**APPENDIX:** Hospital admissions from care homes in England during the COVID-19 pandemic: a retrospective, cross-sectional analysis using linked administrative data

**Appendix Table S1.** ICD-10 chapters, diagnosis code ranges and chapter descriptions. ICD-10, International Statistical Classification of Diseases and Related Health Problems, 10th revision.

|  |  |  |  |
| --- | --- | --- | --- |
| **Chapter** | **Code range** | **Description** | **Short description** |
| 1 | A00-B99 | Certain infectious and parasitic diseases | Infectious, parasitic |
| 2 | C00-D49 | Neoplasms | Neoplasms |
| 3 | D50-D89 | Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism | Blood, blood-forming organs |
| 4 | E00-E89 | Endocrine, nutritional and metabolic diseases | Endocrine, nutritional, metabolic |
| 5 | F01-F99 | Mental, Behavioral and Neurodevelopmental disorders | Mental, behavioral |
| 6 | G00-G99 | Diseases of the nervous system | Nervous system |
| 7 | H00-H59 | Diseases of the eye and adnexa | Eye, adnexa |
| 8 | H60-H95 | Diseases of the ear and mastoid process | Ear, mastoid |
| 9 | I00-I99 | Diseases of the circulatory system | Circulatory system |
| 10 | J00-J99 | Diseases of the respiratory system | Respiratory system |
| 11 | K00-K95 | Diseases of the digestive system | Digestive system |
| 12 | L00-L99 | Diseases of the skin and subcutaneous tissue | Skin, subcutaneous tissue |
| 13 | M00-M99 | Diseases of the musculoskeletal system and connective tissue | Musculoskeletal, connective |
| 14 | N00-N99 | Diseases of the genitourinary system | Genitourinary system |
| 15 | O00-O9A | Pregnancy, childbirth and the puerperium | Pregnancy, childbirth |
| 16 | P00-P96 | Certain conditions originating in the perinatal period | Perinatal |
| 17 | Q00-Q99 | Congenital malformations, deformations and chromosomal abnormalities | Congenital |
| 18 | R00-R99 | Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified | Not elsewhere classified |
| 19 | S00-T88 | Injury, poisoning and certain other consequences of external causes | Injury, poisoning |
| 20 | V00-Y99 | External causes of morbidity | External causes |
| 21 | Z00-Z99 | Factors influencing health status and contact with health services | Factors infl. health status |
| 22 | U00–U99 | Codes for special purposes | Special purposes |

**Appendix Table S2.** ICD-10 diagnosis codes for potentially avoidable causes of emergency admissions. ICD-10, International Statistical Classification of Diseases and Related Health Problems, 10th revision.

|  |  |
| --- | --- |
| **Description** | **Code range** |
| Acute lower respiratory tract infections (LRTI) | J20-J22 |
| Chronic lower respiratory tract infections (LRTI) | J40-J44 |
| Pressure sores | L89 |
| Diabetes | E10-E14 |
| Food and drink issues | R63 (63.0, 63.1, 63.2, 63.3, 63.4, 63.6 and 63.8) |
| Food and liquid pneumonitis | J69 |
| Fractures and sprains | S02, S03, S08, S12, S13, S18, S22, S23, S28, S32, S33, S38, S42, S43, S48, S52, S53, S58, S62, S63, S68, S72, S73, S78, S82, S83, S88, S92, S93, S98, T02, T03, T05, T08, T10 and T12 |
| Intestinal infections | A02-A09 |
| Pneumonia | J12-J18 |
| Urinary tract infections (UTI) | N390 |

**Appendix Table S3.** Comparison of baseline characteristics of the cohorts of residential care home and nursing home residents in January 2019 and January 2020. \*Mean (standard deviation), †Index of Multiple Deprivation quintiles.

