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Some schools impose measles vaccination as admission requirement. Is it for the better or worse?

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Abstract

This thesis analyses the epidemic of the highly infectious measles in a large school children population under the premise that some schools impose measles vaccination as an admission criteria. We develop a model framework for which we can use to analyse the effects of such a measure, and its extent, on important parameters of an epidemic such as the basic reproduction number and the final outcome.

Based on the standard SIR (Susceptible, Infected, Removal) model but with two levels of mixing, a school children population is divided into classes of the same size and a proportion of these classes admit ONLY vaccinated children, leaving the burden of unvaccinated children to be shared by those classes that do not have this admission criteria, according to some distribution. These classes, in turn, can have varying numbers of unvaccinated students. Each student, regardless of vaccination status, makes contact with students who are in the same class (*local* contacts) and also with those who are not in the same class (*global* contacts), which give rise to the two levels of mixing. However, only an unvaccinated student who is contacted by an infectious student can be infected and the infection is immediately. All infectious students who recover (or die) from the virus attain lifetime immunity and can never be infected again.

Results of our analysis show that, in general, not having vaccination admission criteria or increasing the proportion of classes that admit unvaccinated students helps to bring down the basic reproduction number and the proportion of ultimately infected. The extent of this positive effect, however, is contingent on the level of vaccination coverage, how virulent the strain of virus is and how often students make global contacts.

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