Multi-Drug Resistant Tuberculosis: A Comparative Case Study of Mozambique and South Africa

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Executive Summary:

Tuberculosis and multi-drug resistant tuberculosis are serious international health problems which are testing the abilities of nations and the world to respond and care for their citizens. Mozambique and South Africa are two such countries that drug resistant tuberculosis is forcing to face key challenges and problems in their response programs. Despite the fact that both nations are committed to DOTS and are being helped by international programs in their quest to combat TB they are still struggling with their response. Both nations have struggled with healthcare and responding to infectious disease over their troubled histories. Mozambique's history of violence has destroyed its public health capabilities but its commitment to fighting tuberculosis has helped it make some gains. South Africa still struggles with imbalances in its overwhelmed health system and MDR-TB has only added to its pile of daunting situations. Both nations need major changes in their response programs as well as coordination of services and resources. They both also suffer from funding issues, Mozambique in a basic lack of funds and South Africa in juggling its DOTS program versus its MDR-TB program. The TB programs in both countries also suffer from low laboratory capacity, although Mozambique is drastically less equipped than South Africa. Overall, Mozambique and South Africa have a long way to go to effectively respond to TB and MDR-TB and need to make major changes and investments in order to be successful.

Problem Statement:

Tuberculosis is a public health problem that has threatened populations for centuries. Currently about one third of the world's population has been exposed to TB and is therefore at risk for developing TB disease.[1] While treatment is available for TB it is complicated and time consuming making it difficult for many countries to rid themselves of TB. The emergence of extremely drug resistant (XDR-TB) and multi drug resistant tuberculosis (MDR-TB) have only confused prevention and treatment efforts further as they are harder to cure. Throughout the world international organizations such as the World Health Organization (WHO) and individual countries have been waging a war against drug resistant TB with limited success. One area where drug resistant TB has arisen is in Southern Africa, particularly in Mozambique and South Africa. Mozambique has been labeled by the WHO as the 17th country in the world with the highest burden of TB and struggles with basic levels of care.[2] In South Africa, ranked the 4th country with the highest TB burden, a major new challenge has arisen in the prevalence of drug resistant TB and the nation's ability to respond to it. Due to the fact that Mozambique has less cases of multi-drug resistant TB than South Africa despite the fact that it is a poorer country and has limited health services, my research question is: Why is Mozambique apparently doing better than South Africa, despite its much higher level of poverty?

Definition of Terms:

There are a number of terms used in the research question which need clarification in order to properly be addressed. These include the terms 'effectively' from

[1] Zeilinger, Michael, Tuberculosis" Course Lecture. American University, Washington, DC. 28 Jan 2009.

[2] United States Agency for International Development. Tuberculosis: Mozambique. Sept 2006. 8 Apr 2009. <http://www.usaid.gov/our_work/global_health/id/tuberculosis/countries/africa/mozambique_profile.html>.

my research question and also the definitions of 'multi-drug resistant tuberculosis' and 'extremely drug resistant tuberculosis.

The first is the term effectively. Within this research proposal the definition of the term "effectively," as adapted from the Oxford English Dictionary Online, is 'to produce the desired result.'[3] The 'result' in this definition will be an adequate treatment of all those found with drug resistant tuberculosis and a decrease in the number of new cases of drug resistant tuberculosis.

Multi drug resistant tuberculosis, or MDR-TB, is defined as a strain of tuberculosis 'resistant to at least isoniazid and rifampicin', the two major first line drugs for treating tuberculosis.[4] Extremely drug resistant tuberculosis, or XDR-TB, is defined as 'resistance to at least isoniazid, rifampicin, fluoroquinolones and either aminoglycosides (amikacin and kanamycin) or capremycin or both.[5]

Literature Review:

In the field of global health and infectious disease control there are many participants with their own processes and funding. Worldwide there are many organizations that attempt to combat drug resistant TB in their own programs and in assisting nations. The World Health Organization (WHO), which is a worldwide leader in TB control, sets guidelines for national TB programs and attempts to assist all nations. Additionally, each town, district, province and nation has its own priorities in terms of its

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[3] "Effect" Oxford English Dictionary Dec 2008. American University Library. 28 Jan 2009. <http://dictionary.oed.com.proxyau.wrlc.org/cgi/entry/50072301?query_type=word&queryword=effect&first=1&max_to_show=10&sort_type=alpha&result_place=1&search_id=I5Bd-lg14yR-2846&hilite=50072301>.

[4] Ghandi, Neel et al. "Extensively Drug Resistant Tuberculosis as a Cause of Death in Patients Co-Infected with Tuberculosis and HIV in a Rural Area of South Africa." The Lancet 26 Oct 2006: 1575. Academic Search Premier. EBSCO. American University Library. 31 Mar 2009. <http://web.ebscohost.com.proxyau.wrlc.org/ehost/pdf?vid=3&hid=106&sid=ce19c973-4bbd-418e-9520-6687e7016af4%40sessionmgr103>, 1575

[5] Ibid, pg #1576

needs in drug resistant TB control which may differ from each other. Overall, the literature and evaluations of all of these actors needs to be considered in a study of any government programs. Each level of participation is important in creating a program that works and meets the needs of all affected by drug resistant TB.

The World Health Organization on TB Control:

The World Health Organization is the world's premier leader in all health issues and in control of drug resistant TB. The WHO has formulated its own guidelines, individually assists nations on their TB programs and works in conjunction with other organizations to create partnerships to fight drug resistant TB. The most important facet of the WHO's work in TB is its prescription for Directly Observed Therapy Short-Course or DOTS. DOTS is a program of treatment with five essential components that the WHO recommends as the best method for combating TB and preventing drug resistant TB. The WHO has also overseen the creation of the Green Light Committee Initiative, an organization devoted completely to prevention and control of drug resistant TB. The Green Light Committee helps nations in creating successful control programs, assists in providing second line drugs and increasing technical capabilities.[6]

The first component of DOTS is the need for "political commitment with increased and sustained financing."[7] In the past many TB programs have been undermined as political will failed and funding was cut. Once a disease is under control authorities think that it has been properly dealt with and therefore does not need as much funding. However, cuts in funding for TB programs decreases a country's ability to

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[6] "What Is the Green Light Committee Initiative?" World Health Organization 2009. 3 Apr 2009. <http://www.who.int/tb/challenges/mdr/greenlightcommittee/faq1_initiative/en/index.html>.

[7] "Element One: Political Commitment With Increased and Sustained Financing." World Health Organization 2009. 4 Apr 2009. <http://www.who.int/tb/dots/whatisdots/en/index.html>.

prevent transmission and to treat those currently suffering from the disease. Therefore the WHO makes it a point that there must be commitment to programs and funding in order for TB control programs to succeed.

The second WHO guideline in DOTS is "case detection and quality assured bacteriology."[8] Many developing nations struggle to control TB and drug resistant TB because they do not have the laboratory capabilities to adequately diagnose the disease. There are many instances where people who do not have TB are improperly diagnosed with it and those with TB are not treated. Furthermore, testing for drug resistance can take weeks, using up precious time that could have been used for tracking and treatment of the disease. All of these difficulties have prompted the WHO to make laboratory capacity and the ability to properly diagnose TB a priority in TB control programs.

The third component of DOTS is "standardized treatment with supervision and patient support."[9] The rise of drug resistant strains of TB has been linked to treatment failures and poor health services.[10] Patients defaulting treatment only help to create stronger strains of the disease and put their lives in jeopardy. Education and support are needed for these patients so that they understand the impact of the disease and the consequences of ignoring it for themselves and their families. The WHO recommends that treatments be more readily available and not create hardships for patients by forcing them to take time away from work and their families.[11] Additionally, it is also recommended that treatment of patients should be supervised in order to assure that they

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[8] "Element Two: Case Detection Through Quality Assured Bacteriology." World Health Organization 2009. 4 Apr 2009. <http://www.who.int/tb/dots/whatisdots/en/index1.html>.

[9] "Element Three: Standardized Treatment With Supervision and Patient Support." World Health Organization 2009. 4 Apr 2009. <http://www.who.int/tb/dots/whatisdots/en/index2.html>.

[10] "The Management of Drug Resistant Tuberculosis in South Africa". PharmWeb Jun 2009. 6 Apr 2009. <http://www.pharmweb.net/pwmirror/library/tbres/drugres1.pdf>, 6

[11] "Element Three: Standardized Treatment With Supervision and Patient Support."

are taking their medications regularly.[12] All of these pieces of TB treatment greatly impact its success and the ability of health programs to control its spread.

The fourth section of the WHO DOTS program is an "effective drug supply and management system."[13] In order to properly treat TB or any disease the medication needs to be readily available. Programs need to ensure access to appropriate drugs for the entire course of a patient's therapy otherwise there is a risk of the patient developing drug resistance.[14] Additionally, the second line drugs that are essential to treating drug resistance are more expensive and harder to procure.[15] These second line drugs are essential to the treatment and control of drug resistant TB and are absolutely necessary to control programs. Therefore drug supply is extremely important and needs to be available if any program is to be successful.

