

Service Chains' Operational Strategies: Standardization or Customization? Evidence from the Nursing Home Industry

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Problem definition: We investigate how the Degree of Standardization (DoS) across service chain-belonging units impacts units' performance outcomes. We study this question in the nursing home industry. More specifically, we study the DoS in three operational dimensions: customer mix, service offering, and service delivery, and its impact on three nursing home outcomes: financial performance, clinical outcome, and resident welfare. **Academic/practical relevance:** All service chains must decide how unique or standardized each of their units should be, but it is unclear how this decision affects units' performance outcomes. We assess standardization strategies in multiple operational dimensions in chain-belonging nursing homes and their impact on important operational outcomes, and generalize our findings to other service industries. **Methodology:** We use a panel data set covering eleven years (2005 – 2015) of comprehensive measurements of all nursing homes in the U.S. We estimate the relationships between the DoS and important nursing home outcomes using fixed effect models with instrumental variables and clustered standard errors. **Results:** We find that nursing home chains need to (1) customize service delivery and standardize customer mix across units to improve financial performance; (2) standardize customer mix to improve clinical outcome; and (3) customize service delivery to enhance resident welfare. **Managerial implications:** To our knowledge, this study is the first systematic multi-dimensional assessment of multi-unit service firms' standardization strategies from a chain perspective. Our results guide nursing home chains in their (1) strategies of within-chain standardization, and (2) investment decisions in acquiring new properties. Our results also provide broader managerial insights for service chains' standardization strategies and merging and acquisition activities.

Key words: Service Chain, Standardization, Service Operations, Nursing Home, Operational Performance

1. Introduction

Around 70% of activities in the service sector are performed by chain organizations rather than single-unit firms. (Gupta et al. 2015). For example, in the U.S., 33.6% of restaurants in 2018, and more than 60% of hotels in 2019, were chain-affiliated. Thus, service chains, which we define as *multi-unit (a unit refers to one individual facility within a chain organization) firms in service industries owned, leased, or otherwise controlled or managed by a single business entity*, are important analytical components of modern service industries.

Every service chain needs to design strategies determining how standardized the belonging units should be, which systematically affects units' operating outcomes. Some chains rigidly replicate their units' services and processes (Winter and Szulanski 2001): McDonald's exceptional standardization achieves high efficiency, predictability, and control. Other chains differentiate their units: each property in the hotel chain Six Senses Resorts and Spas is structurally flexible, with locally-inspired service experiences targeting its niche market. Between these two extremes, many chains operate in the middle of the "degree of standardization" scale. In the service sector, a standardized strategy is often associated with high efficiency and control (Sandoff 2005), brand consistency and predictability (Winter and Szulanski 2001), decreased variations, errors, and wastes (Gawande 2009), reduced coordination costs (Shapiro and Varian 1999), and faster inter-organizational learning (Ingram and Baum 2001). In contrast, a customized strategy empowers each unit to adjust its practice to fit its local demand, resources, and competition. Customization is also positively linked with perceived service quality and customer satisfaction and loyalty (Coelho and Henseler 2012).

However, it is still unclear how standardized across units a service chain should be. Our research investigates the relationship between the degree of standardization (DoS) across units and their performance outcomes. Moreover, we argue that DoS decisions should be made in multiple operational dimensions. From a service value chain perspective (Alter 2008), a chain should first explore the demand variation across units to decide whether to target the same customer groups at the unit level. Based on potential demand, the chain then determines what services to offer in each unit and how to deliver those offerings to the customers. Thus, customer mix, service offering, and service delivery are crucial aspects for DoS decisions. Many previous studies have assessed the relationship between standardization strategies and operating outcomes (Winter and Szulanski 2001, Wang et al. 2010, Kasiri et al. 2017). However, most focus only on single aspects of standardization strategies, thus neglecting the trade-offs between multiple operational dimensions. For example, to improve financial outcomes, a service chain can either standardize delivery methods to improve efficiency and decrease cost, or customize service offerings to boost revenue. While each approach is likely to affect other operational outcomes such as service quality and customer satisfaction, how to choose the most viable strategy remains a question worth exploring. As far as we know, no study has provided empirical evidence in multiple dimensions. Our research investigates how service chains' standardization strategies in three operational dimensions – customer mix, service offering, and service delivery – impact chains' performance outcomes.

Service chain standardization strategies are also critical for unexpected crises. The outbreak of the 2019 novel coronavirus (COVID-19) significantly disrupted service chain operations and forced chain operators in restaurants, hotels, airlines, nursing homes, etc. to face new DoS decisions. For example, many restaurant chains closed some units but kept others open in less impacted geographic

areas for off-premise operations only (take out, delivery, and curbside pickup). In nursing homes, residents are older adults often with underlying chronic medical conditions, at highest risk from COVID-19. Besides standard infection control, all nursing home chains are obligated to follow the standardized guidance from CMS and the CDC, such as the use of personal protective equipment and restriction on nonessential medical staff and all visitors. Several nursing home chains facilitate some units with telemedicine devices to help residents receive remote clinical care, while other chains educate residents in digital communication to stay connected during quarantine.

We empirically investigate the DoS in service chains in the nursing home industry. According to the CDC, about 60% of the total 15,600 nursing homes are chain operated. Nursing home operations are unique among service entities since they address both clinical and long-term residential needs, requiring a balanced DoS. On the one hand, standardization promotes clinical quality (Chandrasekaran et al. 2012) and cost efficiency (Cichos et al. 2017), which nursing homes need to operate in their low margin industry. On the other hand, customization can improve resident welfare by providing personalized care. This chain-dominated industry, whose success naturally depends on the design of standardization strategies, makes a perfect setting for our study.

Using data from eleven years (2005 – 2015) of comprehensive measurements of all nursing homes certified by CMS, we investigate the relationship between important nursing home outcomes and the DoS in three operational dimensions: customer mix is measured by the percentage of Medicaid residents; service offering by whether or not a nursing home facility has a special care unit; and service delivery by staffing ratio. We use these measurements to calculate our explanatory variables, DoS, which are continuous variables measuring the normalized deviation between each facility's practice and the chain norm.

The outcomes of interest are financial performance, clinical outcome, and resident welfare. Financial performance is measured by the operating margin (Park et al. 2011). Clinical outcome is measured by deficiency citations in clinical areas (Lu and Lu 2016). The number of deficiency citations reflects a facility's level of compliance to the minimum requirements of federal legislation, and is reflected in the CMS Five-Star Quality Rating System for nursing homes. CMS also refers to deficiency citations as a proxy for overall quality of care (Lu and Wedig 2013). Resident welfare is measured by deficiency citations in the following areas: dietary services, quality of care, resident assessment, quality of life, resident behavior and facility practices, admission, transfer, and discharge rights, and resident rights. Residents' quality of life is crucial for nursing homes to build a reputation, receive reimbursement and government support, and attract more customers.

We initiate an unique method to identify nursing home chains: only facilities that bear the same chain names are included in our sample, because such facilities' conduct will impact the chain's reputation; thus, standardization strategies are crucial for these chains. If the chain-belonging

facilities do not bear the chain's name, as is the case in many nursing home chains, then the chain may not necessarily consider within-chain standardization strategies.

We adopt an instrumental variable (IV) approach and use lagged endogenous variables as IVs in our model (Wang and Bellemare 2019, Reed 2015, Tan and Netessine 2014). After sample selection, 3584 nursing home facilities nested within 192 chains are included in the final analysis. When controlling for local market effects, our results show that: (1) to improve chain-belonging properties' financial performance, nursing home chains should standardize customer mix and customize service delivery across belonging units; (2) to improve clinical outcome, nursing home chains should standardize customer mix. A marginally significant finding suggests that nursing home chains customize service delivery to improve resident welfare.

