

# JOURNAL OF INFORMATION SYSTEMS APPLIED RESEARCH

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# JOURNAL OF INFORMATION SYSTEMS APPLIED RESEARCH

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# Short Stay Healthcare Quality in Skilled Nursing Facilities: Occupancy, Nurse Staff Mix, and COVID-19

Elaine Winston  
Elaine.r.winston@hofstra.edu  
Hofstra University  
Hampstead, NY

Jason Xiong  
xiongjj@appstate.edu

Dawn Medlin  
medlinbd@appstate.edu

Appalachian State University  
Boone, NC

Alex Pelaez  
Alexander.Pelaez@hofstra.edu  
Hofstra University  
Hampstead, NY

## Abstract

Recently, there has been a shift in the Skilled Nursing Facility (SNF) industry to provide short stay health care services, rather than long-term care. The shift to short-term care and the availability of government public domain databases of quality measures have become focal points of healthcare discussions during the COVID-19 pandemic. This study explores COVID-19 pandemic outcomes by analyzing government short-stay quality metrics, occupancy rates, and nurse staff mix levels in SNFs. A statistical analysis provides results as predictive factors of short-term quality. These factors are used to explore COVID-19 outcomes. The study indicates that a higher number of Certified Nursing Assistants (CNAs) and Licensed Practical Nurses (LPNs) in relation to the number of Registered Nurses (RNs) suggests better COVID-19 healthcare outcomes. A higher occupancy rate also suggests better COVID-19 outcomes. Additionally, nurse staff who understand Information and Communication Technologies (ICTs) may help improve short-stay quality healthcare outcomes by providing critical information to healthcare administrators and governmental policymakers.

**Keywords:** COVID-19, Skilled Nursing Facilities, Nurse Staff Mix, Short Stay Quality Measures.

## 1. INTRODUCTION

The skilled nursing facility (SNF) provides both

long-term care and short-term care (i.e., stroke and surgery rehabilitation) and has become a focal point for discussions concerning government

quality standards. An SNF can provide a long-term residence for people who require continual nursing care and have significant difficulty coping with activities of daily living (ADL). Residents may include the elderly as well as younger adults with physical or mental disabilities. Additionally, SNFs can provide short-term post-acute care (PAC) for multi-faceted medical conditions.

The SNF industry is composed of 67% privately owned, 7% government-managed, and 24% non-profit organizations (Centers for Medicare & Medicaid Services, 2020). Although privately-owned organizations dominate the industry, the government controls the reimbursement of services based on government-determined quality metrics.

The number of residents in SNFs for long-term care has been declining in the last several years, with the percentage of people 65 years and older in nursing facilities decreasing by 24.5% between 2004 and 2010 (Laes-Kushner, 2018). Some suggest that the decline in occupancy is due to the low-quality of care received by patients at SNFs (Winston et al., 2019; Winston et al., 2021). Current studies indicate that occupancy rates are lower than pre-pandemic rates and that there are many empty beds (Kauffman, 2020). An essential problem of low occupancy rates is that it reduces the revenue that an SNF receives.

Recently, there has been a growing shift in SNFs to provide short-term care rather than long-term care. The increasing need for SNFs to achieve high-level short-stay quality measures (SSQM) relies on a network that is comprised of SNFs, hospitals, and community services. Further, government policies have been shown to impact the quality provided at SNFs through incentives. For example, The Improving Medicare Post-Acute Care Transformation (IMPACT) Act, is a result of the increase in the number of patients transferred from an acute hospital to SNF care. This transformation depends on information communication technology (ICT). SNFs rely on data-driven healthcare services.

First, literature on the SNF industry transformation from providing activities of daily living (ADL) care to rehabilitative post-acute care (PAC) is presented. This includes government technologies and policies that directly affect the quality of healthcare services. Occupancy rate and nurse staff mix (i.e., certified nurse assistants, licensed practitioner nurses, and registered nurses) are reviewed in the context of short-stay healthcare quality. Information on COVID-19 in SNFs is presented. A statistical analysis is then conducted to identify any

relationship among occupancy rate, nurse staff mix, and SSQM. Results are presented. Results, which are based on the pre-pandemic data, the control, are used to explore COVID-19 outcomes at SNF during the first year of the pandemic. Conclusions and potential future research are presented.

