



UNIVERSITY  
OF ALBERTA

# CPA Speaker Series - Business Analytics

Vedat Verter,  
Queens University

Friday, October 4, 2024

10:00 AM - 11:30 AM

Location: BUS 4-06

## Nurse Workload Balancing using Real -Time Location Data

### ABSTRACT

Sustained inequities in the workload distribution can lead to increased stress and reduced job satisfaction, high turnover, and shortages in the nursing team. These imply that healthcare quality could also eventually suffer from the imbalances in nursing workload. We develop a data-driven analytical framework to achieve balanced nurse workloads by optimizing the nurse-patient assignment decisions at the beginning of every shift. To this end, we utilize an extensive data set collected by a real-time location system installed in the surgical services department of a large tertiary hospital. This enabled us to track the care providers as well as the surgical patients through their journey from the emergency department to the operating room, and the surgical ward. The nurse workload is modeled as a multi-attribute, multilinear function, where the significance of each attribute (for the nurse manager) is elicited using an inverse optimization procedure integrated into a clustering method. This involves inverse optimization with a nonlinear integer original problem, which has not been well studied in the literature. The nurse workload balancing problem is then formulated for the upcoming shift, whereby the nurse-patient assignment decisions constitute the primary lever. This requires deploying the proposed dynamic panel-data model to predict each patient's required direct care. We also robustify the model to incorporate the uncertainties in the attribute weights. Through a real-life case-study we show that the proposed approach would have reduced the maximum travel distance by 50% - 77%. In addition, the average ranges for total direct care, maximum travel distance, and number of assigned patients decrease by 65%, 45%, and 31%, respectively.

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