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Tuberculosis is Still a Major Challenge in Africa

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1. Introduction

Africa is constituted of 53 independent countries (taking both South and North Sudan as one), has a one billion population and provides home to about 11% of the world's population. The human population in Africa was projected to grow at the rate of 2.6% from the 770 million people in 2005 to 2 billion in 2050 (Shapley, 2008). It currently carries a huge burden of tuberculosis (TB), estimated at 30% of the total global number of cases in 2009, coming second only after Asia (50%). In the same vein, in 2009, approximately 41% (9/22) of the highest burdened countries (HBCs) with TB worldwide were found in Africa (WHO, 2010a). Similarly, the World Health Organization (WHO) in 2007 estimated that the average incidence of TB in African countries more than doubled between 1995 and 2005 (WHO, 2007).

Generally, the burden of TB in Africa is driven by a generalized HIV epidemic; and the African region accounted for approximately 80% of the estimated 11–13% of the TB deaths which were HIV-positive in 2009 (WHO, 2010a). This problem is compounded by the general weak health care systems, inadequate laboratories, and conditions that promote transmission of infection, resulting in the emergence of drug-resistant *Mycobacterium tuberculosis* strains (Chaisson and Martinson, 2008). Other compounding factors, apart from HIV, that have resulted in the increasing trend of TB in Africa are poverty, which is closely related to malnutrition, crowded living conditions, lack of access to free or affordable health care services, and dependence on traditional healers that can facilitate the transmission of tuberculosis (Parson *et al*., 2011). Occasional wars and civil disturbances worsen this situation and this is even complicated by droughts and regular natural disasters. Other self inflicted problems are poor government funding of health care services, occasioned by massive corruption and leading to diversion of meager local and foreign resources.

Despite these gloomy outlooks, some African countries have achieved commendable landmarks in reversing the frightening global trend of TB. For example, Kenya and the

United Republic of Tanzania were among the 13 countries listed from the HBCs that achieved treatment success rate target of 85% set by WHO for new sputum smear-positive cases of pulmonary TB (WHO, 2010a). Therefore, with concerted efforts and co-ordination within the African continent, greater achievements can be recorded to curtail the scourge of TB which has inflicted so much pain in Africans. Finally, intensified efforts to reduce deaths among HIV/+ TB co-infected cases are needed, especially in sub-Saharan Africa.

2. Surveillance system

The bane of TB diagnosis in Africa has been attributed to poorly coordinated national tuberculosis programs (NTPs), culminating in weak health systems. As a result of this, individuals co-infected with TB/HIV are made to steer through the complicated, harrowing and weak local health systems in order to get medical care. Many shuffle between health clinics for TB medications and district hospitals for antiretroviral drugs in a system where TB and HIV treatment and care are disjointed and therefore disintegrated. While services and drugs are generally free or highly subsidized, patients still complain about the cost of laboratory examinations, hospitalization, and transportation. This arises because patients still have to pay for several other services like X-ray and hospitalization which are really exorbitantly expensive and out of reach for some of the patients. Since most patients have to visit clinics far from their homes, the cost of transportation is often unbearable and the distress of travel further discourages them. Furthermore, TB control relies on passive case finding among individuals self-presenting to health care facilities, followed by either diagnosis based on clinical symptoms or laboratory diagnosis using insensitive sputum smear microscopy. Since repeated visits have to be made because presentations of serial sputum specimens are required (one taken on the spot and the second brought in the following morning), there are generally high default rates due to cost of visits and logistics. As a result of the bottlenecks encountered, patients are reluctant to visit these health facilities, therefore resulting in poor case finding and ability to achieve effective diagnosis and accurate treatment.

Health seeking behavior and non-adherence to therapy has been cited as a major barrier to the control of TB control globally (Gopi *et al*., 2007). There are reports from Nigeria and other developing countries that delay in TB diagnosis and treatment initiation is common (Salami and Oluboyo, 2002; Gopi *et al*., 2007; Odusanya and Babafemi, 2004), and this has been ascribed to negligence's from both the patients and doctors. Delay in diagnosis may aggravate the disease, augment the risk of death and enhance person to person transmission in the community (Odusanya and Babafemi, 2004). In Tanzania, 15% of patients were found to report to a health facility within 30 days of the onset of symptoms (Wandwalo and Morkve, 2000) while studies from Nigeria reported 81% (Enwuru et al., 2002) and 83% (Odusanya and Babafemi, 2004) patients delay for more than one month. Reasons for this are patients visiting local and poorly equipped private medical facilities, chemists, prayer houses and traditional healers; coupled with these, are poor knowledge and awareness about the disease among Africans in general (Odusanya and Babafemi, 2004; Enwuru *et al*., 2007; Okeibunor *et al*., 2007).

