



Protective Measures Taken in Residential Care Homes in England During the COVID-19 Pandemic. An Assessment of the Change in Mortality Rates Before and During the COVID-19 Pandemic Years

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ABSTRACT

Introduction: Mortality rate increased in the period after 1 January 2020 because of the Sars-Cov-2 (coronavirus disease 2019, COVID-19) pandemic. A significant proportion of those deaths occurred within residential care homes who were mandated to put in place stringent preventative measures including vaccinations, regular testing and visitor restrictions, while maintaining access to front-line healthcare. Our question was, by how much did these measures mitigate this increase in mortality rate?

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Methods: The Office of National Statistics (ONS) annually publish deaths, by age and sex, for each small geographic entity – the lower layer super output area (LSOA). A baseline of national average deaths per population in 2017–2019, by age group and sex, was calculated. This was then applied to local populations to calculate values of expected deaths and, when divided by the actual deaths, to create a standardised mortality rate (SMR). The change in standardised mortality rate (CSMR) was calculated as % change in SMR 2020–2022 compared with SMR 2017–2019. Excess deaths were then calculated on the basis of the assumption that CSMR would be 0% without the pandemic. The link between LSOA social deprivation index of multiple deprivation (IMD) score and CSMR was established by simple linear regression for each age group. The Care Quality Commission publish annually a register of residential care homes (RCH) which includes the post code location, which can be linked to an LSOA, and the number of beds split according to nursing care (CH) or purely residential homes (RH). Linking presence of RCH beds in LSOAs to outcome was evaluated in two ways, (1) by the amount with no RCH beds plus three tertiles of RCH bed number as the percent of older population (≥ 65 years) and (2) by the type of beds, those with RH only, CH only, or both RH and CH. CSMR was calculated for each of these cohorts. As RCH are mostly occupied by people aged ≥ 80 years, to estimate the impact of restrictions in care homes compared with

the general community, the difference in CSMR between LSOAs with ‘no RCHs’ and ‘with RCH’ with baseline 0% CSMR were used to calculate the change in excess deaths.

Results: Overall CSMR was 8.4%, (age group <40 years was 5.7%, 40–64 years 13.7%, 65–79 years 11.3%, and ≥80 years 5.9%). This reflected 128,385 excess deaths in 2020–2022 compared with 2017–2019 (by age group <40 years: 2106; 40–64 years: 26,120; 65–79 years: 49,301; and ≥80 years: 50,857). Social disadvantage had the most effect on CSMR in the age 80+ years group; in this group, the lowest five deciles (50%) of LSOAs by IMD score had CSMR of 4.5%, with the CSMR then increasing linearly up to 16% in the top IMD decile. In the age group of 80+ years, the 22,357 LSOAs with ‘no RCH’ had CSMR of 10.0% (as a result of 35,791 excess deaths), while in the 10,484 LSOAs ‘with RCH’ the CSMR was 3.3%, as a result of 17,840 excess deaths. In those LSOAs with only residential homes, the CSMR was 6.4%, and in those with only care homes (i.e. including nursing support), the CSMR was –0.2%. The average IMD score in LSOAs with RCH was 21.3, whereas without RCH, the average IMD at 21.8 was slightly higher, suggesting that social deprivation difference was not a factor in explaining these outcomes. Modelling if ‘no RCH’ CSMR had applied to the LSOAs with RCHs, there might have been 24,968 (+140%) additional deaths. If the CSMR of LSOAs with RCH had been applied to those with no RCH, 32,815 deaths might have been avoided.

Conclusions: We conclude on the basis of the available evidence that precautions put in place for RCH residents significantly mitigated the risk of death following a COVID-19 infection, especially so if they were in nursing homes. This suggests that the sacrifice made by family members in avoiding visits to RCHs did reduce the mortality and that rapid access to first line healthcare provided in nursing homes mitigated the consequences for disruption in normal healthcare provision.

Keywords: Care home; Mortality; COVID-19; General population

Key Summary Points

Why carry out the study?

Numerous studies found that the risk of SARS-Cov-2 (coronavirus disease 2019, COVID-19) infections spreading within a residential care setting was closely linked to the incidence of COVID-19 in the surrounding area in the COVID-19 pandemic

Consequently, residential care homes (RCH) endeavoured to mitigate those risks by implementing non-pharmaceutical interventions such as comprehensive testing, visitor restriction and mandatory wearing of face masks

A critical question remains about how the stringent protective measures implemented in residential care homes influenced the mortality rate of the residents during the COVID-19 pandemic

What was learned from the study?

This study has shown that when comparing the standardised mortality ratios of geographical areas with a high number of RCH beds to those with lower levels, those with higher numbers of RCH beds showed a lower increase in standardised mortality ratio (SMR) at the peak of the COVID-19 pandemic for the period 2020–2022 compared with 2017–2019. This effect on localised geographic mortality rates (determined by lower super output area, LSOA), stratified by care home beds, was greatest for individuals who were aged 80 years or over. This is perhaps not surprising given the that the majority of care home residents are in this age group

Precautions put in place for RCH residents may have mitigated the risk of death following a COVID-19 infection, especially so if they were in nursing homes

This suggests that the sacrifice made by family members in avoiding visits to RCHs did reduce the mortality and that rapid access to first line healthcare provided in nursing homes mitigated the consequences for disruption in normal healthcare provision

These findings are also relevant when considering plans for a future similar event in the UK or elsewhere

INTRODUCTION

Mortality rate in the UK increased in 2022 by 7.2% compared with the 5-year average [1], in association with the Sars-Cov-2 (coronavirus disease 2019, COVID-19) pandemic in 2020 and 2021. Residential care homes (RCH) including nursing care homes took additional precautions during this period to reduce the risk of transmission between staff and residents, plus additional restrictive measures if cases were identified [2]. While seen as a necessity at the time, these mandatory measures caused much distress for care home residents and their families. UK government policy was to restrict RCH visits so that friends and relatives could only interact with residents on-line or through a clear screen/glass window. Other measures included increased testing of patients discharged from hospitals to care homes and regular testing of staff for COVID-19. [3] The recorded RCH COVID-19 vaccination rate was 89.5% by 2023 [4, 5].