|  |  |  |
| --- | --- | --- |
| **Care home type** | **Residential** | **Nursing** |
| **Year** | **2019** | **2020** | **2019** | **2020** |
| N | 139925 | 141891 | 112507 | 115952 |
| Female (%) | 90956 (65.0) | 92018 (64.9) | 73223 (65.1) | 74862 (64.6) |
| Age in years\* | 77 (19) | 77 (19) | 81 (14) | 81 (14) |
| Aged >= 65 years (%) | 109321 (78.1) | 111809 (78.8) | 100371 (89.2) | 103762 (89.5) |
| Charlson Comorbidity Index\* | 1.39 (1.71) | 1.45 (1.75) | 1.79 (1.87) | 1.89 (1.94) |
| Dementia (%) | 54306 (38.8) | 56509 (39.8) | 51803 (46.0) | 54162 (46.7) |
| Follow-up in days\* | 150 (33) | 150 (32) | 145 (38) | 142 (40) |
| Reason for follow-up ending (%) |  |  |  |  |
|  End of care home flag | 6888 (4.9) | 3822 (2.7) | 5394 (4.8) | 2828 (2.4) |
|  Death | 15431 (11.0) | 19232 (13.6) | 18679 (16.6) | 28080 (24.2) |
|  End of study | 117606 (84.0) | 118837 (83.8) | 88434 (78.6) | 85044 (73.3) |
| IMD quintile† (%) |  |  |  |  |
|   1 (least deprived)  | 25129 (18.0) | 25590 (18.0) | 21710 (19.3) | 22661 (19.5) |
|   2  | 29691 (21.2) | 30434 (21.4) | 21486 (19.1) | 21910 (18.9) |
|   3  | 32209 (23.0) | 32386 (22.8) | 23554 (20.9) | 24402 (21.0) |
|  4 | 29013 (20.7) | 29503 (20.8) | 24012 (21.3) | 24106 (20.8) |
|   5 (most deprived)  | 23479 (16.8) | 23693 (16.7) | 21392 (19.0) | 22625 (19.5) |
|  Missing | 404 (0.3) | 285 (0.2) | 353 (0.3) | 248 (0.2) |
| Region (%) |  |  |  |  |
|   East Midlands  | 14409 (10.3) | 14814 (10.4) | 10079 (9.0) | 10055 (8.7) |
|  East of England | 19887 (14.2) | 19991 (14.1) | 10271 (9.1) | 10470 (9.0) |
|  London | 9723 (6.9) | 9472 (6.7) | 11110 (9.9) | 11459 (9.9) |
|  North East | 6963 (5.0) | 7016 (4.9) | 7426 (6.6) | 7878 (6.8) |
|  North West | 17511 (12.5) | 17899 (12.6) | 15684 (13.9) | 16042 (13.8) |
|  South East | 24408 (17.4) | 24494 (17.3) | 22243 (19.8) | 23492 (20.3) |
|  South West | 17661 (12.6) | 18145 (12.8) | 13623 (12.1) | 14009 (12.1) |
|  West Midlands | 14395 (10.3) | 14832 (10.5) | 11933 (10.6) | 12566 (10.8) |
|  Yorkshire and the Humber | 14564 (10.4) | 14943 (10.5) | 9785 (8.7) | 9733 (8.4) |
|  Missing | 404 (0.3) | 285 (0.2) | 353 (0.3) | 248 (0.2) |
| Bed capacity\* | 34 (21) | 35 (21) | 60 (27) | 60 (26) |

**Appendix Table S4.** Number and percentage of COVID-19 hospital admissions with additional diagnosis codes for acute coronary syndromes or stroke (1 March to 31 May 2020), by care home type.

|  |  |  |
| --- | --- | --- |
|  | **Acute coronary syndromes** | **Stroke** |
| **Care home type** | **N** | **%** | **N** | **%** |
| Residential  | 35 | 1.2 | 18 | 0.6 |
| Nursing  | 49 | 1.5 | 12 | 0.4 |

**Appendix Table S5.** Number of emergency admissions and emergency admission rates between 1 March and 31 May in 2019 and 2020, by care home type and ICD-10 chapter of the primary diagnosis code. ICD-10, International Statistical Classification of Diseases and Related Health Problems, 10th revision. \*Admissions per 100 residents per year.

