JOURNAL OF HEALTH CARE FINANCE

Fall 2021

# Nursing Homes Located in Socially Deprived Communities Have Been Disproportionately Affected by COVID-19

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**Abstract**

Health inequities vary along social and economic gradients. The COVID-19 pandemic and nursing home infections have highlighted this fact. Using the Centers for Medicare and Medicaid Services Nursing Home COVID-19 Public File, Brown University's LTCFocus, Robert Graham Center's Social Deprivation Index, and CMS Nursing Home Payroll-Based Journal Staffing Data. We examined the relationship between community resource scarcity, as conceptualized by the Social Deprivation Index (SD), and COVID-19 incidence rates in nursing homes. After controlling for interstate differences, organizational enabling factors, as well as, facility-level resident and community-level characteristics, nursing homes located in communities with medium levels of social deprivation had 4.4% more COVID-19 infection rates (Incidence Rate Ratio [IRR] = 1.04; $p < 0.05$) and communities with high levels of social deprivation had 7.5% higher COVID-19 infection rates (Incidence Rate Ratio [IRR] = 1.07; $p < 0.01$) as compared to nursing facilities located in areas of low social deprivation. From a policy perspective, nursing homes, that are located in socially deprived communities, may need additional resources, such as funding for staffing and personal protective equipment in the face of the pandemic. The COVID-19 pandemic has sharpened the focus on healthcare disparities and societal inequalities in the delivery of long-term care.

## Introduction

Since the early part of 2020, the world has been battling the COVID-19 pandemic. The congregate nature of nursing homes and the average acuity of residents have placed nursing homes at higher risk of COVID-19.[1] At the beginning of the pandemic, nursing homes were some of the hardest-hit healthcare organizations, with more than 30% of COVID-19 deaths attributed to nursing home residents.[2] The COVID-19 pandemic highlighted existing systemic racial/ethnic disparities and other failures in the nursing home industry.[3, 4] As research on COVID-19 has evolved, so have calls for the inclusion of socioeconomic status (SES) as it relates to the exploration of COVID-19 disparities.[5] The inclusion of socio-economic factors can provide context to health disparities research, given that health inequities vary along social and economic gradients.[6, 7] Worse health has been attributed to lower socio-economic position, due to a myriad of complex and interacting factors, such as less adequate housing, food deserts, lower levels of educational and economic opportunity, and greater environmental risk.[8] A community's level of resources can impact the quality and financial performance of healthcare organizations.[9] As such, there is a need to better understand how a community's level of resources, or lack thereof, impacted the incidence rates of COVID-19 in nursing homes.

As the pandemic continues to evolve, so does the existing field of research. This paper explores the relationship between community resource scarcity and COVID-19 incidence rates in nursing homes. We utilized the Social Deprivation Index (SDI), a composite measure of census-track socio-economic factors, to assess resource scarcity in the community.[10] Our paper contributes several unique factors to the ever-growing field of COVID-19 literature. First, it uses the national Centers for Medicare and Medicaid Services (CMS)' COVID-19 Public File through July 11, 2021, to explore COVID-19 incidence rates in nursing homes. Second, we explore how resource availability at the community and organizational level may affect nursing home COVID-19 incidence rates. This analysis will provide further insights into the community and organizational factors associated with nursing homes that have been hit the hardest by COVID-19. Given the evolving nature of this pandemic, our findings may assist managers and policymakers have a better understanding of the factors that place residents at greater risk of COVID-19.

## Conceptual Framework

The conceptual framework draws from tenets of the Resource Dependence Theory (RDT) and the Behavioral Model. According to RDT, the key to organizational performance is "the ability to acquire and maintain resources."[11] RDT suggests that organizations engage in exchange relationships with their environment, to acquire resources in order to function. With RDT, it is the environment that provides "critical" resources needed by the organization.[12] RDT suggests that variations in the availability of resources may explain differences in organizational performance.[13] Organizations actively try to obtain critical resources from the environment, which are critical to their ability to successfully function and carry out their functions. Therefore, a nursing home's failure to prevent COVID-19 may result from the lack of necessary resources from the environment.