3. Infrastructural facilities and laboratory services

"Lack of new diagnostic tools and inadequate laboratory capacity hinders timely detection and management of drug resistance, with catastrophic consequences when dealing with

lethal forms of TB", says Bert Voetberg, a lead health specialist in the World Bank's Africa region. In most African countries, smear microscopy laboratories consist of single rooms and are understaffed. In addition, they generally possess poorly maintained microscopes, and some of these laboratories lack consistent sources of electricity and clean water (Parsons *et al*., 2011). Thus, the critical factor in TB control regarding early diagnosis and treatment that should limit the spread of the disease and reduce mortality is still an enormous problem in Africa. According to Chaisson and Martinson (2008), throughout Africa, the vast majority of the diagnosis of TB rests on the microscopic detection of acid-fast bacilli in sputum; an insensitive technique that is particularly ill suited for the detection of TB in HIV-infected patients, who have fewer bacilli in their sputum and more frequently suffer from extra-pulmonary TB than HIV negative patients. In patients with active pulmonary TB, only an estimated 45% of infections are detected by sputum microscopy when compared to culture (Dye *et al*., 2005). This test, first developed in the 1880s and basically unchanged today, has the advantage of being simple, but has very low sensitivity (especially among HIV-coinfected patients). It is also very dependent on the skills of the technician, and a single technician can only process a relatively small number of slides per day (Perkins *et al*., 2006). In addition, this method cannot differentiate between drug-sensitive and drug resistant TB, nontuberculous mycobacteria, and other Ziehl-Neelsen positive micro-organisms like Nocardia and Rhodococcus species. Due to these limitations, a staggering three million people who present annually with suspected TB may not be properly and timely diagnosed, because their infection (so-called smear-negative disease) cannot be detected by sputum microscopy (Onyebujoh *et al*., 2006). Moreover, a significant over and misdiagnosis is expected because a part of the ZN positives do not represent tuberculosis. Therefore, the timely introduction of the use of light-emitting diode (LED) fluorescence microscopes (FM) will go a long way in improving the shortcomings of the conventional smear diagnosis of TB (Cuevas *et al*., 2011; Hung *et al*., 2007). "The fact that LED microscopes are more affordable than conventional fluorescent microscopes, and can be powered by battery in some cases, makes fluorescent microscopy potentially more widely available, and this should result in a better diagnostic for TB," said lead author Dr. Andrew Whitelaw from the University of Cape Town based on a study carried out in South Africa. It is also believed that other high HIV and TB burden countries in Africa would benefit a lot from the LED microscopy.

Again, laboratories with the capacity to provide culture and (molecular) drug sensitivity test (DST) services are essential for the diagnosis of drug-resistant TB; culture services are also important for diagnosis of smear negative TB, especially in African countries where the prevalence of HIV is high. However, capacity to perform culture and DST is seriously limited in African countries (WHO, 2009). Since the standard of care for TB diagnosis recommended by WHO (2010a) is (i) sputum smear microscopy for all cases and (ii) expansion of the use of culture to diagnose all bacteriologically-positive (not just smear-positive) cases towards the ultimate goal of using culture (or equivalents such as molecular tests) in the diagnosis of all cases, it becomes obvious that most countries in Africa will never achieve this goal because of the serious deficits in both human and infrastructural capacities. This is apparent especially when the demands for a biosafety level 3 facility for culture of *M. tuberculosis* (MTB) is introduced which is out of reach in almost all settings. Currently, very few countries in Africa can effectively carry out culture to confirm cases of TB. As a result of limitation in *Mycobacterium* culture capability, barely 5% countries in Africa can independently carry out drug susceptibility testing for infected TB patients (Table 1). Consequently, accurate diagnosis for effective treatment of TB patients is heavily compromised.