## 2. LITERATURE REVIEW

Public domain healthcare databases provide online data and reports of quality. This is particularly important for the highly competitive SNF industry.

### Information Communication Technology

Information Communication Technology (ICT) (i.e., public domain and open-source health care databases) provide information on a myriad of factors indicating the quality of health care in organizations. These technologies incorporate methodologies for collecting and scrubbing data of personal characteristics. Concepts such as collection bias, data integrity, and accuracy help identify deviations from government standards. Currently, registered nurse (RN) staff in SNFs must have an understanding and knowledge of ICTs to enable government-required real-time reporting of occupancy levels, nurse staff hours per resident, and health progress.

Healthcare administrators who understand database and reporting technologies may analyze data to obtain high reimbursement rates by meeting the government-established metrics for quality, such as the SSQM. The Centers for Medicare and Medicaid Service's public domain provides readily accessible resources that serve as objective evidence of healthcare organization performance. Additionally, the government pays for superior performance through SNFs with exceptional outcomes.

The capability to find and compare SNFs within a community is aided by an official website of the government which provides five-star quality ratings on over 15,000 SNFs in the United States (Medicare, n.d.). Hospitals and communities use the digitized 5-star quality ratings to filter the SNF industry's overall assessment of quality.

### Occupancy

Low occupancy has a negative economic impact on SNFs that operate on low profit margins. Research indicates that the financial performance of an SNF can affect the quality of healthcare services (Weech-Maldonado et al., 2019). There has been a growing shift in SNFs to provide short-term care rather than long-term care. Medicare

reimburses only rehabilitative short-term care and at higher rates than Medicaid, which only reimburses for long-term care. The use of incentives to help direct healthcare service and effectiveness has been used in rural, impoverished areas, as well as, outside the United States (Baumann et al., 2021). SNFs that can provide post-acute care services have an economic advantage in the long-term healthcare industry.

SNF and acute care hospitals have become critical partners. Most recently, twenty percent of all hospitalized Medicare beneficiaries were discharged to an SNF for PAC (Hakkarainen et al., 2016; Yurkofsky et al., 2020). The significant increase in PAC services at the SNF requires attention to government policy that has a direct impact on short stay quality.

In October 2019, the Centers for Medicare and Medicaid Services (CMS) changed its pay-for-service (PPS) reimbursement rate methodology from resource utilization group (RUG) IV to a patient-driven payment model (PDPM). RUGs provided revenue primarily based on length of stay. The PDPM funds more complex nursing care and is focused on the type of rehabilitative services the patient requires (Harrington et al., 2020). This change to payment reimbursement led to a shift of high acuity (i.e., nurse intensive) attention patients from hospital to SNF. The hospital reduces the length of stay of patients (reduced length of stay is incentivized) while the SNF increases PAC services.

The change to PAC from long-term care has revenue and cost implications for the SNFs. Patients with complicated short-term medical needs (e.g., hip surgery and stroke) have higher reimbursement rates than long-term residents who require ADL (Li, 2020). However, the additional revenue of short-term care patients often does not cover the costs that are increased due to the requirements of care (Grabowski et al., 2012), such as nursing staff trained to provide complex healthcare services. Further, rehabilitative (short-term) patients result in greater turnover at SNFs. This results in a lower occupancy rate that eventually reduces revenue.

In addition, there is a growing disparity between quality metrics and healthcare because of the increasing number of new PAC patients being transferred from hospitals to SNFs, according to an Assistant Director of Nursing in a large metropolitan SNF. A new PAC patient describes a patient who is discharged to an SNF the day after an acute care procedure. These patients have a

distinct set of concerns that differ from those patients who are discharged after a 3-day hospital stay.

The government provides a monetary incentive to hospitals for the transfer of fresh PAC patients to an SNF through two programs: 1) Bundled Payment - hospitals can apply for a waiver that will address a 3-day hospital stay required for SNF services post-discharge, and 2) Comprehensive Care for Joint Replacement that allows hospitals to use a 3-day stay waiver.

