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Title of Submission: Generation of morbidity / mortality prediction model for respiratory diseases in Tokyo and Quantitative analysis of health damage reduction effect of environmental policy

Introduction

Megacities face multiple of environmental challenges. Lots of traffic movement, industrial activities, energy consumption cause more CO_2 emission, Temperature rise, and air pollution in megacities. Among them, air pollution is especially serious for human health. The health of the inhabitants has been harmed, leading to cost lot of social and economic costs.

Tokyo is one of them. From around 1960, Tokyo has been suffering from air pollution caused by automobile exhaust gas. (1) However, the real problem is that epidemiological research on air pollution has not progressed in Tokyo until now due to lack of interest of people. (2) In Japan, the number of patients with respiratory illness is increasing (3), but research has not yet clarified what caused it. Tokyo has set a goal of 50% replacement of vehicles that do not emit CO_2, such as EVs, by 2050(4), but the road is steep. Meanwhile, there are very few research papers that evaluate the health effects of environmental measures. The purpose of this study is to first clarify the causes of respiratory disease morbidity and death in Tokyo. Second aim is to make and evaluate a model for predicting the morbidity and mortality of respiratory diseases in Tokyo. Lastly, we evaluate environmental measures in terms of health. In this study, we used Tokyo's electric vehicle diffusion policy as a case study to evaluate health hazard reduction effect of the measures.

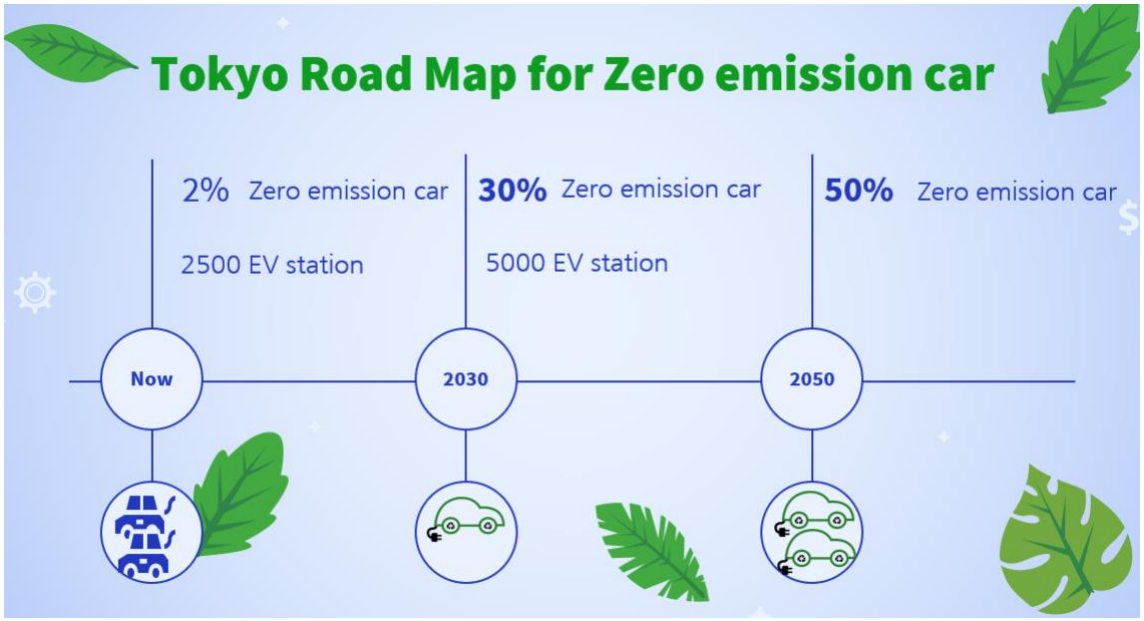

Figure 1. Tokyo Road Map for Zero Emission Car

Key Findings

We considered the cause analysis of respiratory diseases from air pollutants such as nitrogen dioxide, sulfur dioxide, and PM2.5, and meteorological conditions such as Temperature, Wind Speed, and humidity. As a result of multiple regression analysis used for cause analysis, it was found that nitrogen dioxide has the greatest effect on the increase in the number of patients with respiratory diseases. We also found that increased Temperature had the greatest impact on the increase in deaths from respiratory illness. It turns out that pm2.5 has a relatively small impact. This suggests that pm2.5, which is mainly contained in Asian dust from China, affects respiratory diseases due to the influence of nitrogen dioxide, which is mainly contained in automobile exhaust substances.

We have succeeded in developing a model for predicting morbidity and mortality of respiratory diseases in Tokyo. Models were made from linear to non-linear and evaluated for accuracy. This has made it possible to predict how much respiratory disease can be mitigated due to changes in nitrogen dioxide and Temperature. (Figure 2)

We also simulated climate change assuming a scenario in Tokyo where the overall EV usage rate is 100%. As a result, a decrease in Temperature and a decrease in air pollutants were observed. Reflecting this result and the generated model, it was clarified that the number of respiratory diseases and deaths decreased. Finally, in order to calculate the damage reduction effect of the measures, it was possible to estimate the amount of health damage caused by the spread of EV using DALY, which is an index that unifies the loss due to illness and death.

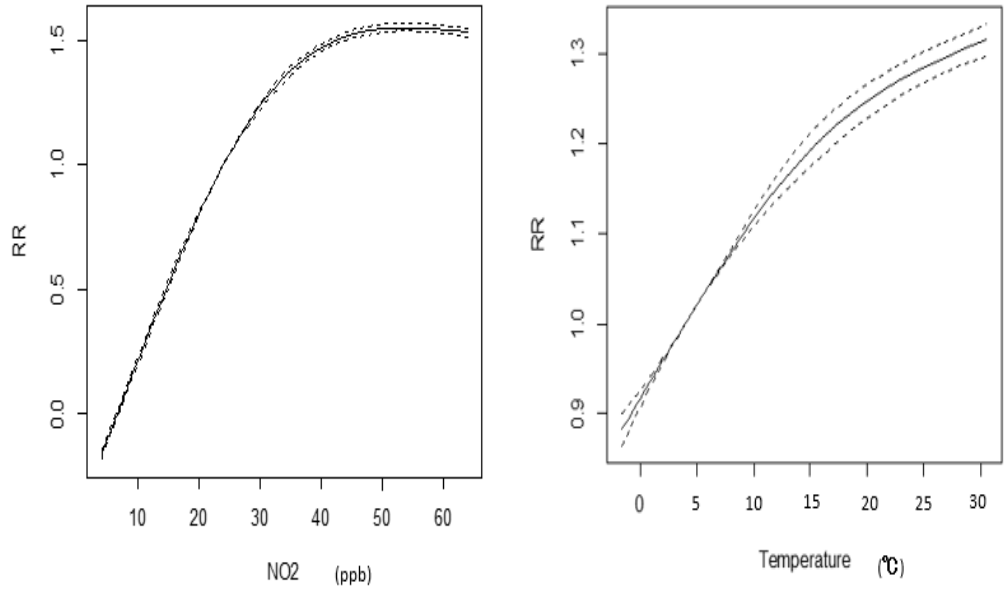

Figure 2. Critical factors and risk for contracting respiratory diseases

< References>

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