Policies to Improve Quality in Virginia's Nursing Homes:

The Role of Local Labor Markets

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Section 1 - Introduction

The poor quality of nursing home care is a longstanding public policy issue both nationally and in the state of Virginia. Medicaid, the public insurance program for low-income persons, is the primary payer for long-term care services, which includes stays in nursing facilities as well as home and community-based care. Nationally, 62% of nursing home residents are enrolled in Medicaid (Kaiser Family Foundation, 2017). Since Medicaid is financed by both federal and state governments, policymakers and program officials at both levels seek to formulate, implement, and evaluate policy with the goal of improving nursing home quality of care.

One of the most important determinants of quality of care in a nursing home is direct care staffing. Low levels of direct care staffing can lead to worse quality measures for nursing home residents like urinary tract infections and pressure ulcers, also known as bed sores (Hickey, 2005). When a facility is understaffed or has high staff turnover, mortality, hospitalization rates, and emergency department visits also increase (Ochieng et al., 2022). Conversely, with higher staffing levels, health outcomes for nursing home residents improve. With more staff, residents experience “lower mortality rates; improved physical functioning; less antibiotic use; fewer pressure ulcers, catheterized residents, and urinary tract infections; lower hospitalization rates; and less weight loss and dehydration” (Harrington et al, 2017).

To increase quality of care and staffing levels, a common approach in public programs is to measure facilities’ quality of care and offer financial rewards for improvements. Examples of such policies intended to increase quality of care include Value-Based-Purchasing (VBP) and pay-for-performance programs. In Virginia in 2021, in response to continued calls for the improvement of nursing home quality of care by policymakers and lobbyists, the Virginia

General Assembly passed legislation requiring the implementation of a nursing facility (NF) VBP program by Virginia Medicaid.

While there is ample prior literature on the link between staffing and quality, there are many questions on the effectiveness of NF VBPs. First, there is the question of if VBPs work as intended. Prior studies (described in more detail below) show mixed evidence of their effects. Second, there is the question of why they do not work as intended. Prior studies show staffing conditions affect VBP implementation. Third, there is the question of whether local economic conditions affect nursing facility performance. Stevens et al. find that economic conditions greatly influence health outcomes, especially in nursing facilities. As unemployment rates rise, mortality in nursing homes decreases (Stevens et al, 2015). Konetzka et al similarly examined the effect of local unemployment on nursing facilities and found that different specialties of healthcare workers are affected differently by rises in unemployment (Konetzka et al, 2018) No prior study has examined the association between county-level labor market conditions and the quality of care in nursing homes in Virginia. Information about these potential effects may be vital to the success of the new NF VBP in Virginia.

To help fill this gap, my research examines the impact of local labor market conditions on the quality of care delivered in Virginia's nursing homes. This study proceeds as follows. Section 2 outlines how quality of care in nursing facilities is quantified. Section 3 identifies policy approaches to improving quality of care in nursing homes, including VBP programs. Section 4 examines the challenges and limitations of implementing Value-Based Purchasing policies. Section 5 describes my methodology for examining the relationship between local labor market conditions and nursing home facilities' quality of care. Section 6 discusses the results of

examining those associations. Finally, section 7 concludes the study, indicating the limitations of my work and potential next steps for this research.

Section 2 - Measuring the Quality of Care in Nursing Homes

While there are various ways to measure the quality of nursing home care, many diverse measures suggest that U.S. nursing home quality has been marked by deficiencies for many years. This section reviews key findings from studies that quantify quality of care in nursing homes.

One set of measures of nursing home quality are known as "outcomes measures;" these refer to the health outcomes of residents. Examples of outcomes measures include the share of residents with pressure ulcers (commonly known as bed sores) or the share of residents being admitted to the hospital from the facility (Castle and Ferguson, 2010), as well as rates of falls and rates of outpatient emergency department use among residents (Centers for Medicare and Medicaid Services, January, 2022). Early studies of quality of care from as far back as 1986 found evidence of poor quality of care as measured by several outcomes measures (National Citizens Coalition for Nursing Home Reform, 2007). Subsequent analysis of the 2004 National Nursing Home Survey found that around 11% of nursing home residents suffered from a pressure ulcer in the past year (Park-Lee & Caffrey, 2009). Given that Chen et al. (2022) also found that only 60-70% of all pressure ulcers tend to be reported in nursing homes, actual pressure ulcer rates may exceed 11%. Another outcome measure of quality is the share of residents with urinary tract infections (UTIs). In 2012, there were over 600,000 urinary tract infections in nursing homes (Herzig et al, 2017). Clearly, quality of care as defined by outcome measures is a serious issue and a longstanding concern.

Another set of quality measures are called “process measures.” Process measures include “the specific steps in a process that lead — either positively or negatively — to a particular outcome metric” (Burton, 2016). Examples include discharge times and medication delays. As an indication of deficiencies in process measures of quality, the Government Accountability Office reported that the majority (82%) of Medicare and Medicaid participating facilities had “an infection prevention and control deficiency, including a lack of regular handwashing” between 2013 and 2017, (Government Accountability Office, 2020). Other process measures include the percentage of patients receiving preventative services such as influenza and pneumococcal vaccines (Centers for Medicare and Medicaid Services, January, 2022). In 2020-2021, only about 60% of Virginia nursing home residents were vaccinated against influenza (Centers for Disease Control and Prevention, 2021).

A third type of quality measures are called “structural measures.” These include the facilities’ use of electronic medical records, number or proportion of board-certified physicians, and the ratio of clinicians to patients (Agency for Healthcare Research and Quality, 2015). An important structural measure of quality is the ratio of direct care providers to patients. Numerous studies have shown that low nurse staffing ratios are associated with worse outcomes measures of quality outcomes (Hickey, 2005). For example, in one study of Department of Veterans Affairs (DVA) nursing homes, higher staffing levels correlated with lower ulcer rates (Hickey, 2005). The National Consumer Voice for Quality Long-Term Care concluded in their summary report on nursing home staffing standards that “the important relationship between nurse and nursing assistant staffing levels and outcomes of care has been well-documented”, further noting that “a systematic review of 87 research articles and reports from 1975-2003 found that high total staffing levels, especially of licensed staff, were associated with higher quality of care in terms of

resident outcomes, particularly functional ability, pressure ulcers, and weight loss" (National Consumer Voice for Quality Long-Term Care, 2022).

Because a significant share of nursing home care is financed by Medicaid, policymakers and program administrators have long been concerned with deficiencies in the quality of care in nursing homes. In 2020, Medicaid paid for 54% of the around $400 million spent on long-term care in the United States (Chidambaram and Burns, 2022). Medicare, the government-funded insurance for individuals ages sixty-five and older, does not cover long-term care services or custodial care, resulting in many older adults applying for Medicaid to cover long-term care services (Medicare.gov, nd.). As a result, 60% of all nursing home residents are estimated to be enrolled in Medicaid (Kaiser Family Foundation, 2017). For some older persons to receive Medicaid coverage, non-housing assets must fall below $2000-$3000, and incomes must be beneath the income threshold for eligibility (Medicaid.gov, n.d.). As the primary funder of long-term care services and many enrollees residing in nursing facilities, quality of care matters in state Medicaid legislation.

Virginia Medicaid officials and legislators have documented the quality issues facing nursing facilities, as has the Centers for Medicare & Medicaid Services (CMS), the federal agency that administers Medicaid, and the media. In 2021, the Virginia Joint Commision on Health Care in its report to the Virginia General Assembly stated that "[m]ore than 60 percent of facilities with low staffing receive poor health inspection ratings" and "one-fifth of Virginia's nursing homes are not meeting expected staffing levels" (Joint Commision on Health Care, 2021). CMS found that the facilities are not meeting the standards as "43% of Virginia's nursing homes received a 1- or 2-star Staffing rating from CMS, indicating inadequate staffing" (Joint Commision on Health Care, 2021). In 2022, *The New Yorker* examined a case study of a private

investment firm acquiring a nursing facility, St. Joseph's Home for the Aged, in Richmond, Virginia (Rafiei, 2022). In attempting to reduce costs, the private investment "significantly cut back staffing," greatly reduced the quality of care provided to St. Joseph's residents, while COVID-19 infections and deaths increased (Rafiei, 2022). Clearly, Virginia is not immune to the issues surrounding staffing and quality of care in Medicaid nursing homes.

Section 3 - Policy Approaches to Improving Quality

A variety of policy approaches have the potential to improve the quality of nursing home care. This section examines two such policies. The first is direct regulation through minimum staffing requirements; the second is the use of financial incentives.

