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Impact of vaccine refusal on vaccine-preventable disease outbreaks

The MMR scare and resulting measles outbreak in the UK and US in 2008 prove that the effectiveness of mass vaccination program can be hampered by the public perception of vaccine risk. By coupling game models and epidemic models, we examined vaccination choice for population stratified into two behavioral groups, pro-vaccinators and vaccine hesitators. Two behavioral groups are assumed to be heterogeneous with respect to their perceptions of vaccine and infection risks. We demonstrate that the pursuit of self-interest among vaccine-hesitators often leads to vaccination levels that are suboptimal for a community, even if complete coverage is achieved among pro-vaccinators. The demand for MMR vaccine across population driven by individual self-interest was found to be more sensitive to the number of vaccine hesitators than to the extent to which vaccine hesitators misperceive the risk of vaccine. Our results show that the discrepancy between the MMR coverages that are driven by self-interest and population interest becomes larger when the cost of vaccination increases. This research illustrates the importance of public education on vaccine safety and infection risk in order to maintain vaccination levels that are sufficient to derive herd immunity.