The final component of a DOTS program is a "monitoring and evaluation system and impact measurement, recording and reporting."[16] To order to appropriately deal with any disease the health services must have a good idea about the scope and spread of it across a population.[17] Accurate reporting is the only way that correct levels of service and medications can be provided. In addition, communication between different levels of health services is also necessary to adequately assure services everywhere.[18] Finally, recording cases and trends is also important so that health services can follow up with

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[12] Ibid
[13] "Element Four: An Effective Drug Supply and Management System." World Health Organization 2009. 4 Apr 2009. <http://www.who.int/tb/dots/whatisdots/en/index3.html>.
[14] "The Management of Drug Resistant Tuberculosis in South Africa.", 9
[15] Ibid, 6
[16] "Element Five: Monitoring and Evaluation System, And Impact Measurement." World Health Organization 2009. 4 Apr 2009. <http://www.who.int/tb/dots/whatisdots/en/index4.html>.
[17] Ibid
[18] Ibid

issues and plan for future trends in the disease. All systems of evaluation and measurement are very important to the success of a TB control program.

Overall, all of these components are pieces of the WHO DOTS recommendations for dealing with TB. Used appropriately DOTS would help stem the creation of drug resistant TB but other standards are needed to address drug resistant strains in existence. As such, the WHO and other organizations have also come together in order to directly address drug resistant TB.

The Global MDR-TB and XDR-TB Response Plan:

The WHO in conjunction with the Stop TB partnership has put out guidelines specifically on the control of drug resistance and actions that need to be taken locally and internationally. Many of the objectives of the Global MDR-TB and XDR-TB Response Plan reinforce DOTS priorities and expand upon them.

A couple of the priorities of the Global Response Plan are exactly the same as DOTS prescriptions, reinforcing the importance of certain aspects of TB and MDR-TB control. The first shared recommendation of DOTS and the Global Response Plan is the need to facilitate access resources and drugs, especially second line drugs.[19] Second line drugs are emphasized because they are absolutely essential to treating drug resistant TB and improper use of them could lead to the creation of dangerous new strains.[20] The second factor advance in the two guidelines is the need for surveillance programs in order to past, current and future trends of the disease and needs for healthcare in response.[21]

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[19] "The Global MDR-TB and XDR-TB Response Plan." World Health Organization 2007. 7 Apr 2009. <http://www.stoptb.org/resource_center/assets/documents/MDR-XDR%20RESPONSE%20PLAN%20PRODUCTION%20FINAL.pdf>.

[20] Ibid

[21] Ibid

Finally, the Global Response Plans reaffirms the importance of laboratory capacity in addressing drug resistance and the need for nations to invest in it.[22]

In addition to confirming DOTS recommendations one of the major priorities the Global Response Plan sets forth is the need to enable health care providers through providing more training, technology and research.[23] The guidelines support increasing capabilities of health personnel and health centers.[24] It calls for the creation of new training modules and an increased number of trainings for health care providers.[25] The response plan also calls for the ability to treat an increased number of patients and increase the capacity of the health centers.[26] Finally, the Global Response Plan asserts the need for increased research and development of drugs and diagnostic tools.[27] With the rise of drug resistance the need for new drugs to treat TB becomes vastly important. In many cases XDR-TB is resistant to most of the available medications which is very dangerous. Additionally, the spread of drug resistant TB is aided by the inability of health care systems to quickly and correctly diagnose drug resistance.[28] New diagnostic tools could help in quick diagnoses and treatment of drug resistance, helping to stem the spread of the disease.

Finally, the Global Response plan also calls for better communications between all levels of care to better respond to needs everywhere.[29] This includes simple communication techniques between care providers at the local, provincial, national and international levels. It also includes the need for the international community to

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[22] Ibid
[23] Ibid
[24] Ibid
[25] Ibid
[26] Ibid
[27] Ibid
[28] Zeilinger, Michael.
[29] "The Global MDR-TB and XDR-TB Response Plan."

coordinate relationships between nations and organizations in order to better equip all combat drug resistant TB.[30] In communication the response plan also speaks of the need to define uniform responses locally and internationally to enable all care providers with appropriate responses.[31]

Overall, these guidelines from the Global Response Plan offer detailed advice and plans of action to nations and the international community to specifically fight drug resistant TB above and beyond DOTS.

Major Challenges to M/XDR Responses:

There are many major issues that beset countries in attempting to deal with drug resistant TB. These so called 'bottlenecks' are numerous and concern every aspect of TB care from treatment and drugs to technological capacity and more.

As DOTS and the Global Response Plan indicate there are some common bottlenecks for all programs. One of the first bottlenecks is a secure drug supply. Problems in the general drug supply are also issues because developing nations often do not have regular access of funds available to provide all drugs regularly, especially second line drugs which are expensive and more regulated.[32] As a result many developing nations struggle to obtain drugs and control them. A second bottleneck is insufficient political will or funding. In order for nations to have a successful response program they need to make TB a priority for their national health programs and their budgets.[33] Without either, nations will have no chance at leading successful anti- MDR-

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[30] Ibid
[31] Ibid
[32] Key Bottlenecks to Effective Prevention and Management of M/XDR-TB." World Health Organization 2009. 9 Apr 2009. <http://www.who.int/tb/challenges/mdr/bottlenecks/bottlenecks_executive_summary.pdf>.
[33] Ibid

TB programs. Finally, all of these factors are impacted by a nation's ability to forecast the future of drug resistance.[34] A lack of surveillance capacity handicaps a nation's ability to plan for response and allocated resources for TB.[35] All of these factors of a TB program are included in DOTS and the Global Response Plan and are some of the most challenging parts of TB response for a nation to provide.

Another bottleneck in combating drug resistance is problems in balancing the provision of care for victims of TB, drug resistant TB and HIV. In many instances gaps are found in the provision of care, where care isn't provided in the public or private sectors.[36] This is exacerbated by substandard care also dominates many of the healthcare systems and contributes to drug resistance.[37] Many gaps in TB care are due to healthcare workforces that do not have the skills or support to be able to address drug resistant TB appropriately.[38] Another problem in general provision of health services are found particularly in care for drug resistant strains.[39] Drug resistance needs specialized diagnosis, treatment and attention which are not often provided.[40] Finally, the last major challenge to TB control is the co-infection of HIV and drug resistant TB is very common in many developing countries.[41] Co-infection of TB and HIV is challenging and expensive to treat because both treatments are long terms and expensive.[42] Combining the TB and HIV programs to address both is an issue all nations need to address.

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[34] Ibid
[35] Ibid
[36] Ibid
[37] Ibid
[38] Ibid
[39] Ibid
[40] Ibid
[41] Ibid
[42] Andrews, Jason R. et al. "Multidrug-Resistant and Extensively Drug-Resistant Tuberculosis: Implications for HIV Epidemic and Antiretroviral Therapy Rollout." Journal of Infectious

Mozambique's Response:

In general response to Mozambique's TB program is mixed. There are many problems and criticisms but Mozambique's political commitments to the control of drug resistant TB have also been applauded. Due to political instability and civil war the country as a whole struggles, especially its health programs which are still lacking funding and infrastructure. Mozambique is frequently cited as having "inadequate coverage, access and quality of care."[43] In general lack of access to healthcare is one of the program's most common critiques as well as a "shortage of human resources".[44] Much of this is attributed to a lack of funding which is a huge limitation to what health services can provide. Major trials are also found in the areas of funding, infrastructure and drug supply which handicap Mozambique's response program as a whole.

First of all, Mozambique's system has seen some positives. Mozambique has been applauded for its good political will and commitment to the fight on TB.[45] Like many countries recovering from war Mozambique has a large number of problems and priorities but the government has chosen to make TB one of those priorities. On another front Mozambique's program for treating TB in urban environments, especially the capital Maputo where it began an ambulatory short course therapy treatment has been efficient.[46]

Diseases 2007: 482-. U Chicago Press. American University Library. 4 Apr 2009. http://www.journals.uchicago.edu, 487

[43] United States Agency for International Development. Tuberculosis: Mozambique.

[44] Ibid

[45] Cliff, Julie et al, 44

[46] Murray, C. J. L. and E. De Jonghe. "Cost-Effectiveness of Chemotherapy for Pulmonary Tuberculosis in Three Sub-Saharan African Countries." The Lancet 23 Nov 1991: 1305. Academic Search Premier. EBSCO. American University Library. 1 Mar 2009. <http://proxyau.wrlc.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=9112300666&site=ehost-live>.

On the other hand, there are many challenges for Mozambique's health system. Funding is one of those issues for Mozambique as a whole, not just in health care. Mozambique is a "highly indebted and very poor" country due to its debilitating civil war.[47] In health care Mozambique relies on foreign aid for its services, 70 percent of its TB expenditures are provided by outside donors.[48] While many grants for TB control have been promised to Mozambique, it has already has to be used appropriately to make a difference in TB.[49] In total the country's reliance on outside assistance for its program makes it more difficult to provide continuous funding for TB programs. Dependence on foreign assistance makes the program as a whole vulnerable to funding crises.

