Supplementary File

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# **Supplementary Figures**

## S1 Flow chart of the patient selection process

**Exclusions**

Total practice CPRD HF population

**252,584**

Not CPRD acceptable standard

**7,307**

HF index date outside of study recruitment window

**164,658**

Acceptable patients

**245,277**

Index date between 1/1/2002 and 01/03/2012

**80,619**

**Data extraction criteria**

<40 years on HF index date

**990**

Exclude if less than 3 years of UTS clinical data before the HF index date

**14,633**

At least 40 years of age

**79,629**

At least 3 years up-to-standard records before HF index date **64,996**

Exclude if clinical data not plausible in relation to date of death

**2,104**

**Data cleaning inclusion criteria**

Plausible data

**62,892**

Exclude if any unexplained gaps in clinical data during study period

**12,778**

No unexplained gaps in longitudinal data

**50,303**

**Total baseline cohort for mortality outcome**

**Matched cohort**

**Cases 26,729**

**Controls 106,916**

Unique HF patients

**50,114**

**Total baseline cohort for hospital admission outcome**

**Matched cohort**

**Cases 24,339**

**Controls 86,450**

Patients with linked hospital episode statistics data,

**30,061**

# **Supplementary Tables**

|  |  |  |
| --- | --- | --- |
| S1 Heart failure selection code set | | |
| CPRD Medcode | Read code | Read term |
| 398 | G580.00 | Congestive heart failure |
| 884 | G581.00 | Left ventricular failure |
| 2062 | G58..00 | Heart failure |
| 2906 | G580.11 | Congestive cardiac failure |
| 4024 | G58z.00 | Heart failure NOS |
| 1223 | G58..11 | Cardiac failure |
| 5942 | G581.13 | Impaired left ventricular function |
| 5255 | G581000 | Acute left ventricular failure |
| 32671 | G580100 | Chronic congestive heart failure |
| 10079 | G580.12 | Right heart failure |
| 9524 | G580.14 | Biventricular failure |
| 17278 | G58z.12 | Cardiac failure NOS |
| 23707 | G580000 | Acute congestive heart failure |
| 10154 | G580.13 | Right ventricular failure |
| 27964 | G582.00 | Acute heart failure |
| 27884 | G580200 | Decompensated cardiac failure |
| 23481 | G581.11 | Asthma – cardiac |
| 43618 | G581.12 | Pulmonary oedema – acute |
| 11424 | G580300 | Compensated cardiac failure |
| 22262 | G58z.11 | Weak heart |
| 12590 | G583.00 | Heart failure with normal ejection fraction |
| 101138 | G580400 | Congestive heart failure due to valvular disease |
| 94870 | G584.00 | Right ventricular failure |
| 104275 | G583.11 | HFNEF - heart failure with normal ejection fraction |
| 101137 | G1yz100 | Rheumatic left ventricular failure |
| 9913 | 101..00 | Heart Failure confirmed |
| 21837 | G232.00 | Hypertensive heart&renal dis wth (congestive) heart failure |

