Multidrug-resistant Tuberculosis in India: Solving the problem by reconstructing the public health infrastructure

Student: Maribel Gamar, Mentor: Dr. Linda J. Laatsch, Ph.D., MT(ASCP) SM, 1 Department of Biomedical Sciences, 2 Department of Clinical Laboratory Sciences

Introduction

Infectious diseases are at a dawn of a new era where strains are becoming resistant to medications that have been used for decades. However, emerging strains with resistance to medications may be prevented through public health measures. Multidrug-resistant tuberculosis (MDR-TB) is of particular concern to public health officials throughout the world. As reported by the CDC, there is an estimated 3 million prevalent TB cases worldwide of which 75,000 are MDR-TB. The adverse effects of TB are exacerbated most when the wrong treatment is given. If an inappropriate course of treatment is given, that is either too short or missing an active ingredient, the strain of bacterium develops resistance, and this form is MDR-TB. At the point of antibiotic resistance, there are limited agents for treatment. In addition, "accumulation of additional resistance mutations leads to extensively resistant TB (XDR-TB)" (Orlica, 2011, p. 11), which is rendered almost untreatable. Unquestionably, high prevalence rates of TB and MDR-TB in developing countries must be addressed with the goal of avoiding a large countries. Nonetheless, are there specific wealthy (USA), politically very committed (Orel and Tomsk, Russia) and specialist management of MDR-TB (Chiang, 2011).

The research conducted was based on primary and secondary literature. It was also necessary to assess TB programs in the United States, with the United States Public Health Infrastructure (CDC) as a location of interest. The research was conducted comparing India and the United States with collaborations from foreign establishments such as PIH. In addition, evaluation of the U.S. public health initiative for infection control offers India a guideline for the integration of many departments working towards a single objective.

Infectious diseases are at a dawn of a new era where strains are becoming resistant to medications that have been used for decades. However, emerging strains with resistance to medications may be prevented through public health measures. Multidrug-resistant tuberculosis (MDR-TB) is of particular concern to public health officials throughout the world. As reported by the CDC, there is an estimated 3 million prevalent TB cases worldwide of which 75,000 are MDR-TB. The adverse effects of TB are exacerbated most when the wrong treatment is given. If an inappropriate course of treatment is given, that is either too short or missing an active ingredient, the strain of bacterium develops resistance, and this form is MDR-TB. At the point of antibiotic resistance, there are limited agents for treatment. In addition, "accumulation of additional resistance mutations leads to extensively resistant TB (XDR-TB)" (Orlica, 2011, p. 11), which is rendered almost untreatable. Unquestionably, high prevalence rates of TB and MDR-TB in developing countries must be addressed with the goal of avoiding a large countries. Nonetheless, are there specific wealthy (USA), politically very committed (Orel and Tomsk, Russia) and specialist management of MDR-TB (Chiang, 2011).

The research conducted was based on primary and secondary literature. It was also necessary to assess TB programs in the United States, with the United States Public Health Infrastructure (CDC) as a location of interest. The research was conducted comparing India and the United States with collaborations from foreign establishments such as PIH. In addition, evaluation of the U.S. public health initiative for infection control offers India a guideline for the integration of many departments working towards a single objective.

M. tuberculosis Background

Transmission:
• Airborne means: coughing, sneezing, etc.
• Nuclei infected droplets infect human host.
• Infection may be latent or active.
• Risk factors allowing for more rapid transmission result from environmental triggers such as overpopulation.

Symptoms: (Tille, 2014)
• 3-week prolonged cough having.
• Sputum discharge, possibly with blood.
• Chest pain with shortness of breathe.

Diagnosis: The only definitive diagnosis for TB is done in labs equipped for the microbiologic procedure of acid-fast bacteria staining and culture (Chiang, Wezenbeek, Mori, & Enarson, 2013).

Treatment:
• Delays in treatment can result multidrug-resistant TB.
• One MDR-TB case left untreated or inadequately treated creates roughly 10-15 new cases of MDR-TB in a period of 1-year (Enarson, 2011).
• As seen in Figure 1, MDR strains are directly transferred from infected to healthy hosts.
• First-line TB drugs:isoniazid and rifampicin are used to treat TB (Tille, 2014).
• Second-line TB drugs: Namely, capreomycin, kanamycin, and amikacin are used for MDR-TB patients when first-line drugs fail. These drugs must be administered for roughly 2-years and are more toxic, expensive, and less effective in curing the patient (Dyer, 2010).

Review of Literature: Risk Factors Affecting India’s Population

Poverty:
• India ranks 119 out of 169 countries based on human development and 41.8% of their population is living below the international poverty line (Kamienie, 2012).
• Consequently, a recent survey done in Delhi, revealed that the "poor were twice more likely to have TB, three times less likely to access TB care, four times less likely to complete treatment and many times more likely to incur impoverishing payments for TB care" (The Union, 2011).
• Figure 3 shows the grave effect that income has on health outcomes. The study sought to determine the reason for the disproportionate care received by the poor. As the wealth quintile increased the prevalence of reported TB cases decreased.

MDR-TB cases detection decreases due to inadequate DST equipment

Lack of Rapid Diagnostic Susceptibility Testing (DST):
• Low-quality diagnostic and treatment services are burdened by the rapidly increasing TB rates.
• MDR-TB cases detection decreases due to inadequate DST equipment.
• Figure 4 shows the results from a study done in a Northern India clinic, regarding the increase in MDR-TB, where MDR-TB and TB susceptible strains increased from 36.4% in 2007 to 40.8% in 2010.
• Increasing surveillance and laboratory technology in developing countries is imperative to improving change.

Conclusion/Implications

Principally, studies of other countries suggested the following guidelines: 1) Establishment of a surveillance system, 2) engaging the community with TB awareness campaigns, and 3) Strengthening NTPs with collaborations from foreign establishments such as PIH. In addition, evaluation of the U.S. public health initiative for infection control offers India a guideline for the integration of many departments working towards a single objective.

Intervention strategies for combating TB must include collaborations between NTPs like RNTCP and foreign nonprofits or NGOs. Funding must be sought both from the national government as well as partnering programs interested in eliminating infectious diseases like MDR-TB. As of 2009, the treatment success for MDR-TB failed to reach the global target of 75% success rate (Chiang et al., 2013).

The research conducted was based on primary and secondary literature. It was also necessary to assess TB programs in the United States, with the United States Public Health Infrastructure (CDC) as a location of interest. The research was conducted comparing India and the United States with collaborations from foreign establishments such as PIH. In addition, evaluation of the U.S. public health initiative for infection control offers India a guideline for the integration of many departments working towards a single objective.

Intervention strategies for combating TB must include collaborations between NTPs like RNTCP and foreign nonprofits or NGOs. Funding must be sought both from the national government as well as partnering programs interested in eliminating infectious diseases like MDR-TB. As of 2009, the treatment success for MDR-TB failed to reach the global target of 75% success rate (Chiang et al., 2013).

The research conducted was based on primary and secondary literature. It was also necessary to assess TB programs in the United States, with the United States Public Health Infrastructure (CDC) as a location of interest. The research was conducted comparing India and the United States with collaborations from foreign establishments such as PIH. In addition, evaluation of the U.S. public health initiative for infection control offers India a guideline for the integration of many departments working towards a single objective.

Intervention strategies for combating TB must include collaborations between NTPs like RNTCP and foreign nonprofits or NGOs. Funding must be sought both from the national government as well as partnering programs interested in eliminating infectious diseases like MDR-TB. As of 2009, the treatment success for MDR-TB failed to reach the global target of 75% success rate (Chiang et al., 2013).