Other funding issues are found in the way that Mozambique supplies its health centers which allows for corruption and theft within the system. In general, clinics are supplied only by in-kind transfers making receiving supplies and medications inconsistent.[50] Clinics only receive money for salaries and therefore have very little ability to obtain appropriate supplies for their needs.[51] Furthermore there are large gaps in most accounting records, especially when it comes to non-salaried staff and the numbers of staff who have been paid by user fees.[52] This lack of information arouses suspicion of corruption and makes it difficult for the government and other agencies to trust local health centers with money and resources. Finally, another problem in funding

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[47] Cliff, Julie et al. "What's in a Name? Policy Transfer in Mozambique: DOTS for Tuberculosis and Syndromic Management for Sexually Transmitted Infections." Journal of Public Health Policy 2004: 38-. Health Module. Proquest. 2 Apr 2009. http://www.proquest.com>, 40

[48] Ibid, 42

[49] Ibid, 51

[50] Amin, Samia et al Eds. Are You Being Served: New Tools for Measuring Service Delivery. Washington, DC: The World Bank, 2008. Ebrary. 2008. American University Library. 10 Apr 2009. <http://site.ebrary.com.proxyau.wrlc.org/lib/americanuniv/docDetail.action?docID=10212639>, 179

[51] Ibid, 179

[52] Ibid, 180

involves user fees. User fees in Mozambique are highly subjective and inconsistently applied to patients making is hard for patients to plan for what they need as well as officials who need to determine how much money is coming in.[53] Irregular user fees indicate the plight of the local health centers and their desperate need for capital. Overall, funding and supplies are major roadblocks for Mozambique's health services and needs to be reformed.

Another challenge to Mozambique's TB program is drug supply. The country's health centers have little access to medications and those that are allotted to them are often stolen before they can reach the health center.[54] Corruption and theft exacerbate the resource dearth even more and hinder Mozambique's ability to provide standardized treatments locally and nationally.[55] Other than stealing, general problems in drug supply are bottlenecks in distribution and the fact that resources flows are not managed well.[56] The whole process is confusing because drugs are distributed differently based on whether they are in kits or packaged individually.[57] Drug kits are distributed based on a center's past volume while individual drugs are supplied based on requisitions.[58] It becomes even more complicated because these requisitions are controlled by different levels of administrators, at the provincial level and the district level who all have control over appropriations.[59] In general the supply and control of drugs in Mozambique is very complicated and hurting local centers' access to drugs and therefore their ability to adequately treat TB.

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[53] Ibid, 184
[54] Ibid, 48
[55] Ibid, 179
[56] Amin, Samia et al, 184
[57] Ibid, 180
[58] Ibid, 180
[59] Ibid, 180

Finally, in addition to funding Mozambique has a lot of general problems with its general infrastructure. The country's health centers suffer under a lack of equipment and low quality of technology where it is found.[60] Its testing capacity is considered 'non-existent" which hampers its ability to detect drug resistance.[61] There is a lot of concern that extremely drug resistant TB is much more prominent in Mozambique than is previously thought because it is undetected.[62] Even more disturbing, a large number of healthcare facilities in Mozambique do not have access to clean water.[63] There are also many criticisms of the lack of hygiene in health centers.[64] Both the lack of water and hygiene indicates how desperately ill-equipped local health centers are. All of these problems have led to low staff morale which is detrimental to the operations of a program at all levels.[65] Staff morale is very important and makes a huge impact on the quality of health services. In general Mozambique's problems in its health care system's capacity are large and negatively impact its most basic functions.

South Africa's Response:

Largely reports and analysis of South Africa's health care response to drug resistant TB has been very negative. There is a general agreement that South Africa's system desperately needs some form of intervention due to its high mortality rates. One author, Annelies Van Rie, describes the problems in South Africa as culminating around

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[60] Ibid, 179

[61] "Mozambique: Winning Small Victories Against HIV and TB." IRIN 30 Sept 2008. Reuters AlertNet. 10 Apr 2009. <http://www.alertnet.org/thenews/newsdesk/IRIN/c82b7397b55e8ba91a685747c7581357.htm>.

[62] Koenig, Robert. "Africa Wrestles With Extreme TB." Science Now 5 Sept 2006. American University Library. 20 Mar 2009. <http://sciencenow.sciencemag.org/cgi/content/full/2006/905/2>.

[63] Ayisi, Ruth Ansah. "Mozambique: Rural Health Centers Struggle to Obtain Water." Global Information Network 30 Aug 2007. Multicultural Module. ProQuest. American University Library. 1 Apr 2009. <http://www.proquest.com/>.

[64] Mozambique: Winning Small Victories Against HIV and TB."

[65] Cliff, Julie et al, 49

"negligent case management" and "poorly functioning health services."[66] Another, Jason Andrews, described the health care infrastructure as "overburdened."[67] Additionally, besides Russia, South Africa spends more money than any other country with a high TB burden and still has a low cure rate.[68] In addition, assessments of the health care infrastructure for combating drug resistant TB in South Africa are extremely negative despite the fact that South Africa's infrastructure is considered to be superior for a developing country.[69] All told the South African government and health care services have a lot to do in order to address drug resistant TB.

While South Africa adheres to DOTS and a policy to combat multi-drug resistance opinions about their successes vary. One study stated that DOTS policy alone will not be enough to combat drug resistance in South Africa.[70] It asserted that public health must address both types of transmission of drug resistant TB. The first way drug resistant TB occurs is through creation by improper administration to TB medications, which DOTS policy would prevent.[71] Another mode of transmission which is common in South Africa is exogenous transmission where drug resistant strains of TB are directly

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[66] Van Rie, Annelies and Donald Enarson. "XDR Tuberculosis: An Indicator of Public Health Negligence." The Lancet 26 Oct 2006: 1554-. Academic Search Premier. EBSCO. American University Library. 3 Apr 2009. <http://web.ebscohost.com.proxyau.wrlc.org/ehost/pdf?vid=5&hid=106&sid=ce19c973-4bbd-418e-9520-6687e7016af4%40sessionmgr103>, 1554

[67] Andrews, Jason R. et al. "Multidrug-Resistant and Extensively Drug-Resistant Tuberculosis: Implications for HIV Epidemic and Antiretroviral Therapy Rollout.", 483

[68] Smart, Theo. "South Africa's Lop-Sided TB Response: More Attention to Prevention of Drug Resistance Required." AIDSMap 31 Oct 2008. Nam. Feb 10 2009. <http://www.aidsmap.com/en/news/50160D62-B408-4EA3-93F3-C63A2C30E0E4.asp>.

[69] Andrews, Jason R. et al. "Multidrug-Resistant and Extensively Drug-Resistant Tuberculosis: Implications for HIV Epidemic and Antiretroviral Therapy Rollout.", 483

[70] Karim, Salim S. Abdool. "XDR- and MDR-TB in Rural South Africa Is Caused by Exogenous Reinfection." AIDS Clinical Care 27 Oct 2008. Journal Watch. 1 Apr 2009. <http://aids-clinical-care.jwatch.org/cgi/content/full/2008/1027/3>.

[71] Ibid

transferred from one person to another.[72] Karim contends that exogenous infection would not be prevented by DOTS programs and therefore response plans to combat drug resistant TB must go above and beyond DOTS requirements to truly stem the spread of drug resistance.[73] On the other hand, Theo Smart declares that South Africa is spending too much money of multi-drug resistant TB to the detriment of its DOTS program.[74] Despite this commitment to drug resistant TB, South Africa's program to combat drug resistance TB has been found lacking and has not received approval from the Green Light Committee.[75] In general, while South Africa is trying to abide by response programs there are differing opinions about its successes and much needs to be done to make its programs more effective.

Many of the problems cited in the South African TB response have to do with the health infrastructure and its abilities to deal with the TB crisis. One of the main concerns is that South Africa's surveillance system in limited by its laboratory capacity.[76] This is a little surprising because in comparison to other developing nations South Africa's laboratory capacity is advanced.[77] Despite its advancements the laboratory capacity has not reached the level the country needs to deal with all of its cases. Additionally, the surveillance system, to track TB and drug resistant TB, is also said to be limited by the country's general public health infrastructure.[78] It is believed that a number of cases of

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[72] Andrews, Jason et al. "Exogenous Re-Infection as a Cause of Multi-Drug Resistant and Extensively Drug Resistant Tuberculosis In Rural South Africa." Journal of Infectious Diseases 2008: 1582. U Chicago Press. American University Library. 4 Apr 2008. <http://www.journals.uchicago.edu>, 1582

[73] Karim, Salim S. Abdool

[74] Smart, Theo.

[75] Andrews, Jason R. et al. "Multidrug-Resistant and Extensively Drug-Resistant Tuberculosis: Implications for HIV Epidemic and Antiretroviral Therapy Rollout.", 487

[76] Ibid, 483

[77] Ibid, 483

[78] Ibid, 483

MDR-TB are both undiagnosed and untreated.[79] More specifically, the architecture of hospitals does not provide good ventilation increasing the risk for transmission of the disease within the hospital wards.[80] Taken as a whole, the public health infrastructure in South Africa needs to be improved to address drug resistant TB.

Other general problems in the program structure have to do with trends of treatment. A general complaint against the South African TB program is that few of its health centers triage patients.[81] There is very little tracking and the health centers simply treat whichever patients are in front of them, making it difficult to prioritize treatment and ensure the correct people are receiving treatment.[82] Additionally, while hospitalization is free many patients who would benefit from it do not go because they lose their welfare benefits while in there, benefits that generally go to supporting more than themselves.[83] Therefore the structure of welfare induces them to choose to forgo lifesaving treatment. In general, these program issues need to be addressed to appropriately deal with TB patients.