|  |  |  |
| --- | --- | --- |
| **Care home type** | **Residential** | **Nursing** |
|  | **2019** | **2020** | **Change (%)** | **2019** | **2020** | **Change (%)** |
| **ICD-10 chapter** |  |  |  |  |  |  |
| 1 | Infectious, parasitic |  |  |  |  |  |  |
|  | N | 1523 | 754 | -769 (-50) | 1433 | 738 | -695 (-48) |
|  | Rate\* | 4.76 | 2.32 | -2.44 (-51) | 5.78 | 2.95 | -2.83 (-49) |
| 3 | Blood, blood-forming organs |  |  |  |  |  |  |
|  | N | 183 | 93 | -90 (-49) | 157 | 74 | -83 (-53) |
|  | Rate\* | 0.57 | 0.29 | -0.29 (-50) | 0.63 | 0.3 | -0.34 (-53) |
| 2 | Neoplasms |  |  |  |  |  |  |
|  | N | 140 | 72 | -68 (-49) | 88 | 60 | -28 (-32) |
|  | Rate\* | 0.44 | 0.22 | -0.22 (-49) | 0.36 | 0.24 | -0.12 (-32) |
| 10 | Respiratory system |  |  |  |  |  |  |
|  | N | 4603 | 2588 | -2015 (-44) | 4140 | 2361 | -1779 (-43) |
|  | Rate\* | 14.39 | 7.96 | -6.43 (-45) | 16.69 | 9.45 | -7.25 (-43) |
| 14 | Genitourinary system |  |  |  |  |  |  |
|  | N | 1740 | 986 | -754 (-43) | 1271 | 717 | -554 (-44) |
|  | Rate\* | 5.44 | 3.03 | -2.41 (-44) | 5.13 | 2.87 | -2.26 (-44) |
| 5 | Mental, behavioural |  |  |  |  |  |  |
|  | N | 625 | 354 | -271 (-43) | 328 | 206 | -122 (-37) |
|  | Rate\* | 1.95 | 1.09 | -0.87 (-44) | 1.32 | 0.82 | -0.5 (-38) |
| 12 | Skin, subcutaneous tissue |  |  |  |  |  |  |
|  | N | 640 | 369 | -271 (-42) | 318 | 188 | -130 (-41) |
|  | Rate\* | 2.00 | 1.14 | -0.87 (-43) | 1.28 | 0.75 | -0.53 (-41) |
| 18 | Not elsewhere classified |  |  |  |  |  |  |
|  | N | 3012 | 1934 | -1078 (-36) | 1816 | 1069 | -747 (-41) |
|  | Rate\* | 9.42 | 5.95 | -3.47 (-37) | 7.32 | 4.28 | -3.05 (-42) |
| 11 | Digestive system |  |  |  |  |  |  |
|  | N | 1339 | 880 | -459 (-34) | 956 | 617 | -339 (-35) |
|  | Rate\* | 4.19 | 2.71 | -1.48 (-35) | 3.86 | 2.47 | -1.39 (-36) |
| 13 | Musculoskeletal, connective |  |  |  |  |  |  |
|  | N | 821 | 540 | -281 (-34) | 441 | 287 | -154 (-35) |
|  | Rate\* | 2.57 | 1.66 | -0.91 (-35) | 1.78 | 1.15 | -0.63 (-35) |
| 9 | Circulatory system |  |  |  |  |  |  |
|  | N | 1604 | 1106 | -498 (-31) | 1036 | 633 | -403 (-39) |
|  | Rate\* | 5.02 | 3.4 | -1.61 (-32) | 4.18 | 2.53 | -1.64 (-39) |
| 6 | Nervous system |  |  |  |  |  |  |
|  | N | 560 | 413 | -147 (-26) | 382 | 258 | -124 (-32) |
|  | Rate\* | 1.75 | 1.27 | -0.48 (-27) | 1.54 | 1.03 | -0.51 (-33) |
| 21 | Factors infl. health status |  |  |  |  |  |  |
|  | N | 109 | 85 | -24 (-22) | 67 | 54 | -13 (-19) |
|  | Rate\* | 0.34 | 0.26 | -0.08 (-23) | 0.27 | 0.22 | -0.05 (-20) |
| 4 | Endocrine, nutritional, metabolic |  |  |  |  |  |  |
|  | N | 513 | 405 | -108 (-21) | 429 | 322 | -107 (-25) |
|  | Rate\* | 1.60 | 1.25 | -0.36 (-22) | 1.73 | 1.29 | -0.44 (-26) |
| 19 | Injury, poisoning |  |  |  |  |  |  |
|  | N | 3883 | 3305 | -578 (-15) | 2419 | 1880 | -539 (-22) |
|  | Rate\* | 12.14 | 10.17 | -1.97 (-16) | 9.75 | 7.52 | -2.23 (-23) |
|  | COVID-19 |  |  |  |  |  |  |
|  | N | 0 | 2960 | - | 0 | 3295 | - |
|  | Rate\* | 0 | 9.11 | - | 0 | 13.18 | - |
|  | Other/Unknown |  |  |  |  |  |  |
|  | N | 207 | 198 | -9 (-4) | 111 | 157 | +46 (+41) |
|  | Rate\* | 0.65 | 0.61 | -0.04 (-6) | 0.45 | 0.63 | +0.18 (+40) |
|  |  |  |  |  |  |  |  |