Similarly, the Behavioral Model by Andersen[14] conceptualizes the availability of resources as an important component of health care utilization and outcomes. In the Andersen model,

predisposing (characteristics of the individual, i.e., age, gender, race/ethnicity), enabling (system or structural factors affecting availability of health service resources to the individual), and need (clinical) factors are posited to act independently or together to influence patterns of healthcare utilization and outcomes.[15] As such, the Behavioral Model uses a system perspective that accounts for individual, community, and provider factors associated with the use of health care services and outcomes.[16] In this study, we focus on the role of community and organizational enabling resources, while controlling for nursing home residents' predisposing and need factors.

Nursing homes that are in socio-economically disadvantaged communities often will have a greater proportion of racial/ethnic minorities. This is likely a result of the historical housing segregation patterns and uneven distribution of resources because of institutional racism in the U.S. This can affect the resource availability of the nursing home. For example, nursing homes in more socio-economically disadvantaged communities may have more difficulties in attracting higher-quality staff and management, as well as attracting non-patient revenues from endowments and gifts. As such, this may affect the delivery of nursing home care and ultimately contribute to disparities in care.

As previously noted, in this study we measure community-level resources using the SDI, a composite measure of socio-economic factors. This composite measure of social deprivation has been found to be a significant improvement in examining community-level poverty, due to its multidimensional aspect.[10] SDI provides further insight as it relates to the communities' level of resources or munificence, and how that may ultimately impact residents' health, such as COVID-19 incidence rates. Thus, we hypothesize that:

***Hypothesis 1:*** *Nursing homes located in communities with greater social deprivation will experience higher COVID-19 incidence rates*

## Methods

### Data

Our study utilized four secondary data sets: CMS Nursing Home COVID-19 Public File, Brown University's LTCFocus, Robert Graham Center's Social Deprivation Index, and CMS Nursing Home Payroll-Based Journal (PBJ) Daily Nurse Staffing. The CMS Nursing Home COVID-19 Public File includes data from the CDC's National Healthcare Safety Network. This is the first national data set to report cumulative COVID-19 related data retrospectively back to January 1, 2020. LTCFocus data provides nursing home organizational, demographic, quality, and market information. The Robert Graham Center contains data on the Social Deprivation Index, calculated based on socio-economic and demographic characteristics of communities. CMS Nursing Home PBJ data collects payroll and other auditable direct care staffing information. The data, when combined with resident census information, is used to report on the level of staff in each nursing home.

## Sample

The study sample consisted of all U.S. nursing homes included in the CMS Nursing Home COVID-19 Public File, or 15,382 nursing homes, which mirrors the national census of facilities. After merging with the various secondary datasets, we had 13,772 nursing homes in our final analytic sample.

## Variables

### Dependent Variable: COVID-19 Incidence Rate

The dependent variable was comprised of COVID-19 infections per nursing home facility. We calculated this as the number of reported COVID-19 related infections from January 1, 2020 to July 11, 2021.

### Independent Variable: Social Deprivation Index

The main independent categorical variable represented the Social Deprivation Index of the community. Social Deprivation Index is a composite measure of socio-economic factors, that includes items, such as percent living in poverty, less than 12 years of schooling, crowding, no car, non-employed, renter-occupied, and single-parent households at the zip code level.[10] To explore the potential non-linear effect of this variable, we classified the community s SDI into three groups based on tertiles: low social deprivation (0 – 33%); medium social deprivation (34-66%), and high social deprivation (67% to 100%). The reference group was communities with a low SDI.

