Tuberculosis control in conflict-affected East Timor, 1996–2004

N. Martins,*†† E. Heldal, §¶ J. Sarmento,**†† R. M. Araujo,‡‡ E. B. Rolandsen,¶†† P. M. Kelly*‡§§

* Menzies School of Health Research, Darwin, Northern Territory, Australia; † Faculty of Public Health, Universidade da Paz, Dili, East Timor; ‡ Institute of Advanced Studies, Charles Darwin University, Darwin, Northern Territory, Australia; § Department of Infectious Disease Epidemiology, Norwegian Institute of Public Health, Oslo, ¶ Caritas Norway, Oslo, Norway; ** National Tuberculosis Control Programme, Dili, †† Caritas Dili, ‡‡ Ministry of Health, Democratic Republic of Timor Leste (RDTL), Dili, East Timor; §§ National Centre for Epidemiology & Population Health, the Australian National University College of Medicine and Health Sciences, Canberra, Australia

SUMMARY

SETTING: East Timor has undergone major political changes in the past 10 years. Tuberculosis (TB) control has flourished, despite chronic low tension conflict, a brief but intense period of high-level conflict and post-conflict reconstruction.

OBJECTIVE: To assess TB control in East Timor from 1996 to 2004.

DESIGN: Data were collected from a variety of sources. Key TB programme indicators were analysed with reference to WHO targets to assess the performance of the three TB control programmes that operated during the study period.

RESULTS: Before 1999, a non-governmental TB control programme was established in several districts in parallel with the government TB programme, and showed optimistic results. External donor funds, technical assistance and local control strategies were key components. In 1999, conflict led to complete disruption of both programmes. In 2000, a National Tuberculosis Control Programme (NTP) was established from the non-governmental programme in collaboration with other partners. The smear-positive TB case notification rate of 108 per 100 000 population is the highest in the region and reflects high population coverage. The cure rate of 81% is close to reaching the WHO target.

CONCLUSION: High-quality TB control has been introduced in conflict-affected East Timor. Further research is needed to examine Timorese approaches to inform other, similar settings.

KEY WORDS: tuberculosis; East Timor; war; health services; epidemiology

TUBERCULOSIS (TB) remains an important problem worldwide, causing around 8 million cases and 2 million deaths each year.1 Conflict and post-conflict reconstruction of health services make TB control problematic.2 A stable population and an adequate infrastructure within a well functioning health system have been argued to be fundamental requirements for the successful implementation of the World Health Organization’s (WHO’s) five-component strategy known as DOTS. The essential elements of DOTS are political commitment, case detection through quality assured bacteriology, standardised treatment with supervision and patient support, an effective drug supply, and a management, monitoring and evaluation system.3 These conditions are problematic in conflict and post-conflict settings. Strong community support, utilisation of outreach workers from different ethnic groups, the use of directly observed treatment (DOT) three times per week and modified treatment regimens have been shown to be effective in conflict-affected situations.3–5 Sudan and Mozambique implemented successful DOTS programmes despite ongoing civil wars.6,7 The objective of the present study is to document the experience of the introduction of DOTS during chronic low-level conflict and its rapid re-establishment and expansion in post-conflict East Timor. We examined key indicators to assess TB control programme performance in East Timor between 1996 and 2004.

STUDY SETTING AND METHODS

Setting

East Timor is divided into 13 districts and 67 sub-districts,8 and has a population of 924 642.9 During the period of Indonesian rule (1974–1999), East Timor experienced ‘ongoing low-level tension’, resulting in the loss of more than one third of its population.10 In August 1999, the Timorese people voted overwhelmingly for independence. In September 1999, East Timor erupted in a wave of violence that devastated up to
70% of the infrastructure in almost every town and village in the country. The territory was subsequently placed under United Nations (UN) administration and became the world’s newest country in May 2002.

TB is a major public health problem in East Timor. In 1995, the estimated prevalence was 707 per 100,000 population and East Timor was included in the expanded Indonesian National Tuberculosis Control Programme (NTP). In 1996, the Catholic Bishop of Dili, Bishop Belo, received the Nobel Prize for Peace and asked the Norwegian government to help control TB in East Timor. This resulted in the establishment of a non-governmental TB programme operated by the Catholic Church (Caritas East Timor) in 1997. This programme operated in parallel with the government and used different treatment regimens and reporting systems. In January 2000, an NTP was established with Caritas East Timor acting as the lead agency.

