TITLE

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

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ABSTRACT

Background: Care home residents have complex healthcare needs but may have faced barriers to accessing hospital treatment during the first wave of the COVID-19 pandemic.

Objective: To examine trends in the number of hospital admissions for care home residents during the first months of the COVID-19 outbreak.

Methods: Retrospective analysis of a national linked dataset on hospital admissions for residential and nursing home residents in England between 20 January 2020 and 28 June 2020, compared to the corresponding period in 2019. Elective and emergency admission rates, normalised to the time spent in care homes across all residents, were derived across the first three months of the pandemic between 1 March and 31 May and primary admissions reasons for this period were compared across years.

Results: Hospital admission rates rapidly declined during early March 2020 and remained substantially lower than in 2019 until the end of June. Between March and May, 2,960 admissions from residential homes (16.2%) and 3,295 admissions from nursing homes (23.7%) were for suspected or confirmed COVID-19. Rates of other emergency admissions decreased by 36% for residential and by 38% for nursing home residents. Emergency admissions for acute coronary syndromes fell by 42% and 28% and emergency admissions for stroke fell by 16% and 24% for residential and nursing home residents, respectively. Elective admission rates declined by 64% for residential and by 61% for nursing home residents.

Conclusions: This is the first study showing that care home residents' hospital use declined during the first wave of COVID-19, potentially resulting in substantial unmet health need that will need to be addressed alongside ongoing pressures from COVID-19.

Keywords:

Hospital admissions, care homes, COVID-19, linked data, administrative data

Highlights:

- The NHS in England rapidly reorganised and reprioritised the delivery of hospital care at the onset of the COVID-19 pandemic.
- There was a substantial and sustained decline in hospital admissions from care homes during the first months of the pandemic.
- The proportion of emergency admissions that were potentially avoidable was broadly similar to the previous year.
- The decrease in admissions may be indicative of substantial unmet healthcare need in residential care settings.
- Further research is needed to understand health outcomes for residents who required urgent care during this period.

BACKGROUND

Worldwide the COVID-19 pandemic has resulted in substantial excess mortality among people living in care homes [1]. Excess deaths have been attributed directly to viral infection, and to increases in deaths due to other causes, most commonly diabetes, heart diseases, Alzheimer's and dementia, and cerebrovascular diseases [2–4]. In England, care homes provide accommodation, personal care and support with daily living for a population of residents with high levels of multimorbidity and frailty, and complex care needs [5–7]. Unlike residential care homes, nursing homes additionally provide 24-hour nursing care to residents, a high proportion of whom are in their last year of life [5,6].

In response to the pandemic, the English National Health Service (NHS) rapidly reorganized and reprioritized the delivery of care in March 2020. National guidelines were issued to consider frailty when determining the appropriate use of critical care in COVID-19 treatment [8]. Non-urgent elective care was paused [9], and there were substantial drops in attendance for emergency care among the general public [10]. Local health systems were asked to provide enhanced primary and community care services to residents of care homes, intended to reduce reliance on acute hospital care [11]. Measures included personalised care and support plans for residents, and patient reviews during remote weekly 'check ins' [12].

There were concerns that guidance based on frailty assessments may have disadvantaged older people wishing to access critical care treatment and was later criticised by the independent regulator of health and adult social care services in England [13,14]. Following concerns about inappropriate uses of advance care plans and do not attempt resuscitation orders early in the pandemic, the regulator issued a clarification stating that hospitals should enable equal access for care home residents to urgent hospital care and treatment for COVID-19 [13,15]. However, governance and effectiveness of joint working arrangements varied between local systems and some care homes reported difficulties in accessing urgent GP and hospital care [16,17]. The perceived risk of infection in hospitals may also have led to changes in patient and carer preferences and care seeking behaviour.

While there is evidence that older people might have been disproportionately affected by disruptions to hospital care [18], there is currently only preliminary evidence for a decrease in hospital admissions for people living in care homes in England [19]. There remains a need to better understand the impact of the pandemic on resident's health status and quality of life and to plan for the capacity required to address unmet care need. However these efforts have been hampered by the lack of a central register of care home residents and the challenge to identify residents in national, routinely collected healthcare data [20]. We therefore used an address-based linkage methodology to examined national trends in elective and emergency hospital admissions for individuals living in residential and nursing homes in England, as well as

changes in the primary reasons for admissions during the first wave of the COVID-19 outbreak.