Locally, general issues of communication and education become major factors. A large issue South Africa has in its communications on the ground.[84] Community health workers need to have better communications between themselves and with health centers

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[79] Ibid, 482

[80] Singh, Jerome Amir et al. "XDR-TB in South Africa: No Time for Denial." PLoS Medicine 23 Jan 2007. 10 Feb 2009. <http://medicine.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.pmed.0040050&ct=1>.

[81] Ibid

[82] Ibid

[83] Ibid

[84] Suri, Arjun et al. "Voices From the Field: Perspectives from Community Health Workers on Health Care Delivery in Rural Kwazulu-Natal, South Africa." Journal of Infectious Diseases 2007: 505. U Chicago Press. American University Library. 2 Apr 2009. <http://www.journals.uchicago.edu>, 508

to better react to patient needs.[85] In addition, better communications are needed with the provincial authorities and hospitals to ensure appropriate access to resources and drug supply at all levels of care. For example, local and district hospitals often have to send their patients with drug resistance to larger hospitals that are farther away because they do not have the second line drugs for treatment.[86] This often hurts patients' chances for treatment because it is very difficult for them to have to travel often for medications. Finally, local issues also include a lack of education.[87] Without education of the population patients will not adhere to their programs or understand the importance of completing their drug regimen. Additionally, without education also fights stigmatization which further disenfranchises the population affected by TB. Education is needed at all levels of a health care system but it's very important locally so that the patients get the information they need to keep themselves alive.

Finally, a major issue impacting control of TB and particularly control of drug resistant TB is the co-occurrence of TB and HIV. The prevalence of HIV severely damaged hopes of TB control in the 1980s and today a co-infection of the two is considered a very dangerous combination.[88] The TB and HIV programs in South Africa developed separately from one another and therefore do not work well together.[89] One example of this is that a TB patient is given a standard drug regimen for TB regardless of their HIV status.[90] A program would need to adjust and be able to offer a regimen that has a better chance of curing a person who has HIV. If any country wants to deal

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[85] Ibid, 508
[86] Ghandi, Neel et al, 1576
[87] Suri, Arjun et al, 509
[88] Van Rie, Annelies and Donald Enarson, 1554
[89] Andrews, Jason R. et al. "Multidrug-Resistant and Extensively Drug-Resistant Tuberculosis: Implications for HIV Epidemic and Antiretroviral Therapy Rollout.", 485
[90] Ghandi, Neel et al, 1576

successfully with one of these diseases it will need to deal with both.[91] South Africa has invested significantly in its antiretroviral (ART) rollout program but it will be undermined if TB is not contended with as well.[92] The same exists for TB programs that do not deal with HIV. South Africa has a policy of testing all TB patients for HIV so that they can be treated for both.[93] This program is criticized because a lot of patients find it too stressful to be tested for HIV while being treated for TB and they fear the results.[94] In total, dealing with HIV is vastly important to TB control and it is something that South Africa does not coordinate well.

On the whole there are many different criticisms of South Africa's TB program. Problems from infrastructure, communications, to drug supply and beyond have been identified as challenges to South Africa's response to drug resistant TB. The country's success and failures in treatment will depend on its ability to correct these issues.

Background:

Rise of Drug Resistant TB:

Over the past few decades drug resistant TB has risen in incidence and in importance in the eyes of the global health community. Different forms of drug resistant TB were discovered in the 1980s and have spread widely since then.[95] Currently, there are 424,000 cases of MDR-TB worldwide per year which constitutes less than four

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[91] Andrews, Jason R. et al. "Multidrug-Resistant and Extensively Drug-Resistant Tuberculosis: Implications for HIV Epidemic and Antiretroviral Therapy Rollout.", 485

[92] Ibid, 485

[93] "Country Profiles: South Africa." World Health Organization 2009. 1 Apr 2009. <http://www.who.int/globalatlas/predefinedreports/tb/PDF_Files/zaf.pdf>.

[94] Suri, Arjun et al, 507

[95] Reichman, Lee B. and Janice Hopkins Tanne. Timebomb: The Global Epidemic of Multi-Drug Resistant Tuberculosis. New York: McGraw-Hill, 2002. Ebrary. 2005. American University Library. 10 Apr 2009. <http://site.ebrary.com.proxyau.wrlc.org/lib/americanuniv/docDetail.action?docID=10041399>, 49

percent of the global TB burden.[96] However, within this number 14 percent of the MDR-TB burden is said to be found in Africa.[97] These statistics are likely to be undervalued because of the lack of ability to diagnose MDR-TB in developing countries.[98] Extremely drug resistant TB has come onto the world scene in the beginning of the new millennium, has been deemed "virtually untreatable" and is considered a grave public health threat."[99] In the years since its discovery XDR-TB has been encountered in 45 different countries all over the globe[100] and has particular incidence in Russia and Asia.[101] It is also said that there are about 40,000 cases of XDR-TB found every year.[102]

TB has been marked by the world community as an important problem in the Millennium Development Goals. Goal six aims to combat the world's major infectious disease and specifically addresses TB in setting the aim to "halt and begin to reverse the incidence of TB by 2015."[103] This goal moves from the objectives of detecting and curing new cases of a majority of new cases in the earlier stages of the twenty-first century to eliminating TB as a public health threat by 2050.[104]

While TB has been effectively dealt with in a majority of the developed world, it is the developing world that is the target of the Millennium Development goal because it still struggles with in. Ninety-five percent of TB disease and ninety-eight percent of TB

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[96] Andrews, Jason R. et al. "Multidrug-Resistant and Extensively Drug-Resistant Tuberculosis: Implications for HIV Epidemic and Antiretroviral Therapy Rollout.", 482

[97] Ibid, 483

[98] Singh, Jerome Amir et al.

[99] "Emergence of XDR-TB." World Health Organization 5 Sept 2006. 8 Apr 2009. <http://www.who.int/mediacentre/news/notes/2006/np23/en/index.html>.

[100] Thom, Anso. "Africa: MDR TB on Rise Worldwide." Health-E 28 Feb 2008. allAfrica. 17 Feb 2009. <http://allafrica.com/stories/200802260804.html>.

[101] "Emergence of XDR-TB."

[102] Thom, Anso.

[103] "Tuberculosis." World Health Organization Mar 2007. 8 Apr 2009. <http://www.who.int/mediacentre/factsheets/fs104/en/>.

[104] Ibid

deaths occur in the developing world.[105] In general it has been proven that TB is a disease of poverty.[106] TB incidence increases in instances of income inequality, overcrowding, unemployment, malnutrition and alcohol and drug abuse.[107] All of these factors are present to varying degrees in many developing countries which continues to fuel the spread of the disease.

Drug resistance came into being because of many factors all relating to problems in treatment of the disease and is completely preventable.[108] Drug resistant is ultimately created by treatment failure which can be caused by many factors in a health program.[109] Cases leading to the creation of drug resistant strains are first found in failures of patient and case management.[110] These failures occur because of failures of health personnel in getting to know the patient and educating the patient.[111] Lack of involvement with the patient hurts patient adherence to treatment which is the most important facet TB control and preventing the creation of drug resistance.[112] Failures in case management also include problems involving frequent staff changes, poor staff morale and poor record keeping.[113] Additionally, another cause of drug resistance in found in problems in the management of the drug supply.[114] Developing nations often experience shortages in drug supply, handicapping abilities to treatment adherence.[115] Moreover, TB drugs are

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[105] Zeilinger, Michael.
[106] Harling, Guy et al. "The Social Epidemiology of Tuberculosis in South Africa." Social Science and Medicine 2008: 492-. Elsevier. Science Direct. American University Library. 18 Apr 2009. <http://www.sciencedirect.com>, 492
[107] Ibid, 498
[108] "The Management of Drug Resistant Tuberculosis in South Africa.", 6
[109] Ibid, 6
[110] Ibid, 6
[111] Ibid, 6
[112] Ibid, 6
[113] Ibid, 6
[114] Ibid, 9
[115] Ibid, 9

expensive so many turn to counterfeit drugs which are a problem because they usually aren't made correctly.[116] Finally, the last major factor in the creation of drug resistance strains is problems in drug prescription.[117] Oftentimes doctors under-prescribe medications allowing the TB strains to adapt without being completely killed.[118] Additionally, when drug resistance is found doctors will often add drugs to a regimen one at a time which is often not sufficient to kill the infection.[119] All of these problems contribute to the creation of drug resistance and need to be prevented in order to halt creation of these dangerous strains, especially with the growing incidence of XDR-TB. Other than the creations of drug resistance exogenous re-infection is becoming more frequent and constitutes a major threat in the spread of drug resistant TB.[120]

Mozambique:

As a nation Mozambique has had a very troubled history. Challenges presented themselves everywhere from the form of colonization that was imposed on Mozambique to liberation struggles and civil war. All of these factors have negatively impacted their abilities to develop in general and more particularly, to address health issues. In order to understand the context of the history and current status of Mozambique's fight against drug resistant TB their general history needs to be taken into account.