To our knowledge, our study is the first systematic multi-dimensional assessment of service firms' standardization strategies from a chain perspective. As the DoS in the operational dimensions of customer mix, service offering, and service delivery presents in the same models simultaneously, the trade-offs among them, neglected in previous studies, are accounted for. We also establish a novel method to identify customer-recognizable chains. We argue that when facilities bear the same chain name, DoS decisions across facilities are more likely to impact customers' perception and performance outcomes. Hence, with this more accurate definition of chains, our analysis results are robust and yield applicable implications for service chains' standardization strategies.

Our study also provides crucial implications for industry practitioners and policymakers. First, a customized strategy in service delivery is associated with improved financial efficiency and resident welfare for chain-belonging nursing home facilities; also, a standardized strategy in customer mix is proven to enhance chain-belonging facilities' financial efficiency and clinical outcome. Practitioners should prioritize the operational goals of the organization before making DoS decisions. On the policy level, since merging and acquisition are still nursing home chains' dominant expansion methods, managing the newly acquired facilities becomes a question worth exploring (Banaszak-Holl et al. 2006). Our findings can help CMS establish policies regarding post-acquisition DoS strategies for new facilities' operating practices. Our findings have been reviewed by several nursing home industry leaders. Upon recognizing the implications stated above, they also pointed out that our results provide valuable guidance for nursing home chain investment strategies: when acquiring new properties, chains can rely on our findings to choose facilities that have similar or different customer mix, service offering, and service delivery strategies compared to the chain norm.

The rest of our paper is organized as follows: in Section 2, we introduce both the academic and practical background of our study. Section 3 presents our data exploration and model design and develops our hypothesis. Section 4 presents our results. In Section 5, we highlight our contribution and discuss its implications.

2. Background and Prior Research

In this section, we summarize previous work on standardization and its relation to within-chain, healthcare, and nursing home settings.

2.1. Standardization as a Strategy

Replication, defined as “the creation and operation of a large number of similar units that deliver a product or perform a service” (Winter and Szulanski 2001), is a widely-used strategy in service chains. It is believed that the superior benefit of replication and knowledge transfer results in a competitive advantage for chains (Argote et al. 2003). The challenge of successfully replicating units raises two questions: should a chain standardize or customize its practices across its units? Which operations should be standardized, which customized?

2.1.1. Whether to Standardize or Customize Many researchers believe that chains should allow units to adapt their practices to “fit the salient characteristics of host environments to maximize unit effectiveness” (Williams 2007, Winter et al. 2012). The principle of Ockham’s razor (Smart 1984), stated as “entities should not be multiplied without necessity,” suggests that each chain unit’s optimal outcome depends on its altering from the chain norm by exactly the right amount contingent to its local context. Extreme uniformity prevents a chain from adapting to local variations and reaching its optimal performance. Other scholars argue that by modifying complex templates, chains risk overwhelming the benefits of local adaptation; thus practices should be strictly standardized (Jensen and Szulanski 2007).

2.1.2. What to Standardize, What to Customize Winter and Szulanski (2001) argue that instead of rigidly standardizing overall operations, standardization should be focused on the replicable traits of a business model. The commonly accepted conclusion is that chain-belonging units should be neither completely customized nor strictly copied.

We augment replication strategy theories by providing empirical answers to the following questions: (1) to what degree should multi-unit service firms standardize across units? (2) What operational aspects should be standardized or customized? (3) How do these decisions impact firms’ various operational outcomes?

The application of replication strategies has been studied in many service contexts, such as the coffee (Yaniv and Brock 2008), banking (Winter and Szulanski 2001), and cruise industries (Weaver 2005). Wang et al. (2010) investigate how standardized and customized service offerings affect customer satisfaction, concluding that a mix of both negatively affects customer satisfaction in the auto repair industry. In contrast, Kasiri et al. (2017) study the impacts of standardized and customized service offerings on customer satisfaction and loyalty in the hotel, healthcare, and education industries, finding that a balance of both is crucial to improve customer satisfaction.

Ding and Keh (2016) study the impact of DoS on customer satisfaction, customer perceived risk, and customer perceived control in hotels and fitness clubs.

While most research focuses on standardization strategies in only one operational dimension, we investigate DoS in multiple dimensions simultaneously: customer mix, service offering, and service delivery. For example, in response to local demands, large service chains can customize customer mix across units, or they can choose to serve a similar customer mix to save staff training and adjustment costs. Standardizing service offering enables a chain to reduce costs through scale economy and to satisfy a broader range of demand, thus increasing customer satisfaction, hence revenue. Customizing service delivery methods gives customers a personalized experience, but standardizing them satisfies customers who expect consistency and predictability. In this study, we examine DoS decisions in each of these three dimensions, controlling to discern the impact of each on performance outcomes in relation to the other two.

2.2. Within-chain Standardization and Its Systematic Effects on Operating Outcomes

Several theories in organization strategy and economics can be relied on when interpreting chain standardization strategies and their systematic effects on chain performance.

2.2.1. Knowledge Transfer Knowledge transfer in organizations is defined as the “process through which one unit is affected by the experience of another” (Argote and Ingram 2000). In service sectors, multi-unit organizations are found to enhance performance through inter-unit knowledge transfer (Darr et al. 1995). Within a chain, the units may transfer skills and knowledge such as the use of specific technologies, R&D capabilities, marketing skills, and administrative procedures. In nursing home chains, effective skills and knowledge generated from practices in one facility can be transferred to another; when necessary, employees may even work for multiple properties to increase staffing flexibility. As the knowledge of effective practices is transferred between facilities, the chain will become standardized and enhance its overall performance outcomes.

However, standardization from knowledge transfer is not always beneficial. In the nursing home industry, ownership and chain affiliation change frequently (Harrington et al. 2011). After merger and acquisition, over-confident corporate managers may force newly acquired facilities to adopt inappropriate practices (Greve 1999); skills and knowledge transferred to improve one operation outcome, such as cost reduction, may harm another, such as resident welfare.

2.2.2. Economy of Scale In classical economics, the concept “economy of scale” refers to the cost reductions that occur when companies increase production, or lower per-unit cost by purchasing large quantities. In the current context, it can be generalized to multi-unit chain organizations having the scale and power to achieve resources, perform administrative tasks at lower costs, or

negotiate for preferential market share. For example, if a nursing home chain wants to implement special care units in multiple facilities, it can negotiate lower prices with medical device suppliers and train employees efficiently in one program. Also, since using skilled nursing facilities for post-acute care has grown substantially, a multi-unit chain is in a better position than independent homes to collaborate with local hospitals and negotiate for customers. If belonging facilities align with the chain's norms in terms of service offering and customer mix, then each facility can achieve cost savings and benefit from an ample customer pool, which in turn enhances chain outcomes.

However, a larger scale does not always lead to better performance. Studies have shown that due mainly to cost constraints, larger nursing home chains have more quality problems than independent homes (Harrington et al. 2001, Kitchener et al. 2008); most poorly performing U.S. nursing homes tend to be owned by large for-profit chains.

2.2.3. Contingency Theory Contingency theory claims that an organization must maximize performance by minimizing the effects of varying constraints (Van de Ven et al. 2013). It argues that there is no “best way” to make decisions; instead, the optimal approach is contingent upon various internal and external situations. Building on this theory, Ketokivi (2006) states that organizations need to adapt and choose operation strategies that best fit task environments. Contingency theory provides a theoretical foundation for chains adopting a more customized strategy. Externally, nursing homes operate in different environments, due to variations in local population, economic development status, law and regulations, and resource accessibility. For example, a majority of U.S. states have established their own minimum staffing requirements for nursing homes. A multi-state nursing home chain may allow facilities in each state to maintain their own staffing level to satisfy operation needs and local requirements. Internally, chain-belonging nursing homes have varied resident profiles requiring customized practices contingent on different care needs.