Admissions where the primary diagnosis code was missing or where the primary diagnosis code corresponded to a chapter that had <10 admissions for at least one year in one care home type were grouped into Other/Unknown. The ICD-10 codes for suspected or confirmed COVID-19 are part of ICD-10 chapter 22. Rows are sorted by increasing % change in residential care homes.

**Appendix Table S6.** Number and rates of emergency hospital admissions for acute coronary syndromes or stroke between 1 March and 31 May in 2019 and 2020, by care home type. \*Admissions per 100 residents per year.

|  |  |  |
| --- | --- | --- |
|  | **Acute coronary syndromes** | **Stroke** |
| **Care home type** | **2019** | **2020** | **Change (%)** | **2019** | **2020** | **Change (%)** |
| Residential  |  |  |  |  |  |  |
|  N | 184 | 106 | -78 (-42) | 416 | 349 | -67 (-16) |
|  Rate\* | 0.58 | 0.33 | -0.25 (-43) | 1.30 | 1.07 | -0.23 (-17) |
| Nursing  |  |  |  |  |  |  |
|  N | 96 | 69 | -27 (-28) | 252 | 191 | -61 (-24) |
|  Rate\* | 0.39 | 0.28 | -0.11 (-29) | 1.02 | 0.76 | -0.25 (-25) |

**Appendix Table S7.** Number and rates of potentially avoidable emergency admissions between 1 March and 31 May in 2019 and 2020, by primary admission reason and care home type. LRTI, lower respiratory tract infection. \*Admissions per 100 residents per year.

