Nursing Homes During the COVID-19 Pandemic—Resident and Staff Cases and Deaths

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COVID-19 is responsible for a disproportionate share of deaths among residents and staff living and working in long-term care (LTC) settings.  While 8 percent of all COVID-19 infections have occurred in LTC, over 40 percent of all COVID-19 deaths are among those in LTC settings (KFF, 2020).  The close quartered living combined with residents who are living with multiple health conditions and staff who are serving multiple residents and households makes LTC settings vulnerable to infection outbreaks.  The risks were known before the pandemic and infection control programs were required by federal law and in most cases, by state law.  Data prior to the pandemic, however, showed that LTC facilities were woefully unprepared with 40 percent of nursing homes having at least 1 infection control deficiency in a given year and over 60 percent having infection deficiencies when measured over several years (GAO, 2020; Gonzalez, 2020).  Data also showed that certain characteristics of nursing homes resulted in fewer deficiencies, including smaller size, non-profit ownership, being in the South or Northeast, and higher CMS 5-star quality ratings (GAO, 2020; Gonzalez, 2020).

As infections spread from the Western U.S. to the particularly hard hit Northeast, it was unclear how quickly COVID-19 was spreading in LTC facilities largely because data reporting at the federal level wasn't required for nursing homes or assisted living facilities (ALFs; only 19 states are reporting ALF data as of late September; KFF.org, 2020).  Initially, nursing homes were only required to report cases and deaths to local health authorities and to the state. Further complicating our knowledge was the temporary suspension of nursing home inspections (unless there were evidence of or complaints regarding immediate jeopardy violations) and a temporary moratorium on visitors. It wasn't until late April that the federal administration began requiring nursing homes to report COVID-19 data to the Centers for Disease Control or face a Civil Money Penalty for non-compliance (CMS.gov, 2020).  Nursing homes were given a deadline of May 17 to report information about the number of cases, deaths, and other data.  As of August 3, almost all nursing homes have reported data.

This issue brief uses those data to examine variation across nursing homes in infection rates and deaths among residents and staff with an eye toward how to reduce future outbreaks. It also examines differences in these outcomes between traditional nursing homes and Green House homes.  Green House homes are expected to have lower rates of infections and possibly deaths for several reasons.  Green House homes are designed to be small—each having between 10-12 Elders who have their own bedrooms and bathrooms and dedicated staff—which could be key to reducing infections.  Green House homes are largely non-profit which has been associated with better quality care and lower health deficiencies.  What sets the Green House homes apart from similarly constructed small household nursing homes is their focus on culture change, creating a meaningful life and deep regard for Elders and staff, and their commitment to periodically collecting and analyzing data, and improving each home.  Therefore, it's expected that the physical design of the Green House homes, combined with their philosophy on Elder care, and commitment to data and quality improvement will result in lower infection rates and deaths.

**Data**

Data used for the following analyses are reported by nursing homes to the Centers for Disease Control and are available at: https://data.cms.gov/stories/s/COVID-19-Nursing-Home-Data/bkwz-xpvg.  These data were merged with CMS' Nursing Home Compare data to obtain information including star ratings, profit-status, and  survey ratings and can be found at: https://www.medicare.gov/nursinghomecompare/search.html.  Finally, a file containing all Green House Project homes was merged with these two datasets.  A major limitation of the data is the inability to conduct longitudinal analyses because nursing homes unevenly reported COVID-19 data over time.  Therefore, the following analysis represents a cross-section of data.

Nursing homes were included in the analysis if they passed CMS' data quality check for their most recent data submission.  Nursing homes that didn't have a star rating because they were not in operation long enough to have been surveyed (n=114) were deleted.  Special Focus Facilities or ones deemed by CMS as having multiple deficiencies over a long period of time don't receive star ratings.  These facilities (n=84) were retained in the data for analysis and assigned star ratings of zero to indicate low quality.  The final sample size is n=14,981 nursing homes.

**Methods**

Descriptive statistics, ordinary least squares regression, and t-tests were employed to understand facility variation—namely, facility size, geographic location, CMS star ratings, COVID-19 admissions and profit status—and COVID-19 infection rates and death rates among residents and the number of infections and deaths among staff.  A separate, exploratory analysis was conducted to compare infection rates and deaths between traditional nursing homes and Green House Project homes (n=40) because the latter, given their person-directed care philosophy, data collection and feedback program, small size, private bedrooms and bathrooms, dedicated staff, household model, and largely non-profit status, are expected to have better outcomes compared to traditional nursing homes as these are all factors that affect quality in long-term care.

**Results**

The following provides an overview of key results from the full analyses (see Appendix for detailed tables and results).

*Descriptive Statistics*

-The total number of COVID-19 resident cases is 213,013 with an average COVID-19 resident infection rate of almost 183 per 1,000 occupied beds.