**METHODS**

We collected data from government and non-government sources, the WHO, consultant reports and review documents. We examined key TB programme indicators to assess the performance of the three TB control programmes that operated during the study period: the Indonesian Ministry of Health (NTP-INO) (1996–1999), the Caritas East Timor Programme (CTP) (1997–1999) and the National Tuberculosis Control Programme of Timor-Leste (NTP-TL) (2000–2004). We drew conclusions about the effectiveness of TB control with reference to WHO targets. A list of definitions used is provided in Table 1.

The authors were unable to collect detailed information on the TB programme under NTP-INO due to the destruction of health documents during the civil conflict of 1999. Information was obtained from personal accounts from the authors or secondary sources such as consultant reports.

**Data analysis**

Patient cohort data were compiled and tables and graphs generated in MS Excel. Statistical analysis was performed using STATA (version 7, STATA Corporation, College Station, TX, USA). Exact 95% confidence intervals (CI) for proportions were calculated using Poisson distribution. Differences in point estimates were calculated using Fisher’s exact test. Maps were produced using MapInfo Professional version 5.5 (MapInfo Corporation, New York, NY, USA, 1999).

Ethical clearance was obtained from the Human Research Ethics Committee of the Menzies School of Health Research in Darwin, Australia. Permission to conduct the study was also given by the Minister of Health of East Timor and the NTP director.

**RESULTS**

**Three TB control programmes**

**Indonesian Government TB Control Programme**

The Indonesian Government TB control programme (NTP-IPO) was based on the DOTS strategy and used a 6-month regimen consisting of rifampicin (RMP), isoniazid, pyrazinamide and ethambutol (2RHZE/4RH). The programme used blister packs of TB drugs (combi-packs) for individualised treatment courses. Most health centres were not conducting cohort analysis. There

---

**Table 1** Diagnostic categories and programme performance indicator definitions

<table>
<thead>
<tr>
<th>Diagnostic categories</th>
<th>Indicator definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>New: a patient who has definitely never taken anti-tuberculosis drugs for more than 1 month.</td>
<td>Treatment success: the sum of patients cured and those who have completed treatment.</td>
</tr>
<tr>
<td>Relapse: a TB patient who previously received treatment and was declared cured and has once again developed sputum smear-positive TB.</td>
<td>Treatment failure: patient who is sputum smear-positive at 5 months or later during treatment.</td>
</tr>
<tr>
<td>Treatment after default: a TB patient who returns to treatment, and is sputum smear-positive, following interruption of treatment for &gt;2 months.</td>
<td>Defaulted: a patient whose treatment was interrupted for &gt;2 consecutive months.</td>
</tr>
<tr>
<td>Failure: a patient who, while on treatment, remained or became smear-positive again 5 months or later after commencing treatment.</td>
<td>Transferred out: a patient who has been transferred to another TB clinic and for whom the treatment outcome is not known.</td>
</tr>
</tbody>
</table>

TB = tuberculosis; DOT = directly observed treatment; WHO = World Health Organization; PTB = pulmonary tuberculosis.
was a laboratory network, but with inadequate training and supervision and poor quality control. Although some *combipacks* were found in most government health centres, very few TB patients were actually treated. DOT was not standard, and most patients received weekly supplies of drugs. External donor assistance to the programme had not been well established. The NTP-INO was destroyed by the conflict in 1999; facilities and drug stocks were lost and staff were displaced.

**Caritas TB Control Programme**
The Caritas TB Control Programme (CTP) was a DOTS programme established through Catholic clinics. Caritas Norway was the main source of funding and technical expertise. The central unit of the TB programme included a Timorese director and regional supervisors. An 8-month treatment regimen (2RHEZ/6HE) was introduced to prevent RMP resistance. Treatment adherence was assisted by the creation of *alburques* (temporary housing) for patients from remote areas during the intensive phase of treatment, the establishment of community-based treatment observers (known as motivators), and the provision of supplementary food and transport costs for some patients. A laboratory network was established, with TB microscopy in each clinic. To allow rapid expansion, 3-month on-the-job training was established at the best performing clinic laboratory in Dili. Reporting and recording was strengthened through regular supervision, evaluation and training activities. Drugs were obtained from reputable international sources. The instability of 1999 severely disrupted the CTP, with all patients discontinuing treatment in the last quarter. However, most staff, many facilities and some equipment survived the conflict.

