## Patient characteristics and comorbidities

* **Demographics/Geographics (✅):**
  + Age (Continuous)
  + Sex (Binary)
  + BMI, height, weight (Continuous)
  + Ethnic group (white, mixed, Asian or Asian British, Black or Black British, other ethnic group, not stated/not known ethnic group) (Categorical)
  + IMD score (Continuous)
  + Postcode district (Categorical)
* **Summary comorbidity measures (✅):**
  + Charlson index (Continuous)
  + Elixhauser score (Continuous)
* **Specific comorbidity (✅):**
  + Had cancers within 365 days before index date (Yes/No)
  + Had 'cardiovascular diseases within 365 days before index date (Yes/No)
  + Had liver and pancreatic diseases within 365 days before index date (Yes/No)
  + Had renal and bladder diseases within 365 days before index date (Yes/No)
  + Had respiratory diseases within 365 days before index date (Yes/No)
  + Had diabetes mellitus within 365 days before index date (Yes/No)
  + Number of admissions within 365 days before index date (Continuous)
  + Cumulative LOS within 365 days before index date, hours (Continuous)

## Previous hospital exposure

* **Overall length of stay (LOS) characteristics (✅):** 
  + Number of admissions within 365 days before index date
  + Cumulative LOS within 365 days before index date, hours
  + Mean/Median/Maximum/Minimum/SD LOS per admission within 365 days before current admission date, hour/admissions (Continuous)
* **Readmission characteristics (✅)**:
  + Current admission is early readmission: ≤30 days from a previous hospitalization event (Yes/No)
  + Current admission is late readmission: >30 to ≤180 days from a previous hospitalization event (Yes/No)
  + Number of early 30-day readmissions within 365 days before index date (Continuous)
  + Time elapsed from most recent early 30-day readmission within 365 days before index date, days (Continuous)

## Length of stay statistics for previous admissions for all patients, by CCS category

* **LOS characteristics of CCS diagnosis categories** **(✅):**
* Historic mean/median/maximum/minimum/SD of the LOS of patients within the same diagnostic category (★) as the patient under-test.

★ = CCS categories:

Allergies and poisoning, intestinal infection, septicaemia and shock, liver and pancreatic disorders, respiratory disorders, meningitis and encephalitis,  skin and subcutaenous disorders, tuberculosis,  bacterial infection, pneumonia, nervous system disorders, infective arthritis and osteomyelitis, HIV and other infections, perinatal, congenital and birth disorders,  influenza, tonsilitis and URTI,  cardiac disorders, genitourinary disorders, gastrointestinal disorders,  mycoses, cancers,  anaemia and diseases of white blood cells, immunity and hematologic disorders, thyroid and endocrine disorders, diabetes mellitus,  fluid disorders, nauea and vomiting,  mental disorders, ischemia, brain damage and coma, medical and device complications, myocardial infarction, congestive heart failure, aortic, venous and lymphatic disorders, gastrointestinal and esophageal disorders, bronchitis and asthma, respiratory failure and arrest, pleurisy, abdominal disorders, arthritis and joint disorders, spinal, skull and face fractures and trauma, renal and bladder disorders, acute renal failure, injuries due to external causes, fever.

## Current admission, administrative data

* **Admission time/source features (✅):**
  + daytime (Continuous: 0 to 24 hours)
  + admission weekday (Continuous: Monday to Sunday)
  + admission month (Continuous: January to December)
  + admission source (Categorical: usual place of residence, non-NHS institutional care, other NHS Provider)
  + number of days since admission (For model design)
  + admission type (Binary: Planned or Emergency)
* **Admission specialty (✅):**

★ = Acute and general medicine; Acute and general surgery; Critical care; Medical subspecialty; Procedural; Surgical subspecialty; Others.

* + Current admission includes admission under ★ at or prior to index date (Yes/No)
  + Admission under ★ at index date (Yes/No)
  + Number of specialty records within 365 days before index
* **Ward stay (✅):**
  + Ward start within 24 hours before index date (Yes/No)
  + Ward start within 48 hours before index date (Yes/No) (Not for d=1)
  + Time elapsed since most recent ward stop before current admission date, day (Continuous)

## Procedures

* **Procedures (✅):**

**All**

* + - Had procedure within 24 hours before index date (Yes/No)
    - Had procedure within 48 hours before index date (Yes/No) (Not for d=1)
    - Had procedure within current admission (Yes/No)
    - Number of procedures within current admission (Continuous)
    - Time elapsed since most recent procedure before index date, day (Continuous)
    - Had procedure within 365 days before current admission date (Yes/No)
    - Number of procedures within 365 days before current admission date (Continuous)

**Radiology**

* + - Had radiology-based procedure within current admission (Yes/No)
    - Had radiology-based procedure within 365 days before index date (Yes/No)
    - Time elapsed since most recent radiology procedure within 365 days before index date (Continuous)
* **Theatres (✅):**
  + Theatre visit within 24 hours before index date (Yes/No)
  + Theatre visit within 48 hours before index date (Yes/No)
  + Theatre visit within current admission (Yes/No)
  + Number of theatres visits within current admission (Continuous)
  + Had a theatre visit within 365 days before index date (Yes/No)
  + Time elapsed since most recent theatre visit within 365 days before index date, day (Continuous)
  + Number of theatres visits within 365 days before index date (Continuous)

