Abstract

The stochasticity of urgent patient arrivals provides a challenge in scheduling them into dedicated operating rooms (ORs). In our study, there are three categories of urgent patients: 30-minute, 6-hour, and 24-hour, distinguished by the maximum waiting time. We divide each day into 4 shifts, and we assume that the 30-minute patients are scheduled in the current shift. We determine the required capacity for the 6-hour and 24-hour patients using two queueing models: M/M/1/K and M/M/1 with priority. We perform a case study for various dedicated capacity levels and arrival rates. To schedule the admitted urgent patients in the dedicated capacity three Markov decision processes (MDP) based models are proposed. In the first MDP model we keep track of the target time of each admitted patient. For this model, it is optimal to treat the patients from the higher urgency levels first. In the next model, we modify the first model by allowing the OR manager to defer some 24-hour patients to another resource, e.g., elective ORs. While treating patients using the same policy as the previous model, the number of deferred patients depends on the costs. In the last model we assign newly arrived patients to a time-slot directly upon arrival. The optimal policy is to schedule 6-hour patients on the next shift, while 24-hour patients are scheduled somewhere before their deadline. As we cannot alter the assignment of the already scheduled patients to admit patients of higher urgency level, this model is less flexible than the other two models. The optimal policy of the proposed models boils down to simple rules that can be implemented easily by hospitals to treat urgent patients before their deadline.