Emergency Room Staff Scheduling Using A Two-Stage Non-linear and 0-1 Integer Programming Model

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Abstract: Emergency rooms are becoming a primary option for patients as healthcare grows more expensive. This strain on operations means that having the right amount of care, i.e., having the correct nurse to patient ratio and staying within the organization's budget constraints is crucial to organizational success. Bon Secours ER in Norfolk, VA is facing this exact dilemma where their need is for a personnel scheduling application that optimizes the staff and their technical capabilities with patient requirements while controlling costs. The challenge is maintaining an adequate nurse to patient ratio while operating in a stochastic demand environment. This is where the current solutions are inadequate.   This paper outlines an approach used to generate optimal staffing schedules using Linear and Non-linear programming tools. The result is a two-stage model in which the first determines the optimal staff count to be assigned per shift per day of the week, and the second determines the weekly schedule for each member based on the daily schedule established in the first stage. The model is showing gains in productivity as it allows the scheduler to quickly formulate a new schedule, and enables management to understand the risk surrounding weak or heavy staffing levels.

Keywords: Emergency Room, Non-linear Programming, Nurse Scheduling, Integer Programming