-The total number of COVID-19 resident deaths is 52, 939 (representing 27 percent of all resident deaths since January 2020).  The average COVID-19 resident death rate is almost 46 deaths per 1,000 occupied beds.

-The total number of staff infections is 165,725 with an average of 11 per nursing home.

-The total number of staff deaths is 830 with an average of less than 1 per nursing home.

*Regression Analyses Results*

Resident COVID-19 Infection Rates

- For-profit ownership, being in the South or Northeast compared to the West, and a greater number of people admitted with COVID-19 were all associated with significant increases in the resident COVID-19 infection rates.

-Higher CMS 5-star overall ratings were associated with a decrease in resident infection rates, as was being in the Midwest compared to the West.

Resident COVID-19 Death Rates

-Being in the South or Northeast compared to the West and the number of people infected with COVID-19 and admitted to the nursing home were associated with significant increases in the resident death rate.

-An increase in the number of certified beds was associated with a slight decrease in the resident death rate.

Staff COVID-19 Infection Rates

-Infections were higher in the South and Northeast compared to the West, and increases in the overall star rating, a greater number of residents admitted with COVID-19, and a greater number of certified beds were associated with increases in the number of staff infections.

-Being in the Midwest compared to the West and higher health survey ratings were associated with fewer staff infections.

Staff COVID-19 Death Rates

-For-profit ownership, being in the Northeast compared to the West, an increase in the number of people admitted with COVID-19, and an increase in the number of certified beds were all associated with slight increases in the number of staff deaths.

-An increase in the health survey rating was associated with a small decrease in the number of staff deaths.

Traditional Nursing Homes vs. Green House Homes

-Resident infection and death rates were significantly higher in traditional nursing homes.

-There were no significant differences in terms of the number of staff infections or death.

**Conclusion**

The analyses presented here indicate that there are several factors that policymakers and nursing homes could employ in the future to reduce threats from infections like COVID-19.  Geographic location was associated with infection and death rates--with nursing homes in the Northeast and South, compared to the West, having higher resident and staff infections and higher resident death rates. Nursing homes in the Northeast (but not the South) had a larger number of staff deaths.  The West, with Washington state being "ground zero" for COVID-19 infections would be expected to have higher rates, however, infection deficiency data showed before the pandemic, that nursing homes in the Northeast and South had a greater rate of deficiencies (see:  https://claudepeppercenter.fsu.edu/research/policy-issue-briefs/infection-control-in-nursing-homes/), which could explain some of the geographic variation.

In the analyses, the number of people with COVID-19 admitted to nursing homes were a consistent predictor of resident infection rates and deaths and the number of infections and deaths among staff. Early in the pandemic, hospitals and policymakers were concerned about the supply of hospital beds to deal with the surge in COVID-19 hospitalizations.  Several states, including New York and New Jersey, ordered nursing homes to accept recovering COVID-19 patients who had been discharged from the hospital, thus placing an already vulnerable population at risk (NPR.org, 2020).  Earlier this year, the CDC published its recommendations to nursing homes accepting COVID-19 positive patients including maintaining a proper supply of personal protective equipment, separating COVID-19 admissions from residents, and creating a dedicated staff for the ward (see: https://www.cdc.gov/coronavirus/2019-ncov/hcp/nursing-homes-responding.html).  CMS also issued a few recommendations (see: https://www.cms.gov/files/document/4220-covid-19-long-term-care-facility-guidance.pdf).  It's unclear how well facilities followed the CDC's and CMS' guidance.  Another potential issue is that nursing homes-- that may not have been prepared to safely take on COVID-19 patients--were incentivized nonetheless by the potential of a short-term stay and thus, a higher reimbursement rate via Medicare. Future decision making should consider the data presented in this brief to assess the risk of placing possibly contagious individuals in LTC facilities.

Improving the quality of care in nursing homes could reduce negative resident and staff outcomes.  The overall CMS quality star rating of the facility was associated with a decrease in resident infection rates, while higher health inspection survey ratings were associated with reduced staff infections and staff deaths. The latter is especially important in the prevention of future outbreaks, especially considering that the most commonly cited survey deficiencies are for infection control and prevention, including a failure to follow proper handwashing procedures and the proper use of personal protective equipment (GAO, 2020).

For-profit ownership should also be taken into consideration when planning for future pandemics.  For-profit ownership was associated with a large increase in resident infection rates and with a small increase in the number of staff deaths.  For-profit facilities tend to be larger and are incentivized to cut staffing and other costs (including training) to generate a profit, potentially leading to weakened infection control practices.

