A355 - Monte carlo modelling of patient flow can aid complex intensive care bed and workforce capacity planning.

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Introduction:
Models for ICU populations based on the Queuing model use arrival rate, length of stay, and bed number [1,2]. These models lack the complexity of specialised ICUs with different admission types, and patient subpopulations.

Methods:
We developed a Monte-Carlo simulation [3] with separate referral rates for emergency, elective, and ventilated patients. Bed occupancy is classified according to admission type with a conversion to prolonged ventilated stays at a rate of 4% [4]. We used data from our Neurointensive care unit to complete the parameters required for the model e.g. 13 beds and 1.725 referrals/day. Outcome measures were bed occupancy, and failed admissions. We tested two scenarios: increased referral rate (4.5/day), and increasing to 20 beds.

Results:
The model simulated our intensive care where we have a high occupancy rate. Increasing referral rate led to a consumed ICU and an increase in failed admissions (figure 1). Lastly, increasing bed numbers eased pressures with fewer failed admissions.

Conclusion:
We recommend a personalised ICU Monte-Carlo population model for specialist units for a more accurate representation of ICU bed occupancy. These ICU specific models should be more useful for predicting staff, bed and financial requirements in specialist units where healthcare resources are changing e.g. increasing geographical referral radius.

References:

Image 1:
Monte Carlo simulations of bed occupancy under 1) normal, 2) increased referral, 3) increased referral and increased capacity conditions.