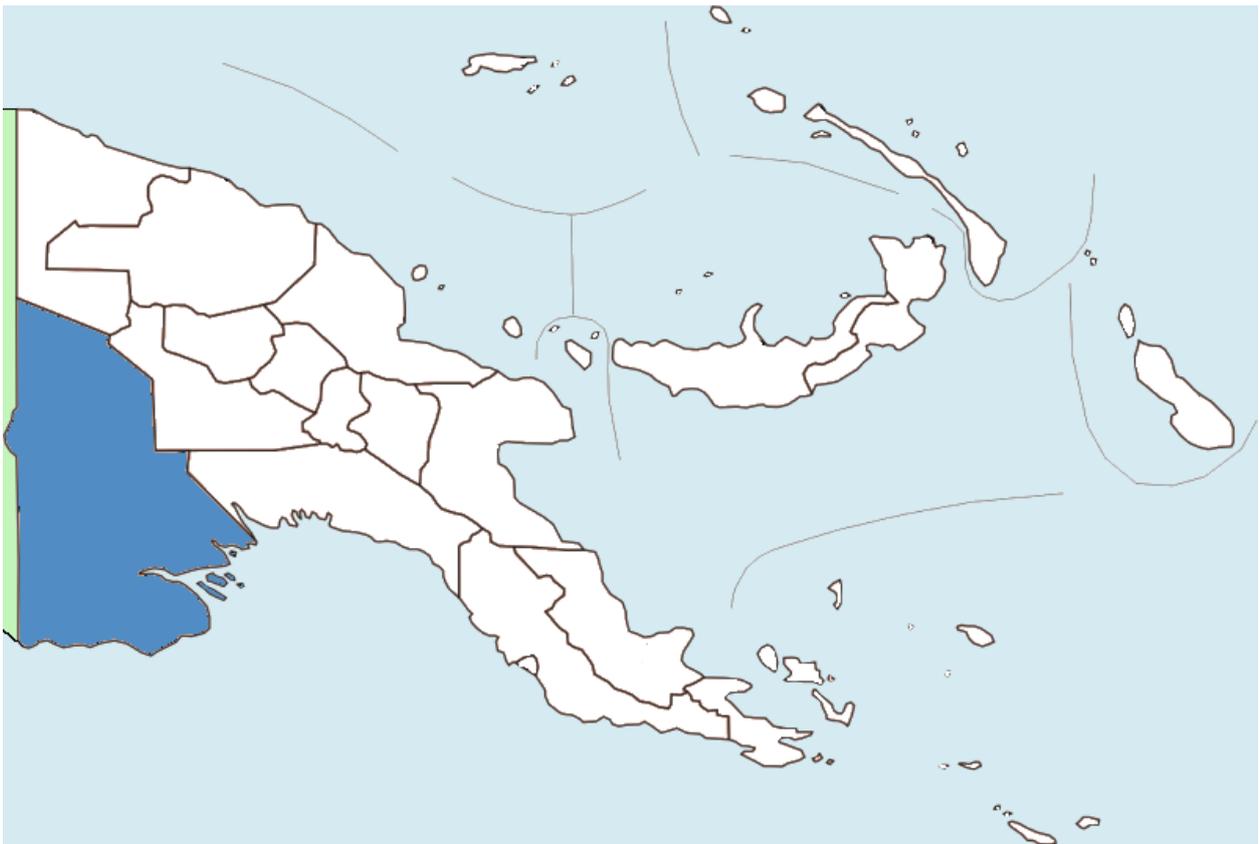


Evaluation of Risks of Tuberculosis in Western Province Papua New Guinea



ACRONYMS & ABBREVIATIONS

| | |
|------------------|---|
| ACSM | ADVOCACY, COMMUNICATION AND SOCIAL MOBILIZATION |
| ART | ANTI RETROVIRAL THERAPY |
| AUSAID | AUSTRALIAN AGENCY FOR INTERNATIONAL DEVELOPMENT |
| BMU | BASIC MANAGEMENT UNIT |
| CM | CAPREOMYCIN |
| Cs | CYCLOSERINE |
| CHW | COMMUNITY HEALTH WORKERS |
| DOT | DIRECTLY OBSERVED TREATMENT |
| DOTS | DIRECTLY OBSERVED TREATMENT, SHORT COURSE |
| DRHS | DIRECTOR RURAL HEALTH SERVICES |
| DRS | DRUG RESISTANCE SURVEILLANCE/ SURVEY |
| E | ETHAMBUTOL |
| FDC | FIXED DOSE COMBINATION |
| FQ | FLUROQUINOLONE |
| FRPG | FLY RIVER PROVINCIAL GOVERNMENT |
| GENEXPERT | NUCLEIC ACID AMPLIFICATION (PCR) TEST FOR TB AND RIFAMPICIN RESISTANCE |
| GFATM | GLOBAL FUND TO FIGHT AIDS, TB AND MALARIA |
| H | ISONIAZID |
| HC | HEALTH CENTRE |
| HEO | HEALTH EXTENSION OFFICER |
| HIV | HUMAN IMMUNODEFICIENCY VIRUS |
| INH | ISONIAZID |
| IPT | ISONIAZID PREVENTIVE THERAPY |
| JTAI | JANE THOMASON & ASSOCIATES INTERNATIONAL |
| KM | KANAMYCIN |

Evaluation of Risks of Tuberculosis in Western Province Papua New Guinea

| | |
|----------------|--|
| MDR | MULTI DRUG RESISTANT (RESISTANT TO AT LEAST ISONIAZID AND RIFAMPICIN) |
| M&E | MONITORING AND EVALUATION |
| MDR-TB | MULTI-DRUG RESISTANT TB |
| NDoH | NATIONAL DEPARTMENT OF HEALTH |
| NTP | NATIONAL TB PROGRAM |
| OFX | OFLOXACIN (A TYPE OF FLUOROQUINOLONE) |
| OTML | OK TEDI MINING LIMITED |
| PHO | PROVINCIAL HEALTH OFFICE |
| PICT | PRACTITIONER INITIATED COUNSELLING AND TESTING |
| PNG | PAPUA NEW GUINEA |
| PNG IMR | PAPUA NEW GUINEA INSTITUTE OF MEDICAL RESEARCH |
| PTB | PULMONARY TUBERCULOSIS |
| PYZ | PYRAZINAMIDE |
| QA | QUALITY ASSURANCE |
| QMRL | QUEENSLAND MYCOBACTERIAL REFERENCE LABORATORY |
| R | RIFAMPICIN |
| R&R | RECORDING AND REPORTING |
| RIF | RIFAMPICIN |
| S | STREPTOMYCIN |
| STI | SEXUALLY TRANSMITTED INFECTION |
| TB | TUBERCULOSIS |
| TSI | TORRES STRAIT ISLANDS |
| WHO | WORLD HEALTH ORGANIZATION |
| XDR | EXTENSIVELY DRUG RESISTANT (TUBERCULOSIS) |
| Z | PYRAZINAMIDE |

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Affiliations

Burnet Institute



Table of Contents

| | |
|---|-----------|
| Acknowledgements..... | 4 |
| Affiliations..... | 4 |
| 1. Executive Summary | 7 |
| <i>Conclusions.....</i> | 9 |
| 2. Background | 10 |
| 2.1 <i>Western Province Health Service.....</i> | 10 |
| 2.2 <i>Programmatic Tuberculosis Management.....</i> | 12 |
| 2.3 <i>Management of TB in PNG: guidelines</i> | 13 |
| Challenges..... | 14 |
| 2.4 <i>MDR TB concerns in the Torres Strait.....</i> | 14 |
| 2.5 <i>Management of TB in the Treaty Villages.....</i> | 15 |
| 2.6 <i>Terms of Reference of this evaluation.....</i> | 16 |
| 2.7 <i>Methodology of this evaluation.....</i> | 17 |
| North Fly | 18 |
| Middle Fly | 18 |
| South Fly | 19 |
| 3. Observations on the health facilities visited | 20 |
| 4. Epidemiology of Tuberculosis..... | 26 |
| 4.1 <i>2011 Tuberculosis incidence according to available data including TB registers</i> | 26 |
| 4.2 <i>Outcomes.....</i> | 26 |
| 4.3 <i>Trends over time</i> | 28 |
| 4.4 <i>MDR TB.....</i> | 31 |
| 4.4.2 <i>MDR Patients treated in Australia 2001-2006.....</i> | 31 |
| Update on cases treated in Australia 2001-2010..... | 32 |
| 4.4.2 <i>Hand-over patients</i> | 32 |
| 4.4.3 <i>Proven or suspect MDR cases whose Treatment was Initiated in Daru Hospital.....</i> | 33 |
| 4.4.4 <i>MDR cases diagnosed by Daru Hospital: Trends over time</i> | 33 |
| 4.5 <i>XDR TB.....</i> | 34 |
| Development of XDR TB | 34 |
| 4.6 <i>HIV and TB.....</i> | 35 |
| 4.7 <i>True incidence estimates and unknowns.....</i> | 35 |
| 4.8 <i>Summary of epidemiology of tuberculosis in Western Province.....</i> | 36 |
| 5. Other diseases and burdens on health system in Western Province | 37 |
| 5.1 <i>Malaria.....</i> | 37 |
| 5.2 <i>Pneumonia.....</i> | 38 |
| 5.3 <i>Gastrointestinal/malnutrition</i> | 38 |
| 5.4 <i>Obstetrics/perinatal.....</i> | 39 |
| 5.5 <i>injury</i> | 39 |
| 5.6 <i>HIV/AIDS.....</i> | 39 |
| 5.7 <i>Preventive health: vaccination</i> | 39 |

Evaluation of Risks of Tuberculosis in Western Province Papua New Guinea

| | |
|--|-----------|
| 6. Achievements in the last 12 months | 41 |
| 6.1 Co-ordination of TB response..... | 41 |
| 6.2 Daru Hospital..... | 41 |
| 6.3 Transport..... | 41 |
| 6.4 Outreach..... | 41 |
| 6.5 HIV/TB..... | 42 |
| 6.6 Contact tracing..... | 42 |
| 6.7 Training..... | 42 |
| 7. Gaps | 43 |
| 7.1 Infection control..... | 43 |
| 7.2 Communication..... | 44 |
| 7.3 Outreach & Education..... | 44 |
| 7.4 Hospital capacity..... | 45 |
| 7.5 Human resources..... | 45 |
| 7.6 HIV testing..... | 45 |
| 8. Risks | 46 |
| 8.1 Risks at the border..... | 46 |
| 8.2 Risks elsewhere..... | 46 |
| 8.3 Risks to programmatic control of tuberculosis..... | 48 |
| 8.4 Long Term Risks..... | 49 |
| 9. Conclusions & Recommendations | 50 |
| 9.1 Risk reduction measures..... | 50 |
| 9.2 Strengthening of TB services in Western Province..... | 51 |
| 9.3 Solve the rural health service crisis in Western Province..... | 51 |
| 9.4 Practical short-term steps..... | 52 |
| Communications..... | 52 |
| Staff support..... | 52 |
| Outreach..... | 52 |
| 9.5 Risks associated with this strategy..... | 53 |
| 9.6 Research..... | 54 |
| 9.7 Limitations of this report..... | 55 |

1. Executive Summary

Tuberculosis in Western Province: tuberculosis (TB) is the major contributor to the infectious diseases burden in Western Province and indeed all of PNG. On my mission, TB was the principal diagnosis in almost all admitted medical patients. Malaria and HIV are also concerns in the Western Province but currently generate a much lower burden in terms of deaths, morbidity, hospitalisations, utilisation of healthcare and cost of treatment. After reviewing five TB registers (two in North Fly, two in Middle Fly and one in South Fly (Daru Hospital)), I estimated that the registered incidence of TB in Western Province is around 500 per 100,000 people per annum, much higher than the national reported rate of 300 and the PNG National Department of Health estimate for Western Province of 150 per 100,000. My estimated rate for Western Province is almost double the overall TB incidence in the WHO-defined African region and similar to rates in Mozambique and Cambodia. Nevertheless, the true incidence of TB is likely to be even higher due to poor access to healthcare and poor rural health services in the region, leading to under-reporting. Under-reporting is likely to be responsible for the unusual case mix in many parts of the region (large number of extra-pulmonary to pulmonary cases, more women than men reported, late presentation of TB), suggesting much TB is missed by registers. Greater outreach into rural areas will provide more robust estimates of TB incidence.

Multi-Drug Resistant (MDR) TB: MDR TB is resistant to isoniazid and rifampicin, the two most effective drugs used in first-line treatment. MDR is much harder to treat, typically taking 20-24 months and much more intensive and expensive therapy. Once MDR TB has emerged, it can be spread from person to person in the same way as drug-sensitive (normal) TB. Rates of MDR TB in Western Province are just now being evaluated, with a genXpert machine in use in Daru Hospital since 18th May 2012. Early results are not encouraging: around 50% of TB-positive sputum tested to date is MDR TB. Thirty-three cases of MDR TB were detected in May-Sept 2012. Port Moresby Hospital is also measuring MDR rates using genXpert, finding around 25% resistance in TB isolates from the National Capital District. Daru Hospital has programmatic management of MDR TB in place, but the remainder of the province as far North as Kiunga does not test for MDR TB or have drugs or infrastructure to manage it. Ninety-two TB patients have been handed over from Torres Strait Island (TSI) clinics to Daru; 33 with MDR TB.

Extensively drug resistant (XDR) TB: XDR TB is MDR TB that is also resistant to two of the second line agents used to treat MDR TB (namely injectable agent and fluoroquinolone). This level of resistant TB is extremely hard to treat and very expensive. Similar to MDR, XDR TB arises as a result of antimicrobial pressure; the use of (inadequate/interrupted) therapy for MDR TB.

Five (this has increased to six since my visit) known cases of XDR TB have arisen in Western Province. The four cases being treated in Daru Hospital have had no prior second-line agents but at least two of the cases have direct epidemiological links to other treated MDR cases; a

third case was a hospital acquired case, a nurse who was treating an XDR case. Two XDR TB cases in people from the Western Province are being treated in Cairns Hospital.

Trends over time: incidence, deaths and treatment failures. The TB registers show incidence rates are increasing in some parts of the province, particularly in Middle Fly and Kiunga Hospital region. Assuming a catchment of 30,000, registered TB rates in Kiunga increased from 600 to 1500 per 100,000 people per annum over the last five years. Rates of failure and default vary dramatically from year to year with recent marked increases in defaults at Kiunga Hospital. Some of the defaults can be attributed to drug shortages and poor rural health infrastructure for Directly Observed Treatment, Short Course (DOTS). Daru had a 10% TB death rate in 2008-2010 and a 5% death rate in 2011. Rates of tuberculosis in Daru seem approximately stable over the last 10 years at around 500 per 100,000.

HIV and TB Rates of HIV in TB cases are estimated based on data from only three hospitals - Daru, Rumginae and Tabubil- as these are the only centres presently routinely testing TB patients for HIV. Rates vary from 5% in Daru to 10% in Tabubil. Background HIV rates are difficult to estimate; from Kiunga urban clinic performing voluntary testing on pregnant women, 10 of 400 (2.5%) tested positive over the last year. These rates rule out the possibility that the current increases in MDR TB and TB incidence are driven by high rates of HIV. However, they are significant and cause concern that if left unabated, the rates of HIV may rise rapidly and become an additional burden on the healthcare system, manifest in increasing incidence of TB in the next five years.

Risk of PNG residents with active TB in the treaty region: Some PNG residents may travel into the treaty territory for traditional activities but are currently restricted from accessing health services. The risk to Australians on Saibai and Boigu islands of acquiring TB from PNG residents (around 2000 people movements per month) remains low as long as contact is confined to trading, fishing and other outdoor activity. Risk increases if activity involves residing with Saibai and Boigu Islanders or sharing schoolrooms or homes without appropriate isolation and ventilation. Education for early detection of tuberculosis, HIV detection and management, 100% neonatal BCG vaccination, cough etiquette training and attention to housing and hospital facilities' ventilation is strongly advised in the treaty regions of the TSI. I was unable to review current practices with regards to this. Evaluation of the TSI region and review of TB cases and isolates (including genotype) from Australian residents in the treaty zone would add substantial evidence on which to estimate risk of cross-border and onward transmission of tuberculosis.

Risk of PNG residents outside the treaty region travelling with active TB: Measures are in place to prevent short-term visits from PNG residents with infectious TB travelling to Australia, including a requirement for a medical exam and chest X-ray prior to visa. These provide some protection to Australia but do not prevent those with latent TB travelling or people with active TB and a longer-term visa travelling to Australia. Australia receives 4500 short-term visits from PNG residents per month and approximately 7000 Australian residents leave for short-term visits to PNG each month.