**The National Tuberculosis Control Programme**
The aim of the National Tuberculosis Control Programme (NTP-TL) was to establish a control programme based on international best practice, adapting it where necessary to local circumstances, which was inclusive of all health care providers in East Timor. The local TB control experience of Caritas East Timor, the financial assistance of Caritas Norway and targeted additional external technical assistance were vital elements that allowed the rapid establishment of the NTP-TL.

The NTP-TL was established mainly through Catholic clinics and, throughout 2000, expanded to international non-governmental organisation (NGO) administered clinics. Caritas Dili (formally known as Caritas East Timor) was appointed as the leading implementing agency, and a series of memoranda of understanding (MoU) were negotiated between the UN administration, Caritas Dili and other partners. By 2001, the NTP was well established through the new government health structure.

All components of DOTS were well implemented in the NTP-TL. The local strategies that had been established by the CTP and outlined above were expanded throughout the country in the NTP-TL, and some new strategies were adopted as required. The DOTS strategy was integrated with the general health services and included government, non-government and private clinics. The general NTP-TL activities were organised through the Central Unit, located at the office of Caritas Dili.

**TB programme performance**

**DOTS coverage**
DOTS coverage and district level TB notification rates are shown in Figures 1 to 3. In 1996, only six (46%) districts in East Timor had adopted DOTS under the INO-NTP. In 1997, the CTP covered 11 (85%) districts and 15 (22%) subdistricts (Figure 1). In many cases, government and Caritas clinics were situated close to each other and shared the same population base. In many subdistricts and in some districts there was no TB programme. By the end of 2004, the NTP-TL was formally operating in all 13 (100%) districts and 56 (84%) subdistricts (Figure 3).

**Case finding**
A laboratory and TB programme manual were produced for both the CTP and the NTP-TL. The CTP microscopy network operated in 13 clinics. Using similar approaches, the NTP-TL microscopy network was established in community health centres, Catholic clinics and some private clinics. In collaboration with the national reference laboratory, both the CTP and the NTP-TL routinely conducted laboratory quality assurance using standard WHO/International Union Against Tuberculosis and Lung Disease methods (Table 2). The ongoing quality assurance has been useful for detecting and correcting major errors in a few clinics. The high error rate in 2001 was almost entirely due to one clinic (error rate 88%). On review, the technician at that laboratory was found to be colour blind and was replaced.

Case finding is summarised in Table 3: 183 new sputum smear-positive cases were registered in the NTP-INO in 1996. There are no data to assess trends in subsequent years. In 1997, the CTP registered and treated over 1000 TB patients. Case finding decreased from 1997 to 1999. In its first year (2000), the NTP-TL registered and treated over 4000 patients. A relatively low proportion of sputum smear-positive cases was detected during the initial period of both the CTP and the NTP-TL.

In 2004, 3724 TB cases were registered and treated under the NTP-TL (Table 3). The TB case notification rate for all cases was 403/100 000 and for new smear-positive cases it was 108. Interestingly, the majority of
cases were reported from one urban district (Figure 3). The proportion of infectious cases decreased significantly, from 31.4% in 2000 to 26.9% in 2004 (Fisher’s exact, $P < 0.001$). The proportion of retreatment cases also continuously decreased. In all but one year, extra-pulmonary and sputum smear-negative cases dominated TB case notification, with up to 72% of cases (2004) in these categories.
Case holding

In 1996, the success rate for sputum smear-positive cases was around 45% under the NTP-INOT.13 The CTP success rate for new smear-positive cases in 1997 was low (50%), mainly due to a high default rate (Figure 4). Similarly, the success rate of the NTP-TL was only 65%, with a high default rate in 2000. The success rate increased continuously to over 80% by the end of 2003, a highly statistically significant improvement (Fisher’s exact, $P < 0.001$).

DISCUSSION

We have documented the three different TB control programmes operating in two different situations in East Timor. There are three main results from this study. First, a non-governmental DOTS programme was established during low-level chronic conflict in East Timor, and although coverage was limited and initial default rates were high, it showed promising improvements before intense conflict disrupted the programme. Second, a unified NTP based on the previous non-governmental programme was rapidly scaled up after brief but intense conflict, and has achieved impressive and sustained results. Finally, both programmes utilised similar local modifications to DOTS, the main difference being the wider coverage and inclusive nature of the post-conflict programme. Although the TB case notification and cure rates are high, the programme still faces problems with a low percentage of smear-positive cases and incomplete coverage in rural sub-districts.

