

## **Integrated tuberculosis and HIV care in a resource-limited setting: experience from the Martin Preuss Centre, Malawi**

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# **Abstract**

## **Objectives**

The dual epidemics of tuberculosis (TB) and HIV have devastated communities in Southern Africa. There is increasing imperative for coordination between TB and HIV services but how best to accomplish this remains unclear. We describe the development and operation of integrated TB and HIV care at the Martin Preuss Centre in Lilongwe, Malawi.

## **Methods**

We used a case study approach to describe the integrated TB/HIV service and to illustrate successes and challenges faced by service providers. We quantified effective TB and HIV integration using indicators defined by the World Health Organization.

## **Results**

The Martin Preuss Centre is a multi-partner organization bringing together governmental and non-governmental providers of HIV and TB services. The custom-designed building facilitates patient flow and infection control, and other important elements include coordinated leadership; joint staff training and meetings; and data systems prompting coordinated care. Some integrated services have worked well from the outset, such as promoting HIV testing among TB patients (96% of TB patients had documented HIV status in 2009). Other aspects of integrated care have been more challenging, for example achieving high uptake of antiretroviral therapy among HIV-positive TB patients, and combining data from paper and electronic systems. Good TB treatment outcomes (>85% cure or completion) have been achieved amongst both HIV-positive and HIV-negative individuals.

## **Conclusions**

High-quality integrated services for TB and HIV care can be provided in a resource-limited setting. Lessons learned may be valuable for service providers in other settings of high HIV and TB prevalence.

## **Introduction**

Infection with human immunodeficiency virus (HIV) dramatically increases the risk of active tuberculosis (TB) (Dye & Williams 2010) and TB is the leading cause of death in HIV-infected individuals (WHO 2009). WHO guidelines recommend that antiretroviral therapy (ART) is started as soon as possible for all patients with HIV-associated TB (WHO 2010), underlining the imperative for effective coordination of TB and HIV services, but how best to accomplish this remains unclear (Legido-Quigley *et al.* 2010), (Theobald *et al.* 2009).

Malawi has a generalized HIV epidemic; 68% of TB cases have HIV infection (USAID 2009). Although the National TB control programme (NTP), and the National AIDS Commission collaborate closely at national policy level, the two programmes remain separate with their own directorates and funding streams.

We describe the development, delivery and outcomes of integrated TB/HIV care at a purpose-built clinic in Malawi, and report lessons learned.

## **Methods**

We used a case study approach, and the WHO framework of "building blocks" of a health system (WHO 2007), to describe integrated TB/HIV services in a clinic in Malawi and highlight the challenges faced by service providers in resource-limited settings. We quantified effective TB/HIV integration using WHO-defined indicators (WHO 2009). Short-term indicators of collaborative activities, defined as "outcomes", include the proportion of TB patients tested for HIV; longer-term, patient-relevant indicators are defined as "impacts" (e.g. the proportion of death as a TB treatment outcome).

## **Model of TB/HIV integrated care**

### **Evolution of the Martin Preuss Centre**

The evolution of integrated TB/HIV care at this centre is summarized in Table 1. In 2001 the Lighthouse Trust, a non-governmental organization, opened the first specialist HIV centre in

Malawi (Phiri *et al.* 2004). In December 2006, the Lighthouse, in partnership with Lilongwe District Health Office, opened the purpose-built Martin Preuss Centre (MPC), providing integrated TB/HIV care, co-located with largest TB registration centre in Malawi.

## **Service delivery**

### ***Package of integrated services and management***

MPC operates as a partnership between the Lighthouse, the District Health Office, the NTP and the HIV/AIDS department at the Ministry of Health.

The clinic comprises three units: the ART unit, the HIV testing unit and the TB unit, which has a sputum submission ("chronic cough") subunit. MPC operates without doctors; clinical officers (who train for three years to obtain a diploma in clinical medicine), nurses, health surveillance assistants (who have ten weeks training in public health) and administrative staff provide all services.

