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Understanding the impact of social contact patterns in epidemiological models

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Respiratory infections such as influenza and COVID-19 primarily spread through social contacts that vary by age, making it critical to understand how interaction patterns influence disease transmission. Age-structured contact matrices play a central role in epidemic modeling; however, obtaining accurate and representative data remains a challenge, especially in low-resource settings.

This talk presents two complementary sensitivity analysis frameworks applied to an age-structured COVID-19 model. The first approach combines Latin Hypercube Sampling with Partial Rank Correlation Coefficients (LHS-PRCC) to assess how variations in contact matrix elements influence transmission outcomes. The second approach is based on eigenvector perturbation analysis of the Next Generation Matrix, providing insights into how specific age-group interactions contribute to changes in the basic reproduction number ($\mathcal{R}_0$). Together, these methods offer a robust understanding of the role of age-structured contact patterns in shaping epidemic dynamics.

Using contact data from Hungary, we identify the most influential age-group interactions driving epidemic spread. Our findings offer actionable insights for optimizing public health interventions, particularly in tailoring age-targeted strategies for effective disease control.

Keywords: social contact patterns, age-structured models, sensitivity analysis

References

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