Despite these additional precautions, deaths in RCH were widely reported in the media in the UK and elsewhere, commonly in the absence of the context that residents were frail and had life-shortening comorbidities [6]. In 2021, the age-standardised mortality rate for care home residents was 12.1% for men and 9.5% for women per 100,000 residents [7]. In contrast, in the general population, the age-standardised mortality rate for men was 1.1% and 0.85% in women per 100,000 in 2021. Care home mortality is always higher, with the leading cause of death in care homes being dementia including Alzheimer's disease (26.4% men and 34% women). During the pandemic (2021), COVID-19 was ascribed as the cause of death in 11.5% men and 10.8% women [8].

The matter of whether the stringent additional infection control measures implemented in the care home sector at the peak of the COVID-19 pandemic were effective in terms of reducing mortality merits further scrutiny.

Excess deaths are used to quantify the additional level of mortality above the expected average. No excess deaths were reported in care homes between June 2022 and 2023 [9]. RCH admission was at its lowest level for over 5 years, during the COVID-19 pandemic [10].

There are few available data on mortality rates in care homes; therefore, we approached this question indirectly by investigating the changes in standardised mortality rate (SMR) in residential care homes as compared with the general population using annual data from lower super output area (LSOA) level. This was evaluated for the COVID-19 pandemic period (2020–2022) as well as the period prior to the pandemic (2017–2019) accounting for the number of RCH beds in each LSOA [11].

METHODS

Local mortality rates are dependent on demographic factors including age, sex, social deprivation and the presence of residential care homes. This cross-sectional study compares the change in standardised mortality rate (CSMR) between the 3-year period before the COVID-19 pandemic (2017–2019) with the 3-year period during and after the pandemic (2020–2022) as a measure for the effectiveness of the lockdown and safety measures [12]. We examined the impact of the number of care home beds in each LSOA [11].

Lower super output areas (LSOA) are the smallest size of geographical area that the census data is aggregated down to and are composed of between 400 and 1200 households [11]. Annual data were obtained from the Office of National Statistics (ONS) [13] relating to the population numbers and deaths by age and sex, taking account of social deprivation score associated with each LSOA in England over the period 2017–2022. These data are not census data. They are compiled by the ONS using the small area population estimates [14] methodology and so are subject to potential variation. However, by consolidating LSOAs into much larger scale groups, this uncertainty is mitigated. In the

2021 census [14], some LSOAs were reassigned; therefore, the published data on LSOA changes were applied to recalculate LSOA data for 2021 and 2022 back to the 2011 units.

The average National Average Mortality Rate (NAMR) over the 3 years of 2017–2019 was calculated from the reported total deaths and population by age and sex. Expected deaths in each cohort could then be determined by applying the NAMR to the given populations both in 2017–2019 and 2020–2022.

The standardised mortality rate (SMR) for both 2017–2019 and 2020–2022 for each cohort were then calculated by dividing the actual sum of reported deaths by the sum of expected deaths. Change in SMR (CSMR) was calculated as the difference in SMR in any cohort between 2020–2022 and 2017–2019 as a percentage of the SMR in 2017–2019.

Excess deaths were then calculated by considering a target CSMR (in the base case, this was 0%), then calculating the expected number of deaths that would have been needed to achieve that figure and then taking the difference to actual reported deaths to derive the excess deaths.

The ONS also publishes index of multiple deprivation (IMD) scores 2019 for every LSOA. The trend in average CSMR across the deciles of IMD2019 score evaluated for each age group.

Residential care homes (RCH) include both residential homes (RH) – which only provide support for daily living; and care homes (CH) – which also provide nursing support. Both types of facility are registered with the Care and Quality Commission (CQC) [15], who annually publish the list of all registered RCH, including their location as UK postcode [16], total number of beds being provided and service provided – this includes differentiating nursing from residential homes. The postcodes are used to place all the RCHs in LSOAs [11].

The effect of RCH on CSMR was evaluated by considering the CSMR according to the presence of RCH in the LSOA. LSOAs were split into four groups: (1) ‘no RCH’, (2) tertile 1 of % RCH beds as % population age 65+ years, (3) equivalent tertile 2 and (4) equivalent tertile 3. The CSMR was then evaluated for each cohort. As 75% of the residents in RCH are

aged 80+ years, the CSMR of population for age 80+ years was compared with CSMR on those aged 65–79 years, in those tertiles.

As RCH may not be split evenly across social deprivation, the effect of social deprivation on CSMR was calculated and the average social deprivation score in LSOA with different levels RCH was also calculated.

To evaluate the difference in effect between RH with no nursing support and CH (that have nursing support), the RCH LSOAs were also split into 3 groups: (1) LSOAs with only RH present, (2) LSOAs with only CH present and (3) LSOAs with both present. The CSMR was then calculated for each of these groups.

To consider the impact of CSMR in terms of number of deaths avoided, two scenarios were applied to the population age 80+ years, in both.

Potential Deaths Avoided in RCH

To estimate if people in care homes had similar mortality risk as those in the community, i.e. LSOAs with no RCH, the CSMR for ‘no RCH’ LSOAs was applied to the LSOAs with RH and CH and the expected SMR on 2020–2022 calculated. This SMR was used to establish the number of deaths potentially occurring in that situation, and the difference to actual data then reflected those deaths potentially avoided by the measures within RCHs.

