Supplemental material

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**Table S1: Multilevel multivariable logistic regression models of factors associated with in-hospital mortality for each period based on multiple imputation**

| Variable | March-May (odds ratio, 95% CI) | June-September (odds ratio, 95% CI) |
|---|---|---|
| **Age band (years)** | | |
| 18-39 | 1 (reference) | 1 (reference) |
| **40-49** | **2.28 (1.96 to 2.67)** | **2.71 (2.41 to 3.04)** |
| **50-59** | **4.69 (4.08 to 5.39)** | **5.15 (4.64 to 5.73)** |
| **60-69** | **8.87 (7.75 to 10.16)** | **10.94 (9.87 to 12.12)** |
| **70-79** | **14.76 (12.9 to 16.88)** | **18.24 (16.47 to 20.2)** |
| **≥ 80** | **21.51 (18.82 to 24.6)** | **28.87 (26.08 to 31.97)** |
| **Sex** | | |
| Female | 1 (reference) | 1 (reference) |
| Male | **1.47 (1.42 to 1.51)** | **1.44 (1.41 to 1.47)** |
| **Deprivation quintile** | | |
| 5 (least deprived) | 1 (reference) | 1 (reference) |
| 4 | 1.02 (0.97 to 1.07) | 1.00 (0.97 to 1.04) |
| 3 | **1.06 (1.01 to 1.12)** | **1.04 (1.00 to 1.07)** |
| 2 | 1.04 (0.99 to 1.09) | **1.03 (1.00 to 1.07)** |
| 1 (most deprived) | **1.06 (1.01 to 1.11)** | **1.05 (1.01 to 1.09)** |
| **Ethnicity** | | |
| White | 1 (reference) | 1 (reference) |
| Bangladeshi | **1.49 (1.21 to 1.82)** | **1.62 (1.45 to 1.80)** |
| Indian | **1.22 (1.11 to 1.33)** | **1.31 (1.23 to 1.40)** |
| Pakistani | **1.20 (1.08 to 1.33)** | **1.22 (1.14 to 1.31)** |
| Other Asian | **1.12 (1.01 to 1.24)** | **1.23 (1.14 to 1.32)** |
| Black African | 1.03 (0.92 to 1.15) | 1.08 (0.96 to 1.20) |
| Black Caribbean | **1.19 (1.08 to 1.31)** | 0.92 (0.84 to 1.01) |
| Other Black | **1.25 (1.07 to 1.46)** | 0.99 (0.86 to 1.14) |
| Mixed | **1.29 (1.09 to 1.52)** | 1.03 (0.89 to 1.18) |
| Other | 1.03 (0.95 to 1.13) | 0.99 (0.92 to 1.07) |
| **Charlson Comorbidity Index items\*** | | |
| Peripheral vascular disease | **1.18 (1.12 to 1.25)** | **1.28 (1.23 to 1.33)** |
| Congestive heart failure | **1.54 (1.48 to 1.59)** | **1.82 (1.78 to 1.87)** |
| Acute myocardial infarction | **1.08 (1.03 to 1.13)** | **1.20 (1.16 to 1.24)** |
| Cerebrovascular disease | **1.06 (1.01 to 1.11)** | **1.12 (1.09 to 1.16)** |
| Dementia | **1.39 (1.34 to 1.44)** | **1.43 (1.39 to 1.47)** |
| Chronic pulmonary disease | **1.08 (1.05 to 1.12)** | **1.31 (1.28 to 1.34)** |
| Connective tissue disease/rheumatic disease | **1.17 (1.08 to 1.26)** | **1.21 (1.15 to 1.28)** |
| Peptic ulcer | 1.00 (0.85 to 1.17) | **1.15 (1.04 to 1.27)** |
| Mild liver disease | 0.94 (0.87 to 1.02) | **1.11 (1.05 to 1.17)** |
| Moderate or severe liver disease | **4.67 (4.12 to 5.29)** | **5.13 (4.71 to 5.59)** |
| Diabetes without chronic complications | **1.12 (1.09 to 1.16)** | **1.06 (1.04 to 1.09)** |
| Diabetes with chronic complications | **1.19 (1.10 to 1.29)** | **1.12 (1.06 to 1.19)** |
| Paraplegia and hemiplegia | **1.11 (1.06 to 1.16)** | **1.15 (1.12 to 1.19)** |
| Renal disease | **1.16 (1.14 to 1.18)** | **1.22 (1.21 to 1.24)** |
| Primary cancer | **1.51 (1.43 to 1.59)** | **1.60 (1.54 to 1.66)** |
| Metastatic carcinoma | **1.98 (1.83 to 2.13)** | **2.59 (2.46 to 2.72)** |
| Obesity | **1.34 (1.27 to 1.42)** | **1.42 (1.37 to 1.47)** |