One option for improving the quality of care is to mandate minimum staffing standards, especially in light of evidence that staffing is associated with better resident outcomes. Currently, federal regulation in this area is lax. Federal law mandates that Medicaid and Medicare certified nursing facilities have a RN on duty for 8 hours each day, and that they "provide 24-hour licensed nursing services, which are sufficient to meet nursing needs of [their] residents" (Centers for Medicare & Medicaid Services, 2021). These standards are quantified in terms of hours of direct care staff per resident day (Joint Commision on Health Care, 2021). However, the vagueness of that mandate makes it difficult to enforce nationally, as federal law does not specify the number of staff hours required or required minimum staffing hours (Karikari-Martin, 2022). In contrast, experts of nursing home quality have suggested stricter thresholds, such as "total minimum direct care staffing levels of 4.1 hours of care per resident day, direct care RN staffing levels of 0.75 hours of care per resident day, and 24-hour RN staffing" (Collier and Harrington, 2008).

A second method for increasing quality of care through legislation is through a Value-Based Purchasing (VBP) program. The goal of a VBP program is to increase quality of care through financial incentives. These programs reward facilities financially based on how quality of care measures up to predetermined metrics (Centers for Medicare & Medicaid Services, March 2022). Some programs may require healthcare facilities to provide their own data and documentation, requiring large time commitments and increased buy-in from staff, making them successful in theory but affecting different facilities in different ways. VBPs can be used for different settings (e.g., hospital, nursing home) or in different payment systems (e.g., public or private insurance). The umbrella term of VBP includes pay-for-performance policies, which also use set metrics to evaluate then financially reward facilities.

In 2021, the Virginia General Assembly considered policy action to improve the quality of nursing home care. Though some legislators advocated for a minimum staffing requirement, the legislature ultimately passed a law establishing a Nursing Facility Value-Based Purchasing (VBP) in Virginia Medicaid. Specifically, the legislature instructed the Department of Medical Assistance Services (DMAS) to establish "a nursing facility (NF) Value-Based Purchasing (VBP) program designed to improve the quality of care furnished to Medicaid members" through financial compensation directly related to performance on quality metrics (Virginia Department of Medical Assistance Services, 2021). All facilities that provide care through Medicaid managed care (nearly all nursing homes in the state) are eligible for this program (Virginia Department of Medical Assistance Services, 2021). It is not a mandatory program, but facilities are incentivized to participate due to the financial reward. This program measures facilities against six predetermined metrics.

Table 1 defines the six quality metrics that were included in the NF VBP subsequently designed by DMAS, and their relative importance in determining the financial compensation each facility will receive. Two of these metrics are focused on staffing levels, which are weighted more heavily in the facilities' performance. These six measures seek to quantify and represent process and outcome measures of quality of care. The two staffing metrics cover structural measures. The rates of resident hospitalizations, emergency department visits, UTIs, and pressure sores quantify as outcome measures.

Under the Nursing Facility Value-Based Purchasing Methodology, DMAS financially compensates nursing facilities based on their performance on each metric as well as their improvement from past years (Virginia Department of Medical Assistance Services, 2021). To determine rewards in the first year of the program, DMAS measured each facility's performance from October 2021 to September of 2022. Unlike other VBPs, DMAS is not requiring facilities to submit the data themselves (Virginia Department of Medical Assistance Services, 2021); DMAS uses data from CMS. Additionally, the financial rewards are larger than the average VBP program and easier to understand. For facilities designated as performing "best," DMAS awards $12.50 per resident day. In contrast, in Grabowski et al (2017), which looked at pay-for-performance in a different setting, the financial rewards were likely "too small to incentivize major changes in quality" (Grabowski et al, 2017). DMAS payments for the first year of this program will be received in two lump sums. The facilities will receive 70% of the financial reward in April 2023 for performance on nurse staffing, UTI rates, and pressure ulcer rates. The remaining 30% of the payment for the metrics of emergency department visits and hospitalization rates will be received later in 2023 (Virginia Department of Medical Assistance Services, 2021).

Section 4 - Challenges and Limitations of Nursing Facility VBPs

While VBPs seem like a potential solution to quality issues in nursing facilities, there are often difficulties in implementation. Below, I outline the literature on VBP evaluation and implementation and the surrounding labor market conditions that can affect a VBPs success. For a thorough literature review of VBP implementation and Quality Improvement (QI) strategies, see Appendix A.

An important study on the impact of a Medicare VBP program for skilled nursing facilities is Grabowski et al (2017). This study used administrative and qualitative data from Arizona, New York, and Wiconsin over three years to observe the financial impact of implementing a VBP in nursing homes. The study found "Medicare savings were observed in Arizona in the first year only and Wisconsin for the first 2 years; no savings were observed in New York" (Grabowski et al, 2017). Ultimately, the study found limited quality improvement. While this is perhaps not the anticipated result, the study concludes that the variety of the facilities included resulted in a very heterogeneous study group and that results might be explained by the small size of the financial reward (Grabowski et al, 2017). Grabowski's study reveals that pay-for-performance models may not necessarily increase quality of care.

Another challenge to NF VBP implementation that rewards staffing increases is the concern that nursing homes are currently facing a longstanding "staffing crisis." As documented by the National Citizens' Coalition on Nursing Home Reform (now the National Consumer Voice for Quality Long-Term Care) in 2001, the facets of this crisis include retention, recruitment, wages and benefits, and workload as just a few examples (National Citizens' Coalition on Nursing Home Reform, 2001). This "crisis" in staffing has persisted for decades and is yet to be sufficiently resolved. Additionally, the COVID-19 pandemic has greatly worsened this staffing

shortage with the “disproportionate impact of the COVID-19 pandemic on nursing facility residents and staff [bringing] increased attention to long-standing workforce issues that can affect care quality and safety, such as staffing shortages and high turnover rates” (Ochieng et al, 2022). Staff retention and job satisfaction remains low in this line of work as “nursing home jobs are considered less desirable, compared to other health care settings” (Joint Commision on Health Care, 2021). Staffing a nursing home has become increasingly difficult and as a result, standards are not being met. As of March of 2022“more than one in four nursing homes nationally reported a shortage of at least one type of staff” (Musumeci et al, 2022). This is also true in Virginia nursing facilities as the Joint Commission on Health Care stated in their 2021 annual report “[a]ll nursing homes in Virginia struggle to recruit and retain staff, and 21 percent of facilities are not providing enough hours of direct care” (Joint Commission on Health Care, 2021).While nursing facilities require different levels of staffing, it is clear that across the nation that nursing homes face a staffing crisis. From recruitment to retention, facilities are finding it increasingly difficult to find and keep workers.

Prior studies of quality improvement efforts offer some insights to the role that local labor market conditions play in nursing homes. Common concerns noted in qualitative studies of quality improvement policy are the feasibility and effectiveness of Value-Based Payment policies as well as a sense of lack of ability to implement positive changes (Bokhour, 2006; Lawrence, 2020, O’Grady, 2020). For example, a facility may lack the ability to increase staffing levels due to few available workers in the area. Toles et al’s (2021) review found that of the studies measuring pressure ulcers, several note how inadequate staffing levels can make QI implementation difficult or impossible. Rosen et al (2005) notes that employees raised concerns over staffing. **Table 2** lists what staff identified as the key issues surrounding the nursing facility.

Staffing shortages are key. In Virginia, these shortages are being felt with "one-fifth of Virginia's nursing homes… not meeting expected staffing levels" (Joint Commision on Health Care, 2021).Other studies note that teamwork and buy-in from employees is essential to a VBP's success (Rosen et al., 2005; Baier et al, 2003). Notably, many healthcare facility workers felt disempowered to successfully implement a VBP due to conditions outside of their control (Rosen et al., 2005). Economic conditions are outside the control of an individual facility. Local economic conditions likely contribute to a facility's quality of care and staffing levels.

Rantz et al (2011) mention staffing as well. The authors hypothesize that the experimental group of nursing facilities, receiving the monthly consultations from expert gerontology nurses, would not only see quality improvement, but also "more organizational attributes of improved working conditions than control facilities, higher staff retention, similar staffing and staff mix, and lower total and direct care costs" (Rantz et al, 2011). However, this did not prove true. While the facilities saw improvements in quality of care, "organizational working conditions, staff retention, staffing, and staff mix and most costs were not affected by the intervention. Leadership turnover was surprisingly excessive in both intervention and control groups" (Rantz et al, 2011). The results of this study suggests that while staffing affects QI strategies, the inverse does not appear to be true: QI strategies cannot improve staffing.

Finally, prior empirical studies show that local economic conditions have potentially dangerous implications for resident quality in nursing homes. Stevens et al (2018), using state-level data from 1978-2006, examine the impact of economic conditions on U.S. nursing home outcomes and find that the health of older Americansis better in an economic recession. Additionally, the authors conclude that nursing home staffing levels rise when state-level unemployment rates are high (Stevens et al, 2018). Given the setting of a nursing home, residents

of nursing facilities are particularly vulnerable to the "cyclical fluctuations" in unemployment that cause higher mortality rates. Additionally, Konetzka et al (2018) examine unemployment rates in connection with nursing home staffing levels. In analyzing county-level data from Californai from 2005-12, the authors found that "as unemployment rates increase, staffing by registered nurses (RNs) decreases but staffing by licensed practical nurses (LPNs) increases" (Konetzka et al, 2018). Both studies suggest that as unemployment rises, nursing facilities have more staff.