Further Opportunity to Avoid Deaths in Community

If similar protections established within RCH were also available to older people within the community, further deaths might have been avoided. The CSMR for both the LSOA with highest percent of RCH beds and also those with CH with nursing were both applied to the other LSOAs to derive the potential SMRs in 2020–2022. These SMRs were used to then calculate the deaths that would have been expected in each case, and the difference to actual data gave an indication of the further opportunity if protective measures for older people in the community had been similar to those within the RCHs.

Ethical approval was not sought as we only analysed aggregated publicly available data.

RESULTS

Table 1 reflects the sum of LSOA data in 2017–2019 to calculate average national mortality rate by sex and age group, then applied as a baseline calibration to determine the local expected deaths both for the 2017–2019 period and then in the 2020–2022 period.

Table 2 and Fig. 1 reflect the actual population and deaths over the two 3-year periods, partitioned by age group. Overall, the number of LSOAs in the 2017–2019 period was 32,844, containing on average 55.96 million individuals with 498,982 deaths/year recorded. They had an average mortality rate of 8.9 deaths per 1000 population. In 2020–2022, there were on average 56.51 million people with 551,975 deaths per year, giving an average mortality rate 9.77 deaths per 1000 population – representing an increase of 8.4% to the 2017–2019 period.

If there had been no change in the mortality rate over the years during and after the pandemic, there would have been 128,336 (7.7%) fewer deaths. For 2020–2022, excess deaths were 2106 in people aged <40 years, 26,120 in the age range 40–64 years, 49,301 in the age range 65–79 years and 50,857 in the age range 80+.

This excess mortality occurred as 55,256 deaths in 2020, 57,432 in 2021 and 15,696 in 2022. Of note, in 2022, the excess mortality effect was lowest in the 80+-year age group (down to 1013 deaths). Change in CSMR between 2017 and 2019 and 2020–2022 was highest in the age group 40–79 years.

Table 3 shows the figures for observed and expected deaths both before and during the COVID-19 pandemic, in LSOA, split by decile of IMD 2019 score; the 50% of LSOAs with lower deprivation had a similar value of CSMR at between 6% and 7%. However, the CSMR increased linearly in the higher deciles, reaching 16% in the highest decile. The top five deciles of social deprivation were linked to 69% of the excess deaths, while the bottom five constituted 31% of excess deaths. This suggests that

Table 1 National average mortality rate (NAMR) deaths /,000 population by sex and age over all LSOAs for 2017–2019

Age group	Male	Female	Age group	Male	Female
<30	0.40	0.25	60–64	8.66	5.72
30–34	0.77	0.40	65–69	13.74	8.86
35–39	1.09	0.65	70–74	21.43	14.30
40–44	1.61	0.98	75–79	37.49	25.75
45–49	2.44	1.56	80–84	66.14	47.76
50–54	3.63	2.35	85+	163.84	145.60
55–59	5.43	3.56	Overall	8.91	8.92

if the CSMR rate achieved in the 50% of least socially deprived areas could be achieved across the country, then 36,000 (28% of total) excess deaths could have been avoided.

Figure 2 shows how the COVID-19 pandemic had a differential effect, per social deprivation, on age groups. In age 80+ years (light blue), LSOAs below IMD 20 (50% of population) had a stable CSMR (~4%); however, in those LSOAs with IMD >20, the CSMR increased linearly in this age group, reaching 16% for IMD >50. For age 65–79 years (green), CSMR was stable to IMD <25 (10%), then stable above IMD 25 at 14%. In age 40–64 years (red), CSMR was stable for IMD <10 at 10%, then also increased to 14%. For age <40 years (dark blue), CSMR was around 0% for IMD <10, then for IMD >10, it fluctuated around 6%. The relation between CSMR and IMD was similar in men and in women.

To investigate the impact of care home beds on the overall increase in mortality, further analysis, by grouping LSOAs by the amount of local RCH beds (expressed as tertile of RCH beds as percent of age-65-years population), showed that there was a difference in mortality between tertiles (Table 4). Out of the entire number of 32,841 LSOA ($n=32,841$), 22,357 LSOAs had no RCH within them. These LSOAs had 4.3% of their population in the ≥80-year age bracket, compared with the 10,484 LSOAs with RCH present, who had 6.1% of their population in the age ≥80 years group.

Table 2 Population, deaths reported, expected deaths based on mortality rate in 2017–2019, change in standardised mortality rate and excess deaths in lower layer super output area (LSOA) by year and age group

	Age < 40 years	Age 40–64 years	Age 65–79 years	Age 80+ years	Total
<i>,000 Population</i>					
2017	27,927	17,662	7309	2722	55,619
2018	28,075	17,723	7411	2769	55,977
2019	28,113	17,820	7517	2837	56,287
Subtotal	84,115	53,205	22,236	8328	167,884
2020	28,137	17,949	7608	2856	56,550
2021	27,909	18,096	7291	2575	55,871
2022	28,209	18,266	7767	2862	57,105
Subtotal	84,255	54,311	22,666	8293	169,526
<i>Reported deaths</i>					
2017	12,227	60,621	137,772	287,476	498,096
2018	12,330	62,735	141,143	297,679	513,887
2019	11,952	61,067	135,383	276,562	484,964
Subtotal	36,509	184,423	414,298	861,717	1,496,947
2020	12,418	72,860	163,519	320,903	569,700
2021	13,248	74,179	160,732	297,733	545,892
2022	13,157	70,441	158,127	298,608	540,333
Subtotal	38,823	217,480	482,378	917,244	1,655,925
<i>Expected deaths (based on mortality rate 2017–2019)</i>					
2020	12,239	63,064	143,797	295,343	514,444
2021	12,167	63,617	139,229	273,448	488,460
2022	12,311	64,680	150,051	297,595	524,637
Subtotal	36,717	191,360	433,077	866,387	1,527,540
<i>Change in standardised mortality rate (CSMR) as percent of 2017–2019 value</i>					
2020	1.46%	15.53%	13.72%	8.65%	10.74%
2021	8.89%	16.60%	15.44%	8.88%	11.76%
2022	6.88%	8.91%	5.38%	0.34%	2.99%
Subtotal	5.74%	13.65%	11.38%	5.87%	8.40%
<i>Excess deaths</i>					
2020	179	9796	19,722	25,560	55,256
2021	1081	10,562	21,503	24,285	57,432