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| **S2 Chronic Obstructive Pulmonary Disease Code set** | | |
| CPRD Medcode | **Read code** | **Read Term** |
| 1001 | H3...00 | Chronic obstructive pulmonary disease |
| 998 | H3...11 | Chronic obstructive airways disease |
| 10863 | H36..00 | Mild chronic obstructive pulmonary disease |
| 5710 | H3z..00 | Chronic obstructive airways disease NOS |
| 10802 | H37..00 | Moderate chronic obstructive pulmonary disease |
| 794 | H32..00 | Emphysema |
| 9876 | H38..00 | Severe chronic obstructive pulmonary disease |
| 93568 | H39..00 | Very severe chronic obstructive pulmonary disease |
| 14798 | H312100 | Emphysematous bronchitis |
| 12166 | H3y..00 | Other specified chronic obstructive airways disease |
| 33450 | H32z.00 | Emphysema NOS |
| 37247 | H3z..11 | Chronic obstructive pulmonary disease NOS |
| 26306 | H320.00 | Chronic bullous emphysema |
| 10980 | H322.00 | Centrilobular emphysema |
| 23492 | H320z00 | Chronic bullous emphysema NOS |
| 44525 | H312z00 | Obstructive chronic bronchitis NOS |
| 11287 | 66YM.00 | Chronic obstructive pulmonary disease annual review |
| 9520 | 66YB.00 | Chronic obstructive pulmonary disease monitoring |
| 28755 | 9Oi0.00 | Chronic obstructive pulmonary disease monitoring 1st letter |
| 18621 | 66YL.00 | Chronic obstructive pulmonary disease follow-up |
| 34202 | 9Oi1.00 | Chronic obstructive pulmonary disease monitoring 2nd letter |
| 18476 | 66YL.11 | COPD follow-up |
| 34215 | 9Oi2.00 | Chronic obstructive pulmonary disease monitoring 3rd letter |
| 18792 | 9Oi..00 | Chronic obstructive pulmonary disease monitoring admin |
| 37371 | 66YD.00 | Chronic obstructive pulmonary disease monitoring due |
| 26018 | 66YS.00 | Chronic obstructive pulmonary disease monitoring by nurse |
| 45771 | 66Yh.00 | Chronic obstructive pulmonary disease does not disturb sleep |
| 45998 | 66YT.00 | Chronic obstructive pulmonary disease monitoring by doctor |
| 3243 | H31..00 | Chronic bronchitis |
| 15157 | H31z.00 | Chronic bronchitis NOS |
| 15626 | H310000 | Chronic catarrhal bronchitis |
| 5798 | H312000 | Chronic asthmatic bronchitis |
| 27819 | H312.00 | Obstructive chronic bronchitis |
| 25603 | H310.00 | Simple chronic bronchitis |
| 5909 | H312011 | Chronic wheezy bronchitis |
| 11150 | H311.00 | Mucopurulent chronic bronchitis |
| 26125 | H312300 | Bronchiolitis obliterans |
| 45089 | H31y100 | Chronic tracheobronchitis |
| 16410 | H32yz00 | Other emphysema NOS |
| 40788 | H32y.00 | Other emphysema |
| 40159 | H311000 | Purulent chronic bronchitis |
| 61118 | H310z00 | Simple chronic bronchitis NOS |
| 104608 | H3A..00 | End stage chronic obstructive airways disease |
| 24248 | H313.00 | Mixed simple and mucopurulent chronic bronchitis |
| 61513 | H311z00 | Mucopurulent chronic bronchitis NOS |
| 63479 | H32y200 | MacLeod's unilateral emphysema |
| 66043 | H31y.00 | Other chronic bronchitis |
| 68066 | H31yz00 | Other chronic bronchitis NOS |
| 46578 | H321.00 | Panlobular emphysema |
| 60188 | H320200 | Giant bullous emphysema |
| 56860 | H320000 | Segmental bullous emphysema |
| 68662 | H320100 | Zonal bullous emphysema |
| 99536 | H320300 | Bullous emphysema with collapse |
| 67040 | H3y..11 | Other specified chronic obstructive pulmonary disease |
| 37959 | H311100 | Fetid chronic bronchitis |
| 70787 | H32y100 | Atrophic (senile) emphysema |
| 59263 | H32y111 | Acute interstitial emphysema |
| 103733 | H320311 | Tension pneumatocoele |
| 92955 | H32y000 | Acute vesicular emphysema |
| 1446 | H312200 | Acute exacerbation of chronic obstructive airways disease |
| 28743 | 66Yf.00 | Number of COPD exacerbations in past year |
| 18501 | 66YI.00 | COPD self-management plan given |
| 7884 | H3y1.00 | Chron obstruct pulmonary dis wth acute exacerbation, unspec |
| 11019 | 8H2R.00 | Admit COPD emergency |
| 42313 | 679V.00 | Health education - chronic obstructive pulmonary disease |
| 101042 | 8BMW.00 | Issue of chronic obstructive pulmonary disease rescue pack |
| 38074 | 9Oi4.00 | Chronic obstructive pulmonary disease monitor phone invite |
| 45777 | 8CR1.00 | Chronic obstructive pulmonary disease clini management plan |
| 19106 | 66Yd.00 | COPD accident and emergency attendance since last visit |
| 19003 | 66Ye.00 | Emergency COPD admission since last appointment |
| 42258 | 9Oi3.00 | Chronic obstructive pulmonary disease monitoring verb invite |
| 21061 | H3y0.00 | Chronic obstruct pulmonary dis with acute lower resp infectn |
| 7092 | H30..12 | Recurrent wheezy bronchitis |
| 103007 | 66YB100 | Chronic obstructive pulmonary disease 6 monthly review |
| 102685 | 66YB000 | Chronic obstructive pulmonary disease 3 monthly review |
| 19721 | 8CE6.00 | Chronic obstructive pulmonary disease leaflet given |
| 99948 | 9kf0.00 | COPD patient unsuitable for pulmonary rehab - enh serv admin |
| 104117 | 661M300 | COPD self-management plan agreed |
| 104169 | 661N300 | COPD self-management plan review |
| 46036 | 66Yi.00 | Multiple COPD emergency hospital admissions |
| 103494 | 14B3.12 | History of chronic obstructive pulmonary disease |
| 104265 | 9e03.00 | GP OOH service notified of COPD care plan |
| 103758 | 8Hkw.00 | Referral to COPD community nursing team |
| 103678 | 8BMa000 | Chronic obstructiv pulmonary disease medication optimisation |
| 45770 | 66Yg.00 | Chronic obstructive pulmonary disease disturbs sleep |
| 105457 | 8CMW500 | Chronic obstructive pulmonary disease care pathway |
| 97800 | 9kf..00 | COPD - enhanced services administration |
| 22905 | H581.00 | Interstitial emphysema |
| 103558 | 8CeD.00 | Preferred place of care for next exacerbation of COPD |
| 104481 | 8CMV.00 | Has chronic obstructive pulmonary disease care plan |
| 98284 | 9kf1.00 | Refer COPD structured smoking assessment - enhanc serv admin |
| 65733 | Hyu3100 | [X]Other specified chronic obstructive pulmonary disease |
| 98283 | 9kf2.00 | COPD structured smoking assessment declined - enh serv admin |
| 104985 | 9NgP.00 | On chronic obstructive pulmonary disease supprtv cre pathway |
| 103760 | 9kf2.11 | COPD structured smoking assessment declined |
| 103864 | 9kf0.11 | COPD patient unsuitable for pulmonary rehabilitation |
| 103400 | 9kf1.11 | Referred for COPD structured smoking assessment |
| 104710 | 9NgP.11 | On COPD (chr obstruc pulmonary disease) supportv cre pathway |

