## 42 STRAIGHT LINE VS TRUE DISTANCE TO NEAREST AED – DOES IT MATTER FOR CARDIAC ARREST COVERAGE?

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**Aim** International guidelines recommend automated external defibrillators (AEDs) to be deployed within 1_ min brisk walk distance to high-risk out-of-hospital cardiac arrest (OHCA) locations. Most studies translate this to a straight line distance of 100m while the true distance may be longer. We aimed to investigate how straight line versus true distances affected the AED coverage of nearby OHCA.

**Methods** We identified all OHCAs (2002–2014) and all public available AEDs in 2014, in Copenhagen, Denmark. Each arrest and AED was geocoded and straight line and true distance from arrest to the nearest AED was calculated. An OHCA was defined as covered by an AED if≤100m.

**Results** Of 4507 OHCAs, 22.3% occurred in public (n=1003) and 77.7% (n=3504) in residential locations. In 2014, there were 1134 public available AEDs. In total, the median distance in straight line was 148m (interquartile range (IQR):87–226), versus 224m (IQR:128–343) in true distance, with an AED coverage of 30.9% (n=1394), versus 18.5% (n=832), respectively. For public arrests, the median distance and AED coverage in straight line was 107m (IQR:53–185) and 48.1% (n=482), versus 167m (IQR:70–274) and 33.6% (n=337) in true distances. The corresponding numbers for residential OHCAs were 158m (IQR:98–239) and 26.0% (n=912) for straight line distance, versus 241m (IQR:146–354) and 14.1% (n=495) for true distance.

**Conclusion** Using true instead of straight line distance provides a more realistic estimation of AED coverage and could help improve public access defibrillation programs.

**Conflict of interest** None declared.

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## 43 TIME DELAY TO CONTACT THE MEDICAL DISPATCH – EUROCALL STUDY IN ROMANIA

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**Aim** To assess the time to connect the telephone call to emergency medical dispatch.

**Methods** Regional randomised study as a part of a prospective, multicenter study was conducted in April 2013 within the Medical Dispatch, Iasi, Romania. The distribution of the 112 calls followed a diurnal distribution using a computer generated sets of random numbers. We analysed the time to contact medical dispatch and its components (Time to first beep, First beep to 112 operator answer,First beep to medical dispatch answer).

**Results** There were planned to do 180 calls (6 calls/24 hour) and we performed only 129 calls (71,66%). The average "Time to first beep" was 3.515±3.447 s, "First beep to 112 operator answer" was 6.823±5.559 s and "First beep to medical dispatch answer" was 24.259±19.584 s. No statistically significant difference in terms of response time when using mobile or landline phone. We found an negative correlation between "First beep to medical dispatch answer" and the hour of calls (p<0,05); thus, the average time of this interval between 00.00–06.00 hour was of 41.724±36 105 s.

**Conclusion** There is a great variation regarding the time to contact the medical dispatcher, mainly during the night. This could be an additional time with negative influence for out of hospital cardiac arrest outcomes.

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## 44 POINT-OF-CARE ANALYSIS OF LACTATE FROM INTRAOSSEOUS SAMPLES DURING RESUSCITATION

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**Aim** Intraosseous (IO) access with power-driven devices has become a commonly used method of vascular access during cardiopulmonary resuscitation (CPR). Blood aspirated to confirm correct IO needle position could readily be available for point-of-care (POC) testing. The aim was to investigate how POC lactate levels of intraosseous blood reflect the lactate values in systemic circulation during VF and resuscitation in order to see whether POC IO samples could be used for clinical decision-making during CPR.

**Methods** We conducted an experimental study comparing POC results of lactate from intraosseous, arterial and venous blood of 23 piglets undergoing induced cardiac arrest (VF) and CPR. All blood samples were analysed with i-STAT POC device and the results were compared using Bland-Altman method (ref 1).

**Results** Prior to VF the IO lactate levels were similar to arterial and venous samples (bias [95% CI] between IO and arterial samples was 0.11 mmol/L [−0.02–0.24] and between IO and venous samples 0.03 mmol/L [−0.25–0.31]). Five minutes after onset of VF, intraosseous lactate levels had increased more than arterial and venous values (bias 3.76 mmol/L [1.93–5.59] and 3.52 mmol/L [1.41–5.64] respectively). Five minutes after initiation of CPR with an automatic CPR device (LucasTM) the difference diminished (bias 0.81 mmol/L, [−0.31–1.93] and 1.50 mmol/L [0.07–2.92]).

**Conclusion** Intraosseous lactate values showed good agreement with arterial and venous values before cardiac arrest, but IO values were clearly higher during VF and CPR. During 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.



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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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