

Applications of age-structured epidemic models for intervention evaluation

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Abstract

Epidemic models have been widely applied in the era of COVID-19. Age-structured epidemic models enable us to consider not only the chronological age but also the class age, which means the time elapsed since an individual enters into a specific class. The class age is useful in considering the infection and vaccination history in each individual. In this talk, we study two kinds of age-structured epidemic models for intervention evaluation against COVID-19.

The first one is a model for the vaccine allocation problem. Using this model, we discuss the optimal interval between the first and second vaccination shots, and the optimal proportion of allocation between the young and the elderly age groups. Our results suggest that the optimal interval between the first and second vaccination shots could depend on the efficacy of vaccine and could be longer than 3 or 4 weeks for the Pfizer and AstraZeneca vaccines. Moreover, we show that the optimal proportion of allocation between the different age groups could highly depend on the heterogeneity in the contact patterns. This is an ongoing joint work with Dr. Taisuke Nakata and Dr. Daisuke Fujii in the University of Tokyo.

The second one is a model for estimating the herd immunity level in Japan. Using this model, taking into account the waning of immunity and the booster effect of the additional vaccination shot, we estimate the herd immunity level for main prefectures in Japan after the seventh wave. Our results suggest that many people could have obtained sufficient immunity by the seventh wave and the beginning of the eighth wave could be delayed. This is a joint work with the program members of Tokyo Foundation for Policy Research.