2.3. Standardization in Healthcare Settings

Since a substantial part of a nursing home's daily operations is to provide clinical care for residents, it is necessary to discuss standardization strategies in healthcare settings.

Strategies of standardization are widely applied in clinical care. The Institute of Medicine's (IOM) 1999 report, *To Err Is Human*, pointed out that a large number of people are injured or die due to preventable medical errors in U.S. hospitals (Donaldson et al. 2000). In response to this alarming fact, several scientifically proven protocols have been developed for common conditions to decrease medical errors. For example, CMS and The Joint Commission developed a set of core process measures for common and serious medical conditions, such as heart failure, pneumonia, and children's asthma (Chandrasekaran et al. 2012, Senot et al. 2016). As Leape (1994) points out, standardized procedures can reduce errors by “reinforcing the pattern recognition that

humans do well,” thus minimizing variation in providers’ judgment. Data shows that hospitals have significantly improved the quality of clinical care by following standard procedures (The Joint Commission 2010), such that patients’ health outcomes improve and hospital readmission rates decrease (Senot et al. 2015). Some argue that decreasing performance variance is a reasonable goal for some hospital practices (Tucker et al. 2007).

Process and procedure are not the only dimensions healthcare organizations can standardize. A common practice of operations management is to reduce outcome variations by decreasing input variations. Although service operations are often subject to a higher degree of input variability than manufacturing operations, the same concept applies (Mondschein and Weintraub 2003, Fitzsimmons et al. 2008, Buell et al. 2021). For example, Shouldice Hernia Hospital strictly standardizes its patients’ conditions, resulting in significantly lower hernia recurrences (Malik et al. 2016).

However, as standardized as procedures could be, clinical healthcare is also personal, case by case, and thus subject to variations requiring customization. In non-clinical healthcare, the recent emphasis on patient-centered care focuses on how care was delivered to and perceived by patients, arguing for interpersonal communication. Research shows that efforts to respond to patients’ unique personal needs can improve patient satisfaction (Rubin et al. 2001) and clinical outcomes (Senot et al. 2015). Thus, customization in healthcare settings is sometimes beneficial and even necessary.

2.4. Nursing Home Studies

The operations of U.S. nursing homes impose unique opportunities and challenges for standardization strategies. For example, long-term residents may develop chronic diseases, such as dementia, stroke, and diabetes mellitus, which require customized care, as do other varying personal characteristics. Facing the wave of aging baby boomers, who are more ethnically, racially and economically diverse than previous generations, long-term care facilities need to allow more flexibility in care, as boomers will want involvement in choosing the care they receive (Siberski and Siberski 2018). Residents can find living in a strictly standardized environment both constraining and dehumanizing; the quality of life decreases with extensive standardization (Kamimura et al. 2007).

However, as the third-largest segment in the U.S. healthcare industry, nursing homes operate at a surprisingly low profit margin. Since it has been demonstrated that more personalized treatment and care may drive up costs (Senot et al. 2015), customizing every aspect of daily operations is not the best approach for nursing homes. Significant multi-plant economies exist in large nursing home chains (McKay 1991), suggesting standardization can reduce costs. Also, standardization in clinical care is proven to reduce errors and improve efficiency, which in the long run reduces costs. Thus, how nursing home chains can optimally balance standardization and customization across all chain-belongs facilities is an issue that urgently needs to be addressed.

Not many nursing home studies have examined within-chain DoS. Banaszak-Holl et al. (2018) explore within-chain standardization in staffing, finding that large for-profit nursing home chains are more likely to standardize staff hours per resident day, but not investigating the impact of DoS on nursing home outcomes. In our research, we aim to uncover the relationship between the DoS in multiple operational dimensions and nursing home chains' performance outcomes.

3. Research Design and Hypothesis Development

In this section, we introduce our data and sample selection process, then establish the measurements of customer mix, service offering, and service delivery, from which we quantitatively define the explanatory variable of DoS in these dimensions. We then establish the measurements of our outcome variables and develop our hypotheses.

3.1. Data and Sample Selection

Our raw data contains eleven years of measures from more than 15,000 nursing home facilities in the U.S., and our final usable sample includes eleven years of measures from 3584 nursing home facilities nested within 192 chains (according to our chain-identifying method). In this section, we detail our data and sample selection process.

3.1.1. Data Most of our data is publicly available at LTCFocus.org, a product of the Shaping Long-Term Care in America Project being conducted at the Brown University Center for Gerontology and Healthcare Research and supported in part by the National Institute on Aging. All U.S. nursing homes certified by CMS are included, combined with data obtained directly from CMS, including annual deficiency citation reports and financial information such as annual cost, operating margin, and revenue. Thus, our data contains detailed yearly information on each nursing home's (1) facility characteristics, such as whether it is hospital-based or has any special care units; (2) resident health status and acuity level, such as average Activities of Daily Living (ADL); (3) resident demographic information; (4) resident admission information; (5) staffing level information, such as registered nurse hours per resident day; (6) the number of deficiency citations issued to the nursing home in each inspection area; and (7) nursing home financial credentials such as cost and operating margin. The period of our study covers from 2005 to 2015.

3.1.2. Sample Selection Only chain-operated nursing homes are included in our sample. Two pieces of information are available to identify nursing home chains: property owner names and facility names. In the U.S., nursing home chain ownership is complex. One owner may own facilities that belong to different chains and carry different chain names; meanwhile, facilities with similar naming patterns may belong to different chains. CMS requires only the name of the licensee of each facility, but ownership data and chain affiliation have not been accurately compiled and

maintained; some nursing homes have 5 to 7 levels of corporate ownership. Given this complexity, we identify customer-recognizable chain names, since nursing homes' reputation plays a crucial role in customers' choices, and all properties sharing the same chain keywords in their name are linked for good or ill repute. We design a two-step method to identify customer-recognizable chains, which utilizes both owner and facility names.

Step 1: We analyze naming patterns of customer-recognizable chains. Under each owner, we extract similar naming patterns using automated text analysis pairing with manual cross-validation by each of the authors. These naming patterns are used as chain identifiers. For example, multiple facilities under one owner have the word "Kindred" in their names; thus "Kindred" is identified as one of the chain identifiers. We then verify the uniqueness of each chain identifier; generic frequently appearing keywords, such as "Nursing and Rehabilitation," are omitted from chain identifier candidates. This analysis process identifies 1598 customer-recognizable chains.

Step 2: We select qualified chains. To satisfy our time-lag analysis, we select chains that have existed for at least two consecutive years; and to ensure a decent sample size to calculate within-chain variance, we select chains with at least three facilities in each existing year. Based on these criteria, 192 chains are qualified. After the selection process, our usable sample size for analysis contains 3584 nursing homes nested within 192 chains from 2005 to 2015. The unit of analysis in our study is each nursing home nested within a chain. A descriptive analysis of chains in our sample is presented in Table 1 in the online supplement.

3.2. Research Design

In this section, we establish measures for our explanatory variables, outcome variables, and control variables, respectively. In Section 3.3, we develop our hypotheses on the relationships between DoS in multiple operational dimensions and nursing homes' performance outcomes.

3.2.1. Measure Development for Explanatory Variables According to the service value chain framework (Alter 2008), a service chain needs to first explore the demand variation among different units, based on which the chain can then decide what services to offer and how to deliver these services. Thus, in our study, we estimate the impact on nursing home outcomes of the DoS in three dimensions: customer mix (CM), service offering (SO), and service delivery (SD).