METHODS

Data sources

We used administrative data on hospital admissions from Secondary Uses Service, a national database of NHS-funded hospital activity in England. As care homes are not reliably recorded as admission source, care home residents were identified through linkage to the patient index from the National Health Applications and Infrastructure Services, as previously described [5,6]. This database contains longitudinal records of patient registrations with general practices in England, including patient address and year and month of death. Data extracts are created on the first Sunday following the 13th day of the month. Patient addresses were matched to Unique Property Reference Numbers and subsequently cross-referenced to care home addresses and characteristics held by the Care Quality Commission, the regulator of social care services in England. Care home opening and closing dates were used to resolve address matches to multiple care homes, which can occur when recorded characteristics of care homes change. Small area-level socioeconomic deprivation (Index of Multiple Deprivation 2019, Office for National Statistics) was added using care home Lower Layer Super Output Areas (LSOA). All processing of addresses and linkage of patient information was carried out by the National Commissioning Data Repository. Data were anonymised in line with the Information Commissioner's Office's code of practice on anonymisation.

Study populations

Individuals were included in the 2020 study cohort if they were recorded as living in a care home on 19 January 2020. These were compared to a cohort of individuals living in a care home on 20 January 2019. Residents of all ages and in all types of care homes were included, including specialist care homes. The cohorts were further split into subgroups based on care home type (residential or nursing) using information provided by the regulator that nursing care was being provided to some residents.

Patient characteristics

Age, sex, and month of death were taken from the patient index. The Charlson index and previous dementia diagnoses for each resident were calculated using primary or secondary diagnosis codes of all hospital admissions from up to three years prior to the respective study start date in January [21–23].

Hospital admissions

The follow-up period for the study was between 21 January and 30 June 2019 or between 20 January and 28 June 2020, respectively. Observations were censored at the date of death, or the end of the care home stay. The end of the care home stay was

defined as the last day of the monthly data extract where an individual's address matched to a care home. The date of death was defined as the last day of the month of death, or the last day of the data extract ending in the month of death, whichever was later.

Hospital admissions were not included if the administrative category was private patient, the admission method was a transfer or missing. Admissions were divided into emergency and elective admissions based on the method of admission. Admission rates per person per year were calculated across all residents, controlling for the number of days spent in a care home. Primary admission reasons were categorised according to the International Classification of Diseases 10 revision (ICD-10) chapter of the primary diagnosis code (Appendix Table S1).

Several acute conditions, as defined by ICD-10 code, were selected for further analysis: suspected or confirmed COVID-19 (U07.1, U07.2) [24], acute coronary syndromes (I20.0, I21.0-4, I21.9, I22.0-2, I22.8-9, I24.8-9) [25], and stroke (I61, I63, I64) [26]. A small number of COVID-19 admissions (n = 37, 0.59% of COVID-19 admissions) were coded as elective; these were not analysed separately. Cataract surgeries were defined using Office of Population Censuses Surveys Classification of Surgical Operations and Procedures (OPCS4) codes C71-C75 [27], based on all procedure codes for any given admission.

We also examined a subset of unplanned hospital admissions from care homes, which have been referred to as potentially avoidable emergency admissions: either because they are generally considered manageable, treatable or preventable outside a hospital setting or because they can be caused by poor care or neglect [28,29]. Potentially avoidable emergency admissions have previously been used as primary outcome measure to evaluate the impact of several initiatives to improve health and care in care homes in England [5,6]. This list of conditions, which was developed by the health and social care regulator, includes acute and chronic lower respiratory tract infections, pressure sores, diabetes, food and drink issues, food and liquid pneumonitis, fractures and sprains, intestinal infections, pneumonia, and urinary tract infections. ICD-10 code lists are shown in Appendix Table S2, including corrections made after consultation with the authors [29].

Although these admissions are not necessarily inappropriate and often cannot be avoided once the condition becomes acute, they may have been preventable at an earlier stage with additional support or better care coordination [5]. For example, while not all falls may be preventable without extreme measures such as restraint, some fractures might be avoidable with appropriate risk assessments and falls prevention. The degree to which potentially avoidable admissions could in fact have been avoided will also be influenced by residents' other health conditions as well as organisational context. For example, urinary tract infections may often be treatable in the community or within the care home but might be less amenable to intervention if complicated by falls or delirium. Nursing support available in a nursing home may enable staff to oversee

treatments that might otherwise require an admission to hospital. However, enhanced primary and community care for care home residents during the COVID-19 outbreak could be expected to have an impact on this group of admissions. Due to the heterogeneity within this group of potentially avoidable admission reasons, we also considered them separately to examine change in the number of admissions during the pandemic.