Table 2 continued

	Age < 40 years	Age 40–64 years	Age 65–79 years	Age 80+ years	Total
2022	846	5761	8076	1013	15,696
Subtotal	2106	26,120	49,301	50,857	128,385

Bold values highlight the age group column

In 2017–2019, and in LSOAs without an RCH in the 80+-years age group, the population was 4.3% of the total population, and their SMR was 0.80 compared with those LSOA with RCH, where age 80+ years was 6.1% of the total population, and the SMR was 1.26.

By contrast, in 2020–2022, the SMR in those LSOAs without RCH was 0.88, giving a CSMR of 10%, while those with RCH had SMR of 1.30, giving a CSMR 3.1%. If we calculate expected deaths on the basis of a CSMR of 0% and then take the difference to actual deaths, in the age 80+ years, 37,791 of these excess deaths were in the community compared with 17,840 excess deaths in the RCH.

When those LSOA with RCH are split tertile by percent RCH beds as percent population age > 65 years, then the above effects were augmented in the higher tertiles of RCH beds.

Social deprivation in LSOAs with and without RCH was similar (IMD average: 21.3 with RCH and IMD average: 21.8 without RCH), suggesting that the difference in social deprivation did not influence this outcome.

The ONS reported that in 2021, 74% of older people in care homes in the UK were age 80+ years. Figure 3 shows the CSMR variation by RCH beds as percent population age > 65 years, split by age group. This shows that the reduction in CSMR was only apparent in the age 80+-year age group, with no effect apparent in the 65–79-year age group, supporting the hypothesis that RCHs are the main source of this effect.

Table 5 examines models that have been used to establish the impact of the COVID-19 pandemic on the number of deaths for the population age 80+ years population, who are the main residents in RCHs and had in total 47,779 excess deaths by (1) the availability of RCH beds within LSOAs and (2) the type of RCH beds present in

LSOA-only RH (i.e. no nursing support), only CH (i.e. that have nursing support) or mixed both RH and CH present.

To examine how the differences in CSMR on were reflected into excess death compared with each other, two scenarios were evaluated in Table 5 for variation by number of beds (1) and by type of care home (2).

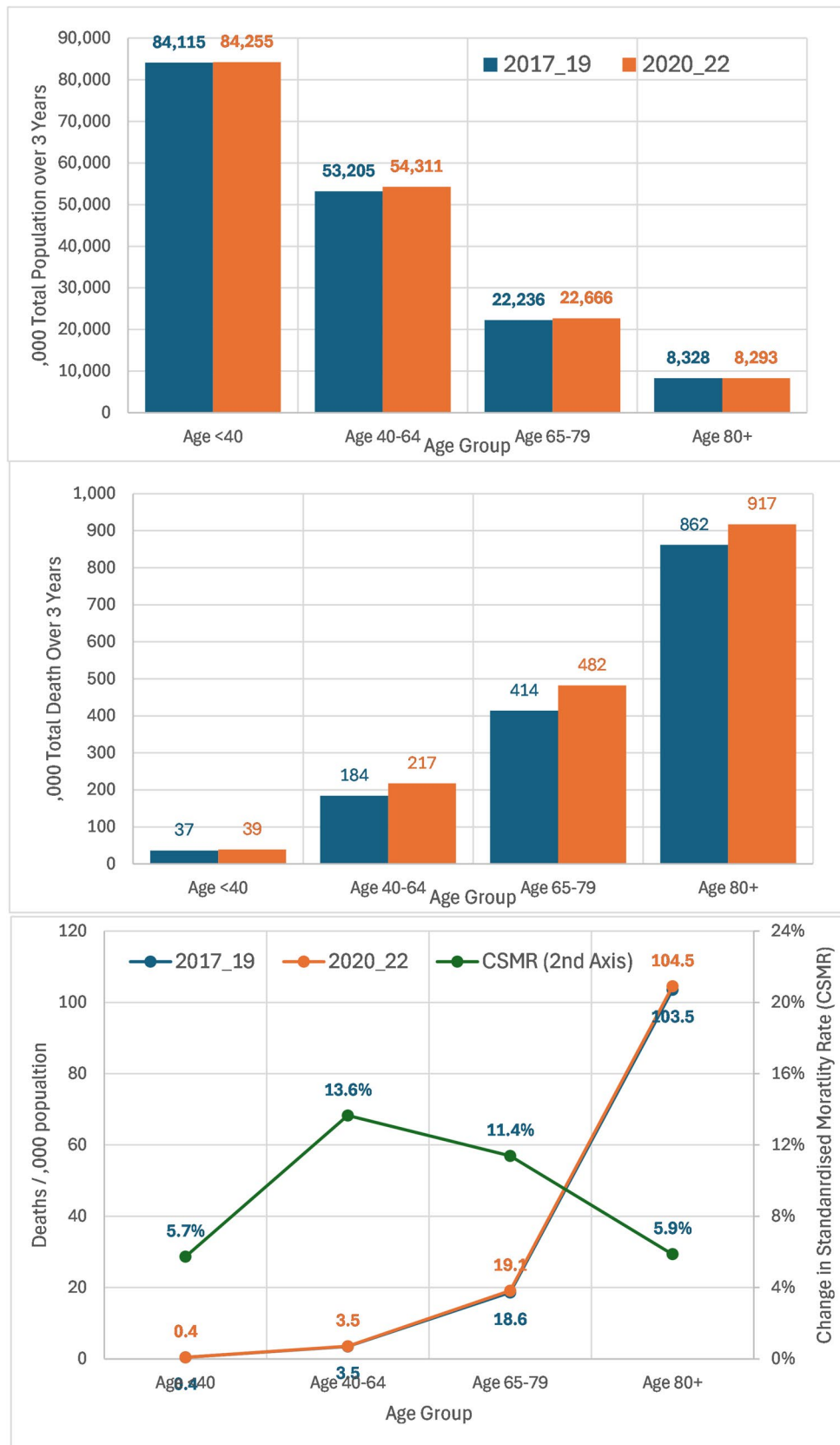
Scenario 1 examined the benefit of RCH restrictions by applying the CSMR from ‘no RCH’ to those LSOAs with RCHs; it suggests that 24,968–27,610 more deaths might have been expected in the age 80+-year population if RCHs had followed the same guidelines as the community and that RCHs with nursing care brought the largest benefits in relation to avoided deaths.