Building on this prior literature, I examine the impact of local labor market conditions on the quality of care and performance of nursing facilities in Virginia. My measures of quality are several measures from CMS' Nursing Home Compare (NHC) which match several quality measures used in the NF VBP. Given the staffing shortage for positions like nursing assistants, do some counties experience these shortages more severely, making it more difficult to adequately staff the facilities in that area? Shortages, lack of training, burnout, and turnover are all affecting nursing homes nationally and in Virginia, making QI strategies more difficult to implement and maintain. How do local labor market conditions across Virginia counties affect nursing homes' staffing levels and quality of care?

Since prior studies suggest that staffing availability impacts nursing homes' quality improvement efforts, I hypothesize that county local labor market conditions will have the following effects: Hypothesis 1: The higher the unemployment rate in the surrounding county, the higher the quality of care in that county's nursing facilities. A high unemployment rate in the county indicates a wide pool of available staff for a nursing facility. I predict that counties with a high pool of potential low-wage and low-trained workers such as nursing assistants will score higher on the NHC quality scores as they are able to quickly recruit new staff.

Unemployment rate helps to operationalize the tightness of a local labor market. A tight local labor market results in few available workers even if there are many available positions. A low unemployment rate in the surrounding county indicates a tight labor market with few available workers; whereas, high rate of unemployment in the county implies the local labor market is not tight. The tightness of a local labor market affects a facilities' ability to recruit employees. As staffing is so closely tied to quality of care in nursing homes, I theorize that the tightness of the local labor market the facility resides in will impact the quality of care delivered in that facility. Furthermore, Stevens et al note that mortality rises as unemployment rates decrease (Stevens et al, 2018). There is an established link between rising unemployment and better health outcomes (Stevens et al, 2018). With the links between hiring more staff and higher quality of care in nursing homes as well as the decreases in mortality rates during periods of high unemployment, I theorize that high county-level unemployment rates will correspond with higher quality of care in the county's nursing facilities.

Hypothesis 2: The higher the employment rate for low wage and low-trained positions of nursing assistants in nursing facilities with the NAICS score of 6321, the lower the quality scores, relative to the size of the county the nursing facility is located in. The employment rate helps to operationalize how tight the labor market is. A county or county equivalent with a high employment rate likely has a tighter labor market than a county with a low employment rate, indicating it will be more difficult to recruit staff, specifically nursing assistants. As quality of care is so closely tied to staffing, I predict high employment rates will result in worse scoring on NHC's quality metrics as it indicates the employment pool in the county while controlling for population size. Additionally, I am specifically interested in the employment rate of nursing

assistants as it is a low-wage and low-trained currently experiencing a staffing shortage both nation and state-wide.

As stated above, the employment rate operationalizes the local labor market. While a higher county-level employment rate signifies better local economic conditions, it also implies a tight local labor market. A tight local labor market with few available workers would likely have high rates of employment, indicating difficulty in hiring. As the nursing assistants in the surrounding county are increasingly employed, individual nursing facilities will likely find it more difficult to recruit staff. Additionally, as Stevens et al (2015) argue, health outcomes decline in better economic conditions, suggesting an association between macroeconomic factors and health, unexplained by the relationship between own-employment and health (Stevens et al, 2015). With rising county-level employment rates for nursing assistants, I anticipate declining health outcomes for nursing facility residents as a tighter labor market impairs facilities' ability to recruit staff.

Hypothesis 3: A higher turnover rate for a county will result in a lower scoring on the NHC quality metrics. A turnover rate represents the hirings and separations of a county in relation to the number of employees. This turnover rate is by county and is specifically of women with a high school degree or less by counties in Virginia working in nursing homes with the NAICS score of 6321. A high turnover rate indicates a high number of workers in the county gaining and losing (or leaving) positions. I hypothesize that having high turnover will result in lower quality of care and therefore a lower score on quality metrics.

A high turnover rate at the county level means there is a high rate of hirings and separations for nursing assistants. Turnover rate is also a way to operationalize the tightness of a local labor market. When turnover rate is high, that indicates a tight local labor market. In a tight

labor market, there are ample job opportunities but not enough workers, allowing workers to "quit more readily, knowing they are likely to find another job quickly" (Public Policy Institute of California, 2022). With many options for other sources of work, employees quit more frequently, seeking other employment. This results in high turnover with high separation rates and high hiring rates. As high turnover rate indicates a tight labor market, high turnover rate will correlate with fewer available workers in the county. This small pool of employees will restrict the ability for individual nursing facilities to hire adequate numbers of staff, resulting in lower quality of care.

Section 5 - Methodology

To test the hypotheses outlined in the previous section, I use county-level and facility-level data from various sources to estimate multivariate regression models, as described below. All data pertain to the year 2021-22.

County-level Data

To measure the unemployment rate, I used data from the Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS) program (Bureau of Labor Statistics, 2023). LAUS data provides an unemployment rate, defined as the number of unemployed people as a percentage of the labor force (the labor force is the sum of the employed and unemployed) , calculated as (Unemployed ÷ Labor Force) x 10 for each county and county equivalent (Bureau of Labor Statistics, 2023). To measure county level nursing employment and turnover rate, I use data from the Quarterly Workforce Indicators (QWI). The QWI are a set of thirty-two economic indicators, including employment, wages, hires, separations, and other measures of employment flow (U.S. Census, 2016). Following Ruffini's methodology, I used data on employment by sex, education, and industry to define nursing assistants in the county (Ruffini, 2021). Specifically. I

selected employment in the nursing home industry using the NAICS code 6231 for nursing care facilities and selected female workers with a high school diploma or less. Less educated female workers are likely to work as nursing assistants in nursing facilities; nursing assistants are low-skill and relatively low paid positions. I divide the employment by a measure of total county population over age 18, obtained from the American Community Survey. The American Community Survey collects detailed population and housing data, offering population estimates in between Census years (United States Census Bureau, 2022). I used the 2021 five-year population estimates by county for the state of Virginia.

Facility-level Measures of Quality

Originally, I intended to use the facility's actual financial rewards, specifically improvement payments, administered by Virginia Medicaid (DMAS) to the facilities as a measure of a facility's ability to improve its quality of care. However, DMAS had to postpone the release of the payment amounts until April 2023, and, I instead chose to study several measures of facility-level quality from the Nursing Home Compare data released by the Centers for Medicare and Medicaid Services. I selected a set of nine quality measures most similar to the six metrics used by DMAS in their pay-for-performance methodology, and shown in Table 1.

These include four outcomes measures of quality: the number of hospitalizations per 1000 long-stay resident days, number of outpatient emergency department visits per 1000 long-stay, the percentage of high-risk long-stay residents with pressure ulcers, and the percentage of long-stay residents with a urinary tract infection. The number of hospitalizations per 1000 long-stay resident days is a quality measure indicating how frequently residents experience adverse health events severe enough to warrant hospitalization. The number of outpatient emergency department visits per 1,000 long-stay resident days quantifies how frequently

residents in a nursing home need emergency care. The percentage of high-risk long-stay residents with pressure ulcers quantifies quality of care as an indicator of the attention and exercise residents are receiving. Residents who are at high risk for pressure ulcers are those who are impaired in bed mobility or transfer, who are comatose,or who suffer from malnutrition (Centers for Medicare & Medicaid Services, 2023). The percentage of long-stay residents with a urinary tract infection also serves as a measure of quality with higher infections in facilities indicating poorer quality of care.

In addition, I use five staffing measures. These include case-mix adjusted total nurse (RN, LPN, aide) hours and total nurse turnover, which is defined as the percentage of nursing staff that left the nursing home over a twelve-month period (Centers for Medicare & Medicaid Services, 2023). The Nursing Home Compare data is from 2022. Case-mix staffing hours per resident per day indicates how fully staffed a facility is, adjusting for hours logged. I am using case-mix staffing hours for the total staff, RNs, LPNs, and nursing aides. Total nursing staff turnover is an additional variable (outside of DMAS' measures) to identify how facility-level turnover is affected by local labor market conditions. It does not quantify quality of care but serves as additional insight into the association between facility workings and local labor market conditions. Turnover rate is defined as the percentage of nursing staff that left the nursing home over a twelve-month period (Centers for Medicare & Medicaid Services, 2023).

Other Facility-Level Data

I used data from Nursing Home Compare to define facility ownership, bed size, and, and location within a hospital. Finally, I used data from Nursing Home Compare to define facility ownership as either nonprofit or for-profit institutions.