PNG risk compared with risks from other countries: Australia records around 1000-1200 cases of active TB per year, most (80-90%) of which are from people born overseas, reactivating latent TB that was acquired in their country of origin. A minority (~3%) of these cases come from PNG, but the numbers are rising steadily (27 in 2005 to 36 in 2009). Most of the PNG nationals notified in Australia come from the TSI border clinics. In 2009, 11 of 31 cases of MDR notified in Australia were from PNG, all from treaty villagers seeking healthcare in Australia.

Influence of the Saibai & Boigu Island Australian clinics: Doctors at these clinics played a key role in alerting Australia to the drug resistant TB problems facing the Western Province and advocating for improved services for tuberculosis in the region. The Western Province requires a strong emphasis on programmatic TB management with public backing, ownership and social mobilisation. A healthcare provider acting outside of this could undermine these efforts. Hence the role for the Saibai and Boigu clinics and physicians needs to be within the Provincial strategy for TB management.

Conclusions

1. Burden of TB, in particular MDR TB, is very high in Western Province, well above current WHO and PNG Department of Health estimates.
2. Ongoing expansion of current activities in programmatic management of TB are likely to improve data reliability & availability; including improved communication, transport and outreach, increased basic management units and training.
3. Managing TB services within a PNG national program is likely to a) reduce the risk of MDR TB transmission to Australian residents in the short term, by reducing the number of PNG Nationals seeking healthcare in Australia and b) reduce risk of increased drug resistance, by reducing access to second line agents and loose drugs available outside a control program.
4. Well-coordinated programmatic TB management and general healthcare provisions for people of the Western Province must be urgently expanded to avoid increases in MDR and XDR TB.

2. Background

The Torres Strait treaty zone takes in some of Australia's Torres Strait Islands and coastal villages along the South Fly coast, Western Province PNG. Movement between PNG and Australia for traditional activity is unrestricted under this treaty. As a consequence of both better access to healthcare in Australia and the large difference in the quality of health services between the two countries, some PNG nationals have been seeking healthcare in Australian clinics. Australian clinicians have reported an increase in PNG nationals accessing health services for TB, and in particular, multi-drug resistant TB [1]. Australian physicians working out of Cairns Hospital undertook to manage these patients, and were also the early advocates for expanded TB treatment, alerting the wider community to the problem and developing specific measures to manage the patients seeking care at the clinics.

PNG, and in particular Western Province, has a struggling health service, with very poor rural health facilities, high absenteeism and frequent shortages of medication. Daru Hospital, the provincial hospital, is remote to some of the treaty villagers seeking care on Saibai and Boigu Island in the Torres Strait, Australia.

Australia has responded to the escalating demand on Australian health services by closing the treaty health clinics to PNG nationals (handover taking place 2011 and 2012) and increasing support for TB services within Western Province, PNG through AusAID assistance. This also coincides with roll out by the Global Fund (GFATM) of programmatic management of TB throughout PNG over the years 2007-2012. Unfortunately, this rollout was delayed for approximately 12 months, and Western Province was one of the Provinces in the last phase of rollout (phase five). Hence programmatic TB rollout commenced in January 2012 for Western Province, PNG and at the time of this report (October 2012) is a work in progress.

The aim of this evaluation mission is to assess the risk of TB and MDR/XDR TB in Western Province, including risk to Australia through the people movement around the treaty region and through other forms of migration.

2.1 Western Province Health Service

The Western Province has the usual challenges of PNG, including lack of access to healthcare facilities, poverty, unemployment and governance problems. However, it has additional problem of being the most remote, largest (in area) and most sparsely populated province. Its population is estimated to be around 210,000 over an area of 100,000km².

Western Province also has two international borders – with Australia and Indonesia. Around 3,000 people live in the Treaty Villages, bordering Australia.

Evaluation of Risks of Tuberculosis in Western Province Papua New Guinea

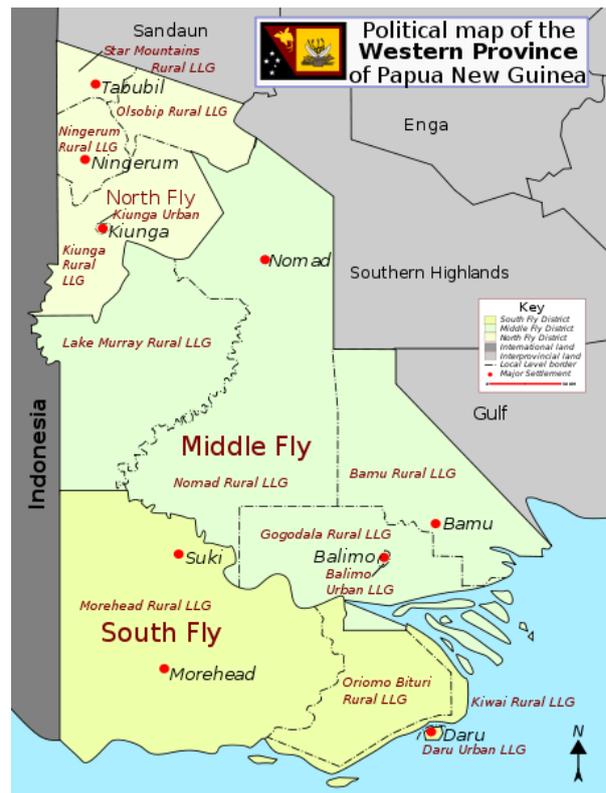
Western Province has three Districts,

The North Fly District,
population ~70,000

The Middle Fly District,
population ~77,000

The South Fly District,
population ~64,000

The provincial capital is Daru with a population of approximately 15,000. It is a small and densely populated island close to the coast of mainland PNG. Daru Township has pockets of populations in settlements (corners) within which there is makeshift housing that is over-crowded and disorganized and lacking community infrastructure, including adequate sanitation and water supply.



The PNG National Health System functions with urban hospitals and a rural health service consisting of a Health Centre and Aid Posts. The Aid Post is a small health facility with one community health worker, supplied with basic medication. The Health Centre is a unit servicing a group of 10 to 20 Aid Posts; these are larger facilities with more staff, usually at Health Extension Officer (HEO) and nursing level. There is a medical referral system from Aid Post to Health Centre to District Hospital to Provincial Hospital and to Port Moresby Hospital if required. Each level of health service has a minimum requirement set by NDoH, however maintaining these minimum standards is challenging.[2] Chronic understaffing, poor maintenance and drug shortages are very common among all levels of health services throughout Western Province.

Daru is the Provincial Hospital in Western Province and is a major referral point for Health Centres, providing secondary care services. It is therefore the referral centre for the residents of the treaty villages who have previously been seeking care in Boigu and Saibai Island clinics.

Daru is the base for the Western Province Provincial Hospital, Provincial Health Office and South Fly District Health Office. However the provincial government is based in Kiunga, in the North Fly District. The District Health Officer controls the human resourcing of health in the Western Province districts, while the Provincial Director of Rural Health Services can play an

advisory role only, which leads to frustrations in delivery planned health interventions in the province.

Table 2-1: Summary of Health Facilities in Western Province

| Districts | Provincial Hospital | District Hospitals | Health Centres | Urban Clinic | Aid Posts | Total |
|--------------|---------------------|--------------------|----------------|--------------|------------|------------|
| North Fly | 0 | 3 | 12 | 1 Kiunga | 53 | 69 |
| Middle Fly | 0 | 1 Balimo* | 13 | 2 | 57 | 73 |
| South Fly | 1 | 0 | 8 | 1 Daru | 54 | 64 |
| Total | 1 | 4 | 33 | 5 | 164 | 206 |

* Two District Hospitals, one funded by Provincial government and one funded by DSIP are currently under construction in Balimo.

2.2 Programmatic Tuberculosis Management

TB is one of the commonest cause of death from infectious diseases globally, causing 1.8 million deaths annually – a tragic outcome for a curable disease. While rates are declining globally, in PNG the rates seem to be increasing. By some estimates, TB is the infectious disease that causes the greatest number of deaths in PNG.

As TB is an infectious disease with a high propensity to develop drug resistance through inadequate therapy (use of only one or two effective agents, inadequate course of treatment), its diagnosis and treatment is of interest beyond the individual, and as such programmatic management in settings of high incidence, such as the Western Province, is essential. Programmatic management of TB is described in detail by WHO [3] and will not be repeated in this report, however a brief outline is necessary to a discussion of the importance of various elements of management, particularly as it relates to treaty villagers. Essential elements of programmatic management of TB are:

1. Rapid detection, clinical assessment and sputum microscopy (smear result available within 3 days)
2. Correct choice of therapy; with multiple agents to which the isolate is susceptible, preferably in fixed dose combination (FDC) pills.
 - a. 2HRZE/4HR¹ for standard therapy
3. Ensuring adequate supervision and full course of therapy is given (this is done through directly observed treatment (DOT))
4. Follow-up with repeat sputum at 2-3 months and again at 5-6 months

¹ Standard notation is used, 2HRZE means 2 months of isoniazid(H) rifampicin (R)pyrazinamide(Z)ethambutol(E)

5. Case finding: children and other household members assessed for symptoms, sputum taken from adults
6. Recording and reporting
7. Monitoring and evaluation
8. HIV and TB integrated management: this involves counselling and offering testing to all TB cases and assessing all HIV cases for active TB, and treating for latent TB
9. MDR TB diagnosis and management

2.3 Management of TB in PNG: guidelines

The essential element in a programmatic response to TB is the Basic Management Unit. A BMU consists of (at a minimum) a health facility, a microscope and trained microscopist, and a TB drug dispensary. Each BMU records TB diagnostic and management activity using three books: a TB suspect Register, a TB Register and a TB Microscopy Register. Triangulation of this data and quarterly reporting is an essential element of Recording and Reporting (R&R) in a TB program.

Management guidelines: TB is diagnosed through an outpatient service. Any person with a cough lasting three or more weeks not responding to standard antibiotics is asked to have 2x sputa tested for Acid-fast Bacilli on smear. All cases of clinically suspicious extra-pulmonary TB are also supposed to have sputum tested. When results confirm smear-positive, TB patients are admitted as inpatients for a variable period depending on the hospital. Standard Category 1 therapy is 2HRZE/4HR², now available in fixed dose combination for adults throughout the province, but not in paediatric formulation.

Most patients remain inpatients for two weeks, then are treated daily with DOTS at outpatients clinic for the remainder of the two month intensive phase. During the continuation phase, a community support worker (a non-family, village leader; having been identified and trained) administers daily DOTS. A two or three month sputum is required for all smear-positive cases and a 5/6 month sputum must be negative to prove cure. Contact tracing is variable but in most centres involves bringing the family members of the case in to the hospital for a clinical review and sputum specimens. At Daru, a chest X-ray is also performed. Small children (<5y) are given isoniazid prevention therapy if they are household members of an index case and do not display features of active TB.

Testing for HIV should be performed using rapid tests, and this has begun in parts of the province, although it is a voluntary process requiring private counselling and has led to reduced numbers of centres being able to conduct tests. All cases of HIV should be assessed clinically for TB and treated with a full course of therapy if TB is found and treated with isoniazid (6H) otherwise according to the PNG National Tuberculosis Management Protocol [4].

People failing therapy are routinely retreated using a slightly different regimen to first-line

² This notation is commonly used and means 2 months of HRZE, called the intensive phase, followed by four months of HR, called the continuation phase

therapy. Category 2 therapy is 2HRZE+S, 1HRZE, 5 HRE regimen used for those who have failed, relapsed or defaulted (for greater than one month) and require retreatment. TB meningitis is treated with 2HRZ+S/ 4HR. Only three centres in PNG can currently detect rifampicin resistance (which usually implies MDR TB, although some isolates can be rifampicin resistant and isoniazid sensitive). Port Moresby Hospital, Daru Hospital and PNG IMR currently have geneXpert machines, while no facility in PNG can perform full drug susceptibility testing. Queensland Health provides this service for Western Province through an arrangement funded by AusAID with the Queensland Mycobacterial Reference Laboratory (QMRL). Daru Hospital and Port Moresby are the only centres in PNG currently programmatically managing MDR TB, which requires many more resources and follows extended guidelines [5].

Challenges

Despite the guidelines, sometimes not all of the components are achieved. The Province's self-assessment of the key challenges to rural health service delivery include: *"huge obstacles such as poor staff morale, law and order problems, poorly managed staff, political indifferences, legislations stumbling blocks, unpaid entailments to staff and the list goes on"*.³

In the Western Province, Aid Posts and Health Centres routinely experience shortages of essential medications. The peripheral health infrastructure is in a poor state of repair, with dilapidated buildings, poor or non-existent staff housing, non-functioning water and sanitary systems, no regular supervision, and erratic logistic support for drugs and equipment. Absenteeism is extremely high in both health services and Aid Posts and maintenance of the facilities is poor [6].

2.4 MDR TB concerns in the Torres Strait

Currently 13 villages along the coast to the East and West of Daru are defined as 'Treaty Villages'. Under the Treaty, Australia is obliged not to prevent or hinder free movement of inhabitants in or near the treaty zone for their livelihood, social, cultural and religious activities.

Some inhabitants of the South Fly District who live in the villages covered by the international treaty have sought care across the border, in Saibai and Boigu islands of the Torres Strait. Those seeking healthcare in Australian services on these islands include several patients with TB, including MDR-TB.

As a consequence of the detection of TB and MDR TB in visitors from PNG to Saibai and Boigu, cross-border meetings have been held and the South Fly Management Project has been developed in cooperation with AusAID. This project aims to strengthen general health services in Western Province as well as to bolster TB services. The administrative structure

³ Draft Health Strategic Plan 2012

that deals with cross-border issues is the Joint Advisory Committee which includes a specific group to deal with health (the Health Issues Committee).

The initial study that brought cases of TB from PNG to public attention was published in 2006, and this was followed with a more compelling paper showing evidence of new cases of TB being MDR TB (i.e. primary acquisition). Below is a timeline of MDR emergence and response in South Fly and cross border cases arising in Australia.

| | | | | | |
|---|--|---|---|---|---|
| 2006 letter to MJA alerting to change in epidemiology | 2008 Australian physicians publish cases in MJA, 60 cases 15 MDR, all highly clustered | 2011 Government announces closure of clinics in Saibi and Boigu Islands | Oct 2011 WHO mission to South Fly district, package of measures announced by AusAID. Handover of border cases commences | Jan 2012 GFATM Programmatic TB launched in Western Province | July 2012 first case of XDR TB found in PNG national from Daru in Cairns Hospital |
|---|--|---|---|---|---|

[7]

[1]

[3]

2.5 Management of TB in the Treaty Villages

WHO conducted a technical assistance mission for the National Tuberculosis Program of the PNG Government, travelling to South Fly in October 2011. One of the health centres that they visited was Mabaduan Health Centre, one of the treaty villages nearest the border with Queensland, and the entry point⁴ for PNG nationals travelling to Saibai Island for traditional activities under the treaty arrangement. Until this year, patients attending Mabaduan Health Centre were able to attend clinics at Saibai and be seen by a visiting Physician, have sputum tested, a chest X-ray and be given therapy, with referral back for interim care at the Mabaduan Clinic.

The WHO report in November 2011 reviewed the management of 17 patients at Mabaduan Health Centre that had been diagnosed and initiated on TB treatment by doctors at Saibai Clinic. The list was from March 2010, and only Mabaduan summary notes were available, not the Saibai clinic notes.

They assess the treatment against the national TB programmatic guidelines and made the following observations [3]:

1. No-one was taking DOT
2. Time from initial sputum to confirmation of a sputum positive case took around six weeks
3. Those on the initiation and continuation phase were on the same regimen; that is rather than 2HRZE/4HR, patients received 6HRZE
4. The drugs were not delivered in FDC
5. The drugs were not in the standard ratio of 1:2:3:5

⁴ While Mabaduan is not the closest point on the mainland to the Torres Strait Islands, it is the point at which permission must be sought to visit treaty islands.

6. Six patients were on second-line agents, four in the initial phase of therapy, only one of whom was taking an injectable aminoglycoside agent.

Below is the Table compiled by WHO, reproduced here as a record of treatment in Mabaduan as assessed by WHO from Mabaduan clinic notes prior to handover of patients.