Green House homes are perhaps the ideal setting in which Elders live meaningful lives, where staff are empowered to provide high quality care, and given their physical design and focus on quality and data, the ideal setting to reduce the transmission of infectious diseases.  Preliminary analyses here indicate that residents fared better in Green House homes, compared to traditional nursing homes (but not staff).  Legislation at the federal and state levels could be introduced to incentivize the development of additional Green House homes--even encouraging their construction as the industry standard--including higher Medicare and Medicaid reimbursements and lifting the moratorium on new nursing home construction (in states like Florida, for example) exclusively for Green House home construction.

In sum, it's likely that we will see future pandemics and preparing communities and institutions where those who are most vulnerable reside, will help to reduce the devastation.  In LTC facilities, this means addressing and challenging the traditional nursing home philosophy and environment with models that promote quality of life and health, like the Green House homes.

**Appendix**

**Results**

Table 1 shows descriptive statistics. The unit of analysis is the nursing home. The first dependent variable, resident COVID-19 infection rate, has an average of almost 183 per 1,000 occupied beds. The second, resident COVID-19 death rate, has an average of almost 46 deaths per 1,000 occupied beds. The third, staff infections, has a total of 165,725 and an average of 11. Finally, the number of staff deaths total 830, with an average of less than 1. For-profit nursing homes make up 70 percent of nursing homes, Green House homes make up less than 1 percent, the average CMS overall rating is slightly over 3, the average CMS survey rating is 2.79, and most nursing homes are located in the Midwest and South. The average number of COVID admissions is almost 6, the average number of certified beds is about 107, and the average number of occupied beds is almost 76. There is a total of 213,013 confirmed COVID-19 cases among residents. Since January 2020, there have been a total number of 189,148 resident deaths due to all causes. Of those deaths, 52,939 are due to COVID-19, representing roughly 27 percent of deaths.

Table 1. Nursing Home Descriptive Statistics

| Variable | Mean/Proportion | Std Dev | Minimum | Maximum |
|---|---|---|---|---|
| *Dependent Variables:* | | | | |
| Resident COVID-19 Infection Rate (Per 1,000 Occupied Beds) | 182.71 | 389.56 | 0 | 29000 |
| Resident COVID-19 Death Rate (Per 1,000 Occupied Beds) | 45.68 | 131.64 | 0 | 7000 |
| Staff Number of Infections (n=165,725) | 11.06 | 15.35 | 0 | 161 |
| Staff Number of Deaths (n=830) | 0.06 | 0.33 | 0 | 10 |
| *Independent Variables:* | | | | |
| For-Profit (n=10,494) | 0.70 | 0.46 | 0 | 1 |
| Green House (n=40) | 0.003 | 0.05 | 0 | 1 |
| CMS 5-Star Overall Rating | 3.20 | 1.43 | 0 | 5 |
| CMS Health Survey Rating | 2.79 | 1.29 | 0 | 5 |
| Midwest (n=4,923) | 0.33 | 0.47 | 0 | 1 |
| South (n=5,242) | 0.35 | 0.48 | 0 | 1 |
| Northeast (n=2,488) | 0.17 | 0.37 | 0 | 1 |

| | | | | |
|---|---|---|---|---|
| Number of COVID Admissions (n=88,398) | 5.90 | 15.15 | 0 | 328 |
| Number of Certified Beds (n=1,598,103) | 106.68 | 60.83 | 2 | 1389 |
| Number of Occupied Beds (n=1,135,696) | 75.81 | 47.88 | 1 | 1952 |

Tables 2 through 5 show regression results.  Table 2 regresses resident COVID-19 infection rate (Per 1,000 Occupied Beds) on all independent variables.  The coefficient for profit status is significant and positive with for-profit ownership being associated with a large increase in the resident infection rate (b= 33.54, p < .001).  The coefficient for CMS 5-star overall rating is significant and negative (b= -14.19, p < .01) meaning that for every one-unit increase in the star rating, the resident infection rate decreases by 14.19.  Geographic location is significant with nursing homes in the Midwest associated with a large decrease (b=-52.61, p < .001) in infection rates compared to those in the West while those located in the South and Northeast, compared to the West are associated with an increase in infection rates. The number of individuals infected with COVID-19 and admitted to nursing homes is associated with an increase in infection rates.  Health Survey rating and the number of certified beds are insignificant.

Table 2.  Resident COVID-19 Infection Rate Regressed on IVs

| Variable | B (SE B) |
|---|---|
| For-Profit | 33.54*** (7.06) |
| CMS 5-Star Overall Rating | -14.19** (4.58) |
| CMS Health Survey Rating | 6.00 (4.98) |
| Midwest | -52.61*** (9.66) |
| South | 34.26** (9.76) |

| Variable | B (SE B) |
|---|---|
| Northeast | 41.55** (11.19) |
| Number of COVID Admissions | 5.36*** (.22) |
| Number of Certified Beds | .03 (.06) |

*p<.05, **p<.01, ***p<.001

Table 3 regresses the resident COVID-19 death rate on independent variables.  Nursing homes in the Northeast and South are associated with a large increase (b=37.88 p < .001, b=10.19 p <.01, respectively) in resident death rates compared to those in the West. The number of individuals infected with COVID-19 and admitted to nursing homes is associated with an increase in infection rates.  The coefficient for number of certified beds is significant, yet very small and negative (b= -.05, p < .01) meaning that for every one-unit increase in the number of certified beds, the resident death rate decreases by -.05.