The DOTS strategy was successfully introduced during and after conflict in East Timor, despite many difficulties. Prior to 1999, the existence of parallel systems and the chronically precarious security situation hampered supervision and the distribution of supplies in both the CTP and the INO-NTP. After the conflict, a highly mobile population, lack of infrastructure, lack of trained staff and lack of financial support were reported as the main obstacles to the re-establishment of DOTS.14

Due to its inclusive nature, the NTP-TL has flourished and is currently serving the majority of the Timorese population. The NTP-TL is a good example of public-private mix with cooperation between government and NGOs.14 The TB case notification rate under the NTP-TL is much higher than the combined notification rate of the TB programmes operating prior to 1999, partly because of the centralised and uniform recording and reporting system and partly due to the higher population coverage. As Kelly et al. reported high rates of TB among East Timorese refugees arriving in Darwin in 1999, this notification rate could reflect the true TB prevalence in East Timor.16

The NTP-TL reported a high number of TB cases at earlier stages of its establishment. This may be explained by poor screening processes, resulting in high recruitment of smear-negative cases. Alternatively, it might be a true figure due to the potential for increasing numbers of TB cases during the emergency period.17 It is also possible that health professionals were more likely to diagnose TB because of the avail-

### Table 2 Results of quality control of sputum microscopy, CTP 1998 and NTP-TL 2001–2003

<table>
<thead>
<tr>
<th>Year</th>
<th>Clinics</th>
<th>Positive</th>
<th>Negative</th>
<th>Total</th>
<th>False positive</th>
<th>False negative</th>
<th>Total</th>
<th>Error rate (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>n</td>
<td></td>
</tr>
<tr>
<td>1998*</td>
<td>13</td>
<td>—</td>
<td>—</td>
<td>859</td>
<td>48</td>
<td>48</td>
<td>5.6 (4.1–7.4)</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>12</td>
<td>406</td>
<td>235</td>
<td>641</td>
<td>84</td>
<td>7</td>
<td>14.2 (11.4–17.4)</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>20</td>
<td>388</td>
<td>109</td>
<td>497</td>
<td>25</td>
<td>7</td>
<td>6.4 (4.4–9.1)</td>
<td></td>
</tr>
<tr>
<td>2003*</td>
<td>20</td>
<td>397</td>
<td>215</td>
<td>612</td>
<td>12</td>
<td>17</td>
<td>4.7 (3.2–6.8)</td>
<td></td>
</tr>
</tbody>
</table>

* Number of smear-positive and smear-negative slides not recorded in 1998.

CTP = Caritas East Timor; NTP-TL = National Tuberculosis Programme of Timor Leste; CI = confidence interval.

### Table 3 TB cases notified by CTP (1997–1999) and NTP-TL (2000–2004)*

<table>
<thead>
<tr>
<th>Year</th>
<th>New (n (%))</th>
<th>Relapse (n (%))</th>
<th>Failure (n (%))</th>
<th>RAD (n (%))</th>
<th>Age &lt;15 years (n (%))</th>
<th>Age ≥15 years (n (%))</th>
<th>EPTB (n (%))</th>
<th>Total (n (%))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>381 (37.5)</td>
<td>7 (0.7)</td>
<td>10 (1.0)</td>
<td>21 (2.1)</td>
<td>110 (10.8)</td>
<td>348 (34.3)</td>
<td>139 (13.7)</td>
<td>1016</td>
</tr>
<tr>
<td>1998*</td>
<td>281 (34.4)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>816</td>
</tr>
<tr>
<td>1999</td>
<td>204 (55.7)</td>
<td>6 (1.6)</td>
<td>3 (0.8)</td>
<td>4 (1.1)</td>
<td>39 (10.7)</td>
<td>66 (18.0)</td>
<td>44 (12.0)</td>
<td>366</td>
</tr>
<tr>
<td>2000</td>
<td>1347 (31.4)</td>
<td>51 (1.2)</td>
<td>20 (0.5)</td>
<td>64 (1.5)</td>
<td>856 (19.9)</td>
<td>1364 (31.8)</td>
<td>589 (13.7)</td>
<td>4291</td>
</tr>
<tr>
<td>2001</td>
<td>1288 (35.1)</td>
<td>27 (0.7)</td>
<td>15 (0.4)</td>
<td>47 (1.3)</td>
<td>585 (15.9)</td>
<td>1007 (27.4)</td>
<td>700 (19.1)</td>
<td>3669</td>
</tr>
<tr>
<td>2002</td>
<td>1091 (39.5)</td>
<td>27 (1.0)</td>
<td>22 (0.8)</td>
<td>20 (0.7)</td>
<td>349 (12.6)</td>
<td>827 (29.9)</td>
<td>427 (15.5)</td>
<td>2763</td>
</tr>
<tr>
<td>2003</td>
<td>1026 (37.7)</td>
<td>20 (0.7)</td>
<td>8 (0.3)</td>
<td>18 (0.7)</td>
<td>431 (15.6)</td>
<td>1240 (44.9)</td>
<td>473 (17.1)</td>
<td>2763</td>
</tr>
<tr>
<td>2004</td>
<td>1000 (26.9)</td>
<td>18 (0.5)</td>
<td>9 (0.2)</td>
<td>13 (0.4)</td>
<td>403 (10.8)</td>
<td>1765 (47.4)</td>
<td>516 (13.9)</td>
<td>3724</td>
</tr>
</tbody>
</table>