Table 2. Age, phase of treatment, drugs and dosages of patients recorded in Mabaduan Health Centre on 17 March 2010 and treated with second-line antituberculosis medications

| Phase | Age | H | R | E | Z | Ak | CS | Mox | PAS |
|--------------|-----|-----|-----|------|------|-----|-----|-----|------|
| Initial | 5 | 75 | 150 | 200 | 750 | 250 | | 100 | 1000 |
| | 22 | 300 | | 800 | | | | 400 | 2000 |
| | 2 | 100 | | 200 | 500 | | 125 | | 2000 |
| | 7 | 200 | | 400 | 750 | | 125 | 200 | 1000 |
| Continuation | 26 | 300 | | 1000 | 2000 | | 250 | 400 | 4000 |
| | 19 | 300 | | 800 | 1500 | | 250 | 450 | |

* drug labels are as follows: H=isoniazid; R= rifampicin; E= ethambutol; Z= pyrazinamide; Ak= amikacin; CS= cycloserine; mox= moxifloxacin; PAS= para amino salicylic acid

The PNG DoH system for managing people from the treaty villages in South Fly is referral to the Health Centres (one of which is Mabaduan) and then to Daru Hospital.

2.6 Terms of Reference of this evaluation

- Undertake an all-inclusive assessment of the TB situation in Western Province in wide consultation with key senior stakeholders in Western Province and Port Moresby
- Based on the situation analysis, lead the development of a strategy to collect initial available data on the epidemiological trends in TB, MDR-TB and XDR-TB, including a strategy for analysis; extrapolate and present an assessment of the public health risks for Western Province and surrounding areas and develop a plan of action for the Provincial Health Office in Daru and AusAID's consideration.
- Oversee and lead the Daru Provincial Health Office's collection of all existing data concerning TB in Western Province from all sources. This will include working with Daru General Hospital, the NDoH (including the Public Health Division and the Health Information Unit), WHO, World Vision and OTDF.
- Once collated, oversee and lead the Provincial Health Office in Daru in analysing the information available and determine the gaps that need to be filled (if any) to inform a detailed health risk assessment.
- Design a detailed plan of action outlining how the missing data can be collected and articulate associated resource requirements in order to support the plan.

- As part of the broader public health assessment of the Province and surrounding areas, oversee and lead the collection and analysis of data available around other key public health risks, particularly pertaining to the South Fly District of Western Province, and conduct a comparative analysis concerning health risks in the region and requirements for more detailed evidence-based responses.

2.7 Methodology of this evaluation

The methodology of this evaluation had five main components

1. LITERATURE REVIEW: INCLUDING PEER-REVIEWED AND OTHER WRITTEN REPORTS

2. INTERVIEWS WITH KEY STAKEHOLDERS

3. FIELD VISITS THROUGHOUT WESTERN PROVINCE

4. REVIEW OF TUBERCULOSIS DATA

5. DEBRIEFS WITH AUSAID

1. LITERATURE REVIEW

Peer-reviewed publications, guidelines [8-10] senate estimates transcripts and department of health reports from Queensland and PNG were reviewed for this report. In addition, the assessment made by WHO was reviewed and current progress compared against it. Some information came from news items. The reference section contains the sources of information directly cited.

2. INTERVIEWS WITH KEY STAKEHOLDERS

Appendices A and B list the specific meetings and timelines of the mission. Below is a brief description of sources of information.

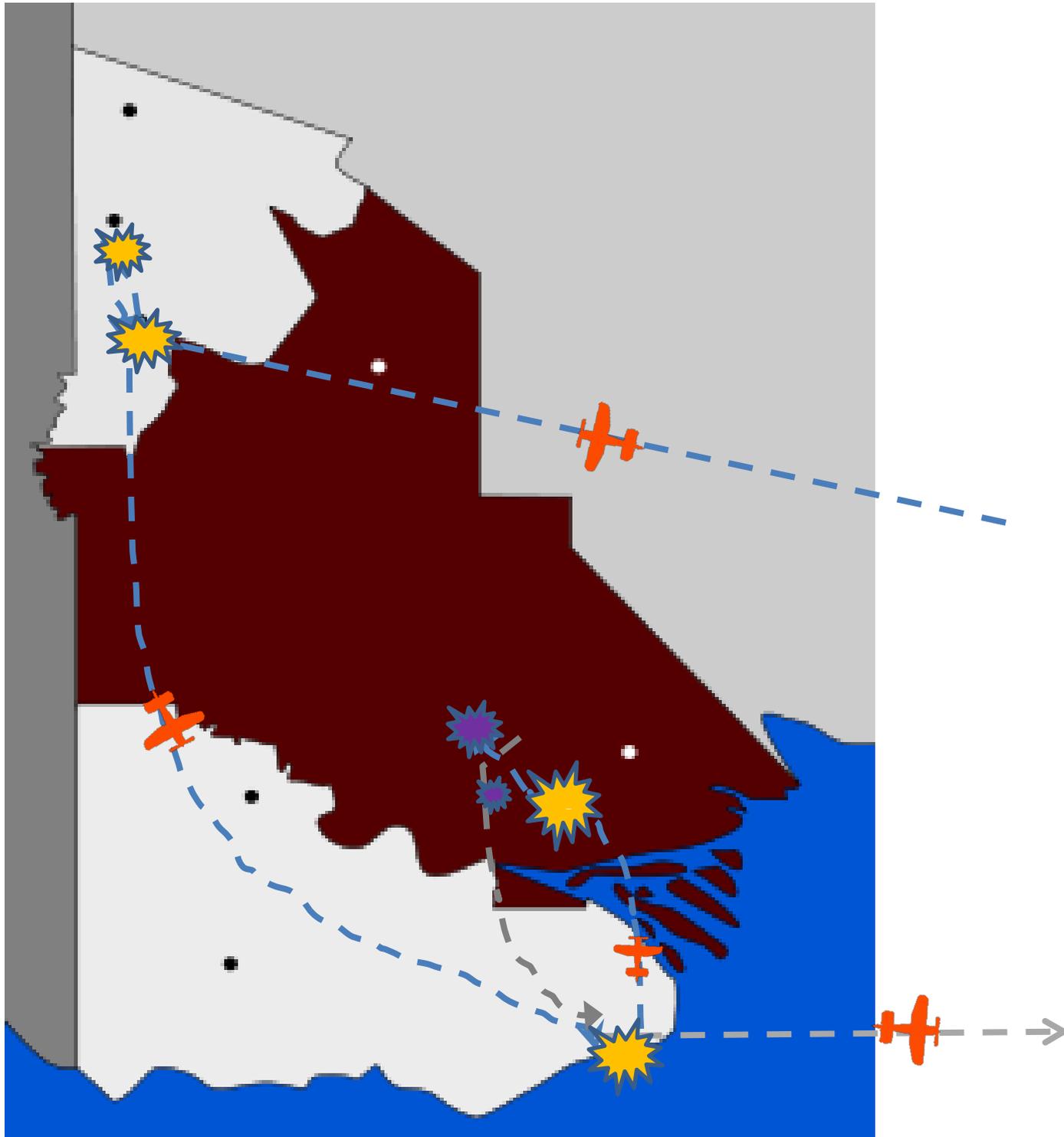
I sought information on the epidemiology of tuberculosis and the strategic challenges to addressing the problem from several sources. At the PNG National Department of Health I met with Dr Aia and Mr Enoch Posanai, National Tuberculosis Programme Manager and Executive Manager Public Health.

I also met with representatives of key funding sources, AUS Aid and World Vision, who are tasked with advocacy, communication and social mobilization (ACSM) for the TB programmatic rollout. WHO representatives in PNG briefed me on their findings documented in the report from the mission to South Fly, in November 2011.

I met with the provincial rural health coordinator, Ms Alice Honjepari (Director of Rural Health Western Province) and two district health officers for North and Middle Fly Districts, Mr John Lari and Mr. Ramsay Siwaeya.

In the Hospitals and Health Centres, I was briefed by the treating Health Extensions Officers, the Doctors and hospital executives, lab technicians and nurses.

Other information came from telephone meetings and emails; Dr Chris Coulter, Dr Tom Konstantinos, and Dr Graham Simpson.



3. FIELD VISITS

North Fly

Hospitals: Kiunga Rumginae

Urban Clinic: Kiunga Catholic mission

Middle Fly

Hospital: Balimo

Health Centre: Awaba

South Fly

Hospital: Daru Hospital

4. REVIEW OF AVAILABLE TUBERCULOSIS DATA

During this evaluation mission I compared data on Western Province at the PNG NDoH with the Provincial Health Office, WP and with Quarterly Reports written by many of the hospitals. There appeared to be no consistent format across these reporting bodies until the very recent programmatic TB rollout. A consistent record was only available for one quarter, and while all centres could show me their reports for this quarter, they had not arrived at either provincial or national centres. Hence, my analysis of TB cases is constructed from original source data where possible, namely, the TB registers (and to a lesser extent the suspect TB registers and TB microbiology registers). Where such data were not available I used the quarterly reports.

The other major source of raw and aggregate data was Mr Abel Marome, the Provincial Health Coordinator for tuberculosis monitoring and evaluation, who was very helpful in providing Excel spreadsheets that he and Dr Rendi Moke had compiled. The PNG National Statistics Office provided 2000 census data for obtaining population denominators and the Australian Bureau of Statistics was useful for providing information on people movement between PNG and Australia.

3. Observations on the health facilities visited

North Fly

Tabubil Hospital

I did not visit Tabubil Hospital; however, it has been described as an effective, well-run health service with doctors on generous fly-in fly-out contracts, good access to medication and well-equipped testing facilities. TB investigation clinics are conducted twice weekly and sputum is processed with a maximum three-day turnaround time. Inpatient stay is two weeks for positive cases and the intensive phase is treated using DOT either at Tabubil Hospital or one of the five Aid Posts associated with the hospital. TB awareness and education activities are conducted. Tabubil has been using FDC since 2005 and performing HIV/TB activities since 2007; testing HIV positive patients for TB occurs in around 75% and testing TB patients for HIV occurs in about 90% of cases.

Rumginae Hospital

This hospital is run by the Evangelical Church of PNG and has had two doctors running it for many years. Of the 60 beds, 20 are designated for TB patients. TB is currently the largest burden for the hospital. The X-ray machine had not been functioning for many months. TB wards were inadequately ventilated with small windows, inadequate light and cross-breeze, but doors were opened to maximise ventilation. No staff wore N95 masks. One hospital staff member was being treated for smear-positive pulmonary TB.

Lack of medical supplies has been a recurrent problem for the hospital, with rifampicin becoming unavailable four to five times per year. FDC was introduced in July 2012. Outreach takes place at remote villages for BCG vaccination of infants. A lab technician performs microscopy including quality assurance (QA) testing. A computer and internet access was available.

While only recently linked with programmatic TB management, Rumginae Hospital had already taken initiatives to ensure good management of TB cases, including performing HIV tests routinely on all TB cases and performing contact tracing by bringing in family members where possible. All smear-positive patients are put on DOTS and kept as inpatients for the intensive phase whenever possible. Family members and volunteers are engaged to assist with DOTS. They have also done drug susceptibility testing (DST) on sputum where failures occur. They have accessed DST via Tabubil Hospital (and from there QMRL). Since 2010, they have had three cases of geneXpert positive TB. Case one was in 2010 and managed with second-line agents through liaison with Port Moresby Hospital, Case two was treated with first line (CatI) drugs and relapsed, was treated with CatII and failed. Subsequently sputum was sent to Tabubil and was geneXpert positive but found to be rifampicin monoresistant. Case 3 was taking second line agents (Cm, oflox, Cs, Z, Eto) for MDR TB from Daru but defaulted.

Kiunga Hospital

Kiunga hospital has approximately 48 beds of which 20 are dedicated to tuberculosis patients. Until January 2012 Kiunga Hospital had no doctor for 15 years. In January two new senior medical staff commenced with funding from Ok Tedi Mining Limited (OTML). Also, the hospital began providing three meals per day for patients in January. Two wards are dedicated to TB management. Dr Francis Wandu is the CEO and responsible for the clinical management of TB. On questioning, staff noted that TB was the largest burden of any condition in the hospital and believed it was on the rise. In particular it was noted that a high proportion of TB is extra-pulmonary TB. One healthcare worker was being treated for TB and one patient admitted for other condition had also presented with TB. TB wards were inadequately ventilated with small windows, inadequate light and cross-breeze, but a new dedicated ward was planned. No staff wore N95 masks.

The TB team consists of Mr Wode Hawks, an HEO who is the District TB control officer, Mr Wangimo, a microscopist, who undertakes regular QA from Queensland QMRL QA specimen testing. The team also includes people responsible for Procurement and supplies, Monitoring and Evaluation (M&E) and ACSM funded by AusAID through World Vision PNG. A computer and internet access were available.

Programmatic training for TB commenced in January, but FDC drugs have only been in place since June 2012. Quarterly reports in the new programmatic form have been in place since July. Training of community health workers is occurring but problems arise with very remote patients finding suitable community health workers (CHWs) within a day's travel for conducting DOTS. Many areas in North Fly and the northern parts of Middle Fly are several days' travel from the nearest Aid Post. Under-supply of TB drugs has been a constant problem for Kiunga Hospital and even with the introduction of FDC kits, insufficient quantities of category 2 kits have been provided. Medicines often arrive close to their expiry date. Previously the hospital frequently ran short of rifampicin, and currently there is no loose rifampicin or streptomycin available. The hospital had not received any operational funds from the North Fly district for Q2 or Q3 2012.

Kiunga do not perceive that they have a problem with MDR, however no testing is taking place. HIV co-management training has taken place and rapid diagnostic kits became available in June 2012, but few HIV tests have been performed on TB patients because of difficulty with counselling. Patients are diagnosed with HIV following voluntary counselling and treatment either at the STI clinic (which is AusAID funded). All HIV + patients are assessed for tuberculosis prior to commencing anti-retroviral therapy (ART), with clinical review, sputum examination and chest X-ray.

TB cases are managed in the ward for 10-14 days, followed by outpatients DOTS during the intensive phase and identification of treatment partners who can supervise the continuation phase of therapy closer to the patients home. For those living close enough, this is performed by a CHW at an Aid Post; for those living more remotely, this is done by a treatment partner (usually a respected member of the village not in the patient's immediate family).

A previous assessment of Kiunga Hospital TB service has found that medication management is erratic, with poor drug inventory systems. Records are not well kept, stock is hard to find, loose drugs are poorly arranged.[6] This is not so much the case for kits of FDC, which are alphabetically arranged for each patient.

Kiunga: Montefort Catholic Mission Urban Clinic

This is a Catholic Health Service, at which HIV counselling and testing takes place in addition to a regular outpatient clinical service. Antenatal testing for HIV is offered to all women attending the antenatal clinic. Approximately 50% agree to testing and to date 400 tests have been performed with 10 positive HIV cases identified. Two patients (a mother and child) being treated at the clinic have HIV/TB coinfection. At the outpatient clinic, rapid diagnostic tests and artemether/lumifantrine combination therapy was commenced in December 2011. Around five patients per day are tested and treated for malaria, and it was reported to me that there has been no detected recurrence or failure. Approximately two new cases per week of suspect/probable TB are referred to the hospital. Drug stock-outs for DOTS follow-up has been a large problem at this clinic, who manage a proportion of the patients from Kiunga Hospital following discharge from the hospital. Other conditions managed include diarrhoea, pneumonia (presumed bacterial) asthma, and fever that tests negative for malaria (potentially Dengue or other viral illness).

Middle Fly

Balimo Hospital

Balimo Hospital has had no doctor for the last 15 years. It has been run by young HEOs and nurses, most of whom were Middle Fly District locals. The hospital was in the old school of nursing building, a temporary arrangement, as a new hospital was being built on the old site.

The hospital was seriously under-equipped, for example, lacking any ability to diagnose diabetes (no glucometer, no biochemical laboratory, no urine dipstick tests). The hospital had 30 beds, of which 12 were dedicated to mycobacterial infection. Two patients in this ward had leprosy, the remainder TB, treated as inpatient either because of failure or, in one case, side effects (blindness following ethambutol therapy). Of the general beds, around half were occupied by TB patients. Other conditions seen were; chronic osteomyelitis in a teenager, hypertension, assault (two cases of family violence, husband to wife), and pig bite. The remaining patients were TB with failure to respond to therapy (x3), or being worked up for TB diagnosis.

FDC was introduced to Balimo in August 2012. Periods of medication run-out were noted as a big problem; particular attention was drawn to the inconvenience of drugs being shipped from the national capital to the provincial capital (Daru) and then to the districts. Recent changes have allowed direct transport. It was noted that District government funding for TB control activities had not been paid in Q2 or Q3 2012. Balimo did not perform routine HIV testing on TB patients, although kits were available, again because private rooms for counselling were not available. They had approximately seven known cases of HIV diagnosed

at the hospital; all had been commenced on cotrimoxazole prevention therapy but none on antiretroviral therapy, and none had been assessed for tuberculosis.

