

Advances in Tuberculosis Disease and Infection Management in Africa.

Harriet Mayanja-Kizza discusses how tuberculosis management in Africa has undergone significant advances in recent years, with the introduction of new diagnostic technologies, better treatment regimens, improving patient support, and TB infection control strategies.

Overview

Tuberculosis (TB) is a bacterial infection caused by the *Mycobacterium tuberculosis* (MTB) organism that primarily affects the lungs, and has a high burden in Africa, where it is a major public health concern.

TB disease is spread through air when an infected person coughs, sneezes, or talks in close proximity to other persons. Although TB is treatable, untreated it can be deadly, especially in children below 5 years, as well as persons living with HIV/AIDS, the undernourished, and the elderly. Tuberculosis disease is higher among persons living in crowded spaces with limited ventilation, as well as those frequenting crowded alcohol-drinking places, especially when they do not have regular meals.

Tuberculosis infection is different from Tuberculosis Disease

Tuberculosis may present as an infection, where a person has the MTB organism in the body, but manages to contain it mainly to the lungs; and the infected person does not present with illness or disease. In fact, many people with a normal immune system can control this infection and remain free of tuberculosis disease all their lives.

In some persons with MTB infection, the bacteria in the body, may awaken, and start to multiply in the lungs especially when the body's immunity to infections goes down as is commonly seen in HIV/AIDS, more so with very low CD4 cell counts.

In some persons, like People Living with HIV/AIDS (PLWHA) and children, MTB bacteria may spread through the bloodstream to other organs like lymph node glands, abdomen, brain, heart, bones and spine, kidneys, and elsewhere. Here, it may cause disease in about 5-15 % of those with the infection, with higher rates mainly among PLWHA.

Tuberculosis burden in Africa

Tuberculosis is the ninth leading cause of death worldwide, with the majority of deaths occurring in Sub-Saharan Africa, especially in HIV/AIDS.¹ In the African region, in 2021 about 2.5 million persons were estimated

to be infected with MTB bacteria, accounting for 25% of the global TB infection burden.² The majority however have no TB disease.

In 2016, worldwide, 10.4 million people fell ill with TB disease. Of these, about 25% were in Africa with an estimated 2.5 million people. In the same year, an estimated 1.7 million died from TB worldwide, with about a quarter, 417,000 deaths in Africa.³ On the other hand, treatment has a major impact. Between 2000 and 2014, 10 million lives were saved in the African Region through TB diagnosis and adequate treatment of TB.¹

There are several reasons why the incidence of TB in Africa is high, including high HIV/AIDS rates, delayed diagnosis, lack of access to proper diagnosis, as well as treatment challenges, with many people in Africa unable to get adequate treatment in time. This is compounded by global limitation of improved tuberculosis diagnostics and treatment strategies.

On a positive side, there have been several advances in the management of TB in Africa in recent years mainly through international collaborative research activities.

Improved Tuberculosis Diagnostic Techniques

In most parts of Africa, TB disease is diagnosed using the sputum cough expectorant, which is processed in laboratories with special chemical stains, and slides looked at under a microscope. This however often needs 1-3 sputum cough samples, with at least one early morning. Also, the test is time-consuming for the laboratory technicians in order to make a clear diagnosis of TB disease.

In addition, a chest X ray is also often required, but many patients in sub-Saharan Africa (SSA) do not have access to X-ray services; and even when available, may be beyond the affordability of those with suspected TB disease cough.

An accurate diagnosis of TB is essential for effective treatment and control. In recent years, new diagnostic technologies have been introduced to improve the speed and accuracy of TB diagnosis, especially in Africa.

Among the new diagnostic tests, is the GeneXpert test, which diagnoses TB disease and the QuantiFERON-TB Gold (DFT Gold) for diagnosis of TB infection.⁴ These tests are more accurate and faster than older traditional tests and can be used in rural areas where there is limited access to health care. In fact, in many SSA countries the GeneXpert test has been introduced, mainly at district hospitals. This GeneXpert MTB/RIF assay, can detect both TB and drug-resistant TB often within two hours.⁵ A study

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conducted in Uganda found that the use of GeneXpert significantly increased TB case detection rates and reduced the time to treatment initiation.⁶ Another study in Ethiopia found that the use of GeneXpert resulted in a significant reduction in deaths among patients with HIV-associated TB.⁷

Another new useful test is the Urine “Determine TB LAM assay” which is quite effective in the diagnosis of TB disease in the body, especially in HIV/AIDS patients, with a result available within a few hours. This approach has been recommended by the World Health Organization and has been adopted in many African countries.

Current Tuberculosis Treatment Strategies

Over the last 20 to 30 years, the standard treatment for tuberculosis disease has been a combination of 4 types of drugs swallowed every day for 6 months in most lung TB patients, but longer with TB of other organs.

This standard treatment includes Rifampicin and Isoniazid tablets for 6 months, together with Ethambutol and Pyrazinamide tablets for the first 2 months. This drug combination in most cases cures the common lung form of tuberculosis among patients presenting for the first time, but this depends on patients swallowing the medications every day till they complete the 6 months as instructed.

One main concern among people on TB disease treatment is forgetting to swallow their pills, or stopping once they feel better, before the end of the 6 months. Not completing the treatment is a major and harmful practice, as it may lead to the tuberculosis worsening again, sometimes with failure to respond to the same drugs if re-started – what is called tuberculosis drug resistance. Some persons may develop this resistance to more, than one of the 4 types of drugs, and this is called Multiple Drug Resistance (MDR).

