CHAPTER 1

Introduction

Tuberculosis is a disease caused by *Mycobacterium tuberculosis* which attacks the lung, which causes pulmonary tuberculosis. However, it can also attack other organs such as bone, skin, gastrointestinal, lymphatic system and liver (Adigun, 2020). Tuberculosis can be active or latent. Active tuberculosis is a condition where the patient is infected with *M.tuberculosis* and shows the clinical symptoms of tuberculosis. While latent tuberculosis is a condition where the patient still has the infection but shows no clinical symptoms. This is due to the remaining pathogens remains latent inside the lesions (Ilievska-Poposka, 2018). Latent tuberculosis can be active tuberculosis if the immune system is disrupted (Talha, 2020).

According to WHO, Indonesia is ranked second in total estimated tuberculosis cases per year in the world (WHO, 2020). In 2018, 569,899 people were identified positive of tuberculosis and it was estimated around 842,000 people positive for tuberculosis. A gap between 840,000 and 569,899 means there are an estimated 272.101 (32%) unreported cases of people living with tuberculosis unidentified. Apart from adults, it could also infect kids with the total of 60,676 kids who were positive for tuberculosis (Kementerian Kesehatan Republik Indonesia, 2020).

The main reason tuberculosis in Indonesia remains high is due to the risk factors that cause the population susceptible to the infection. Some of these factors are crowding, poor ventilation, smoking, malnutrition, low immunity and close contact with patients for prolonged time (Narasimhan, 2013). These risk factors can be easily found in Indonesia in various forms such as crowded public transportation, bad working area, low hygiene level and bad air circulation in slum or also known as Kupat Kumis (Kumuh Padat Kumuh Miskin) in Indonesia (Reksoprodjo, 2020; Hutanamon, 2020). Hence, extensive measures need to be taken so that Indonesia can get tuberculosis under control.

The Indonesian government has launched programs to the spreading of tuberculosis with the hope to eliminate it by 2030. Currently, Indonesia handles tuberculosis by giving BCG vaccination for

kids and Badan Penyelenggara Jaminan Sosial (BPJS) Kesehatan covers the whole fee for the treatment (Pranita, 2020). Apart from the government, some civil society organizations were also established to help eliminate tuberculosis by raising funding for the treatment, educating the people about the risk and treatment of tuberculosis and reminding them to take medicine regularly and mental support (Reksoprodjo, 2020).

Not only being a burden in government funding, tuberculosis is also a burden towards the patient. Long medication treatment regime (at least 6 months) with bad side effects gives mental pressure towards the patients and risks the rise of MultiDrug Resistance Tuberculosis (MDR-TB) due to low education level and lack of compliance in taking the medication by the patients in Indonesia due to absence of symptoms in the first several weeks after medication. MDR-TB medication is more expensive compared to normal tuberculosis (Reksoprodjo, 2020). As per 2017, the Ministry of Health claimed that tuberculosis causes the government to spend 400 billion rupiah annually (Kebijakan Kesehatan Indonesia, 2017). Successful vaccination should give immunity until adulthood which will lessen the burden of tuberculosis medication funding by the government and prevent people from getting tuberculosis in the first place.

Vaccination using BCG has been used in many countries. However, the high level of Tuberculosis shows that the BCG vaccine protective effect diminishes when a child enters adulthood (Andersen, 2005). A new vaccine is needed as a replacement for BCG in order to give immunity towards *M.tuberculosis* to help Indonesia to reach its targets to eliminate tuberculosis by 2030. According to WHO Tuberculosis Vaccine Pipeline, currently there are eight vaccine candidates for tuberculosis in phase II clinical trials, which are MTBVAC, ID93+GLA-SE, TB/FLU-04L,GamTBVac, RUTI, M72/AS01E, H56:IC31 and DAR-901 booster; and three vaccine candidates for tuberculosis in phase III clinical trials, which are MIP, *M.vaccae* and VPM1002 (Martin, 2020; WHO, 2020).