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| **S3 Potential confounders** | |
| Patient factors | Age  Gender  Index of Multiple Deprivation.  Body mass index  Smoking  Alcohol |
| Clinical factors | Cholesterol,  Haemoglobin,  Blood pressure  Estimated glomerular filtration rate  Hypertension,  Ischaemic heart disease  Myocardial infarction  Atrial fibrillation  Diabetes |
| Medications prescribed | Aspirin,  Angiotensin converting enzyme inhibitors  Angiotensin II receptor blockers  Aldosterone antagonists  Beta-blockers  Diuretics |
| Index of Multiple Deprivation (IMD) measures deprivation linked to small housing areas in England and covering seven domains. Domain scores are combined using appropriate weights, generating a single overall IMD which is a useful proxy of individual level deprivation for use in health research. The score was ranked into quintiles, ranging from the lowest deprivation (quintile 1) to the highest (quintile 5).  English Indices of Deprivation 2010 available from: <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6871/1871208.pdf>. | |

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| S4 Missing data pre-imputation | |  |
|  | **Mortality sample** | **Hospitalisation subsample** |
| Patient characteristics | Missing No. (%) | Missing No. (%) |
| IMD | 40.6 | 0.3 |
| BMI (Kg/m2) | 8.9 | 9.6 |
| Cholesterol (mg/dL) | 14.4 | 14.7 |
| Hb (g/dL) | 11.6 | 11.0 |
| Systolic BP (mmHg) | 0.6 | 0.5 |
| Diastolic BP (mmHg) | 0.6 | 0.5 |
| eGFR | 10.5 | 12.4 |
| Smoking | 2.4 | 2.4 |
| Alcohol | 10.1 | 10.1 |
| IMD, index multiple deprivation; BMI, body mass index; Hb, haemoglobin; BP, blood pressure; eGFR, estimated glomerular filtration rate | | |
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| S5 Characteristics of patients with HF and COPD by airflow limitation in those with spirometry data | | | | | | |
|  | **Mortality sample** | | | **Hospitalisation subsample** | | |
| **Patient characteristics** | **All**  **(n=8,515)** | **GOLD 1&2a (n=5,005)** | **GOLD 3&4a (n=3,510)** | **All**  **(n=4,652)** | **GOLD 1&2a (n=2,617)** | **GOLD 3&4a (n=2,035)** |
| Age, years; median [IQR] | 78[IQR 72-83] | 79[71-85] | 77[71-82] | 78[IQR 70-83] | 79[71-84] | 77[70-82] |
| Women; No. (%) | 3,028(35.6) | 1,910(38.2) | 1,118(31.9) | 1,778(38.4) | 1,110(42.4) | 678(33.3) |
| IMD quintile; No. (%) |  |  |  |  |  |  |
| 1 | 812(15.7) | 461(15.0) | 351(16.8) | 710(15.3) | 384(14.7) | 326(16.0) |
| 2 | 1,041(20.1) | 630(20.4) | 411(19.7) | 915(19.7) | 471(18.0) | 444(22.8) |
| 3 | 1,029(19.9) | 632(20.5) | 397(19.0) | 910(19.6) | 518(19.8) | 392(19.3) |
| 4 | 1,118(21.6) | 642(20.8) | 476(22.8) | 1,056(22.7) | 606(23.2) | 450(22.1) |
| 5 | 1,176(22.7) | 719(23.3) | 457(21.9) | 1,061(22.8) | 638(23.4) | 423(20.8) |
| BMI (Kg/m2); median [IQR] | 26.1[22.6-30.4] | 26.6[23.0-30.8] | 25.4[21.9-29.9] | 26.3[22.9-30.5] | 26.9[23.6-31.3] | 25.5[22.0-29.0] |
| Cholesterol (mg/dL); mean (SD) | 170.1±42.5 | 166.3±73.5 | 174±46.4 | 177.9±42.5 | 174.0±42.5 | 181.7±46.4 |
| Hb (g/dL); mean (SD) | 13.0±2.0 | 13.0±1.9 | 13.1±2.0 | 13.4±1.9 | 13.4±1.8 | 13.4±1.9 |
| Systolic BP (mmHg); mean (SD) | 126.8±19.9 | 126.8±19.6 | 126.9±20.3 | 131.4±19.6 | 131.8±19.4 | 130.9±19.9 |