In Scenario 2, the opportunity if RCH standards had been applied for age 80+ years in the community was examined. The CSMR in highest % RCH beds tertile or CH only were applied to all LSOAs; it suggests that if similar support had been offered to all with age 80+ years, then 32,815– 58,128 deaths might have been avoided.

DISCUSSION

There is a perception that residential care homes (RCH) saw a greater increase in mortality during the COVID-19 pandemic compared with the increase in mortality in the general population. This study potentially counters this premise by showing that areas with higher numbers of RCH beds showed a lower increase in SMR at the peak of the COVID-19 pandemic compared with the years before, when compared with the general population SMR for people of a similar age not living in RCH.

The difference versus the general community was more apparent for nursing homes than for



◀**Fig. 1** Total population years, deaths, mortality rate and change in standardised mortality rate (SMR) by age group for 2017–2019 compared with 2020–2022

residential homes. This effect on LSOA mortality stratified by care home beds was greatest for individuals aged 80+ years. This is not surprising given the that the greatest impact of COVID-19 on mortality was in this age group, with less impact in those aged 65–79 years [17, 18]. Furthermore, a higher proportion of individuals in this age group reside in care homes.

Our study used LSOA data with 2021 census RCH bed data to understand the correlation of mortality to care home beds as a means of understanding the effect of protective measures. The grouping of LSOA data by RCH bed number reduces the impact of variation in reporting of RCH bed residents and care home beds.

This study was a data-driven analysis of 33,000 cohorts of the England population, aggregated by geography with differing levels of care home provision and standardised for the normal major sources of mortality variation in age, sex and social deprivation. They were considered both cross-sectionally (differences between classes) and longitudinally (change over time) in an analysis using linkage of historical public data.

We accept that this study was not truly one of hypothesis testing, but rather one to make primary assessments which thereafter could lead to hypothesis testing research. Nevertheless, change over time can reflect into an assumption of causation. The complete national data sets over multiple years were used to avoid selection bias. While other factors such as healthcare provision or ethnicity might play a role, given the wide scope, we believed these would have been second-order effects, and the primary effect would relate to difference in the levels of care provided to the highest risk groups.

Duthey-Magni et al. used RCH data published annually directly to calculate mortality and found that the increase in mortality in April 2020 was due to infected individuals being transferred from hospitals into RCH [19]. They also reported that many deaths occurred in people who were infected with COVID-19 but not

tested. Higher bed occupancy and lower staffing levels were independently associated with risks of COVID-19 infection. Gulliford et al. [20] also described that in April 2020 (the first wave of the COVID-19 pandemic), COVID-19 had a disproportionately greater impact on the mortality of care home residents in England compared with older residents of private homes.

The level of frailty and number of long-term conditions were found to be effect modifiers [20], being more strongly associated with the mortality of community-dwelling patients than those living in care homes. The significant effect of COVID-19 on the mortality of care home residents in England, compared with older residents of private homes, has also been reported following the first wave but not thereafter. This may be because in early April 2020, the UK government implemented protective measures (applicable in England) for RCH. [17] These restrictions were then partially eased in January 2022 following the success of the National Health Service (NHS) vaccine programme [21, 22]. In the light of the above findings, we suggest that these measures were effective in reducing mortality in RCH, as the areas with high numbers of RCH beds had lower rates of increase in mortality.

A 2022 study [17] compared the relative mortality rate between individuals aged 65 years and older who were registered at their general practice as residing in a private residence compared to a residential care home. The authors reported that age-standardised mortality risk increased significantly more in care homes compared with private residents in April 2020 compared with February 2019. However, the study included the earliest months of the COVID-19 pandemic, when not all the protective measures had been fully implemented in care home settings. Importantly, the authors noted a reduction in the relative mortality risk of care home residents during the second wave.

