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A Nested-Compliance Table Policy for Emergency Medical Service Systems under Relocation

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The goal of Emergency Medical Service (EMS) systems is to provide rapid response to emergency calls in order to save lives. This paper proposes a relocation strategy to improve the performance of EMS systems. In practice, EMS systems often use a compliance table to relocate ambulances. A compliance table specifies ambulance base stations as a function of the state of the system. We consider a nested-compliance table, which restricts the number of relocations that can occur simultaneously. We formulate the nested-compliance table model as an integer programming model in order to maximize expected coverage. We determine an optimal nested-compliance table policy using steady state probabilities of a Markov chain model with relocation as input parameters. These parameter approximations are independent of the exact compliance table used. We assume that there is a single type of medical unit, single call priority, and no patient queue. We validate the model by applying the nested-compliance table policies in a simulated system using a real-world data. The numerical results show the benefit of our model over a static policy based on the adjusted maximum expected covering location problem (AMEXCLP).

Keywords: Emergency medical service, Relocation, Nested-compliance table, Markov queuing model

1. Introduction

The goal of emergency medical service (EMS) systems is to save the lives of emergency patients. The potential for improving performance of EMS systems is directly related to reducing response time, which is in turn related to increasing coverage, where coverage is defined as the proportion of calls that can be responded to within a given time standard (e.g. 9 minutes).