| Diastolic BP (mmHg); mean (SD) | 70.9±11.4 | 70.9±11.2 | 71.0±11.6 | 73.0±11.5 | 73.2±11.6 | 72.7±11.4 |
| Diuretics; No. (%) | 6,987(82.1) | 4,055(81.0) | 2,932(83.5) | 3,721(80.0) | 2,033(77.7) | 1,688(83.0) |
| Beta blocker; No. (%) | 3,136(36.8) | 2,071(41.4) | 1,065(30.3) | 961(20.7) | 640(24.5) | 321(15.8) |
| ACEi; No. (%) | 4,612(54.2) | 2,719(54.3) | 1,893(53.9) | 2,774(59.6) | 1,553(59.3) | 1,221(60.0) |
| ARB; No. (%) | 1,439(16.9) | 4,051(19.1) | 3,025(86.2) | 699(15.0) | 460(17.6) | 239(11.7) |
| Aspirin; No. (%) | 6,382(75.0) | 3,889(77.7) | 2,493(77.7) | 3,185(68.5) | 1,875(71.7) | 1,310(64.4) |
| AA; No. (%) | 1,847(21.7) | 1,119(22.4) | 728(71.0) | 578(12.4) | 326(12.5) | 252(12.4) |
| COPD medications; No. (%) | | | | | | |
| No medications | 935(11.0) | 689(13.8) | 246(7.0) | 741(15.9) | 464(17.7) | 277(13.6) |
| Short term inhalers only | 632(7.4) | 435(8.7) | 197(5.6) | 427(9.2) | 293(11.2) | 134(6.7) |
| Monotherapy | 1,020(12.0) | 699(14.0) | 321(9.2) | 576(12.4) | 367(14.0) | 209(10.3) |
| Dual therapy | 1,545(18.1) | 996(19.9) | 549(15.6) | 894(19.2) | 576(22.0) | 318(15.6) |
| Triple therapy | 1,639(19.30 | 862(17.2) | 777(22.1) | 764(16.4) | 336(12.8) | 428(21.0) |
| Oral steroids but no oxygen | 2,385(28.0) | 1,185(23.7) | 1,198(34.1) | 1,152(24.8) | 554(21.2) | 598(29.3) |
| Oxygen therapy | 361(4.2) | 139(2.8) | 222(6.3) | 98(2.1) | 27(1.0) | 71(3.5) |
| Diabetes; No. (%) | 2,018(23.7) | 1,276(25.5) | 742(21.1) | 827(17.8) | 504(19.3) | 323(15.9) |
| Renal disease (eGFR <60 ml/min/m2); No. (%) | 4,039(50.3) | 2,548(54.3) | 1,455(44.5) | 1,551(47.5) | 945(50.8) | 606(43.2) |
| Atrial fibrillation ; No. (%) | 3,215(37.8) | 1,956(32.7) | 1,259(35.9) | 1,493(32.1) | 851(32.5) | 642(31.6) |
| Hypertension; No. (%) | 4,703(55.2) | 2,914(58.2) | 1,789(51.0) | 2,434(52.3) | 1,486(56.8) | 948(46.6) |
| Ischamic heart disease; No. (%) | 3,604(42.3) | 2,318(46.3) | 1,286(36.6) | 1,815(39.0) | 1,126(43.0) | 689(33.9) |
| Myocardial infarction; No. (%) | 2,315(27.2) | 1,457(29.1) | 2,414(24.4) | 875(18.8) | 582(22.2) | 293(14.2) |
| Smoking status; No. (%) |  |  |  |  |  |  |
| Current | 1,242(14.6) | 766(15.3) | 476(13.6) | 915(19.7) | 468(17.9) | 447(22.0) |
| Not current | 5,632(66.1) | 3,328(66.5) | 2,304(65.6) | 661(14.2) | 380(14.5) | 281(13.8) |
| Past smoker | 1,641(19.3) | 911(18.2) | 730(20.8) | 3,076(66.1) | 1,769(67.6) | 1,307(64.2) |
| Alcohol status; No. (%) |  |  |  |  |  |  |
| Current | 1,979(23.2) | 1,139(22.8) | 840(23.9) | 3,481(74.8) | 1,964(75.1) | 1,517(74.6) |
| Not current | 528(6.2) | 305(6.1) | 223(6.4) | 980(21.1) | 562(21.5) | 418(20.5) |
| Past drinker | 6,008(70.6) | 3,561(71.2) | 2,447(69.7) | 191(4.1) | 91(3.5) | 100(4.9) |
| HF, heart failure; IMD, index multiple deprivation (1=least deprived, 5=most deprived); BMI, body mass index; Hb, haemoglobin; BP, blood pressure; ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; AA, aldosterone antagonist (spironolactone or eplerenone**);** COPD, chronic obstructive pulmonary disease; eGFR, estimated glomerular filtration rate  a GOLD stages refer to airflow limitation grades in GOLD guidelines. 1: FEV1 ≥80% normal (mild) 2: FEV1 50-79% normal (moderate) 3: FEV1 30-49% normal (severe) 4: FEV1 <30% normal (very severe) | | | | | | |

