

Vaccine-preventable disease outbreaks and community-level vaccination coverage

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This research project will examine the complex relationships among vaccination coverage, herd immunity, and vaccine-preventable infectious disease outbreaks. Vaccination programs are one of the most successful public health interventions. However, in the United States, 48 of 50 states allow non-medical exemptions (NMEs) from vaccination requirements based on personal or philosophical grounds or religious beliefs. Also, despite the demonstrated success of vaccination programs, concerns over vaccine safety have led to increases in refusal and/or delay of vaccination. In some places, the prevalence of NMEs has yielded dangerously low levels of vaccination coverage.

Recent outbreaks of measles, pertussis (whooping cough), and other previously controlled infections highlight the potential consequences of reduced coverage rates. However, the progression of a single imported case of an infectious disease into an epidemic also is dependent on other factors, such as population mixing patterns and the contagiousness of the causative pathogen. Our overall goal is to create improved outbreak risk maps to create precise disease' and location' specific risk projections. Our proposed project will make progress toward this ambitious public health goal by: (1) conducting a rigorous analysis of how herd immunity has been operationalized in the epidemiological literature and coupled with geographic concepts and (2) applying the results of that multidisciplinary analysis to the development of a novel vaccine coverage-adjusted risk map. The results of these explorations will be submitted to respected peer-reviewed journals and presented at academic conferences. These projects will provide the preliminary results (and the coauthored publication record) necessary for this new team of collaborators to accomplish a third research objective: (3) submitting a competitive proposal to NIH. Our innovative approach to improving public health will generate both the theoretical and applied outcomes necessary for the development of an externally funded follow-up project that advances science and informs public health policy.