



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



JAMDA

journal homepage: www.jamda.com

Original Study

The Adverse Effects of the COVID-19 Pandemic on Nursing Home Resident Well-Being


 Michael Levere PhD^{a,*}, Patricia Rowan MPP^b, Andrea Wysocki PhD^c
^a *Mathematica, Princeton, NJ, USA*^b *Mathematica, Wellington, FL, USA*^c *Mathematica, Chicago, IL, USA*

A B S T R A C T

Keywords:

COVID-19
nursing home residents
well-being
pandemic

Objective: Quantify the effects of the COVID-19 pandemic on nursing home resident well-being.

Design: Quantitative analysis of resident-level assessment data.

Setting and participants: Long-stay residents living in Connecticut nursing homes.

Methods: We used Minimum Data Set assessments to measure nursing home resident outcomes observed in each week between March and July 2020 for long-stay residents (eg, those in the nursing home for at least 100 days) who lived in a nursing home at the beginning of the pandemic. We compared outcomes to those observed at the beginning of the pandemic, controlling for both resident characteristics and patterns for outcomes observed in 2017–2019.

Results: We found that nursing home resident outcomes worsened on a broad array of measures. The prevalence of depressive symptoms increased by 6 percentage points relative to before the pandemic in the beginning of March—representing a 15% increase. The share of residents with unplanned substantial weight loss also increased by 6 percentage points relative to the beginning of March—representing a 150% increase. We also found significant increases in episodes of incontinence (4 percentage points) and significant reductions in cognitive functioning. Our findings suggest that loneliness and isolation play an important role. Though unplanned substantial weight loss was greatest for those who contracted COVID-19 (about 10% of residents observed in each week), residents who did not contract COVID-19 also physically deteriorated (about 7.5% of residents in each week).

Conclusions and Implications: These analyses show that the pandemic had substantial impacts on nursing home residents beyond what can be quantified by cases and deaths, adversely affecting the physical and emotional well-being of residents. Future policy changes to limit the spread of COVID-19 or other infectious disease outbreaks should consider any additional costs beyond the direct effects of morbidity and mortality due to COVID-19.

© 2021 AMDA – The Society for Post-Acute and Long-Term Care Medicine.

The SARS-CoV-2 (COVID-19) pandemic severely affected nursing home residents. Despite representing only about 1% of the total population in the United States, COVID-19 deaths in nursing homes make up nearly 40% of total COVID-19 deaths. On March 13, 2020, with cases spreading rapidly in these congregate care settings, the Centers

for Medicare & Medicaid Services directed nursing homes to limit all visitors, including nonessential workers. These policies were necessary because of the greater risk of complications and death in these congregate settings.¹ They also gave nursing homes a chance to accumulate personal protective equipment (PPE) to help make interactions with staff less risky. Some nursing homes also experienced other complicating factors, such as staff absences due to illness or fear of the virus, which may have further limited the level of social interaction and attention from staff to which residents were accustomed.^{2,3}

Yet focusing only on cases and deaths, as is often the case with statistics related to the pandemic, does not capture the full impact of the pandemic on nursing home residents. Nursing home residents, like all people, may have also experienced loneliness, isolation, and physical deterioration stemming from measures intended to reduce

This work was funded by the Connecticut Department of Public Health under contract to [organization] to conduct an independent assessment of the COVID-19 pandemic on long-term care residents. This publication does not express the views of the Department or the State of Connecticut. The views and opinions expressed are those of the authors.

The authors declare no conflicts of interest.

* Address correspondence to Michael Levere, PhD, Mathematica, 600 Alexander Park, Princeton NJ 08540, USA.

E-mail address: mlevere@mathematica-mpr.com (M. Levere).

<https://doi.org/10.1016/j.jamda.2021.03.010>

1525-8610/© 2021 AMDA – The Society for Post-Acute and Long-Term Care Medicine.

the spread of COVID-19.^{4,5} Clearly, reducing the spread of the virus, and thus deaths, is an essential policy goal. However, these additional costs cannot simply be overlooked—any carefully thought-out policy must weigh both the benefits and the costs. For example, in the debate around opening schools, the costs of lost educational opportunities for children due to remote learning, and the way those lost opportunities may cumulate as students who fall behind struggle to catch up, are an important consideration.

Similarly, in nursing homes, it is essential to understand and quantify how the pandemic affected well-being among all residents, not just those who contracted the virus. Because of the disruption to routines and the limited interaction during the pandemic, nursing home residents may have experienced adverse effects even beyond the direct effects of the virus.⁵ The potential reduction in direct care from family members, visitors, and staff may have also affected residents' well-being. Policies that restricted visitors and limited resident movement and social interactions likely prevented the virus from spreading further and bought nursing homes and states time to procure sufficient PPE and increase testing capacity. Yet these policies also may have costs. Without face-to-face interactions, many nursing home residents struggle to remain engaged with others.⁶ Social isolation and loneliness among older adults have been identified as serious public health concerns that are associated with poor health outcomes, such as depression and cognitive decline as well as physical morbidity and mortality.⁷

In this article, we use resident-level assessment data from 224 nursing homes in Connecticut to summarize the effects of the pandemic on nursing home resident well-being. These analyses indicate that COVID-19 cases and deaths alone do not capture the full impact of the pandemic on residents' well-being. Changes in well-being could be the direct result of the pandemic, as well as the indirect result of a variety of causes. These indirect factors include fears associated with the virus or grief from losing friends and loved ones; changes in care practices such as declines in the provision of therapy; and policies put in place to limit the spread of the virus, such as restricting residents to their room and limiting visitation, which increased isolation of nursing home residents. Very little research to date has quantified the way that the pandemic has affected people's well-being.^{8,9}

We consider several different measures that are important to capturing physical, psychosocial, and emotional well-being. The direct effects of being sick with COVID-19 could affect several of these measures. However, these measures may also capture impacts stemming from isolation and changes in direct care. The measures include the presence of any depressive symptoms, as well as rates of unplanned substantial weight loss, which can come from a variety of causes but generally indicates physical deterioration.¹⁰