### Control Variables

Based on the Behavioral Model, we included organizational enabling factors (resource availability) that may affect resident health outcomes, especially related to COVID-19 infection. The lack of organizational resources may have resulted in less than adequate COVID-19 prevention and mitigation strategies, which may have resulted in higher incidence rates. Organizational enabling factors included payer-mix (percent of Medicare and Medicaid); total bed size, occupancy rate; for-profit status (ownership), chain affiliation, and RN, LPN, and CNA total hours. *Payer mix* identifies the proportion of the facilities residents who are on Medicaid and Medicare. Compared to private pay and Medicare, Medicaid has a lower reimbursement for nursing home care. The lower level of financial resources will affect operations, as nursing home administrators will be forced to make trade-off decisions due to limited resources. Such decisions may include having lower levels of RN staffing and instead, hiring other nurses who may be less experienced, educated, and expensive. Other organizational factors, such as occupancy rate, for-profit status, chain affiliation, and staffing patterns can also affect resource availability, and ultimately affect disparities in care. *Size* captures the total number of beds within the nursing home *Occupancy rate* is the percentage of occupied nursing home beds. As the occupancy rate decreases, nursing homes will have less revenue, which ultimately can impact the ability of the nursing home to provide quality care; however, in the case of COVID-19, with greater occupancy, there may be greater crowding and increased transmission of this respiratory virus. *Ownership* is a dichotomous variable that identifies whether a nursing home is for-profit (0 = not-for-profit; 1=

for-profit). *Chain affiliation* reflects whether the nursing home is part of a chain (0 = free-standing; 1= chain affiliated). *Total RN, LPN, and CNA Hours* reflected the total number of RN, LPN, and CNA hours within nursing homes using auditable Payroll-Based Journal data.

Aligned with the predisposing and need factors from the Behavioral Model, control variables consisted of facility-level resident and community characteristics that may increase the risk of COVID-19 mortality: percent of minorities, percent of females, percent of residents 65 years and older, average resident acuity, and COVID-19 cases in the county. *Percent of minorities* is the percent of all the nursing home residents who are racial/ethnic minorities. *Percent of females* is the percent of all nursing home residents who were female. *Percent of individuals 65 and older* is the proportion of all residents who are 65 and older to the total nursing home population. *Acuity Index* is an average measure of the resident's level of care needed. This measure is based on the number of residents needing various levels of assistance with mobility, activities of daily living (ADL), special treatments, as well as, the proportion of residents that are bedfast, exhibit dementia, and who require assistance with ambulation or transfers. The main community predisposing factor was the total number of COVID-19 cases in the county or *Total Number of County COVID Cases.*

Analysis

Bivariate statistics were conducted to examine nursing homes' characteristics as they related to Social Deprivation Index groups (low, medium, and high). Multivariate regression was used to model the relationship between nursing home resident COVID-19 infections and the independent variables. Given the overdispersion of the count dependent variable (number of COVID-19 infections), negative binomial regressions were used. The negative binomial coefficients are reported in the incident rate ratio (IRR) form. The relationship between the *COVID-19 Incidence Rate* and the *Social Deprivation Index* were analyzed, as well as, organizational enabling factors, and facility-level resident and community-level characteristics. In addition, we controlled for interstate differences using state-fixed effects.

## Results

As of July 11, 2021, nursing homes located in areas of high social deprivation had COVID-19 incidence rates of 53% as compared to areas of low social deprivation that were at 49%. The bivariate analysis (**Table 1**) shows that nursing homes located in areas of high social deprivation had more beds and a higher Medicaid payer-mix, fewer females, and residents with a higher acuity index as compared to the communities that had medium and low amounts of social deprivation. Eighty-one percent of the nursing homes in high areas of social deprivation were for-profit, as compared to 74% in low areas of social deprivation. One of the most telling factors, was the percent of minorities, as nursing homes located in areas of low social deprivation only had 17%, while communities with high levels of social deprivation had a minority resident mix of 37%. Nursing homes in high areas of social deprivation had fewer total RN hours and more LPN and CNA total hours.

