UNIVERSITY OF ALBERTA

CPA Speaker Series - Business Analytics

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Friday, October 20, 2023

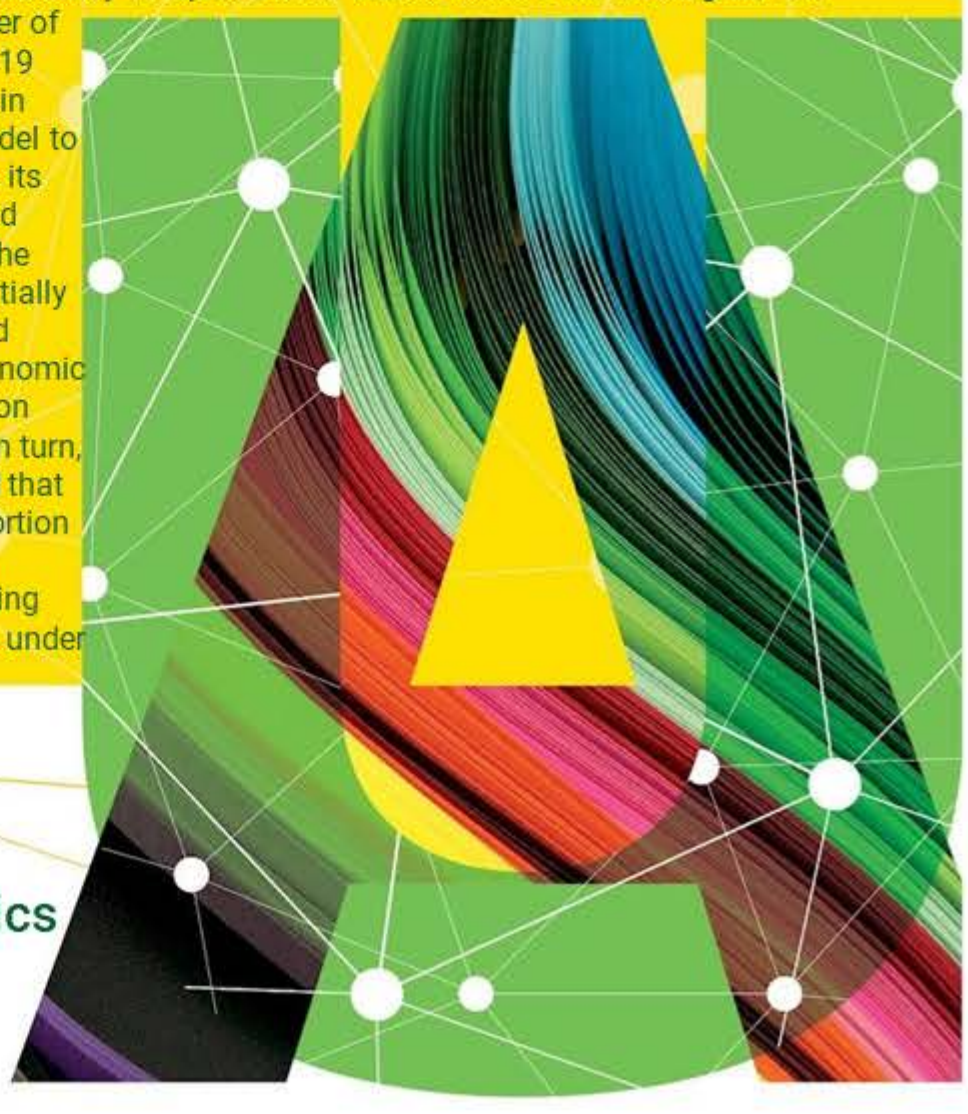
10:00 AM - 11:30 AM

Location: BUS 4-04

Integrated operations and disease modeling to evaluate COVID-19 pandemic response: Illustrative examples from India

ABSTRACT

During the COVID-19 pandemic, several countries including India went through different phases of response spanning measures such as lockdown, testing and tracing, and vaccination. Designing these interventions and measuring their potential impact often necessitates combining two different types of models: transmission or epidemiological modeling that captures the spread of the pandemic in a population and operations or systems modeling that captures the costs and constraints associated with the implementation of various measures. In this talk, I will share four examples of such modeling from my research. In the first example, we examine the decision of lifting lockdown restrictions after the first wave to limit the impact of the second wave in terms of deaths, hospitalization, and economic impact. We show how data on seroprevalence (i.e., fraction of the population that is exposed to the infection) can inform the speed of testing to prevent a resurgent wave from overwhelming hospital capacity. In the second example, also from the early phase of the pandemic, we study the optimal management events of social and economic importance (e.g., elections and agricultural procurement) that cannot be shutdown despite their transmission risk. Unlike one-time events (such as sporting events or political rallies), using the example of agriculture procurement in the Indian state of Punjab, we show that reducing the extent of crowding might not always be effective as it can prolong the events leading to increased prevalence in the community and increased number of infectious attendees. In the third example, we study seroprevalence based vaccination strategies, i.e., prioritizing geographic areas with low seroprevalence (greater number of susceptible individuals) to increase the cost-effectiveness of COVID-19 vaccination in the presence of limited vaccine supply and supply chain capacity. We use an integrated supply chain and epidemiological model to calculate the cost and duration of the vaccination strategy as well as its impact on disease incidence. We find that such seroprevalence based strategies are not more cost-effective than a uniform rollout unless the difference in seroprevalence across rural and urban areas is substantially large. In the fourth example, we develop an integrated operations and disease transmission model to evaluate the cost-effectiveness of genomic surveillance systems. Here, genomic surveillance provides information regarding the prevailing strains of the virus in the population which, in turn, Informs appropriate public health decisions albeit with a lag. We find that the cost-effectiveness might not always be higher for a greater proportion of samples being sequenced and that it depends on the time of the emergence of the new variant as well as the capacity of the sequencing system. We also analyze operational and epidemiological conditions under which a centralized or a decentralized sequencing system is more cost-effective.



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