## DNA CPR

* **Do not attempt cardiopulmonary resuscitation record (DNACPR) (✅):**
  + DNACPR recorded as a decision on current admission (Yes/No)
  + Time elapsed since most recent DNACPR record (in any admission) (Continuous)

## Vital signs

* **Vital signs (✅):**

**including** ★: **HR, RR, SBP, DBP, Temp, sats, O2 L/min, O2 delivery device, AVPU score**

* Mean / Max / Min / SD ★ value within 24 hours before index date (Continuous)
* Mean / Max / Min / SD ★ value within 48 hours before index date (Continuous)
* Mean / Max / Min / SD ★ value within current admission before index date (Continuous)
* Number of vital sign records in last 24 hours (Continuous)
* **NEWS 2 score**
  + Mean / Max / Min / SD value within 24 hours before index date
  + Mean / Max / Min / SD value within 48 hours before index date
  + Mean / Max / Min / SD value within current admission before index date

## Drug prescriptions

* **Prescribed antibiotics** **(✅):**
* Current antibiotic use within 24 hours before index date (Yes/No)
* Current antibiotic use within 48 hours before index date (Yes/No) (Not for d=1)
* New antibiotics within 24 hours before index date (Yes/No)
* New antibiotics within 48 hours before index date (Yes/No) (Not for d=1)
* Antibiotics use completed within 24 hours before index date (Yes/No)
* Antibiotics use completed within 48 hours before index date (Yes/No) (Not for d=1)

## Laboratory tests

* **Blood cultures (✅):**
  + Positive blood culture result within 24 hours before index date (Yes/No)
  + Positive blood culture result within 48 hours before index date (Yes/No) (Not for d=1)
  + Positive blood culture result within current admission (Yes/No)
* **All microbiology tests – antibiotic resistance (✅):**
* ESBL/CPE isolated in current admission (Yes/No)
* VRE isolated in current admission (Yes/No)
* MRSA isolated in current admission (Yes/No)
* ESBL/CPE isolated in last 365 days (Yes/No)
* VRE isolated in last 365 days (Yes/No)
* MRSA isolated in last 365 days (Yes/No)
* **Laboratory blood tests (✅):**
* Mean ★ value within 24 hours before index date (Continuous)
* ★ tested within 24 hours before index date (Yes/No)
* Maximum ★ value within 48 hours before index date (Not for d=1)
* ★ tested within 48 hours before index date (Yes/No) (Not for d=1)
* Maximum ★ value within current admission (Continuous)
* Minimum ★ value within current admission (Continuous)
* ★ tested within current admission (Yes/No).
* Number of ★ records within 365 days before index date (Continuous)

Lab tests grouped as follows **(✅)**:

* + **Complete blood counts:**

Mean cell hemoglobin, pg Mean corpuscular hemoglobin concentration, g/L Mean corpuscular volume, fL Neutrophils, x10\*9/L Lymphocytes, x10\*9/L Eosinophils, x10\*9/L Basophils, x10\*9/L Mean platelet volume, fL Platelets, x10\*9/L White cell count, x10\*9/L Red cell count, x10\*12/L Nucleated red blood cells, x10\*9/L Hematocrit, L/L

* + **Liver and renal functions:**

Potassium, mmol/L Albumin, g/L Sodium, mmol/L Urea, mmol/L Total protein, g/L Creatinine, umol/L Alkaline phosphatase, IU/L Aspartate aminotransferase, IU/L Alanine transaminase, IU/L Bilirubin, umol/L

* + **Lipid and glucose profiles:**

Fraction of oxyhemoglobin, % Hemoglobin A1c, % Triglyceride, mmol/L High-density lipoprotein cholesterol, mmol/L Total cholesterol, mmol/L Glucose, mmol/l Calculated LDL, mmol/L

* + **Cardiac, clotting, inflammatory, and acid–base tests**

D-dimer, ug/L FEU Cardiac troponin-I, microg/L Lactate dehydrogenase, IU/L Activated partial thromboplastin time, seconds C-reactive protein, mg/L Prothrombin time, seconds Bicarbonate (HCO3-), mmol/L Base excess (Actual), mmol/kg Base excess (Standard), mmol/L PCO2, kPa Calcium, mmol/L

* + **Blood gases**

cCl-, mmol/L cLac, mmol/L cCa2+, mmol/L ctO2c, vol% P5Oc, kPa FiO2, % PO2, kPa Oxygen saturation, % Fraction of carboxyhaemoglobin, % Estimated osmolality, mosmol/kg cNa+, mmol/L cK+, mmol/L

* + **Subclinical biomarkers**

Albumin to creatinine ratio, mg/mmol Protein to creatinine ratio Total-cholesterol-to-HDL ratio Free-Kappa-Free-Lambda ratio International normalized ratio Mean corpuscular hemoglobin concentration, g/L Tacrolimus concentration, ng/ml Transferrin saturation, %