Mozambique was colonized by the Portuguese, whose form of colonialism was marked by oppression and exploitation.[121] The Portuguese used their colonies not to

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[116] Zeilinger, Michael. "Malaria" Course Lecture. American University, Washington, DC. 21 Jan 2009.
[117] Ibid, 6
[118] Ibid, 6
[119] Ibid, 6
[120] Andrews, Jason et al. "Exogenous Re-Infection as a Cause of Multi-Drug Resistant and Extensively Drug Resistant Tuberculosis In Rural South Africa.", 1582
[121] Mayer, Jean. "Development Problems and Prospects in Portuguese Speaking Africa." International Labor Review 1990: 459-. Health Module. Proquest. 4 Apr 2009. <http://www.proquest.com>, 459

settle in or to export from, as many nations did, but as bases for their international explorations.[122] As such they did not generally invest in infrastructure for their colonies at all because their own needs were limited. Even Mozambique, which was considered to be the "second most extensively colonized" of Portugal's colonies, received very little that could enable the nation or the local populations.[123] At the end of the Portuguese regime 80 percent of all government posts were held by the Portuguese and the colonizers also dominated the private sector leaving very few capable Mozambicans.[124] Even if the Portuguese were interested in development they would not have been able to accomplish much in the years leading up to independence because of the large liberation movement led by the Mozambique Liberation Front (FRELIMO).[125] Upon winning independence the Portuguese allowed FRELIMO to take control on the country after their departure.[126] However, there was no advanced preparation by any party for Portugal's withdrawal leaving Mozambique 'paralyzed.'[127] Mozambicans had very little education or experience that could have prepared them for running their own country.[128]

After independence Mozambique's government moved towards socialist governance and began to make wide reforms with the support of the Soviet Union.[129] These reform efforts were interrupted very quickly when civil war broke out. At this time both Rhodesia and South Africa were dealing with insurgencies that sought shelter

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[122] Ibid, 460
[123] Ibid, 463
[124] Ibid, 467
[125] "Mozambique Timeline." The Crawfurd Homepage. 7 Apr 2009. <http://crawfurd.dk/africa/mozambique_timeline.htm>.
[126] "Ibid
[127] Mayer, Jean, 463
[128] "Mozambique Timeline."
[129] Ibid

in Mozambique.[130] In response to this Rhodesia created the National Resistance Movement of Mozambique (RENAMO) to fight its own insurgents within Mozambique.[131] This movement soon gathered followers, came to oppose the FRELIMO government and gained South African support.[132] The violence that followed was highly destructive and resulted in massive amounts of death and displacement within Mozambique.[133] In the 1990s a cease fire was signed, multi-party politics were introduced in the country and Mozambican refugees flooded back into the country.[134] In recent years Mozambique has been relatively stable but extremely poor with two-thirds of its population in "absolute poverty."[135]

Mozambique's rocky and violent history has made a huge impact on its health care system and its response to drug resistant TB. While the country was challenged overall it did have some successes due to some good policy decisions Mozambique has made a commitment to addressing TB. Nevertheless, as a whole Mozambique is sorely challenged by health issues and its own capability to address them.

The exodus of the Portuguese in 1975 not only handicapped the government but also the health system. In the aftermath of their withdrawal only 80 doctors were left in the entire country and they had very little ability to run health services.[136] The FRELIMO government soon abolished private health care and nationalized all health services.[137] The new government ambitiously committed to a system of primary health care (PHC) as a standard which attempts to make "health care made universally

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[130] Ibid
[131] Ibid
[132] Ibid
[133] Mayer, Jean, 467
[134] "Mozambique Timeline."
[135] Mayer, Jean, 467
[136] Cliff, Julie et al, 41
[137] Ibid, 41

accessible to individuals and families in the community."[138] This system of PHC made healthcare free for individuals at the point of delivery.[139] The government also reformed its pharmaceutical policy and made access to generic drugs a priority.[140] In this post-independence period the healthcare system was also helped by arrival of 200 ex-patriot doctors from around the world.[141] The TB program in Mozambique had its own problems. At the time of independence the TB program was largely urban based, something that the Ministry of Health sought to remedy.[142]

In the 1980s the government health services also had to deal with the civil war which was severely impeding its capabilities. The violence in the 1980s destroyed many healthcare facilities and forced others to close.[143] At this time Mozambique's Ministry of Health was receiving a lot of international aid for its TB program and brought in Karel Styblo, an international TB expert, to redefine their TB plan.[144] Styblo recommended a demanding new program to combat TB called short course therapy.[145] Short course therapy required two months of directly observed treatment and committed to evaluation, notification and a guaranteed drug supply.[146] It was first applied in Maputo, the capital city, in 1984 and 1985.[147]

The next decade found even more problems from Mozambique. The influx of refugees strained resources and the United Nations tried to help by building health clinics as a part of its peace keeping mission but the government still faced a multitude of

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[138] Madeley, R, 322
[139] Ibid, 323
[140] Cliff, Julie et al, 41
[141] Ibid, 41
[142] Ibid, 42
[143] Mayer, Jean, 467
[144] Cliff, Julie et al, 43
[145] Ibid, 43
[146] Ibid, 43
[147] Ibid, 43

challenges.[148] Despite the fact that it was facing needs at all sides the government remained committed to its TB program.[149] The government's implementation of short course therapy was said to be "meticulously planned and managed."[150] The program also saw a twenty-five percent increase in treatment cure rates.[151] Short course therapy was made successful by local experimentation and had a strong level of commitment from local leaders that a new program doesn't often see.[152] This short course therapy later became a part of the DOTS program recommended by the WHO.[153]

Currently Mozambique has to confront a variety of issues with its TB program. TB incidence in the country is high, totaling around 440 new cases out of 100,000 per year.[154] In 2004 the country saw around 92,000 new TB cases.[155] DOTS therapy in Mozambique has a treatment success rate of 79 percent but a case detection rate of about 40 percent.[156] However, these statistics vary and the Tete province was reported as having a 38 percent rate of treatment successes.[157] The difference in percentages between treatment success and case detection indicates that while Mozambique is successfully treating the cases they encounter a vast majority of cases are not even detected. Additionally, drug resistant TB has found its way onto the scene with 3.5 percent of

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[148] Mozambique: After the Homecoming. " The Economist 5 Aug 1995: 42-. ABI/INFORM Global. ProQuest. American University Library. 2 Apr 2009 <http://www.proquest.com>.
[149] Cliff, Julie et al, 44
[150] Ibid, 47
[151] Murray, C. J. L. and E. De Jonghe.
[152] Gonzalez-Block, Miguel A. "What's in a Policy Context? " Journal of Public Health Policy 25.1 (2004): 56-. Health Module. ProQuest. American Uninversity Library. 1 Apr 2009. <http://www.proquest.com/>.
[153] Ibid
[154] "Country Profiles: Mozambique." World Health Organization 2009. 13 Apr 2009. <http://www.who.int/globalatlas/predefinedreports/tb/PDF_Files/moz.pdf>.
[155] United States Agency for International Development. Tuberculosis: Mozambique
[156] United States Agency for International Development. Tuberculosis: Mozambique
[157] "Mozambique's Tete Province Takes Steps to Combat TB, Drug Resistant TB."

Mozambique's new TB cases having drug resistance.[158] Furthermore, a comparison of estimates of the prevalence of drug resistance found that only 11 percent of MDR-TB is being detected and treated.[159] There have been relatively few cases of XDR but it is expected that those numbers are underestimated because of the lack of capacity to diagnose drug resistance.[160] Finally, co-infection of TB and HIV complicates the TB crisis in Mozambique even further with 47 percent of TB patients also infected with HIV.[161] However, t is estimated that only 29 percent of HIV co-infection is detected in the country. [162] Moreover, while 93 percent of co-infection cases are treated for TB only 33 percent are treated for HIV.[163]

Challenges to combating TB in Mozambique are numerous. One of the major problems is a very basic lack of resources in most health centers. A lot of health centers do not even have access to potable water, not to mention the technology needed to diagnose TB.[164] A general lack of hygiene also helps the spread of TB around the country.[165] Laboratory capacity in Mozambique is devastatingly low and it prevents the country from even being able to identify XDR within its population.[166] Additionally, health infrastructure needed to address TB is still centered in urban areas which restricts the nation's abilities to address TB throughout the country.[167] The government has

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[158] Ibid
[159] "Country Profiles: Mozambique."
[160] "Mozambique's Tete Province Takes Steps to Combat TB, Drug Resistant TB." Global Health Reporting 30 Sept. 2008. 17 Feb 2009. <http://www.globalhealthreporting.org/article.asp?DR_ID=54733>.
[161] "Country Profiles: Mozambique."
[162] Ibid
[163] Ibid
[164] Ayisi, Ruth Ansah.
[165] Mozambique: Winning Small Victories Against HIV and TB."
[166] Ibid
[167] Gonzales- Block, Miguel, 47

invested in expanding health infrastructure and staff but it may not be enough.[168] The health staff in general is over worked and demoralized, a situation that only gets worse as perceptions that the TB program is losing funding spread.[169]

Additional issues for Mozambique are funding, the distribution of resources and HIV co-infection. The country has a problem with funding for TB because it is so impoverished and its people have little money for health services.[170] Most of its budget comes from foreign donors making Mozambique dependent on aid.[171] Resources are a huge issue for Mozambique which sees a lot of issues in the distribution of resources. The nation's system for distributing drugs and other resources is complicated and uncoordinated leading to issues in drug provision.[172] A lot of corruption results and many drugs never make it to the health centers. [173] Mozambique nation does not have a good tracking system either which also contributes to corruption and lost supplies.[174] Finally, within Mozambique 30 percent of TB cases are co-infected with HIV, a situation that requires more effort by the government on both TB and HIV.[175] Overall, Mozambique faces a lot of serious problems in its TB program that it needs to address if the country hopes to get TB and drug resistant TB under control.