MDR TB is difficult to treat, requiring another combination of TB drugs, called “second-line drugs”, for up to two years, this time including daily injections for up to seven months.

In a study in Uganda, the prevalence of multidrug-resistant TB was estimated at 3.3% of all new Tb patients, and resistance to second-line drugs was also detected.⁸

Improved Tuberculosis treatment

Of recent, there has been significant research in Africa and internationally towards better TB drugs in particular highly effective and shorter duration of treatment.

New drugs developed for tuberculosis include Bedaquiline, Delamanid, Pretonamid and Rifabutin. These drugs combined with some of the older drugs have been shown through research in various countries to be more effective than older drugs; safe, able to be used for shorter periods, and can also be used to treat drug-resistant TB.

One such treatment is a 4-month regimen containing 2 newer drugs Rifampentine and Moxifloxacin, with two older drugs Isoniazid and Pyrazinamide for a total of 4 months, which has shown good results in TB disease.⁹ In fact, the WHO has updated its guidelines for the treatment of tuberculosis to include this shorter effective new Tb treatment for persons above 12 years of age.¹⁰

In addition, there are various medications that can be given to persons with MTB infection, before they get sick with TB disease. These include the older regimen of once every day isoniazid tablets swallowed for 6 to 9 months, but the long duration is a challenge for many persons.

New shorter treatments of MTB infection (before a person gets sick with TB disease) are now being investigated in different research studies. These include tablets or capsules of:

Drugs	Frequency	Total duration	Reference
Isoniazid plus Rifampentine	once a week	12 doses only	11
Rifampin alone	once a day	4 months	12
Isoniazid plus Rifampin	once a day	3 months	13
Rifampentine alone	Once a day	6 weeks	14

Improved Patient Support

Tuberculosis treatment requires good adherence to medication for at least 6 months. However, not all patients can sustain this adequately. Efforts to improve patient adherence and provide support during the 6 months of treatment, include involvement of the patient’s family and other relatives, or the local community healthcare workers such as nearby clinics, to help encourage and remind patients to take their medications and provide counseling and support.

With the advent of mobile phones, innovations such as the Mobile health strategy or “mHealth” technology which can have automatic text messaging to provide patients with information and reminders about their treatment has proved to be useful.¹¹ Another form of mHealth treatment compliance includes asking a patient to take a short video of themselves as they swallow their tablets every day, but this requires a smartphone – which are still limited in many parts of Africa. These patient-centered strategies have been found to be possible and effective in improving treatment adherence and outcomes in many African countries, in addition to reducing the burden on healthcare facilities alone.

In addition, since many patients with HIV/AIDS also have TB, the integration of TB and HIV management at one clinic visit for both illnesses has also been a major advancement in Africa, as it decreases the time patients need to attend the clinics for the two diseases. This approach has been adopted by the Sub-Saharan Africa national TB and HIV programs and has led to improved patient outcomes.

Improved TB Control Strategies

TB control strategies in Uganda and Africa have traditionally focused on looking for sick TB patients for treatment. However, new strategies have been developed that aim to proactively identify and treat TB cases in high-risk populations.

In Africa, a number of strategies have been implemented to reduce the spread of TB, including contact tracing and active case finding. Contact tracing means examining persons who live or closely work, or even share sleeping space as in dormitories with a person



Patients Receiving TB treatment. Courtesy of Emmanuel Ani

proven to have lung TB disease. This has been shown to be effective at reducing the spread of the disease. Also it is important to test PLWHA at clinic visits to look for early TB disease, for early treatment, and decrease infecting others in their households or workplaces.

To make a diagnosis of TB disease easier and quicker in the communities, research has indicated that a “Point of Care - POC” test can be possible in the near future. This would entail a drop of blood on a TB test strip, putting the strip in a machine, and getting a “positive or negative” result – similar to a diabetes mellitus blood strip test or even a pregnancy urine strip test.¹²

Once this technology reaches the market, it will be easier for governments to test many persons in a community for a quick and easy POC test to determine who may have TB diseases for further care at a health center

Tuberculosis Vaccine Research

Another advance is the development of new TB vaccines. The most promising vaccine is called “MVA85A”, and it is currently being tested in different countries in the world, with plans to have the research on this vaccine effectiveness also in various African countries in the next couple of years. An effective and safe TB vaccine would go a long way in the global control and eradication of TB disease.

Conclusion

In conclusion, TB remains a major global health concern, especially in Africa where it is one of the leading causes of death. Tuberculosis management in Africa has undergone significant advances in recent years, with the introduction of new diagnostic technologies, better treatment regimens, improving patient support, and TB infection control strategies. The integration of TB and HIV management has also been a major advancement toward decreasing TB disease and deaths among PLWHA in Africa.

Future more, shorter effective treatment regimens, use of community-based point-of-care diagnostics, and a potential effective safe vaccine will go a long way towards TB control, and eventually eradication globally. These advances would significantly improve TB outcomes and reduce the burden of TB on patients and health systems in many African countries.

However, significant challenges remain, including the need for increased funding, improved infrastructure, with greater awareness and education about TB among the general public and healthcare workers, and policy makers.

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