|  |  |  |
| --- | --- | --- |
| **Care home type** | **Residential** | **Nursing** |
| **Condition** | **2019** | **2020** | **Change (%)** | **2019** | **2020** | **Change (%)** |
| Pneumonia |  |  |  |  |  |  |
|  N | 2354 | 1437 | -917 (-39) | 1958 | 1214 | -744 (-38) |
|  Rate\* | 7.36 | 4.42 | -2.94 (-40) | 7.90 | 4.86 | -3.04 (-38) |
| Fractures and sprains |  |  |  |  |  |  |
|  N | 1646 | 1589 | -57 (-3) | 922 | 826 | -96 (-10) |
|  Rate\* | 5.15 | 4.89 | -0.26 (-5) | 3.72 | 3.31 | -0.41 (-11) |
| Urinary tract infections |  |  |  |  |  |  |
|  N | 1295 | 630 | -665 (-51) | 903 | 452 | -451 (-50) |
|  Rate\* | 4.05 | 1.94 | -2.11 (-52) | 3.64 | 1.81 | -1.83 (-50) |
| Acute LRTIs |  |  |  |  |  |  |
|  N | 827 | 439 | -388 (-47) | 587 | 343 | -244 (-42) |
|  Rate\* | 2.59 | 1.35 | -1.23 (-48) | 2.37 | 1.37 | -1 (-42) |
| Food and liquid pneumonitis |  |  |  |  |  |  |
|  N | 595 | 320 | -275 (-46) | 914 | 494 | -420 (-46) |
|  Rate\* | 1.86 | 0.99 | -0.88 (-47) | 3.69 | 1.98 | -1.71 (-46) |
| Chronic LRTIs |  |  |  |  |  |  |
|  N | 516 | 248 | -268 (-52) | 443 | 206 | -237 (-53) |
|  Rate\* | 1.61 | 0.76 | -0.85 (-53) | 1.79 | 0.82 | -0.96 (-54) |
| Intestinal infections |  |  |  |  |  |  |
|  N | 229 | 100 | -129 (-56) | 122 | 77 | -45 (-37) |
|  Rate\* | 0.72 | 0.31 | -0.41 (-57) | 0.49 | 0.31 | -0.18 (-37) |
| Diabetes |  |  |  |  |  |  |
|  N | 114 | 112 | -2 (-2) | 142 | 109 | -33 (-23) |
|  Rate\* | 0.36 | 0.35 | -0.01 (-3) | 0.57 | 0.44 | -0.14 (-24) |
| Food and drink issues |  |  |  |  |  |  |
|  N | 52 | 26 | -26 (-50) | 27 | 16 | -11 (-41) |
|  Rate\* | 0.16 | 0.08 | -0.08 (-51) | 0.11 | 0.06 | -0.05 (-41) |
| Pressure sores |  |  |  |  |  |  |
|  N | 24 | 25 | +1 (+4) | 34 | 18 | -16 (-47) |
|  Rate\* | 0.08 | 0.08 | 0.002 (+3) | 0.14 | 0.07 | -0.07 (-47) |

**Appendix Table S8.** Number and rates of elective admissions with cataract procedures between 1 March and 31 May in 2019 and 2020, by care home type. \*Admissions per 100 residents per year.

|  |  |  |
| --- | --- | --- |
|  | **Admissions** | **Rate\*** |
| **Care home type** | **2019** | **2020** | **Change (%)** | **2019** | **2020** | **Change (%)** |
| Residential  | 371 | 71 | -300 (-81) | 1.16 | 0.22 | -0.94 (-81) |
| Nursing  | 252 | 49 | -203 (-81) | 1.02 | 0.20 | -0.82 (-81) |

**Appendix Figure S1.** Data cleaning workflow to create cohorts of care home residents in January 2019 and January 2020.

1. Patient index records with address matched to a care home

n = 345,985

Care home residents, January 2019

n = 358,905

Care home residents, January 2020

Exclude records only matching to care homes not listed as open

n = 254,138

n = 259,309

2. Patient index records with address match to open care homes

n = 91,847 (26.5%)

n = 99,596 (27.7%)

n = 252,432

n = 257,843

3. Patient index records with unique address match to an open care home

n = 1,706 (0.67%)

n = 1,466 (0.56%)

Exclude records with multiple matches to open care homes

**Appendix Figure S2.** Assessment of similarity between cohorts of care home residents in January 2019 and January 2020.



**Appendix Figure S3.** Number and percentage of COVID-19 hospital admissions between 1 March and 31 May 2020, by number of additional diagnoses codes and care home type.



**Appendix Figure S4.** Number and percentage of COVID-19 hospital admissions with additional diagnosis codes in other ICD-10 chapters (1 March to 31 May 2020), by care home type.

****

**Appendix Figure S5.** Assessment of similarity of the characteristics between care home residents admitted to National Health Service hospital trusts in England for suspected or confirmed COVID-19 or for other primary diagnoses, by care home type (1 March to 31 May 2019, and 1 March to 31 May 2020). Includes ordinary elective admissions, elective day cases and emergency admission.

****