Methods

I merged the facility-level observations to county-level data and used the resulting dataset to estimate the multivariate regressions shown in Equations (1) - (4) below

(1) $Q_{FC} = \beta_0 + \beta_1 \text{Unemployment Rate}_C + \beta_2 \text{Size}_{FC} + \beta_3 \text{Nonprofit}_{FC} + \beta_4 \text{ Medicaid Funding}_{FC} + \beta_5 \text{ Hospital Location}_{FC} + \varepsilon_{FC}$

(2) $Q_{FC} = \beta_0 + \beta_1 \text{Employment Rate}_C + \beta_2 \text{Size}_{FC} + \beta_3 \text{Nonprofit}_{FC} + \beta_4 \text{Medicaid Funding}_{FC} + \beta_5 \text{ Hospital Location}_{FC} + \varepsilon_{FC}$

(3) $Q_{FC} = \beta_0 + \beta_1 \text{Turnover Rate}_C + \beta_2 \text{Size}_{FC} + \beta_3 \text{Nonprofit}_{FC} + \beta_4 \text{Medicaid Funding}_{FC} + \beta_5 \text{ Hospital Location}_{FC} + \varepsilon_{FC}$

(4) $Q_{FC} = \beta_0 + \beta_1 \text{Turnover Rate}_C + \beta_2 \text{Employment Rate}_C + \beta_3 \text{Unemployment Rate}_C + \beta_4 \text{Size}_{FC} + \beta_4 \text{Nonprofit}_{FC} + \beta_5 \text{ Medicaid Funding}_{FC} + \beta_6 \text{ Hospital Location}_{FC} + \varepsilon_{FC}$

The dependent variable in each regression equation, denoted as Q, is some measure of the quality of care in an individual nursing home F located in county C. The main independent variable is some measure of local labor market conditions in the county C.

For each dependent variable, I estimate three models, each using a separate measure of the local labor market: the general unemployment rate, the nurse assistant specific employment rate, and nursing assistant turnover. Each measure is defined at the level of the county in which the facility is located. The unemployment rate is the most crude measure of local labor market conditions as it is a county-wide metric and not specific to nursing facilities. The employment rate is the count of employed women with a high school degree or less by county in Virginia working in nursing facilities with the NAICS score 6321 divided by the county's population over the age of eighteen. This employment rate is meant to approximate the available pool of workers, and I predict will impact the case-mix staffing measures which accounts for the hours logged by the facility staff. With a smaller employee pool, current staff will likely need to log more hours to cover the demand of the facility. Staff turnover is a county measure yielded by using the

accessions (hires) and separations (firings, retirements, resignations, etc) of women with a high school degree or less by counties in Virginia working in nursing homes with the NAICS score 6321. The accessions and separations were multiplied by one half and divided by the employment number, yielding the turnover rate.

Control variables include size of the facility, a binary indicator of ownership (non profit relative to for-profit), a binary indicator of whether the facility is located in a hospital (relative to being a standalone facility), and share of resident days paid for by Medicaid (as opposed to payers like Medicare and private sources).

The number of beds for each facility serves as a control for facility size. Likely, facilities with a higher volume of residents will require more staffing. The facility's ownership serves as a control for facility funding. In a systematic review of 82 articles, on average, nonprofit nursing homes deliver better quality of care than for-profit facilities (Comondore et al, 2009). Ownership has an impact on the quality of care delivered to residents. For-profit facilities "tended to devote fewer resources to direct patient care, resulting in poorer quality of care for residents" (Center for Medicare Advocacy, 2012). Medicaid funding is represented through the share of resident days paid for by Medicaid for each facility. Medicaid pays less than other payers. Facilities that are receiving a high share of days paid for Medicaid are likely facilities with lower quality of care. High share of Medicaid indicates low resource facilities, likely indicating lower quality of care (Harrington, 2017).

Finally, the location of a facility may have an impact on the level of staffing, funding, and quality of care provided. In order to account for this, I am using a dummy variable if the facility is located in a hospital H = facility location and 1 = in a hospital and 0 = facility is located independently from a hospital. Facilities that exist within a hospital operate differently and likely

can pull available personnel from other departments of the hospital as hospitals are increasing the flexibility in the role of Registered Nurses (Davis & Wunderlich, 1996). Additionally, how a hospital recruits, trains, and retains workers differs from a stand-alone nursing facility.

Section 6 - Results

Descriptive Analysis of the Sample

Table 3 provides the descriptive statistics of mean and standard deviation of the dependent and explanatory variables used in the regression analysis. Notably, some variables are raw numbers while others are rates or percentages. The mean of the number of hospitalizations per 1000 long-stay resident days is 1.354. The mean of outpatient emergency department visits per 1000 long-stay resident days is 1.006. The mean of the percentage of long-stay residents with a urinary tract infection is 2.623. The mean of the percentage of high risk long-stay residents with pressure ulcers is 8.689. The mean of case-mix nurse aide staffing hours per resident per day is 2.060. The average facility nursing staff turnover rate is 56.540. The average number of beds in a facility is 113.323. The mean of the number of hospitalizations per 1000 long-stay resident days is 1.354. The average facility in my dataset has 1.006 outpatient emergency department visits per 1000 long-stay resident days. The mean of the percentage of long-stay residents with a urinary tract infection is 2.623. The average facility has a percentage of high risk long-stay residents with pressure ulcers of 8.689. The average number of case-mix total nurse staffing hours per resident per day is 3.216; whereas, the mean number of case-mix nurse aide staffing hours per resident per day is 2.06. Finally, the mean facility nursing staff turnover is 56.54.

Table 4 provides more detail on the key explanatory variables of county unemployment rate, county nursing assistant employment rate, and county nursing assistant turnover rate.

County unemployment rate ranges from 2.5 to 10.5 with a 25th percentile of 3.5 and a 75th percentile of 4.8. County nursing assistant employment rate ranges from 0.030 to 0.254 with a 25th percentile of 0.068 and a 75th percentile of 0.120. County nursing assistant turnover rate ranges from 0.737 to 1.814 with a 25th percentile of 1.041 and a 75th percentile of 1.239.

Table 5 shows the correlation between each of the three key explanatory variables. Correlations were low between all three variables with the association between county-level nursing assistant employment rate and county-level unemployment rate the highest (0.2789).

Results and Discussion of Regression Analysis

Tables 6, 7, 8, and 9 display the results of estimating the multiple regression models shown in Equations (1) through (4). Table 6 contains the regression output for Equation (1), where the county-level unemployment rate is the key explanatory variable. The results show that the relationships between the county unemployment rate and the dependent variables are mostly positive and statistically insignificant. The relationships between hospitalization rates, UTI rates, and pressure ulcer rates and the unemployment rate are positive and statistically insignificant. However, there is a statistically significant association between the number of outpatient emergency department visits per 1,000 long-stay resident days and the unemployment rate. The relationship is positive and weak. This is approximately a 6% increase in emergency department visits per 1,000 residents with each unit increase in county unemployment rate. The relationships between the staffing measures (case-mix hours) and the county unemployment rate are mostly negative and statistically insignificant. The relationship between facility-level staff turnover and unemployment rate is positive, but not statistically significant (P value=0.923). Notably, the control variables of non-profit ownership and share of Medicaid funding are associated with several dependent variables and are statistically significant. Specifically, relative to for-profit

facilities, non-profit facilities have higher quality of care. There is a positive association between the share of Medicaid funding and poor quality outcomes.

Table 7 contains the regression output for Equation (2), where the county-level nursing assistant employment rate is the key explanatory variable. Number of hospitalizations and percentage of urinary tract infections are weakly and positively associated with employment rate, while emergency department visits and percentage of pressure ulcers are weakly and negatively associated. However, none of the relationships between the five quality measures and the employment rate are statistically significant. All four case-mix staffing hour measures are weakly and negatively correlated with the employment rate. None of those relationships are statistically significant. Facility-level turnover is positively associated with employment rate. For every one unit increase in employment rate, the facility turnover rate increases by 84.66 units. This is a statistically significant relationship, indicating as the employment rate of nursing assistants rises in the surrounding county, facility-level nursing staff turnover also increases. In this regression, whether a facility resides within a hospital has a statistically significant, positive relationship with the percentage of long-stay residents with urinary tract infections. However, facility location does not have a statistically significant relationship with any other quality metric. Overall, this regression is not strong evidence for my hypothesis that as the employment rate increases in the surrounding county, the quality of care in nursing homes will decrease.

