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Comparison of TB in India and Japan

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Abstract. Tuberculosis bacterium (TB) is still a major world public problem, especially in Southeast Asia. Data in 2021 from WHO showed that 10,600,000 population infected with TB and more than 10% among them died. Tuberculosis, as a bacterial disease, is capable of infecting different organs of human body, especially lung, which cause many serious symptoms and even death. It can spread through the air or small liquid drops that produced by breath, speaking and so on. This review firstly describes the characteristic of TB infection in India and Japan, compares the past tuberculosis situation between the two countries, and summarizes some shortcomings of TB control in India including lack of nationwide surveys, lower vaccination coverage, and low-quality welfare system to the health of citizens. The purpose is to provide some possible solutions for India to reduce TB from learn the experience of prevention and control in Japan, such as increasing TB education and providing nutritional supplements to undernourished people.

Keywords: Tuberculosis, India, Japan, comparison, solutions.

1. Introduction

Data in 2021 from WHO showed that 10,600,000 population infected with tuberculosis bacterium (TB) and more than 10% among them died, especially serious in Southeast Asia [1]. And some population contract TB with higher risk, such as HIV patients, medical workers, elders, and people in centralized management including prison, nursing house and so on) [1].

Tuberculosis, as a bacterial disease, is capable of infecting different organs of human body, especially lung [2], which cause many serious symptoms and even death. It can spread through the air or small liquid drops that produced by breath, speaking and so on [2]. Most people infected with TB, belong to latent infection without symptoms although the bacterium exist in bodies of infected individuals, whom possess positive skin/blood test reaction, but can't infect others. The incubation period is about 3 to 9 weeks from primary lesion to obvious tuberculin reaction [3]. If they do not receive appropriate treatments, some of them will develop tuberculosis and infect others, especially in the condition of vulnerable immune system [3]. According to a survey in 2023, the symptoms of TB including cough with or without blood and mucus, chest pain with breathing, night sweats, and so on [3].

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2. Tuberculosis in India

The characteristics of high TB burden countries or regions is high incidence more than 100/100,000 according to WHO handbook [1]. India is known to be one of the highest TB burden countries, which incidence is higher than that. What's more, India belongs to lower middle-income county according to data from the World Bank. In 2019, India had 2,640,000 cases, and 436,000 of them died from TB, accounting for one quarter in the world [4], which still has a long way for them to meet this goal of reduction 80% incidence at 2025 although the incidence has been decreasing (Figure 1) [5]. The incidence has reached the lowest level since 2015, but it still above the threshold of 100/100,000 population incidence. In addition, the incidence of tuberculosis increased again in 2021, higher than the past few decades. The main features of TB infection in India are that the incidence of TB increases with ages both in males and females, and males is higher than females in the most age groups, especially in people over 80s [5]. It's to be noticed that the relative incidence declines between the 65 and 69, although the incidence of this group is still higher than the under 50s groups [5]. The survey in 2021, involved 69054 eligible people to take chest X-ray to check if they have symptoms of TB infection, supplied more information of TB in India. The researchers divided the volunteers into three age groups including group of 15 to 34, group of 35 to 54, and group of over 55. The result showed that people over 55 have the highest rate of TB (969 people, 7.1%) in comparison of the groups of 15 to 34 age (116 people, 0.4%) and 35-54 age (476 people, 2.1%) [6], demonstrating that he elder people are at higher risk of tuberculosis.

