**面向校园疫情防控的人群运动行为及疫情传播建模研究**

在本文中，我们提出了一种基于代理的模型，模拟一个相对真实的校园环境，用于分析COVID-19 在大学校园内的传播和校园防疫政策的有效性。我们基于目前对 COVID-19 的了解，修改标准的SEIR模型，将感染类分为无症状感染者、轻症感染者和重症感染者，同时提出基于空间风险和空间感染人数的感染概率公式，模拟校园中病毒的传播和感染。我们的目标是深入了解哪些措施最有效，并且尽可能准确地预测每日的感染人数。本文另一个创新在于，将学校管理政策的强度和代理对政策遵从度同时研究。我们通过最终感染人数的相对变化以及对基本再生数R0的影响来分析防疫政策有效性。我们发现，核酸轮检和佩戴口罩是非常有效的单一防控措施。学校制定强有力的管理政策结合学生对管理政策的积极遵守才能有效的控制校园疫情的传播。最后，我们使用来自维拉诺瓦大学 2020 年秋季 COVID-19在线数据验证模型，发现当超级传播事件被纳入模型时模型和数据拟合效果很好。

关键词：基于代理建模；SEIR；校园疫情建模；基本再生系数；校园防疫有效性

In this paper, we propose agent-based model which can simulate a relatively realistic campus environment for analyzing the spread of COVID-19 on campuses and the effectiveness of campus epidemic prevention policies. Based on our current understanding of COVID-19, we modified the standard SEIR model to divide the infection categories into asymptomatic infections, mild infections and severe infections. At the same time, the infection probability formula based on spatial risk and spatial infection number is proposed to simulate the spread and infection of the virus in the campus.Our goal is to gain insight into which measures are most effective and to predict daily infections as accurately as possible. Another innovation of this paper lies in the simultaneous study of the strength of school management policy and the degree of compliance of agents with the policy. We analyze the effectiveness of epidemic prevention policies through the relative changes in the final number of infections and the impact on the basic reproduction number R0. We have found that testing and quarantine and wearing masks are most effective single prevention and control measures. The campus can effectively control the spread of the epidemic by formulating strong management policies and students' active compliance with the management policies. Finally, we validate the model using data from Villanova University's Fall 2020 COVID-19 online data and find that the model and data fit well when superspreading events are incorporated into the model.

Keywords: agent based modeling; SEIR； Campus epidemic modeling; Basic regeneration coefficient; Effectiveness of campus epidemic prevention