Methods

We used the Long-Term Care Minimum Data Set (MDS) assessments for nursing home residents across all nursing homes in Connecticut. For each year between 2017 and 2020, we limited data to only include people residing in a nursing home on March 9 of that year to counteract selection bias. We only included long-stay residents, who must have lived in the nursing home for at least 100 days as of March 9. We then used an event study framework to assess how the pandemic affected nursing home resident well-being. In 2020, we compared average outcomes for people observed in each week to average outcomes observed the week of March 10, the omitted period. To control for general cyclical trends, we then differenced off a "placebo" event study analysis averaged across 2017, 2018, and 2019; for long-stay nursing home residents on March 9 of 2017, 2018, and 2019, we computed the same event study framework and differenced off the "impact" in those years where there was no pandemic. We also

controlled for differences in resident characteristics, both through direct regression controls and through weighting. Together, these help to control for potential selection biases, though some bias may remain, as discussed below.

The total study sample included 29,097 unique people who were long-stay residents of a nursing home as of March 9 in any of the years from 2017 to 2020. Each person can potentially be present in all 4 years of the sample if they resided in the nursing home as of March 9 of each year and had lived in the home for at least 3 months at that time. Outcomes for individuals are nonoverlapping because outcomes were measured only through July 31 of each calendar year. These residents came from 224 unique nursing homes. In each year, the unique number of people present in the nursing home as of March 9 was nearly identical, ranging from a low of 14,510 in 2020 to a high of 15,210 in 2017.

We considered 6 primary outcome measures: (1) a binary variable for having any depressive symptoms, (2) a binary variable for having unplanned substantial weight loss, (3) a binary variable for having a severe pressure ulcer, (4) a binary variable for having any episode of incontinence, (5) the cognitive functioning scale,¹¹ and (6) the activities of daily living score.¹² For those residents in a nursing home in Connecticut on March 9, 2020, we measured these outcomes in all subsequent regular assessments (excluding entry and discharge, as well as significant changes or corrections) in MDS data through July 31, 2020. We grouped these assessments by the week of the observation date. A person had any depressive symptoms if their score on the Patient Health Questionnaire–9 (PHQ-9) was greater than zero. The score was based on the resident's self-assessment where possible, but in some instances, a PHQ-9 score was based on a staff observation. A person had unplanned substantial weight loss if he or she lost more than 5% of her weight in the past month (or more than 10% in the past 6 months). The cognitive functioning scale ranged from 0 to 6, with a higher score indicating a more severe impairment. The activities of daily living scale ranged from 0 to 16, with a higher score indicating that the resident required more functional assistance or support.

Statistical Analysis

We analyzed changes in well-being from resident assessments over time to measure the effects of the COVID-19 pandemic. Our analysis used an event study framework by measuring the average difference in outcomes for people observed in each week relative to the week of March 10, the baseline period just before COVID-19 began to affect nursing homes in Connecticut. To the extent that the pandemic was an important factor in patterns in outcomes, we would expect to find changes grow over time, likely peaking sometime in mid-April to early May to correspond with the peak of the pandemic in Connecticut during our study period.

Though this analysis measured the change in well-being over time, various types of selection bias threaten the interpretation that the changes in well-being are the causal impact of the pandemic. For example, people exited the nursing home over time for a variety of reasons, such as death or no longer requiring care. The residents who remained for long periods of time may inherently differ from those who exited, which could affect outcomes. We controlled for this type of selection bias threat by using a similar event study approach for 2017–2019, and then differencing off the placebo "impact" in those years. We limited the sample in those years to people in the facility on March 9 and measured differences in the average outcomes for each week relative to the week of March 10. By differencing this from the observed trends for 2020, we estimated something akin to a "differences-in-event studies," or a combination of a difference-in-differences and event study framework. This controlled for the way that residents' well-being was likely to deteriorate over time, both due

to general aging as well as to changes in the composition of the sample.

For each outcome, we also reweighted residents in each week to ensure that the average characteristics of observed residents matched the average composition of residents observed in the week of March 10. To do this, we used entropy balancing.¹³ This process balances covariates to ensure 2 groups exactly match on a broad array of characteristics. We matched on residents' age, gender, race/ethnicity, active diagnoses, and the value for the well-being outcome observed in the period most recently preceding March 9, 2020. We also directly controlled for these characteristics in our regression.

The analysis was therefore based on a linear regression model considering outcomes measured for each individual in a given week and year. All people with regular assessments in 2017–2020 were pooled together in the regression. We estimated the average difference in outcomes relative to those observed in the week of March 10, controlling for the same difference observed in 2017–2019. The model is therefore similar to a difference-in-differences specification. Estimates in the weeks before March 10 indicate whether there were any pre-trends. We included the same covariates in the model as those that were used as matching characteristics for entropy balancing. Additionally, we included nursing home fixed effects to flexibly control for any fixed facility characteristics, such as the type of residents they serve and quality ratings. Standard errors were clustered at the nursing home level.

Results

Our sample included a total of 29,097 long-stay nursing home residents in 224 Connecticut nursing homes from 2017 to 2020. Of these, 14,510 were living in the nursing home in 2020 (Table 1).

Characteristics of residents were mostly similar across all 4 years. For those present in 2020, the average resident was 80 years old. About 82% were non-Hispanic white, and 33% were male. Residents had a variety of health conditions; the most common were heart or circulation diagnoses (50.2%), psychiatric diagnoses or mood disorders (38.8%), neurologic diagnoses (33.7%), and metabolic diagnoses (27.1%). Among long-stay nursing home residents in the home in March 2020, nearly 40% contracted COVID-19 and more than 10% died from COVID-19 by the end of July 2020.