Statistical analyses

In Figure 1 showing trends in weekly admission rates, a locally estimated smoothing function was fitted for each group (using the *geom_smooth* function of the R package *ggplot2* and the default *loess* smoothing function). To assess the similarity between years of baseline characteristics of study cohorts and of admitted patients, absolute standardised mean differences were calculated using the R package *tableone*. They are defined as the difference in means of a given characteristic as a percentage of the pooled standard deviation, with a cut-off value of 10% being widely adopted for negligible imbalance between groups [30]. Standardised mean differences allow comparisons of the magnitude of difference between groups, rather than statistical significance. They can be used across variables of different scales and have the advantage that they are not dependent on sample size. We used R (version 3.6.3) for data processing and analysis and SAS (version 7.12) for data cleaning and analysis of comorbidities [31]. Analysis code is available on GitHub (https://github.com/HFAnalyticsLab/COVID19_care_homes).

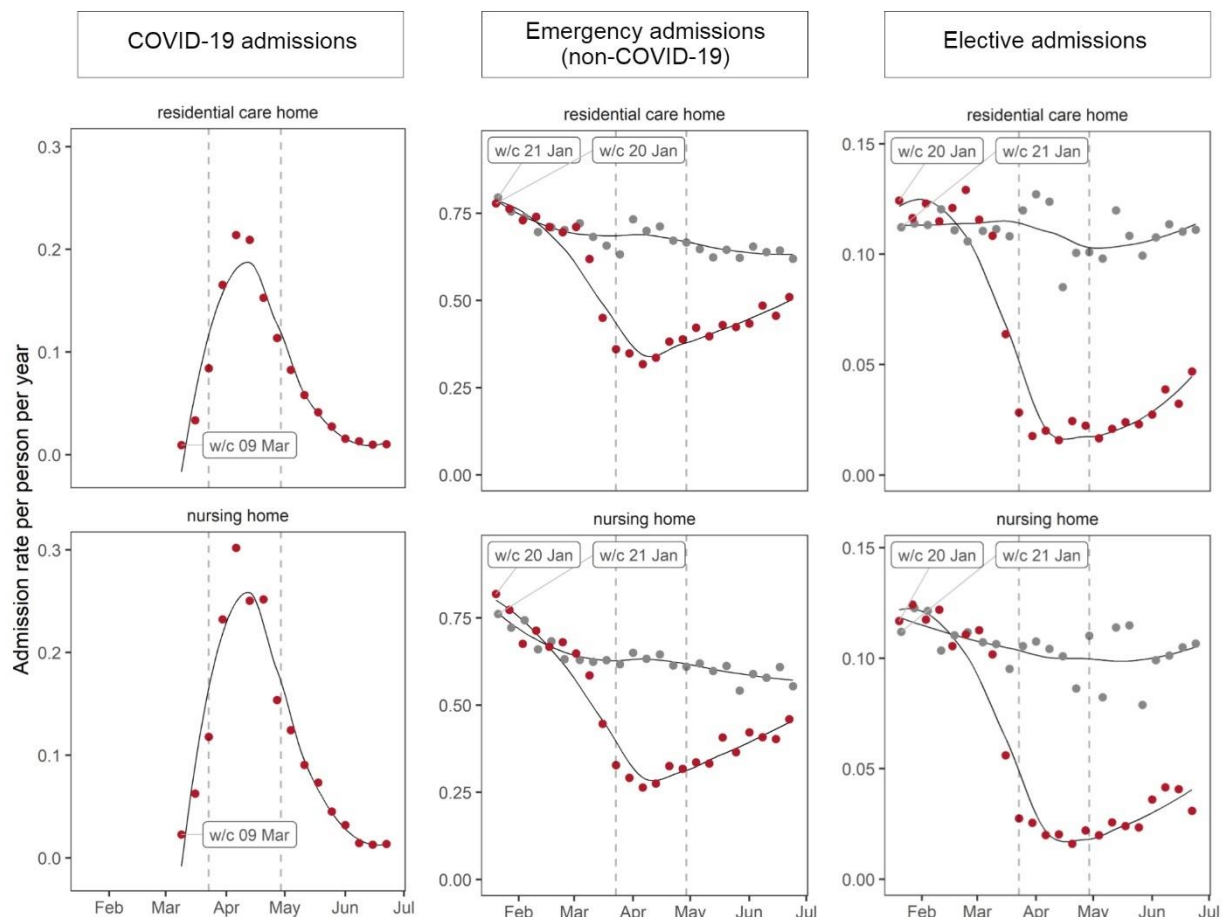
RESULTS

Study populations

We identified 252,432 residents living in a care home in January 2019 and 257,843 residents in January 2020 (45% in nursing homes in both years) who met the inclusion criteria. A data cleaning flow chart is shown in Appendix Figure S1. The demographic characteristics of individuals living in residential and nursing homes were broadly similar in January 2019 and 2020, but mortality during the follow-up period was higher in 2020 (Appendix Table S3 and Appendix Figure S2).