Other studies explored the risk of hospital readmission within 30 days of SNF admission and found a significant correlation with SNF quality ratings (Rahman, 2016), hours of physical therapy (Jung et al., 2016), days at the skilled nursing facility (Hansen et al., 2011), and a mismatch between patient needs and the services provided by SNFs (Stone et al., 2010; Hansen, et al., 2011).

The Hospital Readmissions Reduction Program reduces payments to hospitals with excess readmissions. Residents who return to a hospital following acute care are often placed under observation (OS) rather than readmitted. In 2015, 2.1 million people were in hospitals under OS status (Bunis 2015). The status of OS does not meet Medicare's criteria for further reimbursement at an SNF. Therefore, only a small percentage of residents after observation can go back to the SNF. From a data-specific view, these residents cannot be considered as discharged back to the community from their short stay at the SNF, which is rewarded.

Before COVID-19, the SNF industry reported that 48.57 % of patients returned from an SNF to the community (Saliba et al., 2018). This means that less than half of the residents who use an SNF for short-term rehabilitation made it home. This low rate of return necessitates more study on the disparity between actual short-term health care residents receive at SNFs and the SSQM.

#### **Nurse Staff Mix**

In this study, nurse staff mix refers to the combination of three key categories of nursing personnel used in the SNF: registered nurses (RNs), licensed practical nurses (LPNs), and certified nursing assistants (CNAs). There is a positive relationship between the number of nursing staff who provide long-term ADL care to residents and the quality of care (Harrington, et al., 2020a), and higher levels of RN staffing led to better resident long-term outcomes (i.e., fewer pressure ulcers); improved ADL and lower

mortality rates (Backhaus et al., 2014).

Government staffing metrics require that SNFs have enough RNs, LPNs, and CNAs to provide adequate nursing care for long-term care activities. The LPN performs nursing tasks related to ADL. LPNs are limited in the tasks they may perform for PAC patients (e.g., supervising the distribution of prescriptions and wound bandage maintenance). CNAs help with ADL activities. These assistants are trained to help the residents eat, stay clean and move, as required in the resident care reports. CNAs are not trained to perform any medical service.

“The government overall staff quality rating requires SNFs to have only one RN for at least 8 consecutive hours a day, 7 days a week, and a second designated RN to serve as the director of nursing on a full-time basis (except for low occupancy and/or small SNF)” (Public Health, 2022).

Only the RN is licensed to perform a diagnostic evaluation. This means as patients arrive at the SNF the RN with a medical advisory team (from the hospital) determines the level of PAC.

Inadequate staffing levels have significant consequences. Lower staff levels in facilities before the pandemic made these SNFs more vulnerable to the coronavirus, resulting in more than 28,000 U.S. nursing home residents and worker deaths reported at the end of May 2020 (Yourish et al., 2020; Mathews et al., 2020).

### COVID-19 in SNFs

COVID-19 deaths in nursing homes assisted living and other long-term care facilities made up over a third of all U.S. deaths in 2020, based on the COVID Tracking Project (CTP) data, which includes (The COVID-Tracking Project, 2021). Yet, studies found no association between COVID-19 death rates and the SNF overall five-star quality rating or infection control deficiencies (Figueroa et al., 2020; He et al., 2020). A positive association was reported between COVID-19 deaths and low nurse staff ratings (Harrington et al., 2020b), for-profit ownership (Harrington et al., 2020b), and a high percentage of minority residents (Chidambaram et al., 2020).

Research indicates that adequate sick pay, minimal use of outside agency staff, increased staff-to-bed ratio, and staff cohorts (Shallcross et al., 2021) reduce the transmission of COVID-19 among nurses. The combination of high occupancy rates and low staffing levels was

associated with increased risks of infection (Ochieng et al., 2021). Nurse staff levels are a critical aspect of COVID-19 care (Desroches et al., 2021). The number of new admissions to the facility and poor compliance with isolation procedures resulted in high viral loads and transmission rates (Gibson et al., 2020; Abrams et al., 2020).

