MEETING AGENDA

Title:	Human Behavior and the Dynamics of Epidemics
Location:	Guyot 100
Timing:	February 25, 2025, 2 PM until 5 PM
Format:	7 presentations of 15 minutes each, followed by 5 minutes of discussion, leaving some time for general discussion at the end.
Zoom:	Join Zoom Meeting https://princeton.zoom.us/j/92055004932

AGENDA DETAILS

2:00 WELCOME

2:05 BALTAZAR ESPINOZA

Title: Modeling social complexity in epidemiology: risk perception and adaptive human behavior

Abstract: The recent pandemics have highlighted critical factors that need to be addressed in the modern study of epidemic dynamics, such as the role of human behavior, economics, biosurveillance, and information sharing. The intertwined processes, where individuals make behavioral decisions driven by epidemic dynamics, which in turn reshape the progression of the contagion, make epidemics complex adaptive systems. In this talk, I will show that incorporating adaptive human behavior into epidemiological models can lead to unexpected results. Specifically, I will discuss scenarios in which individuals' risk perceptions can increase or decrease the final epidemic size, producing a hysteresis-like effect.

2:25 MARCELA ORDORICA

Title: Opinion Dynamics and Epidemic Spread in the SIS Model

Abstract: Pandemics present significant challenges to health systems and understanding how infections spread is essential for designing effective control measures. Traditional compartmental epidemiological models, like SIS and SIR, focus on disease dynamics but overlook how human behavior influences infection spread. We present a mathematical model that couples human behavior with infection spread, focusing on how a population's willingness to engage in risky behaviors (e.g., not wearing a mask) or reduce it (e.g., practicing social distancing) adapts in response to the risk of infection. We expand on the SIS model and show

how behaviors such as risk seeking or risk aversion affect infection trajectories. We find two regimes: In the first one, human behavior has a limited impact and trajectories behave like in the SIS model. In the second regime the population stabilizes at one of two endemic states. The first state, characterized by higher infection levels, reflects a preference for risk seeking behavior. The second, characterized by lower infection levels, reflects a preference for risk aversion. We additionally show that when a population is highly sensitive to peer pressure, risk aversion can lead to complete infection eradication. We examine numerically the extension of this model to a network of populations and explore how cooperation or antagonism between them affects infection levels.

2:45 JUDE KONG

Title: Adaptive Changes in Sexual Behavior in the High-Risk Population in Response to Human Mpox Transmission Can Control the Outbreak: Insights from a Two-Group, Two-Route Epidemic Model

Abstract: Mpox, a zoonotic disease caused by the mpox virus, is emerging as a sexually transmitted disease (STD). Since the end of April 2022, an mpox outbreak has been ongoing. Mathematical modeling plays a crucial role in monitoring, controlling, and forecasting infectious disease outbreaks, including those caused by STDs. In this talk, I will present a compartmentalized epidemiological model that we designed to track the dynamics of mpox and the results we obtained from analyzing the model. The model incorporates sexual behavior dynamics and stratifies the population into high- and low-risk groups. We explore and compare different intervention strategies targeting the high-risk population: i) a scenario of control strategies, implementing a policy geared towards the use of condoms and/or sexual abstinence (robust control strategy); ii) a scenario of control strategies with risk compensation behavior change, assuming a compensation through conducting more sexual encounters for adopting protective behavioral strategies (risk compensation strategy); and iii) a scenario of control strategies with behavior change in response to the doubling rate (adaptive control strategy).

3:05 ARI FREEDMAN

Title: The multifaceted role of information in guiding disease risk perception

Abstract: Our relationships with disease outbreaks are outlined by the information available to us, dictating how we perceive risk of infection. Risk perception can in turn affect our behavior and subsequently the course of an epidemic. A crucial missing link in our understanding of behavior-disease feedbacks is the form of the function relating disease information to risk perception. I will cover a few cases through data and theory that illustrate the importance of disease information and the function linking information to risk perception, from protective and testing-related behaviors to availability of genomic sequences.

3:25 BREAK

3:45 ABBA GUMEL

Title: Mathematical assessment of the role of human behavior on the SARS-CoV-2 pandemic

Abstract: In addition to inflicting unprecedented public health and socioeconomic burden, the recent SARS-CoV-2 pandemic was associated with high levels of mis(dis)information, fear,

peer influence, inconsistency in public health messaging, and polarization, resulting in heterogeneities in human behavior changes and attitudes towards the pandemic across communities. This lecture will briefly discuss some of our mathematical modeling efforts for assessing the population-level impact of human behavior changes and attitudes (with respect to adherence or lack thereof to public health intervention and mitigation measures) on the spread and control of the SARS-CoV-2 pandemic in the United States.

4:05 MADHAV MARATHE

Title: Computational Socio-Behavioral Epidemiology

Abstract: COVID-19 represents the first pandemic since the H1N1 outbreak more than a decade ago. COVID-19 epidemic continues to evolve four years after it started; but it is undeniable that the pandemic had severe economic, social, and health impact. Pandemics such as COVID-19 are intertwined with social, political and economic considerations and in fact they co-evolve. The fear and anxiety caused by a pandemic is inherently a social phenomenon. It drives the pandemic and the economic policies and outcomes. Similarly mask wearing, vaccination acceptance, vaccine nationalism are driven by individual and collective behaviors. Political actions, individual and collective behavior and public policies by governments are not only governed by facts but public perceptions, fear, anxiety and the need to demonstrate concrete action by leaders to infuse confidence in ordinary citizens. In this talk I will outline a program in computational socio-behavioral epidemiology --- the transdisciplinary program aims to understand the interplay between epidemic and socio-behavioral systems with the overarching goal of developing comprehensive implementation strategies to curb outbreaks. Development of computational models to support real-world questions will be discussed during the talk.

4:25 SIMON LEVIN

Title: Individual behaviors and the collective good during pandemics:

Abstract: The classical theory of epidemics has paid little attention to adaptive behaviors by individuals during epidemics. In the last several decades, there has been considerable progress in filling these gaps, especially in relation to individual risk tolerances. However, until the recent pandemics, almost all such efforts assumed individual utility functions that ignored the interests of others, and more generally the collective good. Although the importance of such omissions has been well appreciated in relation to antibiotic resistance, the Covid-19 pandemic brought to the fore the importance of societal concerns involving for example not only vaccines but also non-pharmaceutical interventions. In this talk, I will focus on efforts to address these shortcomings, trying to summarize what the previous talks have covered

4:45 GENERAL DISCUSSION