

of antibiotic resistance among human pathogens represents a major threat to public health.

Hervé Agaisse

Department of Microbial Pathogenesis, Yale School of Medicine, Boyer Center for Molecular Medicine, New Haven, CT, USA
 herve.agaisse@yale.edu

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Herd immunity and the herd severity effect



Vaccination reduces morbidity and mortality by making infections and related diseases less common. A natural conclusion might be that breakthrough cases of vaccine-preventable disease would also become less severe. However, the opposite seems to be true for diseases that are more severe when acquired after childhood, according to the study by Nina Fefferman and Elena Naumova¹ published in *The Lancet Infectious Diseases*. Their finding is somewhat counterintuitive: higher vaccination rates that approach herd immunity levels mean that fewer people overall get sick, but those who get sick might have much more severe illnesses than in previous generations. As the authors mention, vaccines not only protect those who accept them, but they can also make health outcomes worse for those who do not. The occurrence underlying Fefferman and Naumova’s model deserves a name, perhaps the herd severity effect.

An antecedent of the herd severity effect is that, as vaccination makes disease less common, it also pushes breakthrough cases to older individuals. Thus, children targeted for vaccination will increasingly be separated by years and decades from people who get sick in their teens or twenties. Many believe that this separation has discouraged uptake of other vaccines. For example, guidelines² call for routine administration of human papillomavirus vaccine to children aged 11 or 12 years, but cervical cancers caused by human papillomavirus

infection generally occur in women aged 40 years or older.³ The long lag between infection and disease means that paediatricians and others who provide adolescent vaccines generally do not treat the patients whose cancers result from chronic human papillomavirus infection. Thus, for both parents and health-care providers, human papillomavirus vaccination might seem less urgent because its benefits are harder to imagine.

The study by Fefferman and Naumova has limitations typical of modelling exercises, including a need for replication in a dataset that does not require assembling best guesses about population variables. Such replications will be expensive and necessitate specialised and perhaps unique data collection systems. Additionally, the herd severity effect is specific to the many diseases, such as rubella and chickenpox, which are more severe when contracted after early childhood. Other limitations of the Fefferman and Naumova analyses include the absence of confidence intervals around estimates, suggesting caution when interpreting the results.

These findings might be a potent tool to motivate hesitant parents to vaccinate their children. Underuse of vaccines is a complex problem with many causes, parent refusal being a commonly cited culprit.⁴ Coverage for most early childhood vaccines in the USA was more than 90% in 2013.⁵ However, a very small

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but increasing minority of parents refuse vaccinations for their children.^{6,7} Many parents have never seen the diseases that childhood vaccines protect against precisely because vaccines have made these diseases rare. Therefore, logically, learning that these diseases are worse than previously thought should be a powerful motivator for vaccination, but we believe this is not true.

Clinicians do not engage parents in extensive discussions about many clinical services, including vaccination. A common way to present vaccines is for the clinician to note the child is due for several vaccines, mention that the nurse will give them at the end of the visit, and move on with the clinical encounter. This approach to vaccination communication engenders trust, reduces hesitancy, and encourages vaccination.⁸ A common alternative is to introduce the vaccines, ask if the parent has any concerns, and mention that it is up to the parent to decide whether the child should receive the vaccines. This approach might lead parents to wonder whether anything is wrong with the vaccines.

Wishful thinking by economists notwithstanding, research suggests that people do not naturally keep a ledger for costs and benefits updated in their heads for all the activities of life. People simplify many mental tasks, including medical decisions.⁹ Thus, we disagree with the authors' suggestion that "...this evaluation of the costs and benefits of vaccination should become an integral part of the conversation between physicians and parents or patients as they consider the relative risks

of vaccine acceptance".¹ The herd severity effect will have an important role in discussions between physicians and patients, but we believe that role is likely to be, and should be, limited. A more appropriate and valuable role might be in modelling the cost effectiveness and likely effect of vaccination.

*Noel T Brewer, Jennifer L Moss

University of North Carolina, Chapel Hill, NC 27599, USA
ntb@unc.edu

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Geostatistical modelling of schistosomiasis prevalence

Around 90% of all schistosomiasis cases are in sub-Saharan Africa,¹ but transmission is focal. Knowledge of the exact locations of these cases, therefore, is important for the efficient control of the parasites. In *The Lancet Infectious Diseases*, Ying-Si Lai and colleagues² describe a Bayesian geostatistical method that draws on parasitological surveys and sociodemographic and environmental data to construct maps predicting the risk of infection with *Schistosoma mansoni* and *Schistosoma haematobium* in sub-Saharan Africa and Madagascar. The estimates are calculated spatially, by the application of a grid of 5×5 km squares, and temporally by grouping studies done before 1980,

between 1980 and 1999, and during or after 2000. Clearly, this approach is very useful to help direct schistosomiasis surveillance and control through preventive chemotherapy with the drug praziquantel.³ Ideally, though, preventive chemotherapy should be complemented with behavioural and environmental interventions, such as the prevention of swimming in open water, construction of safe swimming pools,⁴ provision of suitable safe water supplies for drinking, bathing, washing and adequate sanitation,^{5,6} appropriate management of irrigation systems,⁷ and, perhaps, use of molluscicides to kill intermediate host snails.⁸



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