Table 8 contains the regression output for Equation (3), where the county-level nursing assistant turnover rate is the key explanatory variable. Overall, the relationships between the quality measures and county-level turnover rate were weak and statistically significant. However, the relationship between percentage of residents with pressure ulcers and turnover rate is statistically significant. For every one unit increase in county-level nursing assistant turnover

rate, there is a 5.650 unit increase in the percentage of residents with pressure ulcers. The case-mix staffing measures are also not significantly associated with the turnover rate. However, the facility-level turnover rate is related to the county-level turnover rate. This relationship is statistically significant. For every one unit increase in county-level turnover, there is a 45.04 unit increase in facility-level turnover. Understandably, the surrounding county-level turnover is closely correlated to the facility-level staff turnover. Overall, the relationships between dependent and explanatory variables is also predominantly weak and statistically insignificant in this regression equation.

Table 9 contains the regression output for Equation (4), where the county-level unemployment rate, county-level nursing assistant employment rate, and county-level nursing assistant turnover rate are the key explanatory variables. With all key explanatory variables in the same regression equation, the output does not differ very much from the outputs of Tables 6, 7, and 8. The majority of the relationships between the key explanatory variables and the dependent variables are not statistically significant. The relationship between the number of emergency department visits per 1,000 long-stay residents and county unemployment rate is significantly correlated with a weak and positive association. For every one unit increase in county-level unemployment rate, there is a 0.069 increase in the number of outpatient emergency department visits per 1,000 long-stay resident days. Additionally, the relationship between percentage of residents with pressure ulcers and county-level nursing assistant turnover rate is positive and statistically significant, indicating an increase in pressure sores with higher county-level turnover. For every one unit increase in county-level nursing assistant turnover, there is a 5.731 unit increase in the percentage of pressure ulcers among residents. While this is only one segment of the regression output, it aligns with my hypothesis that with higher nursing assistant

turnover, quality of care in nursing homes decreases. As true in each regression output, the control variables of share of resident days paid for by Medicaid and non-profit ownership are strongly related to the dependent variables. These relationships are statistically significant. In this regression equation, the relationship between facility-level turnover and the size of the facility is negative and statistically significant. This indicates that larger facilities may experience less staff turnover. Overall, while this equation accounts for all three local labor market indicators, there is still little evidence to support my hypotheses.

Overall, none of the regression analyses indicate strong evidence for my hypotheses. There are few statistically significant relationships between any of the measures of local labor market conditions and the various quality and staffing metrics. However, the regression analysis consistently yielded significant relationships between the dependent variables and Medicaid payments and non-profit ownership. These two control variables were consistently statistically related to both quality and staffing metrics.

Section 7 - Conclusions

Quality in nursing facilities has long been a policy concern. In implementing quality improvement programs, economic conditions will likely influence effectiveness. I theorized that in the state of Virginia, local labor market indicators of county-level unemployment rate, county nursing assistant employment rate, and county nursing assistant turnover rate would impact the quality of care provided by nursing facilities. I hypothesized the following three relationships between local labor market conditions and quality of care: the higher the unemployment rate in the surrounding county, the higher the quality of care in that county's nursing facilities; the higher employment rate for low wage and low-trained positions of nursing assistants in nursing facilities with the NAICS score of 6321, the lower the quality scores, relative to the size of the

county the nursing facility is located in; a higher turnover rate for a county will result in a lower scoring on the NHC quality metrics. To test these hypotheses, I ran a regression analysis with county and facility-level data.

Overall, my empirical analysis does not show strong support for my three hypotheses. While these results do not align with my hypothesis on unemployment rate, the associations between local labor market indicators and measures of nursing facility quality of care are predominantly statistically insignificant. While there is not strong evidence to support my hypotheses, the regression analysis still yields interesting information on the relationship between facility traits and quality of care. Notably, the type of ownership of a facility and the share of resident days paid for by Medicaid have statistically significant relationships with several quality of care measures. Increasingly, more non-profit nursing facilities are becoming for-profit; however, non-profit facilities provide better quality of care (Rafiei, 2022; Comondore et al, 2009). As the share of resident days paid for by Medicaid increases, quality of care decreases. I can infer that facilities that have a high share of days paid for by Medicaid are lower-funded facilities as Medicaid pays less to facilities than other insurers (Kaiser Family Foundation, 2017). Funding clearly influences quality. As VBPs pay facilities more for Medicaid residents, this relationship indicates many facilities in Virginia will be very incentivized to improve under DMAS' VBP policy.

As with any cross-sectional study, this study has limitations. In my setting, one limitation is the relatively low variation in unemployment rates in a single year from county to county as evident by **Table 4.** Given this lack of variation between counties, the lack of statistical significance in the relationship between unemployment rate and quality of care measures is

understandable. A multi-state and multi-year analysis would further illustrate how these labor market conditions affect nursing home staffing and quality of care.

Moreover, it would also be interesting to examine different dependent variables. I selected Virginia NFs initially to examine the impact of DMAS' VBP policy. The dependent variables I ultimately used in my regression align closely with the six quality metrics used by DMAS. Future research that examines different quality measures would further illustrate the role of local labor market conditions on the quality of care in nursing facilities.

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Tables:

Table 1: Program Quality Measures

Metric	Definition	Domain
Days without Minimum RN Hours	Facility reported RN staffing hours each day within a quarter. Required standards addressed	Staffing
Total Nursing Hours Per Resident Day	Total nurse staffing hours per resident day within a quarter, adjusted for case-mix.	Staffing
Number of Hospitalizations Per 1,000 Long-Stay Resident Days	Number of unplanned inpatient admissions or outpatient observation stays that occurred during a one-year period among long-stay residents.	Avoidance of Negative Care Events
Number of Outpatient Emergency Department Visits per 1,000 Long-Stay Resident Days	Number of all-cause outpatient ED visits occurring in a one-year period while the individual is a long-term NH resident.	Avoidance of Negative Care Events
Percentage of long-stay High-Risk Residents with Pressure Ulcers	Percentage of long-stay, high-risk residents with Stage II-IV or unstageable pressure ulcers.	Avoidance of Negative Care Events
Percentage of long stay Residents with a Urinary Tract Infection (UTI)	Percentage of long-stay residents who have had a UTI within the past 30 days.	Avoidance of Negative Care Events

Adapted from Virginia DMAS, 2021

Table 2: Categorization of Key Issues with VBPs Identified by Staff

Staffing	**Management**	**Compensation**	**Facility or Resources**	**Resident Care**
Staff Shortages	Chain of command	Higher wages	Equipment	Activities
Training	Quality of leadership	Fair wages	Food	Staff-resident interaction
Scheduling	Ability to listen to staff	Bonus or benefits	Procedures and processes	Generic resident care issues
Communication	Supervision			
Absenteeism	Equitable treatment			
Accountability				
Morale				
Teamwork				

Adapted from Rosen et al., 2005

Table 3: Descriptive Statistics of Dependent and Explanatory Variables (2022)

Measure	Mean	Std Deviation
Dependent Variables		
Number of hospitalizations per 1000 long-stay resident days (n=269)	1.354	.558
Number of outpatient emergency department visits per 1000 long-stay resident days (n=269)	1.006	.599
Percentage of long-stay residents with a urinary tract infection (n=282)	2.623	2.581
Percentage of high risk long-stay residents with pressure ulcers (n=281)	8.689	4.708
Case-Mix Nurse Aide Staffing Hours per Resident per Day (n=282)	2.060	.125
Case-Mix LPN Staffing Hours per Resident per Day (n=282)	.752	.064
Case-Mix RN Staffing Hours per Resident per Day (n=282)	.404	.120
Case-Mix Total Nurse Staffing Hours per Resident per Day (n=282)	3.216	.241
Facility Nursing Staff Turnover (n=216)	56.540	16.792
Key Explanatory Variables		
County Unemployment Rate	4.256	1.252
County Nursing Assistant Employment Rate	.100	.0434
County Nursing Assistant Turnover Rate	1.130	.152
Other Explanatory Variables (Controls)		
Size of Facility (Number of Beds) (n=288)	113.323	53.285
Non-Profit Ownership Status (n=278)	.442	.498
Medicaid Funding (Share of Days Paid for by Medicaid) (n=244)	61.274	21.446
Facility Location in or Outside of a Hospital (n=288)	.0278	.165

Table 4: Detailed Summary Statistics for Key Explanatory Variables (County-Level, 2021-22) (n=133)

Measure	Minimum	10th Percentile	25th Percentile	50th Percentile (Median)	75th Percentile	90th Percentile	Maximum	Mean	Std Deviation
County Unemployment Rate	2.5	3.1	3.5	3.9	4.8	5.7	10.5	4.256184	1.251802
County Nursing Assistant Employment Rate	.0300541	.0509745	.0684979	.0947602	.1203663	.1573704	.2541213	.099971	.04341
County Nursing Assistant Turnover Rate	.7374408	.9686757	1.040922	1.090357	1.238803	1.325869	1.814093	1.129506	.1518409

Table 5: Correlation Coefficient Matrix for Key Explanatory Variables

	County Unemployment Rate	County Nursing Assistant Employment Rate	County Nursing Assistant Turnover Rate
County Unemployment Rate	1.0000 (283 obs.)		
County Nursing Assistant Employment Rate	0.2789 P = 0.0000 (283 obs.)	1.0000 (283 obs.)	
County Nursing Assistant Turnover Rate	0.1977 P = 0.0008 (283 obs.)	0.2417 P = 0.0000 (283 obs.)	1.0000 (283 obs.)

