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4S2.3 Catching the risk of measles outbreaks in a clustered society

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Introduction Continuous assessment of vaccination coverage is required to prevent the resurgence of measles and hence to create a window of opportunity for elimination and, eventually, eradication. Low incidence of measles disease, (religious) beliefs and disproportionate perceptions about side-effects tend to decrease vaccination coverage. Given local socioeconomic and cultural contexts, this can give rise to clusters of susceptible individuals, which may enable measles resurgence when they are sparked by a re-introduction. Individual-based (or agent-based) models allow exploring heterogeneous between-host interactions, conditional on immune status. As such, each person in the population is represented as a unique entity with a set of individual characteristics and the implications of health state related clustering can be studied.

Aim To analyze the relation between documented measles outbreaks in Flanders and to which extent susceptibility has to be clustered with current vaccine coverage.

Methods

We calibrated our open-source individual-based model “Stride” to reproduce measles outbreaks in Flanders between 2010–2015. We fit our synthetic population and social contact patterns to census and survey data for Flanders. Finally, we used a Latin-Hypercube design-ofexperiment to obtain insights into model dynamics regarding the clustering of vaccine induced immune and/or susceptible individuals.

Results

The emergence of complex transmission dynamics based on social contact patterns and the distribution of immunological states, provide essential information on the extent of effective herd-immunity, i.e. the protection of susceptible individuals through the transmission disruption by immune individuals. Clustering (the probability to be connected with a person with an equal initial health state) of immune individuals has no effect on total incidence. At equal overall vaccination coverage, the threat to public health seems greater when susceptibles are spatially and socially clustered than when they are evenly dispersed among the population. We quantified this threat for Flanders. Conclusion Clustering of susceptibles can have an important “protected island” effect at intermediate vaccination coverage, though this protection might decline in high coverage conditions.