The new hospital, funded through Ok Tedi Fly River Development Program and run by Mission Health Service, had 10 beds dedicated to tuberculosis and an isolation room. However, the isolation room had no negative pressure and the windows were small, hence ventilation was inadequate. Also the numbers of TB patients means that they occupy many of the beds in the general medical ward. There is a second new hospital at Balimo, completed in 2012 but as yet not equipped, which remains unused apart from the staff accommodation.

Awaba Health Centre

This is a mission-run Health Centre with three nurses, four community health workers, no microscope and 10 beds. It had a catchment population of around 16,000 people in 15 villages. They noted an increase in TB cases in the last 12 months, with many failures. The Health Centre had electricity for around 14 hours per day. A solar-powered fridge donated by AusAID had not been functioning for many months. The health Centre was generally run down, and poorly ventilated, although TB patients arriving for DOTS generally remained outdoors. No food is available for patients at the Health Centre. The beds were occupied by TB day patients arriving for DOTS and three TB inpatients, one six-year-old girl with severe asthma and a three-year-old boy with undiagnosed massive hepatomegaly. Awaba had no diagnostic test kits for HIV and had not performed HIV testing on any patient.

Awaba had no computer access but had good Digicel mobile phone coverage and arranged communication access to Mr Abel Marome (Provincial TB coordinator) through a Blackberry user group.

South Fly

Daru Hospital

Daru Hospital is the provincial hospital of Western Province. Between 2010 and January 2012 it had only one doctor, Dr Lano. In January another doctor, Dr Pinnai, commenced and now they have Dr Rendi Moke, in charge of clinical TB services, as well as a general medical registrar and obstetric/gynaecology registrar.

Three wards of the hospital are dedicated to TB, one general TB (16 beds), one MDR TB (10 beds) and a third for "overflow" patients (12 beds). Within the MDR TB ward there is an XDR TB bay (four beds) that has a door that can be closed. In addition, patients are sometimes required to sleep in the outpatient acute ward, which has three beds. Of the 10 patients reviewed in the general medical ward all had probable tuberculosis except one thyrotoxicosis, one crocodile bite, and one lung cancer (which could also have been TB as no histology was available). The paediatric ward was entirely filled with TB patients – four with TB meningitis, three with pulmonary TB.

Communications: internet is intermittent in Daru, as is Digicel coverage. No fax or scanner is available for the hospital. Electricity runs 24 hours per day. Drugs and equipment arrive from Port Moresby every two months. Chronic undersupply was reported.

HIV testing of all TB cases is expected at Daru hospital with HIV rapid diagnostic kits available and Practitioner Initiated Counselling and Testing (PICT) occurring. Referral of all new TB cases to HIV services at the STI clinic is routine. Additionally, all HIV positive cases are tested for TB by clinical examination, chest X-ray and sputum smear. Additionally, this is followed by genXpert testing regardless of smear status (both negative and positive smears).

Hospital Outpatient Activity

There are approximately 420 outpatient appointments per week, of which 70% are TB reviews. There are around six new TB cases and around 2-3 new diagnoses of MDR per week. Thirty-seven patients with MDR arrive at outpatients daily for DOT, some of whom are in intensive phase and receiving daily injections (Kanamycin/Capreomycin).

Fifty-eight patients with pulmonary TB with a susceptible isolate are taking DOT at Daru Hospital outpatients. Twenty-nine of these are receiving category 1 drugs and 29 receiving category 2 drugs. Twenty-two patients with sensitive TB are receiving treatment at home in Daru under the care of Daru Hospital.

South Fly Outreach ACSM

While in Daru I witnessed considerable activity in community education and mobilization including involvement with a float and a booth at the Independence Day celebrations. Training of HEOs, nurses and volunteers in DOTS, was also taking place.

Table 3-1 summary of tuberculosis management at sites visited (and Tabubil Hospital)

| | Micro- scopy | R&R | Drugs/FD C | HIV /TR | M&E | MDR TR | ACSM |
|----------|-----------------|------|---------------|------------|-----|-----------|--------------|
| Tabubil | Y | Y | | Y | Y | AD | Y |
| Rumginae | Y | Y | Y | Y | N | AD | |
| Kiunga | Y | POOR | Y RECENT | N | N | no | EARLY stages |
| Balimo | Y | ~ | Y | N | N | no | N |
| Awaba | N | POOR | N | N | N | no | N |
| Daru | Y | Y | Y | Y | Y | Y | Y |

Evaluation of Risks of Tuberculosis in Western Province Papua New Guinea

Table 3-2 Response to questions about Health Centre

| | electricit | staff | Communication | Water | Highes | TB rates |
|----------|------------|----------|---------------|------------|--------|------------|
| Tabubil | 24h | Drs | Internet | reliable | | |
| Rumginae | 24h | 2Dr, | Internet, | Tank water | TB | increasing |
| Kiunga | 24h | 2 Drs, | Computer, | | TB | increasing |
| Balimo | 10-12h | HEOs | Digicel | Not | TB | increasing |
| Awaba | 12h | 3 nurses | Digicel | Not | TB | increasing |
| Daru | 24h | 3 Dr, | Poor, slow | Tank water | tuberc | increasing |

4. Epidemiology of Tuberculosis

The availability of correctly filled quarterly reports and TB registers was patchy, with Daru Hospital having the longest cohort of data (from 2002 onwards) which was also entered into an electronic spread sheet. From other sites I mostly accessed hand entered data available from Jan 2011 in TB registers. My initial Province-wide assessment of case presentations therefore begins in January 2011; shown in Table 4-1.

Trends are difficult to assess in view of the lack of reliable prospective data throughout the province. However, trends can be assessed in Daru Hospital.

4.1 2011 Tuberculosis incidence according to available data including TB registers

Table 4-1 summarises the data on estimated incidence of TB as per the TB registers. Incidence varies from district to district but is high across all districts. Caveats: some of these BMUs do not report accurate proportions of smear-positive confirmed pulmonary TB, because of incomplete use of microscopy facilities, poor recording of results or because microbiology facilities do not exist. Denominator data are hard to assess both because recent census data are not yet released and because determining the regions of catchment for each hospital/health centre is difficult.

| | NEW | OLD | TOTAL | DENOMINATOR | INCIDENCE |
|----------|-----|-----|-------|-------------|-----------|
| TABUBIL | | | 81 | 16k | 506 |
| RUMGINAE | 80 | 6 | 86 | 20k | 430 |
| KIUNGA | 319 | 102 | 421 | 40k | 1053 |
| BALIMO | 115 | 17 | 132 | 40k | 330 |
| AWABA | | | 61 | 16k | 381 |
| DARU | 216 | 101 | 317 | 68k | 466 |
| TOTAL | | | 1097 | 200k | 549 |

Table 4-1 Incidence of all cases of TB by region and overall province

4.2 Outcomes

TB treatment success rates in Daru Hospital from 2007 up to early 2012 are approximately 70%, with approximately 10% each of death, default and failure. Balimo Hospital has a lower success rate with higher default rate. Additionally, many patients are transferred back to the Health Centre from which they were referred. Kiunga Hospital in North Fly shows a different pattern with very high default numbers (based on the available data, Q1-Q4 2011).

Figure 4-1 Outcome for pulmonary TB cases Daru Hospital

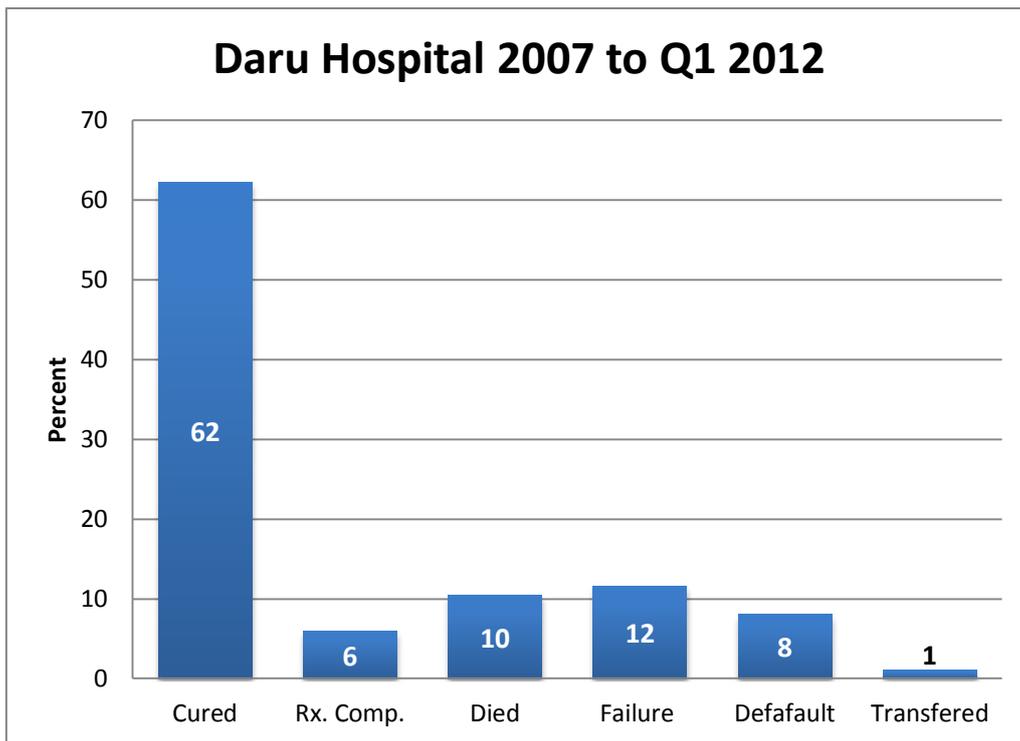


Figure: 4-2 Outcomes for all TB Q1-Q4 2011 Balimo Hospital, Middle Fly

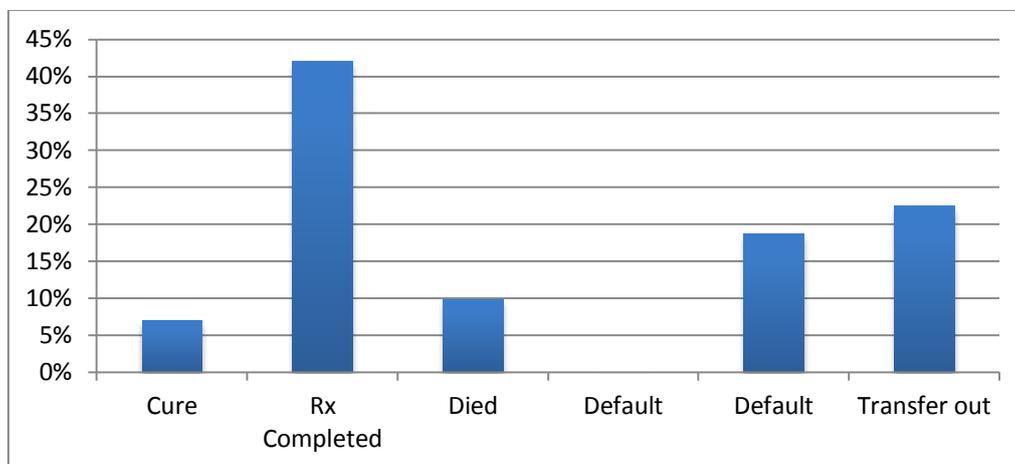
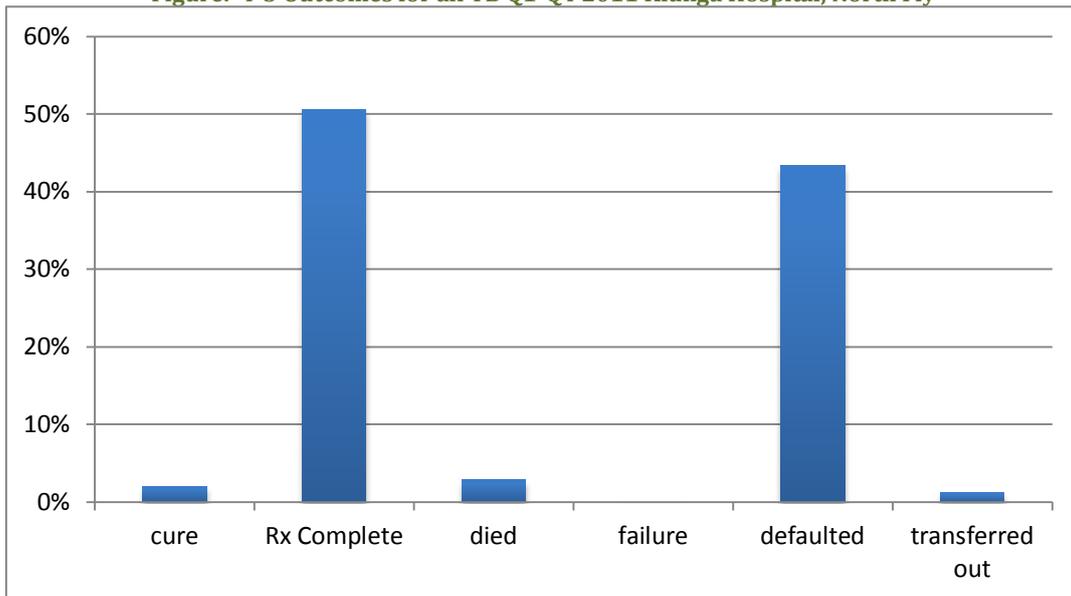


Figure: 4-3 Outcomes for all TB Q1-Q4 2011 Kiunga Hospital, North Fly



4.3 Trends over time

Daru hospital had reliable data on cases of TB in South Fly dating as far back as 2002. Figure 4-4 below suggests that rates of recorded TB have not increased in the last 10 years.

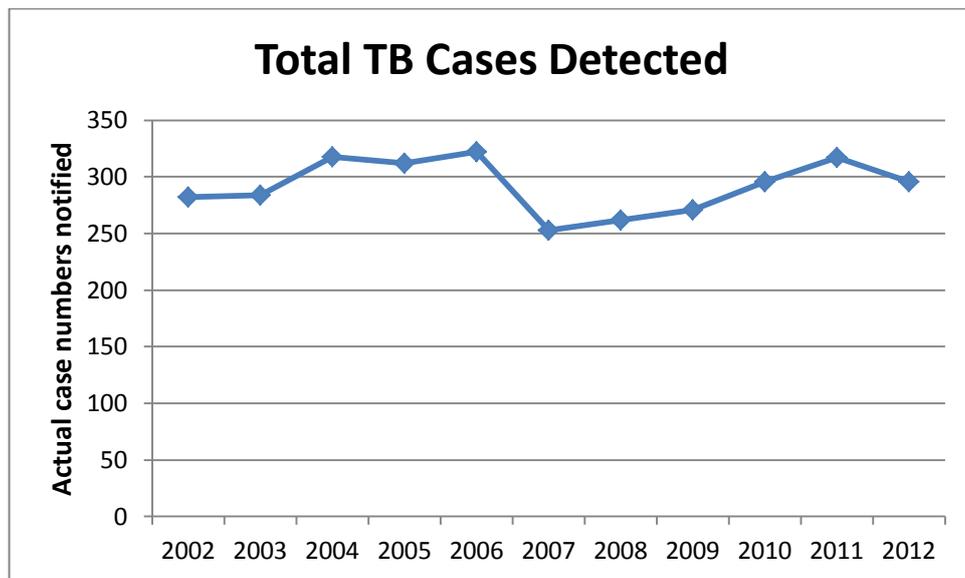


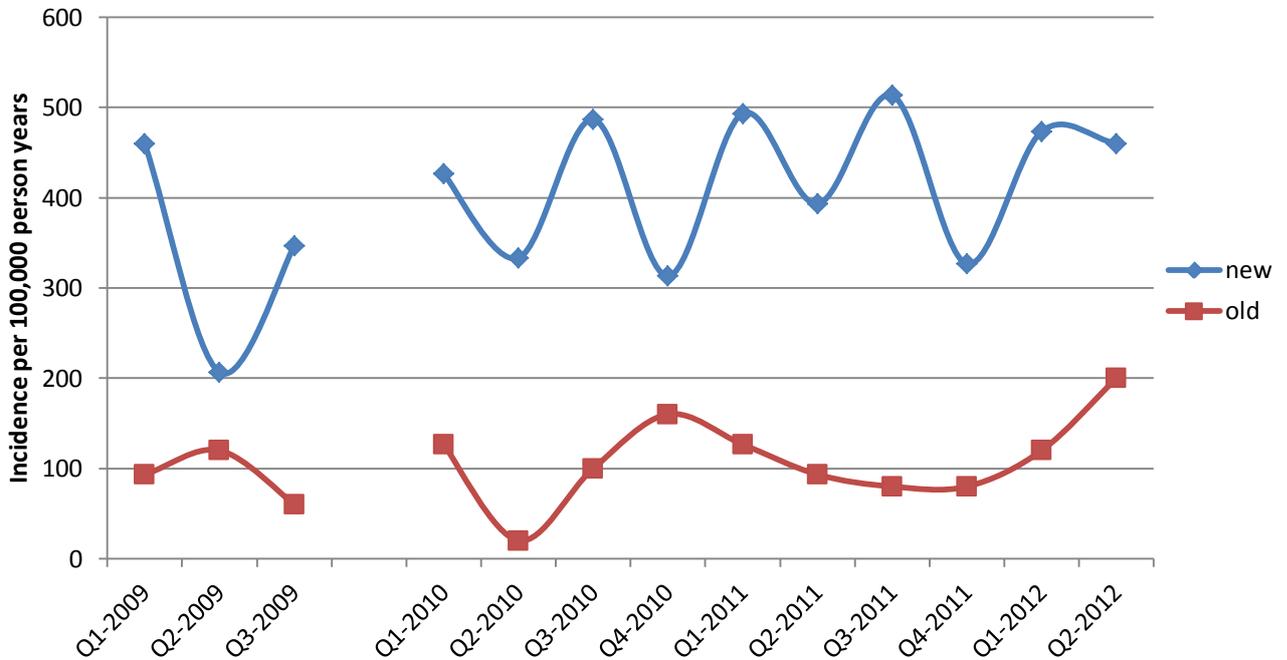
Figure 4-4 total notified cases of TB in South Fly District 2002 to 2012

For the remaining BMUs, data goes back a variable period. Below is a sample of hospitals from each of the districts, describing trends over time of old and new TB cases. Kiunga Hospital in North Fly seems to have a much higher incidence than the other Hospitals. This could be a true finding and needs further investigation. Another possibility is that the catchment region for Kiunga could in fact be much larger than estimated as it sits in the south part of the North

Evaluation of Risks of Tuberculosis in Western Province Papua New Guinea

Fly district and may take patients from a large region incorporating much of North Fly and Middle Fly.

