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TRENDS IN HOSPITAL-LEVEL EFFECTS ATTRIBUTABLE TO MORTALITY AFTER ACUTE MYOCARDIAL INFARCTION: A STUDY OF 698 092 PATIENTS FROM THE MYOCARDIAL ISCHAEMIA NATIONAL AUDIT PROJECT (MINAP) 2004–2010

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Background Mortality rates after hospitalisation for acute myocardial infarction (AMI) have fallen substantially, but vary by hospital. Whilst previous studies have reported the extent to which the residual (unexplained) variance in outcomes from AMI can be attributed to patients and hospitals, there are no reports quantifying hospital level residual variation over time.

Methods We studied 698 092 patients admitted to 247 hospitals in England and Wales from 2004 through 2010 inclusive with ST-elevation myocardial infarction (STEMI) and non ST-elevation

Table 1 Patient characteristics and data misingness for 2004

2004	STEMI		NSTEMI		Missing
n=81669	Male (n=22858)	Female (n=9385)	Male (n=31026)	Female (n=18299)	0.1%
Mean age in years (SD)	62.8 (13.1)	71.4 (13.6)	69.4 (13.3)	75.8 (12.6)	0.3%
Mean SBP (SD)	134.3 (27.5)	133.6 (29.9)	140.2 (27.2)	142.9 (29.7)	15.7%
Mean heart rate (SD)	77.7 (19.7)	80.7 (21.6)	81.2 (22.3)	85.7 (22.9)	15.8%
ST deviation (%)	20665 (94.2%)	8322 (92.5%)	7884 (26.7%)	4583 (26.3%)	4.6%
Elevated enzymes (%)	21601 (94.5%)	8903 (94.9%)	29356 (94.6%)	17297 (94.5%)	0.0%
Cardiac arrest (%)	2302 (10.8%)	992 (11.3%)	1026 (3.4%)	584 (3.3%)	4.1%
Chronic renal failure (%)	583 (3.0%)	327 (4.1%)	2574 (8.8%)	1516 (8.8%)	9.4%
Loop diuretic (%)	3059 (16.8%)	1909 (25.6%)	7798 (28.5%)	6308 (38.7%)	15.1%

Table 2 Patient characteristics and data missingness for 2010

2010	STEMI		NSTEMI		Missing
n=72845	Male (n=20421)	Female (n=9352)	Male (n=25936)	Female (16393)	1.0%
Mean age in years (SD)	64 (12.8)	72.5 (12.5)	69.5 (12.9)	76 (11.9)	0.3%
Mean SBP (SD)	139.7 (29.5)	137.8 (31.5)	141.5 (29.0)	144.2 (31.5)	16.9%
Mean heart rate (SD)	77.1 (21.4)	80.4 (22.8)	83.1 (24.4)	88.3 (24.6)	15.6%
ST deviation (%)	19030 (95.6%)	8654 (95.0%)	6319 (30.3%)	4047 (31.0%)	12.6%
Elevated enzymes (%)	19915 (97.5%)	9147 (97.8%	25475 (98.2%	16094 (98.2%)	0.0%
Cardiac arrest (%)	2255 (12.2%)	1229 (14.4%)	1528 (6.5%)	978 (6.6%)	9.1%
Chronic renal failure (%)	322 (1.8%)	187 (2.3%)	1210 (5.2%)	712 (4.8%)	10.7%
Loop diuretic (%)	3646 (23.2%)	2456 (34.%)	7483 (35.2%)	6313 (47.3%)	20.4%

myocardial infarction (NSTEMI). Multiple imputation (MI) was used to handle missing data. Bayesian multi-level modelling was applied to each year of data standardising for all-cause in-hospital and 30-day mortality using covariates from the adjusted mini-GRACE risk score. Hospital volume effects were modelled. Hospital-level effects were, therefore, the proportion of variance in mortality explained by the hospital (but not attributable to case mix). Models were fitted using an uninformative half-Cauchy prior distribution over 100 000 MCMC iterations, the posterior distributions of 15 multiply imputed datasets pooled and the hospital-level effects reported with 95% credible limits (CI).

Results Tables 1 and 2 show the patient characteristics by STEMI and NSTEMI, along with the percentages of missing data before multiple imputation, for 2004 and 2010. The IQR of adjusted 30-day mortality rates was 8.3% to 12.6% in 2004 and 5.5% to 8.5% in 2010.

Figure 1 shows that for STEMI, on average only 10% and 5% of the variance in in-hospital and 30-day mortality respectively were explained by the hospital. For NSTEMI, the hospital-level effects were higher at 15% and 7% respectively. The size of the effects did not change substantially over time. Over the study period, the fixed (ORs for adjusted mini-GRACE covariates) effects for STEMI and NSTEMI mortality were constant and the models were not sensitive to choice of priors, missing data or hospital volume.

Conclusions Despite significant reduction in early mortally after AMI, early mortality rates vary in England and Wales. However, the residual variation in mortality rates attributable hospital effects appears small, and therefore could be explained by the used of evidence-based medications and interventions.

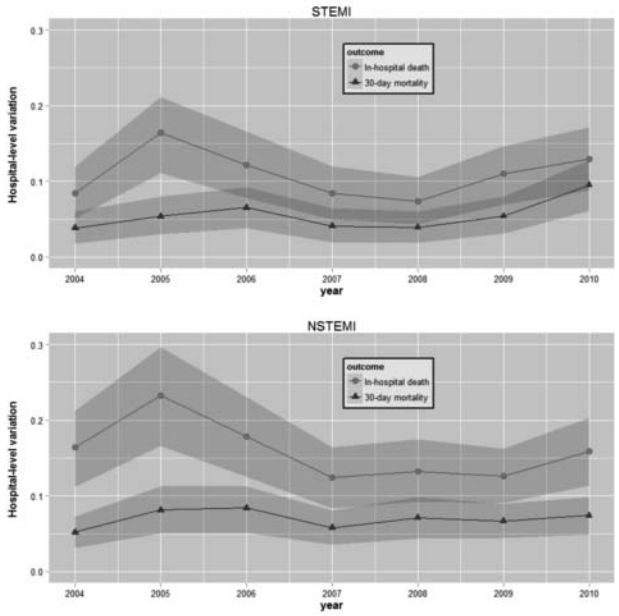

Figure 1 Adjusted hospital-level variation in in-hospital and 30-day mortality for STEMI and NSTEMI.