Customer Mix (CM) is measured by the percentage of residents whose primary financial support is Medicaid in each nursing home facility in each year. The percentage of Medicaid residents is a suitable measure of CM since it aggregates three pieces of information. First, it represents the payment source structure in the nursing home. Second, it implies the residents' acuity level, as studies show that Medicaid residents are associated with poorer health status (Weissert and Scanlon 1985). Third, it implies the types of care needed. In the U.S., Medicare and most forms

of private health insurance cover only skilled nursing stays following a recent hospitalization up to 100 days. Medicaid, on the other hand, pays for the largest share of long-term care services. The daily care needed by long-term residents is very different from the care needed by residents recently discharged from a hospital. A facility can decide how many Medicaid residents it accepts; thus the measure of the percentage of Medicaid residents ranges from 0% to 100% .

For Facility i in Chain j in Year t , the *Customer Mix* is defined as:

$$Customer\ Mix_{ijt} = (Number\ of\ Medicaid\ Residents_{ijt} / Total\ Number\ of\ Residents_{ijt}) * 100\% , \quad (1)$$

Service Offering (SO) is measured by the representative offering in nursing homes of a special care unit (SCU). A binary variable with value 1 indicates the nursing home facility has an SCU, while 0 means the opposite, and the unit level is each facility in each year. SCUs are crucial service offerings that differentiate a nursing home from its competitors, beyond basic required services such as lodging and meals (Gruneir et al. 2007). Banaszak-Holl et al. (1996) point out that SCUs, especially dementia units, have become important service offerings for nursing homes to draw demand, and some facilities even feel “pressured” to offer this service in response to the trends. Many studies have explored how offering SCUs benefits nursing homes’ operating outcomes. For example, offering SCUs is linked to better quality care (Joyce et al. 2018), more resident social integration (Abbott et al. 2017), improved resident health (Cadigan et al. 2012), and increased occupancy level (Castle 2008). Also, SCUs are a decisive criterion for assessing whether a nursing home can provide comprehensive and complex care for residents with specific chronic conditions. Although some studies found chain-affiliated nursing homes are more likely to offer SCUs than their independent counterparts (Banaszak-Holl et al. 1996), it is unclear whether a nursing home chain should provide SCUs in a uniform manner.

For Facility i in Chain j in Year t , the *Service Offering* is defined as:

$$Service\ Offering_{ijt} = \begin{cases} 1, & \text{if Facility } i \text{ in Chain } j \text{ provides any SCU during Year } t \\ 0, & \text{if Facility } i \text{ in Chain } j \text{ provides no SCU during Year } t \end{cases} , \quad (2)$$

Service Delivery (SD) is estimated by the staffing ratio of each facility in each year. It is calculated by the registered nurse hours divided by total nurse hours per resident day, including registered nurse hours, licensed practical nurse hours, and certified nursing assistant hours. In the service sector, the adequacy and competency of staff and providers have always been irreplaceable aspects in valuing the quality of service delivery. In healthcare settings, the WHO (2018) listed workforce as one of the foundations to measure service delivery. In nursing homes, staffing impacts resident care directly as a critical component of service delivery and indirectly through staff welfare. Studies have found that nursing home service quality is impacted by both staffing hours and the relative

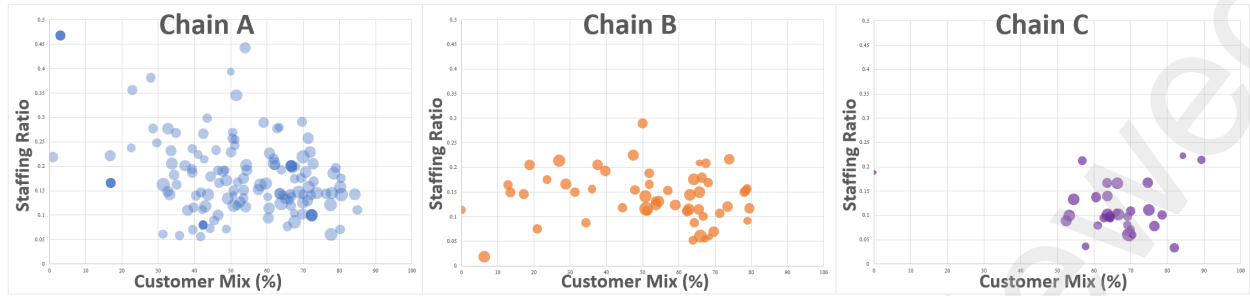


Figure 1 Chain A: Customized in both dimensions; Chain B: Standardized in one dimension while customized in another dimension; Chain C: Standardized in both dimensions.

mix of staff, with greater dependence on registered nursing staff leading to better resident health (Harrington et al. 2012). U.S. nursing homes have long suffered from inadequate staffing, and many serious quality problems can be traced back to it (Harrington et al. 2016). Higher staffing ratios of more professional staff members are often linked to better quality, but if the ratio is higher than necessary, it also means wasted staffing costs.

For Facility i in Chain j in Year t , the *Service Delivery* is defined as:

$$Service\ Delivery_{ijt} = RNhrs_{ijt} / (RNhrs_{ijt} + LPNhrs_{ijt} + CNAhrs_{ijt}), \quad (3)$$

Our initial data exploration validates our measurements of CM, SO, SD, and our research question. Figure 1 shows different standardization strategies taken by different chains. The X-axis represents the customer mix in nursing home facilities, and the Y-axis represents the service delivery. Each figure illustrates one nursing home chain, and each bubble represents a facility. These figures demonstrate a clear pattern that in some chains, such as Chain A, each facility is unique in terms of customer mix and service delivery – the facilities of Chain A are scattered in a large range along both the X-axis and Y-axis – whereas facilities in other chains, such as Chain B, are similar to each other in terms of service delivery but are differentiated in terms of customer mix. Then there are chains whose facilities are very similar to each other in both dimensions, such as Chain C. Inspired by revealed data patterns and existing insights (Banaszak-Holl et al. 2002, Banaszak-Holl et al. 2018, Buell et al. 2021), we measure the DoS by the normalized distance between each focal facility and the mean of its belonging chain.

For the operational dimensions CM, SO, and SD, we first calculate the chain yearly average of each dimension, then calculate the absolute value of the difference between each facility and its belonging chain's yearly average, then use this value to divide by yearly chain average to get focal-normalized value. As elaborated in Section 2.2, we argue that every facility should play a role in the DoS measure, because a systematic effect exists between each facility's practice and chain

outcomes. One facility's practice change will affect the chain norm hence the DoS measure. Since this is a measure of distance, the larger the value, the more customized the focal facility. Thus, we take the negative of this value to estimate the DoS: the larger the value, the more standardized the focal facility. For Facility i in Chain j in Year t :

$$\text{Degree of Standardization in Customer Mix}'_{ijt} = -\frac{\Delta(CM_{ijt})}{CM_{.jt}} = -\frac{|CM_{ijt} - \overline{CM}_{.jt}|}{CM_{.jt}}, \quad (4)$$

$$\text{Degree of Standardization in Service Offering}'_{ijt} = -\frac{\Delta(SO_{ijt})}{SO_{.jt}} = -\frac{|SO_{ijt} - \overline{SO}_{.jt}|}{SO_{.jt}}, \quad (5)$$

$$\text{Degree of Standardization in Service Delivery}'_{ijt} = -\frac{\Delta(SD_{ijt})}{SD_{.jt}} = -\frac{|SD_{ijt} - \overline{SD}_{.jt}|}{SD_{.jt}}, \quad (6)$$

3.2.2. Measure Development for Outcome Variables We study nursing home facilities' financial performance, clinical outcome, and resident welfare; each outcome is estimated with a separate model.

Financial Performance is measured by the operating margin of each facility in each year. Operating margin is the ratio of operating income over revenue, and it is a validated indicator of the financial ability and risk of a firm (Park et al. 2011). Higher operating margin generally indicates the company is efficient in operating and transferring sales into profit. In 2013, CMS established the Medicare Bundled Payment for Care Improvement (BPCI). To secure Medicare reimbursement, both for-profit and non-profit nursing homes are pressured to provide higher quality care with less financial resources. Thus, improving operating margin is a critical goal for nursing homes.

