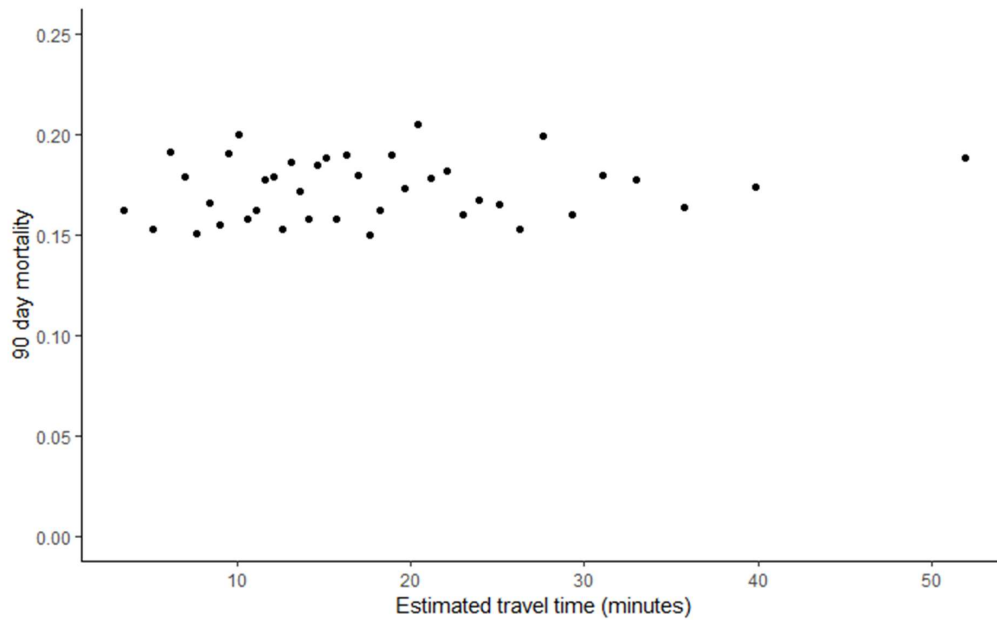
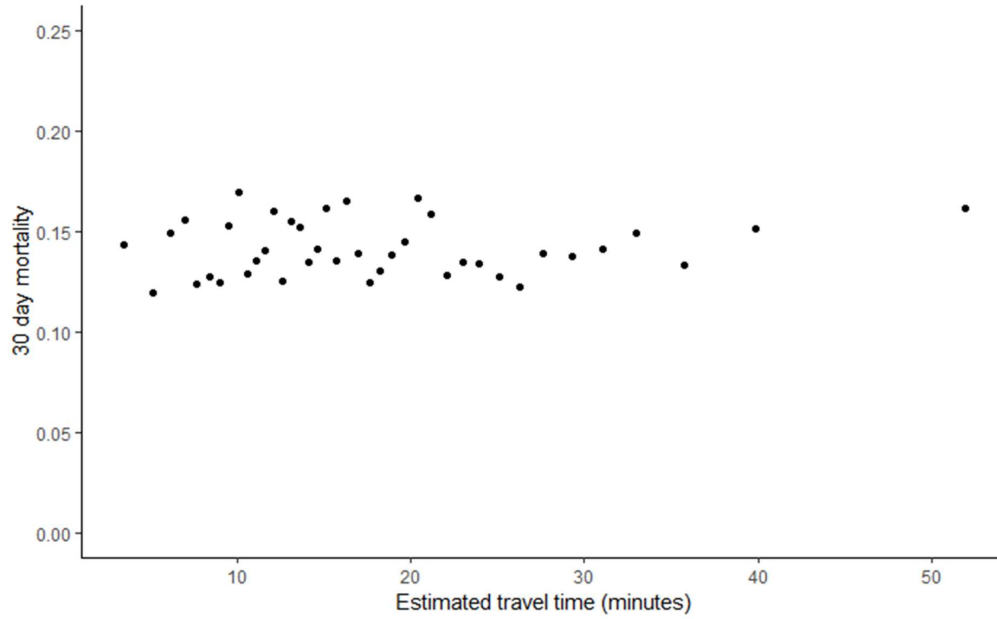


Supplementary Figure 1 | The relationship between estimated travel time and mortality

Figure produced by grouping 22 772 patients into 40 approximately equal sized groups defined by percentiles of estimated travel time and plotting against the proportion of (unadjusted) mortality in each group.