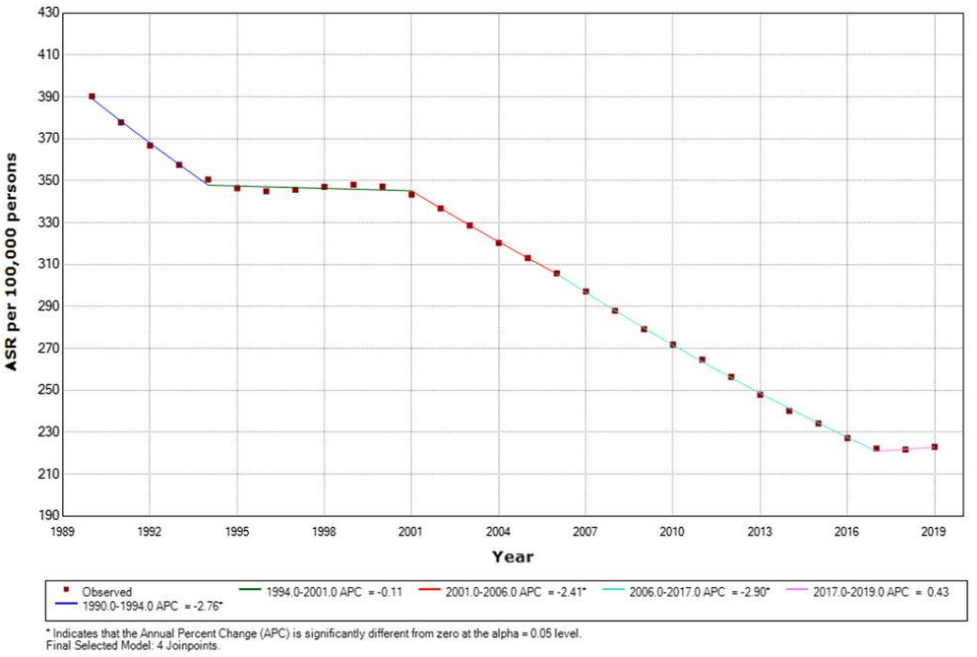

Figure 1. Incidence trends in both sexes of India between 1990 and 2019 [5].

Another phenomenon of TB in India is that the prevalence varies greatly in different places. For example, the prevalence was the highest in the state of Arunachal Pradesh (840/100,000 population), whereas the prevalence was only 50/100,000 population in Daman and Diu [7]. In addition, a study of the relationship between multidimensional poverty and tuberculosis in India found that the prevalence of tuberculosis in population of multidimensional poverty was 4.80‰ compared to 2.50‰ among the non-multidimensional poor [7]. A great mount of people are suffering from malnourished in India. More than 50% of TB cases are influenced by under nutrition [8], demonstrating the association between TB and poverty.

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3. Tuberculosis in Japan

The epidemic of TB is worse in Asia than in Europe. For example, Japan, managing a high-level medical service, still have an incidence of 10-100/100,000 population with mid-burden. For example, the incidence was 16.7/100,000 people, much higher than western countries with 4-5 fold, although the government had made many efforts to handle with tuberculosis [9]. The study of Lu et al showed that newly reported infections decline slowly from 364 to 296 per 1,000,000 population during 2007 to 2018 [9], with a little peak between 2007 and 2013 (Figure 2), then sharply reduction, which is quite different with the pattern of India. Similar to India, the males have higher incidence than females in TB and the incidence rate increases with the ages in Japan . More than 60% of TB patients are people over 65 [9], especially in men aged > 85. In addition, 68.4% of TB patients are unemployed [9].