Table 3.  Resident COVID-19 Death Rate Regressed on IVs

| Variable | B (SE B) |
|---|---|
| For-Profit | 3.54 (2.38) |
| CMS 5-Star Overall Rating | -1.22 (1.54) |
| CMS Health Survey Rating | -1.52 (1.67) |
| Midwest | .67 (3.25) |
| South | 10.19** (3.28) |
| Northeast | 37.88*** (3.76) |

| | |
|---|---|
| Number of COVID Admissions | 2.17*** (.07) |
| Number of Certified Beds | -.05** (.02) |

*p<.05, **p<.01, ***p<.001

Table 4 regresses the staff COVID-19 infection rate on all independent variables. Nursing homes located in the South and Northeast are associated with an increase in the number of staff infections (b=2.64, p < .001, b=.88, p < .05), compared to those in the West. Nursing homes located in the Midwest compared to the West are associated with a decrease (b=-2.62, p<.001) in the number of staff infections. Results show that for every one-unit increase in the star rating, the number of staff infections increase by .95. By contrast, for every one-unit increase in the health survey rating, the number of staff infections decrease by .62. The coefficients for the number of residents admitted with COVID and the number of certified beds are also significant and positive.

Table 4. Staff COVID-19 Infections Regressed on IVs

| Variable | B (SE B) |
|---|---|
| For-Profit | -.08 (.24) |
| CMS 5-Star Overall Rating | .95*** (.16) |
| CMS Health Survey Rating | -.62** (.17) |
| Midwest | -2.62*** (.33) |
| South | 2.64*** (.33) |
| Northeast | .88* (.38) |
| Number of COVID Admissions | .27*** (.01) |

| Variable | B (SE B) |
|---|---|
| Number of Certified Beds | .09***<br>(.001) |

*p<.05, **p<.01, ***p<.001

Table 5 regresses the number of staff COVID-19 deaths on all independent variables.  The coefficients are small.  For-profit ownership and being in the Northeast are significant and positively associated with an increase in the number of staff deaths.  The number of residents admitted for COVID and the number of certified beds are significant and positively associated with an increase in the number of staff deaths.  The health survey rating is negatively associated with the number of staff deaths.

Table 5.  Staff COVID-19 Deaths Regressed on IVs

| **Variable** | B (SE B) |
|---|---|
| For-Profit | .01*<br>(.01) |
| CMS 5-Star Overall Rating | .01<br>(.004) |
| CMS Health Survey Rating | -.01**<br>(.004) |
| Midwest | -.00 (.01) |
| South | .01 (.01) |
| Northeast | .02*<br>(.01) |
| Number of COVID Admissions | .003***<br>(.000) |
| Number of Certified Beds | .003***<br>(.000) |

*p<.05, **p<.01, ***p<.001

**COVID-19 Outcomes in Green House Homes vs. Traditional Nursing Homes**

Green House homes were identified in the data (n=40, occupied beds=3,475) and compared to traditional nursing homes (n=14,941, occupied beds=1,135,696) for all outcomes.  There are 203 resident COVID-19 infections in Green Houses, compared to 213,216 in traditional nursing homes. Green House homes have 45 resident deaths, compared to 58,894 in traditional nursing homes.  Regarding staff, Green House homes have 401 staff infections and 1 staff death, compared to 165,324 staff infections and 829 staff deaths in traditional nursing homes.

Independent samples t-tests using the Satterthwaite method were conducted to test whether the mean infection rates and deaths are significantly different between the two settings. Traditional nursing homes' resident COVID-19 infection rates ($M$ = 183, $SD$ = 390) compared to Green House homes' ($M$ = 58.35, $SD$ = 97.11) are significantly higher, $t(42)$ = 7.95, $p$ <.0001.  Traditional nursing homes' resident COVID-19 death rates ($M$ = 45.78, $SD$ = 131.8) compared to Green House homes' ($M$ = 10.45, $SD$ = 28.59) are also significantly higher, $t(44)$ = 7.60, $p$ <.0001.  There are no significant differences for numbers of staff infections, $t(39)$ = .50, $p$ =.62 between traditional nursing homes ($M$ = 11.07, $SD$ = 15.35) and Green House homes ($M$ = 10.03, $SD$ = 13.16).  There are also no significant differences for number of staff deaths, $t(39)$ = 1.21, $p$ =.23 between traditional nursing homes ($M$ = .06, $SD$ = .33) and Green House homes ($M$ = .03, $SD$ =.16).