Table 6: The Association Between County Unemployment Rate and Nursing Facility Quality Measures

	Number of hospitalizations per 1000 long-stay resident days	Number of outpatient emergency department visits per 1000 long-stay resident days	Percentage of long-stay residents with a urinary tract infection	Percentage of high risk long-stay residents with pressure ulcers	Case-Mix Nurse Aide Staffing Hours per Resident per Day	Case-Mix LPN Staffing Hours per Resident per Day	Case-Mix RN Staffing Hours per Resident per Day	Case-Mix Total Nurse Staffing Hours per Resident per Day	Facility Nursing Staff Turnover
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
County Unemployment Rate	0.00334	0.0576*	0.0970	0.379	-0.000132	0.000341	-0.00846	-0.00825	0.349
	(0.0283)	(0.0292)	(0.107)	(0.230)	(0.00591)	(0.00298)	(0.00554)	(0.0118)	(0.923)
Size of Facility (Number of Beds)	0.00126	-0.00130	-0.00255	0.00883	6.31e-05	5.36e-05	-5.18e-05	6.49e-05	-0.0205
	(0.000784)	(0.000810)	(0.00293)	(0.00631)	(0.000162)	(8.14e-05)	(0.000151)	(0.000323)	(0.0248)
Nonprofit-Owned	0.00105	-0.0777	0.771**	-0.191	0.0445***	-0.0161*	0.00268	0.0311	-7.758***
	(0.0805)	(0.0842)	(0.303)	(0.657)	(0.0164)	(0.00829)	(0.0155)	(0.0327)	(2.820)
Medicaid Funding (Share of Days Paid for by Medicaid)	0.00362*	0.00991***	-0.0252***	0.0174	-0.00121***	0.000828***	0.00126***	0.000871	0.0915
	(0.00198)	(0.00205)	(0.00741)	(0.0160)	(0.000393)	(0.000198)	(0.000368)	(0.000784)	(0.0669)
Facility Resides within a Hospital	0.318	0.331	1.639*	1.475	-0.0726	-0.00406	0.0202	-0.0565	11.25
	(0.278)	(0.287)	(0.946)	(2.038)	(0.0477)	(0.0240)	(0.0447)	(0.0952)	(8.399)
Number of obs.	222	222	227	227	224	224	224	224	175

Notes: Each column represents the correlation between the dependent variables and the explanatory and control variables, using an OLS model. Standard error is clustered by county. Each regression is estimated following equation # in the text.

* for P<.1, ** for P<.05, *** for P<.01

Table 7: The Association Between Nursing Assistant County-Level Staff Turnover Rate and Nursing Facility Quality Measures

	Number of hospitalizations per 1000 long-stay resident days	Number of outpatient emergency department visits per 1000 long-stay resident days	Percentage of long-stay residents with a urinary tract infection	Percentage of high risk long-stay residents with pressure ulcers	Case-Mix Nurse Aide Staffing Hours per Resident per Day	Case-Mix LPN Staffing Hours per Resident per Day	Case-Mix RN Staffing Hours per Resident per Day	Case-Mix Total Nurse Staffing Hours per Resident per Day	Total Nursing Staff Turnover
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
County Nursing Assistant Turnover Rate	0.320	0.239	-0.0489	5.650***	-0.0346	0.0235	0.0188	0.00773	45.04***
	(0.247)	(0.258)	(0.939)	(1.996)	(0.0519)	(0.0261)	(0.0489)	(0.104)	(7.381)
Size of Facility (Number of Beds)	0.00117	-0.00141*	-0.00261	0.00696	7.35e-05	4.64e-05	-5.17e-05	6.83e-05	-0.0335
	(0.000783)	(0.000818)	(0.00295)	(0.00626)	(0.000162)	(8.16e-05)	(0.000153)	(0.000324)	(0.0226)
Nonprofit-Owned	0.00787	-0.0815	0.754**	-0.108	0.0441***	-0.0158*	0.00430	0.0325	-5.515**
	(0.0800)	(0.0835)	(0.302)	(0.642)	(0.0163)	(0.00822)	(0.0154)	(0.0327)	(2.624)
Medicaid Funding (Share of Days Paid for by Medicaid)	0.00407**	0.0105***	-0.0247***	0.0275*	-0.00125***	0.000855***	0.00123***	0.000832	0.177***
	(0.00200)	(0.00209)	(0.00753)	(0.0160)	(0.000395)	(0.000199)	(0.000372)	(0.000790)	(0.0621)
Facility Resides within a Hospital	0.297	0.290	1.624*	1.194	-0.0723	-0.00430	0.0195	-0.0570	8.029
	(0.277)	(0.289)	(0.949)	(2.015)	(0.0477)	(0.0240)	(0.0449)	(0.0953)	(7.625)
Number of obs.	222	222	227	227	224	224	224	224	175

Notes: Each column represents the correlation between the dependent variables and the explanatory and control variables, using an OLS model. Standard error is clustered by county. Each regression is estimated following equation # in the text.

* for P<.1, ** for P<.05, *** for P<.01

Table 8: The Association Between County Nursing Assistant Employment Rate and Nursing Facility Quality Measures

	Number of hospitalizations per 1000 long-stay resident days	Number of outpatient emergency department visits per 1000 long-stay resident days	Percentage of long-stay residents with a urinary tract infection	Percentage of high risk long-stay residents with pressure ulcers	Case-Mix Nurse Aide Staffing Hours per Resident per Day	Case-Mix LPN Staffing Hours per Resident per Day	Case-Mix RN Staffing Hours per Resident per Day	Case-Mix Total Nurse Staffing Hours per Resident per Day	Total Nursing Staff Turnover
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
County Nursing Assistant Employment Rate	1.351	-0.775	3.763	-2.870	-0.178	-0.00666	-0.134	-0.319	84.66***
	(0.928)	(0.971)	(3.523)	(7.636)	(0.195)	(0.0983)	(0.184)	(0.390)	(30.96)
Size of Facility (Number of Beds)	0.000932	-0.00116	-0.00353	0.00921	0.000106	5.50e-05	-1.42e-05	0.000147	-0.0409
	(0.000811)	(0.000849)	(0.00305)	(0.00660)	(0.000168)	(8.46e-05)	(0.000158)	(0.000335)	(0.0254)
Nonprofit-Owned	-0.0160	-0.0776	0.710**	-0.217	0.0464***	-0.0161*	0.00538	0.0357	-8.697***
	(0.0805)	(0.0842)	(0.303)	(0.657)	(0.0164)	(0.00829)	(0.0155)	(0.0328)	(2.820)
Medicaid Funding (Share of Days Paid for by Medicaid)	0.00392**	0.0100***	-0.0239***	0.0188	-0.00126***	0.000828***	0.00117***	0.000744	0.116*
	(0.00198)	(0.00207)	(0.00742)	(0.0161)	(0.000394)	(0.000198)	(0.000371)	(0.000786)	(0.0661)
Facility Resides within a Hospital	0.343	0.289	1.699*	1.350	-0.0759	-0.00416	0.0172	-0.0629	12.61
	(0.277)	(0.289)	(0.277)	(2.055)	(0.0477)	(0.0241)	(0.0450)	(0.0954)	(8.238)
Number of obs.	222	222	227	227	224	224	224	224	175

Notes: Each column represents the correlation between the dependent variables and the explanatory and control variables, using an OLS model. Standard error is clustered by county. Each regression is estimated following equation # in the text.