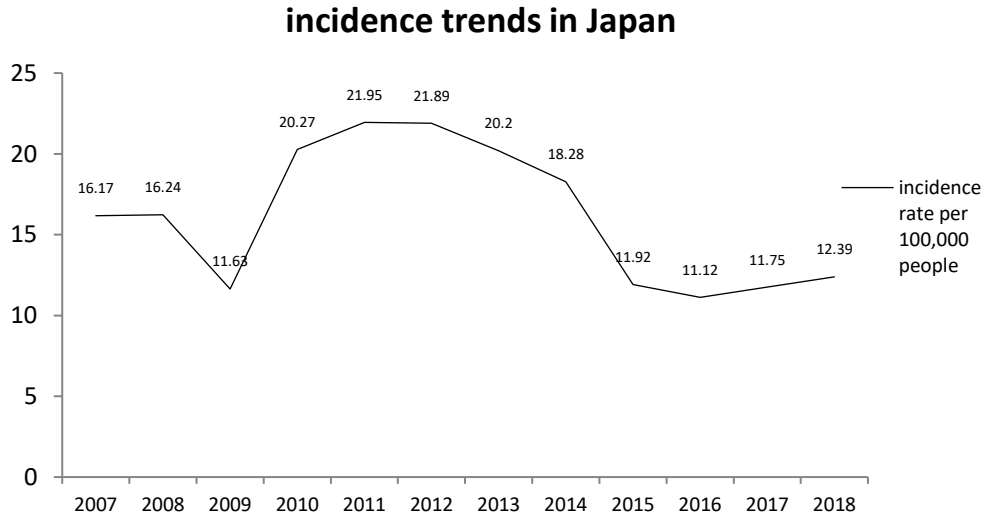

Figure 2. Annual incidence rate in Japan from 2007 to 2018 [10].

A study in 2021 showed another characteristic of TB infection in Japan is that the number of TB cases in different parts of Japan varies greatly, which is similar to India. For example, Tokyo had 120 outbreaks, then Osaka (62), Kanagawa (37), Aichi (35) and Fukuoka (31), whereas the relative low ratio located in Tottori, Tokushima and Yamaguchi (all 2), and Fukui and Yamanashi (both 0) [10]. In addition, the number in workplace is relatively high, which is highest significantly in nursing center and psychiatric hospitals [10]. Meanwhile, there also some relates between season and TB outbreaks in Japan. The TB cases were more often broke out in winter [10] since the windows are closed to keep warm, supporting TB transmission indoors. In addition, it is confused that the number of TB outbreaks increased in last two decades. A possible explanation is that TB cases stood out and easily to be detected with the decrement of TB incidence.

4. The comparison in TB between two countries

As the information mentioned above, there are many differences about TB between India and Japan. Firstly, Japan is a medium TB burden country but India is a high TB burden country. The incidence of TB in India in the past few decades was much higher than Japan. The TB incidence is (223-390)/100,000 from 1990 to 2019 in India [5], whereas the incidence of TB in Japan was no more than 16.7 per 100,000 people until 2012 [9]. Although the Indian government put so many efforts on TB prevention in the past few decades and achieved some goal, they still remain one of the highest TB burden countries in the world. These reasons may explain the above difference. Japan conducts regularly including the elderly population and immigrants, while India lacks the nationwide TB survey

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[11]. Another reason is that Japan has better economic background and welfare-system than India, resulting in Japan can quarantine and heal TB patients more efficient, eventually help Japan reduce the spread of epidemic. In compassion with Japan, India's poor public-private health partnership adds to the burden of TB in India [5].

Secondly, the cases in India broke out more in rural areas while the cases in Japan were often found in urban. Of the 605 incidents from 1993 to 2015, 120 were found in Tokyo [10]. In Japan, the workplaces are the most common places for TB outbreak following by health and welfare facilities [10]. These facilities are more common in big cities. This phenomenon happened because these facilities keep the windows closed to keep warm during winter, which enhances the spread of TB. Family infections are present in Japan but is much lower than in the above facilities [10]. In India, more studies concentrated on rural areas. In these areas, people experience more TB infections. For example, a community survey in south India showed that more than half people had not been vaccinated against BCG [6]. Another reason is the lack of awareness of TB in rural areas, which many people do not report TB infections in time because of stigma. At the same time, small clinics in India villages also lack effective diagnosis and isolation [6], leading to the spread of TB in families and communities in Indian rural areas. In addition, the 14 percent of Indian's population suffers from malnutrition according to the World Bank report in 2018 [8]. And more than 50% of TB patients are malnutrition [8], especially in rural areas.