The share of residents remaining in the nursing home decreased over time in each year, though the decrease was differentially larger in 2020 (Figure 1). The patterns through mid-April were nearly identical across all 4 years. However, by the end of July in 2017, 2018, and 2019, about 78% of residents remained, whereas at the end of July 2020 only 64% of residents remained. Though this pattern could bias our findings, the characteristics of remaining residents did not differ across years (Supplementary Figure 1). We estimated our primary regression model discussed earlier (excluding the weighting and controls) using age, gender, race/ethnicity, and several medical conditions as outcomes. We found no significant differential changes in characteristics for the 2020 cohort, suggesting that though the number of residents decreased in 2020, there were no systematic patterns likely to introduce selection bias. Further, our primary regression model used weights to mechanically equate the characteristics of residents in all weeks.

Descriptive trends in nursing home outcomes suggest that the pandemic led to a differential increase in the prevalence of any depressive symptoms, unplanned substantial weight loss, and incontinence, as well as worsened cognitive functioning as measured by the Cognitive Function Scale (Supplementary Figure 2). The figure shows average outcomes for residents with regular assessments observed in each week, among the set of people present in the nursing home as of

Table 1
Characteristics of Connecticut Nursing Home Residents at Baseline

| Characteristic | 2017 (n = 15,210) | 2018 (n = 14,736) | 2019 (n = 14,665) | 2020 (n = 14,510) | 2020 Residents | |
|----------------------------------|-------------------|-------------------|-------------------|-------------------|------------------------------|-----------------------------|
| | | | | | COVID-19 Positive (n = 5586) | Died of COVID-19 (n = 1599) |
| Age, y | 81.5 | 81.1 | 80.8 | 80.4 | 79.3 | 83.8 |
| Male | 30.3 | 31.4 | 31.9 | 32.8 | 35.4 | 38.5 |
| Race and ethnicity | | | | | | |
| Non-Hispanic white | 83.8 | 83.1 | 82.3 | 81.5 | 78.8 | 80.4 |
| Non-Hispanic black | 9.7 | 10.0 | 10.6 | 11.1 | 13.0 | 13.4 |
| Hispanic | 5.7 | 6.0 | 6.1 | 6.4 | 7.3 | 4.9 |
| Health conditions | | | | | | |
| Cancer diagnosis | 1.9 | 5.5 | 5.1 | 8.1 | 8.5 | 9.6 |
| Heart or circulation diagnosis | 42.1 | 49.9 | 49.6 | 50.2 | 52.9 | 60.4 |
| Gastrointestinal diagnosis | 0.2 | 0.6 | 0.6 | 0.5 | 0.5 | 0.9 |
| Genitourinary diagnosis | 0.8 | 2.3 | 2.4 | 2.5 | 2.9 | 5.2 |
| Metabolic diagnosis | 19.7 | 25.6 | 26.8 | 27.0 | 29.0 | 34.0 |
| Musculoskeletal diagnosis | 2.2 | 5.7 | 5.2 | 3.6 | 4.1 | 7.1 |
| Neurologic diagnosis | 29.8 | 30.7 | 30.8 | 33.7 | 34.2 | 36.7 |
| Nutritional diagnosis | 2.0 | 2.7 | 2.7 | 4.3 | 4.2 | 5.0 |
| Psychiatric or mood disorder | 34.4 | 35.1 | 36.7 | 38.8 | 40.8 | 40.2 |
| Pulmonary diagnosis | 0.9 | 1.2 | 1.6 | 2.1 | 2.0 | 2.6 |
| Vision diagnosis | 6.5 | 16.5 | 15.3 | 11.3 | 13.0 | 23.4 |
| Recent fall | 19.9 | 20.5 | 20.5 | 20.1 | 20.0 | 23.3 |
| Has catheter | 3.2 | 3.0 | 3.2 | 3.1 | 2.8 | 2.9 |
| Antipsychotic medication | 14.1 | 13.8 | 14.2 | 13.6 | 12.8 | 13.8 |
| Antianxiety medication | 18.9 | 18.1 | 17.3 | 16.5 | 17.2 | 15.0 |
| Has any depressive symptoms | 44.3 | 40.8 | 39.2 | 44.9 | 42.7 | 42.6 |
| Unplanned weight loss | 4.1 | 4.0 | 4.3 | 4.0 | 3.8 | 5.7 |
| Severe pressure ulcer | 2.6 | 2.5 | 2.4 | 2.2 | 2.0 | 2.1 |
| Cognitive Function Scale score | 2.4 | 2.4 | 2.3 | 2.3 | 2.3 | 2.6 |
| Activities of Daily Living score | 7.1 | 7.0 | 6.8 | 6.7 | 6.5 | 7.5 |
| Incontinence | 66.1 | 65.3 | 65.4 | 64.7 | 62.7 | 73.2 |

All characteristics are percentages except for age and the Cognitive Function Scale and Activities of Daily Living scores. The table reports the average characteristics for all people who lived in a nursing home on March 9 of the given year. Characteristics are measured in the most recent regular assessment prior to March 9.

March 9. The trends for 2020 were noticeably different from the trend for 2019 for several of these outcomes. Our formal regression model, discussed below, provides the most comprehensive rigorous evidence of the estimated impact of the pandemic on well-being.

Shortly after the pandemic peaked in Connecticut in April, the percentage of long-stay nursing home residents with any depressive symptoms increased by about 6 percentage points relative to the percentage before the epidemic in early March (Figure 2A). Before the outbreak, about 45% of residents experienced any depressive symptoms. The statistically significant increase of 6 percentage points in mid-April to mid-May therefore represents a relative increase of 15%. The percentage of residents with depressive symptoms started to decline in mid-May, both after the peak of the pandemic and when Connecticut started to allow visitors again in an outdoor setting.

Nursing home residents also experienced physical deterioration, with large, statistically significant increases in unplanned substantial weight loss (Figure 2B). Substantial unplanned weight loss is associated with an increased risk of hospitalizations and death.¹⁴ Weight loss started to slowly increase in mid-April—the height of the pandemic. Each week in June and July, the 6–percentage point increase in the share experiencing substantial weight loss represented a 150% increase relative to the beginning of March (and relative to the average from 2017 to 2019).