Countries	Population (Million)	Burden of TB incidence (no. of cases /100,000 individuals/ yr)	% of TB patients that are HIV positive (%)	Mortality due to TB/100,000 population	Smear microscopy laboratories per 100,000 population	Culture labs per 5 million population	Drug susceptibility test (DST) labs/ 10 million population	Second line DST Available	Local TB Funding	National Reference TB Laboratory
Algeria	35	59	NA	2.4	0.7	3.7	0.9	In country	Poor	Yes
Angola	18	298	15	30	0.8	0.3	0.5	No	Fair	Yes
Benin	9	93	16	17	0.6	0.6	0.6	In country	Poor	Yes
Botswana	2	694	66	57	2.3	2.6	5.1	Outside	Poor	Yes
Burkina Faso	16	215	20	55	0.7	0	0	Outside	Poor	Yes
Burundi	8	348	46	77	2.0	0.6	0	No	Poor	Yes
Cameroon	20	182	40	17	NA	NA	NA	In and outside	Poor	Yes
Cape Verde	<1	148	20	27	3.2	0	0	Outside	Poor	Yes
Central African Republic	4	327	33	44	1.6	1.1	2.3	No	Very poor	Yes
Chad	11	283	-	63	0.5	0	0	No	Very poor	Yes
Comoros	<1	39	-	7.8	NA	NA	NA	No	Very poor	Yes
Congo,* Democratic Republic (DRC)	66	372	20	76	2.2	<0.1	0.2	No	Poor	Yes
Congo, Republic	4	382	48	43	0.7	0	0	Outside	Very poor	Yes
Cote d'Ivoire	21	399	30	85	0.5	0.2	0.5	No	Poor	Yes
Djiboutu	<1	620	10	77	1.9	5.8	0	Outside	Very poor	Yes
Egypt	83	19	0	1.1	0.3	1.1	0.1	In country	Fair/ Good	Yes
Equitorial Guinea	<1	117	17	5	4.3	0	0	No	Very Good	No
Eritrea	5	99	-	14	1.5	1.0	2.0	Outside	Poor	Yes
Ethiopia*	83	359	20	64	1.4	0.1	0.2	Outside	Good	Yes
Gabon	1	501	59	62	0.9	3.4	6.8	Outside	Poor	No
Gambia, The	2	269	16	48	1.9	2.9	5.9	No	Poor	Yes
Ghana	24	201	22	46	1.0	0.6	0.8	No	Fair	Yes
Guinea	10	3	24	72	0.5	0.5	1.0	In country	Poor	Yes
Guinea-Bissau	2	229	-	30	3.3	NA	NA	No	Poor	Yes
Kenya*	40	305	44	15	3.0	0.8	1.0	Outside	Poor	Yes
Lesotho	2	634	77	14 (9.5)	0.9	2.4	4.8	Outside	NA	No
Liberia	4	28	1	59	3.7	0	0	In country	Poor	No
Libya	6	40	15	4.1	0.4	2.3	3.1	No	Poor	Yes
Madagascar	20	261	-	57	1.3	0.3	0.5	In country	Poor	Yes
Malawi	15	304	64	25	1.3	0.7	0.7	Outside	Poor	Yes
Mali	13	324	16	88	0.6	0.8	1.5	Outside	Poor	Yes
Mauritania	3	330	12	90	2.2	1.5	3.0	No	Poor	Yes
Mauritius	1	22	6	<1	NA	NA	NA	Outside	NA	Yes
Morocco	32	92	NA	5.8	0.5	2.2	0.6	Outside	Poor	Yes
Mozambique*	23	409	66	38	1.9	0.2	0.4	Outside	Poor	Yes
Namibia	2	727	58	31	1.4	2.3	4.6	Outside country	Good	Yes

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Niger	15	181	12	41	0.3	0	0	Outside country	Very poor	No
Nigeria*	155	295	26	73	0.7	0.1	0.2	Outside country	Fair	Yes
Rwanda	10	376	34	76	1.9	0.5	1.0	No	Poor	Yes
Sao Tome & Principe	<1	98	13	19	1.2	0	0	No	Poor	Yes
Senegal	13	282	7	72	0.7	1.2	2.4	In country	Poor	Yes
Seychelles	<1	31	-	2.6	NA	NA	NA	In and outside	Poor	No
Sierra Leone	6	644	11	158	2.0	NA	NA	No	Very poor	Yes
Somalia	9	285	NA	58	0.6	0	0	Non	Very poor	No
South Africa*	50	971	58	45	0.5	1.6	3.2	In and outside country	Excellent	Yes
Sudan	42	119	4	24	0.9	0.1	0.2	Non	Poor	Yes
Swaziland	1	1257	13	64	NA	NA	NA	Outside country	Good	Yes
Tanzania*	44	183	37	9	1.6	0.1	0.2	Outside country	Poor	Yes
Togo	7	446	25	113	1.7	0.8	1.5	Non	Very poor	Yes
Tunisia	10	24	2	1.8	0.6	3.4	4.9	In country	Excellent	Yes
Uganda*	33	293	54	29	2.5	0.9	1.2	In country	Poor	Yes
Zambia	13	433	67	27	1.7	NA	2.3	Non	Poor	Yes
Zimbabwe*	13	742	78	82	1.0	0.4	0.8	Non	Poor	Yes