Multiple imputation was implemented using the 'mi' command in Stata. A multiple imputation by chained equations (MICE) algorithm was used since the values to be imputed were categorical. Given the small number of missing values, five imputed datasets were used, and the imputation model was based on age band only to avoid over fitting.

Models are multilevel, multivariable models that included each of the variables listed as fixed effects and for NHS hospital trust as a random effect.

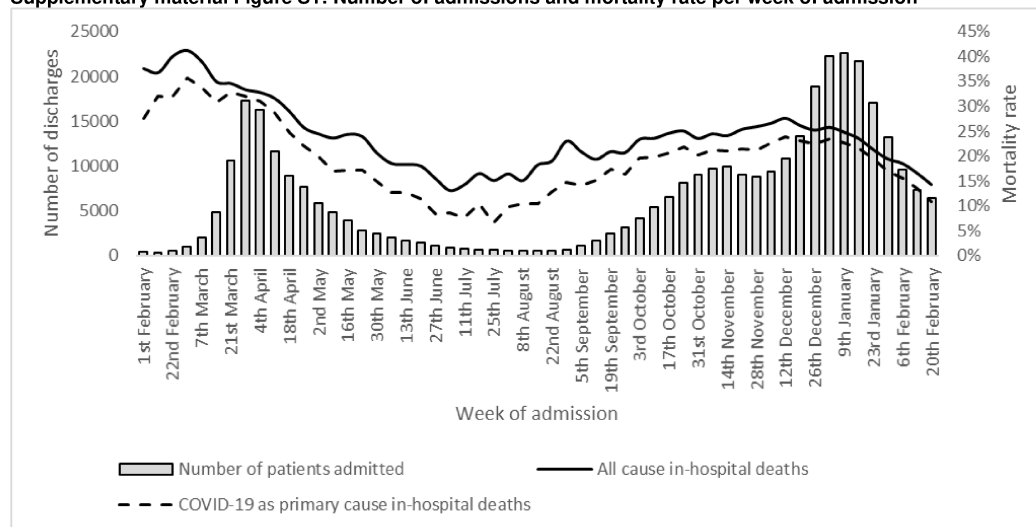A stable odds ratio for the comorbidity HIV/AIDS could not be calculated due to small numbers.

\* For Charlson Comorbidity Index items, the reference category is patients without the specified comorbidity. For Charlson Comorbidity Index items relating to liver disease, diabetes and cancer, three mutually exclusive categories were used.