Figure 4-5 shows the trends in old and new cases by quarter from 2009 for Daru catchment region, South Fly District and Balimo catchment region in Middle Fly district



Incidence of TB Balimo Middle Fly

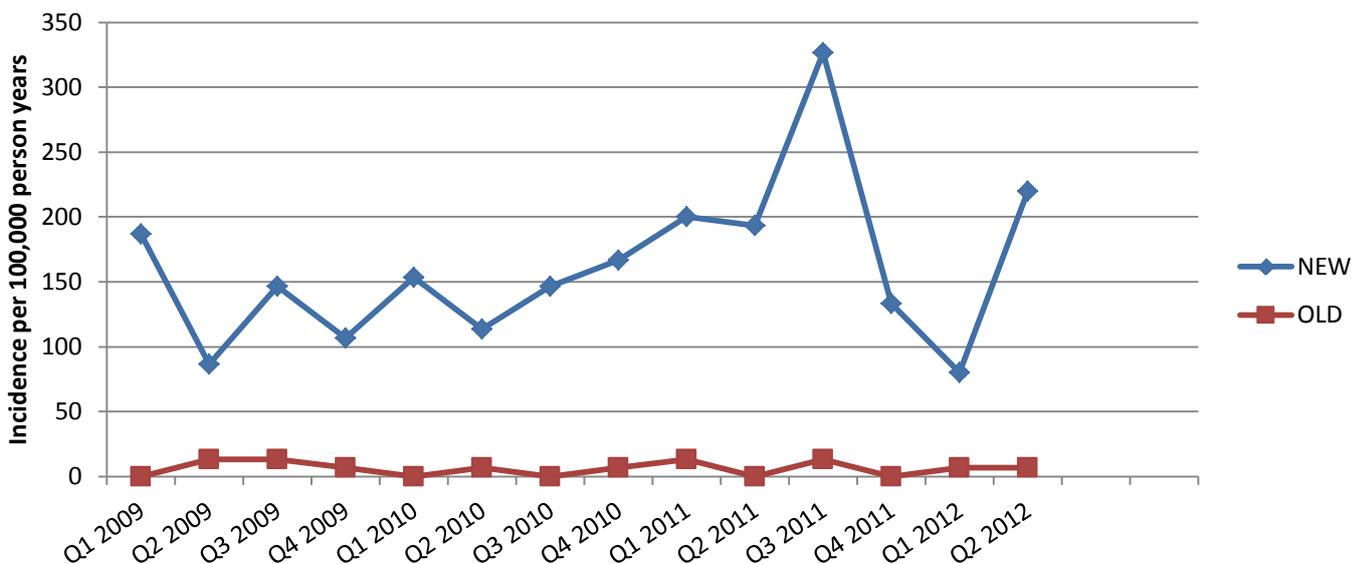
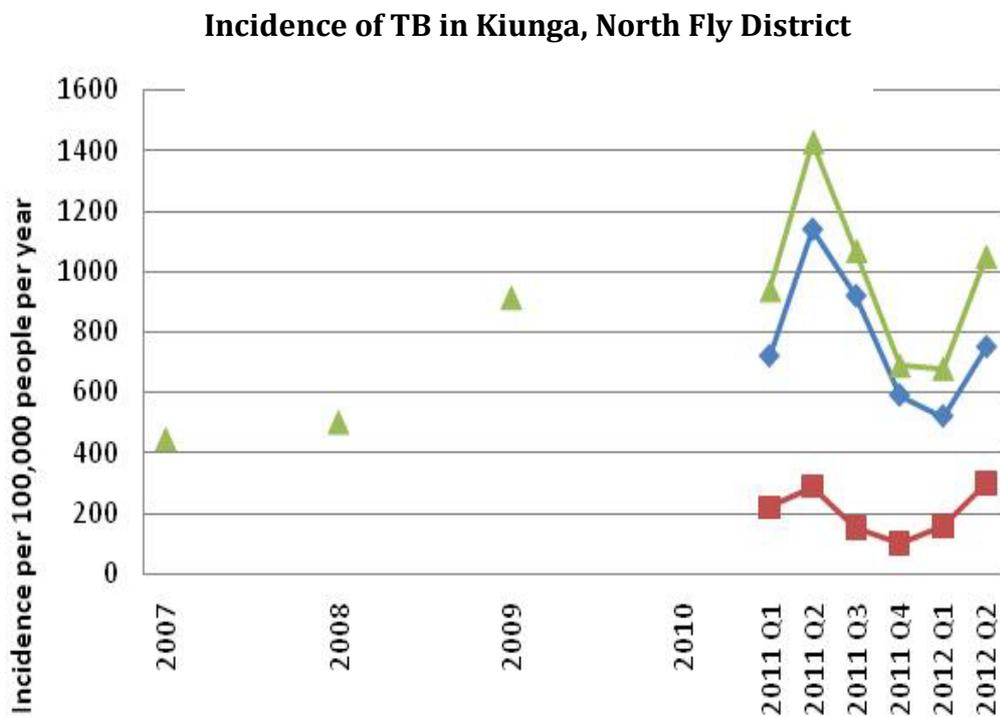
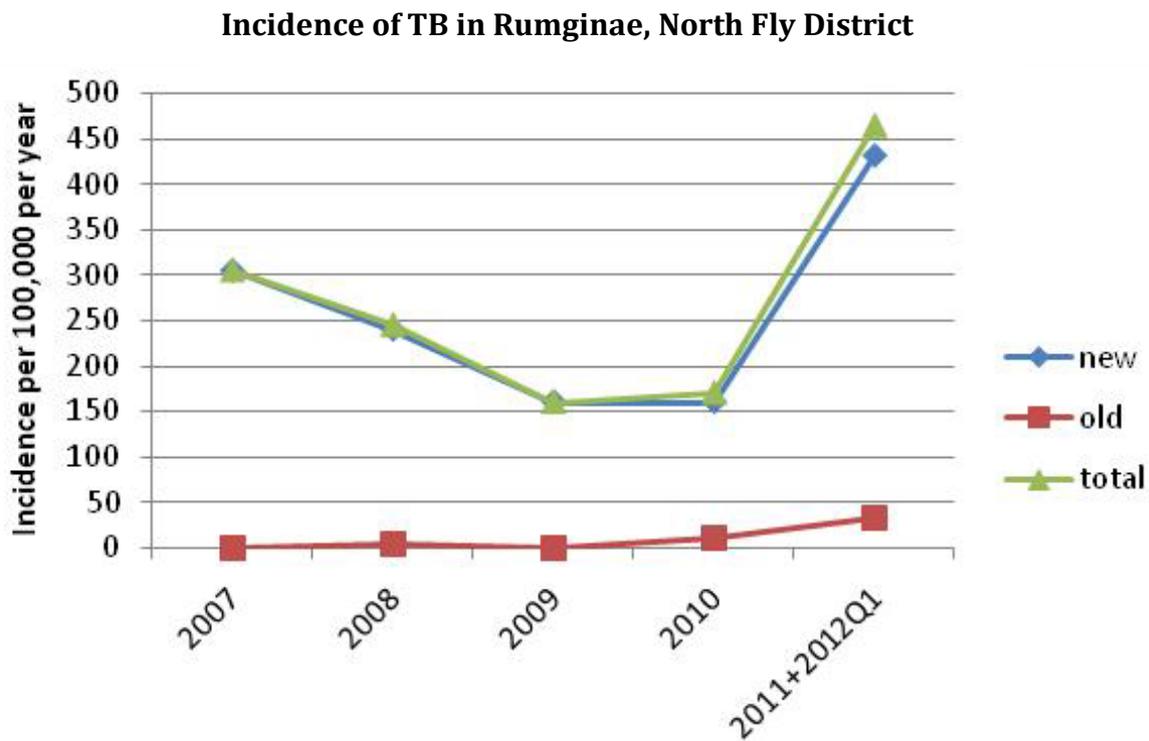


Figure 4-6: Incidence of Tuberculosis in Rumginae and Kiunga Hospitals, North Fly



4.4 MDR TB

MDR TB has been recognised in the South Fly region since 2001. Gilpin et al. published data on the years 2001-2006 in 2008, describing 60 cases of TB treated in clinics on Saibi and Boigu Islands in the Torres Strait[1], 15 of whom had MDR TB isolates. Since 2008, MDR treatment has also been initiated at Daru Hospital. This section documents the PNG patients initiated at TSI from 2001-2006 and the PNG patients treated from 2001 to 2011 in the Cairns TB control region – including the patients handed over to the care of Daru Hospital from the TSI clinics and the patients commenced on treatment at Daru Hospital.

4.4.2 MDR Patients treated in Australia 2001-2006

In a paper published in 2008, Gilpin et al. described 60 PNG patients who presented to TSI clinics from 2001 to 2006 with tuberculosis, 15 of whom had MDR TB. The authors highlighted the complexities of treating these patients and the numerous barriers they faced, including transport costs that were sufficient to deter patients from returning for care, interruption of supply of medication and poor compliance to therapy.

The results presented for the 15 MDR cases highlight the difficulties faced treating patients in cross-border clinics; the outcomes being six deaths and two defaults on therapy. Additionally logistic difficulties meant that injectable agents were often not used. Gilpin et al. described some of the actions taken to improve management, such as providing fuel for patients, stockpiling of drugs and use of blister packs (in lieu of FDC pills). They also increased the frequency of clinics and provision of care on the islands. Additionally efforts were made to coordinate management with the Health Centre at Mabaduan, the nearest Health Centre in PNG.

Table 4-2 MDR cases: treatment initiated in Australia 2001-2006

| | Total | On Rx | Died | Completed Rx | Cured | Failed | Transfer Out | Defaulted |
|-------|-------|-------|------|--------------|-------|--------|--------------|-----------|
| 2001 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 2002 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 6 | 0 | 1 | 4 | 0 | 0 | 0 | 1 |
| 2006 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| Total | 15 | 3 | 6 | 4 | | | | 2 |

Table 4-3 Outcomes for first 15 MDR TB cases treated at TSI clinics, data taken from Gilpin et al. [1]

Update on cases treated in Australia 2001-2010⁵

Within the Cairns Regional TB Control Unit, encompassing Far North Queensland and the TSI, 214 PNG patients were treated for tuberculosis of whom 173 were sputum culture positive. Thirty-nine had received prior TB treatment in PNG, none in Australia. Of the 173 sputum positive cases 85 (49%) were fully susceptible isolates and 59 (34%) were culture confirmed MDR cases. One also had quinolone resistance. Overall outcomes showed 11% default rates and 10% death rates, with the remaining 79% having completed therapy, still on therapy, or transferred out. Five (3.3%) of the 214 patients tested positive for HIV. Twenty-one PNG Nationals presented in Cairns Hospital, being residents of Cairns rather than temporary treaty region visitors.

4.4.2 Hand-over patients

Ninety-two TB patients were handed over to Daru Hospital from late 2011 to mid 2012; 33 of whom had MDR TB. Of the 33, 12 had been on therapy, six of whom had interrupted and ceased therapy (default) and six had completed therapy. Of the remaining 21, nine continue on therapy and 10 have successfully completed therapy at Daru Hospital; one has defaulted and one has died. The death occurred in an HIV-positive patient after completion of therapy, from causes related to HIV/AIDS.

Table 4-3 Hand-over patients with tuberculosis.

| Type of TB | Completed Treatment (QH) | Completed Treatment (PNG) | On Treatment (PNG) | Default interrupted prior to handover | Default interrupted after handover | Died | Total |
|--------------|--------------------------|---------------------------|--------------------|---------------------------------------|------------------------------------|----------|-----------|
| Not MDR | 16 | 35 | 4 | 3 | | | 58 |
| MDR | 6 | 10 | 9 | 6 | 1 | 1* | 33 |
| TOTAL | 22 | 46 | 13 | 9 | 1 | 1 | 92 |

*this patient died of HIV/AIDS following cessation of therapy

In addition to the patients listed in Table 4-3 above, nine patients were handed over prior to commencing treatment for TB. Two of these were subsequently found to have MDR TB.

I reviewed the treatment handover notes of nine of the 33 MDR patients (I did not review the original notes, only copies of handover notes). Of the nine patients, one had recorded use of an injectable agent (amikacin), no other injectable agents were recorded, five effective drugs were used in four cases, four effective drugs were used in two cases and three effective drugs

⁵ Thanks to Dr Graham Simpson for supplying this information

were used in three cases (assuming all second-line agents were drugs to which the isolate tested susceptible).

4.4.3 Proven or suspect MDR cases whose Treatment was Initiated in Daru Hospital

Daru Hospital is the only hospital in the province with a genXpert machine (and one of only three in the country). Rumginae and Tabubil Hospital in North Fly have had drug susceptibility tests performed by directly accessing services in Queensland. Rumginae reports three recent cases of genXpert rifampicin resistant TB, one of which was resistant to rifampicin only, the other two were MDR TB.

Between 17th May 2012 and 20th September 2012, 125 individual patients had sputa examined by genXpert testing; 62 were positive for tuberculosis, of whom 33 were positive for rifampicin resistance genotype. An additional 11 cases this year are probably MDR-positive in extrapulmonary TB cases or those who were unable to produce sputum.

| | Total | On Rx | Died | Completed Rx | Cured | Failed | Transfer Out | Defaulted |
|------|-------|-------|------|--------------|-------|--------|--------------|-----------|
| 2008 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 2010 | 12 | 4 | 7 | 0 | 0 | 0 | 1 | 0 |
| 2011 | 28 | 20* | 7 | 0 | 0 | 0 | 1 | 0 |
| 2012 | 44 | 42** | 2 | 0 | 0 | 0 | 0 | 0 |

Table 4-4 MDR TB cases treated in Daru Hospital since 2008. Number on a planned treatment course of at least 18 months of at least four active agents: *20 **42

Treatment for MDR TB prior to DST results in Daru

PNG TB guidelines recommend standard treatment for suspected MDR prior to culture of five agents: Pyrazinamide (Z) Kanamycin (Km) o/Levofloxacin (Lfx) Ethionamide (Eto) and Cycloserine (Cs). However, local resistance patterns show high proportion of Eto resistance, low proportion of ethambutol resistance and moderate level of pyrazinamide resistance, so Eto has been replaced with ethambutol. Additionally Kanamycin has not been used in Western Province because of drug procurement problems, so Capreomycin is used instead. Reviewing the available drug susceptibility tests, on average four of the five agents would be active for most isolates.