Data indicates that SNFs do not have the healthcare professionals or the capabilities (i.e., PPE and technology) to manage COVID-19. The COVID-19 death rate in SNFs increased from 0.48 to 1.88, per 100 residents and new COVID-19 cases increased from 2.6 to 10.8, per 100 from the second to the fourth quarter of 2020 (Paulin, 2021). The increase in infection rates is instead of policies that after first requiring SNFs to admit COVID-19 patients (Khim, 2020a) then prohibited SNFs from accepting residents diagnosed with COVID-19 (Khim, 2020b).

The research questions for the following study are:

- 1: Is there an association between occupancy rate and short stay quality measures (SSQM)?
- 2: Is there an association between nurse staff mix, which is the ratio (CNA + LPN) / RN hours per resident per day, and short stay quality measures (SSQM)?
- 3: Do predictions of SSQM also predict COVID-19 healthcare outcomes?

### 3. RESEARCH METHODOLOGY

The study uses ordinal logistic regression to investigate factors of short-term healthcare quality related to occupancy rates and the nurse staff mix. In this study, the goal is to understand factors of occupancy and nurse staff mix that suggest a likelihood of an increase or decrease in healthcare quality at the SNF. The dependent variable is the government-determined short-stay quality measure (SSQM). See Appendix A for the list of measures the government uses to calculate the short-stay quality measure. The government derives and reports a five-star SSQM rating based on these measures.

The predictor variables are 1) occupancy rate and 2) (CNA + LPN)/RN hours per resident per day. These factors are not part of the calculation of SSQM.

Ordinal logistic regression was used in both industry and state-level:

*Regression Equation: SSQM = occupancy rate + (CNA & LPN)/RN hours per resident per day*

The dataset used in this study was submitted by SNFs and reported by the Center for Medicare and Medicaid Services (CMS) as of March 1, 2020. The dataset includes approximately 15,000 SNFs. Note, 13,001 SNFs observations, certified by CMS, were used in this study. SNFs that had unreported data for any study variable were removed from the dataset.

The data variables used in this study are the number of certified beds, the average number of residents per day, reported CNA, LPN, and RN hours per resident per day, and SSQM.

### Factors of PAC

Occupancy rate is used as a predictor factor in the ordinal logistic regression of SSQM. In this study, the occupancy rate is based on two variables of data collected. 1) The average number of residents per day and 2) the number of certified beds. Certified beds in an SNF are validated by government inspection. The occupancy rate is calculated by taking the average number of residents per day in a facility divided by the number of certified beds at the facility. The average number of residents per day was calculated from the SNF record of residents in bed count on every nursing shift and reported daily.

*Occupancy rate = Number of resident days/Number of available bed days.*

The occupancy rate considers daily bed use that fluctuates. Therefore, it reflects the SNF's use of physical resources.

A second predictor factor for SSQM is nurse staff mix. The nurse staff mix separates nursing assistants and practitioners from the registered nurse, who administers medical care. CNA, LPN, and RN hours per resident per day were used to predict SSQM. Note, the factor nurse staff mix is a ratio of nurse staff hours. (Importantly, the nurse staff mix is not a single nurse category, and the ratio requires a calculation of three nurse categories). The nurse staff mix used as a predictor of SSQM is shown below as a ratio:

*(CNA + LPN) reported hours per resident per day / RN reported hours per resident per day*

The CNA and the LPN reported hours per resident per day are combined so that the impact of the RN level of resident care is isolated. Nurse staff mix assesses the levels of different types of

nurses by the SNF, which is based on government recommendations.

The short-stay quality metric (SSQM) is the dependent variable and is used as a surrogate measure of SNF short-stay post-acute healthcare quality. The SSQM ranges from poor to excellent quality. This SSQM (see Appendix A) does not include the number of certified beds, the average number of residents per day, and staff hours resident per day (i.e., RN, LPN, or CNA). A focus of the quality metric is on the discharge of residents to the community as well as readmission to a hospital. The use of SNFs for short-stay PAC has only recently received attention from government reporting.