*African countries listed among the 22 high TB burdened nations in the world

Table 1. Showing the burden and challenges of TB in African countries

To respond to the urgent need for simple and rapid diagnostic tools at the point of treatment in HBCs, the Xpert MTB/RIF assay (GeneXpert, Cephied), a rapid molecular test for TB and rifampicin (RIF) resistance was recently developed. Though relatively new, this molecular assay has been described as one of the most promising in routine diagnosis in developing countries owing to its high sensitivity (98.2%), specificity (99.2%) and short turn-around time (2 hours) (Van Rie *et al*., 2010). With regards to the detection of RIF resistance, the assay was reported to be highly sensitive (≥97.6%) and specific (≥98.1%), with performance characteristics which are superior to drug susceptibility testing by conventional culture-based assays and line probe assays (Boehme *et al*., 2010). The rapid detection of MTB in sputum and RIF- resistance allows the physician to make critical patient management decisions regarding therapy during the same medical encounter. As conventional sputum smear microscopy has limited sensitivity and culture takes at least 4–6 weeks to produce result, the Xpert MTB/RIF assay seems a major improvement in African countries where proper facilities are scarce and rates of loss to follow-up are high. The additional advantage of the Xpert MTB/RIF assay is that when performed correctly, it is not associated with a measurable infection risk and results in a lower biohazard compared with conventional smear microscopy, making the assay suitable for

point-of-care (POC) use in the typical African setting where bio-containment facilities are not readily available (Banada *et al*., 2010).

4. Co-morbidities of TB and HIV/AIDS

Globally, an estimated 11-13% of the newly diagnosed TB patients are HIV positive and approximately 80% of these cases are in Africa (WHO, 2010a). The HIV infection is an established epidemiological factor causing additional challenges to the diagnosis of TB; hence, a major contributor to the increased incidence of TB across the world. Infection with HIV-1 increases the risk of reactivating latent TB infection by 80- to 100-fold, and HIV patients who acquire new TB infections also have higher rates of disease progression (Parson *et al*., 2011). Tuberculosis can occur at all points in the immunosuppressive spectrum of HIV disease, with variable presentations, and, particularly in African countries, where TB is always a major indicator of HIV. Multiple studies have shown that fatality rates are higher for HIV-TB-co-infected patients who are on anti-TB treatment but not antiretroviral therapy (16 to 35%) than for treated TB patients who are HIV negative (4 to 9%) (Mukardi *et al*., 2001). The study carried out by Ackah *et al*, (1995), in Abidjan, Coˆte d'Ivoire, indicated that the highest death rates occurred in co-infected patients with the lowest CD4 cell counts. This is the same picture in most areas in Africa where HIV is prevalent. Unfortunately, despite the scale up of TB treatment in South Africa, the epidemic of HIV in that country has grievously compromised TB care and control. This scenario has manifested in increased incidence of multidrug resistance TB (MDR-TB) and extensively drug-resistant TB (XDR-TB). The sequel of all these compounding scenarios is a situation in which TB and HIV synergistically potentiates each other in the affected patients leading to difficulties in the accurate diagnosis of TB and eventually in increased rate of mortalities in the region.

Notwithstanding the huge funds expended to fight AIDS, TB and Malaria by the Global Fund and PEPFAR in Africa, the bulk of these funds have been spent on AIDS, therefore leaving a huge deficit in the area of TB. Consequently, most attention in the past was diverted at building both human and infrastructural capacities for AIDS prevention; while that for TB was scarcely given the needed support. This has led to limited diagnostic capacity for TB despite the prompt diagnosis of HIV in some cases; hence, leading to most patients dying of TB. Therefore, the parlance "living with HIV, dying of TB" has become a recurrent decimal in most African countries where TB and HIV are endemic (Parson *et al*., 2011; Dorman and Chaisson, 2007; Gandhi *et al*., 2006).

