TB in children; experiences from a low to middle income country, Papua New Guinea

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Papua New Guinea (PNG)

- Situated in the south western Pacific and directly north of Australia
- Largest country in the Pacific with a population of almost 9 million people
- Known for its rugged mountainous terrains and it’s vast scattered islands
- Known for it’s variety of cultures and it’s biological diversity
- A land of different tribes with well over 800 different native languages
- Set backs with our delivery of health services in view of difficult geographical terrains and different cultural beliefs and language barriers
- Common language- PNG ‘Tok pisin’
TB in PNG

- TB incidence: 432/100,000 (7th worldwide)
- ~30,000 cases/year
- 26% of total reported TB cases occur in children (highest worldwide)

The majority of children diagnosed with MDR reflect that of adults. Most are currently in Daru and Port Moresby, but are reported throughout PNG.

Source: BMC Infectious disease

Daru, Western Province
CNR = >2,000/100,000

Port Moresby (National Capital District)
CNR = 1,117/100,000
### PNG TB Case Notification Trend: 2017-2022

- **An CNR increase of 19% in 2022 from an average increase of 6-7% over the 5 years. Slides courtesy of NTP/WHO**

#### Province 2021 2022 % of Increase

<table>
<thead>
<tr>
<th>Province</th>
<th>2021</th>
<th>2022</th>
<th>% of Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>HELA</td>
<td>599</td>
<td>1345</td>
<td>55%</td>
</tr>
<tr>
<td>NEW IRELAND</td>
<td>154</td>
<td>284</td>
<td>46%</td>
</tr>
<tr>
<td>EAST SEPIK</td>
<td>1540</td>
<td>2738</td>
<td>44%</td>
</tr>
<tr>
<td>JIWAKA</td>
<td>552</td>
<td>894</td>
<td>38%</td>
</tr>
<tr>
<td>WHP</td>
<td>1217</td>
<td>1646</td>
<td>26%</td>
</tr>
<tr>
<td>CHIMBU</td>
<td>1506</td>
<td>1943</td>
<td>22%</td>
</tr>
<tr>
<td>MADANG</td>
<td>1675</td>
<td>2135</td>
<td>22%</td>
</tr>
<tr>
<td>ORO</td>
<td>908</td>
<td>1157</td>
<td>22%</td>
</tr>
<tr>
<td>WNB</td>
<td>2502</td>
<td>3184</td>
<td>21%</td>
</tr>
<tr>
<td>NCD</td>
<td>5309</td>
<td>6685</td>
<td>21%</td>
</tr>
<tr>
<td>EHP</td>
<td>1754</td>
<td>2123</td>
<td>17%</td>
</tr>
<tr>
<td>SHP</td>
<td>700</td>
<td>821</td>
<td>15%</td>
</tr>
</tbody>
</table>

**Grand Total** 30234 37135 19%
Paediatric Ward at Port Moresby General Hospital (PMGH)

- 150 paediatric beds / 3,000 admissions
  - TB is the 3rd leading cause of admission (~13% of all admissions)

- 900 children started on TB treatment yearly (outpatient + inpatient)
  - 450 admitted
  - 10% in-hospital mortality for children diagnosed with TB if admitted
  - Present with severe disease,
  - 7% with HIV (new/CLHIV)
  - 40% with moderate/severe malnutrition
TB in adults

- TB is the #1 cause of admission to the adult wards
- Adults admit ~1,000 persons with TB yearly
### Table 1. DESCRIPTION OF 444 CHILDREN STARTED ON DSTB TREATMENT AT PMGH IN THE FIRST 6 MONTHS OF 2023

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
<th>Total (n=444)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment site/ Catchment area</td>
<td>PMGH TB Clinic</td>
<td>92</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>Other (BMU outside of PMGH)</td>
<td>352</td>
<td>79%</td>
</tr>
<tr>
<td>Province or Origin</td>
<td>NCD</td>
<td>239</td>
<td>54%</td>
</tr>
<tr>
<td></td>
<td>Central Province</td>
<td>105</td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td>Other/Unknown</td>
<td>20</td>
<td>5%</td>
</tr>
<tr>
<td>Inpatient vs Outpatient diagnosis (N=389)</td>
<td>Inpatient diagnosis</td>
<td>210</td>
<td>47%</td>
</tr>
<tr>
<td></td>
<td>Outpatient diagnosis</td>
<td>179</td>
<td>40%</td>
</tr>
<tr>
<td>Presence of malnutrition (n=347)</td>
<td>Moderate malnutrition</td>
<td>59</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>Severe malnutrition</td>
<td>93</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>Overall (Mod + severe)</td>
<td>152</td>
<td>34%</td>
</tr>
<tr>
<td>Xpert testing completed</td>
<td>Yes</td>
<td>271</td>
<td>61%</td>
</tr>
<tr>
<td>Xpert testing results OVERALL</td>
<td>MTB detected; RR not detected - overall</td>
<td>73/444</td>
<td>16%</td>
</tr>
<tr>
<td>Xpert testing results among those tested (n=252)</td>
<td>MTB detected; RR not detected – among children who received xpert testing</td>
<td>73/271</td>
<td>27%</td>
</tr>
</tbody>
</table>

### Registration of TB Patients

PMGH serves as an entry point for TB diagnosis and initiation of treatment.

