

Nurse Staffing under Absenteeism: A Distributionally Robust Optimization Approach

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Synopsis. We study the nurse staffing problem under random nurse demand and absenteeism. Notably, the nurse absenteeism uncertainty is endogenous, i.e., the rate of nurses showing up for work partially depends on the nurse staffing level. For the quality of care, many hospitals have developed float pools of nurses by cross-training, so that a pool nurse can be assigned to the units short of nurses. In this talk, we propose a distributionally robust nurse staffing (DRNS) model that considers endogenous uncertainty. We derive a decomposition algorithm to solve the general model. In addition, we identify several special float pool structures that allow us to reformulate the DRNS model as a monolithic mixed-integer linear program, which facilitates off-the-shelf commercial solvers. Furthermore, we optimize the float pool design to reduce the cross-training. The numerical case studies, based on the data of a collaborating hospital, lead to recommendations for the float pool design from an operational perspective.

Bio. Ruiwei Jiang is an Assistant Professor of Industrial & Operations Engineering at the University of Michigan. He conducts research on the theory of stochastic and robust optimization, integer programming, and their applications on power systems and healthcare operations. Ruiwei's research has been recognized with an NSF Career Award and two awards in the INFORMS Junior Faculty Interest Group paper competition.