**Table 1. Bivariate Statistics of the Relationship between Study Variables and Nursing Home Racial/Ethnic Mix (N= 13,772)**

| Variables | Low Social Deprivation Index (1-33%) Mean (SD) | Medium Social Deprivation Index (34-66%) Mean (SD) | High Social Deprivation Index (67-100%) Mean (SD) | p-value |
|---|---|---|---|---|
| COVID-19 Incidence Rate | 49.2 (0.73) | 48.2 (0.60) | 53.58 (0.62) | 0.001 |
| **Organizational Enabling Factors** | | | | |
| | | | | |
| Medicaid Share (%) | 55.7 (0.42) | 62.2 (0.35) | 66.1 (0.35) | 0.001 |
| Medicare Share (%) | 15.2 (0.24) | 14.0 (0.21) | 13.3 (0.19) | 0.001 |
| Total Beds (%) | 118.9 (1.16) | 113.7 (0.94) | 126.15 (1.11) | 0.001 |
| Occupancy Rate (%) | 81.1 (0.24) | 79.4 (0.25) | 81.2 (0.23) | 0.001 |
| Ownership (For-profit) | 74% (0.01) | 77% (0.01) | 81% (0.01) | 0.001 |
| Chain Affiliated | 65% (0.01) | 68% (0.01) | 61% (0.01) | 0.001 |
| Total RN Hours | 41.5 (0.62) | 33.5 (0.55) | 33.9 (0.56) | 0.001 |
| Total LPN Hours | 68.1 (0.82) | 64.5 (0.69) | 77.0 (0.80) | 0.001 |
| Total CNA Hours | 167.7 (1.91) | 157.3 (1.73) | 180.0 (1.95) | 0.001 |
| **Resident-Level and Community-Level Predisposing and Need Factors** | | | | |
| Resident Minorities (%) | 17.2 (0.32) | 18.8 (0.34) | 36.7 (0.43) | 0.001 |
| Female Residents (%) | 58.4 (0.15) | 57.5 (0.15) | 54.1 (0.17) | 0.001 |
| Residents 65+ (%) | 16.2 (0.23) | 19.3 (0.22) | 24.2 (0.27) | 0.001 |
| Resident Acuity Index | 12.2 (0.02) | 12.2 (0.02) | 12.4 (0.03) | 0.001 |
| Total Number of County-Level COVID-19 Cases | 76,995 (2,524) | 68,358 (3,015) | 148,035 (4,803) | 0.001 |

SOURCE: Author's own analysis of study datasets.
NOTES: For continuous variables, t-tests were utilized. For categorical variables, chi-squares were utilized.

Negative binomial regression results with Incidence Rate Ratios (IRR) are presented in **Table 2**. Compared to nursing homes in communities with low social deprivation, those located in medium and high social deprivation, experienced a 4% ($p < 0.05$) and 7% ($p < 0.01$) higher infection rate of COVID-19, respectively. Total nursing home size ($p < 0.001$), occupancy ($p < 0.01$), and Medicaid payer-mix ($p < 0.05$) were positively associated with COVID-19 incidence rates. Nursing homes that were chain-affiliated had 6% higher rate of COVID-19 infection rates ($p < 0.01$), and for those that were for-profit the COVID-19 incidence rate jumped to 16.7% ($p < 0.001$). Total RN hours ($p < 0.05$) and total CNA hours ($p < 0.001$) were negatively associated with COVID-19 infection rates, as well as residents over the age of 65 ($p < 0.001$) and percent of minorities ($p < 0.001$).

**Table 2. Negative Binomial Regression Results for Incidence Rate Ratios (IRR) of COVID-19 Infection Rates in Nursing Homes (N= 13,772)**