Children are started on treatment and then discharged for registration at local BM.

Goal is to register >80% of children diagnosed with TB.
Figure 4. Rates of HIV testing for children diagnosed with TB at PMGH

- **TB cases diagnosed and started on treatment at PMGH**
- **% of children receiving an HIV test**
- **% with TB-HIV co-infection (known and new HIV cases)**
- **% newly diagnosed HIV**

Data points for years 2016 to 2022:

- 2016: 381 cases, 37% HIV testing, 12.9% co-infection, 0% newly diagnosed
- 2017: 810 cases, 66% HIV testing, 11.6% co-infection, 0% newly diagnosed
- 2018: 588 cases, 55% HIV testing, 6.7% co-infection, 0% newly diagnosed
- 2019: 1069 cases, 86% HIV testing, 9.1% co-infection, 0% newly diagnosed
- 2020: 702 cases, 84% HIV testing, 4.1% co-infection, 0% newly diagnosed
- 2021: 876 cases, 83% HIV testing, 2.9% co-infection, 0% newly diagnosed
- 2022: 912 cases, 90% HIV testing, 6.9% co-infection, 2.9% newly diagnosed
<table>
<thead>
<tr>
<th>DSTB</th>
<th>2019</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>TB cases diagnosed and started on treatment at PMGH</em></td>
<td>810</td>
<td>588</td>
<td>1077</td>
<td>702</td>
<td>876</td>
<td>912</td>
</tr>
<tr>
<td># children receiving Xpert testing</td>
<td>25</td>
<td>241</td>
<td>709</td>
<td>402</td>
<td>597</td>
<td>518</td>
</tr>
<tr>
<td>% of children receiving Xpert testing</td>
<td>3%</td>
<td>41%</td>
<td>66%</td>
<td>57%</td>
<td>68%</td>
<td>57%</td>
</tr>
<tr>
<td># of cases bacteriologically confirmed by Xpert</td>
<td>0</td>
<td>5</td>
<td>283</td>
<td>101</td>
<td>132</td>
<td>169</td>
</tr>
<tr>
<td>% of cases bacteriologically confirmed overall</td>
<td>0%</td>
<td>0.85%</td>
<td>283/1077</td>
<td>26%</td>
<td>101/702</td>
<td>14%</td>
</tr>
<tr>
<td>% of cases bacteriologically confirmed among children tested</td>
<td>0%</td>
<td>2%</td>
<td>283/709</td>
<td>40%</td>
<td>101/402</td>
<td>25%</td>
</tr>
</tbody>
</table>

*2016 represents 5 months of data collection

The true confirmation rate is somewhere in between the “Confirmed Overall” and “Confirmed among children tested”
Drug resistant TB in PNG
PNG- Estimates of MDR-TB among TB

• Among new TB cases: 4%
• Among previously treated TB cases: 23%
• Estimates of MDR/RR-TB Incidence: 24/100,000 population
• Estimated new MDR-TB cases for 2021 was 2,400 of which only 535 (22%) were detected.
• Estimated MDR/RR-TB treatment coverage in 2021 is 22%: The global average is 36% coverage

Slides courtesy of PNG NTP & WHO
DR-TB Treatment outcome rates

Treatment outcome of RR/MDR-TB

Year | Treatment success rate | Death rate | Failure rate | LTFU rate | Not Evaluated rate
--- | --- | --- | --- | --- | ---
2015 | 58% | 2% | 11% | 13% | 0%
2016 | 52% | 8% | 11% | 12% | 10%
2017 | 63% | 8% | 14% | 25% | 20%
2018 | 68% | 1% | 14% | 15% | 30%
2019 | 67% | 2% | 15% | 3% | 40%
2020 | 71% | 1% | 12% | 3% | 50%
2021 | 61% | 5% | 13% | 6% | 50%
2022 | 63% | 5% | 11% | 9% | 50%
2023 | 69% | 2% | 11% | 3% | 60%
# Treatment outcomes for children with DRTB in PMGH