Outcomes for all patients commenced on second-line agents at Daru Hospital are given. It should be noted that so far, successful treatment (completion or cure) has not occurred for patients whose treatment was initiated in Daru, however many are well on treatment. From 2008 to 2010, death rate was very high, with nine (60%) of 15 patients dying. In 2011 and 2012, nine (12.5%) of 72 have died, one transferred out and the remainder are still on treatment.

4.4.4 MDR cases diagnosed by Daru Hospital: Trends over time

The rate of MDR TB is increasing rapidly at Daru Hospital. A GeneXpert machine has been available since 17th May 2012, hence the ability to diagnose has improved greatly. Previously, MDR TB was diagnosed by QMRL after isolates were sent to Queensland. Figure 4-8 shows

also that the number of new cases of MDR TB is increasing, suggesting a recent trend to community transmission of MDR TB.

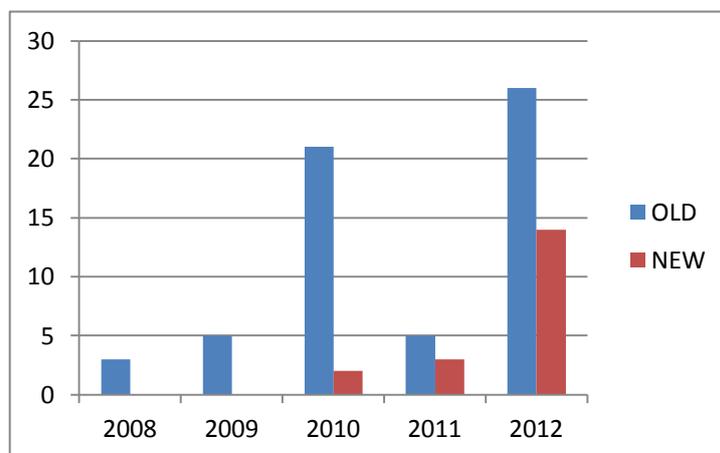


Figure 4-8: trend in diagnosis of MDR TB at Daru Hospital.
'Old' means pre-treated for TB, 'new' means first presentation with TB

Of the isolates that have been found positive for MDR TB or positive for rifampicin resistance on GeneXpert, 30 have final results for drug susceptibility testing returned and finalised from QMRL. Proportion of isolates resistant to each antibiotic were: streptomycin 93%, Ethionamide 93%, Pyrazinamide 43% Ethambutol 27%.

These results are worse than the results found in treaty villagers' TB isolates by a study from Australia, that found 93%, 87%, 18% and 10% for these anti-TB agents respectively[11].

4.5 XDR TB

Development of XDR TB⁶

Following the commencement of culture and drug susceptibility testing of selected patient sputa in 2010, it was recognised that fluoroquinolone resistance was present in this patient population. Fluoroquinolones are one of the 2 classes of drugs that distinguishes XDR from MDR TB. Isolates with resistance to both one of the injectable agents and fluoroquinolones (i.e. XDR TB) have subsequently been found.

Four patients with XDR TB are currently being managed at Daru Hospital, with the first case being characterised as XDR in early July 2012. MDR and XDR isolates from the South Fly District which have been typed by the QMRL have been found to be of the East Asian genetic lineage (so called "Beijing strain"). Although obtaining satisfactory discriminatory molecular strain typing is problematic in the Beijing strain, all four XDR strains appear indistinguishable on testing performed to date and are also very similar to the isolates found in the MDR cases. All four patients have never been treated with second-line agents for longer than one month,

⁶ With thanks to Dr Chris Coulter for this information

hence providing strong epidemiological evidence that primary transmission of XDR TB is occurring in the Western Province. The second case has a clear epidemiological link to the first, being a healthcare worker treating this XDR case. XDR patients at Daru Hospital all have Capreomycin resistance but retain susceptibility to the two other injectable agents tested (amikacin and kanamycin).

In addition to these four patients, two patients have recently (2012) been documented to also harbour XDR-TB strains with sputa being collected at Cairns Hospital, Queensland. Both patients are Nationals of PNG and are known to have received treatment with second line drugs previously. Molecular strain typing shows very close similarity to the type strain from Daru but show some differences in resistance mutational analysis. In addition one patient demonstrated kanamycin resistance only of the second line injectable agents while the second patient demonstrated resistance to all injectable agents. It is the writer's understanding that one patient is currently being treated in Cairns hospital while the second is currently in PNG.

4.6 HIV and TB

Daru Hospital commenced routine PICT in 2012. Still only around 50% of people with TB consent to testing. Of the 41 cases of MDR TB tested, two (~5%) are HIV positive. Of the other TB cases, 124 tests have been performed in 2012, of which four (3%) are HIV-positive. Very little information from Tabubil Hospital was available to me, but outcomes for the first 6 months of 2012 showed that of 62 people with tuberculosis tested for HIV, six (10%) were positive.

Rumginae and Daru Hospital have a program of integrated management of HIV and tuberculosis; other Health Centres do not. Balimo and Kiunga stated that they had only just received programmatic management training and rapid diagnostic test kits for HIV, hence were planning to commence routine testing of HIV in TB patients in the near future. Access to private rooms and expertise for counselling prior to testing was a barrier to testing in these facilities.

4.7 True incidence estimates and unknowns

Many have described the number of TB cases observed in the Western Province as the "tip of the iceberg". Evidence for a large proportion of TB being untreated and undiagnosed is difficult to obtain. The severity of disease in those presenting suggests late presentation, reflecting difficulty accessing or a reluctance to use the healthcare facilities, while the high proportion of extra-pulmonary cases detected may represent under-diagnosis of pulmonary TB, particularly in areas that are not routinely performing sputum microscopy. Rough mapping of origin of cases of TB captured by the healthcare system suggests an unequal distribution of cases throughout the Western Province population, with higher numbers of cases reported closer to the healthcare facilities, again suggesting the possibility of under-diagnosis.

To obtain better estimates of TB incidence, expansion of the current TB control programme is required, with increase in the number of BMUs. Considerable upgrading of facilities will be required including training of staff, in particular a microscopist at each site, along with better logistics for ensuring reliable medication distribution. Communication improvements must also be a priority; capitalising on the recent availability of the Digicel network would be an important pragmatic step. Detailed recommendations are given in section 7.

4.8 Summary of epidemiology of tuberculosis in Western Province

TB appears to be increasing in incidence in the North Fly district but change in incidence is less clear in the South Fly and Middle Fly districts. Incidence of tuberculosis is conservatively estimated at about 550 per 100,000. Considerably more data are required to confirm this, including outreach to remote parts of the province and improved recording and reporting, with greater emphasis on testing sputum for all cases. Availability of the 2011 census will be useful to determine more accurate denominators. There is clear evidence that the rate of MDR overall is increasing as is the rate of new MDR (in previously untreated patients). The incidence of MDR TB is estimated at over 100 per 100,000 per year in the Daru catchment, based on genXpert testing. XDR TB has also been found and evidence suggests that transmission of XDR TB is occurring.

High death rates for MDR TB occurred in the first dozen cases in both Daru hospital (2008-2010) and Saibai and Boigu island clinics (2001-2006). Some of the reasons for this were very late presentation of cases, time prior to confirmation of drug resistance, and high default rates in patients, often due to circumstances beyond the patients control including cost of travel. Both clinics have had improvement in outcomes with reduced mortality and default rates over time. Overall TB treatment success rates are around 70% in Daru with around 10% default 10% failure and 10% death. Similar default and death rates were found at Saibai/Boigu clinics but no failures were reported. Early failures at Daru Hospital are likely to be due to lack DST until 2010 and lack of routine DST, until 2012.

HIV rates in western province do not appear to be driving tuberculosis incidence, since observed rates of HIV in patients with tuberculosis is 3% - little more than the estimated community rates (although this estimate is imprecise). Tabubil had higher HIV rates in the last 12 months, with 10% HIV positivity in TB patients. Tabubil has a more mobile population, drawing workers from National Capital District and other provinces, and may reflect the rates in hotspots around PNG.

5. Other diseases and burdens on health system in Western Province

During my evaluation in WP, I came to the conclusion that TB was by a wide margin the greatest disease burden on the hospitals and Health Centres that I visited in terms of time in hospitals dedicated to the care of patients. There is also a firm belief held by practitioners, supported by some data, that TB is an increasing problem. Part of the burden is that significant time is spent as an inpatient, leading to high consumption of health resources. This of course escalates when treating MDR rather than sensitive TB, with an estimated cost of ordinary TB of 60Kina, compared with 15000Kina for MDR. MDR patients are kept in hospital for much longer too, with up to eight months hospitalisation to ensure completion of the intensive phase of therapy.

Most of the beds in hospitals I visited were occupied by TB patients. The next most substantial activity of the hospitals was obstetric confinements. Nevertheless, some conditions can be a burden without requiring such extensive inpatient care; below is a list of other significant health problems faced by Western Province. The information presented comes mostly from the 2011 Sector Performance Review [12].

5.1 Malaria

In recent years, malaria has been the commonest cause of outpatient visits in Western Province, making up nearly one third of all visits in 2007/8. Western Province experienced over 400 malaria cases per 1000 population in 2006 but this fell gradually to 2010. The new treatment regimen, with combined artemether/lumefantrine tablets and rapid diagnostic tests, has improved management of malaria over the last 12 months. Bed nets have also been widely distributed. Malaria is now a less common cause of hospitalisation and death, though records from just five years ago put it at 4.7% of deaths, the 8th biggest cause of death in Western Province.

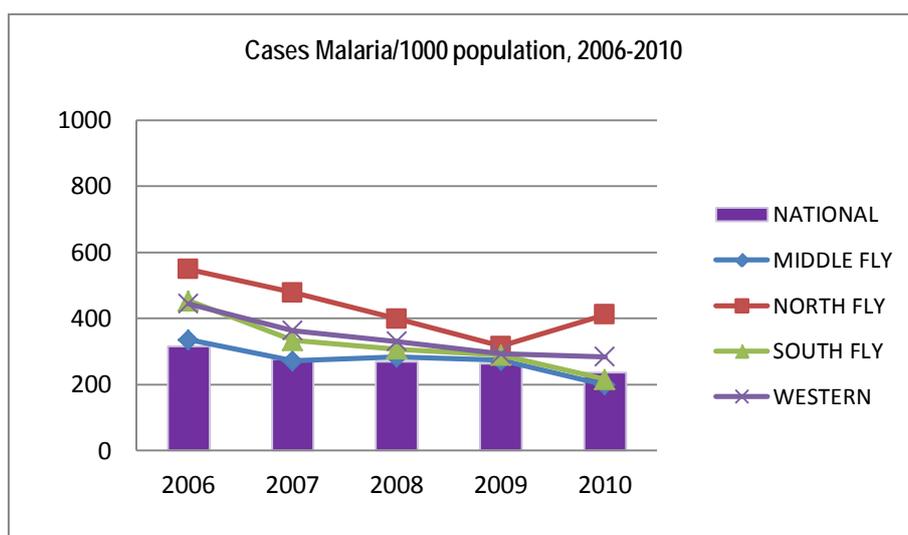


Figure 5-1 Incidence of Malaria in Western Province 2006-2010

5.2 Pneumonia

Table 5-1 shows the case fatality rate of children admitted to hospital with pneumonia 2006-2010. The result that stands out most is the sudden increase in the South Fly in 2009. TB is likely to be the causative agent in some of these deaths.

| % of children admitted with pneumonia who die in hospital/HC, 2006-2010 | | | | | |
|---|-------|-------|-------|-------|--------|
| | 2006 | 2007 | 2008 | 2009 | 2010 |
| MIDDLE FLY | 4.76% | 1.06% | 3.60% | 1.44% | 0.00% |
| NORTH FLY | 2.51% | 2.39% | 4.74% | 3.60% | 2.05% |
| SOUTH FLY | 4.26% | 1.18% | 1.18% | 9.59% | 13.79% |
| WESTERN | 3.24% | 1.80% | 3.79% | 3.90% | 2.58% |
| NATIONAL | 3.08% | 2.62% | 2.60% | 3.19% | 2.84% |

Table 5-1 Mortality rates from pneumonia in children admitted to hospital

5.3 Gastrointestinal/malnutrition

The incidence of diarrhoea in children in Western Province has been steady at around 400 per thousand (see Figure 5-2), higher than the national average. North Fly region has the highest rates in this data series. Since these data were collected, a country-wide cholera epidemic has affected Daru Island and the Fly River region, which would lead to increase incidence in year 2011.

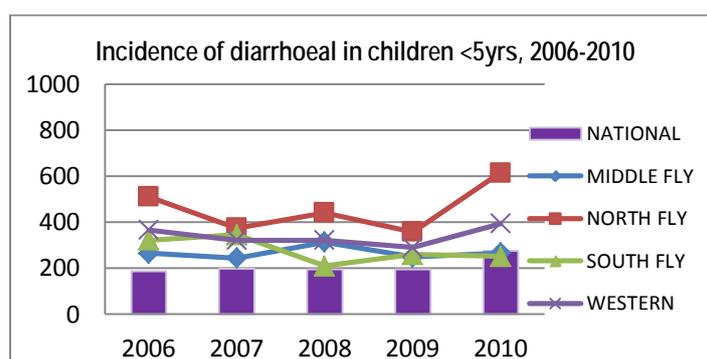


Figure 5-2 Incidence of Diarrhoea in children <5y in Western Province 2006-2010

The proportion of children in Western Province who are underweight is about the national average at around 25% (see Figure 5.3) and this is stable.

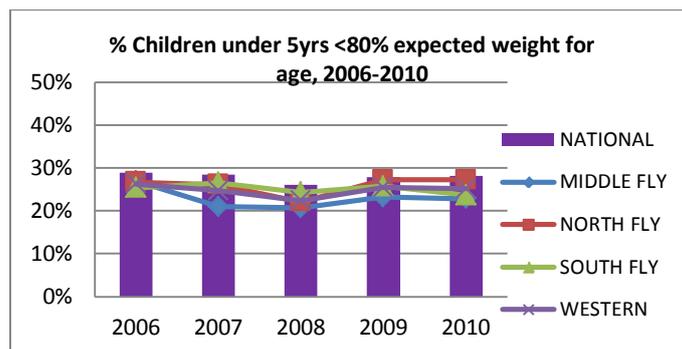


Figure 5-3 Incidence of malnutrition in Western Province 2006-2010

5.4 Obstetrics/perinatal

Attendance at antenatal clinics is around 60% (at least one visit) and birth supervision also around 60% in Western Province, higher than the national average of 40%. Family planning rates are much higher than the national average with around 330 (couple-years protected) per 1000.

5.5 injury

Visits to outpatients for injury are high in the Western Province, greater than the national average (Figure 5.4).

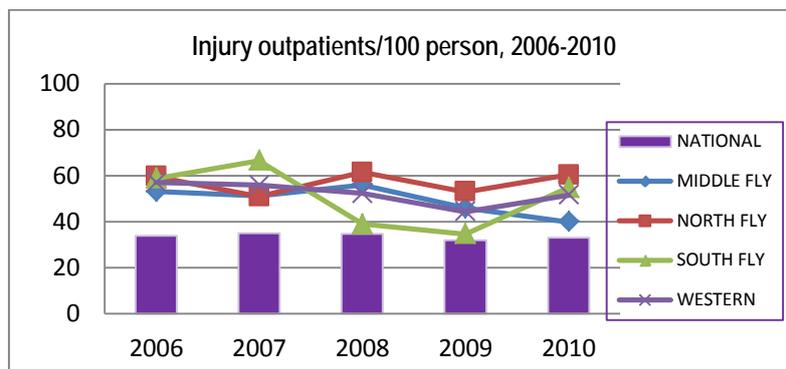


Figure 5-4 Incidence of Presentation with Injury in Western Province 2006-2010

5.6 HIV/AIDS

Testing is not available in many parts of the province and it is likely that HIV is significantly under-reported. I have made a brief assessment of HIV from the data gained while in the province (see Section 4-6). The antenatal clinic HIV positive rate was 2.5% in one clinic reviewed in Western Province, the same rate reported at antenatal clinic in Port Moresby in 2010 [12]. Nationwide in 2010 the proportion of antenatal HIV tests that were positive was 0.7% but some regions have higher incidence. The Highlands and the Southern Region, including the National Capital District, have been reported as having higher rates of HIV.

