

Nurse Staffing for Inpatient Settings Using a Stochastic Modeling Approach

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Consistent evidence from observational studies suggests that inadequate nurse staffing in hospitals and heavy nurse workload threaten patient safety and quality of care. Every additional registered nurse per patient is associated with a risk reduction in hospital-related mortality by 9 and 16 percent in intensive-care and surgical units, respectively. There are recommended nurse-to-patient ratios for different types of inpatient settings. However, patients in a hospital unit may have different acuity levels based on the severity of care needed. This may impact the staffing needs of the unit potentially rendering a fixed nurse-to-patient ratio ineffective. To address this gap, this study aims at determining nurse-staffing strategies that account for the patient acuity. A stochastic model and solution approach are proposed to identify the optimal staffing level for an inpatient unit with any given patient mix. The objectives are to minimize staffing costs while ensuring timely delivery of patient care, which is measured using metrics such as the probability of excessive delays in providing care. The proposed model will capture the uncertainty associated with the volume and duration of care provided to different acuity levels. This will be achieved through the application of Queueing Theory and Discrete-event Simulation techniques.