5. Newer diagnostics

In the face of various diagnostic challenges of TB due to compounding factors like poverty, HIV/AIDS and lately, the MDR-TB and XDR-TB infections in some African countries like South Africa, an urgent need has arisen for newer technologies to facilitate prompt diagnosis of TB. Clinical management of TB in African countries is hampered by the lack of rapid, simple and effective diagnostic tests. Correct diagnosis of TB is needed to improve treatment, reduce transmission, and control development of drug resistance.

6. Public-private collaborations

The internationally recommended DOTS strategy has been successfully implemented in the public sector by many National Tuberculosis Programs (NTPs), but in the private sector the

quality of care is generally very poor (Uplekar and Rangan, 1993; Uplekar *et al*., 1998). Since the situation of the NTPs in Africa is far from perfect, the problem has been further complicated by the poor operation of the DOTS program in the expanding private sector that is supposed to be a major TB care provider. Resulting from the weak link between the public and private practitioners in terms of complementary activities, funding and operational researches, several TB programs that are of immense benefits to the patients are denied. This is particularly worrisome in the area of TB diagnosis were limited facilities are available for patient care. Because of the very weak interactions, only few private practitioners in the urban settings provide quality diagnostic services that can support patient care. Moreover, only few of these private care givers are accessible to foreign agencies that can support in the scale up TB diagnosis. The resultant effect of this is a huge gap in TB diagnosis and therefore increased burden of the disease especially among rural dwellers that rely mostly on traditional healers who are not normally integrated into healthcare systems by government establishments. Obviously, these practitioners usually do not work according to the national guidelines for the treatment of TB.

Since traditional practices are common place in Africa and majority of Africans still live in rural settings with low literacy rate, many patients patronize local herbalists and quacks who pretend to be physicians and health givers. Traditionally, since herbal centers are not as expensive as most government health clinics, they are the first point of call for patients. Here, local herbs and other ritual concoctions are given, which in some cases worsen the patients health and this could be on for several weeks to years. Sadly, some of these patients die and some infect their relatives before recourse to government clinics/hospitals when complications would have set in. However, recent findings in the area of ethno-medicine have shown that some of the herbal medications have promising anti-tuberculosis activities. A lot therefore needs to be done by government and private research agencies to look into these assertions and see how traditional health care providers can be integrated into supporting TB care in rural settings in Africa.

Both formal and informal private practitioners comprise the health sector, working on voluntary basis or for profit. The number of professional societies, private hospitals, corporate health providers as well as community and traditional healing homes is fast growing. Therefore, mechanisms for collaboration between the public and private health sectors should be established. In order to promote compliance with treatment guidelines, private care providers should be involved in their development, or checks on the adherence to treatment and cure should be organized by the public sector. They should also be empowered to facilitate training within the sector. Improved program coverage, patient access to diagnostic and treatment services, increased case detection and treatment outcomes, and improved overall quality of care are some of the potential benefits of involving private health providers in delivery of services (Uplekar and Shepards, 1991; Pathania *et al*., 1997). A model of successful public-private sector collaboration in TB control that is commendable in Africa is exemplified by the activities of the Damien Foundation, Belgium, a voluntary non-profit private TB support agency in Nigeria. This collaboration has over the years led to the achievement of about 85% TB active case finding and establishment of the first MDR-TB treatment Center in Nigeria. Though such other agencies abound in other African countries, however, more demonstrable milestones in terms of TB control coverage has to be set and seen to be achieved to justify the huge money said to be expended by these agencies in Africa.

7. Funding of TB control programs

With the gross domestic product (GDP) of the entire African continent valued at $2.2 million (World Bank, 2011) as against that of the US which is estimated at between $14.6-14.7 trillion (World Bank 2011; BEA, 2011), it is obvious that the continent will be unable to effectively finance and take care of its huge health burden. This is more obvious since the highest placed economy in Africa, Egypt is rated 25 globally with GDP of $467, 000 and the lowest country, Sao Tome and Principe rated 177 globally with GDP of $300. With the myriad of diseases, wars natural disasters and massive corruption in the continent, it will be difficult to fund TB care and especially the diagnostic component given the huge resources required both in human and infrastructural capacities. From the recently released WHO 2010 TB report, nearly all countries in the region relied on external funding and support for its DOTS program (WHO, 2010a). Consequently, TB program across the continent is poorly funded; with only about 5-15% barely in a situation to fund their program domestically (Table 1). Unfortunately, due to the recent global recession seriously having its unprecedented effects on the economy of western nations, the budgets of most donor agencies are grossly reduced, leaving great deficits and reduction in TB control support in Africa.