Trends in hospital admissions

To examine trends in hospital admissions, we quantified weekly rates of COVID-19 admissions, other emergency admissions and elective admissions between 20 January 2020 and 28 June 2020 and compared these with the corresponding period in 2019 (Figure 1). For each type of admission, as well as for categories of primary admissions reasons, we subsequently compared the number of admissions during the first three months of the COVID-19 outbreak in England, between 1 March and 31 May 2020, with the same period in 2019.

Figure 1. Weekly hospital admission rates of care home residents to National Health Service trusts in England, by care home type and admission type. A locally estimated smoothing spline is fitted through the weekly admission rates for 2019 and 2020. The date of the UK-wide COVID-19 lockdown (23 March 2020) and the date on which NHS providers were asked to resume elective activity (29 April 2020) are shown as vertical dashed lines. Elective admissions include ordinary admissions and day cases. Emergency admissions (non-COVID-19) are defined as admissions that had a primary diagnosis code other than confirmed or suspected COVID-19. COVID-19 admissions are only shown for weeks where there were more than 10 admissions from both types of care home. w/c; week commencing.

COVID-19 hospital admissions

Weekly COVID-19 admission rates rose sharply from the week commencing 9th March 2020 until mid-April, followed by a decline throughout May 2020 (Figure 1). Between 1 March and 31 May, 2,960 admissions from residential homes and 3,295 admissions from nursing homes were for suspected or confirmed COVID-19 (Table 1), corresponding to 16.2% and 23.7% of all admissions, respectively.

Table 1. **Characteristics of residents from residential and nursing homes admitted to National Health Service hospital trusts in England, by primary diagnosis (1 March to 31 May 2019, and 1 March to 31 May 2020).** Admissions include ordinary elective admissions, elective day cases and emergency admissions. IMD, Index of Multiple Deprivation. *Mean (standard deviation).

Care home type	Residential			Nursing		
Year	2019	2020		2019	2020	
Primary diagnosis	All	COVID-19	Other	All	COVID-19	Other
N	24995	2960	15348	17903	3295	10597
Female (%)	15410 (61.7)	1609 (54.4)	9380 (61.1)	9956 (55.6)	1604 (48.7)	5712 (53.9)
Age in years*	81 (15)	83 (11)	81 (15)	79 (14)	79 (12)	79 (14)
Charlson Index*	2.03 (1.93)	2.11 (1.89)	2.09 (1.95)	2.30 (2.03)	2.29 (2.01)	2.35 (2.06)
Dementia (%)	12103 (48.4)	1618 (54.7)	7774 (50.7)	8860 (49.5)	1768 (53.7)	5389 (50.9)
IMD quintile (%)						
1 (least deprived)	4783 (19.1)	615 (20.8)	2990 (19.5)	4165 (23.3)	891 (27.0)	2456 (23.2)
2	5423 (21.7)	664 (22.4)	3405 (22.2)	3589 (20.0)	762 (23.1)	2105 (19.9)
3	5533 (22.1)	659 (22.3)	3343 (21.8)	3721 (20.8)	605 (18.4)	2227 (21.0)
4	5016 (20.1)	609 (20.6)	3133 (20.4)	3477 (19.4)	597 (18.1)	1986 (18.7)
5 (most deprived)	4162 (16.7)	403 (13.6)	2443 (15.9)	2888 (16.1)	429 (13.0)	1799 (17.0)
Missing	78 (0.3)	10 (0.3)	34 (0.2)	63 (0.4)	11 (0.3)	24 (0.2)
Region (%)						
East Midlands	1260 (5.0)	161 (5.4)	763 (5.0)	1324 (7.4)	255 (7.7)	886 (8.4)
East of England	2659 (10.6)	313 (10.6)	1617 (10.5)	1698 (9.5)	324 (9.8)	922 (8.7)
London	2951 (11.8)	419 (14.2)	1811 (11.8)	2016 (11.3)	439 (13.3)	1116 (10.5)
North East	3488 (14.0)	418 (14.1)	2032 (13.2)	2803 (15.7)	553 (16.8)	1604 (15.1)
North West	2541 (10.2)	127 (4.3)	1717 (11.2)	1547 (8.6)	132 (4.0)	954 (9.0)
South East	2696 (10.8)	295 (10.0)	1662 (10.8)	1688 (9.4)	245 (7.4)	1066 (10.1)
South West	3747 (15.0)	530 (17.9)	2385 (15.5)	1746 (9.8)	362 (11.0)	1130 (10.7)
West Midlands	1718 (6.9)	378 (12.8)	868 (5.7)	2163 (12.1)	536 (16.3)	1060 (10.0)
Yorkshire and the Humber	3857 (15.4)	309 (10.4)	2459 (16.0)	2855 (15.9)	438 (13.3)	1835 (17.3)
Missing	78 (0.3)	10 (0.3)	34 (0.2)	63 (0.4)	11 (0.3)	24 (0.2)
Bed capacity*	37 (20)	44 (22)	38 (21)	61 (27)	65 (28)	61 (27)

