

# Regional inter-hospital variability in survival for Utstein comparator group patients following out-of-hospital cardiac arrest: a multi-centre observational study.

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## Background

Out-of-hospital cardiac arrest (OHCA) is a prevalent medical emergency with significant mortality. Despite algorithmic OHCA guidelines in England, substantial geographic variance in survival is reported. There are no published data on the association between individual receiving cardiac centres and outcome. The aim of this study was to compare survival-to-discharge between hospitals in a large regional cohort of Utstein-comparator patients following OHCA.

## Methods

This multi-centre observational study was performed in the East of England, 2018-2022. Following successful resuscitation, patients were conveyed by the ambulance service to one of five cardiac centres capable of providing 24/7 primary percutaneous coronary intervention. Patients who are declined by the cardiac centre are conveyed to the nearest Type-1 emergency department (T1ED).

Prospectively captured data for Utstein-comparator group ( $\geq 16$ -years-old, bystander witnessed, initial shockable rhythm, presumed cardiac aetiology) patients were included. The primary outcome was survival-to-discharge.

The following anonymised data items were retrieved: patient demographics, bystander actions, EMS process, interventions, receiving hospital, and outcome. A purposeful selection logistic regression model was used. The unadjusted odds ratios of survival in the five cardiac centres were computed, using the centre with the best survival used as the reference group. Other variables (Table 1) were explored in turn to identify the unadjusted association with the outcome.

Potential confounders were then included in a multivariate logistic regression model and sequentially eliminated until only significant variables remained. Results of the primary outcome are reported as adjusted Odds Ratios (aOR) with 95% confidence intervals; significance was pre-defined,  $p < 0.05$ . The study met UK National Institute for Health Research criteria for service evaluation and therefore ethical review was waived.

Table 1: Pre-hospital OHCA variables included in analysis

Variable	Definition
Age (years)	
Sex (male/female)	
Ethnicity	
EMS response time (minutes)	Interval between 999 (emergency) call origin and arrival of EMS
Public defibrillator used (yes/no)	
Bystander-CPR (yes/no)	
Time to ROSC (minutes)	Interval between 999-call origin and the start of a ROSC that lasted $\geq 10$ mins
Defibrillations delivered (number)	
HEMS co-attendance (yes/no)	
ROSC at hospital arrival (yes/no)	
Intubated prehospital (yes/no)	
Adrenaline administered (yes/no)	
Location of OHCA (home/not home)	
Deprivation score quintile	

## Results

During the study period 18,276 OHCA patients were identified;  $n=2407$  (13.2%) Utstein-comparator group. After predefined exclusions, 1456 patients were included in the final analysis.  $N=776$  (53.3%) patients survived-to-discharge. There was a significant difference in survival-to-discharge between receiving hospitals; range 32.3%-64.7%.  $N=862$  (59.2%) patients were transported to a cardiac centre (A, B, C, D, E), the remainder were transported to a non-specialist T1ED ('Other').

Centre C and 'Other' non-specialist centres had a significantly worse survival-to-discharge compared to Centre E (the hospital with the greatest survival), aOR 0.54 (95%CI 0.32-0.91) and aOR 0.49 (95%CI 0.30-0.80), respectively (Table 2). There was no significant relationship between number of patients per centre and survival,  $p=0.9$ .

Table 2: Multivariate regression analysis of survival to hospital discharge in Utstein comparator group patients by receiving Cardiac Centre (A,B,C,D,E), and other hospitals (Other) in the East of England, 2018-2022.

Centre	Adjusted Odds Ratio (95%CI)	p-value
E	Ref	-
A	0.66 (0.36-1.20)	0.18
B	0.78 (0.38-1.62)	0.51
C	0.54 (0.32-0.91)	0.02*
D	0.86 (0.52-1.44)	0.57
Other	0.49 (0.30-0.80)	0.004**

## Conclusion

These data demonstrate there is significant inter-hospital variability in survival-to-discharge for Utstein comparator group patients following out-of-hospital cardiac arrest in the East of England. None of the potential confounders included in the statistical model significantly affected the primary outcome and there was no observed relationship between number of patients received per centre and survival.

Therefore, the survival differences observed are unlikely to be due to differences in the prehospital resuscitation phase, but instead may represent differences in the care provided between centres following admission.

The significantly worse outcome observed in patients transported to a non-cardiac centre is somewhat reassuring in affirming the benefits of specialist centres in this cohort, and supports the national guidance on disposition post-OHCA.



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