* Data for other categories of TB patients for 1998 were missing due to the destruction of Caritas TB documents in 1999.

TB = tuberculosis; CTP = Caritas East Timor; NTP-TL = National Tuberculosis Programme of Timor Leste; RAD = return after default; EPTB = extra-pulmonary tuberculosis.
ability of TB drugs where other treatments were lacking. Training of health staff on diagnostic pathways in 2000 may have contributed to the increased proportion of smear-positive cases from 2001 to 2003. The reason for a lower proportion of smear-positive diagnoses from 2004 requires further evaluation. Despite the potential for overdiagnosis of TB, the high TB case notification also reflects the expansion of the programme throughout most of the country. It will require further attention from all stakeholders to advocate for resources to reach Timor Leste’s Millennium Development Goal targets. The fewer infections over the last 3 years under the NTP-TL might reflect decreasing TB transmission; however, it is unfortunately more likely to reflect diagnostic inaccuracies. The continuous reduction in retreatment cases probably reflects good treatment adherence and a low rate of drug resistance in this country, although the unusually low level of retreatment cases raises the question of under-reporting.

The success rate under the CTP was unacceptably low in the first year, but consistently increased every quarter up to early 1999. The success rate of 81% under the NTP-TL is close to the WHO global targets. The retrospective nature of the data collection may also have affected the analysis in the different time periods. Despite this, we believe that the data presented and the analysis we have undertaken are a fair reflection of the experience of the introduction of DOTS in conflict and post-conflict settings in East Timor.

CONCLUSION

The DOTS strategy was successfully introduced in East Timor during and after the cessation of conflict. In the East Timor context, the causes of the low proportion of smear-positive cases require further research so that interventions can be designed and evaluated. Research is needed to further examine the important elements for rapid and sustainable development of TB programmes in other conflict and post-conflict settings.

Acknowledgements

The Northern Territory Department of Health and Community Services (Australia), the WHO and AusAID are thanked for their assistance. N Martins is supported by the UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Disease. P Kelly is supported by the National Health and Medical Research Council (Australia). S Firestone prepared the maps.

References

CONTEXTE : Au cours des 10 dernières années, l’Est du Timor a subi d’importantes modifications politiques. La lutte antituberculeuse a progressé malgré un conflit chronique à faible tension, un conflit bref mais de haute intensité et la reconstruction après conflit.


SCHEMA : On a prélevé les données de toute une série de sources. Les indicateurs-clé du programme de tuberculose (TB) ont été analysés en les comparant aux objectifs de l’Organisation Mondial de la Santé (OMS) pour évaluer la performance des trois programmes de lutte antituberculeuse qui ont fonctionné au cours de la période d’étude.

RESULTATS : Avant 1999, un programme de lutte antituberculeuse non-gouvernemental a été mis en route dans plusieurs districts parallèlement au programme TB du gouvernement et a donné des résultats favorables. Ses composantes-clé ont été les fonds de donateurs externes, l’assistance technique et les stratégies locales de lutte antituberculeuse. En 1999, le conflit a entraîné une dés-intégration complète des deux programmes. En 2000, on a élaboré un programme national de lutte antituberculeuse à partir du programme non-gouvernemental en collaboration avec d’autres partenaires. Les déclarations de cas de TB à bacilloscopie positive ont atteint 108/100 000, soit les plus élevées de la région, et reflètent une large couverture de la population. Le taux de guérison de 81% est proche de la cible de l’OMS.

CONCLUSION : On a introduit un programme de lutte antituberculeuse de haute qualité dans l’Est du Timor attesté par les conflits. Des recherches complémentaires s’imposent pour examiner les approches du Timor afin de fournir des informations à d’autres contextes similaires.