The government reports five levels of short stay quality. The association between the five-star government ratings (i.e., levels) and occupancy rate and nurse staff mix were statistically tested. There was no statistically significant difference between SSQM ratings 2 and 3 and SSQM ratings 4 and 5. Ratings were merged to represent low, medium, and elevated levels of SSQM. They are categorized into three ordinal ratings: 1 low, 2 medium, and 3 high. The SSQM categories were tested for Type 1 error using Tukey HSD. These 3 ratings were used, rather than the five-star government ratings.

## 4. DATA ANALYSIS

The results provide an understanding of short-term healthcare quality in SNFs. First, the SNF industry-level results are reported. Second, state-level results are presented.

The SNF industry-level logistic regression was run using R, with the occupancy rate\* measured in multiples of 10% to detect changes more readily in the rate. The coefficients, t statistic, and p-values are shown in Table 1 below. P-values are computed by comparing the t-value against the standard normal distribution, (n = 13,0001, in this study).

a. Increasing occupancy rate by 10% results in a .119 log of odds of achieving a higher SSQM rating (i.e., move from low to medium quality rating). Computing the natural e raised to this exponent provides the odds ratio, a more interpretable measure. Thus, e to the power of .119 equals 1.126.

That is for every 10% increase in occupancy rate the odds (i.e., likelihood) of improving the SSQM rating is 12.6% (i.e., moving to a higher-level quality rating). Table 1 below summarizes the



results of the logistic regression analysis (it does not show the natural e computation).

**Table 1. Results of Ordinal Logistic Regression**

Occupancy rate* coefficient	t stat.	p value	Ratio (CNA+LPN)/RN coefficient	t stat.	P value
.119	10.37	0	-.109	-25.15	0

b. Increasing the (CNA + LPN) hours per resident per day more than increasing the RN hours per resident per day (e.g., the ratio increases) results in a -.109 log of odds of achieving a lower SSQM rating (i.e., move from medium to low-quality rating). Once again, we raise e to the coefficient in the model, resulting in e to the power of -.109 which equals .897. Since this number is below 1, the result is a lower likelihood and thus we obtain .103 (1 - .897).

That is for every 1 unit increase in the ratio of (CNA + LPN) / RN hours per resident per day the odds of getting a lower SSQM is 10% (i.e., moving to a lower quality rating).

Table 2 presents the summary of results that includes occupancy rate and nurse staff mix. It identifies how the statistical result relates to short stay quality measures.

This result has implications for SNF administrators. The occupancy level is a statistically significant factor that helps to predict short-term PAC quality (i.e., a higher occupancy rate predicts a higher SSQM rating). There is an association between occupancy rate and SSQM.

**Table 2. Summary of Results for Predicting SSQM**

Factor	Statistically Significant for predicting SSQM	Association with Improving SSQM
Occupancy Rate	Yes	Positive
(CNA +LPN)/RN hours per resident per day	Yes	Negative

The ratio of (CNA + LPN) /RN care is a statistically significant factor that helps predict short-term

PAC quality (i.e., a higher ratio, that is more CNAs and LPNs predict a lower SSQM rating). This indicates that there is an association between nurse staff mix and SSQM.

In the next section, an exploratory correlation between factors presented in table 2 above and COVID-19 deaths in SNF is presented. This study considers the care of COVID-19 residents in SNFs as an extraordinary health care service. Although COVID 19 is short-term in nature, it is different than SSQM, which is focused on post-acute care (i.e., strokes and hip replacement surgeries). This preliminary exploration may help SNFs better understand adjustments that may be required in occupancy levels and nurse staff mix for viral outbreaks.

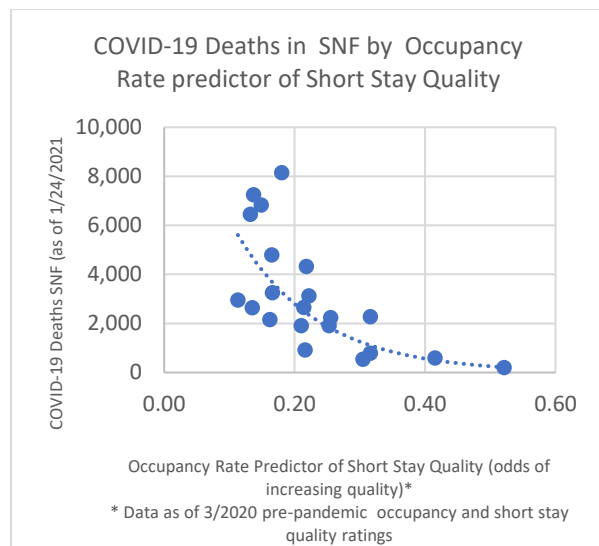
**Exploratory correlation between COVID-19 outcomes and SSQM**