### ***Infrastructure and clinic flow***

#### *Building*

The clinic was purpose-built to facilitate infection control; measures include open-air waiting areas. The ART and HIV testing units are located around a central courtyard (**Figure 1**) whereas the sputum submission unit and TB unit are accessed using an exterior walkway, separating TB suspects and patients from HIV clinic attendees.

#### *Clinic flow*

From the front desk, patients are directed by colour-coded signs to the appropriate waiting-area for educational sessions (see **Figure 1**).

***TB suspects (chronic coughers):*** a health surveillance assistant enquires about symptoms, past medical history and reviews the patient-held "health passport" for documentation of HIV status. Patients with unconfirmed HIV status attend the HIV testing room within the TB unit for rapid testing and in-session results. Patients are instructed on how to submit sputum samples; they return for results after three days with a treatment "guardian", in case TB treatment needs to be commenced. Patients with negative sputum smears undergo chest radiography, and return the next day with the radiograph for review by a TB clinical officer.

**TB patients:** confirmed TB patients are registered and issued with a paper TB master-card [see Appendix 1] and TB identity card. The HIV testing team, in an adjacent room, provides rapid HIV testing to every TB patient before TB medication is dispensed. A TB clinical officer trained in ART provision reviews all HIV-positive TB patients; prescribes co-trimoxazole and TB treatment (dispensed from TB pharmacy) the same day; and instructs the patients to make an appointment for an ART education session within the week. Patients return with a guardian within 2-3 weeks to see a TB clinical officer to start ART. ART follow-up care is provided at the TB unit for the duration of the TB treatment. After TB treatment completion, patients on ART are transferred to the ART unit to continue on life-long ART.

**HIV testing clients:** following group then individual pre-test counseling, HIV rapid testing is performed anonymously, with data on sex, age and marital status only collected in a paper register. If a second test confirms reactive status, the patient is referred to the ART unit for registration, same-day clinical staging by an ART clinical officer, and blood sample for CD4 count (turnaround time 1-2 weeks).

**ART and pre-ART patients:** ART-eligible patients must bring a treatment "guardian" and attend an education session about ART and adherence before starting ART. Uncomplicated patients on ART are seen by a nurse at follow-up; ART clinical officers see all "complicated" patients, including children, patients with severe side effects and those on second-line ART and review ART and CPT eligibility among pre-ART patients.

The electronic data system includes prompts to ensure that ART and pre-ART patients are screened for TB at each visit; TB suspects (defined by national guidelines as those with cough [of any duration], fever, night sweats or weight loss) are referred to the "chronic cough" unit. The ART clinical officer provides TB and ART care within the ART unit if the patient is diagnosed with TB, thus maintaining continuity of care.

#### *Human resources*

TB unit staff are government employees whereas the ART and HIV testing unit staff are Lighthouse employees with public and private funding. The lead clinical officer/operational manager is employed by District Health Office with performance-based support from the Lighthouse. Training for all staff follows national recommendations, and there is *ad hoc* cross-cover by appropriately trained staff.

Staff from all units attend daily brief organizational meetings, which provide a platform for discussion of clinical, logistical or managerial issues.

## ***Information management***

### *Data systems*

Demographic data are entered into an electronic system and a bar code is placed in the health passport, held by most Malawians.

ART patient data, including blood results and medication, are captured directly into an electronic system. Each patient also has a paper ART master-card [Appendix 2], used if the patient transfers to another clinic. The pharmacy and 'chronic cough' unit are linked to the electronic data system; a printed sticker is placed on the paper ART master-card whenever medication is issued. A separate paper-based "chronic cough" register [Appendix 3] captures data on history, HIV status and sputum results. TB-related data are entered in a paper register and master-card, but the TB clinical officer can access ART data on the electronic data system.

### *Monitoring and evaluation of collaborative TB/HIV activities*

For patients who complete TB treatment at their local DOTS centre, TB master-cards are sent back to MPC on TB treatment completion or default, and treatment outcomes are updated in the central TB register. TB data from the paper register are retrospectively entered by Lighthouse staff into an offline electronic database and matched with ART data using patient identifiers such as name, date of birth and address. This process is time-intensive and error-prone, but essential for evaluation of outcomes of HIV-positive TB patients. Monitoring and evaluation of ART and pre-ART care is simplified by virtue of the real-time electronic data system.

