rajanpur: 49% Male, 51% Female
- Khusab: 45% Male, 55% Female
- Larkana: 49% Male, 51% Female
- Washuk: 35% Male, 65% Female
- Zhob: 49% Male, 52% Female
- Buner: 41% Male, 59% Female
- Swat: 66% Male, 34% Female
- Batagram: 54% Male, 46% Female
- Lasbella: 59% Male, 41% Female
- Mirpur Khas: 59% Male, 41% Female
Site for referral of TB-suspects by Non-NTP Providers

- District TB Center: 55%
- Public Lab: 15%
- Private Lab: 28%
- Other Providers: 2%
Conclusion

- The study estimated a low proportion of cases notified to NTP, with incidence rates higher than official estimates. There is a need to strengthen TB Surveillance to reduce under-reporting
We highly acknowledge support from WHO EMRO from the proposal writing to actual implementation in field and tremendous support in analysis and manuscript preparation.

Health Protection Agency for statistical analysis inputs and manuscript preparation.

University of Bergen to supervise and guide overall process.
Briefing to monitoring mission
Social Security hospital Visit

28/03/2012
Informal Provider (Homeopath)
Field Visit to Clinics
Thanks for your attention