**Supplementary material Table S2: Multilevel logistic regression model of in-hospital mortality for variables modelled as categorical or linear terms**
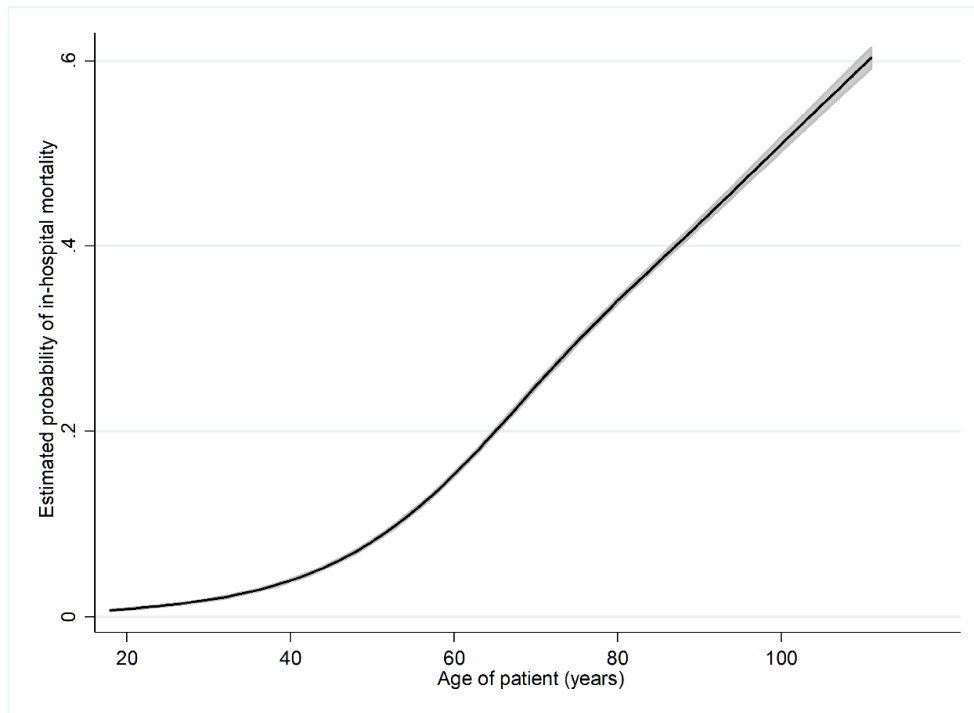
| Variable | Odds ratios (95% CIs) |
|---|---|
| **Index of multiple deprivation score** | 1.00 (1.00 to 1.00) |
| **Sex** | |
| Female | 1 (reference) |
| Male | **1.47 (1.45 to 1.50)** |
| **Ethnicity** | |
| White | 1 (reference) |
| Bangladeshi | **1.64 (1.49 to 1.81)** |
| Indian | **1.31 (1.25 to 1.39)** |
| Pakistani | **1.27 (1.20 to 1.35)** |
| Other Asian | **1.24 (1.16 to 1.32)** |
| Black African | 1.08 (1.00 to 1.17) |
| Black Caribbean | 0.98 (0.91 to 1.05) |
| Other Black | 1.10 (0.98 to 1.22) |
| Mixed | **1.14 (1.03 to 1.27)** |
| Other | 1.01 (0.95 to 1.07) |
| **Charlson Comorbidity Index items*** | |
| Peripheral vascular disease | **1.28 (1.24 to 1.32)** |
| Congestive heart failure | **1.74 (1.70 to 1.78)** |
| Acute myocardial infarction | **1.15 (1.12 to 1.18)** |
| Cerebrovascular disease | **1.12 (1.09 to 1.15)** |
| Dementia | **1.40 (1.37 to 1.43)** |
| Chronic pulmonary disease | **1.25 (1.23 to 1.28)** |
| Connective tissue disease/rheumatic disease | **1.25 (1.19 to 1.30)** |
| Peptic ulcer | **1.14 (1.04 to 1.25)** |
| Mild liver disease | **1.12 (1.07 to 1.18)** |
| Moderate or severe liver disease | **5.61 (5.21 to 6.05)** |
| Diabetes without chronic complications | **1.10 (1.08 to 1.12)** |
| Diabetes with chronic complications | **1.19 (1.13 to 1.24)** |
| Paraplegia and hemiplegia | **1.16 (1.13 to 1.19)** |
| Renal disease | **1.19 (1.18 to 1.20)** |
| Primary cancer | **1.59 (1.53 to 1.64)** |
| Metastatic carcinoma | **2.51 (1.40 to 2.62)** |
| Obesity | **1.46 (1.42 to 1.51)** |

Models are based on data for 343,237 patients with no missing data. A stable odds ratio for the comorbidity HIV/AIDS could not be calculated due to small numbers. Significant relationships are marked in bold. * For Charlson Comorbidity Index items the reference category is patients without the specified comorbidity. For Charlson Comorbidity Index items relating to liver disease, diabetes and cancer three mutually exclusive categories were used. CI = confidence interval

**Supplementary material Figure S1: Number of admissions and mortality rate per week of admission**

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**Supplementary material Figure S2: Predicted probability of in-hospital mortality by age for with 95% confidence intervals shown as grey shading**

**Supplementary material Figure S3: Predicted probability of in-hospital mortality by admission date for with 95% confidence intervals shown as grey shading**