## **Measures of effectiveness of integration of TB/HIV care**

Table 2 shows indicators of integration of TB/HIV care (WHO 2009) from 2007-2009. A high percentage of TB patients have HIV status recorded in the TB register (93% in 2007 and 2008, and 96% in 2009). The percentage of HIV-positive TB patients started or continued on ART during TB treatment has improved from 53% (501/946) in 2007 to 68% (775/1138)

in 2009. TB outcomes by HIV status are shown in Table 3; of note is the high proportion of patients achieving cure or treatment completion, and the low TB case fatality rates in HIV-positive TB patients (4% in 2007, 2008 and 2009).

## **Discussion**

Some integrated TB/HIV services at MPC have been successful from the outset, such as the high uptake of HIV testing of TB patients, whilst other interventions have required refinement to overcome barriers, summarised in Table 4.

## **Lessons learnt**

### ***Partnership between different agencies***

MPC is a marriage between two agencies with distinct organizational cultures; Lighthouse staff are highly motivated, whereas staff motivation can be a challenge in the public health sector. Disparities in style of team management and pay may accentuate this. Efforts to address this issue include appointment of an MPC Team Leader who provides a communication bridge between units, improving co-ordination. Regular joint training and feedback fosters a culture of continual service improvement, and the benefits to patients (such as ART for TB/HIV patients) are visible and motivating to staff.

### ***ART initiation in TB patients***

Although the proportion of HIV-positive TB patients initiating ART has increased since integration of TB/HIV care, it remains suboptimal. According to clinic protocol, HIV-positive TB patients are reviewed by a TB clinical officer; however, in practice, health surveillance assistants, who are not trained in ART provision, often see smear-positive HIV-positive TB patients, start TB treatment and refer onto the local DOTS centre, and occasionally omit to arrange follow-up for ART initiation.

Some HIV-positive TB patients decide to start ART at a clinic closer to home, but some peripheral ART clinics are reluctant to manage patients on concurrent TB treatment due to concerns including drug interactions and immune reconstitution syndrome. Lighthouse/MPC ART clinical officers currently provide specialist input at peripheral ART clinics to address this.

TB patients diagnosed with HIV in the TB unit receive ART from the ART pharmacy,

representing an infection control risk: ideally, ART should be dispensed by TB clinicians in their clinic rooms, and staff training is needed to overcome this barrier.

### ***Data management and monitoring and evaluation***

A key component of successful integration is the availability of integrated monitoring and evaluation tools. The revision of TB monitoring tools to capture HIV data was an important step in the evolutionary process. The current process to link the two systems is arduous and error-prone and raises concerns about data quality. Further technological advances are in progress in order to standardize data management across the centre and there are plans to pilot an electronic data system for coordinated ART and TB management.

Limitations of the case study approach include lack of a comparator, hence we cannot define unequivocally what service components are critical to success. MPC is relatively well-resourced, but not all the elements which we believe contribute to good outcomes are resource-related, e.g. leadership and facilitating communications. The purpose-built clinic facilitates infection control and this cannot immediately be replicated elsewhere, but some components could be introduced at low cost, such as open-air waiting areas.

In conclusion, integration of care for TB and HIV has been greatly facilitated by the establishment of this purpose-built centre. The physical design of the building facilitates patient flow and infection control; however, successful integration of care depends on much more than architecture. Bringing staff from the two programmes together with daily meetings and joint training, and strong leadership, with a culture of seeking continual improvements to care, seem equally important in the success of this facility.