By the end of this period, 1.9% of the residential cohort and 2.6% of the nursing home cohort had been admitted to hospital at least once for suspected or confirmed COVID-19 (2,716 and 3,051 residents, respectively). When additionally including admissions where COVID-19 was recorded but was not the primary diagnosis, this increased to 2.7% and 3.4% of the residential and nursing home cohort (3,794 and 3,980 residents),

respectively. Residents admitted for COVID-19 were less likely to be female, lived in larger care homes and were more likely to live in London and the West Midlands, compared to residents admitted for other reasons (Table 1 and Appendix Figure S3). A previous diagnosis of dementia was more common among care home residents admitted for COVID-19 than among those admitted to hospital for other reasons. For nursing home residents, COVID-19 admissions (as compared to non-COVID-19 admissions) were more concentrated in less deprived areas and for residential care homes, residents admitted for COVID-19 were older.

Non-COVID19 emergency admissions

The rates of emergency admissions with primary diagnoses other than COVID-19 decreased by over a third during the first three months of the outbreak compared to the same period in 2019, with a 36% decrease for residential (7,420 fewer admissions) and 38% decrease for nursing home residents (5,771 fewer admissions, Table 2).

Table 2. Number of hospital admissions and hospital admission rates of care home residents to National Health Service trusts in England between 1 March and 31 May in 2019 and 2020, by care home type and admission type. *Includes ordinary admissions and day cases.

Care home type	Residential			Nursing		
	2019	2020	Change (%)	2019	2020	Change (%)
Elective*						
N	3493	1266	-2227 (-64)	2511	976	-1535 (-61)
Per person per year	0.11	0.04	-0.07 (-64)	0.10	0.04	-0.06 (-61)
Emergency, all						
N	21502	17042	-4460 (-21)	15392	12916	-2476 (-16)
Per person per year	0.67	0.52	-0.15 (-22)	0.62	0.52	-0.10 (-17)
Emergency, COVID-19						
N	-	2960	-	-	3295	-
Per person per year	-	0.09	-	-	0.13	-
Emergency, other primary diagnosis						
N	21502	14082	-7420 (-35)	15392	9621	-5771 (-37)
Per person per year	0.67	0.43	-0.24 (-36)	0.62	0.38	-0.24 (-38)
Emergency, potentially avoidable						
N	7652	4926	-2726 (-36)	6052	3755	-2297 (-38)
Per person per year	0.24	0.15	-0.09 (-37)	0.24	0.15	-0.09 (-38)

The magnitude of change varied between admissions associated with different ICD-10 diagnosis chapters, with the largest decline seen in infectious and parasitic diseases and diseases of the blood, and the smallest decline for injuries and poisoning (Appendix

Table S4). Admissions for acute coronary syndromes fell by 42% and 28% and admissions for stroke fell by 16% and 24% for residents from residential and nursing homes, respectively (Appendix Table S5).

The overall proportion of (non-COVID-19) emergency admissions that occurred for potentially avoidable reasons within this period were similar in both years, at around 35% of admissions from residential care homes and 39% of admissions from nursing homes (Table 2). Admissions for urinary tract infections (UTI) fell by half in 2020 compared to 2019 for both residential (665 fewer admissions) and nursing home residents (451 fewer admissions, Figure 2). Admissions for pneumonia decreased by over a third for both residential (917 fewer admissions) and nursing home residents (744 fewer admissions) but remained the most common potentially avoidable admission reason. The number of admissions for fractures and sprains remained broadly similar for both residential and nursing home residents.

Elective hospital admissions

Compared to the same period in 2019, elective hospital admission rates during the first three months of the pandemic in England decreased by 64% for residential care homes (2,227 fewer admissions) and by 61% for nursing homes (1,535 fewer admissions, Table 2). Both for residential and nursing home residents there were fewer admissions across all ICD-10 chapters in 2020 compared to 2019 (Table 3).

