
JING LI, California State University Northridge

Modeling the waning and boosting of immunity from infection or vaccination

Immunity following natural infection or immunization may wane, increasing susceptibility to infection with time since infection or vaccination. Symptoms, and concomitantly infectiousness, depend on residual immunity. We quantify these phenomena in a model population composed of individuals whose susceptibility, infectiousness, and symptoms all vary with immune status. We also model age, which affects contact, vaccination, and possibly waning rates. The resurgences of pertussis that have been observed wherever effective vaccination programs have reduced typical disease among young children follow from these processes. As one example, we compare simulations with the experience of Sweden following resumption of pertussis vaccination after the hiatus from 1979 to 1996, reproducing the observations leading health authorities to introduce booster doses among school-aged children and adolescents in 2007 and 2014, respectively. Because pertussis comprises a spectrum of symptoms, only the most severe of which are medically attended, accurate models are needed to design optimal vaccination programs where surveillance is less effective.