

Fighting Tuberculosis: From China to America

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Short Communication

Tuberculosis (TB) is an ancient disease and a modern day problem. In the early 1900s, TB killed one out of every seven people living in Europe and the United States. Though no longer so frightened in these regions, TB is still a serious global public health threat. According to the 2016 WHO report, in 2015, there were an estimated 10.4 million new TB cases worldwide, 1.0 million (10%) of them were children. People living with HIV accounted for 1.2 million (11%) of all new TB cases [1]. More alarmingly, multidrug-resistant tuberculosis (MDR TB) and extensively drug resistant tuberculosis (XDR TB) cases are on the rise. In 2015, 3.9% of new and 21% of previously treated TB cases were estimated to have been caused by MDR-TB. In 2014, MDR-TB accounted for only 3.3% of new TB cases.

TB became known as “consumption” or the “romantic disease.” The female TB patient often looked slim, pale, with large eyes and pink cheeks. Therefore, many artists have romanticized the images of the TB patients [2,3]. Recently a British bioartist, Anna Dumitriu, articulated the romantic association of TB from social and scientific perspectives in an exhibition in London (<https://wellcome.ac.uk/news/romantic-disease-artistic-investigation-tuberculosis-anna-dumitriu>, accessed April 8, 2017).

In reality, what one can't see beneath the rosy appearance is the deteriorating condition of the patient's lungs. In many resource-limited countries, patients were often undiagnosed until the late stage of the diseases when there were severe symptoms. The initial symptoms of TB patients, such as cough, low fever, lack of appetite, and fatigue, are often trivial and easy to ignore.

TB is associated with poverty and mostly affects the poorest of the poor [4]. The disease also imposes financial burdens on patients and their families, either directly due to the cost of the diagnosis and treatment or indirectly due to the income loss [5]. TB is an example of how an infectious disease can dramatically contribute to and result in poverty.

Both India and China are rising economic powers, yet, they rank number one and two in the world in TB cases. The post-2015 End TB Strategy proposes targets of 50% reduction in TB incidence and 75% reduction in mortality from TB by 2025, and the key countries include India, China, and South Africa [6,7].

Due to the low incidence of TB in the US, many Americans are unaware of the serious public health threat of this infectious disease. In 2014, there were only 9,421 cases reported in the US, which is very low compared to the other countries in the world [8]. However, in 2015, 9,557 TB cases were reported (CDC Data). Although the increase in the TB cases was not dramatic, it is cause for concern. This was the first time in 23 years the TB cases had increased. This has caused great concerns since this was the first time in 23 years TB cases increased in

the U.S. The New York Times, the Washington Post, and the Huffington Post have all published this disappointing data and raised questions why this has occurred and what the US can do about it (http://www.huffingtonpost.com/entry/tuberculosis-us-increase_us_56f3f3f4e4b0c3ef5218107a). One of the reasons seemed to be the lack of vigorous TB screening for foreign workers, especially for those who came from TB high burden countries.

TB is an airborne disease and therefore there is no country boundaries to prevent its transmission. In order to protect Americans from developing TB, one of the strategies is to build global alliances to reduce TB burden in high incidence countries. Only when the global burden of the disease is controlled can America reach the goal of eliminating TB by 2035 [9].

My life has been intertwined with TB. After graduating from the medical school, I was assigned to work in a TB hospital located in a suburb of Tianjin, a seashore city only 40 miles from Beijing. TB incidence and mortality rates were very high in the 1980s and 1990s in China [6]. Many of my patients had very severe lung damage when they came to the hospital for the first time. Some of them died soon after they were admitted. Due to the communicable nature of TB, sometimes the family members or friends of these patients also fell ill.

Although working in a TB hospital was not my choice, I immediately loved my responsibility to help the vulnerable TB patients. The TB hospital faculties were very outdated at that time. My first assignment as a young physician was to clean the cell culture tubes with my hands and brushes. During years of medical practice, I have treated thousands TB patients including MDR-TB patients with severe hemoptysis. When the bacteria damages the blood vessels, the blood accumulates in the soft lung tissue, resulting in hemoptysis.

It is a sad reality that ample data has shown TB healthcare workers are at higher risk for contracting TB than the general population [10]. Similarly, 30% of the death cases during the severe acute respiratory syndrome (SARS) epidemic were healthcare workers [11]. But my commitment for helping my TB patients persevered. I cared for thousands of TB patients during 13 years as a physician before I left the country and pursued a career in cancer research.