Cognitive function scores also indicated temporary but meaningful deterioration of resident functioning (Figure 2D).¹¹ In mid-April, the average cognitive function score spiked by 0.11 points, a statistically significant 5% increase relative to the average of 2.31 points observed in early March. This timing nearly exactly corresponded to the peak of the pandemic. In subsequent weeks, the increases in the cognitive function score slowly waned, until the scores were no longer significantly different from before the pandemic by mid-May.

Residents also experienced a significant increase in episodes of incontinence (Figure 2F). Similar to the patterns observed for other outcomes, impacts were statistically significant in the period from mid-April to late May. The increase of nearly 4 percentage points represented a 6% increase relative to the approximately 65% of nursing home residents with incontinence in early March (or relative to the similar share with incontinence on average from 2017 to 2019).

Several outcomes did not seem to be affected by the pandemic. We found no significant impacts on severe pressure ulcers or on the activities of daily living score, which captures resident functioning (Figure 2D and E). We also examined several other outcomes (not pictured), such as having a recent fall or urinary tract infection, or taking antipsychotic or antianxiety medication. These outcomes did not show significant changes.

As a robustness check, we also estimated all results including short-stay residents (those who had been in the nursing home for less than 100 days as of March 9, 2020). Results were essentially the same, with findings available on request. Though understanding well-being among short-stay residents is important, the fact that they were likely to leave the facility more quickly and might have exacerbated differential trends stemming from the pandemic makes it easier to interpret the findings with only long-stay residents. However, well-being declined for short-stay residents as well when we conducted a similar analysis on that population.

Changes in outcomes likely reflect both the direct effects of COVID-19 among those who contracted it and indirect effects on those who did not become infected. For example, about 10% of residents who contracted COVID-19 observed each week experienced unplanned substantial weight loss from the last week of May to the end of July (Figure 3B). Though the percentage of residents with unplanned weight loss was lower for those who did not become infected—about 7.5% each week over the same period—it still meaningfully increased relative to the 4% baseline. Patterns for other outcomes were less substantial, though they also had noticeable differences between

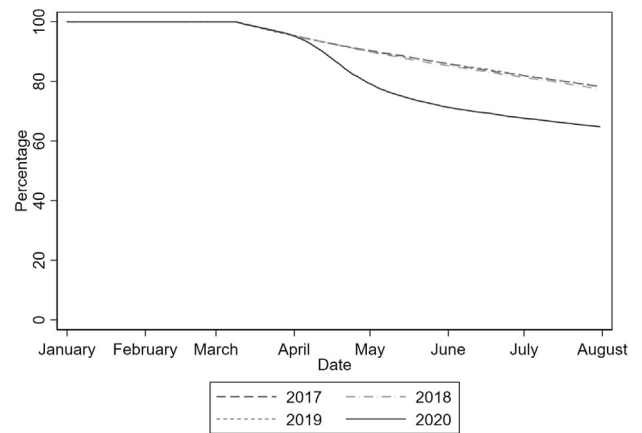


Fig. 1. Graph demonstrating the attrition of long-stay residents between March 9 and August 31 of 2020, 2019, 2018, and 2017. The January–March 9 time period was used to define our long-stay study sample for each year.

those who did and did not contract COVID-19 in the prepandemic period.

Discussion

Our findings show that the pandemic had substantial impacts on nursing home residents beyond what can be quantified by cases and deaths. On several measures—such as rates of depression, incidence of substantial unplanned weight loss, cognitive functioning, and incontinence—nursing home resident outcomes worsened. The timing of these changes corresponded to the timing of the evolution of the pandemic.

The pattern of the results suggests that isolation, potentially stemming from general trends of reductions in direct care provision (discussed below) or from policies that restricted visitors, contributes to the reductions in resident well-being. We found that even residents who did not contract COVID-19 experienced some physical deterioration, indicating that even those who did not get sick were affected. Additionally, our finding of increases in incontinence, a physical manifestation, suggests that something beyond just fear and despair must have contributed to changes in well-being.

The nature of the pandemic required immediate and substantial policy actions, such as restricting visitors and limiting resident movement within the facility, to limit the number of fatalities. These policies assisted nursing homes in procuring sufficient PPE for residents and staff and cohorting residents according to their COVID-19 status. Yet, they may have also been one contributing factor to the reduction in well-being we found, suggesting that policy makers need to consider both the costs and benefits of such policies. Previous research has found that, through targeted interventions, the negative impacts of social isolation can be mitigated.¹⁵

Nursing home administrators and advocacy organizations have cited the effects of reduced visitation and social interactions in the initial months of the pandemic on resident outcomes, such as weight loss and failure to thrive.⁶ Recent research also found that though high quality nursing homes experienced less mortality from COVID-19, they experienced greater non-COVID deaths, particularly in counties with low COVID-19 case rates.¹⁶ These observations are consistent with our findings on outcomes, such as depression and unplanned substantial weight loss, and reflect the substantial evidence base on the health risks of social isolation and loneliness.⁷

Nursing homes often faced staffing shortages during the pandemic, which might lead to an inability to provide the same level of care and attention as usual.^{2,3} There is a well-documented