South Africa:

South Africa's divisive and discriminatory history has severely impacted its provisions for a large segment of its population. South Africa has always been a divided

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[168] Amin, Samia et al, 179
[169] Cliff, Julie et al, 49
[170] "Mozambique: After the Homecoming."
[171] Cliff, Julie et al, 42
[172] Amin, Samia et al, 185
[173] Ibid, 185
[174] Gonzales-Block, Miguel, 48
[175] United States Agency for International Development. Tuberculosis: Mozambique.

nation, with differing racial, ethnic and national identities fighting over control.[176] This contention began in the colonial period when the Dutch established a settlement on the coast of South Africa to provide for ships making the journey around the coast.[177] The Dutch very carefully tried to keep their settlers away from the interior of the country but they were not successful at this.[178] Many settlers expanded into the interior of South Africa trading, settling and fighting with the native populations.[179] Therefore there were already warring populations competing for prominence when the country came under British control in 1805.[180] The arrival of the British only added to this power struggle and British control was vehemently opposed by the Dutch Afrikaner population.[181] In 1910 South Africa was given self-governing powers under the auspices of the British with the white population completely in control.[182] In 1948 the Afrikaner population took over the government and began the apartheid regime.[183] Discriminatory apartheid politics began with petty apartheid segregating use of public spaces and relationships, including health services.[184] The government soon moved into grand apartheid which was a huge social engineering project moving mass populations and economically disenfranchising the black population.[185] Blacks were moved from white areas into "homelands" that often had nothing to do with the areas they came from.[186] They were also deprived of education, the ability to run businesses and soon even their

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[176] Craig, Daniel. "South Africa. " Course Lecture. American University, Washington, DC. 7 Apr 2009.
[177] Ibid
[178] Ibid
[179] Ibid
[180] Ibid
[181] Ibid
[182] The State Department. Background Note: South Africa Mar 2009. 7 Apr 2009. <http://www.state.gov/r/pa/ei/bgn/2898.htm>.
[183] Ibid
[184] Ibid
[185] Ibid
[186] Ibid

citizenship.[187] The apartheid regime soon turned the "homelands" they created into sovereign territories and revoked the South African citizenship of all people living in those areas.[188] All of these actions were meant to keep the black populations down.

This regime would not last long. The African National Congress (ANC), a strong local political party, kept up resistance and had the support of the people.[189] Protests became more and more common and the South African government responded violently.[190] As news of these massacres spread it incurred international condemnation and the world began to move against the apartheid regime.[191] The world's embargo weakened the South African government and soon the Afrikaners and the world began discussions with the ANC on how apartheid would end.[192] In the late 1980s and early 1990s the South African President F.W. de Klerk began discussions with ANC leader Nelson Mandela and the two leaders oversaw the dismantling of apartheid until Mandela was elected President.[193] As a President Mandela focused on reconciliation and reform attempting to move South Africa past accusatory politics and reintroduce the country to the world market.[194] All of these reforms have given South Africa unprecedented progress but the state still faced a multitude of challenges, disease being one of them.

The history of South Africa's healthcare is very similar in its discriminatory politics. Colonial healthcare under the Dutch and British was practically non-existent.[195] The colonizers cared for their own populations and ignored the plights of the native

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[187] Ibid
[188] Craig, Daniel
[189] Ibid
[190] Ibid
[191] Ibid
[192] Ibid
[193] Ibid
[194] Ibid
[195] Foster, Kira E. "Clinics, Comnunity and Cost Recovery: Primary Health Care and Neoliberalism in Post-Apartheid South Africa." Cultural Dynamics 17.3 (2005): 244

people leaving "stark inequalities" in care.[196] Healthcare would only be provided to locals when their health problems became big enough to threaten the white population.[197] Healthcare for the non-white population continued to be decentralized and grew in a haphazard manner.[198] In the 20th Century a population movement toward urban areas created health crises that forced the white government to provide some services to native populations.[199] In particular the government felt a lot of pressure from miners whose workers were incapacitated by TB.[200] In the 1940s the government's responses mostly took the form providing basic health services and experimental programs.[201] National health centers were created to provide primary care but hospitals remained solely provincial.[202] Later during apartheid all health centers were segregated into three different distinct departments for whites, coloureds and blacks in their respective areas.[203] The different departments were completely separate and unequal with little to no communications between them.[204] When the "homelands" were created the responsibility for healthcare was passed to local leadership.[205]

These discriminatory policies continued until the end of apartheid in the 1990s. In 1992 segregation ended in health centers and the three separate departments were merged into one.[206] When Mandela assumed the Presidency he made huge steps in healthcare making policies to provide free care for pregnant women and children under

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[196] Ibid, 244
[197] Ibid, 245
[198] Ibid, 244
[199] Ibid, 244
[200] Ibid, 244
[201] Ibid, 244
[202] Ibid, 244
[203] Ibid, 245
[204] Ibid, 245
[205] Ibid, 245
[206] Ibid, 245

six.[207] However, these reforms were not prepared for and severely overwhelmed South Africa's healthcare system and hurt staff morale.[208] This became an even bigger problem in 1996 when free care was extended to all of the uninsured.[209] In the late 1990s all of these efforts were made to expand access to primary care and moves were also made to improve health infrastructure.[210] A step in TB control also came in 1996 with South Africa's adoption of DOTS protocol.[211]

Currently South Africa is struggling to fight a major rise in TB. In 1998 the country had 338 cases per 100,000 and in 2008 there were expected to be 940 cases, representing a sharp increase over the past decade.[212] The South African government is still committed to DOTS and all districts have DOTS programs.[213] DOTS case detection rates are at 78% and treatment success rates are at 74%.[214] Despite the fact that South Africa has decent treatment success rates, coverage within districts is spotty.[215] Finally, HIV co-infection rates with TB in South Africa are very high representing 73 percent of all TB cases.[216] It is also estimated that HIV detection in TB patients is low, at 26 percent.[217] Furthermore, while treatment of TB in co-infection patients is at 67 percent, HIV treatment is only at 35 percent.[218] These indicators show that HIV co-infection with TB is a major issue for South Africa and one that is not being addressed.

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[207] Ibid, 245
[208] Ibid, 246
[209] Ibid, 246
[210] Ibid, 250
[211] United States Agency for International Development. Tuberculosis: South Africa.
[212] United States Agency for International Development. Tuberculosis: South Africa
[213] Ibid
[214] "Country Profiles: South Africa."
[215] United States Agency for International Development. Tuberculosis: South Africa
[216] "Country Profiles: South Africa."
[217] Ibid
[218] Ibid

Incidences of MDR are rising and currently represent 1.8 percent of new cases.[219] Another indicator of the spread of drug resistance in South Africa is the fact that XDR has been detected in all nine provinces.[220] Drug resistant TB came to the limelight in South Africa with a study done in a city called Tugela Ferry of the KwaZulu-Natal province. In this study of 544 patients 221 were found to have MDR and 53 had XDR.[221] Many of the patients who had XDR in KwaZulu Natal were never previously treated for TB, indicating that is was spreading from person to person.[222] This suggests that DOTS alone will not be enough for South Africa because it does not ward against spread through exogenous re-infection.[223] On the other hand it has also been suggested that South Africa is spending too much money on controlling drug resistance (up to seventy percent of its TB budget!) and not committing enough to its DOTS programs.[224]

The South African government has been made some strides forward in addressing TB. First they have invested in research on new tools for rapid diagnostics which would drastically improve their ability to detect drug resistance in patients.[225] The government has also supplied in training, sending personnel to Latvia to learn about response programs.[226] They have also committed to detection and tracing programs, training 3000 health personnel to work on defaulter tracing teams.[227] The South African Medical Association (SAMA) has set up an online training system to train doctors in dealing with

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[219] United States Agency for International Development. Tuberculosis: South Africa
[220] "FIND, the SAMRC and NHLS seal MOU to begin trial of two new tests for MDR-TB in South Africa."
[221] "Emergence of XDR-TB."
[222] Karim, Salim S. Adbool
[223] Ibid
[224] Smart, Theo.
[225] "FIND, the SAMRC and NHLS seal MOU to begin trial of two new tests for MDR-TB in South Africa."
[226] Flanagan, Lousie. "Experts Say MDR-TB Needs More Pro-Active Response." South African Press Association 6 Mar 2007. 17 Feb 2009. <http://www.aegis.org/news/sapa/2007/SA070301.html>.
[227] Smart, Theo.