* for P<.1, ** for P<.05, *** for P<.01

Table 9: The Association Between County Unemployment Rate, Nursing Assistant County-Level Staff Turnover Rate, and County Nursing Assistant Employment Rate and Nursing Facility Quality Measures

	Number of hospitalizations per 1000 long-stay resident days	Number of outpatient emergency department visits per 1000 long-stay resident days	Percentage of long-stay residents with a urinary tract infection	Percentage of high risk long-stay residents with pressure ulcers	Case-Mix Nurse Aide Staffing Hours per Resident per Day	Case-Mix LPN Staffing Hours per Resident per Day	Case-Mix RN Staffing Hours per Resident per Day	Case-Mix Total Nurse Staffing Hours per Resident per Day	Total Nursing Staff Turnover
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
County Unemployment Rate	-0.0148	0.0690**	0.0730	0.369	0.00215	7.72e-05	-0.00852	-0.00629	-0.995
	(0.0300)	(0.0310)	(0.114)	(0.241)	(0.00629)	(0.00317)	(0.00590)	(0.0126)	(0.869)
County Nursing Assistant Employment Rate	1.283	-1.683	3.304	-11.47	-0.178	-0.0272	-0.0750	-0.281	56.23*
	(0.995)	(1.030)	(3.783)	(8.004)	(0.209)	(0.105)	(0.196)	(0.418)	(29.98)
County Nursing Assistant Turnover Rate	0.269	0.224	-0.361	5.731***	-0.0281	0.0249	0.0368	0.0337	43.47***
	(0.256)	(0.265)	(0.971)	(2.055)	(0.0537)	(0.0270)	(0.0504)	(0.107)	(7.594)
Size of Facility (Number of Beds)	0.000862	-0.000948	-0.00326	0.0100	0.000116	5.25e-05	-4.50e-05	0.000123	-0.0474**
	(0.000819)	(0.000847)	(0.00308)	(0.00652)	(0.000170)	(8.55e-05)	(0.000159)	(0.000339)	(0.0235)
Nonprofit-Owned	-0.0113	-0.0501	0.718**	0.0908	0.0463***	-0.0155*	0.00396	0.0347	-6.505**
	(0.0814)	(0.0842)	(0.307)	(0.651)	(0.0166)	(0.00836)	(0.0156)	(0.0332)	(2.655)
Medicaid Funding (Share of Days Paid for by Medicaid)	0.00435**	0.00979***	-0.0249***	0.0232	-0.00130***	0.000850***	0.00128***	0.000826	0.192***
	(0.00202)	(0.00209)	(0.00761)	(0.0161)	(0.000402)	(0.000203)	(0.000377)	(0.000804)	(0.0623)
Facility Resides within a Hospital	0.319	0.289	1.716*	1.021	-0.0758	-0.00482	0.0184	-0.0622	9.073
	(0.278)	(0.288)	(0.953)	(2.016)	(0.0480)	(0.0242)	(0.0450)	(0.0959)	(7.602)
Number of obs.	222	222	227	227	224	224	224	224	175

Notes: Each column represents the correlation between the dependent variables and the explanatory and control variables, using an OLS model. Standard error is clustered by county. Each regression is estimated following equation # in the text.

* for P<.1, ** for P<.05, *** for P<.01

Appendix A - Prior Evidence on VBP Effects on Quality

Existing literature evaluates the impact of VBP policies. Qualitative and mixed-method studies examine the impact of VBP programs on various facilities and respondents. The following articles study the response from healthcare facilities to the introduction of a VBP policy. Additionally, a separate literature examines specific strategies for quality improvement (QI) in healthcare facilities. Facilities use quality improvement strategies as a method to perform well in VBP policies. Below, I outline how facilities approach improving quality of care via specific QI strategies.

Literature on Value-Based Payment Models

To find literature relevant to my own research, I conducted a literature review. I began searching primarily PubMed and Google Scholar, using key terms such as "qualitative," "semi structured interviews," "Value-based payment," and "pay-for-performance." Of the eight qualitative articles reviewed, four used semi-structured in-person interviews (Damberg, 2019 ; Trude, 2006; Lawrence, 2020; Wu, Cater, and Pines, 2019), two used phone interviews (Bokhour, 2006; Khullar, 2021), and one used focus groups (O'Grady, 2020). Length of interviews range from 35 minutes (Bokhour, 2006) to an hour and a half (O'Grady, 2020). Researchers commonly used software to extract key themes from interview transcripts and used transcription software to dictate their in-person interviews. Selection of participants ranged from random sampling (Damberg, 2019; Khullar, 2021) to hand-selected participants or volunteers (Bokhour, 2006).

Bokhour (2006) conducted a single-state study in Massachusetts, using semi structured phone interviews (Bokhour, 2006). Interviewers used an interview guide with suggested questions and areas of interest. The focus was on physician responses and opinions on

pay-for-performance policies. The interviews revealed that clinicians had mixed opinions on quality incentive programs (Bokhour, 2006). Providers expressed that they did not feel in control over attaining quality targets, and while they saw quality incentives as potential agents for change, saw the quantification and measurement of quality as inconsistent and problematic (Bokhour, 2006). The author concludes that the physicians feel the operating environment of pay-for-performance policies is complex and confusing (Bokhour, 2006). Feasibility and effectiveness are strong concerns for implementing a pay-for-performance policy.

Khullar et al (2021) similarly investigated physicians' views on VBPs, specifically the Merit-Based Incentive Payment System (MIPS). MIPS is a Medicare value-based purchasing system, focusing on clinicians. Interviewers conducted semi structured telephone interviews with thirty leaders from physician practices, including specialities of primary care and general surgery (Khullar et al, 2021). Interviewees were selected first through the use of the Medical Group Management Association's membership database to determine eligible individuals then random selection (Khullar et al, 2021). Similar to Bokhour, Khullar's findings indicate that physicians resent the amount of time and energy many VBPs require. With MIPS, clinicians were required to report their own data, and respondents noted considerable time and cost associated with using the technology required to report to MIPS (Khullar et al, 2021). Overall, physicians voiced that the burden of VBP might outweigh the benefits.

O'Grady et al (2020) interviewed five focus groups of substance abuse disorder treatment providers about VBP implementation. They posed three main questions: "How are you viewing changes in the healthcare system toward VBP and what are the impacts of these changes on you as a SUD service provider? How are you preparing your staff and organization to meet the challenges? What assistance do you need from the State?" (O'Grady, 2020). Respondents noted

competing demands between providers and insurance as well as confusion and overwhelmed administrators (O'Grady, 2020). Overall, providers voiced that they need support and open channels of communication from administrators in order to successfully implement a VBP.

Wu, Cater, and Pines (2019) examine VBP models in emergency medicine. Respondents voiced concerns over effectiveness and feasibility of VBPs in emergency departments (Wu, Cater, and Pines, 2019). The study concludes that there is an opportunity for cost reduction with the implementation of a VBP in emergency departments; however, respondents voiced concern over implementation, administrative burden, and insufficient income (Wu, Cater, and Pines, 2019). Interviewees also feared a loss of autonomy for care providers and a decrease in care compensations under a VBP model (Wu, Cater, and Pines, 2019). Overall, like many studies in the available literature, Wu, Cater, and Pines' study adds to the voices of clinicians who have concerns over VBP implementation in their facilities.

Trude's study (2006) was multi-state across twelve metropolitan areas interviewing executives from thirty-five health plans. The in-person interviews revealed that most insurance companies are planning on introducing pay-for-performance models for physicians and hospitals (Trude, 2006). At the time of the study, there were no standardized measures or metrics for pay-for-performance models and considerable variation existed across facilities and different health plans, reflecting local conditions (Trude, 2006). Providers felt standardization of quality metrics would greatly improve their ability to measure facilities' performance, and respondents suggested federal legislation may be the best path forward in that goal (Trude, 2006). Overall, providers were hoping to implement pay-for-performance models but had suggestions for tailoring the models to fix arising problems.

Damberg et al (2019), like Trude's study, present insurance providers' opinions on VBPs. Interviewing forty physician organizations, the in-person interviews followed by a survey on cost reduction sought to answer the following questions: "Do physician organizations feel VBPs increase quality of care? What are the effects of VBP on costs?" (Damberg et al, 2019). Respondents voiced challenges with IT systems, physician understanding of programs, and VBPs for specialties outside of organizations (Damberg et al, 2019). The article concludes by suggesting physician organizations increase financial incentives, engage specialists in redesigning care under VBPs, strengthen exchange of information with physicians (Damberg et al, 2019). The results of this study align closely with physicians' concerns and issues in the existing literature. Interestingly, where physicians feel the need for increased information sharing, so do insurance providers. While this study identified areas for improvement, it is encouraging that both insurance providers and clinicians (as evidenced by the literature) seem to be aware of the challenges of VBPs.

Lawrence et al (2020) examines intake and evaluation in nursing facilities in the context of VBPs. These semi structured in-person interviews focused on three skilled nursing facilities in one state with eighteen clinicians as interviewees (Lawrence et al, 2020). Of the articles included in this literature review, this article most closely mirrors my own research's setting of nursing facilities. The term "clinician" in this article includes physicians, nurses, therapists, and liaisons (Lawrence et al, 2020). Lawrence et al (2020) seek to understand how VBP reforms hamper or aid how nursing facilities evaluate older adult residents who may require hospitalization. The results aligned closely with Khullar and Bokhour's findings; confusion and time demands resulted in less motivation to comply with or participate in VBPs. Informants noted concerns with inconsistency and inadequacy in the transfer of medical documents and that payment

models encourage hospitals to discharge patients quickly (Lawrence et al, 2020). Overall, informants noted concern and apprehension about the influence of VBPs on the screening and admission of older adults into nursing facilities.