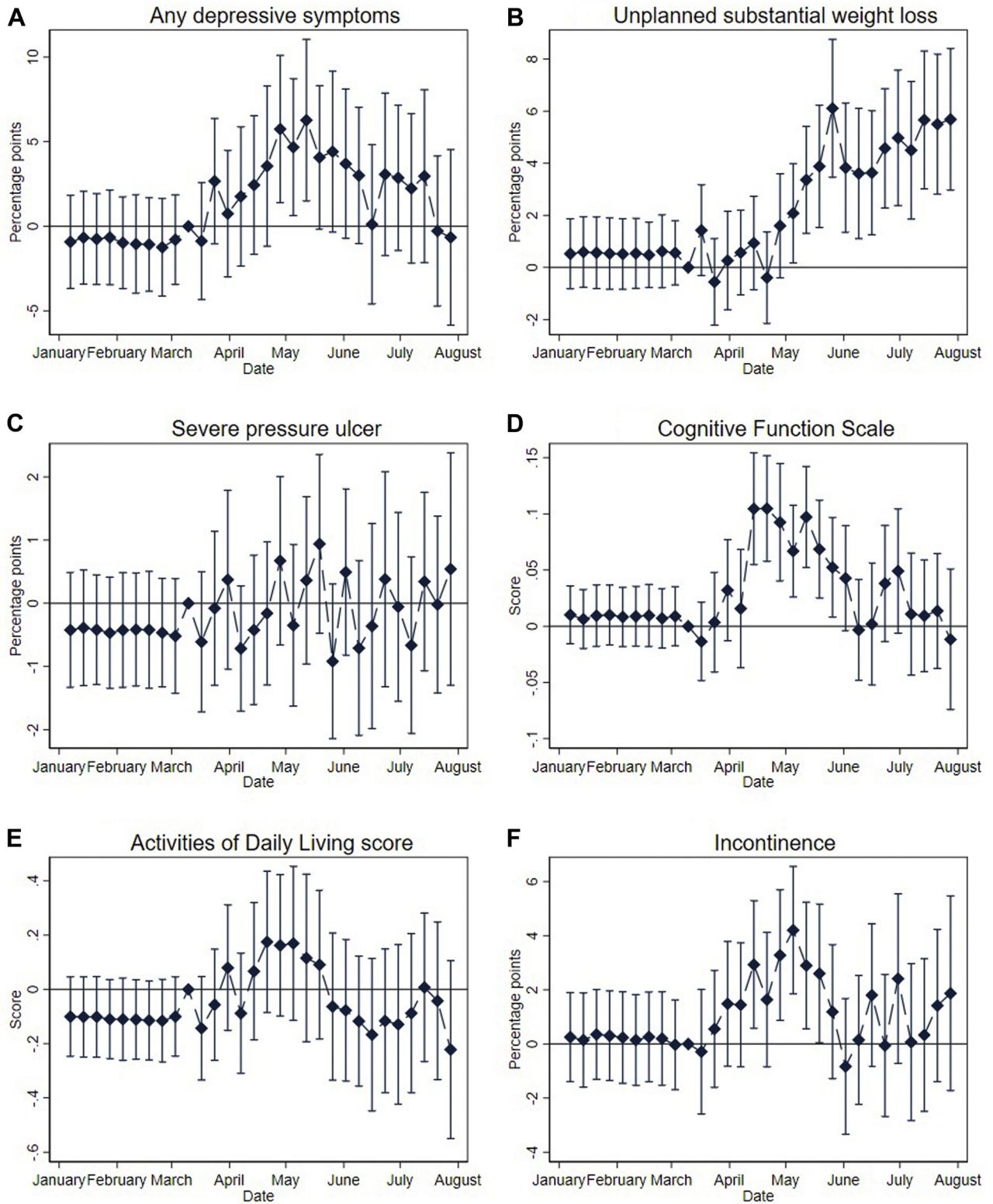


Fig. 2. The figure uses an event study framework to estimate the impact of the pandemic on outcomes. Each point represents the impact of the pandemic in that week, relative to an impact of zero in the week of March 10, 2020, which represents the onset of the pandemic. Mechanically, this means that each point shows the difference in average outcomes for residents with regular MDS assessments that week in 2020 relative to outcomes observed in the same week averaged across 2017–2019, relative to a difference of zero in the week of March 10. For each of the 4 years included in the regression, the sample includes long-stay residents of the nursing home present as of March 9 of that year who had a regular assessment during the given time period. The points in January and February show pre-trends for the same sample of people. The model also reweights the sample in each week to ensure observable characteristics are equal in all time periods, and controls directly for these characteristics. Bars represent the 95% confidence interval accounting for standard errors clustered at the nursing home level, so that statistical significance is indicated if the bars are wholly above or below the zero line. The Cognitive Function Scale ranges from 0 to 6, with a higher score indicating a more severe impairment. The Activities of Daily Living scale ranges from 0 to 16, with a higher score indicating that the resident requires more functional assistance or support.

