

Quantifying the transmission dynamics of diphtheria outbreak among refugees

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A Rohingya refugee camp in Cox's Bazar, Bangladesh experienced a large-scale diphtheria epidemic in 2017. The background information of previously immune fraction among refugees cannot be explicitly estimated, and thus we conducted an uncertainty analysis of the basic reproduction number, R_0 . A renewal process model was devised to estimate the R_0 and ascertainment rate of cases, and loss of susceptible individuals was modeled as one minus the sum of initially immune fraction and the fraction naturally infected during the epidemic. To account for the uncertainty of initially immune fraction, we employed a Latin Hypercube sampling (LHS) method. R_0 ranged from 4.7 to 14.8 with the median estimate at 7.2. R_0 was positively correlated with ascertainment rates. Sensitivity analysis indicated that R_0 would become smaller with greater variance of the generation time. Estimated R_0 was broadly consistent with published estimate from endemic data, indicating that the vaccination coverage of 86% has to be satisfied to prevent the epidemic by means of mass vaccination. LHS was particularly useful in the setting of a refugee camp in which the background health status is poorly quantified.

The present study was done jointly with Ryota Matsuyama, Akira Endo, Hyojung Lee, Takayuki Yamaguchi, Shinya Tsuzuki, and Hiroshi Nishiura (Graduate School of Medicine, Hokkaido University) and based on the work [1].

References

- [1] R. Matsuyama, A. R. Akhmetzhanov, A. Endo, H. Lee, T. Yamaguchi, S. Tsuzuki, H. Nishiura *Uncertainty and sensitivity analysis of the basic reproduction number of diphtheria: a case study of a Rohingya refugee camp in Bangladesh, November–December 2017*. PeerJ **6**: e4583 (doi: 10.7717/peerj.4583)

*Mini-Symposium: Modelling migration and associated importation events of infectious diseases