**Title: Forecasting short-term hourly Emergency Department arrivals**

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**Abstract:** An accurate forecast of Emergency Department (ED) arrivals by hour of the day is critical to meet patients’ demand It will enable planners to match ED staff to number of arrivals, redeploy staff and reconfigure units, if required. This can have many advantages for healthcare staff and the quality of care delivered to patients. In this study, we develop an innovative model based on Generalised Additive Models and an advanced dynamic model based on exponential smoothing, to generate hourly probabilistic forecast of ED arrivals. We compare the forecast accuracy of these models against appropriate benchmarks including TBATS, Poisson Regression, Prophet, and a simple empirical distribution. We use Root Mean Squared Error (RMSE) to examine the point forecast accuracy and the forecast distribution accuracy is assessed using Quantile Bias, PinBall Score and Pinball Skill Score. Our results indicate that the proposed models outperform their benchmarks for both point and probabilistic forecasts. Our developed models can also be generalised to forecast hourly arrivals in other services such as hospitals, ambulance, or clinical desk services.

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