Supplementary Figure 2| Directed Acyclic Graph showing relationships between variables and groups of variables. Variables on the causal path shown in green were not included in the study model as possible mediators of any distance effect.

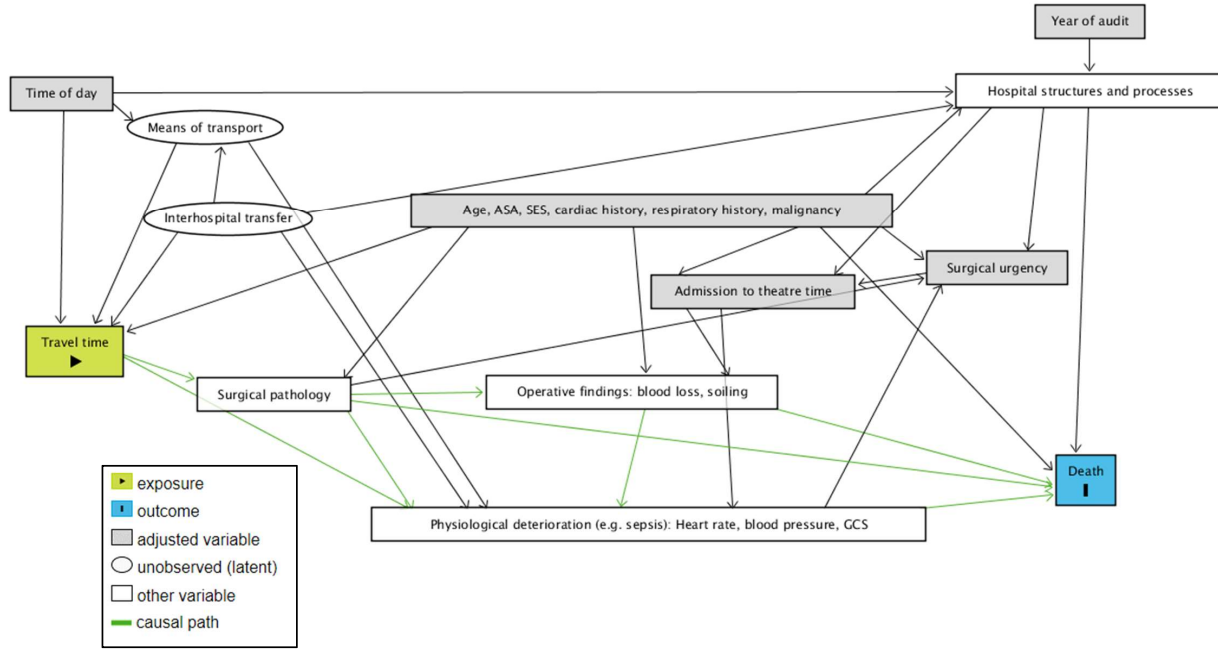


Figure produced using DAGitty version 3.0 ([www.dagitty.net](http://www.dagitty.net)).

| <i>Supplementary Table 1   Selection of covariates from the NELA risk adjustment model</i>                           |             |   |                         |
|--|-------------|---|-------------------------|
| Candidate variable   |             | Transformation  | Included in study model |
| <b>Demographic</b>   |             |   |                         |
| Age  | Continuous  | Rescaled, Linear + quadratic  | Yes                     |
| Sex  | Categorical |   | Yes                     |
| Year of audit  | Categorical |   | Yes                     |
| <b>Preoperative</b>  |             |   |                         |
| ASA  | Ordinal     | ASA 1 & 2 combined  | Yes                     |
| Urgency  | Ordinal     | “Within 6 hours” and “emergency delayed for resuscitation” combined | Yes                     |
| ECG  | Ordinal     |   | No †                    |
| Respiratory history  | Ordinal     | Limiting dyspnoea and dyspnoea at rest combined                     | Yes                     |
| Cardiac signs  | Ordinal     |   | Yes                     |
| <b>Physiological</b>   |             |   |                         |
| Creatinine   | Continuous  |   | No †                    |
| Sodium   | Continuous  |   | No †                    |
| Potassium  | Continuous  |   | No †                    |
| Urea   | Continuous  |   | No †                    |
| White blood cell count   | Continuous  |   | No †                    |
| Haemoglobin  | Continuous  |   | No †                    |
| Pulse  | Continuous  |   | No †                    |
| Systolic blood pressure  | Continuous  |   | No †                    |
| GCS  | Ordinal     | 3–8 and 9 - 13 grouped  | No †                    |
| <b>Perioperative</b>   |             |   |                         |
| Soiling  | Ordinal     |   | No †                    |
| Blood loss   | Ordinal     |   | No †                    |
| Malignancy   | Ordinal     |   | Yes                     |
| Operative severity   | Ordinal     |   | No †                    |
| Number of procedures   | Categorical |   | No ‡                    |
| <b>Interaction effects</b>   |             |   |                         |
| Age * ASA  |             |   | Yes                     |
| ASA * respiratory signs  |             |   | Yes                     |
| <b>Variables not included in the NELA risk adjustment model</b>  |             |   |                         |
| Estimated travel time  | Continuous  | Linear  | Yes                     |
| Index of multiple deprivation  | Ordinal     |   | Yes                     |
| Time from admission to theatre *   | Continuous  | Categorised by number of days                                       | Yes                     |
| Time of hospital admission   | Clock time  | Categorised into 4-hour intervals                                   | Yes                     |
| * categorised due to high frequency of missing data † causative pathway with distance ‡ multiple procedures excluded |             |   |                         |
| ASA = American Society of Anesthesiologists physical status classification system, GCS = Glasgow coma scale,         |             |   |                         |