TB which had already trained 2554 doctors by 2003.[228] Going forward the government has sought to rethink its response to XDR and one of the things that it is considering is quarantining patients.[229]

South Africa faces a number of challenges to its program. One major complication in treating TB is co-infection with HIV; around 70 percent of South Africa's TB cases are also infected with HIV.[230] Health programs need to deal with both TB and HIV in order to effectively treat patients but the programs in South Africa developed separately and therefore do not adequately deal with each other.[231] One of the good things that South Africa does to is provide voluntary counseling and testing (VCT) for HIV to all of its TB patients which is a first step towards combining treatments.[232] Another huge issue for South Africa's TB program in stigma, because HIV and TB are found together people are ashamed to admit they have TB, fearing that they have or will be accused of having HIV.[233]

Another area that presents challenges to South Africa is institutional policies. One of these policies states that patients should not be treated for drug resistance unless they've failed treatment once before.[234] That policy is dangerous because many patients

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[228] Flanagan, Lousie.

[229] VOA News: XDR-TB Causes South Africa To Review AIDS Policy." US Fed News Service, Including US State News 16 Feb 2007. General Interest Module. ProQuest. American University Library. 1 Apr 2009. <http://www.proquest.com/>.

[230] "Country Profiles: South Africa."

[231] Andrews, Jason R. et al. "Multidrug-Resistant and Extensively Drug-Resistant Tuberculosis: Implications for HIV Epidemic and Antiretroviral Therapy Rollout."

[232] Daftary, A. et al. "HIV Testing and Disclosure: A Qualitative Analysis of TB Patients in South Africa." AIDS Care Apr 2007: 572-. Academic Search Premier. EBSCO. American University Library. 5 Apr 2009. <http://web.ebscohost.com.proxyau.wrlc.org/ehost/pdf?vid=4&hid=106&sid=ce19c973-4bbd-418e-9520-6687e7016af4%40sessionmgr103>, 572

[233] Suri, Arjun et al, 509

[234] Singh, Jerome Amir et al.

are being seen with acquired resistance that does not result from previous treatment.[235] An additional treatment problem is that patients are given a standard regime despite their HIV status.[236] This creates problems because HIV positive patients often need a more rigorous treatment regime.[237] Another policy issue is that most health centers have no triage.[238] Instead of prioritizing patients centers treat only those people in front of them, often treating people incorrectly or not all.[239] Furthermore, policies about treatment and where certain treatments are available have a huge impact on patients' ability to receive treatment. Most TB treatment is home based care but treatment for drug resistance is only found in hospitals.[240] Many people don't have the ability to get to the hospital or stay there for long period of time. Additionally, people with welfare are even less able to go to a hospital because once admitted they lose their other welfare, welfare that their families depend on as well.[241] A lack of education about TB is the final policy problem, which leads to defaulting on treatment and other problems in patient cooperation.[242] This is one of the main causes of treatment defaults and therefore contributes to the creation of drug resistance.

A major problem for South Africa is lack of health infrastructure. Limited laboratory capacity hurts their ability to diagnose drug resistance and therefore limits their ability to react to the crisis.[243] As it stands patients have to wait four to six weeks to find out if they have a drug resistant strain but if their drug resistance status cannot be

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[235] Ibid
[236] Ghandi, Neel et al, 1576
[237] Ibid, 1576
[238] Suri, Arjun et al, 510
[239] Singh, Jerome Amir et al.
[240] Ghandi, Neel et al, 1576
[241] Singh, Jerome Amir et al.
[242] Suri, Arjun et al, 509
[243] Kapp, Clare. "XDR Tuberculosis Spreads Across South Africa." The Lancet 3 Mar 2007: 729-. Science Direct. American University Library. 1 Mar 2009. <http://www.sciencedirect.com>, 729

discovered at all there is no way to deal with the disease.[244] MDR-TB and XDR-TB are considered to be underreported.[245] Another infrastructure problem for South Africa is the ventilation systems in its hospitals.[246] Most of the hospitals are naturally ventilated and in these hospitals one third of all the patients can be infected by just one person being present with TB.[247] A lot of the equipment to prevent transmission of TB, such as negative pressure rooms are complicated and expensive.

Finally, a last major issue presents itself in personnel issues. Staff in South Africa is largely overworked and has low morale.[248] The staff struggles with a number of issues including poor communication, little support and low pay.[249] They are also in danger of contracting TB as the spread of the disease in healthcare workers in the country is high.[250] Staff are the heart of any healthcare response and its successes and failures. All of the problems health personnel face are a huge detriment to the TB program, especially when they are not protected from contraction of the disease.

Analysis:

Overall, the problems facing Mozambique and South Africa in TB and drug resistant TB are daunting. While Mozambique has better statistics than South Africa it is not actually doing better because its statistics represent the country's inability to even diagnose drug resistance and collect data. South Africa has more technical capacity but

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[244] Andrews, Jason R. et al. "Multidrug-Resistant and Extensively Drug-Resistant Tuberculosis: Implications for HIV Epidemic and Antiretroviral Therapy Rollout.", 486
[245] Singh, Jerome Amir et al.
[246] Ibid
[247] Andrews, Jason R. et al. "Multidrug-Resistant and Extensively Drug-Resistant Tuberculosis: Implications for HIV Epidemic and Antiretroviral Therapy Rollout.", 485
[248] Suri, Arjun et al, 510
[249] Ibid, 510
[250] "University of KwaZulu Natal, South Africa; Tuberculosis Incidence is High in Healthcare Workers in KwaZulu-Natal. " Aging & Elder Health Week 6 Aug 2006: 179. Health Module. ProQuest. American University Library. 1 Apr 2009. <http://www.proquest.com>, 179

its TB program is overwhelmed and badly coordinated. In general, drug resistant TB represents a health crisis that neither country seems capable of handling. The prevention and treatment of TB alone is expensive, lengthy and very technical and responding to drug resistance is even more so. The current capacities of both Mozambique and South Africa are too low to effectively deal with drug resistant TB.

In both Mozambique and South Africa's fight against MDR-TB one thing is clear; they cannot do what must be done alone. The process of contending with TB is costly and highly technical. First of all, the basic costs for medications and equipment are exorbitant and represent a huge burden for developing countries. Treating MDR-TB is extremely expensive and XDR-TB is even more so. Providing these medications for a significant population is not realistically in the power of the countries. Furthermore, developing countries are dependent on the West for a lot of the medications and equipment. The technical capacity needed to manufacture drugs or even to set up laboratories to test for drug resistance is huge; both countries would struggle enormously if left to their own devices in these areas. Additionally, in order for these countries to realistically be able to address MDR-TB research and development needs to be done in medications and diagnostic tools. The rise in drug resistance, especially XDR-TB, underlines the need for new TB drugs that can combat resistant strains of the disease. Current testing for drug resistance takes weeks and is highly technical, new and faster diagnostics are needed for countries to be able to diagnose and treat drug resistance everywhere without the need for an advanced lab.[251] The process of creating and testing new drugs and diagnostic tools is costly both in time and resources making is very

[251] "FIND, the SAMRC and NHLS seal MOU to begin trial of two new tests for MDR-TB in South Africa."

difficult for developing nations to invest in. Most pharmaceutical companies will not invest in products for developing nations because they don't believe that they will be able to make profits off of them.[252] Therefore, the development of new pharmaceutical products like those needed to fight TB is made mainly under the direction of Western donors.[253] Overall, all of these facets of the fight against drug resistant TB are very important and the fact is that developing nations, Mozambique and South Africa included, do not have the technology or the financial resources to be able to invest in them without Western support. International commitment and funding to drug resistant TB is essential if both countries hope to be successful in their fight against the disease.

In TB programs there are no quick fixes. To deal with the epidemic the countries need to commit a lot of time, money and restructuring for their health systems to even handle a decent TB program. Both countries TB systems are uncoordinated and overburdened. They need better management systems and coordination at all levels. Additionally, both need to deal with policies surrounding TB, HIV and healthcare in general in order to enable themselves to address all of the problems surrounding TB. Both systems need a complete overhaul and major changes in the basic of TB prevention and care which would be very challenging to a developed country not to mention developing countries.

A major issue in TB control is the widespread co-occurrence of TB and HIV throughout Mozambique and South Africa. In Africa in general and especially in Southern Africa HIV/AIDS is a major issue that countries and the international

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[252] Shah, Anup. "Pharmaceutical Companies and Medical Research." Global Issuses. 25 Jan 2007. 13 Apr 2009. < http://www.globalissues.org/article/52/pharmaceutical-corporations-and-medical-research>.

[253] Ibid

community have invested vast resources to defeat. In MDR-TB control the importance of addressing both TB and HIV is highly stressed. It is acknowledged that one cannot be defeated without dealing with the other. However HIV programs do not seem to demonstrate the same commitment to the importance of TB control in fighting HIV. In Mozambique and South Africa the co-occurrence of TB and HIV is very high but neither country has a program combines care to deal with both. The control programs are separate and treatment is separate. Without a program to deal with both the pairing of the disease will only undermine the individual control processes from each side. Both countries have programs to test all TB patients for HIV but that is all.[254] Testing all TB patients for HIV is positive but needs to be backed up with treatment of both diseases if they hope to deal with either. Neither country successfully treats both in a majority of their patients.[255] Treatment for both TB and HIV are complicated and long term making them easier to implement together. TB programs and HIV programs can learn from one another's successes and contribute to the furthering of one another. Both countries need to better integrate their programs for both TB and HIV and deal with both disease if they ever hope to eradicate TB and MDR-TB.