| COVID-19 Resident Incidence Rate Ratios | IRR | | 95% CI | p-value |
|---|---|---|---|---|
| Social Deprivation Index<br>0-33% | reference | | | |
| 34-66% | 1.04 | * | 1.00 - 1.09 | 0.048 |
| 67-100% | 1.07 | ** | 1.03 - 1.13 | 0.002 |
| **Organizational Enabling Factors** | | | | |
| Medicaid Share (%) | 1.01 | ** | 1.00 – 1.01 | 0.011 |
| Medicare Share (%) | 0.99 | | 0.99 – 1.01 | 0.346 |
| Total Beds (%) | 1.00 | *** | 1.00 – 1.01 | 0.001 |
| Occupancy Rate (%) | 1.01 | * | 1.00 – 1.01 | 0.002 |
| Ownership (For-profit) | 1.17 | *** | 1.12 – 1.22 | 0.001 |
| Chain Affiliated | 1.06 | ** | 1.02 – 1.10 | 0.002 |
| Total RN Hours | 0.99 | * | 0.99 – 1.00 | 0.011 |
| Total LPN Hours | 1.00 | | 0.99 – 1.01 | 0.451 |
| Total CNA Hours | 0.99 | *** | 0.99 – 1.00 | 0.001 |
| **Resident-Level and Community-Level Predisposing and Need Factors** | | | | |
| Female Residents (%) | 0.99 | | 0.99 – 1.01 | 0.367 |
| Residents 65+ (%) | 0.99 | *** | 0.99 – 1.00 | 0.001 |
| Resident Acuity Index | 0.99 | | 0.98 – 1.00 | 0.439 |
| Resident Minorities (%) | 0.99 | *** | 0.99 – 1.00 | 0.001 |
| Total Number of County-Level COVID-19 Cases | 1.00 | | 1.00 – 1.01 | 0.961 |

SOURCE: Author's own analysis of study datasets.
NOTES *$p$<0.05, **$p$ <0.01, ***$p$ <0.001.
NOTES: Controlled for interstate differences by using state fixed effects

## Discussion

Our study found that nursing homes located in communities with greater social deprivation had higher COVID-19 incidence rates, even after controlling for organizational-level resources. The lack of available resources in the community translated into worse resident outcomes. Communities that experience social deprivation, often lack critical resources, and these findings belie an ugly but prominent truth, that the existing systemic disparities have real negative impacts on health outcomes.[17] Our findings are consistent with studies on the hospital sector, that have shown that hospitals located in areas with higher social deprivation experience worse healthcare-associated infection rates.[18, 19]

There are several potential mechanisms by which community social deprivation may affect COVID-19 incidence rates in nursing homes, and more broadly quality of care. Nursing homes in more socio-economically disadvantaged communities may have more difficulties in recruiting and retaining top-notch and more highly educated management. Previous research has shown that nursing home administrator's educational level is associated with better quality.[20]

Similarly, nursing homes in more socially deprived areas may have more difficulty in recruiting and retaining higher-quality nurse staffing. Given nursing staff shortages, these facilities may have particular difficulty in recruiting and retaining RNs. This may have been particularly acute during the COVID-19 pandemic.[21] This may be reflected in part in the observed significantly lower RN hours in nursing homes with greater social deprivation. Furthermore, nursing homes in socially deprived areas may have a greater reliance on part-time and contract nurse staffing, and these nurses are more likely to work at multiple facilities. A study by Chen and colleagues[22] showed that 49% of nursing home COVID-19 cases were attributed to cross-facility staff movement. Nurses and staff that traveled from one facility to another may have unwittingly transferred the virus.

Finally, facilities in socially deprived areas may have more difficulty in attracting non-patient revenues from endowments and gifts. As such, this may affect the delivery of nursing home care and ultimately contribute to disparities in care. For example, our results show that nursing homes in socially deprived areas are more likely to be for-profit, which are less likely to benefit from endowments and gifts. Non-patient revenues can be a source of slack resources that can serve as a buffer during periods of crisis, such as COVID-19.