It is not possible to evaluate which aspects of the controls in RCH brought the most benefits. However, the difference between residential homes and care homes suggests that, as both had similar conditions applied, a significant part of the benefits came from maintaining good access to first line healthcare – both primary and secondary. This continued to be provided by the

Table 3 Association between social deprivation lower layer super output area (LSOA) split by IMD 2019 score decile on expected deaths based on average 2017–2019 mortality rate

	10	9	8	7	6	5	4	3	2	1	Total
Number LSOA	3285	3284	3285	3284	3282	3285	3283	3285	3284	3284	32,841
Mean IMD	4.2	7.3	9.9	12.7	15.9	19.5	23.9	29.7	38.1	55.5	21.7
<i>2017–2019</i>											
Population total million life years	16.2	16.4	16.6	16.6	17.1	17.0	17.2	17.3	17.0	16.7	167.9
Total Actual ,000 deaths	133	144	149	153	154	153	152	148	152	159	1,497
Expected ,000 deaths*	177	173	170	167	163	153	141	127	117	108	1497
SMR	0.75	0.83	0.87	0.91	0.95	1.00	1.08	1.16	1.29	1.48	1.00
<i>2020–2022</i>											
Population total million life years years million	16.3	16.6	16.8	16.8	17.3	17.1	17.3	17.4	17.1	16.9	169.5
Total Actual ,000 deaths	149	161	165	169	170	169	168	163	167	176	1656
Expected ,000 deaths	186	182	178	174	168	157	142	125	114	102	1527
SMR	0.80	0.88	0.92	0.97	1.02	1.08	1.18	1.30	1.47	1.72	1.08
CSMR	6.9%	6.1%	6.1%	6.3%	7.0%	8.1%	9.2%	12.1%	13.8%	15.9%	8.4%

Bold values highlight the age group column

SMR standardised annual mortality rate, LSOA lower layer super output area, IMD social deprivation score, CSMR change in standardised mortality rate

nursing staff in care homes but became more restricted for older residents in the community (and those in residential homes) by the restrictions on access to GPs and hospitals.

Our analysis was of the age 80+ years population as they are the main residents of RCH. These residents would have had daily observation by health care workers. However, in the younger age group (65–79 years), there were an estimated 49,000 excess deaths. We suggest that these individuals, living mainly in community, might have had better outcomes if they had more direct access to primary and secondary

healthcare in the COVID-19 peak pandemic period.

Early data from China demonstrated that the case-fatality ratio of COVID-19 increased with age, from 0.4% or lower in patients aged in their 40s or younger, 1.3% among those in their 50s, 3.6% in their 60s, 8% in their 70s, to 14.8% in their 80s or older [23]. A more profound effect of ageing was shown by COVID-19 case-fatality ratio data from Italy, the first country affected by the pandemic after China. Case-fatality ratios were less than 0.4% or lower in patients aged in the 40s or younger, 1% among those in their

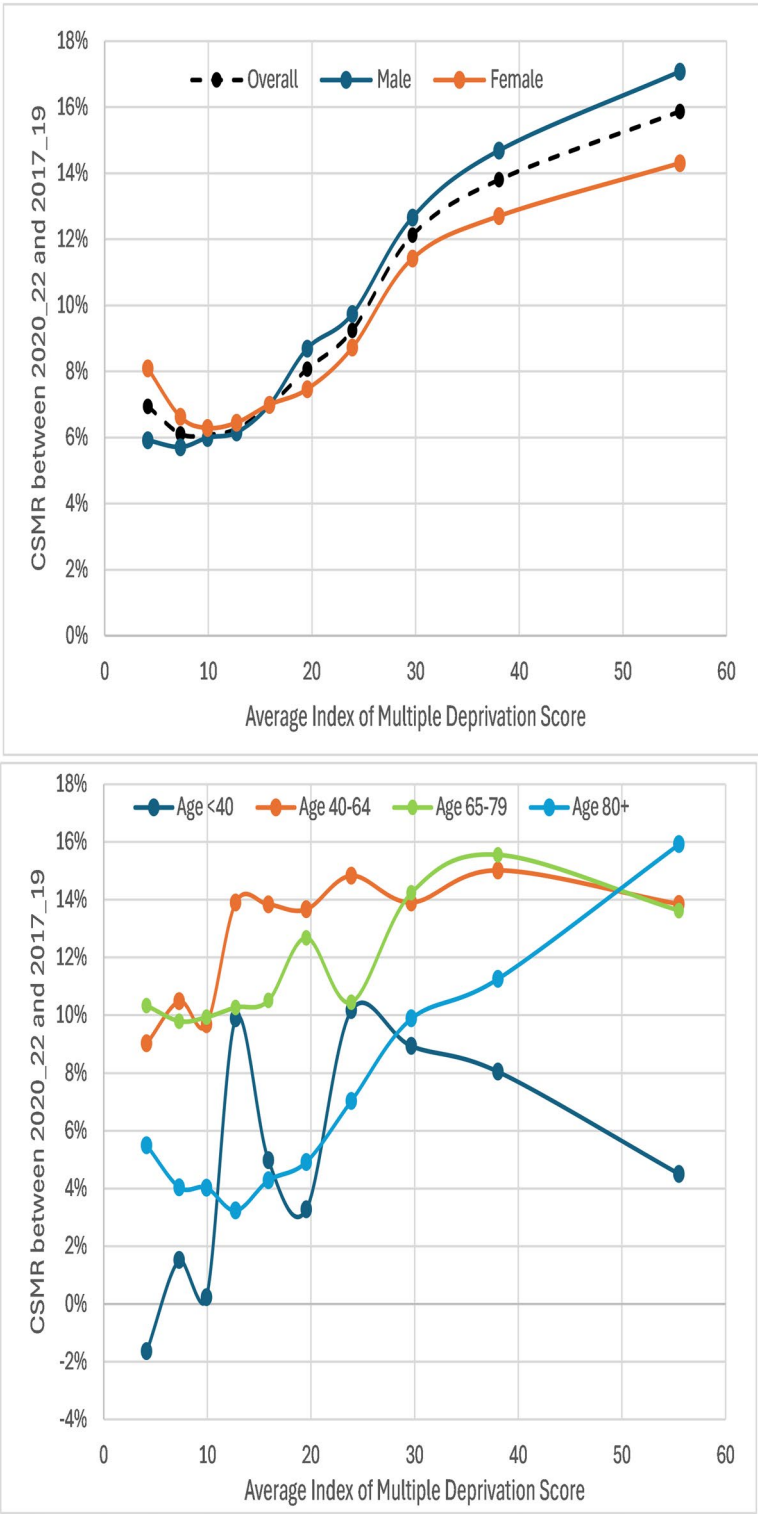


Fig. 2 Impact of social deprivation on CSMR by age group and sex

Table 4 Association between the presence of residential care homes (RCH) beds in each lower layer super output area (LSOA) on change in standardised mortality rate (CSMR)