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| S6 Characteristics of patients with HF and COPD by spirometry availability | | | | |
|  | **Mortality sample Hospitalisation subsample** | | | | |
| **Patient characteristics** | **COPD patients without spirometry (n=9,693)** | **COPD patients with spirometry (n=8,515)** | |  | | --- | |  |   **COPD patients without spirometry (n=7,251)** | **COPD patients with spirometry (n=4,652)** | |
| Age, years; median [IQR] | 77[IQR 70-83] | 78[IQR 72-83] | 76[IQR 69-82] | 78[IQR 70-83] | |
| Women; No. (%) | 4,219(42.4) | 3,028(35.6) | 3,194(44.31) | 1,778(38.4) | |
| IMD quintile; No. (%) |  |  |  |  | |
| 1 | 852(14.5) | 812(15.7) | 1,077(14.9) | 710(15.3) | |
| 2 | 1,196(20.3) | 1,041(20.1) | 1,499(20.0) | 915(19.7) | |
| 3 | 1,262(21.4) | 1,029(19.9) | 1,551(21.4) | 910(19.6) | |
| 4 | 1,402(23.8) | 1,118(21.6) | 1,661(22.9) | 1,056(22.7) | |
| 5 | 1,185(20.1) | 1,176(22.7) | 1,514(20.9) | 1,061(22.8) | |
| BMI (Kg/m2); median [IQR] | 27.1[23.5-31.6] | 26.1[22.6-30.4] | 27.1[23.8-31.8] | 26.3[22.9-30.5] | |
| Cholesterol (mg/dL); mean (SD) | 177.9±46.4 | 170.1±42.5 | 185.6±46.4 | 177.9±42.5 | |
| Hb (g/dL); mean (SD) | 13.2±1.8 | 13.0±2.0 | 13.6±1.7 | 13.4±1.9 | |
| Systolic BP (mmHg); mean (SD) | 130.7±19.7 | 126.8±19.9 | 133.6±19.9 | 131.4±19.6 | |
| Diastolic BP (mmHg); mean (SD) | 73.1±11.0 | 70.9±11.4 | 75.1±11.0 | 73.0±11.5 | |
| Diuretics; No. (%) | 7,970(80.0) | 6,987(82.1) | 5,304(73.2) | 3,721(80.0) | |
| Beta blocker; No. (%) | 3,650(36.6) | 3,136(36.8) | 1,430(19.7) | 961(20.7) | |
| ACEi; No. (%) | 5,348(53.7) | 4,612(54.2) | 4,141(57.1) | 2,774(59.6) | |
| ARB; No. (%) | 1,597(16.0) | 1,439(16.9) | 1,193(16.5) | 699(15.0) | |
| Aspirin; No. (%) | 7,149(71.9) | 6,382(75.0) | 4,696(64.8) | 3,185(68.5) | |
| AA; No. (%) | 2,019(20.3) | 1,847(21.7) | 1,002(13.8) | 578(12.4) | |
| Diabetes; No. (%) | 2,258(22.7) | 2,018(23.7) | 1,280(17.7) | 827(17.8) | |
| Renal disease (eGFR <60 ml/min/m2); No. (%) | 4,435(49.5) | 4,039(50.3) | 3,265 (45.0) | 1,551(47.5) | |
| Atrial fibrillation ; No. (%) | 3,261(32.7) | 3,215(37.8) | 2,006(27.7) | 1,493(32.1) | |
| Hypertension; No. (%) | 5,393(54.1) | 4,703(55.2) | 3,754(51.8) | 2,434(52.3) | |
| Ischamic heart disease; No. (%) | 3,980(40.0) | 3,604(42.3) | 2,502(34.5) | 1,815(39.0) | |
| Myocardial infarction; No. (%) | 2,414(24.2) | 2,315(27.2) | 1,360(18.8) | 875(18.8) | |
| Smoking status; No. (%) |  |  |  |  | |
| Current | 1,950(19.6) | 1,242(14.6) | 1,606(22.2) | 915(19.7) | |
| Not current | 5,836(58.6) | 5,632(66.1) | 1,406(19.4) | 661(14.2) | |
| Past smoker | 2,177(21.9) | 1,641(19.3) | 4,239(58.5) | 3,076(66.1) | |
| Alcohol status; No. (%) |  |  |  |  | |
| Current | 2,526(25.4) | 1,979(23.2) | 5,250(72.4) | 3,481(74.8) | |
| Not current | 577(5.8) | 528(6.2) | 1,633(22.5) | 980(21.1) | |
| Past drinker | 6,860(68.9) | 6,008(70.6) | 633(5.1) | 191(4.1) | |
| HF, heart failure; IMD, index multiple deprivation (1=least deprived, 5=most deprived); BMI, body mass index; Hb, haemoglobin; BP, blood pressure; ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; AA, aldosterone antagonist (spironolactone or eplerenone**);** COPD, chronic obstructive pulmonary disease; eGFR, estimated glomerular filtration rate | | | | | |

