From modeling to practice: outcomes from modeling-informed COVID-19 mitigation strategies for effective outbreak prevention during the Tokyo and Beijing Olympic and Paralympic Games

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The COVID-19 pandemic necessitated that mass gatherings be canceled, postponed, or downsized to reduce disease spread. One such example was the Tokyo 2020 Olympic and Paralympic Games – postponed in March 2020 to the Summer of 2021. While the organizers hoped vaccines would be readily available for athletes, vaccination rates were heterogeneous across countries, and the emergence of vaccine-evasive SARS-CoV-2 variants of concern required that further mitigation strategies be implemented. We developed an individual-based model that explicitly modeled SARS-CoV-2 transmission, within-host viral dynamics, and athlete-athlete interactions to optimize strategies for testing and containment of COVID-19 infections. We describe optimal testing strategies that minimize transmission while also enabling athletes to still compete. Finally, we detail how sparse data on the human mixing patterns during mass gatherings like the Olympic Games impacted modeled results, and how such uncertainties impacted deviations between predicted and observed case counts. Effective testing enabled the Tokyo Olympic and Paralympic Games to occur safely with a positivity rate of less than 0.07% and a secondary attack rate of 2%, consistent with the forecasted 1.5 – 2.4% rate. Based on these successes, in February and March, 2022, Beijing hosted the 2022 Winter Olympic Games as scheduled. Results from the testing programs at both the Tokyo and Beijing Games show that the modeling-informed measures put in place were effective at preventing the spread of COVID-19 within the Games, and ensured that neither event became a COVID-19-spreading event. This talk details the development of such an agent-based model, comparisons between forecasts and observed case counts, and public health takeaways for mass gathering preparedness and pandemic response.

"The science may be complicated, but why we do it is not." Chirag Kumar is an advocate for using science to address the world's greatest inequities and advance healthcare for all. In line with this mission, he is currently a Biden-Harris US Digital Core Fellow with the Center for Forecasting and Outbreak Analytics at the US CDC where he leads efforts to make human-centered models that can help in early mitigation of outbreaks. Most recently, he co-led the modeling for the revision to the pan-respiratory isolation guidance.

His work has been published in The Lancet, Nature Communications, Plos Medicine, Plos One, and he gave a TEDx Talk illuminating his vision for how science should be used in service of society. He is a graduate of Princeton University (summa cum laude) where he studied Chemistry with minors in Applied Mathematics, Global Health, and Quantitative Biology.

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