	Overall	No RCH	RCH Total	% RCH beds tertiles		
				T1	T2	T3
Number of LSOA	32,841	22,357	10,484	3494	3495	3495
Average IMD	21.7	21.8	21.3	19.5	19.0	25.4
2020–2022 total population ,000 life years	169,525	113,910	55,614	18,690	18,527	18,395
2020–2022 total deaths	1,655,925	901,391	754,534	180,290	249,996	324,248
RCH average beds	457,464	0	457,464	37,197	133,995	286,272
Residential care home beds as % pop > 65	4.4%	0.0%	12.0%	2.8%	9.7%	25.1%
<i>2017–2019</i>						
Pop age 65–79 years (% total)	22,665,974 (13.4%)	14,569,185 (12.8%)	8,096,789 (14.6%)	2,870,443 (15.4%)	2,922,073 (15.8%)	2,304,273 (12.5%)
Pop age 80+ years (% total)	8,293,055 (4.9%)	4,912,136 (4.3%)	3,380,919 (6.1%)	1,046,097 (5.6%)	1,220,371 (6.6%)	1,114,451 (6.1%)
Deaths 65–79 years (% total)	482,378 (29.1%)	291,230 (32.3%)	168,785 (26.5%)	54,727 (30.4%)	63,385 (25.4%)	73,036 (22.5%)
Deaths 80+ years (% total)	917,244 (55.4%)	443,256 (49.2%)	473,988 (62.8%)	97,956 (54.3%)	158,611 (63.4%)	217,421 (67.1%)
<i>SMR 2017–2022</i>						
Age 65–79 years	1.00	0.94	1.10	0.89	1.01	1.48
Age 80+ years	1.00	0.80	1.26	0.84	1.16	1.70
<i>SMR 2020–2022 based on 2017–2019 mortality rate</i>						
Age 65–79 years	1.11	1.05	1.22	0.99	1.12	1.65
Age 80+ years	1.06	0.88	1.30	0.90	1.21	1.75
<i>CSMR</i>						
Age 65–79 years	11.4%	11.9%	11.0%	10.7%	11.0%	11.5%

Table 4 continued

	Overall	No RCH	RCH Total	% RCH beds tertiles		
				T1	T2	T3
Age 80+ years	5.9%	10.0%	3.3%	6.7%	3.9%	2.9%
<i>Excess deaths</i>						
Age 65–79 years	42,343	26,170	16,881	4664	5539	6679
Age 80+ years	47,779	35,791	17,840	5739	5816	6284

LSOA lower layer super output area, *RCH* residential care homes, *SMR* standardised mortality rate

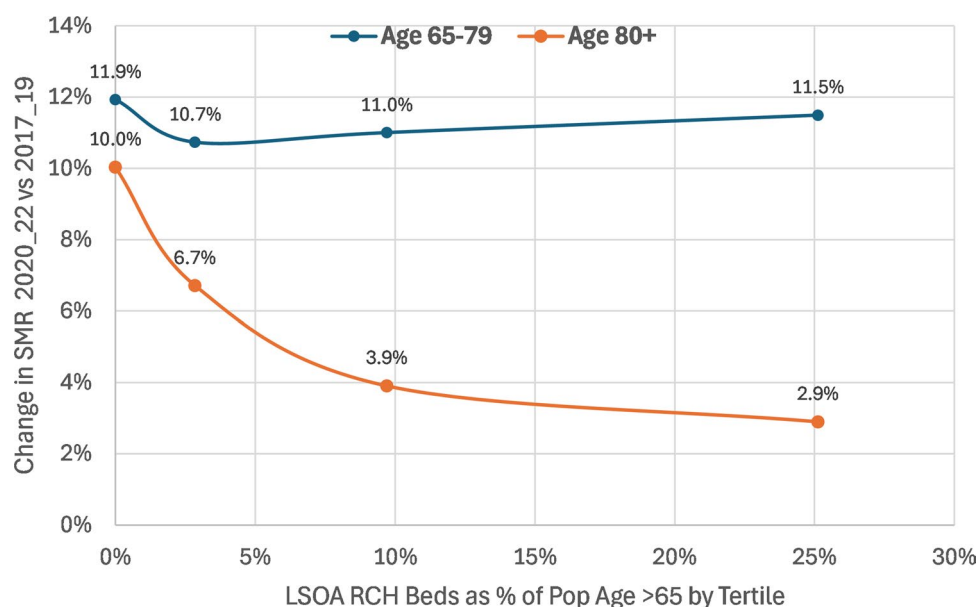


Fig. 3 Change in SMR between 2017 and 19 and 2020–2022 linked to RCH beds as percentage of population aged > 65 years, by tertiles, for age 65–79 years and age 80+ years

50s, 3.5% in their 60s, and 12.8% in their 70s, increasing to 20.2% in their 80s and above [24]. Across the world, the gradient in mortality differed by region.