One decade later, I returned to the TB world in the United States and worked for the TB programs at the National Institutes of Health, the world premier medical research institute for HIV and co-infection. I have been overseeing TB clinical research projects that aimed to find the best treatment and prevention strategies. I was surprised to find that the diagnosis and treatment used for TB had not changed in twelve years. The treatment for TB still takes 6 months. Treatment for MDR TB takes more than 2 years. TB has been neglected by the funding agencies and healthcare authorities because its low incidence

in the developed countries. TB's status as a disease of poverty limits the financial incentives to develop treatment.

The devastating situation was succinctly described by the former FDA commissioner, Dr. Margaret Hamburg, who said: "TB is the only disease where one can go hibernation for decades, and wake up with no changes."

New drugs and vaccines for TB are urgently needed. Clinical trials are necessary for drug development, but the worldwide lack of clinical trial capacity has been a huge hurdle. TB research needs to be done in region where disease is prevalent. China has the world's second largest TB population, after India. Therefore, China must establish and expend clinical research capacity for TB treatment.

Accompanied by the lead Chinese TB physicians, my colleagues at the NIH and I were able to visit many TB hospitals to understand the reality of TB in China in a very personal way. China has changed dramatically since I left in 1996. The country has miraculously lifted millions of people out of poverty. However, to my surprise, most of the TB hospitals were largely unchanged. TB patients were cramped in small hospitals and were treated in poor conditions. In comparison to other fields of medicine, TB is a neglected disease in China similar to everywhere else in the world.

TB patients are crying out for effective treatment. The good news is, in recent years, a joint effort between many international organizations has been established to conquer this devastating disease. For the first time, two new TB drugs, delamanid, and bedaquiline, were developed by the Janssen and Otsuka pharmaceutical companies. These drugs have been approved by many national drug authorities. And by the end of 2016, 39 out of 70 high TB burden countries have already treated TB patients with the new medications. Chinese TB clinical research laboratory in 2012 shown in Figure 1.



Figure 1: Dr. Richard Hafner (Branch Chief of the Tuberculosis Clinical Research Branch at the Division of AIDS, National Institute of Allergy and Infectious Diseases), Dr. Ling Li, Deputy Director of Beijing Chest Hospital, and the Author, Dr. Jing Bao were visiting Chinese TB clinical research laboratory in 2012.

Now the World Health Organization (WHO) has set up the End TB Strategy. The strategy aims to end the global TB epidemic, with targets to reduce TB deaths by 95% and to cut new cases by 90% between 2015 and 2035, and to ensure that no family is burdened with catastrophic expenses due to TB. To reach these goals, we need to first better

understand the severity of the disease and its airborne nature. In this highly-globalized world, an airborne disease can spread to the other side of the world faster than ever.

Second, we need to leverage our resources to develop sustainable, affordable, and reliable diagnostic tools and treatment strategies. New and effective interventions are great, but if they are too costly for the poor TB patients to afford, how useful can they be?

The tuberculosis control post in a TB hospital in China (Figure 2).



Figure 2: The tuberculosis control post in a TB hospital in China.

Third, we need to reduce TB co-morbidities, a huge issue to be aware of, and to address. TB complicates HIV/AIDS especially in African countries where lethal synergy exists [7,12]. TB is also a risk factor for HIV/AIDS and the major cause of death of AIDS [13]. The TB and T2DM co-epidemic has also raised the huge concerns in both non-communicable and communicable disease community [14]. DM patients are three times more likely to develop TB than the general population. TB may trigger the development of DM [15]. TB is also associated with cancers, including lung cancer and non-lung cancer especially in the smoking population [16-18].

Finally, we need a joint effort from all countries in the world. TB is a cunning disease and will not go away easily. TB is also a social disease with enormous implication and influence to the economics and politics of every county. Therefore, no country or organization alone can successfully fight this disease. To eliminate TB, we must resolve to improve the healthcare system worldwide and pursue research advocacy and social mobilization to engage all care providers.

TB control is the global health priority for China and America. The two countries should work side by side to conquer this serious public health problem. The meaningful collaboration between these two global powers will be beneficial to the TB patients all over the world. It is a win-win strategy that both countries work together towards the goal that WHO has set up to eliminate TB as a public health problem by 2050. The world should not accept otherwise.

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