Among the three most commons ICD-10 chapters (neoplasms, eye conditions, conditions of the digestive system), the largest decrease, both in relative and absolute terms, was seen for admissions for eye conditions (a decline of 77% and 78% for residents of residential and nursing homes, respectively), corresponding to a total of 732 fewer admissions than in 2019. This was also reflected in the number of hospital admissions with a record of cataract surgeries, which decreased by 81% in both care settings (503 fewer admissions with cataract procedures in total, Appendix Table S6). In contrast, admissions for neoplasms had a smaller percentage decrease (a decrease of 51% and 47% for residential and nursing home residents, respectively), with a total of 493 fewer admissions across both care settings.

Figure 2. Number of potentially avoidable emergency admissions between 1 March and 31 May in 2019 and 2020, by primary admission reason and care home type. Bars are labelled to show the absolute and percent difference between 2019 and 2002, by care home type. LRTI, lower respiratory tract infection.

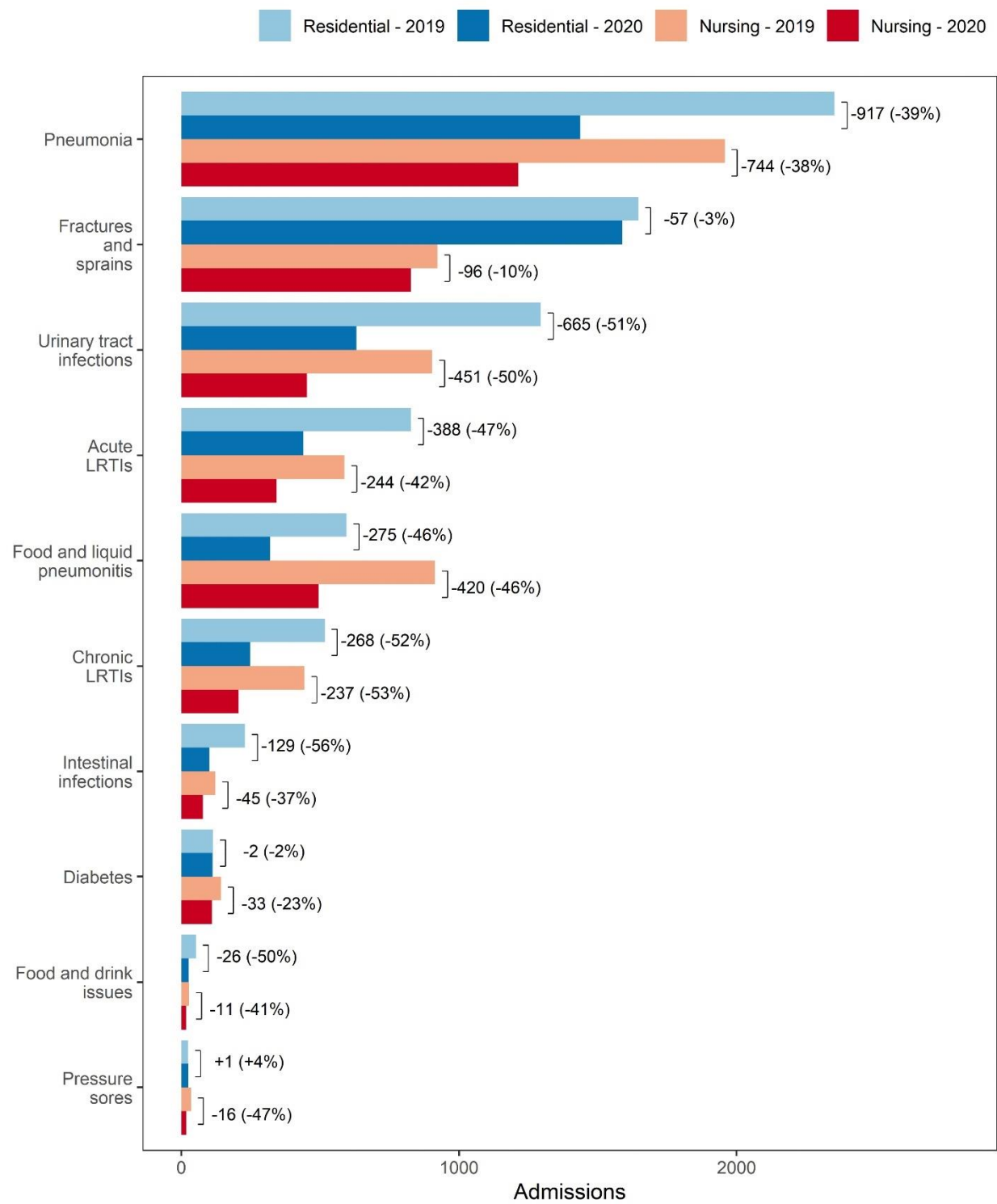



Table 3. Number of elective admissions (ordinary admissions and day cases) and changes in the number of elective admissions between 1 March and 31 May in 2019 and 2020, by care home type and ICD-10 chapter of the primary diagnosis code. Admissions where the primary diagnosis code corresponded to a chapter that had <10 admissions for at least one year in one care home type were grouped into Other. Rows are sorted by increasing % change in residential care homes. ICD-10, International Statistical Classification of Diseases and Related Health Problems, 10th revision.