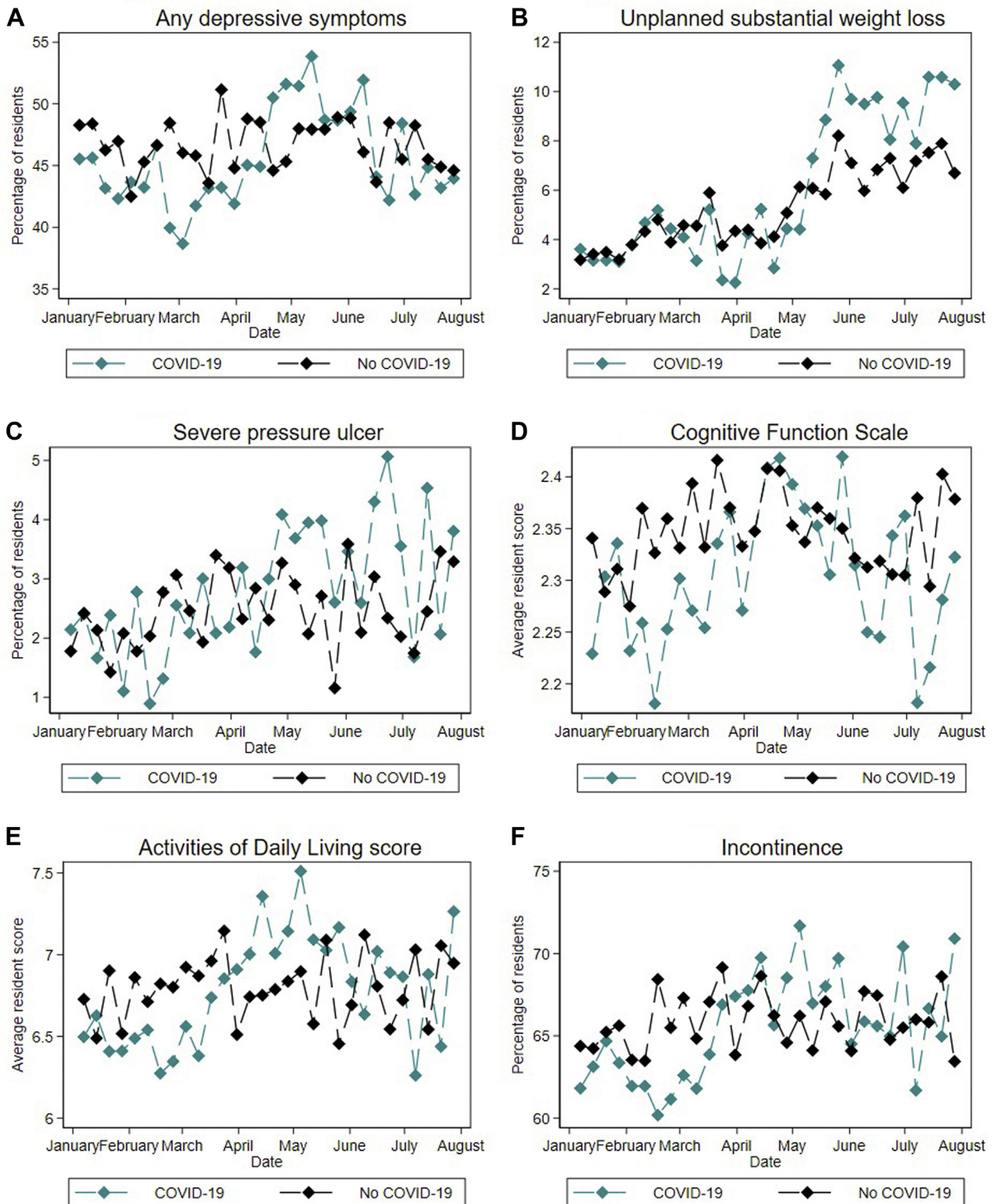


Fig. 3. The figure plots average outcomes observed in each week, reporting separately by whether or not the resident ever tested positive for COVID-19. It only includes long-stay residents of the nursing home who were present in the facility as of March 9, 2020. The Cognitive Function Scale ranges from 0 to 6, with a higher score indicating a more severe impairment. The Activities of Daily Living Scale ranges from 0 to 16, with a higher score indicating that the resident requires more functional assistance or support.

relationship between the level of staffing in nursing homes and the quality of care received by residents.¹⁷ Nursing homes have long struggled to maintain sufficient staffing due to the low wages and demanding nature of the work. The COVID-19 outbreak may have

exacerbated these challenges.¹⁸ These demands also likely impacted staff availability for direct care provision. The fear of the virus, negative media coverage of nursing homes, and focus on hospital staff and resources compounded an already stressful situation for

nursing home staff who were overburdened given staff shortages and new responsibilities to address COVID-19 protocols.^{19,20} These challenges contributed to the crisis situation in many nursing homes. Additionally, limitations on visitors meant that family members and other unpaid caregivers, who normally provide important supplemental care to nursing home residents, could no longer fulfill that role. Consistent with a reduction in direct care provision, we found that the incidence of incontinence increased during the height of the pandemic in Connecticut.

One important limitation to our findings is the potential for selection bias. Selection bias in the MDS data could be an important factor for individual-level outcomes, both in terms of who got sick and in terms of well-being. Residents are supposed to be assessed on admission, on discharge, every 3 months, and if there is a significant change in status. Though we excluded admission, discharge, and significant change assessments, the pandemic could still have influenced who is included in these resident assessments data in a variety of ways. First, we found more people exited the facility than in a typical year, potentially to avoid exposure to COVID-19. Additionally, more than 10% of residents living in a nursing home on March 9, 2020, died from COVID-19. Those who died likely would have experienced decreases in physical and mental well-being before their death, but they are not observed in the data. Thus, these analyses may underestimate the total impact of the pandemic on residents' well-being. Second, residents may be more likely to have a significant change in their status, particularly if they became infected with COVID-19. Third, staff may have had limited time to complete regular resident assessments because they needed to focus all energies on controlling the outbreak to the extent possible. However, less than 1% of regular ongoing assessments were delayed (ie, occurred after more than 95 days) both in 2020 and in previous years.