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**Table 1. Evolution of integrated tuberculosis and HIV services at the Martin Preuss Centre**

<b>Timeline</b>	<b>Details</b>
2001	Founding of the Lighthouse Trust, a non-governmental organization, as the first specialist HIV centre at Kamuzu Central Hospital, Malawi
2002	Malawi National Tuberculosis Programme and National AIDS Commission develop 3 year plan for HIV/TB activities including provision of antiretroviral therapy (ART) and cotrimoxazole for all HIV-positive TB cases
2004	National ART scale-up plan implemented, based on principles of DOTS strategy and experience from Malawi's highly effective TB control programme
December 2006	<p>Martin Preuss Centre opened at Bwaila Hospital as a partnership between Lighthouse trust and Lilongwe District Health Office.</p> <p>All HIV-positive TB patients initiated on antiretroviral therapy regardless of CD4 count</p> <p>Routine provider-initiated screening for TB signs and symptoms of all HIV-positive patients at every antiretroviral therapy visit</p> <p>6-month rifampicin-based TB regimen: fixed dose combination as daily directly observed therapy for newly-diagnosed TB patients</p> <p>Co-trimoxazole preventive therapy provision immediately following HIV diagnosis in HIV-positive TB patients</p> <p>Opt-out provider-initiated HIV counseling and testing for TB patients</p>
April 2007	Piloting of revised national TB monitoring tools (master-cards and paper register) incorporating data on HIV diagnosis, antiretroviral therapy and co-trimoxazole preventive therapy.
January 2009	TB clinical officers trained to initiate and provide antiretroviral therapy integrated with TB treatment to all HIV-positive TB patients for the duration of TB treatment.
Feb 2009	Early antiretroviral therapy initiation (2 weeks after TB treatment initiation) for HIV-positive TB patients.
April 2009	Provider initiated opt-out HIV testing and counseling for TB suspects – “chronic coughers”
September 2010	Register for chronic coughers modified to include HIV testing and counseling results
October 2010	Development of electronic monitoring tools for coordinated HIV and TB management

**Table 2. Measures of effectiveness of TB and HIV care integration at the Martin Preuss Centre**

Calendar period of reporting*	Measure of effectiveness of integration								
	"Outcome" measure						"Impact" measure		
	% TB pts with HIV status recorded in register	% TB suspects with HIV result recorded in 'register**	% HIV+ pts on ART recorded as having TB screen at last visit	% HIV+ TB pts started/ continued on during TB treatment:			% HIV+ pts alive and retained in care after starting ART at:		
n/total (%)	n/total (%)	n/total (%)	ART	ART during first 2mths of TB treatment	CPT	6 months	1 year	2 years	
			n/total (%)	n/total (%)	n/total (%)	n/total (%)	n/total (%)	n/total (%)	n/total (%)
2007	3464/3720 (93)	-	-	501/946 (53)	-	-	1615/2010 (80)	1421/2010 (71)	1226/2010 (61)
2008	3983/4282 (93)	-	-	758/1289 (59)	221/1289 (17)	836/955 (88)	2142/2716 (79)	1951/2716 (72)	-
2009	3092/3231 (96)	2476/3983 (62)	2649/2851 (93)	775/1138 (68)	434/1138 (38)	1076/1138 (95)	2233/2851 (78)	-	-

\* Each calendar period starts from the 1<sup>st</sup> January to 31<sup>st</sup> December.

\*\* Reporting period starts from 1<sup>st</sup> April 2009

**Table 3. TB treatment outcomes by HIV status**

Calendar period of reporting	TB treatment outcomes by HIV status											
	HIV-positive cases						HIV-negative cases					
	n/total (%)						n/total (%)					
	Cure/complete	Died	Failure	Default	Transfer	Not known	Cured/complete	Died	Failure	Default	Transfer	Not known
2007	2013/2326 (87)	104/2326 (4)	5/2326 (0)	80/2326 (3)	81/2326 (3)	43/2326 (2)	947/1093 (86)	35/1093 (3)	4/1093 (0)	50/1093 (5)	38/1093 (3)	19/1093 (2)
2008	2220/2544 (87)	93/2544 (4)	5/2544 (0)	68/2544 (3)	44/2544 (2)	114/2544 (4)	1131/1305 (87)	36/1305 (3)	12/1305 (1)	34/1305 (3)	31/1305 (2)	61/1305 (5)
2009	1337/2005 (67)	88/2005 (4)	5/2005 (0)	38/2005 (2)	45/2005 (2)	492/2005 (25)*	733/1011 (73)	25/1011 (2)	3/1011 (0)	22/1011 (2)	22/1011 (2)	206/1011 (20)*