For Facility i in Chain j in Year t , *Operating Margin* is:

$$\text{Operating Margin}_{ijt} = \frac{\text{Operating Income}_{ijt}}{\text{Total Revenue}_{ijt}}, \quad (7)$$

Clinical Outcome is measured using the weighted number of deficiency citations in clinical areas, including infection control, pharmacy services, dental services, specialized services, physician services, and nursing services, in each facility in each year. CMS conducts yearly nursing home surveys following survey protocols and federal requirements to determine whether a non-compliance citation is appropriate. If any of the inspected areas contain quality indicators that are judged substandard by the inspection team, a deficiency citation will be issued for that indicator. Multiple citations can be issued on one indicator. Deficiency citations are often used as a nursing home quality measure (Lu and Lu 2016); the validity of this measure can be found in Lu and Wedig (2013). Many CMS nursing home quality measures are, in fact, clinical measures, such as re-hospitalization rate,

percentage of residents with pressure ulcers, and percentage of residents with severe pain. Thus, clinical outcome is another important goal for nursing homes.

For Facility i in Chain j in Year t , the clinical outcome is equal to the number of deficiency citations in clinical areas divided by total occupied beds.

$$\text{Clinical Outcome}_{ijt} = \frac{\Sigma(\text{Clinical Citations}_{ijt})}{\text{Occupancy}_{ijt} * \text{Total Beds}_{ijt}}, \quad (8)$$

Resident Welfare is estimated by the weighted total number of deficiency citations in resident welfare areas, including dietary services, quality of care, resident assessment, quality of life, resident behavior and facility practices, admission, transfer, and discharge rights, and resident rights, in each facility in each year. To our knowledge, ours is the first study to use deficiency citations as the indicator of general living conditions and quality for nursing home residents. Other widely used measures are the resident self-reported quality of life and satisfaction scales (Kane et al. 2003). However, due to some residents' cognitive ability issues, selection bias may skew self-reported surveys. We argue that the "check-list" method is more objective than self-reported information.

For Facility i in Chain j in Year t :

$$\text{Resident Welfare}_{ijt} = \frac{\Sigma(\text{Resident Welfare Citations}_{ijt})}{\text{Occupancy}_{ijt} * \text{Total Beds}_{ijt}}, \quad (9)$$

3.2.3. Control Variables We control for important facility-level, chain-level, and local market-level factors in our models due to their potential impact on nursing home operational outcomes and chain-level standardization strategies, for example, average CM, SO, and SD for the local market each year, size of the chains and facilities, and property types. We also add chain level, local market level, and yearly fixed effects in our models. A detailed list of our control variables is presented in the online supplement.

3.3. Hypothesis Development

This section presents our hypothesized relationships between our explanatory variables (i.e., DoS in CM, SO, and SD) and nursing homes' performance outcomes.

3.3.1. Degree of Standardization in Customer Mix As necessary inputs of service processes, customers hold high-level variability due to individual inherent differences. In service operations, input variation affects output variation (Mondschein and Weintraub 2003, Fitzsimmons et al. 2008, Buell et al. 2021); thus, the degree of variation in customers across chain-belonging units has a profound influence on performance outcomes.

For a nursing home chain operating in multiple locations, the potential customer groups may vary by local factors, such as sociodemographic characteristics and environmental issues that

induce chronic diseases. Although some chains may choose to customize customer mix, appealing to various groups to maximize revenue, maintaining a similar customer mix across locations will increase chain-level operational efficiency and reduce extra costs (Squire et al. 2006), for example through knowledge sharing and staffing management guidelines. Hence, we hypothesize that although increased DoS (i.e., more standardization) in customer mix may decrease revenue, it can positively impact operational efficiency (measured by operating margin).

In nursing home chains, rigid standardization in customer mix can negatively impact residents' experience by limiting their options and potentially compromising their rights. In fact, research found that standardization positively affects clinical outcome while negatively affecting patient experience (Chandrasekaran et al. 2012). Meanwhile, standardizing customers further enables standardization in clinical procedures by knowledge transfer and reducing procedure complexity, thus reducing errors and leading to fewer deficiency citations in clinical areas. For example, through strictly standardizing its patients' conditions, Shouldice Hernia Hospital achieves significantly lower recurrences than its peer hospitals. Thus, we hypothesize that standardization in customer mix negatively affects resident welfare but positively impacts clinical outcome.

HYPOTHESIS 1A. DoS in customer mix of a chain-belongs nursing home facility is positively associated with its operating margin;

HYPOTHESIS 1B. DoS in customer mix of a chain-belongs nursing home facility is positively associated with its clinical outcome;

HYPOTHESIS 1C. DoS in customer mix of a chain-belongs nursing home facility is negatively associated with its resident welfare.

3.3.2. Degree of Standardization in Service Offering One fundamental trade-off in operations management is the increased revenue from a wide variety of product offerings versus the increased costs through the loss of scale economies (MacDuffie et al. 1996). Researchers have studied this controversial issue for years, without reaching any consensus of a one-fit-for-all strategy. A more focused product strategy can reduce costs and increase efficacy, whereas a more flexible strategy allows firms to respond to changing demand quickly and attract more customers (Heizer et al. 2017). In the context of our study, we view health and care as regional, since risk for diseases, such as Alzheimer's and dementia, depends partially on geographic region (Alzheimer's Association 2021). The demand for specialty care varies across locations due to local disease profiles. Therefore, nursing home chains will operate with more financial efficiency if they provide SCUs only in locations with high demand; this customization strategy reduces unnecessary costs while capturing revenue from customers with such needs. Thus, we hypothesize that standardization in service offering across chain-belongs facilities will negatively impact financial performance.

Within a nursing home chain, standardization in service offering further enables the process of knowledge transfer: clinical skills and experience generated from caring for one SCU's residents can be transferred to another SCU. When necessary, employees may rotate between multiple SCUs to share skills and effective clinical practices, which can become standardized procedures, thus decreasing variation and error. Hence, we hypothesize that increased DoS in service offering across chain-belongs facilities decreases clinical deficiency citations.

Customers value high product variety (Merle et al. 2010); product mix and flexibility are crucial competitive advantages to satisfy both existing and new customers. When chains provide some nursing homes with SCUs and some without, residents will have the option to choose facilities according to their needs and transfer if they gradually develop needs for SCUs. Thus, we hypothesize that DoS in service offering is negatively associated with resident welfare.

HYPOTHESIS 2A. DoS in service offering of a chain-belongs nursing home facility is negatively associated with its financial performance;

HYPOTHESIS 2B. DoS in service offering of a chain-belongs nursing home facility is positively associated with its clinical outcome;

HYPOTHESIS 2C. DoS in service offering of a chain-belongs nursing home facility is negatively associated with its resident welfare.

3.3.3. Degree of Standardization in Service Delivery Standardization in service delivery can marginally contribute to process standardization, which in healthcare settings is proven to reduce resource usage and enhance operational efficiency (Andritsos and Tang 2014). Nevertheless, we hypothesize that standardization in service delivery will negatively affect nursing homes' operating margins. Staff benefits and salaries construct the greatest expense category and a significant part of revenue, even as labor costs vary with chain-belongs facilities' market conditions. Moreover, resident profiles entail varied health conditions and care needs. As each facility aims to meet the minimum state staffing requirements, minimize staffing costs, and maintain an adequate staffing level to care for its residents' needs, we hypothesize that nursing home chains need to customize across facilities to achieve higher financial performance.