| <i>Supplementary Table 2   Missing data and multiple imputation of missing data</i>   |                                      |               |       |   |              |       |
|---|--------------------------------------|---------------|-------|---|--------------|-------|
| <b>Comparison between exposure and outcome variables by presence of missing data</b>  |                                      |               |       |   |              |       |
|   | <b>Complete records (n = 21 901)</b> |               |       | <b>Missing data in any covariate of study model (n = 871)</b> |              |       |
| Median travel time, minutes (IQR)   | 16.0 (10.9 to 23.4)                  |               |       | 16.2 (10.1 to 24.4)   |              |       |
| 30 day mortality, n (%)   | 3 119 (14.2)                         |               |       | 105 (12.1)  |              |       |
| 90 day mortality, n (%)   | 3 806 (17.4)                         |               |       | 134 (15.4)  |              |       |
| <b>Multiple imputation</b>  |                                      |               |       |   |              |       |
| Ordinal data were imputed using ordered logistic regression and continuous data (non-parametric) using predictive mean matching.  |                                      |               |       |   |              |       |
| Variables included in the imputation model: Age, age <sup>2</sup> , sex, year of audit, ASA, urgency, ECG signs, cardiac history, respiratory history, creatinine (196), sodium (48), potassium, urea, white blood count, haemoglobin, pulse rate, systolic blood pressure, Glasgow coma scale, soiling, blood loss, malignancy, operative severity, travel time, index of multiple deprivation, time of admission, time from admission to theatre, 30 day mortality, 90 day mortality. |                                      |               |       |   |              |       |
| The frequency of missing data for variables in the study models and imputation model are shown below:   |                                      |               |       |   |              |       |
|   | Type                                 | n (%) missing |       | Imputation method   |              |       |
| <b>Missing data in variables used in study models</b>   |                                      |               |       |   |              |       |
| Index of multiple deprivation   | Ordinal                              | 655 (2.9)     |       | Ordered logistic regression                                   |              |       |
| Respiratory history   | Ordinal                              | 103 (0.4)     |       | Ordered logistic regression                                   |              |       |
| Cardiac history   | Ordinal                              | 100 (0.4)     |       | Ordered logistic regression                                   |              |       |
| Malignancy  | Ordinal                              | 100 (0.4)     |       | Ordered logistic regression                                   |              |       |
| <b>Missing data in variables not included in the study models</b>   |                                      |               |       |   |              |       |
| ECG signs   | Ordinal                              | 156 (0.69)    |       | Ordered logistic regression                                   |              |       |
| Creatinine  | Continuous                           | 196 (0.86)    |       | Predictive mean matching                                      |              |       |
| Sodium  | Continuous                           | 48 (0.21)     |       | Predictive mean matching                                      |              |       |
| Potassium   | Continuous                           | 159 (0.70)    |       | Predictive mean matching                                      |              |       |
| Urea  | Continuous                           | 359 (1.58)    |       | Predictive mean matching                                      |              |       |
| White cell count  | Continuous                           | 81 (0.36)     |       | Predictive mean matching                                      |              |       |
| Haemoglobin   | Continuous                           | 48 (0.21)     |       | Predictive mean matching                                      |              |       |
| Pulse rate  | Continuous                           | 213 (0.94)    |       | Predictive mean matching                                      |              |       |
| Systolic blood pressure   | Continuous                           | 239 (1.05)    |       | Predictive mean matching                                      |              |       |
| Glasgow coma scale  | Ordinal                              | 139 (0.61)    |       | Ordered logistic regression                                   |              |       |
| Soiling   | Ordinal                              | 116 (0.51)    |       | Ordered logistic regression                                   |              |       |
| Blood loss  | Ordinal                              | 220 (0.97)    |       | Ordered logistic regression                                   |              |       |
| <b>Results of regression models obtained without imputation (complete case analysis): Relationship between estimated travel time (per 10 minutes) and mortality</b>   |                                      |               |       |   |              |       |
|   | <b>30 day mortality</b>              |               |       | <b>90 day mortality</b>                                       |              |       |
|   | OR                                   | CI            | p     | OR  | CI           | P     |
| <b>Surgical urgency within six hours (n = 21 901)</b>   |                                      |               |       |   |              |       |
| Unadjusted  | 1.01                                 | 0.97 to 1.05  | 0.604 | 1.01  | 0.98 to 1.05 | 0.482 |
| Patient level model   | 1.00                                 | 0.96 to 1.05  | 0.898 | 1.01  | 0.97 to 1.05 | 0.734 |
| Multilevel model  | 1.01                                 | 0.97 to 1.06  | 0.699 | 1.01  | 0.97 to 1.06 | 0.541 |
| <b>Surgical urgency within two hours (n = 5 168)</b>  |                                      |               |       |   |              |       |
| Unadjusted  | 1.04                                 | 0.98 to 1.11  | 0.225 | 1.03  | 0.97 to 1.09 | 0.341 |
| Patient level model   | 1.02                                 | 0.95 to 1.09  | 0.643 | 1.00  | 0.93 to 1.07 | 0.999 |
| Multilevel model  | 1.02                                 | 0.94 to 1.10  | 0.653 | 1.00  | 0.93 to 1.08 | 0.991 |
| OR = odds ratio, CI = 95% confidence interval, IQR = interquartile range  |                                      |               |       |   |              |       |
| Adjusting variables in patient level model: age, age <sup>2</sup> , ASA, respiratory history, cardiac history, malignancy, sex, index of multiple deprivation, audit year, time of hospital admission, time from admission to theatre, age * ASA, respiratory history * ASA.  |                                      |               |       |   |              |       |
| Multilevel model: patient level model variables and random intercept term for hospital.   |                                      |               |       |   |              |       |