Care home type		Residential			Nursing		
		2019	2020	Change (%)	2019	2020	Change (%)
ICD-10 chapter							
7	Eye, adnexa	553	128	-425 (-77)	393	86	-307 (-78)
13	Musculoskeletal, connective	228	55	-173 (-76)	140	32	-108 (-77)
11	Digestive system	603	152	-451 (-75)	326	91	-235 (-72)
6	Nervous system	99	29	-70 (-71)	136	76	-60 (-44)
12	Skin, subcutaneous tissue	128	38	-90 (-70)	76	40	-36 (-47)
14	Genitourinary system	178	57	-121 (-68)	221	51	-170 (-77)
18	Not elsewhere classified	197	77	-120 (-61)	143	65	-78 (-55)
21	Factors infl. health status	171	69	-102 (-60)	252	96	-156 (-62)
19	Injury, poisoning	88	36	-52 (-59)	93	45	-48 (-52)
3	Blood, blood-forming organs	260	107	-153 (-59)	117	68	-49 (-42)
2	Neoplasms	592	293	-299 (-51)	412	218	-194 (-47)
9	Circulatory system	121	64	-57 (-47)	75	26	-49 (-65)
5	Mental, behavioural	52	30	-22 (-42)	16	13	-3 (-19)
	Other	111	34	-77 (-69)	59	18	-41 (-69)
	Unknown	112	97	-15 (-13)	52	51	-1 (-2)

DISCUSSION

Principal findings

To free hospital capacity for patients critically ill with COVID-19 and to reduce the risk of infection during the first wave of the pandemic, local health systems and the NHS in England rapidly reorganised care pathways. This led to concerns that care home residents may have faced barriers to accessing hospital care. During the first months of the pandemic, between 1 March and 31 May 2020, there were 6,255 admissions for suspected or confirmed COVID-19 from residential care settings, which peaked during the first half of April. Admissions for COVID-19 were skewed towards larger care homes and care homes located in London and the West Midlands. Compared to the same

period in 2019, there were 13,191 fewer emergency admissions for reasons other than COVID-19, a decline of over a third. This was only partially due to a decrease in potentially avoidable conditions, as proportion of emergency admissions that were potentially avoidable was broadly similar to the previous year. However, we observed substantial changes in the number of admissions for some potentially avoidable reasons, such as UTIs. The most substantial drop was seen for elective admissions, where there were 3,762 fewer admissions from residential care settings than in 2019, a decline of close to two thirds compared to the year before.

Strengths and limitations

Our study has several strengths. It captures all admissions to NHS hospitals, and it uses a validated data linkage method to identify care home residents in routinely collected hospital data, as care home residents are not routinely flagged in administrative hospital records. Therefore, it provides the first comprehensive overview over hospital inpatient activity of care home residents in England during the pandemic. Our study has some limitations. As the address matching methodology is based on patient address held by general practices, we may miss residents who moved into a care home around the time of the study start or where the address had not been updated. During the early stages of the outbreak, COVID-19 diagnoses might not have been accurately captured in hospital records, and for all admissions the severity of the condition would not be captured in the data. Following a COVID-19 incident in care home, other residents in the same home may have been less likely to seek hospital treatment for other care needs due to isolation measures. This was possible to be determined without access to linked data on care home outbreaks. The list of potentially avoidable reasons was developed by the regulator for an analysis focusing on trends in hospital care use by older people but was not specifically designed for care home residents [29]. While it is based on a list of commonly defined ambulatory care sensitive conditions and captures the most common preventable causes of harm in care homes [32], further validation of the individual conditions as a marker of potentially avoidable admissions in the care home population is needed.

Comparison with previous work

The baseline hospital admission rates for our cohort of residents, as well as their relative proportions, are similar to a previous study of care home residents in England aged 65 or over, which reported 0.77 and 0.70 annual admissions per resident [6]. The small difference in observed rates might be explained by the different age cutoff and the fact that we used data from March, April and May, rather than data on admissions across a whole year. We also found that there were more COVID-19 admissions from nursing homes than from residential care homes. This is consistent with emerging evidence that care home size is an important risk factor for experiencing a COVID-19 outbreak and nursing homes on average have a greater number of beds [33]. In our study, 2.2% of residents experienced a hospital admission for COVID-19 between 1 March and 31 May 2020. A survey of 9,081 care homes in England between 26 May

and 20 June 2020 reported that 11% of residents had tested positive for COVID-19 [34]. Excess mortality attributable to COVID-19 in care homes in England up to 7th August 2020 has been estimated to be equivalent to 6.5% of care home beds [3].