8. Political commitment

Most African countries are politically unstable and bereft of governments that can provide long term policies to sustain the health system. Given these political challenges, and problems of incessant wars, it is difficult to implement and sustain successful DOTS programs. Of particular reference is Somalia that has been deprived of stable government for almost two decades; therefore, it has no political commitment that will help facilitate any national TB control program. This is evident from the absence of a national TB reference laboratory and a non-existent platform (either local or foreign) to screen for drug resistant TB (WHO, 2010a). Unfortunately however, due to ignorance and lack of political will, some African countries fail to acknowledge the burden of MDR-TB despite the overwhelming evidence that points at this. Fortunately though, after so much foot dragging, some countries in Africa have finally set up mechanisms to carry out national MDR-TB surveys in collaboration with Global fund, Center for Disease Control (CDC) and WHO. One of such countries is Nigeria, and preliminary findings from the survey conducted indicate a high rate of MDR-TB (unpublished personal communication).

In other African countries with apparently stable governments, they are faced with self made problems like corruption, civil unrest that discourage full implementation of the TB control programs. Of particular importance again is the epidemic of HIV/AIDS which has incapacitated Africa, and leaving most governments with no option than to tackle the greater evil and leaving others like TB and Malaria for later days.

Despite the challenges African governments are responsible for; it is most unfortunate that most have only paid lips service to tackling the problem of TB. Sadly enough, they are only gored on by the carrot and stick approaches of the western nations and agencies before they made the little commitment seen so far. It is obvious that a larger role of the African Union (AU) is needed to tackle the challenges of TB. In this direction, there is a need for an AU Blue Print on the policy, mechanism, funding and achievable milestones within a practicable timeframe to reduce the burden of TB comparable to rates seen in Europe and other areas of the world with low burden of the disease.

9. Operational research

The fact that new technologies regarding TB diagnosis and control have been successful in western nations and regions of the world, does not necessarily translate to its success in Africa. In theory, biosafety level 3 laboratories are needed to conduct culture of MTB, however, so far such highly expensive and technically demanding facilities are very scarce in Africa. But also the recently developed molecular techniques that in principle do not need such expensive facilities are not as simple to implement in Africa as some assume. For example, despite the promise of the Xpert MTB/RIF assay in clinical trials, evidence has shown that knowledge to support the broader dissemination and implementation of those interventions (e.g., cost and financing of the intervention, provider training, availability of resources, monitoring the quality of intervention delivery) has limited the successful implementation of such innovations. Our previous experience has shown that substantial barriers have existed to limit prior attempts at implementing new technologies, such as the microscopic observation drug susceptibility assay (MODS) and the nitrate reductase assay (NRA). Accordingly, none of these techniques have been successfully integrated into the diagnostic algorithm for TB in Africa. Since no empirically-supported models exist to guide the dissemination and implementation of some of these technologies, sound operational feasibility projects are required before they are integrated into TB programs in Africa. Failure to carry out these assessments in the past, have lead to serious dire consequences in TB diagnosis despite huge resources that has been expended.

In order to make adequate use of promising pilot research findings, especially translational researches are required in African countries before new techniques are rolled out on a large scale. Of great importance here are translational researches bothering on the use of stool for prompt diagnosis of pediatric TB (Cadmus *et al*., 2009), adaptation of the front loading smear microscopy (Ramsay et al., 2009), and the use of light emitting diode (LED) microscopes (Cuevas *et al*., 2011) to mention a few. These translational researches are urgently needed giving the advantages they may offer in combating TB in the continent.

10. Role of international agencies

International agencies have played leading roles in the prevention and control of TB in most African countries in the past 50 years. Therefore, most diagnostic improvements experienced in Africa are driven by foreign donors and expertise. For example, the United States Government through its President's Emergency Plan for AIDS Relief (PEPFAR) spent about $307 million in 15 African countries between 2005 and 2008 for TB/HIV co-infected persons covering 367,000 patients (TTGHC, USA, 2009). Principally, the cost covered among other things routine TB screening in HIV infected people and improving laboratory surveillance systems in order to detect outbreaks of MDR- and XDR-TB. However, judging from the enormity of the burden of TB in the continent, it is obvious that the funds from the US and agencies from other western nations are not sufficient; hence, more needs to be done. This is particularly important in the areas of massive laboratory scale up and quality personnel that will operate the various laboratories since all these are grossly inadequate.