Conclusions and Implications

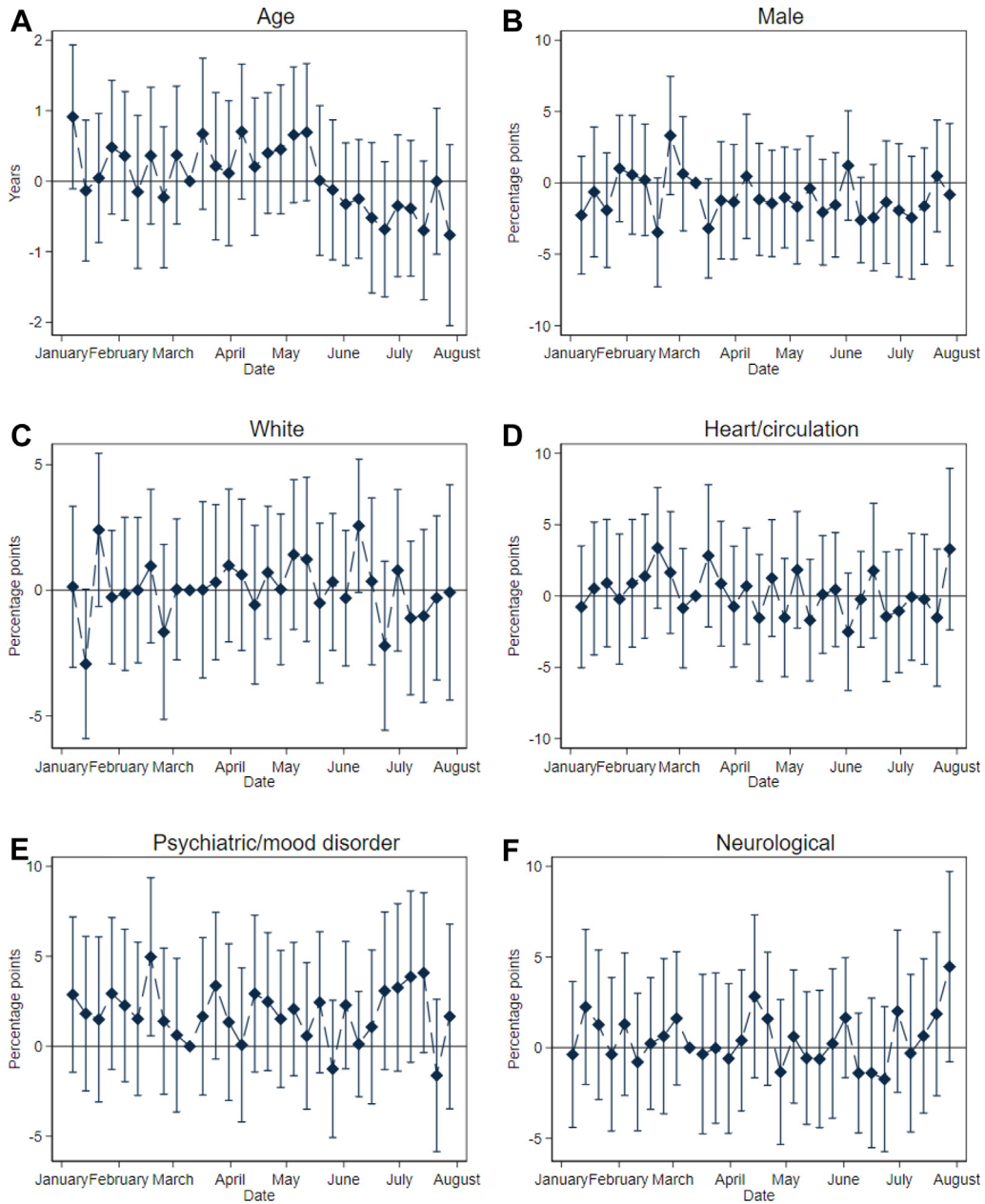
The well-being of nursing home residents declined as a result of the pandemic, in ways beyond the direct effects of COVID-19. Our analysis only covers the first 4 months of the pandemic; future research could assess how the pandemic impacted well-being over the longer term, particularly as restrictions remained in place for longer periods. It would be especially valuable to disentangle some of the potential mechanisms driving the reductions in well-being, such as fears associated with the virus or grief from losing friends and loved ones; changes in care practices; and policies put in place to limit the spread of the virus, such as restricting residents to their room and limiting visitation. Future policy changes to limit the spread of COVID-19 or other infectious disease outbreaks should consider any additional costs beyond the direct effects of morbidity and mortality due to COVID-19. Our findings highlight the importance of being responsive to the recommendations made by the independent Nursing Home Commission and other stakeholders to put person-centered care at the forefront of any new guidance for nursing homes to respond to the COVID-19 crisis.⁸

Acknowledgments

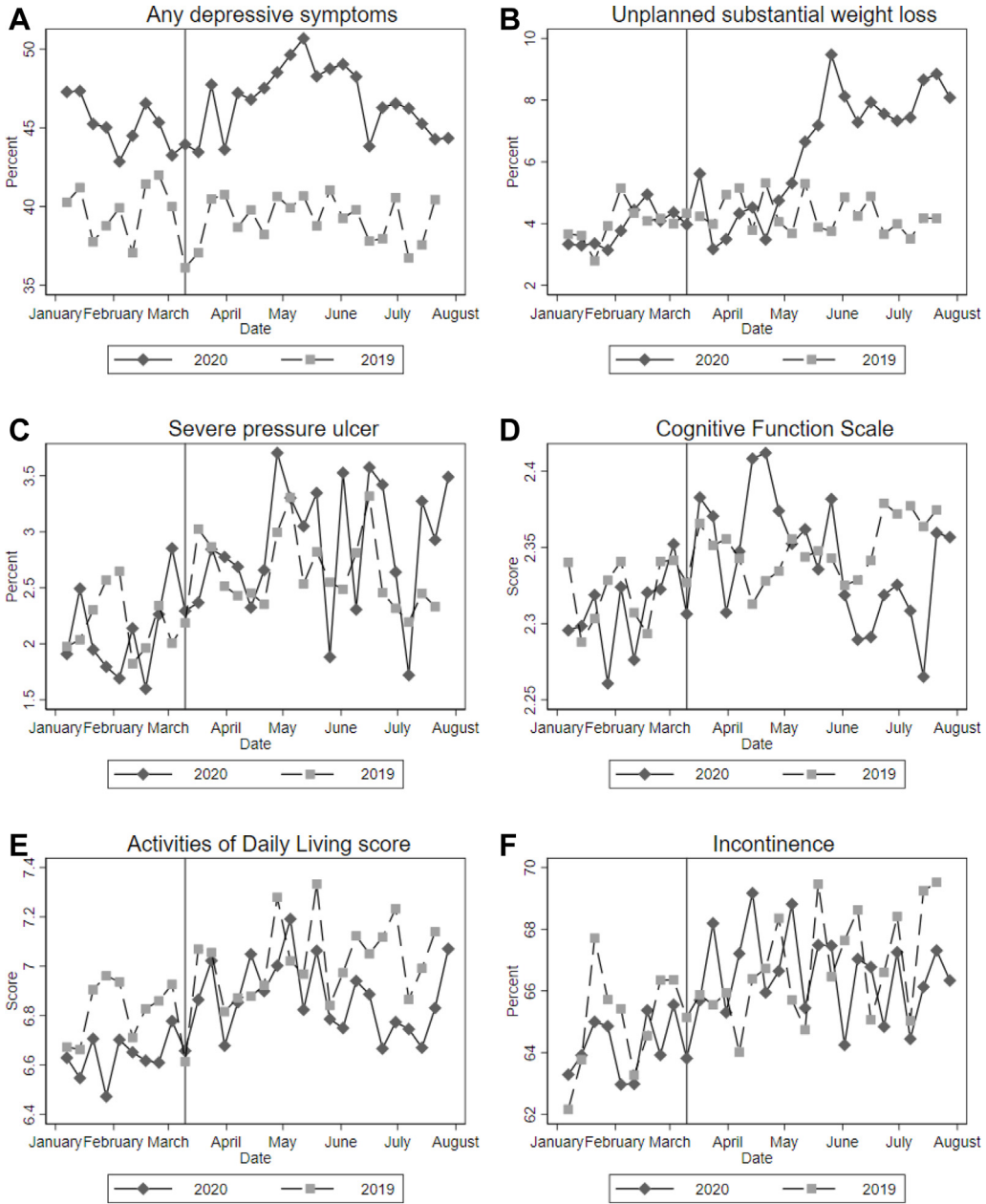
We are grateful to Reena Gupta, Rebecca Lester, Kristie Liao, Jenna Libersky, Debra Lipson, Donna Maselli, Julie Robison, and Patricia Bowen, who contributed to other elements of our work studying the spread of COVID-19 in nursing homes and whose feedback improved this analysis. We are also grateful to everyone who supported this work by participating in interviews that helped us better understand the ongoing pandemic—particularly residents of long-term care facilities and their family members—and sharing their experiences.

