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 45o 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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