Summary

Essays on Evaluation of Global Health Policy on Tuberculosis Control

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Infectious respiratory diseases have threatened our lives and had a global impact on our health and our economy for decades. In particular, Tuberculosis (TB) is a threat to global health; it was one of the top 10 causes of death worldwide in 2019, according to the World Health Organization (WHO). TB eradication has been widely discussed as global health issue to be resolved, from the viewpoint of human security. Based on WHO End TB Strategy 2015, an international strategy framework has been set for holistically combating TB through intensified TB research and innovation in the development of new technologies at the national and global levels. Even though multiple sectors have engaged in innovative approaches toward more appropriate medical and programmatic health care services, due to inadequate research information sharing there are knowledge gaps

between policymakers and researchers. The evaluation of research efforts, health research trends, and priorities must reflect previous research contributions to the achievement of national and global TB strategic goals.

In Japan, a health care system for respiratory tract infections, including TB, has been developed in a multifaceted and systematic way so as to provide people with easy access to medical care and treatment for the prevention and control of TB. Nevertheless, in low and middle-income countries (LMICs), TB control is ineffective due to inadequate health care development and insufficient systems; there has been only limited reduction in TB morbidity and mortality. On the other hand, the situation in high-income countries such as Japan has been improved thanks to medical science progress and ongoing strengthening of the health care system—although comprehensive evaluation of global health policy in terms of TB control by means of Japanese research in LMICs has not been sufficiently evaluated.

Therefore, international health research, development, and assistance related to LMIC issues ranging from global health-related to respiratory tract infections are essential for human security. For that reason, it is essential to achieve a full understanding of the needed level of effectiveness, through evaluation studies that can support global health policy formulation. Under those circumstances, it is indispensable to conduct

quantitative analysis evaluation studies to determine the effectiveness of TB control in health for LMICs. For example, in 2021, Nepal was a high TB burden country, with an increasing prevalence of cases. We choose Nepal as the target country of this study because of the increase in the number of Nepalese students and laborers in Japan since 2010. To fill a perceived evaluation analysis methodology gap, the study reported in this dissertation conducted evidence-based evaluations of TB controls to confirm the validity of the results and develop a policy evaluation method to support the formulation of policy recommendations.

We first evaluated the contributions of scientific research to global health achievements aimed at the elimination of TB by identifying major trends in Japan's scientific research development, as evidenced by published articles. Then, we conducted topic modeling to generate a probability distribution of topics influenced by academic text documents on TB research in the pre-proceeded dataset for the period 1999–2019. In-depth analysis for the learning of latent topics was conducted using Latent Dirichlet Allocation (LDA) modeling using the Python library Gensim. In addition, we categorized the results of the analysis into five spectra of TB research for each affiliated country in terms of intensified research and innovation toward the implementation of the END TB Strategy. We found that Japan had the highest proportion of clinical studies and medical

trials as case reports in the fields studied. At the same time, the contribution of Japan to reciprocal linkage with social factors affecting wider health systems and dynamics among policy effectiveness was extremely low. We conducted policy effectiveness evaluation, evaluating the reciprocal relationship between social factors, to identify weaknesses in Japan's TB research engagement. Gaining an understanding the priorities and contributions of pulmonary tuberculosis research in Japan by means of international comparisons will help guide decision-making toward the implementation of future medical and health policies.

Secondly, we applied multilevel logistic regression to examine the association between demographic and socioeconomic factors and TB awareness, using data from the Nepal Demographic and Health Survey (June 2016 to January 2017). The results showed a high level of TB awareness in all seven provinces of Nepal. Importantly, socioeconomic factors such as wealth, education, and owning a mobile phone were found to be significantly associated with TB awareness—and socioeconomic determinants were found to be influential factors associated with TB awareness in Nepal. The wide variation in the level of awareness at the regional level emphasizes the importance of formulating tailored strategies for the raising of TB awareness. For instance, mobile phones promise to be an effective strategy for the promotion of TB awareness at a regional level. This

study provides valuable evidence to support further research on the contribution of information and communication technology (ICT) usage to the raising of TB awareness in Nepal.

Thirdly, we conducted cost-benefit analysis of data sourced from the Nepal Demographic and Health Survey and Japan's Legal Affairs Bureau and Tuberculosis Surveillance Center, to examine the effect of Japan's pre-entry TB screening policy, including testing and treatment in Japan and Nepal for the period 2014–2018. The total cost, total benefit, and net benefit for both countries were compared for two policy scenarios, "With" and "Without", using net present value (NPV). In order to address parameter difference for uncertainty, we conducted a sensitivity analysis using Monte Carlo simulation with secondary transmission rate. The results showed that implementing a policy of pre-entry TB screening for foreign migrants with a high TB burden arriving in Japan from Nepal would achieve efficient cost-saving by reducing the number of newly diagnosed TB cases, including those with transmission risk. Moreover, the results indicate that pre-entry TB screening would have prevented an increase in the number of new TB cases in Japan and reduced TB healthcare costs and capacity loss.

The research findings highlight the importance of TB research on trend identification, technology application, and collaboration in TB control towards significant

progress in global health, science, and technology diplomacy. We close with a depiction of research limitations, and provide lists of future prospects based on the evaluation analysis.