\* A significant proportion of TB treatment outcomes for 2009 are outstanding as master-cards have not yet to been returned by the peripheral health clinics

**Table 4. Principal issues concerning integration of care for TB and HIV**

WHO recommended collaborative TB/HIV activities <sup>15</sup>	Issues	Approach	Assessment
<b>Establish the mechanisms for collaboration</b>	Effective coordination of two separate programmes	<p><u>Management</u> Team leader jointly appointed by District Health Office with performance based support from the Lighthouse, chairs daily clinical meetings attended by team members from each unit; these serve as a platform to discuss any clinical, logistical or managerial issues</p> <p><u>Training for service providers</u> Standardized training in HIV testing, ART provision, TB monitoring tools and TB treatment for all clinical officers and nurses in both programmes</p>	Higher levels of motivation amongst Lighthouse staff
	Monitoring and evaluation (M&E) of collaborative TB/HIV activities	<p>National TB monitoring tools (paper register and master-card) revised to include information on HIV diagnosis, ART and CPT; adopted by NTP and scaled up nationally.</p> <p>Electronic data system in ART unit and TB unit to capture real time ART-related data has made process much simpler to perform</p> <p>Evaluation of outcomes of HIV+ TB pts requires error-prone process of retrospectively entering paper-based TB data into an offline electronic database</p>	<p>Electronic systems facilitate M&amp;E of ART and pre-ART care</p> <p>Laborious, and concerns about data quality when evaluating outcomes of HIV+ TB patients</p>
	Effective infection control to reduce risk of nosocomial TB transmission	<p>Architectural design of the building separates TB suspects/patients from the other patients</p> <p>Open air waiting areas with educational sessions promoting cough etiquette and cough hygiene</p> <p>Safe sputum collection as patients expectorate sputum at home and submit samples to the 'sputum submission unit' attached to the outside of the building</p>	Not formally assessed
<b>Decrease the burden of TB in people living with HIV/AIDS</b>	Maximizing TB case-finding in ART and pre-ART patients	Inbuilt prompts in the electronic data system during the consultation ensure that ART clinical officers and nurses perform a symptom screen at each visit for pre-ART and ART patients	High uptake of TB screening at each visit achieved following implementation of electronic data system
	Introduction of IPT	Not implemented as not part of national policy	-
<b>Decrease the burden of HIV in TB patients</b>	Maximizing HIV testing for TB patients	Patient flow within the TB unit incorporating HIV testing as an integral component of care prior to dispensing TB medication	High coverage of HIV testing among TB patients from the outset
	Maximizing CPT provision for HIV+ TB patients	<p>Training and regular clinical meetings ensure that TB clinical officers routinely prescribe CPT for all HIV+ TB pts</p> <p>Access to CPT enhanced by ease of availability of CPT from the TB pharmacy</p>	High uptake achieved from outset.
	Increasing the proportion of HIV+ TB patients started on ART	<p>Increased number TB clinical officers required to provide 'medicalised' ART care to HIV+ TB pts within the TB unit.</p> <p>Addressing patient negative perceptions about ART and TB co-treatment by the production of leaflet stating the benefits of treating both diseases</p>	Improvement seen over time but target of 75% HIV+ TB pts on ART during TB treatment yet to be achieved
	Maximizing HIV testing for 'TB suspects'	<p>TB suspects routinely recommended to go for HIV testing within TB unit</p> <p>Aim to provide more patient education sessions in the waiting area to increase awareness in service users about importance of HIV testing</p>	Uptake of HIV testing in TB suspects below target, probably because HIV testing not embedded within the care pathway.

Figure 1. Building plan of the Martin Preuss Centre