Overall, despite differences in methodology, the articles had several similar themes and conclusions. Respondents were concerned with the time and effort that many VBPs require from clinicians to collect performance data. While Virginia DMAS is responsible for data collection under the Nursing Facility Value-Based Purchasing Methodology, additional time and energy hampers successful VBP implementation. Coordination between administrators and clinicians is also necessary for smooth implementation, requiring additional labor from participating facilities (Lawrence, 2020).

Differences in the literature's results seem to stem from the type of facility chosen and respondents. The type of facility surveyed may result in different VBP opinions. For example, substance abuse treatment facility employees (O'Grady, 2020) and skilled nursing facility employees (Lawrence, 2021) may have very different experiences with and opinions on VBPs. How insurance companies feel (Damberg, 2019; Trude, 2006) is different from how physicians (Bokhour, 2006; Khullar, 2021) feel, which is different from how nurses and administrators feel (Lawrence, 2020). These individual groups are also not necessarily homogeneous within themselves. Physicians appear to be less likely to have positive attitudes towards VBPs, many citing concerns over reimbursement rates as reason for their hesitancy (Bokhour, 2006; Khullar, 2021).

Literature on Quality Improvement Strategies

I conducted a scan of the literature surrounding quality improvement (QI) initiatives and strategies. Quality improvement initiatives are a framework "used to systematically improve

care" (Centers for Medicare & Medicaid Services, 2021). The purpose of this review was to familiarize myself with what quality improvement strategies consisted of and the language and procedures around quality improvement. Below, I use Toles, et al's (2021) scoping review to unpack specific QI strategies used in nursing facilities, specifically to reduce rates of pressure ulcers. Then, I revisit Toles' review with a focus on staffing and how it can affect QI strategies.

In a scoping review, Toles et al (2021) explore the various strategies employed to improve quality of care in nursing homes. Toles notes the most common QI strategies were "in-person training (n = 55), technical assistance (n = 50), tools/toolkits, (n = 47), audit and feedback (n = 40), and implementation teams (n = 39)" (Toles et al, 2021). Many facilities combined strategies in their attempts to increase quality. Leeman et al (2015) define in-person training as "pre-planned educational and/or skill-building sessions typically provided within group settings" and technical assistance is "interactive support that is individualized to the specific needs of individuals or teams" (Leeman et al, 2015). Tools or toolkits are considered "informational resources designed to organize, summarize, and/or communicate knowledge (Leeman et al, 2015)." Toles at al note, however, that they must include "any electronic or print resource that practitioners might use to plan, implement, or evaluate an intervention" (Toles et al, 2021). Audit and feedback is defined as "The support system's strategy of monitoring and providing feedback on delivery system performance" (Leeman et al, 2015). Toles et al also reference Powell et al's (2015) work on defining implementation teams as "[t]eams that were established and supported to plan and guide implementation" (Powell et al, 2015; Toles et al, 2021). These strategies are most common in QI initiatives.

Table 2 from Toles' review details each of the fifty-two articles' setting, problem, project or study name, number of QI strategies, implementation outcomes, and outcomes (Toles et al,

2021). One metric DMAS will be evaluating nursing facilities on is pressure ulcer rates. The incidence of pressure ulcers can be a proximation of overall quality of care. In articles examining pressure ulcer rates in nursing homes, the authors found QI strategies of on-time programs, collaboration with a QIO, real-time feedback, on-site consultations, and collaborative models (Olsho, 2014; Abel et al, 2005; Rosen et al, 2005; Rantz et al, 2011; Baier et al, 2003). These terms and concepts are explained below.

Olsho et al. (2014) examines the effectiveness of On-Time programs on four nursing homes in New York on pressure ulcer rates. The On-Time program is a report-based QI intervention, created by the CDS for nursing homes. It centers on team-based approaches to care and uses Health Information Technology (HIT) systems to generate weekly reports. These facilities used the pressure ulcer prevention module of the On-Time program. The weekly reports profiled residents with pressure ulcers and their changeable risk factors like nutrition status (Olsho et al, 2014). This allows the care team to target their interventions to the specific needs of the resident and observe the outcome on pressure ulcers. The study found “large and statistically significant reductions in pressure ulcer incidences with implementation of core On-Time components” (Olsho et al, 2014).

Abel et al. (2005) also examined pressure ulcers through measuring the impact of process of care system changes when facilities collaborated with a Quality Improvement Organization (QIO) program in Texas. The federal QIO program is a national quality improvement effort. CMS defines a QIO as a “ group of health quality experts, clinicians, and consumers organized to improve the quality of care delivered to people with Medicare” (Centers for Medicare & Medicaid Services, August 2022). The facilities in this study used implementation of process of care system changes in collaboration with a state QIO (named the Texas Medical Foundation) in

order to improve their pressure ulcer prevention practices (Abel et al, 2005). Partnering with a QIO brings in an implementation team to the facility, who evaluated the current practices and provided tools and education for improvement. The study selected twelve quality indicators to judge pressure ulcer incidence improvement on, and, overall, the facilities' performances significantly increased in 8 of those indicators (Abel et al, 2005). Using the implementation team from Texas Medical Foundation proved to help reduce pressure ulcer incidence.

Rosen et al (2005) studied two nursing homes engaging in QI strategies focused on "staff empowerment, enhanced ability through training, and financial incentives" (Rosen et al, 2005). The facilities saw little measurable success. Eighteen months later, the facilities added real-time feedback to their QI strategies. Employees and residents gave detailed feedback and reports of residents quality of life at six-month intervals (Rosen et al, 2005). The inclusion of this feedback in the form of structured feedback greatly reduced the incidence of pressure ulcers in one of the two nursing homes, which had been having high ulcer rates (Rosen et al, 2005). This study revealed the need for communication and continual assessment of QI strategies. The original strategies were ineffective on their own. However, when coupled with the real-time feedback of structured assessments every six months, the staff empowerment, extra training, and financial incentives greatly improved quality of care.

Rantz el al (2011) conducted a randomized multi-level intervention consisting of on-site consultations from expert nurses in gerontology for two years (Rantz et al, 2011). The study had both an intervention group, which received monthly consultations and a control group, which engaged in no QI strategies (Rantz et al, 2011). The two year consultations were meant to "build organizational capacity to create and sustain improvement in quality of care" (Rantz et al, 2011). The experimental group saw reductions in pressure ulcer rates. Additionally, residents of the

experimental group lost weight (Rantz et al, 2011). This is similar to an implementation team approach to QI; however, this study introduced monthly meetings and guidance tailored to each facility. Overall, this strategy, though labor-intensive for the expert nurses, yielded statistically significant quality improvement and was low-cost (Rantz et al, 2011). The authors concluded that nursing facilities with difficulties with quality of care need expert help and continuous consultation in order to build capacity to implement QI strategies on their own in the future.

Baier et al (2003) examines the use of a collaborative model of QI improvement for pressure ulcer rates. Quality improvement teams from 29 nursing facilities in New Jersey, Pennsylvania, and Rhode Island attended workshops centered on improving quality of care (Baier et al, 2003). The teams "attended a series of workshops to review clinical guidelines and quality improvement principles and to share best practices, and worked one-on-one with mentors to implement quality improvement techniques and to collect data independently" (Baier et al, 2003). This approach proved effective with six out of eight prevention process measures significantly improving; these process measures were based on the Agency for Healthcare Research and Quality (AHRQ) guidelines (Baier et al, 2003). This collaborative model includes training, mentorship, and data collection.

Largely, authors quantifying the results of QI strategies found a need for the literature to become more specific. They found "only 27% of studies examined improvement with specific interventions or practice guidelines; for example, in a QI program to improve pain management" (Toles et al, 2021). Toles' (2021) scoping review identified a need for more study in how quality improvement unfolds in nursing facilities as "the disproportionate focus on QI strategies used by those external to NHs, as compared to those used by staff in NHs, may be an area for improvement" (Toles et al, 2021). The studies discuss using QI strategies, but fail to name the

specific issue in quality these improvements are targeted towards as facilities often employ quality improvement strategies to broadly improve overall quality. If a nursing facility administrator was hoping to use a QI strategy to target specifically bed sores/pressure ulcers, for example, there is no one strategy that has been proven successful for that specific metric of quality of care. QI strategies appear to target quality of care as a whole rather than specific metrics.

However, while Toles et al (2021) note a need for specificity in future literature examining QI strategies, the literature shows these programs are effective. Facilities saw reductions in pressure ulcers and emergency department visits as " the more commonly improved resident outcomes were pressure ulcers (N = 5), hospital transfers (N = 3), and resident falls (N = 2)" (Toles et al, 2021). The literature assures that QI strategies work, but available studies fail to clearly identify which strategies are best for specific challenges to quality of care. More research appears to be needed to identify which strategies work to increase different metrics of quality of care.