Implications

Our analysis shows that care home residents' use of inpatient hospital care decreased during the first three months of the pandemic. The largest decreases were elective care and some potentially avoidable admissions, such as urinary tract infections. We saw large variation within the group of conditions associated with potentially avoidable admissions and their changes during the COVID-19 outbreak, compared to the previous year. However, interpretating these differences is complex as not all conditions within this group will be equally amenable to prevention and treatment in the community. Some acute emergency conditions, including acute coronary syndromes and stroke, also saw decreases admissions, indicating that fewer residents received appropriate urgent hospital care.

These changes are likely to be driven by several factors. Firstly, avoiding hospital admission has previously been seen as preferable by both clinicians and residents [35]. This sentiment may have grown stronger due to the perceived risk of contracting COVID-19 in hospital. Secondly, as previous evidence shows that some avoidable emergency admissions can be reduced through enhanced primary care in care homes [5], the additional support provided by primary and community care teams may have been successful in avoiding some of these during the COVID-19 outbreak [36]. Consistent with the observed variation in the changes of avoidable admission reasons seen in this study, some avoidable causes, such as UTIs, might be more amenable to intervention without an admission. Finally, visiting restrictions and enhanced control measures might have led to fewer admissions due to other communicable infections.

However, our analysis does not allow us to differentiate whether admissions were prevented through out of hospital care, whether treatment in the care home was prioritised, or whether conditions remained undiagnosed. In addition, further research is needed to examine the outcomes for patients and residents during this period. The rapid and sustained changes in care pathways highlight the increased need care workers and families have for support from geriatricians and other health care staff in advance care planning with patients [37]. Elective admission rates for all conditions were lowest during April and rose through May and June but remained far below historical levels until the end of June, with potentially concerning consequences for unmet elective care need. If unmet need is concentrated in high symptom burden conditions such as cataract then, while not prolonging life, lack of treatment will have a significant impact on quality of life [38].

Conclusion

This study is the first comprehensive national analysis of care home residents' hospital use in England during the early months of the COVID-19 outbreak. Our study shows

that there was a substantial decline in hospital admissions of care home residents during the early months of the pandemic, potentially resulting in substantial unmet healthcare need in residential care settings.

ABBREVIATIONS

COVID-19, disease caused by the SARS-CoV-2 (2019-nCoV) coronavirus; NHS, National Health Service, ICD-10, International Statistical Classification of Diseases and Related Health Problems, 10th revision; IMD, Index of Multiple Deprivation; OPCS4, Office for Population Censuses and Surveys Classification of Surgical Operations and Procedures, fourth revision; LRTI, lower respiratory tract infection; LSOA, Lower Layer Super Output Area; SD, standard deviation; UTI, urinary tract infection; w/c, week commencing.

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FOOTNOTES

Contributors: SD conceived the study and SD and FG designed the study. FG, RB and KH analysed and interpreted the data. FG, KH and SD drafted the first version of the manuscript. All authors contributed to, read, and approved the final manuscript. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted. SD is the guarantor.

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Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Ethics approval: As we used routinely collected and pseudonymised data for our analysis, which were made available through an agreement approved by NHS England, no further ethics approval was required.

Availability of data and materials: The analysis code is available at https://github.com/HFAnalyticsLab/COVID19_care_homes. Data used in this study cannot be made publicly available due to the conditions of the data sharing agreement.

SUPPLEMENTARY APPENDICES

Appendix Table S1. ICD-10 chapters, diagnosis code ranges and chapter descriptions.

Appendix Table S2. ICD-10 diagnosis codes for potentially avoidable causes of emergency admissions.

Appendix Table S3. Comparison of baseline characteristics of the cohorts of residential care home and nursing home residents in January 2019 and January 2020.

Appendix Table S4. Number of emergency admissions and changes in the number of emergency admissions between 1 March and 31 May in 2019 and 2020, by care home type and ICD-10 chapter of the primary diagnosis code.

Appendix Table S5. Number of emergency hospital admissions for acute coronary syndromes or stroke between 1 March and 31 May in 2019 and 2020, by care home type.

Appendix Table S6. Number of admissions with cataract procedures between 1 March and 31 May in 2019 and 2020, by care home type.

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