



PERSPECTIVE

Enhanced laboratory capacity development: a boost for effective tuberculosis control in resource-limited settings



Abraham Sunday Alabi^{a,b,*}, Afsatou Ndama Traoré^{a,c}, Marguerite Massinga Loembe^{a,b,g}, Ulysse Ateba-Ngoa^{a,b}, Matthias Frank^b, Ayola Akim Adegnika^{a,b}, Bertrand Lell^{a,b}, Jocelyn Mahoumbou^d, Carsten Köhler^{b,e}, Peter Gottfried Kremsner^{a,b,e}, Martin Peter Grobusch^{a,b,e,f} on behalf of the CERMEL TB CapDev Group[§]

^a Centre des Recherches Médicales de Lambaréné (CERMEL), PB 118, Lambaréné, Gabon

^b Eberhard Karls Universität, Institut für Tropenmedizin, Tübingen, Germany

^c Microbiology Department, University of Venda, Thohoyandou, South Africa

^d Programme National de Lutte Contre la Tuberculose (PNLT), Ministry of Health, Libreville, Gabon

^e German Centre for Infection Research (DZIF), Partner Site Tübingen, Tübingen, Germany

^f Centre of Tropical Medicine and Travel Medicine, Department of Infectious Diseases, Amsterdam Medical Centre, University of Amsterdam, The Netherlands

^g Département de Bactériologie Virologie, Faculté de médecine, Université des Sciences de la Santé, Libreville, Gabon

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SUMMARY

Both routine and research tuberculosis (TB) laboratory capacity urgently need to be expanded in large parts of Sub-Saharan Africa. In 2009, the Centre de Recherches Médicales de Lambaréné (CERMEL) took a strategic decision to expand its activities by building TB laboratory capacity to address research questions and to improve routine diagnostic and treatment capacity. Over the past 7 years, a standard laboratory has been developed that is contributing significantly to TB diagnosis, treatment, and control in Gabon; training has also been provided for TB research staff in Central Africa. CERMEL has a cordial relationship with the Gabon National TB Control Programme (PNLT), which has culminated in a successful Global Fund joint application. This endeavour is considered a model for similar developments needed in areas of high TB prevalence and where TB control remains poor to date.

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1. Introduction

Despite the overall global progress in tuberculosis (TB) control over the past years, TB remains one of the deadliest communicable diseases. According to the World Health Organization (WHO),¹ there were an estimated 10.4 million new (incident) TB cases globally in 2015, amongst which 480 000 were new cases of multidrug-resistant TB (MDR-TB) and an additional 100 000 were rifampicin-resistant TB (RR-TB). During the same period, 1.8 million people died of TB, including 0.4 million who were HIV-infected.¹ The African region accounts for about one-fourth of the world's cases, and TB incidence is still increasing in many parts of Sub-Saharan Africa, fuelled in part by the HIV-AIDS pandemic. In addition, the emergence of MDR- and even extensively drug-resistant (XDR)-TB provides new challenges and further threatens the control of TB. Whilst there are regions in the world where the

* Corresponding author. Tel.: +241 07176021.

E-mail address: aalabi02@yahoo.co.uk (A.S. Alabi).

§ Davy Ulrich Kombila, Ronald Edoa, Francis T. Foguim, Bache Emmanuel Bache, Harry Kaba Mabala, Arnault Guy Mfoumbi, Chester Mevyann, Pacome Agbo Achimi, Susan Gould, Matthew McCall, and Selidgi Todagbe Agnandji (Centre des Recherches Médicales de Lambaréné (CERMEL), Lambaréné, Gabon); Ellen Bruske (Eberhard Karls Universität, Institut für Tropenmedizin, Tübingen, Germany); Saskia Janssen and Anne Lia Cremers (Centre of Tropical Medicine and Travel Medicine, Department of Infectious Diseases, Amsterdam Medical Centre, University of Amsterdam, The Netherlands); Sabine Bélar (Department of Paediatric Pneumology and Immunology, Charité-Universitätsmedizin Berlin, Berlin, Germany); Patrick Beckert and Stefan Niemann (Molecular and Experimental Mycobacteriology, Research Centre Borstel, Borstel, Germany, and German Centre for Infection Research, Partner Site Hamburg–Lübeck–Borstel, Germany); Sabine Rüsche-Gerdes and Katharina Kranzer (National Reference Centre for Mycobacteria, Forschungszentrum Borstel, Borstel, Germany).

extent of the problem has been assessed, at least over the past couple of years, other areas have remained by-and-large neglected, thus limiting the prospects for comprehensive advances in TB control, as laid out in the WHO End TB strategy,¹ if they remain inadequately addressed.

The laboratory plays a critical role in the diagnosis of TB and in the monitoring of treatment. According to the WHO, the effective diagnosis and treatment of TB saved an estimated 43 million lives between 2000 and 2014.² However, with the usual meagre resources available and in view of competing health needs in middle- and low-income countries, the laboratory is often neglected and remains very often the weakest link in TB control efforts. Therefore, there is an urgent need to strengthen laboratory services in such countries to ensure early and accurate diagnosis of TB and encourage early enrolment of patients into treatment programmes. To address this gap in the setting of Gabon, the Centre de Recherches Médicales de Lambaréné (CERMEL) in Lambaréné, instigated the establishment of a TB Laboratory in 2009 with very limited seed money. Based on this experience, it is postulated that investing in TB laboratory capacity development is a good choice with measurable and tangible yields over a short time span, allowing stepwise improvements and capacity building to meet local and regional needs. In this article, we share the challenges faced, progress made, and lessons learned in the belief that this model could be replicated in similar semi-rural settings across Africa.