*Supplementary Table 3 | Hospital structural characteristics*

|   | <b>Road distance to closest other hospital that accepts emergency general surgical admissions</b> |                    |                    |                  |
|---|---|--------------------|--------------------|------------------|
|   | <b>0 to 15 km</b>   | <b>15 to 30 km</b> | <b>30 to 50 km</b> | <b>50+ km</b>    |
| n   | 62  | 60                 | 35                 | 14               |
| Case volume, median (IQR)*  | 52 (29 to 66)   | 59 (44 to 76)      | 63 (50 to 84)      | 50 (34 to 88)    |
| Adult inpatient beds, median (IQR)                                    | 516 (381 to 723)  | 513 (364 to 643)   | 500 (374 to 597)   | 378 (244 to 466) |
| Adult inpatient gastrointestinal surgery beds, median (IQR)           | 70 (50 to 95)   | 73 (59 to 99)      | 76 (56 to 99)      | 67 (50 to 88)    |
| Dedicated acute surgical assessment unit, n (%)                       | 38 (61.3)   | 43 (71.7)          | 24 (68.6)          | 10 (71.4)        |
| Inpatient emergency surgical unit, n (%)                              | 21 (33.8)   | 24 (40.0)          | 13 (37.1)          | 3 (21.4)         |
| General surgical ambulatory care unit, n (%)                          | 41 (66.1)   | 38 (63.3)          | 14 (40.0)          | 6 (42.9)         |
| Elderly medicine service, n (%)                                       | 61 (98.4)   | 57 (95.0)          | 34 (97.1)          | 14 (100.0)       |
| Tertiary referral centre for gastrointestinal surgery, n (%)          | 33 (53.2)   | 18 (30.0)          | 9 (25.7)           | 1 (7.1)          |
| Critical care unit with 24 hour critical care consultant cover, n (%) | 60 (96.8)   | 55 (91.7)          | 31 (88.6)          | 11 (78.6)        |