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| S7 Interactions | |  |  |  |
|  | **Mortality sample** | | **Hospitalisation subsample** |  |
|  | Adjusted OR (95% CI)a | Interaction term (P) | Adjusted OR (95% CI)a | Interaction term (P) |
| HF with no COPD (reference group) | 1.0 |  | 1.0 |  |
| COPD in females | 1.41(1.30,1.53) |  | 1.37(1.25,1.50) |  |
| COPD in males | 1.26(1.18,1.34) | 0.007 | 1.31(1.21,1.42) | 0.748 |
| COPD in those prescribed beta blockers | 1.40(1.29,1.52) |  | 1.25(1.09,1.43) |  |
| COPD in those not prescribed beta blockers | 1.22(1.15,1.31) | 0.06 | 1.35(1.26,1.43) | 0.09 |
| COPD, chronic obstructive pulmonary disease; OR, odds ratio; CI confidence interval.  a All models adjusted for age, gender, body mass index (BMI), cholesterol, estimated glomerular filtration rate (eGFR), eGFR2, Haemoglobin (Hb), Hb2, systolic blood pressure (SBP), SBP2, diuretics, beta-blocker, angiotensin-converting enzyme inhibitor; angiotensin receptor blocker; aldosterone antagonist (spironolactone or eplerenone), Aspirin, atrial fibrillation, hypertension, ischemic heart disease, myocardial infarction, diabetes, smoking, alcohol and previous hospitalisation in 12-months (Hospitalisation models only). | | | | |