<table>
<thead>
<tr>
<th>DRTB cases</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>1H23</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRTB cases</td>
<td>13</td>
<td>19</td>
<td>33</td>
<td>21</td>
<td>39</td>
<td>29</td>
<td>35</td>
<td>14</td>
<td>214*</td>
</tr>
<tr>
<td>Treatment completed</td>
<td>9 (69%)</td>
<td>15 (78%)</td>
<td>25 (76%)</td>
<td>21 (100%)</td>
<td>27 (70%)</td>
<td>22 (75%)</td>
<td>30 (86%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Died</td>
<td>2 (15%)</td>
<td>3 (16%)</td>
<td>6 (18%)</td>
<td>0</td>
<td>6 (15%)</td>
<td>7 (24%)</td>
<td>5 (12%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Total = 214 cases since 2014 and 2015 (data not shown for those years)
Current Regimens for DRTB in PNG

Pediatric regimens:
(i) 6 BDQ-Lfx-Lzd-Cfz/12 Lfx-Lzd-Cfz (longer all-oral regimen)
(ii) Adults: will introduce BPaL next year
## PNG SUPPLEMENT

### Drug-resistant tuberculosis diagnosis since Xpert® MTB/RIF introduction in Papua New Guinea, 2012–2017

E. K. Lavu, K. Johnson, J. Banamu, S. Pandey, R. Carter, C. Coulter, P. Aia, S. S. Majumdar, B. J.

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**Table 2** Genotypic susceptibility of *Mycobacterium tuberculosis* strains in NCD, Daru, and other PNG provinces

<table>
<thead>
<tr>
<th>WHO Group</th>
<th>Anti-TB drug</th>
<th>% NCD strains susceptible (n = 66)</th>
<th>% Daru strains susceptible (n = 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>Levofloxacin OR moxifloxacin</td>
<td>95</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>Bedaquiline</td>
<td>98</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Linezolid</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Group B</td>
<td>Clofazimine</td>
<td>98</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Cycloserine OR terizidone</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Group C</td>
<td>Ethambutol</td>
<td>52*</td>
<td>44*</td>
</tr>
<tr>
<td></td>
<td>Delamanid</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Pyrazinamide</td>
<td>61*</td>
<td>43*</td>
</tr>
<tr>
<td></td>
<td>Imipenem-cilastatin OR meropenem, with clavulanic acid</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td>Amikacin</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>Streptomycin</td>
<td>36</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Ethionamide OR prothionamide</td>
<td>38*</td>
<td>14*</td>
</tr>
<tr>
<td></td>
<td>Para-aminosalicylic acid</td>
<td>98</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>High dose Isoniazid</td>
<td>27*</td>
<td>33*</td>
</tr>
</tbody>
</table>

NCD: National Capital District, PNG: Papua New Guinea, TR: Tuberculosis
CHILD WITH MDR-TB (CONFIRMED OR CLINICALLY DIAGNOSED)

DECIDE IF CHILD HAS “SEVERE” OR “NON-SEVERE DISEASE” TO DETERMINE DURATION

DETERMINE IF CHILD HAS KNOWN OR POSSIBLE FLQ RESISTANCE TO DECIDE ON REGIMEN COMPOSITION

FLQ resistance not documented or unlikely: BDQ-LFX-CFZ-CS-LZD* *LZD can be given for 8 weeks or omitted in children with non-severe disease and risk factors for toxicity

FLQ resistance is documented or is likely: BDQ-DLM-CFZ-CS-LZD* *duration of LZD can be determined based on disease severity and risk factors for toxicity

Practical guidance

OPTIONAL

Management of Multidrug-Resistant Tuberculosis in Children: A FIELD GUIDE

Slides courtesy of Steve Graham and Ben Marais
Snapshot of DR-TB children at PMGH

- 2014-2023 = 214 DRTB case (started on treatment)

- Confirmed bacteriologically (X-pert) = 160/214 (75%)

- Cultures sent = 128/214 (60%)
  - Culture positive 40/128 (30%)
  - Only 31/128 (24%) with DST results

- MDR contact identified overall = 70/214 (32%)

- Previously treated for TB = 93/214 (43%)

- No prior TB treatment history = 121/214 (56%)
  - 51/121 (42%) - Had an MDR contact
  - 70/121 (58%) - No MDR contact, No prior treatment history
    - 66/70 (95%) were X-pert confirmed RR

- HIV positive = 8/200 (4%)

- MAM/SAM = 39/168 (23%)
Preventive therapy for child MDR contacts
TB Reach Grant
“TB Free PNG”

- Maternal Newborn Child Health (MNCH) TB Program
- Family-centered TB detection and linkage to care for peri-natal women
Introduction of radiology access to Maternity unity

20,000-30,000 screening CXR/year for TB at PMGH

AI software
1. MinXray at maternity
2. Main hospital
3. TBC (containerized xray)
TB Free PNG

• Scale up TB screening and diagnosis of pregnant and post-partum mothers
  – 77 moms with DSTB diagnosed, (1 MDR)
    • over last 4 months
  – Screen family members at home
  – Connection to community treatment supporters (NTP/WVI)
  – Introduction of CAD/AI software to PMGH (including pregnant women) expected 4Q23
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• The Port Moresby General Hospital (PMGH)
Tenk yu tru!