We found that communities with higher levels of social deprivation were characterized by a greater proportion of racial/ethnic minorities. As such, our findings align with prior research suggesting that the nursing home industry operates as a two-tier system based on socio-economic status and race/ethnicity.[23, 24] Minority populations, such as Blacks and Hispanics, tend to have fewer alternatives for high-quality nursing home care relative to Whites.[25] Nursing home care is often geographically constrained to a certain community.[26] The delivery of high-quality nursing home care is not equitable. Nursing homes remain relatively segregated, roughly mirroring the residential segregation within a community.[24]

Nursing homes that were for-profit had significantly higher rates of COVID-19 infection rates. This may allude to the priorities set by the organization. For-profit organizations try to maximize shareholder profitability. The extant literature has shown that organizational and ownership characteristics of a nursing home can have an impact on performance.[9, 27] For example, for-profit nursing homes have experienced higher COVID-19 mortality.[4, 28] Perhaps, since the primary motive of for-profit nursing homes is profit maximization, this may have come at the cost of being under-prepared for the COVID-19 pandemic. Additionally, chain-affiliated nursing homes had higher rates of COVID-19 infection. The practice of cross-facility staff sharing may have been more prevalent in chain-affiliated nursing homes, which may have contributed to higher COVID-19 incidence rates.

Larger nursing homes and organizations with higher occupancy experienced higher COVID-19 infection rates. This may be attributable to the congregate nature of these facilities. Nursing homes with more beds and more residents may be less likely to be able to socially distance and have greater opportunities for cross-infection among the residents and staff.[29]

Nursing homes with higher Medicaid payer-mix had higher levels of COVID-19 infection rates. Medicaid has lower payments as compared to Medicare or private payers, thus having a higher Medicaid census may put additional financial pressures on the nursing homes. Poorly resourced nursing homes were more likely to report nurse staffing shortages and may be more susceptible to the spread of COVID-19.[30, 31]

Nursing homes that reported higher RN and CNA total hours reported less COVID-19 infection rates. More RN and CNA hours may have been able to help reduce and control infection, as more nurse hours may have meant that there were more opportunities to provide assistance in the form of educational, safety guidelines, and prevention measures. The scope of this pandemic is something that most health care facilities were not adequately prepared for. The fact that greater nursing hours resulted in reduced infection rates, speaks to the importance of appropriate staffing levels. As previously noted, nursing homes in socially deprived areas may have a greater shortage of nurse staff, and therefore may need additional resources to have appropriate levels of nursing care.

Beyond these measures, nursing homes may also need to train staff on how to communicate with residents (and each other) effectively and affectively, as to facilitate more productive communication but to also ease tensions and uncertainty, especially among residents with cognitive impairments and/or dementia. Furthermore, nursing homes have to educate and train their staff on the importance of personal protective equipment, active screening, social distancing, and how to effectively identify and treat residents who have been exposed.[32] There is a need to provide information to the residents and staff about COVID-19, along with the warning signs, and provide active screenings. From a process standpoint, this includes wearing gowns, gloves, facemask, and eye protection; however, this may be challenging in nursing homes where there are limited resources. Policymakers may need to intervene to ensure proper protection equipment is available for all nursing home facilities. Nursing homes must reinforce adherence to infection prevention and control measures, including hand hygiene and selection and use of personal protective equipment.[33] Healthcare leaders must use this crisis as an opportunity to learn and grow in order to be better prepared for the future.

As such, federal and state-level policymakers should provide additional resources to these vulnerable nursing homes to help offset the cost of quality measures that will help reduce the risk of viral transmission. Such strategies could include disproportionate payments as in the case of hospitals. The allocation of financial resources to these nursing homes may be one way to provide these organizations with the additional support that they need.

There are some limitations in this study that should be noted. First, the CMS Nursing Home COVID-19 Public File is a dataset that is revised weekly, and our data was as of July 11, 2021. Due to the rapidly changing nature of this pandemic, the data may not reflect the current environment. Second, we were limited by the availability of data especially as it related to resident

level. Some factors, such as vaccination rates or vaccine hesitancy were not readily available for this study, and such factors may have an impact on COVID-19 incidence rates.

Despite these limitations, this study sheds light on the systemic disparities found in lower-resourced communities. These findings underscore prior research showing that the nursing home industry operates on a two-tier system based on socio-economic status. Policy interventions are needed to address some of the resource allocation and systemic inequality at the core of these disparities. COVID-19 has sharpened the focus on structural and societal inequalities that have long existed.

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