\*case volume is number of urgent (< 6hour) cases performed in the audit year 2015-2016, IQR = interquartile range

| <i>Supplementary Table 4   Multilevel logistic regression model (surgery within six hours) for 30 and 90 day mortality</i> |                  |                |        |                  |                |        |
|--|------------------|----------------|--------|------------------|----------------|--------|
| Predictors   | 30 day mortality |                |        | 90 day mortality |                |        |
|  | OR               | CI             | P      | OR               | CI             | P      |
| Age  | 1.81             | 1.23 to 2.68   | 0.003  | 1.65             | 1.16 to 2.35   | 0.006  |
| Age <sup>2</sup>   | 1.64             | 1.19 to 2.28   | 0.003  | 1.68             | 1.24 to 2.28   | 0.001  |
| ASA 1 or 2   | REF              |                |        | REF              |                |        |
| ASA 3  | 2.79             | 2.32 to 3.37   | <0.001 | 2.94             | 2.51 to 3.45   | <0.001 |
| ASA 4  | 13.20            | 11.10 to 15.70 | <0.001 | 12.18            | 10.45 to 14.20 | <0.001 |
| ASA 5  | 53.18            | 40.82 to 69.29 | <0.001 | 46.39            | 35.86 to 60.01 | <0.001 |
| No dyspnoea  | REF              |                |        | REF              |                |        |
| Dyspnoea on exertion / mild COPD   | 1.70             | 1.22 to 2.35   | 0.001  | 1.60             | 1.19 to 2.14   | 0.002  |
| Limiting or dyspnoea at rest   | 3.40             | 1.93 to 6.01   | <0.001 | 3.71             | 2.22 to 6.20   | <0.001 |
| No failure   | REF              |                |        | REF              |                |        |
| Diuretic, digoxin, antianginal or antihypertensive therapy   | 1.07             | 0.97 to 1.18   | 0.201  | 1.08             | 0.98 to 1.19   | 0.113  |
| Oedema, warfarin or borderline cardiomegaly  | 1.18             | 1.00 to 1.38   | 0.046  | 1.26             | 1.08 to 1.47   | 0.003  |
| Raised JVP or cardiomegaly   | 1.27             | 0.97 to 1.67   | 0.086  | 1.36             | 1.04 to 1.78   | 0.023  |
| Female   | 1.01             | 0.93 to 1.10   | 0.874  | 0.99             | 0.92 to 1.08   | 0.878  |
| Hospital admission 00:00 to 03:59  | REF              |                |        | REF              |                |        |
| Hospital admission 04:00 to 07:59  | 1.01             | 0.84 to 1.21   | 0.917  | 0.99             | 0.83 to 1.17   | 0.873  |
| Hospital admission 08:00 to 11:59  | 1.08             | 0.92 to 1.27   | 0.335  | 1.05             | 0.91 to 1.22   | 0.505  |
| Hospital admission 12:00 to 15:59  | 1.01             | 0.87 to 1.17   | 0.918  | 0.99             | 0.86 to 1.13   | 0.835  |
| Hospital admission 16:00 to 19:59  | 1.08             | 0.93 to 1.26   | 0.298  | 1.02             | 0.88 to 1.17   | 0.790  |
| Hospital admission 20:00 to 23:59  | 1.08             | 0.92 to 1.26   | 0.330  | 1.05             | 0.91 to 1.22   | 0.475  |
