THE INFLUENCE OF RISK-TAKING BEHAVIOR ON THE EVOLUTION OF INFECTIOUS DISEASES

In this project we will develop and analyze epidemic models of various complexity that take into account behavioral factors in the infection transmission term. In its simplest form the transmission rate is modeled as a contact rate between susceptible S (i.e. healthy people that can be infected) and infectious I. An example is given by standard incidence:

$$\lambda \frac{SI}{P},$$

where P is the total population. This term indicates the number of new infections per unit of time: λ incorporates the number of successful contacts made by a typical infectious individual and S/P is the probability that a given contact is with a susceptible. In most epidemic models λ is a constant and it incorporates the level of exposure risk for each individual: the number of contacts in the population and the probability of those contacts to be close enough for infection to occur. For example, in the case of influenza, λ clearly is greater for individuals who spend longer hours in crowded environments: school, public transportation, etc.

In our project we will generalize this constant term to include a *risk-taking behavior* component. Individuals may increase or decrease their level of exposure due to a multitude of factors. Some of these factors will increase the *risk-taking behavior* (mild diseases or diseases with an easy cure, larger number of recovered individuals suggesting the disease is not serious, etc) and some others will decrease their exposure risk (severe infections, diseases without treatment available or with unpleasant symptoms). For example, the transmission term described above can be generalized to

$$\lambda(R) \frac{SI}{P}$$

where R is the number of recovered individuals from the disease. Thus $\lambda(R)$ is now a function that increases with R indicating that people will take more chances and, therefore, are more likely to catch the disease if the disease is perceived as being mild due to the high number of recovered people. Our analysis will focus on identifying the conditions when these behavioral factors alone can change the course of the epidemic in a fundamental way, for example from disease clearance to persistence. We will also study this problem for a variety of diseases that require both one-sex and gender structured models.

For more details of the types of problems that I address in my research visit my webpage: http://faculty.valpo.edu/dmaxin/