The relationship between DoS in service delivery and clinical outcome can be viewed from two perspectives. First of all, high standardization in service delivery across nursing homes facilitates knowledge transfer of effective practices and clinical management strategies, thus decreasing errors. Furthermore, just like customers, service deliverers are a crucial input for service operations; reduced staffing variation reduces variation in clinical outcomes. In healthcare settings, less variation is associated with better clinical quality (Andritsos and Tang 2014, Chandrasekaran

et al. 2012). Thus, we hypothesize that standardization in service delivery improves nursing homes' clinical outcome.

In service operations, during a “customized service encounter” (service encounters with a wide variety of customer demands), highly standardized service delivery decreases customer perceived service quality (Victorino et al. 2013). This conclusion applies to nursing home settings, which provide both clinical care and long-term residency. As residents have varied personalities, lifestyles, and health profiles, a “one-for-all” staffing ratio cannot suit all chain-belonging facilities. Each facility needs to customize staff to suit its residents' distinctive needs and improve their welfare.

HYPOTHESIS 3A. DoS in service delivery of a chain-belonging nursing home facility is negatively associated with its financial performance;

HYPOTHESIS 3B. DoS in service delivery of a chain-belonging nursing home facility is positively associated with its clinical outcome;

HYPOTHESIS 3C. DoS in service delivery of a chain-belonging nursing home facility is negatively associated with its resident welfare.

4. Analysis and Results

In this section, we show the correlation analysis of included variables and rule out any potential multicollinearity issues. We clarify our research method and establish model specifications, then test our hypotheses and present the model results.

4.1. Correlation Analysis

Our correlation analysis indicates that the largest observed correlations are *Market Average Service Delivery* with *Registered Nurse Hours per Patient Day* (0.497) and with *Average RUGCMI* (0.432). Neither correlation coefficient exceeds 0.5, and both are anticipated to pose no bias in the analysis. A correlation table is available in the online supplement. Since multicollinearity does not present significantly, we will use all variables described in the correlation table.

4.2. Model Specification

We adopt an instrumental variable (IV) two-stage least squares (2SLS) approach to estimate the effects of DoS in multiple operational outcomes. We also add year, chain, and market-level fixed effects and clustered standard errors in our models. We elaborate our methods as follows.

First, we utilize the time-series nature of our panel data to establish causal relationships. More specifically, we use outcome variables in year $(t + 1)$ and explanatory variables (DoS in CM, SO, and SD) in year (t) in our models, suggesting the chain-level standardization decisions in year (t) have an effect on nursing home outcome measures in year $(t + 1)$. Utilizing the nature of panel

data (lag or lead independent or dependent variables) to prove causality is a common practice in social science (Halaby 2004, Wooldridge 2010). We argue that operating decisions and efforts take time to reflect in operating outcomes, and these lagged effects can be captured by leading outcome variables in analyses (Evanschitzky et al. 2012). We choose the lag of one year because CMS conducts an annual inspection of all nursing home facilities, and facilities typically adjust operating strategies based on this yearly feedback. The one-year time lag is also used and justified in previous research (Banaszak-Holl et al. 2002).

We also add local market-level, chain-level, and yearly fixed effects in our models. From the economic perspective, adding local market-level fixed effects soaks up systematic differences between markets that are time-invariant; and adding the chain-level fixed effects accounts for time-invariant variance at the chain level, which may influence performance. The yearly fixed effects account for unobservable time-variant variance. Adding these fixed effects can better isolate the effect of our explanatory variables. From the statistical perspective, building on work by Moral-Benito (2013), Leszczensky and Wolbring (2019) used Monte Carlo simulations to reveal that lagged panel models with fixed effects can address bias arising from reverse causality under a wide range of conditions and help circumvent issues of misspecified lags. We also cluster standard errors at the market level. Thus, with our panel data, we first estimate the following linear regression model:

For Facility i belonging to Chain j in Market k in Year t , the regression equation can be written as:

$$\mathbf{y}_{ijkt+1} = \boldsymbol{\alpha}^T + \mathbf{DoS}_{ijkt}\beta_1 + \mathbf{W}_{it}\beta_2 + \mathbf{W}'_{jt}\beta_3 + \mathbf{W}''_{kt}\beta_4 + \mathbf{z}_t + \mathbf{c}_j + \mathbf{m}_k + \boldsymbol{\epsilon}_{ijkt+1}, \quad (10)$$

Where \mathbf{y}_{ijkt+1} is the nursing home facility outcomes in year $(t+1)$, namely, operating margin, clinical outcome, and resident welfare; \mathbf{DoS}_{ijkt} is a matrix of explanatory variables in year (t) , which are the DoS in customer mix, service offering, and service delivery; \mathbf{W}_{it} is a matrix containing facility-level control variables; \mathbf{W}'_{jt} contains chain-level control variables; \mathbf{W}''_{kt} contains local market-level control variables; \mathbf{z}_t is the yearly fixed effect; \mathbf{c}_j is the chain fixed effect; \mathbf{m}_k is the market fixed effect; and $\boldsymbol{\epsilon}_{ijkt+1}$ is a vector of facility-specific errors clustered by the market level.

Based on equation (10), we then adopt an instrumental variable (IV) two-stage least squares (2SLS) approach, using lagged endogenous variables as IVs in our models. Although the time-lagging model in equation (10) helps to address concerns of reverse causality, endogeneity brought by omitted variables can still be a valid concern. Rather than merely replacing the contemporaneous dependent variables with their lead value (equation (10)), we also use lagged values of endogenous explanatory variables as IVs (i.e., we use explanatory variables in year $(t-1)$ as IVs for explanatory variables in year (t)) (Reed 2015, Tan and Netessine 2014). Lagged explanatory variables are

commonly used as IVs to address endogeneity concerns in empirical studies with observational data (Wang and Bellemare 2019, Siebert and Zubanov 2010).

In the nursing home industry, CMS's annual inspection provides valuable feedback for each nursing home, which is used to adjust operating strategies. Thus, the yearly lagged explanatory variables should be correlated with the explanatory variables in the current year (which satisfies the "relevance" requirement of the IV approach). Also, we assume the lagged variables are uncorrelated with the error (which satisfies the "exclusion restriction" requirement of the IV approach), since the operational decisions in year $(t - 1)$ should not determine the unobserved factors of operating outcomes in year $(t + 1)$. Thus, explanatory variables in year $(t - 1)$ can serve as valid IVs for explanatory variables in year (t) (Wooldridge 2010). With evidence from simulations, Reed (2015) suggests that using lagged values of the endogenous variables as IVs is valid when (1) the IVs do not themselves belong in the respective estimating equation, and (2) the IVs are significantly correlated with the endogenous variables. Both of these requirements are met in our study. We use the 2SLS method to estimate the effects of IVs given its robustness even with the presence of multicollinearity issues, and its ability to provide consistent estimates of the dependent variables with a large sample (Tan and Netessine 2014).

Stage 1. In the stage 1 model we estimate endogenous explanatory variables. We regress each endogenous explanatory variable in year (t) on all exogenous variables in the model, including the corresponding explanatory variable in year $(t - 1)$ (i.e., our IV) and exogenous covariates (i.e., our control variables in equation (10)). The predicted values of the explanatory variables in year (t) , $\widehat{\mathbf{DoS}}_{ijkt}$, are calculated to be used in the stage 2 model.