To explore a relationship between SSQM and COVID-19 outcomes we use the logistic regression equation used at the SNF industry level by state level. We explore this relationship by using CMS public data for total COVID-19 deaths in SNFs per State, as of Jan 31, 2021 (February 3, 2021). This presents almost a year of experience with COVID-19. Although the CMS COVID-19 deaths dataset changes monthly a goal of this study is to better understand the viability of using both the occupancy predictor and nurse staff mix predictor coefficients determined for SSQM. This exploration may have the potential to help guide SNFs in better management of pandemic healthcare conditions. The dataset is used at the state level because of nuances in each state (i.e., demographics and policy characteristics).

At the state level, ordinal logistic regression (see equation above) was run for both occupancy rate and (CNA+LPN)/RN hours per resident per day as predictors for SSQM. Using this ordinal regression, the COVID-19 deaths per state, regression coefficients, and statistically significant p-values for state coefficients are shown in Appendices B and C.

The ordinal logistic regression was run as a hierarchical multi-level regression model with the occupancy rate coefficients representing the likelihood of moving to a better SSQM rating (see Appendix B). The ratio (CNA + LP) / RN hours per resident per day coefficient, on the other hand, represents a likelihood of moving to a lower SSQM rating (see Appendix C). The predictions of SSQM therefore may also help predict COVID-19 healthcare outcomes.

The statistically significant state coefficients of the predictor variables of SSQM are correlated with the total number of COVID-19 deaths by state. The number of COVID-19 deaths is used as a surrogate for COVID-19 outcome in the SNF. This was done separately for occupancy rate and nurse staff mix ratio. The correlation analysis was computed using the Spearman method. There is a negative correlation between the occupancy coefficient, as a predictor of higher SSQM, and the total number of COVID-19 deaths. Graph 1 below shows this correlation. The Spearman correlation coefficient is  $-.52$  and at the  $.05$  significance level with a power of  $.80$  ( $r = -.52$ ,  $n = 26$ ,  $\alpha = .05$ ,  $\text{Power} = .80$ ).



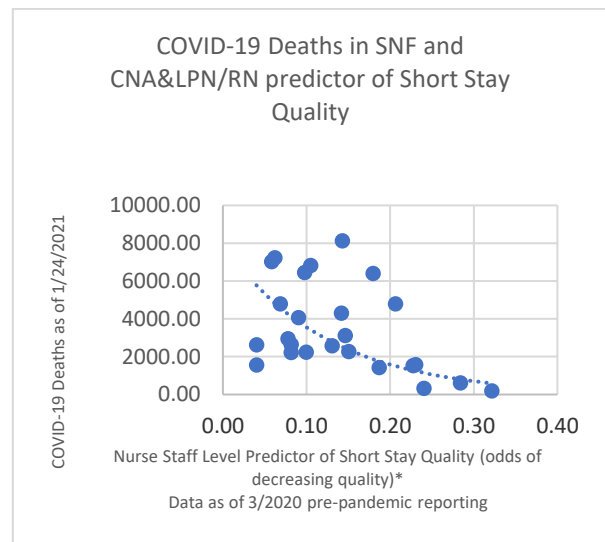
**Figure 1. COVID-19 Deaths in SNF by Occupancy Rate predictor of Short Stay Quality**

A possible suggestion for this relationship is that at higher occupancy rates there will be less room for COVID-19 admissions. The SNF becomes less condensed with COVID-19 viral load. Further, SNFs that have higher occupancy rates receive more revenue from the government that pays for the short-term care requirement per resident case. This higher revenue may improve the ability of the SNF to manage viral infection outbreaks with the purchase of personal protection equipment, and resources to protect staff and their family and implement new procedures for improved safety.

b. There is a moderate positive correlation between the ratio of  $(\text{CNA} + \text{LP}) / \text{RN}$  hours of resident per day coefficient, as a predictor of lower SSQM, and the total number of COVID-19

deaths by state. Graph 2 below shows this correlation. The Spearman correlation coefficient is  $.41$  and at  $\alpha = .10$  significance level with power of  $.70$  ( $r = .41$ ,  $n = 27$ ,  $\alpha = .10$ ,  $\text{Power} = .70$ ).