Thirdly, the incidence of TB in India has declined continuously since 1990s [5], but the incidence of TB rose up during 2007 and 2013 and fell down sharply in Japan [9]. The following reasons may lead to this phenomenon. The TB situation in India is much more serious than Japan, and it is easier for the Indian government to reduce the same number of TB cases as Japan, leading to more obvious effects than Japan. In comparison to India, Japan's data as a whole is much more complete. What's more, the attention to TB in Japan has slackened in the past few years [9]. Although TB in Japan has fluctuated somewhat, it is still far better than India's overall.

But there are also some similarities between two countries in terms of TB. Firstly, those at high risk of TB infection are older people in both societies. Moreover, TB infection is both more severe in male than in female [5, 9]. Secondly, there are some similarities in the populations where the outbreaks occur although there are some differences in locations of TB outbreaks in two countries. In India, multidimensional poverty populations have higher risk than non-poor populations [7]. The prevalence of TB among the multidimensional poor was twice compared to non-poor population [7]. The multidimensional poverty includes under nutrition, poor education and uptight standard of living, such as no access to improved sanitation facilities, to clean water, and to use "dirty" cooking fuel and so on. Similar to India, 68.4% of TB patients were unemployed with a relative low living conditions during 2007 to 2018 [9].

5. Possible solutions to India

In Japan, nearly all the young people have received BCG vaccine. Although BCG is not a very effective vaccine and does not protect well against primary infection in adult, it still protects against disseminated forms of TB cases in kids [12]. A study in India also showed that people vaccinated with BCG had a much lower rate than those not vaccinated [6]. The data from more than 50 countries and over 95% coverage showed that BCG vaccine approved for application in clinic of the worldwide [12]. The BCG vaccine, which has been used for more than 100 years, is cheaper than developing new vaccines and it still be used in countries of high TB burden such as India. Japan is a medium TB burden country, which BCG coverage is close to 100% [9], suggesting India should do more to promote vaccination among at-risk groups.

In Japan, certain population is regularly tested, including people in mental hospitals, nursing homes, prisons and so on [9]. And the Ministry of Health, Labour and Welfare adopted the WHO's new strategy in 2014, considering widespread screening for latent TB infections, especially among the elderly and some migrants, and strengthening TB control in large cities based on geographical differences [9]. In India, regular TB testing still have many shortcomings and areas have not been

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adequately investigated [11]. The TB situation in India varies greatly and more population-based surveys across the country are needed to help the government plan and control more efficiently in India.

Another area that cannot be ignored is civic education. In recent years, Japan strengthened the publicity and education of TB prevention since the concern of Japanese citizens about TB has declined. Moreover, the higher education level of citizens in Japan is conducive to the promotion of epidemic prevention knowledge. India has a large number of people without formal education, so they have a poor understanding of TB and how to treat it [7]. Many people do not avoid the high risk of infection in India, which promotes the spread of disease. It is necessary for India to advocate widespreadly the knowledge of prevention and control TB to reduce the incidence and prevalence of tuberculosis.

Japan has a better welfare system and protecting public's health is a very key part of welfare. Complications such as malnutrition and parasitic infection are common in TB-endemic countries such as India [8]. Providing nutritional supplements to the public is an option worth considering to India government. Malnutrition leads to a deficiency of the innate immune system, which is made worse by common parasitic infections in India. Follow-up of the blood samples in a study showed that the malnourished participants had increased immune response levels after continuous nutritional supplementation [8]. This makes a lot of sense in India where medical resources are scarce. Improving the immunity of the population can not only reduce the new TB cases, but also improve the success rate of TB control in the affected population.

6. Conclusion

Although India has made some progress in TB control in the past few decades, it still far from India's target of 80% reducing of TB incidence by 2025. Japan has some similarities to India in the characteristics of TB infected population and has much better TB control. India can learn from Japan's experience to narrow down the TB epidemic. India should spend more energy on enhancement of vaccines, spreading TB knowledge, increasing TB research and improving the health of its people in the future. But in this paper, some details of TB in two countries are still different. For example, there is some lag in the TB research data of two countries, more recent information is unclear. Japan's experience for India can only be used as a reference, which needs to develop measures that are more tailored to the actual situation.

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