Stage 2. The stage 2 models use the predicted values, $\widehat{\mathbf{DoS}}_{ijkt}$, from the stage 1 model as explanatory variables to estimate the coefficients of equation (10):

For Facility i belonging to Chain j in Market k in Year t , our final model can be written as:

$$\mathbf{y}_{ijkt+1} = \boldsymbol{\alpha}'^T + \widehat{\mathbf{DoS}}_{ijkt}\beta'_1 + \mathbf{W}_{it}\beta'_2 + \mathbf{W}'_{jt}\beta'_3 + \mathbf{W}''_{kt}\beta'_4 + \mathbf{z}_t + \mathbf{c}_j + \mathbf{m}_k + \boldsymbol{\epsilon}'_{ijkt+1}, \quad (11)$$

Where \mathbf{y}_{ijkt+1} is the nursing home facility outcome variable in year $(t + 1)$; $\widehat{\mathbf{DoS}}_{ijkt}$ is a matrix of predicted values of explanatory variables in year (t) ; \mathbf{W}_{it} is a matrix containing facility-level control variables; \mathbf{W}'_{jt} contains chain-level control variables; \mathbf{W}''_{kt} contains local market-level control variables; \mathbf{z}_t is the yearly fixed effect; \mathbf{c}_j is the chain fixed effect; \mathbf{m}_k is the market fixed effect; and $\boldsymbol{\epsilon}'_{ijkt+1}$ is a vector of facility-specific errors clustered by the market level. We use equation (11) to run three separate models for financial performance, clinical outcome, and resident welfare.

Table 1 Results and Hypotheses

	Financial Performance	Clinical Outcome	Resident Welfare
DoS in Customer Mix	H1A Supported	H1B Supported	H1C Not Supported
	<i>p-value (0.0014)</i> <i>Adjusted p-value (0.0042)</i>	<i>p-value (0.0245)</i> <i>Adjusted p-value (0.0736)</i>	
DoS in Service Offering	H2A Not Supported	H2B Not Supported	H2C Not Supported
DoS in Service Delivery	H3A Supported	H3B Not Supported	H3C Marginally Supported
	<i>p-value (0.0285)</i> <i>Adjusted p-value (0.0854)</i>		<i>p-value (0.0639)</i> <i>Adjusted p-value (0.1917)</i>

Notes. The Adjusted p-values are p-values after the Bonferroni correction

4.3. Results and Discussions

Table 1 shows an overview of our results with both the original p-values and p-values after the Bonferroni correction. The final results for all three models are shown in Table 2. We now discuss model results in detail.

4.3.1. Model 1: Operating Margin Our results indicate that DoS in customer mix positively affects chain-belonging nursing homes' financial efficiency, which is measured by the operating margin. As shown in Model 1 in Table 2, the coefficient is ($\beta_{CM,OM} = 2.26 \times 10^{-2}$). This finding remains significant at $p < 0.05$ even after the strict Bonferroni correction. According to this finding, chain-belonging nursing homes should standardize customer mix relative to the chain norm to improve financial efficiency. Thus, Hypothesis 1A is supported.

This coefficient can be better interpreted with an example. Consider Chain A has multiple nursing home facilities with an average customer mix of 15%. The chain plans to decrease one facility's customer mix from 90% to 20%. Recall that DoS is a facility-level measure; the larger the DoS, the more standardized (relative to the chain norm) the facility. The facility's DoS in customer mix then changes from -5 ($-(|90\% - 15\%|)/15\%$) to -0.33 ($-(|20\% - 15\%|)/15\%$), becoming more standardized. According to the model coefficient, holding all other variables constant, this change will increase this facility's operating margin by 10.56% ($|2.26 \times 10^{-2} \times ((-0.33) - (-5))| \times 100\%$). In 2015, nursing homes in the U.S. generated an average of \$11,566,000 in total revenue.¹

¹ <https://www.statista.com/statistics/323229/average-nursing-home-revenue-in-top-and-bottom-three-states/>

Table 2 Yearly Fixed Effect Model Results

	Model 1 Operating Margin	Model 2 Clinical Outcome	Model 3 Resident Welfare
Constant	-2373.0000** (794.5000)	360.9000*** (104.9000)	65700.0000* (25510.0000)
<i>Explanatory Variables</i>			
DoS in Service Offering	-9.8520 (12.5300)	0.6394 (1.6540)	322.7000 (402.3000)
DoS in Service Delivery	-169.6000* (77.4200)	4.8770 (10.2200)	4606.0000. (2485.0000)
DoS in Customer Mix	226.1000** (70.7000)	-20.9900* (9.3320)	-868.3000 (2270.0000)
<i>Facility-Level Control Variables</i>			
Average ADL	27.9100*** (6.9350)	0.6338 (0.9158)	279.5000 (222.7000)
Average RUGCM	412.3000* (168.6000)	1.5260 (22.2500)	-6335.0000 (5411.0000)
Registered Nurse Hours	-43.1000 (64.2000)	-9.0560 (8.4750)	-7430.0000*** (2061.0000)
Number of Beds in Facility	2.4570*** (0.3309)	-0.7894*** (0.0437)	141.1000*** (10.6200)
Occupancy	20.7500*** (1.1100)	-2.0430*** (0.1465)	-126.3000*** (35.6200)
For-profit	853.1000*** (107.4000)	11.7300 (14.2300)	3151.0000 (3448.0000)
Hospital-based	834.7000 (584.9000)	-124.0000 (77.2000)	-37520.0000* (18780.0000)
Cost	-0.0165*** (0.0009)	-0.0001 (0.0001)	-0.0130 (0.0283)
<i>Chain-Level Control Variables</i>			
Number of Facilities in Chain	-2.2360** (0.7949)	-0.0841 (0.1050)	54.5500* (25.5200)
<i>Location/Market-Level Control Variables</i>			
Market Average Service offering	-217.6000* (88.4600)	2.2750 (11.6800)	-1097.0000 (2840.0000)
Market Average Service Delivery	38.9300 (62.0400)	-19.5100* (8.1900)	-983.8000 (1992.0000)
Market Average Customer Mix	-1.1820 (2.1170)	-0.2110 (0.2794)	-7.2290 (67.9700)
Number of Facilities in Market	-7.8250 (5.9110)	0.6605 (0.7802)	153.5000 (189.8000)
Local Income	0.0018 (0.0017)	0.0000 (0.0002)	0.0261 (0.0550)
Local Senior Population	-0.0005* (0.0002)	0.0000 (0.0000)	0.0217** (0.0075)
Local Number of Registered Nurses	-0.0044. (0.0027)	0.0002 (0.0004)	0.1081 (0.0857)
<i>Fixed Effects</i>			
Yearly Fixed Effect	Yes	Yes	Yes
Chain-Level Fixed Effects	Yes	Yes	Yes
Location/Market-Level Fixed Effects	Yes	Yes	Yes
R ²	0.4017	0.2753	0.3038
Adjusted R ²	0.3637	0.2293	0.2596
Degree of Freedom	14116	14110	14116
F-statistic	10.58***	5.982***	6.874***

Notes. The reported coefficients and standard errors were multiplied by 10⁴

.p < 0.1; *p < 0.05; **p < 0.01; ***p < 0.001

Holding total revenue constant, the change in DoS in customer mix will yield a \$1,221,239 ($10.56\% \times \$11,566,000$) increase in operating income for this property in Chain A. However, if the operating income does not change, then the higher operating margin implies a decrease in total revenue. That is, standardization in customer mix improves operating efficiency and the organization's ability to transfer sales into profit, not necessarily total revenue. The potential explanation is that different geographic areas have varied populations, implying a varied proportion of Medicare and Medicaid enrollees with various needs. Strictly standardizing customer mix may hinder the chain's ability to capture the local demands and thus decrease total revenue. However, standardization in customer mix allows a chain to establish standard procedures and benefit from knowledge transfer, enhancing operating efficiency and reducing costs.

In the online supplement, we include a simulation study to explore scenarios associated with changing units' behaviors along the customer mix metric. Figure 1 in the online supplement shows how operating margin changes as a chain become more standardized in customer mix.

