resuscitation IO lactate values seem to represent better the metabolic state at tissue level than arterial or venous lactate.

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45 FRONTIERS OF PERFORMANCE: USING A MATHEMATICAL MODEL TO DISCOVER UNOBSERVABLE PERFORMANCE LIMITS IN A PRE-HOSPITAL AND RETRIEVAL SERVICE

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Aim We aimed to establish if a validated computer model could derive otherwise unobservable performance limits for a physician-led pre-hospital and retrieval service.

Methods Using our previously validated model for the ScotSTAR Emergency Medical Retrieval Service (EMRS), we randomly simulated varying numbers of primary pre-hospital and secondary retrieval missions using the MATLAB software suite Simulink program. The parameters of simultaneous retrieval rate and number of missed primary missions were calculated and plotted. The 45^o tangent of the corresponding exponential curve was identified and used as the performance frontier.

Results Based on the current system demand, the number of missed primaries rose exponentially above a performance frontier of 400 missed primaries per year on a total of 1550 completed primary missions per year (corresponding to 15% absolute service utilisation). However, the simultaneous retrieval rate for both primary and secondary retrieval rose exponentially above 12% at 810 primary missions per year (corresponding to 13% utilisation).

Conclusion These results provide a useful insight into potential system performance, and its limitations. When combined with forecasting of service growth and demand, they provide useful guidance on what a service may be able to achieve. By knowing the limits of achievable performance, we can also work to derive an absolute number of missions as a specification limit. Furthermore, they illustrate the importance of maintaining relatively low service utilisation in order to achieve rapid response to critically ill or injured patients.

Conflict of interest None declared.

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46 FORECASTING THE DEMAND PROFILE FOR A PHYSICIAN-LED PRE-HOSPITAL CARE SERVICE USING A MATHEMATICAL MODEL

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Aim We aimed to investigate if a queueing-theory derived, stochastic, computerised mathematical model could accurately predict the number and seasonal pattern of primary pre-hospital missions undertaken by a physician-led pre-hospital and retrieval service in 2016.

Methods We used queueing theory to derive parameters for a computer model built using the MATLAB software suite Simulink program. The model was primed with retrospective data, validated with contemporaneous data and then used to forecast 1 year ahead. A total of 100 iterations of the model were studied. The model output was compared to the real-world data with regard to total number of missions and seasonal pattern using standard statistical tests.

Results Our model forecast 547 missions (95% CI 516–586) during the prospective study period, compared to 565 real-world missions. (t-test $p=0.21$). The seasonal patterns were adequately matched to generate a non-significant result under the Kolmogorov-Smirnov test ($p=0.14$).

Conclusion Our model was able to correctly predict the number of pre-hospital primary retrieval missions undertaken by the ScotSTAR Emergency Medical Retrieval Service (EMRS) by demonstrating no statistically significant differences to the real-world mission numbers or distribution. This suggests that a queueing theory derived model is able to accurately replicate, and forecast, the real-world performance of ScotSTAR EMRS operations. This finding presents useful implications for resource utilisation, asset allocation and investigating system capability.

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Conflict of interest None declared.

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