Fewer COVID-19 deaths have a relationship with a larger ratio of  $(\text{CNA} + \text{LPN}) / \text{RN}$  hours per resident per day. This result is surprising because a larger ratio was a predictor of lower short-term post-acute care quality. This seems counter-intuitive that increasing the nurse staff mix (which means increasing certified nurse assistants and licensed practitioners relative to the number of RNs) predicts lower SSQM yet correlates to increasing COVID-19 outcomes as shown through the surrogate measure of COVID-19 deaths at the SNF. In other words, this exploration may indicate that a better COVID-19 healthcare outcome has an association with a higher nurse staff-mix ratio. Yet, the higher ratio is a predictor of lower SSQM.



**Figure 2. COVID-19 Deaths in SNF and CNA&LPN/RN predictor of Short Stay Quality**

It is possible that in the case of infectious disease care when there are more CNAs, each CNA will have fewer patients per shift as well as a higher likelihood that the CNA will stay in one unit in the SNF. If the SNF has fewer CNAs, then each CNA will have to take care of more patients, as well as a float to other units and floors. In this situation, the CNA is more likely to help spread COVID-19 in the SNF.

**Table 3. Summary of Results: SNF Factors and Results**

SNF Factors	Environment Before COVID-19	Regression Result on SSQM	Environment COVID-19 Era	Correlation of regression result with COVID-19 outcomes*
Occupancy rate	Converting of long-term beds to short-stay PAC to maintain occupancy.	A higher Occupancy rate predicts higher SSQM.	Bed vacancies are filled with COVID-19-positive patients.	Occupancy Rate as a predictor of SSQM has a negative correlation with COVID-19 deaths (Higher occupancy may be correlated with better COVID-19 healthcare outcomes).
(CNA+LPN)/RN hours per resident per day	Changing staff healthcare tasks from ADL to PAC.	A higher ratio predicts lower SSQM.	CNAs and LPNs & RNs help with viral outbreaks.	Nurse Staff Mix Ratio as a predictor of SSQM has a positive correlation with COVID-19 deaths. (Higher nurse staff mix ratio may be correlated with better COVID-19 healthcare outcomes).

\*COVID 19 deaths at SNF may be considered a surrogate for COVID-19 healthcare outcome.

### 5. CONCLUSIONS

The focus of the paper was on short-stay PAC quality. CMS public domain data was used for occupancy, nurse staff mix based on hours per resident and SSQM. COVID-19 deaths were reported in SNFs at the state level. Table 3 presents the summary of the results.

The COVID-19 pandemic emphasizes the importance of occupancy. The pre-pandemic occupancy rate may have limited the number of COVID-19-positive patients that could be admitted to an SNF. Also, focusing on occupancy rates may improve the likelihood of better short-term health care quality because of the increased revenue from more residents. The occupancy rate depends on PAC services, which are incentivized by the government. Therefore, a higher occupancy may also reflect hospital and community reliance on the SNF for short-term rehabilitative care. This necessitates ICT to help assist in the transfer of patients with their electronic medical records.

Further, the government established fixed nurse staff levels for SNFs may hinder short-term healthcare quality. The government assigns quality stars to SNFs that achieve predetermined nurse staff level metrics. Guidance and government incentives may begin to help define a process for adjusting nurse staff mix during extraordinary healthcare crisis conditions, such as COVID-19. The ability of SNFs to provide high-quality short-stay healthcare relies on agile processes and relationships with hospitals and communities. A future paper that explores resource agility in SNFs as a competitive asset may help guide administrators and managers.