| IMD 1 = least deprived   | REF              |                |        | REF              |                |        |
| IMD 2  | 1.17             | 1.02 to 1.34   | 0.027  | 1.13             | 0.99 to 1.28   | 0.071  |
| IMD 3  | 1.10             | 0.96 to 1.27   | 0.180  | 1.10             | 0.96 to 1.25   | 0.167  |
| IMD 4  | 1.15             | 1.00 to 1.32   | 0.058  | 1.14             | 1.00 to 1.30   | 0.044  |
| IMD 5 = most deprived  | 1.36             | 1.18 to 1.57   | <0.001 | 1.32             | 1.15 to 1.50   | <0.001 |
| Audit year 1   | REF              |                |        | REF              |                |        |
| Audit year 2   | 0.98             | 0.88 to 1.09   | 0.691  | 0.95             | 0.87 to 1.05   | 0.341  |
| Audit year 3   | 0.99             | 0.89 to 1.09   | 0.802  | 0.98             | 0.89 to 1.08   | 0.697  |
| Surgery within 24hrs of admission  | REF              |                |        | REF              |                |        |
| 24-48hrs   | 0.86             | 0.77 to 0.95   | 0.003  | 0.88             | 0.80 to 0.97   | 0.010  |
| No malignancy  | REF              |                |        | REF              |                |        |
| Primary only   | 1.10             | 0.95 to 1.28   | 0.205  | 1.21             | 1.05 to 1.39   | 0.007  |
| Nodal metastases   | 1.28             | 1.01 to 1.62   | 0.038  | 1.90             | 1.54 to 2.33   | <0.001 |
| Distant metastases   | 2.29             | 1.95 to 2.69   | <0.001 | 4.20             | 3.63 to 4.87   | <0.001 |
| Estimated travel time  | 1.02             | 0.97 to 1.06   | 0.512  | 1.02             | 0.97 to 1.06   | 0.472  |
| Age * ASA3   | 0.59             | 0.49 to 0.71   | <0.001 | 0.59             | 0.51 to 0.70   | <0.001 |
| Age * ASA4   | 0.46             | 0.39 to 0.55   | <0.001 | 0.51             | 0.44 to 0.60   | <0.001 |
| Age * ASA5   | 0.43             | 0.34 to 0.54   | <0.001 | 0.47             | 0.38 to 0.60   | <0.001 |
| ASA3 * mild COPD   | 0.84             | 0.58 to 1.22   | 0.358  | 0.89             | 0.64 to 1.24   | 0.500  |
| ASA4 * mild COPD   | 0.72             | 0.51 to 1.04   | 0.078  | 0.77             | 0.55 to 1.07   | 0.119  |
| ASA5 * mild COPD   | 0.53             | 0.31 to 0.89   | 0.016  | 0.52             | 0.32 to 0.87   | 0.013  |
| ASA3 * limiting dyspnoea   | 0.62             | 0.34 to 1.13   | 0.119  | 0.52             | 0.30 to 0.90   | 0.020  |
| ASA4 * limiting dyspnoea   | 0.39             | 0.22 to 0.71   | 0.002  | 0.37             | 0.22 to 0.62   | <0.001 |
| ASA5 * limiting dyspnoea   | 0.36             | 0.18 to 0.72   | 0.004  | 0.34             | 0.18 to 0.64   | 0.001  |
| <b>Random Effects</b>  |                  |                |        |                  |                |        |
| Random intercept (hospital)  | 0.02             |                |        | 0.03             |                |        |
| Observations   | 22 772           |                |        | 22 772           |                |        |