2. The TB challenge

In Gabon, despite efforts made by the Government through the National TB Control Programme, 'Programme National de Lutte Contre la Tuberculose (PNLT)', TB remains a major public health challenge. The incidence of TB (including HIV + TB) is 465 per 100 000 population,³ placing Gabon amongst the highest-incidence countries for TB worldwide.¹ Access to the laboratory diagnosis of TB is limited, with microscopy (Ziehl–Neelsen) being the only option available in most hospitals and diagnostic centres across the country. As at 2009, culture and drug susceptibility testing (DST) was available only at the Military Hospital in Libreville (the capital city of Gabon). Hence case detection, treatment, and monitoring were sub-optimal, with this constituting a major impediment to the effectiveness of national TB control efforts.

CERMEL, formerly known as the Medical Research Unit (MRU) of the Albert Schweitzer Hospital, Lambaréné, Gabon, was established over 30 years ago in order to study major causes of disease burden in the local population.^{4,5} Over the years, it has grown to become a leading African Research Centre, specializing in the pathophysiology and treatment of infectious diseases prevalent in Central Africa. Malaria research has been the main focus of CERMEL since inception, and a series of studies on the epidemiology of malaria and the clinical development of novel antimalarial combination therapies and vaccine candidates has been performed; the results of these studies have been published in high impact scientific journals and they have led to changes in medical practice.^{6–8} CERMEL also has a track record of conducting highly successful clinical trials, with the most recently completed trials with a high clinical impact being (1) the RTS,S malaria vaccine trial (MAL 55),⁹ (2) the GM22 candidate malaria vaccine trial,¹⁰ and (3) the Malaria in Pregnancy Preventive Alternative Drugs (MiPPAD) study.¹¹ In recent years, CERMEL has also diversified its research portfolio to include other infectious diseases including TB and HIV and has maintained a strong partnership with the Institute of Tropical Medicine, University of Tübingen, in Germany.¹²

3. Strategies for overcoming the TB challenge

3.1. Laboratory infrastructure development

In view of limited resources precluding the construction of a new TB laboratory building, a large building space previously used as an archive was refurbished; this refurbishment took place between July 2009 and January 2010 (Figure 1a). The refurbished space was partitioned into four separate rooms, serving as the laboratory office, sample reception room, slide preparation room, and culture/DST room (Figure 1b). An additional external room adjacent to the laboratory was also acquired for use as a dedicated molecular mycobacteriology laboratory. Starting with basic microscopy, the capabilities of the laboratory were expanded to cover TB culture, DST, and molecular diagnostics. Timelines for the major deliverables in the laboratory development process are shown in Table 1. Right from the outset, the Government of Gabon, through the Ministry of Health (MoH), and the PNLT were engaged in the process. Regular joint meetings were held, culminating in the signing of an official partnership and collaboration agreement in 2014 between CERMEL and the MoH. With this partnership, it was possible to obtain necessary government approvals with minimal delay.

3.2. Staff training and competency

A standardized and systematic format of laboratory staff training both locally (on site) and internationally (abroad) was established. Local training consists of documented training in each of the analytical sample processes in the laboratory, namely TB microscopy, culture, DST, and the use of rapid molecular tests (Xpert MTB/RIF and line probe assays). Training is done in

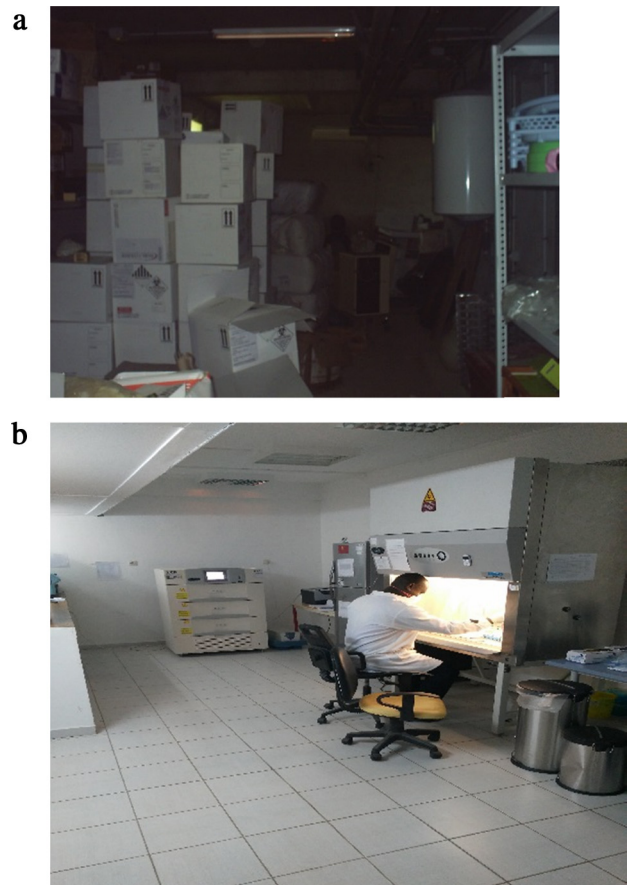


Figure 1. (a) The laboratory as an archive before being refurbished. (b) New look of the TB culture room after the refurbishment had been completed.

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