

# **Forecasting the Volume of Patient Arrival to an Emergency Department in Hong Kong using Time Series Regression Method and Artificial Intelligence Method**

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## Abstract

Emergency Department(ED) is the frontline of providing emergency care in a hospital and decision-making around ED has been driving a rising number of attentions in quality management field in recent years. Among most areas, the ED is the busiest department in a hospital and facing increasing stress year after year. According to the statistical data, in the UK, the increase of patient arrivals was estimated at 3-5% per year in 1994, meanwhile a 27% was noted in California, USA during the 1990s, which shows that number of patient arrivals has been rising steadily. However, relative ED resources have failed to keep up with these continuous increases in recent years, which lead to problems with overcrowding in ED. A retrospective study among the published papers shows that related research can be classified according to six planning modules: demand forecasting, days-off scheduling, shift scheduling, line-of-work construction, task assignment and staff assignment. After a comprehensive review on these approaches, we have found that a well performed prediction of the uncertain volume of patient arrivals is an important prerequisite of conducting the rostering and scheduling, either in the simulation-based approach or in the mathematical programming approach. Based on this motivation, first, we proposed a series of time series regression method and artificial intelligence method to forecast hourly and daily patient volumes at an emergency department in Hong Kong. Then, The patient arrival data set were collected for the period July 1, 2009, through June 30, 2011 and then split into training set(70%) and testing set(30%). After that, forecasts were made for horizons ranging from 1 to 7 days in advance using the data in testing set. Finally, mean absolute percentage error was used as the metric to compare the performance of each prediction model.