Nurse staff metrics could become flexible and ad-hoc based on emerging healthcare situations.

A study on the use of ICT to monitor and connect the healthcare organization network (i.e., SNFs, hospitals, and community) may be valuable to improve short stay quality as SNF provides increasingly complex medical procedures. Overall ratings for SNFs should focus on SSQM.

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**Appendix A. Short Stay Quality Measures**

(<https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/NursingHomeQualityInits/NHQIQualityMeasures>)

Percentage of short-stay residents who were re-hospitalized after a nursing home admission. Reporting began 01/01/20
Percentage of short-stay residents who have had an outpatient emergency department visit. Reporting began 01/01/20
Percentage of short-stay residents who got antipsychotic medication for the first time. Reporting began 01/10/20
Percentage of SNF residents with pressure ulcers that are new or worsened (SNF QRP). Reporting began 10/24/18 then changed to skin integrity reporting began FY 2020
Rate of a successful return to home and community from an SNF (SNF QRP). Reporting began 10/24/18
Percentage of short-stay residents who improved in their ability to move around on their own. *Not clear when reporting began
Percentage of short-stay residents who needed and got a flu shot for the current flu season. . *Not clear when reporting began
Percentage of short-stay residents who needed and got a vaccine to prevent pneumonia. . *Not clear when reporting began
Percentage of SNF residents who experience one or more falls with a major injury during their SNF stay (SNF QRP). Reporting began 10/24/18
Percentage of SNF residents whose functional abilities were assessed, and functional goals were included in their treatment plan (SNF QRP). Reporting began 10/24/18
Rate of potentially preventable hospital readmissions 30 days after discharge from an SNF (SNF QRP). Reporting began 10/24/19
Medicare Spending Per Beneficiary (MSPB) for residents in SNFs (SNF QRP). Reporting began 10/24/18

**Appendix B. Occupancy Rate**

Occupancy Rate			
Total Resident SNF COVID Deaths	State	Occupancy Rate Predictor SSQM	p-value
1907	AR	0.25	0.004
909	AZ	0.22	0.031
7037	CA	-0.23	0
2649	GA	0.21	0.015
4795	IN	0.17	0.003
2641	LA	0.14	0.081
4316	MA	0.22	0.012
1906	MD	0.21	0.045
200	ME	0.52	0.048
3124	MI	0.22	0.003
2153	MN	0.16	0.075
3249	MO	0.17	0.003
1576	MS	0.72	0.001
2952	NC	0.11	0.076
590	ND	0.42	0.088
782	NE	0.32	0.002
533	NM	0.31	0.026
327	NV	-0.34	0.049
6829	NY	0.15	0.057
6452	OH	0.13	0.014
8138	PA	0.18	0.012
1426	SC	-0.16	0.048
2275	TN	0.32	0
7243	TX	0.14	0
2232	VA	0.26	0.019
78	VT	1.14	0.009



**Appendix C. (CNA+LPN)/RN Hours Per Resident Per Day  
 (CNA+LPN)/RN hours per resident per day**

Total Resident SNF COVID Deaths	State	(CNA+LPN)/RN hours per resident per day predictor SSQM	p-value
7037	CA	-0.06	0
1537	CO	-0.26	0.002
2579	CT	-0.14	0.013
341	DE	-0.82	0.01
4063	FL	-0.1	0
2649	GA	-0.09	0.001
6415	IL	-0.2	0
4795	IN	-0.07	0.017
2243	KY	-0.11	0.015
2641	LA	-0.04	0.017
4316	MA	-0.15	0.001
200	ME	-0.39	0.007
3124	MI	-0.16	0
1576	MS	-0.26	0
2952	NC	-0.08	0.013
4803	NJ	-0.23	0
533	NM	0.26	0.03
327	NV	-0.28	0.023
6829	NY	-0.11	0.002
6452	OH	-0.1	0
1564	OK	-0.04	0.045
8138	PA	-0.15	0
1426	SC	-0.21	0
2275	TN	-0.16	0
7243	TX	-0.06	0
2232	VA	-0.09	0.019
626	WV	-0.33	0.002