Our findings should be set against the systematic review of Schneider et al. in 2023 [25]. The authors concluded that the measures put in place in long-term care placements such as social isolation, lack of social contact and paucity of activities had detrimental impact on the wellbeing and quality of life of residents and their relatives, stating that although the measures helped protecting residents against infections, they also

imposed psychological stress on the people who had to live with these measures.

There is clearly room for further work. These observations do run counter to the messaging at the time that care homes were a source of increased risks and show that the policies and sacrifices required might have delivered offered significant benefit. The analysis of care home mortality is not straightforward – we present here an analysis of the best available data.

We believe that it is fair to conclude from the observed differences between the three classes identified no care homes, residential care home and nursing care home – that the differences

Table 5 Estimating residential care homes (RCH) association with mortality and excess deaths both by (1) number of RCH beds and (2) by type of RCH beds in local population age 80+ years**(1) LSOAs with RCH split by beds as percent of pop > 65 years**

	No RCH	LSOA tertiles by RCH beds as % age 65+ years			Overall
		T1	T2	T3	
Population years age 80+ years	4,912,136	1,046,097	1,220,371	1,114,451	8,293,055
% of total population	59.2%	12.6%	14.7%	13.4%	
RCH beds	0	37,197	133,995	286,272	457,464
RCH beds % age 80+ years, annual	0.0%	10.7%	32.9%	77.1%	16.5%
Deaths age 80+ years	443,256	97,956	158,611	217,421	917,244
% of total deaths	48.3%	10.7%	17.3%	23.7%	
Expected deaths age 80+ years	402,845	91,798	152,650	211,296	866,387
CSMR age 80+ years	10.0%	6.7%	3.9%	2.9%	5.9%
Excess deaths age 80+ years	40,411	6158	5961	6125	50,857
Scenario 1: current gain – deaths avoided if CSMR same as no RCH					
Deaths avoided	0	2772	8499	13,697	24,968
Scenario 2: future gains – potential deaths avoided if T3 CSMR applied to all					
Potential deaths avoided	27,924	3399	1492	0	32,815

(2) LSOAs with RCH split by residential homes (RH), i.e. no nursing, care homes (CH), i.e. with nursing, and both RH and CH

	None	Only RH	Both RH/CH	Only CH	Total
Population years age 80+ years	4,912,136	1,964,225	613,305	803,389	8,293,055
% of total population	59.2%	23.7%	7.4%	9.7%	
RCH beds	0	233,958	82,754	140,752	457,464
RCH beds % age 80+ years, annual	0.0%	35.7%	40.5%	52.6%	16.5%
Deaths age 80+ years	443,256	233,004	108,525	132,459	917,244
% of total deaths	48.3%	25.4%	11.8%	14.4%	
Expected deaths age 80+ years	402,845	218,925	106,696	132,764	866,387
CSMR age 80+ years	10.0%	6.4%	1.7%	−0.2%	5.9%
Excess deaths age 80+ years	40,411	14,079	1829	−305	50,857
Scenario 1: current gain – deaths avoided if CSMR same as no RCH					
Deaths avoided	0	7163	8065	12,381	27,610
Scenario 2: future gains – potential deaths avoided if nursing support CSMR applied to all					
Potential deaths avoided	41,433	14,616	2079	0	58,128

Bold values highlight the age group column

LSOA lower layer super output area, *RCH* residential care homes, *CSMR* change in standardised mortality rate

in outcome between these might have derived from the level of isolation and support being provided to the vulnerable groups.

Limitations: we have used a model based on RCH capacity at LSOA level rather than mortality rates at the level of an RCH. However, such data are not available. The application of an LSOA social deprivation IMD score is a potential source of bias, given the population size of each LSOA.

A strength of the study is that we have been able to access LSOA mortality data for the whole of England and hence are less affected by regional variation. The actual occupancy of the reported RCH beds was not available; therefore, it was taken as the same value over the two 3-year periods and across these different classes. This is a weakness of this analysis, as any fluctuation would reflect into changes in the measured mortality rate; therefore, some of the lower measured mortality rate could be explained by a lowering in RCH occupancy rate.

The period of the COVID pandemic that we have evaluated (2020–2022) includes the final months of 2022 when the care home restrictions were being eased. It is possible that some of the improvement in mortality may reflect the vaccine booster programme that had matured by that stage. However, examining year-by-year, data for 2021 were broadly comparable to 2020 and returning to baseline in 2022. In the UK, the care home sector is large and varied in design. In 2023, it consisted of 7500 distinct providers operating 15,500 homes of various sizes, ranging from 1 to 250 beds, collectively caring for approximately 500,000 adults [26] Our recent analysis might hide variation in outcomes within this disparate group.

CONCLUSIONS

During the COVID-19 pandemic, areas that contained more care homes showed a smaller increase in mortality compared with community-living individuals, particularly for individuals aged 80 years or more. We

suggest that the precautions put in place for RCH residents may have mitigated the risk of death following a COVID-19 infection, especially so if they were in nursing homes. This finding suggests that the sacrifice made by family members in avoiding visits to RCHs did reduce the mortality and that rapid access to first line healthcare provided in nursing homes mitigated the consequences for disruption in normal healthcare provision.

Further understanding of the importance of speed of roll-out of protective measures in vulnerable populations in planning for future pandemics is important, as this study showed that they were effective in reducing mortality in older vulnerable individuals.

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Data availability. The data that support the findings of this study are publicly available or on request from the corresponding author.

Declarations

Conflict of Interest. Michael Stedman, Samuel Kitching, Martin Whyte and Adrian Heald have nothing to disclose.

Ethical Approval. Ethical approval was not sought as we only analysed aggregated publicly available data.

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