Supplementary Table 5 | Multilevel logistic regression model (surgery within two hours) for 30 and 90 day mortality

| Predictors   | 30 day mortality |                |        | 90 day mortality |                |        |
|--|------------------|----------------|--------|------------------|----------------|--------|
|  | OR               | CI             | P      | OR               | CI             | P      |
| Age  | 1.35             | 0.75 to 2.41   | 0.318  | 1.32             | 0.76 to 2.31   | 0.322  |
| Age <sup>2</sup>   | 1.88             | 1.13 to 3.12   | 0.014  | 1.96             | 1.21 to 3.16   | 0.006  |
| ASA 1 or 2   | REF              |                |        | REF              |                |        |
| ASA 3  | 1.55             | 1.11 to 2.16   | 0.011  | 1.87             | 1.38 to 2.53   | <0.001 |
| ASA 4  | 6.98             | 5.30 to 9.18   | <0.001 | 7.13             | 5.48 to 9.26   | <0.001 |
| ASA 5  | 22.22            | 15.61 to 31.63 | <0.001 | 21.86            | 15.45 to 30.94 | <0.001 |
| No dyspnoea  | REF              |                |        | REF              |                |        |
| Dyspnoea on exertion / mild COPD                           | 2.16             | 1.17 to 3.98   | 0.014  | 2.18             | 1.22 to 3.92   | 0.009  |
| Limiting or dyspnoea at rest                               | 3.65             | 1.32 to 10.11  | 0.013  | 3.32             | 1.20 to 9.20   | 0.021  |
| No failure   | REF              |                |        | REF              |                |        |
| Diuretic, digoxin, antianginal or antihypertensive therapy | 1.04             | 0.87 to 1.23   | 0.684  | 1.09             | 0.93 to 1.29   | 0.294  |
| Oedema, warfarin or borderline cardiomegaly                | 1.25             | 0.95 to 1.64   | 0.115  | 1.38             | 1.05 to 1.81   | 0.020  |
| Raised JVP or cardiomegaly                                 | 1.18             | 0.73 to 1.92   | 0.494  | 1.16             | 0.72 to 1.88   | 0.542  |
| Female   | 0.93             | 0.81 to 1.07   | 0.295  | 0.88             | 0.77 to 1.01   | 0.076  |
| Hospital admission 00:00 to 03:59                          | REF              |                |        | REF              |                |        |
| Hospital admission 04:00 to 07:59                          | 1.06             | 0.79 to 1.43   | 0.682  | 1.15             | 0.86 to 1.53   | 0.336  |
| Hospital admission 08:00 to 11:59                          | 1.15             | 0.88 to 1.50   | 0.297  | 1.15             | 0.89 to 1.49   | 0.291  |
| Hospital admission 12:00 to 15:59                          | 1.17             | 0.91 to 1.50   | 0.224  | 1.16             | 0.91 to 1.48   | 0.239  |
| Hospital admission 16:00 to 19:59                          | 1.09             | 0.85 to 1.40   | 0.508  | 1.08             | 0.84 to 1.38   | 0.560  |
| Hospital admission 20:00 to 23:59                          | 1.12             | 0.86 to 1.45   | 0.404  | 1.19             | 0.92 to 1.53   | 0.189  |
| IMD 1 = least deprived                                     | REF              |                |        | REF              |                |        |
| IMD 2  | 1.13             | 0.90 to 1.43   | 0.297  | 1.15             | 0.91 to 1.44   | 0.237  |
| IMD 3  | 1.08             | 0.86 to 1.36   | 0.518  | 1.10             | 0.88 to 1.38   | 0.390  |
| IMD 4  | 1.10             | 0.87 to 1.40   | 0.420  | 1.10             | 0.87 to 1.38   | 0.438  |
| IMD 5 = most deprived                                      | 1.26             | 1.00 to 1.59   | 0.052  | 1.26             | 1.01 to 1.58   | 0.041  |
| Audit year 1   | REF              |                |        | REF              |                |        |
| Audit year 2   | 1.07             | 0.90 to 1.27   | 0.449  | 0.99             | 0.84 to 1.17   | 0.920  |
| Audit year 3   | 1.07             | 0.90 to 1.27   | 0.443  | 0.99             | 0.84 to 1.17   | 0.909  |
| Surgery within 24hrs of admission                          | REF              |                |        | REF              |                |        |
| 24-48hrs   | 1.02             | 0.84 to 1.23   | 0.878  | 0.93             | 0.77 to 1.12   | 0.432  |
| No malignancy  | REF              |                |        | REF              |                |        |
| Primary only   | 1.03             | 0.78 to 1.36   | 0.813  | 1.15             | 0.88 to 1.51   | 0.295  |
| Nodal metastases   | 1.52             | 0.95 to 2.43   | 0.081  | 1.97             | 1.25 to 3.11   | 0.003  |
| Distant metastases   | 2.33             | 1.65 to 3.27   | <0.001 | 3.61             | 2.57 to 5.06   | <0.001 |
| Estimated travel time                                      | 1.02             | 0.95 to 1.10   | 0.574  | 1.01             | 0.94 to 1.08   | 0.858  |
| Age * ASA3   | 0.84             | 0.61 to 1.16   | 0.294  | 0.70             | 0.52 to 0.94   | 0.018  |
| Age * ASA4   | 0.61             | 0.47 to 0.80   | <0.001 | 0.59             | 0.45 to 0.76   | <0.001 |
| Age * ASA5   | 0.50             | 0.36 to 0.70   | <0.001 | 0.51             | 0.37 to 0.70   | <0.001 |
| ASA3 * mild COPD   | 0.82             | 0.40 to 1.66   | 0.582  | 0.82             | 0.42 to 1.61   | 0.570  |
| ASA4 * mild COPD   | 0.60             | 0.31 to 1.16   | 0.127  | 0.62             | 0.33 to 1.17   | 0.138  |
| ASA5 * mild COPD   | 0.36             | 0.16 to 0.79   | 0.012  | 0.36             | 0.16 to 0.78   | 0.010  |
| ASA3 * limiting dyspnoea                                   | 0.66             | 0.22 to 1.97   | 0.461  | 0.68             | 0.23 to 2.00   | 0.485  |
| ASA4 * limiting dyspnoea                                   | 0.37             | 0.13 to 1.06   | 0.064  | 0.44             | 0.15 to 1.24   | 0.119  |
| ASA5 * limiting dyspnoea                                   | 0.37             | 0.12 to 1.13   | 0.080  | 0.42             | 0.14 to 1.30   | 0.134  |
| <b>Random Effects</b>                                      |                  |                |        |                  |                |        |
| Random intercept (hospital)                                | 0.05             |                |        | 0.06             |                |        |
| Observations   | 5 386            |                |        | 5 386            |                |        |