In addition to HIV and TB co-infection, both countries face many of the same problems in their TB programs. Both of their systems are ill-equipped to handle MDR-TB and need to be reorganized to better address the issues and provide for their people. While both countries are committed to DOTS programs and internationally set guidelines on dealing with TB they both fail to meet major tenements of these guidelines. First regulations of the response plans in general are not good. Basic monitoring and

[254] "Country Profiles: South Africa."
[255] Ibid

surveillance systems for the countries are not available and neither have accurate data on the breadth of the disease, especially drug resistance, within their borders. Additionally, patient records and tracking are also very important and are missing. Another major challenge for the two countries is drug supply. In order to treat TB and MDR-TB drugs have to be given in exact combinations for exact periods of time. Complications in drug supply impede their abilities to provide this specialized regimen and help the creation of drug resistance. Additionally, second line drugs are very expensive and harder to acquire making it extremely difficult for developing countries to provide them for their citizens. Without proper drug supply neither TB nor MDR-TB can be adequately treated or prevented from spreading. Therefore, a commitment to better supply of drugs is needed to fight MDR-TB. Finally, laboratory capacity is very important for TB and MDR-TB programs. Without good lab capacities both countries are unable to even discover the accurate numbers of TB and drug resistant TB present in their populations. Laboratory capacity is one of the most basic needs of a TB program and is one of the most lacking portions of both Mozambique and South Africa's programs.

Further challenges for Mozambique and South Africa are found in communications and personnel. Basic communications of health workers and providers from local to national levels are absent and need to be improved in order to better coordinate response to needs. Secondly, another problem both nations face is with personnel. A lack of qualified health personnel is present in the histories of both nations and more recently both struggle with low staff morale. Morale in particular worsens as health personnel are overworked, underpaid and live constantly amidst and overwhelmed system that cannot react to the people's needs. In order to fight TB both countries need

better regulations, communications, training programs and resources to better equip their staff.

Mozambique:

Mozambique committed very early to a good TB control program. The government's commitment to Styblo's short course chemotherapy guidelines put the nation on a good path for TB prevention and control from the start of its independent initiatives. That commitment also set the stage for Mozambique to easily accept DOTS protocol once it became an internationally recommended program because they were already on the same path. Nevertheless, incessant conflict and absolute poverty overrode any gains the country had made. Mozambique lacks the most basic services for primary health care let alone the ability to deal with complicated TB treatments. When the country cannot even provide clean water and sanitation for a lot of its health clinics more intricate processes are almost impossible. In addition, even in places where the nation has resources to give its health centers corruption interferes. Corruption is a major issue for Mozambique, which sees a huge amount of its drugs disappear before reaching health centers. Historically, TB treatment programs have been better in urban environments, especially Maputo, but for true control Mozambique will have to extend treatments all the way through the countryside. Statistics for the country are lower than those of South Africa despite the nation's lack of resource but it only reflects their inability to detect TB and MDR-TB within their population. A lack of basic screening hurts the nation's ability to even comprehend the scale of the epidemic they are facing. In total Mozambique is drastically ill-equipped to deal with TB and needs to improve its most basic factors of care before it can even attempt to address TB.

South Africa:

On the whole South Africa is much more financially and technologically equipped to deal with TB and MDR-TB. It has invested more in its health system in general and has more funds at its disposal to deal with TB. However, South Africa is still faced with huge challenges in healthcare not only in TB but also in HIV. Moreover, the nation's healthcare system is still unorganized and overwhelmed from its divided history and transition from providing for few to providing for all. The system is still incapable of dealing with the needs of all of its patients and struggles in communication and prioritization. The biggest problem in South Africa's healthcare system is the lack of triage which is present at every level of care. From the lowest rung clinics are unable to triage patients and choose which has the best chance of succeeding on treatment with their limited resources. At the highest level the nation struggles with prioritizing DOTS treatment and dealing with MDR-TB. South Africa needs to commit to DOTS and balance its work on MDR so that both programs have a chance to work. If the nation fails to implement DOTS it will only exacerbate MDR-TB issues, the most important part of TB control is preventing the creation of drug resistance. Basic facets of TB treatment also need to be re-determined to give patients better access to treatment, especially for MDR. The nation's current system which discourages people from committing to treatment needs to end. Most importantly, healthcare programs in South Africa have been subjected to all shenanigans due to political shifting that needs to come to an end if the country is to deal with TB. Lack of political commitment is one of South Africa's biggest problems in TB control and needs to be a first priority to the program.

Recommendations and Conclusion:

My first recommendation is that Mozambique and South Africa should increase activity and participation with the international community. There are always international funding resources that can continue to aid both nations' TB programs. Additionally, international commitment is needed for investment in new technologies, drugs and diagnostics for TB control. Western governments and donors can induce pharmaceutical companies to invest in TB alternatives in a way that developing nations cannot. Most new drugs and technologies would vastly improve the ability of both nations to test and treat their TB patients. Furthermore, both Mozambique and South Africa should re-evaluate their programs for drug resistance TB and drug supply to get them approved by the Green Light Committee (GLC). Involvement with the GLC would vastly aid both Mozambique and South Africa's access to second line drugs. Moreover, the GLC would also assist the nations in their technical capacity, giving them the capabilities that both desperately need in order to address drug resistance. Finally, if the nations were approved by the GLC then the committee would do surveillance of their approved programs, taking that responsibility out of the hands of the government.

Specifically, Mozambique needs to focus on providing basic drugs and amenities to their health programs and their TB program. Without basic access to funds and resources their clinics are incapacitated. Mozambique has good treatment success rates and to continue that trend it needs to expand slowly, maintaining and improving the quality of care, laboratory capacity and regular supply of drugs to new areas. Once ensuring DOTS in certain areas they can move on to expanding access further. A good DOTS program is the most important piece of TB work because it would prevent the

creation of drug resistant strains. Additionally, the Ministry of Health should work on combining the TB and HIV programs. Both are small so they are still at a stage where they can be realistically be combined. Finally, Mozambique should invest in human capital and ensure that it has enough personnel trained in TB prevention and care. Education is key to a successful program and it is essential that qualified people are the ones providing TB care.

On the other hand, South Africa's programs are more advanced and therefore have different needs. First of all, South Africa needs to prioritize DOTS before committing to a major MDR-TB plan. Without good DOTS control they will only be contributing to the drug resistance crisis. South Africa should continue to invest in trainings along with the South African Medical Association to ensure that their doctors are capable of combating TB. In addition, despite the fact that the TB and HIV programs are completely separate, South Africa needs to move towards combining them. They need to expand voluntary counseling and testing in TB patients and introduce TB testing in HIV patients. South Africa also needs to ensure that each program has the resources to treat both diseases. TB patients co-infected with HIV need to be on both the appropriate first or second line TB drugs and antiretroviral medications. The programs are too separate to truly combine now but each program can move towards addressing both in order to have more successful outcomes for their patients. South Africa also needs to work on its policies on drug prescription. Exogenous re-infection and HIV co-infection with TB complicate the types of TB and the strengths of drugs needed for treatment. Doctors need to be able to decide which drug combinations are best for their patients after diagnosis and not to handicapped by policies on drug treatments. Finally, South

Africa needs to protect its patients and health care workers in all of its healthcare facilities by preventing exogenous re-infection. There are relatively cheap solutions, other than negative pressure rooms, that can be used to prevent patient to patient transmission. Hospitals can adjust their organization of patients and separate TB and MDR-TB patients from others in order to prevent transmission from one patient to the next. Another solution to prevent the spread of TB in hospitals is improving the natural ventilation of hospitals and clinics using equipment like air filters.[256] South Africa also needs to adopt and enforce better policies on transmission prevention for healthcare workers including respirator mask wear and coughing techniques.

Taken as a whole, Mozambique and South Africa face major problems and challenges in their TB and MDR-TB programs. While the statistics may appear to indicate that Mozambique is performing better than South Africa and that is not the case. If one of the two is performing better is would be South Africa which has a much higher capacity for detection and treatment of TB. Despite that, overall both nations are struggling with drug resistant TB and have large issues to address. The challenges they face are vast and require huge changes in the structure of their health programs, and funding and major investments in technology and drugs. Furthermore, none of these objectives can be accomplished without resilient political commitment to them. MDR-TB is a key threat to the health and stability of both countries which will impact the fate of both their populations and the nations as a whole. The way Mozambique and South Africa respond to MDR-TB will also impact international guidelines and regulations for the future as the world attempts to learn how to adapt and combat drug resistant TB.

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[256] Andrews, Jason R. et al. "Multidrug-Resistant and Extensively Drug-Resistant Tuberculosis: Implications for HIV Epidemic and Antiretroviral Therapy Rollout."

Overall, drug resistant TB has the potential to threaten populations all over the world and the way Mozambique and South Africa respond to it will affect the disease's prevalence in their country, their region and the world.

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