References

1. COVID Tracking Project. The long-term care COVID tracker. Available at: <https://covidtracking.com/data/longtermcare>. Accessed September 14, 2020. Published 2020.
2. McGarry BE, Grabowski DC, Barnett ML. Severe staffing and personal protective equipment shortages faced by nursing homes during the COVID-19 pandemic. *Health Aff* 2020;39:1812–1821.
3. Xu H, Intrator O, Bowblis JR. Shortages of staff in nursing homes during the COVID-19 pandemic: What are the driving factors? *J Am Med Dir Assoc* 2020; 21:1371–1377.
4. Simard J, Volicer L. Loneliness and isolation in long-term care and the COVID-19 pandemic. *J Am Med Dir Assoc* 2020;21:966–967.
5. Pitkälä KH. COVID-19 has hit nursing homes hard. *Eur Geriatr Med* 2020;11: 889–891.
6. Abbasi J. Social isolation—The other COVID-19 threat in nursing homes. *JAMA* 2020;324:619–620.
7. National Academies of Sciences, Engineering, and Medicine. *Social Isolation and Loneliness in Older Adults: Opportunities for the Health Care System*. Washington, DC: The National Academies Press; 2020.
8. MITRE. Coronavirus Commission on Safety and Quality in Nursing Homes. McClean, VA: MITRE Corp, 2020. Available at: <https://edit.cms.gov/files/document/covid-final-nh-commission-report.pdf>. Accessed October 4, 2020.
9. Verbeek H, Gerritsen DL, Backhaus R, et al. Allowing visitors back in the nursing home during the COVID-19 crisis: A Dutch national study into first experiences and impact on well-being. *J Am Med Dir Assoc* 2020;21:900–904.
10. Gaddey H, Holder K. Unintentional weight loss in older adults. *Am Fam Physician* 2014;89:718–722.
11. Thomas K, Dosa D, Wysocki A, Mor V. The Minimum Data Set 3.0 Cognitive Function Scale. *Med Care* 2017;55:e68–e72.
12. Morris JN, Fries BE, Morris SA. Scaling ADLs within the MDS. *J Gerontol A Biol Sci Med Sci* 1999;54:M546–M553.
13. Hainmuller J. Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies. *Polit Anal* 2012; 20:25–46.
14. Simmons S, Keeler E, Zhuo X, et al. Prevention of unintentional weight loss in nursing home residents: A controlled trial of feeding assistance. *J Am Geriatr Soc* 2020;56:1466–1473.
15. McArthur C, Saari M, Heckman GA, et al. Evaluating the effect of COVID-19 pandemic lockdown on long-term care residents' mental health: A data-driven approach in New Brunswick. *J Am Med Dir Assoc* 2021;22:187–192.
16. Cronin CJ, Evans WE. *Nursing Home Quality, COVID-19 Deaths, and Excess Mortality*. Cambridge, MA: NBER Working Paper No. 28012; 2020.
17. Schnelle J, Simmons S, Harrington C, et al. Relationship of nursing home staffing to quality of care. *Health Serv Res* 2004;39:225–250.
18. Ouslander J, Grabowski D. COVID-19 in nursing homes: Calming the perfect storm. *J Am Geriatr Soc* 2020;68:2153–2162.
19. McGilton KS, Escrig-Pinol A, Gordon A, et al. Uncovering the devaluation of nursing home staff during COVID-19: Are we fueling the next health care crisis? *J Am Med Dir Assoc* 2020;21:962–965.
20. White EM, Wetle TF, Reddy A, Baier RR. Front-line nursing home staff experiences during the COVID-19 pandemic. *J Am Med Dir Assoc* 2021;22:199–203.



Supplementary Fig. 1. The figure uses the same event study framework as the primary impact model but shows whether the characteristics of residents who are observed in each week differ over time. Each point represents the impact of the pandemic on the sample in that week, relative to those observed in the week of March 10, 2020, which represents the onset of the pandemic. Mechanically, this means that each point shows the difference in average characteristics for residents with regular MDS assessments that week in 2020 relative to characteristics observed in the same week averaged across 2017–2019, relative to a difference of zero in the week of March 10. For each of the 4 years included in the regression, the sample includes people who lived in the nursing home on March 9 of that year and includes all subsequent observations through July 31. The points in January and February show pre-trends for the same sample of people. The model does not reweight or control for any characteristics, unlike the primary impact model. Bars represent the 95% confidence interval accounting for standard errors clustered at the nursing home level, so that statistical significance at the 95% level is indicated if the bars are wholly above or below the zero line.



Supplementary Fig. 2. The figure shows average outcomes for residents with regular MDS assessments over time (grouped by week). It includes long-stay residents who were present as of March 9 of the given year and had a regular assessment during the given time period. The Cognitive Function Scale ranges from 0 to 6, with a higher score indicating a more severe impairment. The Activities of Daily Living Scale ranges from 0 to 16, with a higher score indicating that the resident requires more functional assistance or support.