Currently, in Nigeria with the support of the PEPFAR program sponsored by the US government, the University of Maryland, through its Institute of Human Virology (IHV), center in Nigeria is supporting the Nigerian TB program in setting up a TB training school with a biosafety level 3 facility in northern Nigeria. The center has the capacity to carry out

LED fluorescence microscopy, culture and molecular techniques like the Hain assays as well as ancillary HIV diagnostic tests. Though similar sophisticated facilities abound in other African countries like Gambia, Mali, South Africa and Tanzania, they remain highly inadequate. Unfortunately, some of these facilities are merely for research and information gathering, rather than large scale use for TB control in such countries. However, since each program is handled by specific interest, there is limited coverage and sometimes no coordination even at the national level.

In other to facilitate effective TB care in African countries, there is a need for coalition of foreign donors to achieve optimal TB control platform for diagnosis and treatment. A step towards this direction is the formation of "The Tuberculosis Coalition for Technical Assistance (TBCTA). The coalition is guiding TB CARE I which is a USAID five year cooperative agreement (2010-2015) that has been awarded to TBCTA with KNCV Tuberculosis Foundation of the Netherlands as the lead partner. TBCTA is a unique coalition of the major international organizations in TB control. The coalition includes American Thoracic Society (ATS), FHI 360, International Union Against Tuberculosis and Lung Disease (The Union), Japan Anti-Tuberculosis Association (JATA), KNCV Tuberculosis Foundation, Management Sciences for Health (MSH), World Health Organization (WHO). The aim of TB CARE is to contribute to reaching the following specific USAID goals in the TB CARE countries (some African countries inclusive) with significant investment. It aims at (1) Sustaining or exceeding 84% case detection rate and 87% treatment success rate; (2). Treat successfully 2. 55 million new sputum-positive TB cases; (3). Diagnose and treat 57,200 new cases of multi-drug resistant (MDR) TB. Finally, TB CARE focuses on five priority areas that are needed for TB control in Africa namely: increasing political commitment for DOTS; strengthening and expanding DOTS Programs; increasing public and private sector partnerships; strengthening TB and HIV/AIDS collaboration; improving human and institutional capacity. With this anticipated initiative getting fully implemented in Africa, it is envisaged, that there will be a major turn-around in TB care through accurate diagnosis and treatment of patients.

11. Recommendations

To optimize TB control in the African continent, major changes are needed. The local political engagement needs to be enforced, not only to regulate the delicate relationship between the weak public Health care system and the expanding private sector, but also to stimulate international involvement in addressing the challenges faced. If more funding would be available, the implementation of new approaches in the diagnosis and treatment of TB should be considered a scientific discipline in itself; with serious considerations given to the integration of new methods and technologies before they are rolled out in Africa.

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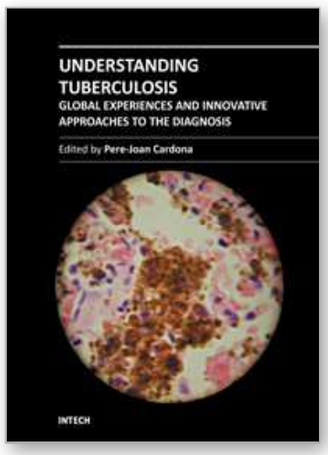

Understanding Tuberculosis - Global Experiences and Innovative Approaches to the Diagnosis

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Mycobacterium tuberculosis is a disease that is transmitted through aerosol. This is the reason why it is estimated that a third of humankind is already infected by Mycobacterium tuberculosis. The vast majority of the infected do not know about their status. Mycobacterium tuberculosis is a silent pathogen, causing no symptomatology at all during the infection. In addition, infected people cannot cause further infections. Unfortunately, an estimated 10 per cent of the infected population has the probability to develop the disease, making it very difficult to eradicate. Once in this stage, the bacilli can be transmitted to other persons and the development of clinical symptoms is very progressive. Therefore the diagnosis, especially the discrimination between infection and disease, is a real challenge. In this book, we present the experience of worldwide specialists on the diagnosis, along with its lights and shadows.

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