5.7 Preventive health: vaccination

Evaluation of Risks of Tuberculosis in Western Province Papua New Guinea

Outreach and vaccination activities are falling both at a national and provincial level, indicated by the very low rate of 3rd dose pentavalent vaccine coverage (Figure 5-5).

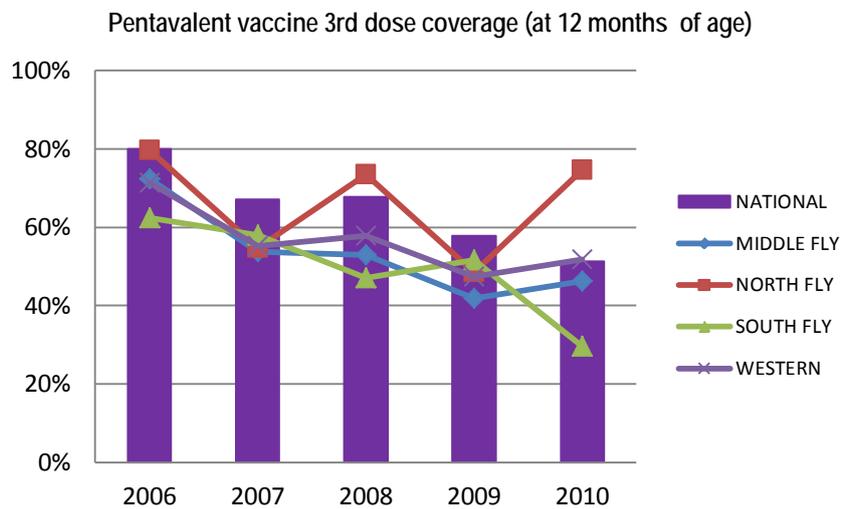


Figure 5-5 Vaccine coverage in Western Province: 3rd dose pentavalent vaccine

6. Achievements in the last 12 months

Following the assessment of TB services in the South Fly by WHO in October 2011, recommendations were made (see Appendix 4 for key recommendations). AusAID introduced support to strengthen TB services in Western Province. Below is an assessment of the activities undertaken in the last 12 months as a result of these efforts.

6.1 Co-ordination of TB response

A Provincial TB coordinator has been appointed to Western Province. Each district has a district TB coordinator. Community health workers, volunteers for DOT and microscopists have been trained. Staff have been employed for advocacy and community mobilisation.

Secure drug supplies have been procured from a WHO QA drug supplier. Communications have been improved through the provision of computers and Blackberry mobile phones.

A TB control centre has been established on site at Daru Hospital with office space and computer and communications equipment. Monitoring and evaluation of the South Fly TB situation is now very comprehensive.

6.2 Daru Hospital

The hospital has been provided with a digital X-ray machine, a geneXpert machine and cartridges, a large supply of N95 masks and an additional ward has been refurbished for additional temporary accommodation of TB inpatients. A new isolation ward is currently being built.

6.3 Transport

Transport has been increased through the acquisition and use of the water ambulance *Medics Queen* and the use of cars in Daru and Kiunga.

6.4 Outreach

Community outreach on Daru Island is taking place for the purposes of education & contact tracing. The *Medics Queens* has been used for 6 visits to Mabaduan since arriving in mid-May. It has visited as far as Balimo on one visit.

In 2012 to date DOTS training has been provided to four HEOs, 10 nursing officers, 25 CHWs and two others. PICT training for HIV testing has been conducted for three HEOs, nine nurses and 12 CHWs. Each district is training community treatment providers; this year to date, Daru has trained 20 community treatment providers bringing the total available in the Daru region to 40.

6.5 HIV/TB

Integration of TB HIV services has commenced in Daru and is ready to commence in both Kiunga and Balimo. Of the 296 patients treated in Daru from January to September 2012, 170 had undergone HIV testing.

6.6 Contact tracing

Contact tracing is occurring and clinics have been set up in Daru and Kiunga specifically for review of contacts.

6.7 Training

Training of CHWs, HEOs and microscopists in programmatic TB management has taken place in all districts in Western Province. ACSM training has also been accomplished and both Kiunga and Daru have an active ACSM unit for TB.

7. Gaps

While the service, and programmatic management of TB in Western Province has undergone large improvements over the last 12 months, some areas could be improved.

7.1 Infection control

Figure 7-1 is an approximate depiction of the TB and medical ward layout at Daru Hospital. It shows the infection control risk through ventilation that runs in the direction of the arrow, from MDR to sensitive TB wards through to the general medical wards and staff offices. The large arrow shows the direction of the breeze. Even more concerning is that most of the beds in the general medical ward were occupied with probable TB cases, causing great risk to those admitted to the hospital without TB.

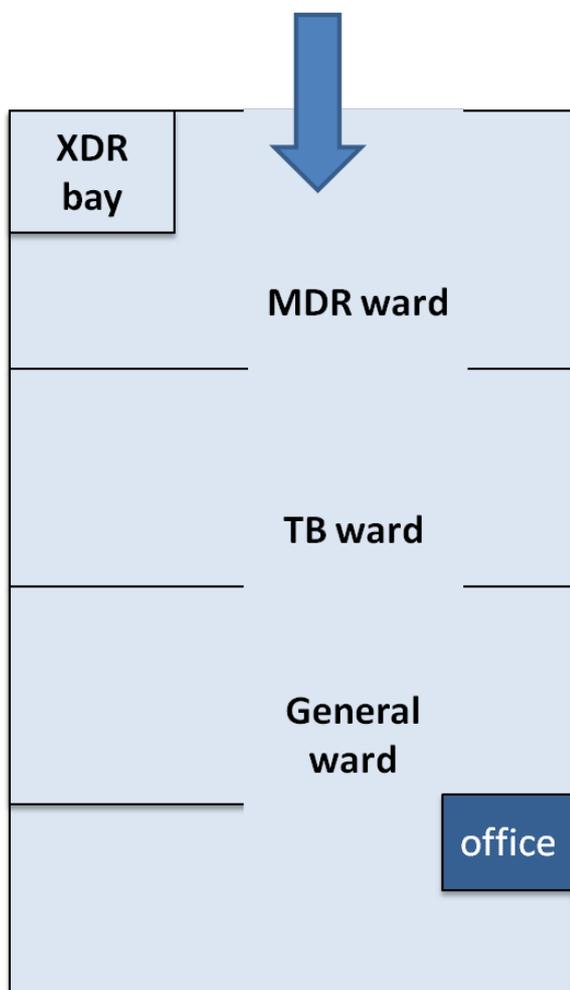


Figure 7-1 sketch of the medical and tuberculosis wards at Daru Hospital

No medical staff wore the N95 masks correctly at Daru Hospital, with some nursing staff wearing surgical masks. At Balimo Hospital only one healthcare worker wore the mask correctly, no other sites had any health workers wearing N95 masks. This was despite masks being available, for example at Daru Hospital. Other aspects of infection control were also poorly managed, including access to running water and soap for hand washing, and also disposal of clinical waste. As reported, XDR TB has been diagnosed in a healthcare worker caring for another XDR case at Daru Hospital. This is very concerning and can be avoided in the future with relatively little effort or additional expense. Other hospitals also reported hospital-acquired cases of TB; two patients at Kiunga and one at Rumginae had hospital acquired TB at the time of my visit.

A review of cases of TB at Daru Hospital showed over 20 cases of tuberculosis in healthcare workers in the last 10 years. Not all of these were necessarily hospital acquired.

7.2 Communication

Communication between BMUs and in particular to the provincial TB coordinator is inadequate, despite the measures already in place to improve it. During my review, the Provincial tuberculosis coordinator, Mr Abel Marome, was beginning to gather a group of people responsible for communicating quarterly reports and for the purposes of referral and outreach, including review of patients failing therapy, using a Blackberry phone and user group. More could be done in this regard. In particular, Digicel services in Daru were suboptimal for good communication and alternatives need to be found.

7.3 Outreach & Education

One of the concerns in Western Province is that observed tuberculosis cases are the tip of the iceberg. It is in fact impossible to say whether this is the case with the current standard of recording and reporting and measurement and evaluation in Western Province. In particular, there are very few functioning BMUs in Western Province, while some of the existent BMUs are not satisfying minimum requirements, such as having a microscope and trained microscopist, and in others recording and reporting is very limited.

Delayed access to care and late presentation of disease is evident, both in observing the patients at point of care and on reviewing notes and databases. Many patients present severely malnourished, with extensive disease. There is a resistance to come to hospital, and this is particularly the case with the treaty villagers.

More BMUs are required, but need funding, staff and training. In addition to this outreach and supervision is required for BMUs. Aid Posts and Health Centres that are not BMUs also require assistance with TB diagnosis, referral and management. Areas that appear to have poorest access to TB healthcare are along the Fly River and in the Southern part of North Fly and in the inland part of South Fly (however, I recommend further study to confirm this).

7.4 Hospital capacity

The hospitals are under substantial strain as a result of dealing with TB. In particular Daru Hospital has a very high case load, and with the high rates of MDR TB this workload is likely to increase. Many of the health workers are under strain and the wards are crowded. The greatest concern is that non-TB patients are mixing with TB patients as a result of the high burden of TB; this must be addressed quickly. Separate wards are required for people under investigation, known smear-positive cases, known MDR cases and known XDR cases. People under investigation should be investigated as outpatients wherever possible and when requiring inpatient attention, cases should have sputum examination performed on the same day.

7.5 Human resources

While capacity is improving, much more support is required at all levels but in particular in M&E and implementation of programmatic management. The program remains fragile while the TB provincial coordinator continues to have such a high workload and while there are few others in the management team able to carry out some of the essential tasks, including training, supervision, M&E, recording and reporting. Rural health staff levels are extremely low, with many Aid Posts unmanned and high rates of staff absenteeism. Church-run services have fewer problems with absenteeism and maintaining staff, however many of the physical structures (the health centres, the aid posts) are poorly maintained.

7.6 HIV testing

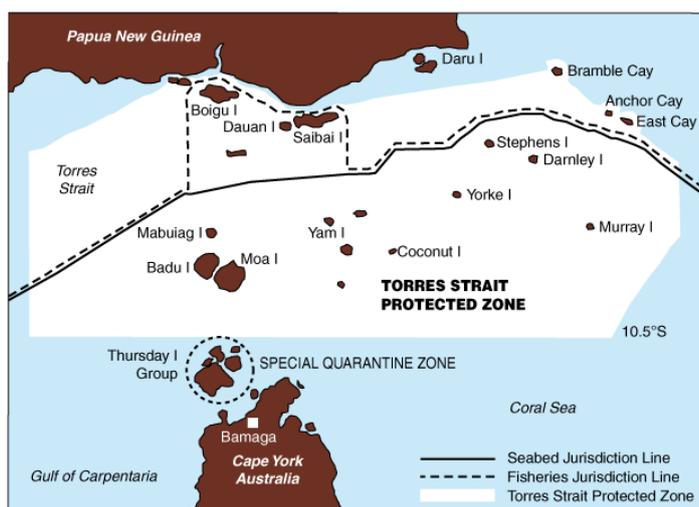
HIV testing capacity has been developed, with access to rapid tests available to all hospitals and some Health Centres. Nevertheless, not all hospitals have been routinely testing TB patients for HIV. It seems the bottleneck is in the PICT phase. HEOs and nurses trained in PICT have cited poor availability of private space as a reason for this. Additionally, uptake rates are poor, for example in the prenatal clinic (only 50%). It is worth exploring cultural and professional causes that could be contributing to this result, as well as investing in space to remove this obstacle to PICT.

8. Risks

8.1 Risks at the border

TB is a disease transmitted from person to person during periods of sustained close proximity. There is no definitive evidence that MDR or XDR is more or less transmissible than other forms of TB. Reducing risk of TB transmission from PNG nationals to Australians involves reducing time spent in close proximity with active pulmonary (smear-positive) TB cases. Most activities undertaken by treaty villagers in Saibai and Boigu Islands involve short stays of one to two days and outdoor interactions such as trading and fishing. These pose a low risk of transmission for each individual visit, but with thousands of visits per year may pose a long-term risk of spreading MDR/XDR TB into the TSI communities.

The other risk is to Torres Strait Islanders visiting treaty villagers in PNG. Overnight stays of Torres Strait Islanders with families in treaty villages and vice versa pose considerable risk.



Source: Giplin et al 2008.[1]

Treaty villagers made 27,705 approved visits to Australia in the year 1/7/2011 to 30/6/2012. Each visit requires clearance at Mabaduan and must be for an approved purpose. Since the closure of the Saibai and Boigu Island clinics, seeking healthcare is no longer an allowable reason to visit these islands and 1069 patients seeking healthcare along with 1316 companions have been denied entry to Australian territories. This diminishes the risk to people living in Saibi and Boigu Islands, at least in the short term.

8.2 Risks elsewhere

Another source of risk affects Australian expatriates working in PNG. The National Capital District has a very high rate of TB of >1000 per 100,000 and a rate of MDR TB of 22% on

geneXpert testing.⁷ Seven thousand Australians travel for short stays to PNG each year. This poses only a small risk unless Australians are visiting homes and having overnight stays with PNG citizens.

PNG citizens can also visit Australia by air, arriving in Cairns or Brisbane airports. To be granted a tourist visa, PNG nationals must have a health check, answer questions about TB and have a chest X-ray. Hence mechanisms are in place to reduce the risk of TB to Australians and fellow travellers provided these rule are properly applied. The risk of breakdown of this system has been demonstrated twice in recent months, with PNG nationals known to have TB flying to Cairns for treatment. Some PNG Nationals have long term visas, for example to study, which would allow travel to Cairns without a medical review. Additionally, PNG citizens may be free of TB on travel to Australia but may subsequently reactivate latent TB. In general, reactivation of TB in expatriates of high incident countries occurs at a rate of around one to two per thousand person years [13]. Cases of tuberculosis in PNG nationals residing in Cairns have been reported in Cairns Hospital (21 over 10 years).

Because TB incidence appears to be rising and drug resistance is certainly increasing, Australia is likely to see some cases of MDR TB in PNG nationals in coming years. However, based on current rates of TB in PNG nationals residing in Australia (leaving aside Boigu and Saibai Island cases) the expected number is small; estimates should be possible by examining Australian notification data at the level of country of residence (item missing in Table 8-1 below). The number is around two per year in the Cairns region, and other cases around Australia are to be expected.

To put this in context, Australia notifies around 1000-1200 cases of active TB per year. In 2009, 30 were from the treaty villages of PGN via Saibi and Boigu Island clinics. Of the MDR cases seen in Australia in 2009, 11 of 31 cases were from Saibai and Boigu clinics.

| | MDR TB PNG via TSI | MDR TB other PNG visitors | MDR TB in indigenous TSI | MDR TB total | Sensitive TB PNG via TSI | Sensitive TB other PNG visitors | Sensitive TB in indigenous TSI | TB total AU Bact conf |
|------|--------------------|---------------------------|--------------------------|--------------|--------------------------|---------------------------------|--------------------------------|-----------------------|
| 2007 | 13 | 0 | 0 | 24 | | | | 872 |
| 2008 | 6 | 0 | 0 | 21 | 27 | | 3 | 886 |
| 2009 | 11 | 0 | 0 | 31 | 31 | | 2 | 1062 |

Table 8-1 Breakdown of Australian notifications of tuberculosis by region of origin and drug susceptibility, sensitive implies "not MDR".

⁷ personal communication Dr Aia, TB control, NDoH

Table 8-1 table has been reconstructed from several TB surveillance reports, from both Queensland Health and DoHA and as such does contain some inferred data [14-17]. Data are not publically available for number of PNG nationals excluding the Saibai/Boigu Island cases or the number of Torres Strait Islanders (for all years) with active TB notified and the table is incomplete. It has recently been reported⁸ that there have been 11, 6 and 1 case in Torres Strait Islanders in the years 2010, 2011 and 2012 (year to date), respectively.

In assessing the risks to Australians of the TB epidemic in PNG, it should first be noted that MDR and XDR TB are no more infectious than fully sensitive TB. For many years Australian-born residents have had a risk of TB of less than 1 per 100,000 person-years. This is unlikely to change dramatically because the factors that keep this figure so low include small household size and good ventilation, lack of crowding of households, rapid presentation with illness and universal access to healthcare, in addition to rapid, effective isolation of cases and contact tracing and other screening activities. As years pass, the proportion of TB cases that are MDR TB will inevitably increase as global incidence of MDR increases. This proportion is likely to increase sooner in PNG nationals. In 2009, a third of all MDR TB came from the Saibai and Boigu Islands.