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| **S8 Sensitivity analyses** | |  |
|  | **Mortality** | **Hospitalisation** |
|  | Adjusted OR (95% CI)a | Adjusted OR (95% CI)a |
| HF with no COPD (reference group) | 1.0 | 1.0 |
| COPD | 1.31(1.26,1.36) | 1.32(1.24,1.42) |
| COPD adjusted additionally for deprivation | 1.28(1.20,1.36) | N/A |
| COPD in those with a spirometry recording | 1.93(1.83,2.04) | 1.53(1.42,1.65) |
| COPD in those without a spirometry recording | 0.87(0.82,0.92)b | 1.20(1.12,1.26) b |
| COPD: HF index before 1st April 2006 | 1.36(1.28,1.44) | 1.39(1.29,1.50) |
| COPD: HF index after 1st April 2006 | 1.27(1.19,1.35)b | 1.28(1.19,1.36)b |
| COPD in those without spirometry(reference group) | 1.0 | 1.0 |
| COPD in those with a spirometry recording | 2.22(2.06,2.39) | 1.28(1.17,1.40) |
| COPD, chronic obstructive pulmonary disease; OR, odds ratio; CI confidence interval.  a All models adjusted for age, gender, body mass index (BMI), cholesterol, estimated glomerular filtration rate (eGFR), eGFR2, Haemoglobin (Hb), Hb2, systolic blood pressure (SBP), SBP2, diuretics, beta-blocker, angiotensin-converting enzyme inhibitor; angiotensin receptor blocker; aldosterone antagonist (spironolactone or eplerenone), Aspirin, atrial fibrillation, hypertension, ischemic heart disease, myocardial infarction, diabetes, smoking, alcohol and previous hospitalisation in 12-months (Hospitalisation models only).  b Significant interaction (P>0.05) | | |