*Supplementary Table 6 | Sensitivity analysis of the relationship between travel time (per 10 minutes) and mortality without limiting to 5 closest hospitals (travel time variable not winsorised)*

|   | 30 day mortality |              |       | 90 day mortality |              |       |
|---|------------------|--------------|-------|------------------|--------------|-------|
|   | OR               | CI           | p     | OR               | CI           | P     |
| <b>Surgical urgency within six hours (n = 23 851)</b> |                  |              |       |                  |              |       |
| Unadjusted  | 0.98             | 0.96 to 0.99 | 0.005 | 0.97             | 0.96 to 0.99 | 0.001 |
| Patient level model                                   | 0.99             | 0.97 to 1.01 | 0.187 | 0.99             | 0.97 to 1.00 | 0.092 |
| Multilevel model                                      | 0.99             | 0.97 to 1.01 | 0.272 | 0.99             | 0.97 to 1.00 | 0.141 |
| <b>Surgical urgency within two hours (n = 5 656)</b>  |                  |              |       |                  |              |       |
| Unadjusted  | 0.98             | 0.95 to 1.00 | 0.105 | 0.98             | 0.95 to 1.00 | 0.061 |
| Patient level model                                   | 0.99             | 0.95 to 1.02 | 0.382 | 0.98             | 0.95 to 1.01 | 0.263 |
| Multilevel model                                      | 0.99             | 0.95 to 1.02 | 0.380 | 0.98             | 0.95 to 1.01 | 0.271 |

OR = odds ratio, CI = 95% confidence interval  
 Adjusting variables in patient level model: age, age<sup>2</sup>, ASA, respiratory history, cardiac history, malignancy, sex, index of multiple deprivation, audit year, time of hospital admission, time from admission to theatre, age \* ASA, respiratory history \* ASA.  
 Multilevel model: patient level model variables and random intercept term for hospital.

*Supplementary Table 7 | Sensitivity analysis of the relationship between travel time (per 10 minutes) and mortality for patients that attended their closest hospital only (travel time variable not winsorised)*

|   | 30 day mortality |              |       | 90 day mortality |              |       |
|---|------------------|--------------|-------|------------------|--------------|-------|
|   | OR               | CI           | p     | OR               | CI           | P     |
| <b>Surgical urgency within six hours (n = 18 529)</b> |                  |              |       |                  |              |       |
| Unadjusted  | 1.00             | 0.96 to 1.05 | 0.869 | 1.01             | 0.96 to 1.05 | 0.805 |
| Patient level model                                   | 0.99             | 0.94 to 1.05 | 0.753 | 0.99             | 0.94 to 1.04 | 0.727 |
| Multilevel model                                      | 1.00             | 0.95 to 1.06 | 0.989 | 1.00             | 0.95 to 1.05 | 0.991 |
| <b>Surgical urgency within two hours (n = 4 353)</b>  |                  |              |       |                  |              |       |
| Unadjusted  | 1.01             | 0.94 to 1.09 | 0.773 | 1.00             | 0.93 to 1.08 | 0.919 |
| Patient level model                                   | 0.98             | 0.90 to 1.07 | 0.659 | 0.97             | 0.89 to 1.05 | 0.425 |
| Multilevel model                                      | 0.98             | 0.90 to 1.07 | 0.674 | 0.97             | 0.89 to 1.05 | 0.443 |

OR = odds ratio, CI = 95% confidence interval  
 Adjusting variables in patient level model: age, age<sup>2</sup>, ASA, respiratory history, cardiac history, malignancy, sex, index of multiple deprivation, audit year, time of hospital admission, time from admission to theatre, age \* ASA, respiratory history \* ASA.  
 Multilevel model: patient level model variables and random intercept term for hospital.

*Supplementary Table 8 | Estimated travel time to hospital grouped by surgical urgency category*

|   | Surgical urgency                            |                               |                      | p = 0.382 |
|---|---|-------------------------------|----------------------|-----------|
|   | Emergency surgery delayed for resuscitation | Immediate (less than 2 hours) | Urgent (2 – 6 hours) |           |
| Estimated travel time, mins, median (IQR) | 16.9 (11.1 to 23.6)                         | 16.0 (10.9 to 23.7)           | 15.9 (10.8 to 23.4)  |           |
| IQR = interquartile range                 |   |                               |                      |           |