As the TB epidemic and rise of MDR TB unfolds in PNG, increasing numbers of nationals may travel to Australia to seek healthcare. However, only a privileged minority of PNG's seven million citizens can afford to do this. Management must therefore be directed in country at the risk to PNG citizens of increasing TB prevalence and increasing drug resistance.

8.3 Risks to programmatic control of tuberculosis

Programmatic TB control along WHO guidelines is being implemented vigorously in Daru and rolled out steadily in Western Province. The fundamental principles of programmatic control are rapid case detection with sputum microscopy, treatment with recommended regimens, DOT, good recording and reporting, and M&E. Programmatic management of drug-resistant TB is in place in Daru. This includes DST for all smear-positive isolates and reliable supply and use of second-line drugs, including one injectable agent for at least eight months and at least four drugs to which the isolate tests susceptible for at least 20 months. DOT during the intensive phase is an essential part of TB management. It would pose an increased risk of emergence of further drug resistance to have clinics working outside the programmatic management framework, for example being unable to provide adequate follow-up. Defaulter-finding must be part of the program.

The challenges faced in treating people across the international border are multiple and complex. Default rates are high often for reasons of poverty and inability to self-fund travel to

⁸ From The Australian newspaper: original source of information Queensland Health, not confirmed

clinics[1]. Payment for travel was one strategy for encouraging return to clinic and completion of therapy used by Gilpin et al. This strategy has now also been adopted in Daru Hospital for coastal villagers. Another strategy that has been proposed in programmatic control within Western Province is a nominal payment for community DOT volunteers.

The closure of the Boigu and Saibai clinics has led to transfer of many TB patients to Daru Hospital. While some of these patients are residents of treaty villages, 25 of the 32 handover patients with MDR TB reside in or around Daru. Patients treated at Daru with smear-positive MDR TB receive an injectable agent, capreomycin, for a minimum of eight months and receive five active agents, based on DST for at least 20 months, which is in accordance with WHO guidelines[18].

8.4 Long Term Risks

The incidence of TB in Western Province is high, considerably higher than is publicly reported or nationally registered, however evidence that it is increasing is currently patchy and regional. What is certainly increasing is the rate of MDR TB and retreatment rates. MDR TB will put a huge strain on the healthcare system in Western Province and likely all of PNG.

Drug resistant TB, along with rising HIV positivity rates (should that occur), will substantially increase the death rates from TB in Western Province over the next 5-10 years. The rate of TB that is drug resistant may be so high that simple programmatic management will be insufficient to control the disease even if it is implemented very effectively throughout the Province. This is certainly true of South Fly district around Daru Hospital and the treaty villages. Attempting to control high levels of MDR TB in Western Province without a very significant investment in its healthcare infrastructure could lead to a breakdown in the healthcare system, with insufficient staffing, medication and hospital beds to manage MDR TB properly. The inevitable consequence of this would be the increasing emergence of XDR TB. To avoid this outcome, more investment in TB management is required, and in particular district and provincial level government engagement and cooperation is necessary, as is the engagement of the hospital executive in all hospitals throughout the province.

9. Conclusions & Recommendations

Western Province is striving for many of the goals outlined by WHO for management of TB [19]. Challenges are many, and the extremely high rate of MDR TB is foremost in the list of challenges. Daru Hospital is undertaking programmatic management of drug resistant TB along WHO guidelines, while other government hospitals are following simple programmatic management of TB. Chief among the aims of the program are providing all people of the Western Province with easy access to a functioning health facility, educating the community about TB, encouraging early presentation, contact tracing and case finding.

Sustained commitment is fundamental to the success of the program. MDR treatment is around 200 times as expensive as standard TB treatment, so for a programme in Western Province to be successful it will require much greater infrastructure, especially around BMUs and in rural Aid Posts for those requiring treatment support. Time spent in hospital with MDR TB is also much longer and measures are necessary to boost hospital beds throughout South Fly (and potentially the other districts).

Cross-border cooperation will continue to be required, as some PNG nationals will inevitably continue to seek care in Australia, albeit at a lower rate than prior to the closure of clinics. Sharing of information about cross-border cases needs to continue and in particular details of cases and management history for ongoing care needs to be communicated from Australian clinicians to PNG when patients return. Additionally, Australia needs to rapidly notify PNG when PNG nationals cross the border and are diagnosed with TB in Australia. Australia has an obligation to notify TB cases to TB control centres on suspicion so that contact tracing can commence in PNG.

9.1 Risk reduction measures

Australia accepts immigrants from countries with high TB incidence and with a global increase in MDR TB Australia can expect to see more cases of MDR in the coming years. This increase in MDR and in TB in general has been declared a global emergency by WHO. Australia has very low incidence of TB by global standards and is likely to continue to do so, because of its affluence, low rates of household crowding, good ventilation, general hygiene and good health, and access to healthcare. Case finding and rapid diagnosis and treatment of cases also plays a role.

The most important risk reduction measure at the PNG-Australian border for Australians is to reduce the probability of long durations of exposure of Australians to PNG nationals. The ways to address this are:

1. To enhance the facility at Mabaduan to make it acceptable to the treaty villagers in the region. This will require several components, including full staffing of the clinic, a same-day service for sputum microscopy and a reliable supply of appropriate medications. Upgrading of this facility also requires reliable electricity, a drug storage facility that can maintain steady temperature and humidity, and clean reliable water supply and

sewerage. Good communications between the Health Centre and Daru Hospital and frequent outreach, both for clinicians to come to the Health Centre and for patients to go to Daru, is also essential. Care of patients needs to be moved closer to their home villages earlier to prevent defaulting and frustration with the health service.

2. Torres Strait Islanders need to be educated about TB, its mode of transmission and risks, encouraged to present early with cough or fever, and discouraged from spending time in crowded housing conditions while visiting treaty villagers.
3. Referrals of any PNG nationals presenting at clinics in Saibai and Boigu should be made directly to the WP TB coordinator and Daru Hospital and Mabaduan Health Centre in order to transfer patients to where programmatic management can take place.

The clinics at Saibai and Boigu have the potential to play a role in TB management in the Western Province, in much the same way that QMRL is currently playing an important role in TB diagnostics and DST. However in its current form this service would be rather limited as only 3% of Western Province is permitted to access these islands. The suggestion of allowing movement of health professionals across to treaty villages to provide mentoring and support in PNG (twinning arrangements) has merit and would assist in developing sound cross-border control strategies.

Now that South Fly District is making measurable progress in setting up programmatic management of TB including MDR TB management, focus must be on strengthening and expanding this program. For clinicians working within Australian territory to continue to play a role in the care of PNG nationals, it is imperative that their services be integrated into PNG's management of TB in Western Province. This, for example, would require reporting cases to Western Province TB management and using the TB programmatic management procedures, including FDC drug kits and TB register for recording and reporting. The strong emphasis on programmatic TB could be undermined by clinics acting outside of programmatic management guidelines.

9.2 Strengthening of TB services in Western Province

TB services in the Western Province have been improved considerably in the last 12 months, as described in Section 7. Further work is planned as programmatic TB management is rolled out, including an increase in training and recruitment of CHWs for TB management, better integration with HIV services, and improved communication of reports.

9.3 Solve the rural health service crisis in Western Province

Currently most government-run Aid Posts in Western Province are not staffed, due to a combination of lack of available skilled CHWs applicants and prolonged absenteeism. Absenteeism rates are around 50% in the rural health service. Reasons provided to me to explain this include the poor state of the facilities, in some places poor treatment of the CHWs by the local community, and the policy of continuing to pay staff whether they remain at work or not for months or years.

Western Province has a crisis in the provision of rural health care delivery that will be tested in coming months and years by the growing number of people needing MDR TB treatment and the burden that puts on Health Centres who will need to outsource some of this management to Aid Posts.

9.4 Practical short-term steps

Below I outline some practical short-term steps that would improve TB management in Western Province. They are not intended to be exhaustive or long-term goals.

Communications

Communications must be improved and concentrating on BMUs having access to TB control coordinators is the first step. Digicel coverage in Western Province is now very good, but Daru in particular has very slow internet. A reliable method of rapid internet-capable communication would improve the reliability and speed of data reporting enormously. This may require that Daru Hospital TB control centre invests in a viaSat and some additional equipment including a fax machine and scanner/printer. Most computers I viewed in Western Province were riddled with computer viruses, so investing in antiviral software is essential.

The JTAI-developed data-input software being used at the Provincial Health office for monitoring drug requirements/stocks/deliveries could be adapted to allow for rapid input of data in a way consistent with WHO TB reporting requirements, or another, very simple Excel file could be used throughout the province for all BMUs to report outcomes.

Staff support

One of the concerns about PNG's TB programme in its current form is that everyone working in the programme is under considerable strain, particularly the nurses, doctors and HEOs in the hospitals. In Daru in particular, conditions are crowded and Outpatients is very busy. Adequate housing for staff is required to maintain staff morale and ensure staff retention. More staff must be recruited and trained if more BMUs are to be opened and functioning.

Outreach

Areas with greatest difficulty accessing healthcare need to be reached in order to assess the incidence of TB in the Western Province and to estimate the proportion of TB that is MDR. Areas to target include the mainland/inland part of South Fly and along the Fly River in Middle Fly including up to Lake Murray. Closer examination of BMUs and national population statistics will give more precise guidance as to target areas.

Greater use should be made of the medical water ambulance, the *Medic Queen*. Outreach clinics around the treaty villages and up the Fly River are urgently needed and can be used for patient transfer, outreach clinics, training and supervision of HEOs and microscopists in BMUs.

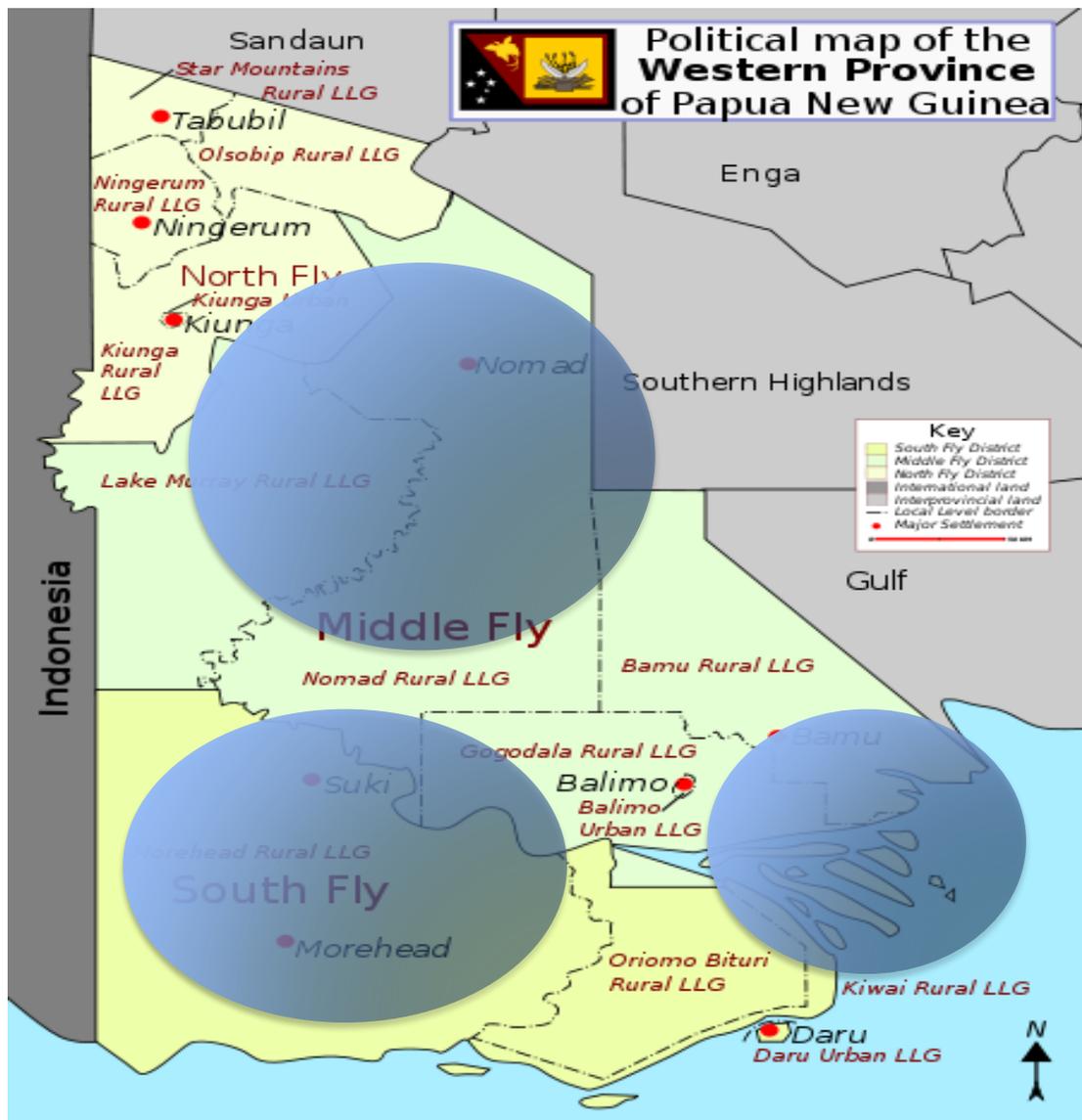


Figure 9-1 areas that are most remote from district hospitals need to be evaluated for tuberculosis and MDR TB rates.

9.5 Risks associated with this strategy

The recent AusAID investment to support TB control in South Fly includes TB-specific activities alongside activities which have a wider health system strengthening capability such as: an X-ray machine for Daru, a marine ambulance for patient transport, a TB physician with general physician responsibilities, and building of additional wards for patient isolation. There is a well-established literature on the negative effects of vertical programs (where only one disease is aggressively pursued) on already weak health systems. Adverse effects potentially include the migration of the few skilled existing staff to the new, better-funded program, and a subsequent drop in overall system performance. This risk will need to be actively evaluated and managed in South Fly to ensure the TB-related efforts are positively impacting on the wider health system’s capability and capacity. However, in my opinion, the

strategy of increasing TB services rather than concentrating on horizontal health programmes specifically is currently the better strategy since TB is undoubtedly the greatest infectious disease burden in South Fly, and vertical programmes already exist for HIV (and other areas such as immunisation and sexual health). Additionally, the state of the rural health service in the province is poor, with many Aid Posts not functioning so that installing CHWs into Aid Posts and Health Centres for TB management will provide additional basic health services.

The rollout of programmatic TB management to Middle and North Fly must continue, but a rapid assessment of drug susceptibility is needed. Daru will be one of the centres for a drug resistance survey that will take place nationwide, and this survey will be very informative. However, it is imperative that the Middle and North Fly provinces be assessed for MDR TB rates and the programmes be developed in response. Continuing on FDC and short course DOTS may lead only to further drug resistance if MDR and mono-resistance rates are high. The Western Province TB management team along with National TB managers should consider abandoning the Category II drugs for failed therapy, since streptomycin resistance levels are so high. All clinical failures from all parts of the Province should be able to send sputum samples to Daru Hospital.

9.6 Research

Research that would be of great assistance in managing TB in the Western province includes:

1. Genotyping of isolates to test for epidemiologically-linked clusters. This has the potential both to track the spatiotemporal spread of TB and also the rate of spread and rate of drug resistance acquired. It can also give a firm estimate of the likely transmission of TB from PNG to TSI residents.
2. Further study at a population level of the social determinants of disease, including rates of HIV, alcoholism, diabetes, lung disease, smoking, indoor air pollution and malnutrition, poverty and crowding.
3. Operational research to investigate efficient management of drug delivery and other service deliveries in the context of large logistical challenges in Western Province.
4. Modelling of intervention strategies and the potential impact and adverse consequences, such as has begun with work by Hickson et al.[20]. This could also include risk models for transmission of MDR TB to Australia and endogenous transmission within Australia.
5. Qualitative research involving the people of the treaty villages, their response to illness and the reasons behind actions surrounding transfer of care. This research was suggested by Dr Tom Konstantinos and I think could be a very useful study; aside from its general contribution to anthropology, it will give insights into current and future TB management and may in itself be therapeutic.

9.7 Limitations of this report

This study was conducted over 20 days, with 14 of those days spent in Papua New Guinea. Much of the data presented in Chapter 4 is from original data entered into BMUs and some is taken from aggregate data and spread sheets. Some of the BMU record keeping made assessment difficult and I was unable to verify all of the aggregate data and electronic record. Additionally, I was unable to access the latest census figures in time for this report. Therefore, the incidence rates given in this report should be regarded as indicative only and further work needs to be done as outlined in the report to get more robust estimates.

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