Our results also suggest that DoS in service delivery is negatively associated with chain-belonging nursing homes' financial efficiency. As shown in Model 1 in Table 2, the coefficient is ($\beta_{SD,OM} = -1.70 \times 10^{-2}$). This finding is significant at $p < 0.05$ before the Bonferroni correction, at $p < 0.1$ after. Based on this finding, chain-belonging nursing homes should customize service delivery to improve financial performance. Thus, Hypothesis 3A is supported.

Again, an example demonstrates the impact. Consider Chain B has an average service delivery level of 5%, and intends to increase one facility's service delivery from 5% to 50%. The facility's DoS measure in service delivery then changes from 0 to -9, becoming more customized. Based on the coefficient, this change will increase this facility's operating margin by 15.26%. Besides the potential influence of the local market, such as state requirements on minimum staffing and varied labor availability and costs, different resident profiles in each nursing home also explain this finding. Since each facility has an different residents profile, such as acuity level and chronicle diseases, the care needed varies across chain-belonging facilities. Thus, each facility staffs according to residents' needs. A high staffing ratio suggests a better capability to meet needs, but higher than the actual needs will induce unnecessary staffing costs, which reduces the operating margin.

Although the two examples given are on the extreme side (rarely will a facility's customer mix change drastically from 90% to 20%), they illustrate the scope of impact.

4.3.2. Model 2: Clinical Outcome Our results indicate that DoS in customer mix is negatively associated with the number of clinical deficiency citations in chain-belonging nursing homes. As shown in Model 2 of Table 2, the coefficient is ($\beta_{CM,CO} = -2.10 \times 10^{-3}$). This finding is significant at $p < 0.05$ before the Bonferroni correction, at $p < 0.1$ after. This finding suggests that to

improve clinical outcome (receive fewer deficiency citations), chain-belongs nursing homes should standardize customer mix relative to the chain norm. Hence, Hypothesis 1B is supported.

Consider Chain C has an average of 90% customer mix, and Chain C intends to increase one of its facilities' customer mix from 10% to 90%. This facility's DoS measure in customer mix changes from -0.89 to 0, becoming more standardized. According to the coefficient, the number of deficiency citations per occupied bed in the clinical area will decrease by 0.002. If this facility has 1000 occupied beds, this change can decrease its annual clinical deficiency citation by 2.

Having a similar resident structure across facilities enables a chain to establish uniform clinical procedures and staff training programs at the chain level. As demonstrated in multiple single organization studies, strictly following standardized procedures in the clinical environment can decrease human errors and increase conformance quality. In a chain, similar effects can be magnified through knowledge transfer, sharing efficient practices across facilities with similar resident structures and care needs. As mentioned, a pioneering example in standardizing care receivers for better clinical results is the Shouldice Hernia Centre, which treats only patients with specific types of abdominal hernias and also strictly controls patients' conditions such as body weight and previous medical records. Despite its controversial reputation, Shouldice Hospital has a significantly lower risk of subsequent surgery for recurrence (of inguinal hernia) than at a general hospital. Also, as a nursing home industry leader points out, having the same customer mix across belonging facilities enables the corporate to design an efficient staffing strategy, such as clinical staff training programs, for all belonging facilities. During COVID-19, all certified nursing homes have been required to follow CMS guidance when accepting and transferring residents exposed to the coronavirus, a "standard" condition that allows nursing homes to quickly and safely respond to admission and transfer tasks.

4.3.3. Model 3: Resident Welfare Results indicate DoS in service delivery is positively associated with the number of resident welfare citations in chain-belongs nursing homes. As shown in Model 3 of Table 2, the coefficient is ($\beta_{SD,RW} = 4.61 \times 10^{-1}$). This finding is significant at $p < 0.1$ before the Bonferroni correction. Thus, Hypothesis 3C is marginally supported. Since this finding is not as robust, we forego examples and only discuss the implications in terms of directions. This finding suggests that chain-belongs nursing homes should customize service delivery to improve resident welfare (receive fewer deficiency citations).

One plausible explanation is residents' differences in personalities, lifestyles, and health conditions. Each facility should maintain a staffing ratio fitted to satisfy these varied needs. Also, many aspects of resident welfare improvement require financial investment, such as staff training on accommodating resident needs, designing and hosting resident activities, and improving the physical environment. The nursing home industry's low operating margin requires the investment

in resident welfare of money saved from maintaining the appropriate staffing ratio for each facility to satisfy both residents' needs and minimum state regulations.

One insight from a nursing home practitioner is the role of each facility's leadership in a culture of resident welfare. If the culture is nourishing and loving, residents will have a higher quality of life. The local facility's leadership and staffing levels highly influence the forming of a facility's culture. Furthermore, when each facility has its own culture, personality, strength, and focus, its staff will have more autonomy and feel more fulfilled, thus reducing the turnover rate and relevant costs such as rehiring, retraining, and hire agency costs; as well as improving the quality of service, which drives up occupancy. This insight helps explain why service delivery is better left to local decisions than standardized across all facilities.

An interesting finding is that DoS in service offering is not significant in any of the three models. One explanation is that the decision to install SCUs in a facility largely depends on the local market conditions. As many diseases such as Alzheimer's and dementia have geographic patterns, chains could choose to facilitate SCUs in areas with special care needs. Competitors in the same local market also influence this decision. As we strictly controlled for the influence of local markets in our model (by adding market fixed effects and market-level baseline and controls), the effects of DoS are not significant.

5. Conclusions

This study investigates the relationships between the within-chain degree of standardization (DoS) in three operational dimensions, i.e., customer mix, service offering, and service delivery, and chain-belonging nursing homes' performance outcomes, including financial performance, clinical outcome, and resident welfare. These relationships are crucially important and worth exploring. Over the last century, multi-unit organizations have emerged as the dominant organizational form in the service industry (Greve and Baum 2001); examples can be found in hotels, restaurants, and nursing homes. Specifically, more than 60% of U.S. nursing homes are chain operated. How similar the facilities should be within a service chain is a decision faced by every multi-unit firm: should all facilities that bear the same chain name follow the same operating procedures, or should they each maintain their own characteristics? As no adequate research has solved this puzzle, our study intends to fill this gap.

With eleven years of comprehensive U.S. nursing home data, we use an instrumental variable approach to explore the impact of DoS on chain-belonging units' performance outcomes. We find that for improvements in different outcomes, different standardization strategies should be considered. For financial performance, a nursing home chain needs to standardize customer mix and customize service delivery across its belonging facilities. We also find that customization in service delivery positively affects chain-belonging nursing homes' resident welfare. Our results also

indicate that standardization in customer mix among chain-belongs nursing homes is positively associated with clinical outcome. We hypothesized that the DoS in service offering would influence chain-belongs facilities' operational outcomes; however, this hypothesis is not supported.

5.1. Contributions to Literature

To our knowledge, this study is the first systematic multi-dimensional assessment of service firms' standardization strategies from a chain perspective.

First, we are among the very few studies to explore service standardization strategies at a chain level. Although chain operations is a major form in the service industry, only a few studies explore within-chain DoS and its impact on outcomes. To a certain extent, literature in brand consistency, multi-property localization, and organizational structure is relevant to this topic. However, literature in these areas focuses more on marketing strategies and organization theories, not exploring multiple operational dimensions to conclude whether a service chain should standardize or customize its operations practice.

Second, our study focuses on multiple operational dimensions. We empirically examine the impact of within-chain DoS in each of three dimensions – customer mix, service offering, and service delivery – on outcomes, with all three dimensions present in the same model. Intuitively, these three operational dimensions seem to be interconnected: targeted customers influence services offered, which further shape service delivery methods. Thus, decisions on standardization for all dimensions could be intertwined and may seem to be made once for all. However, our correlation analysis shows no evidence that the DoS in the three dimensions are correlated. Hence, the effect of each dimension needs to be estimated uniquely while the other two are in the picture. Indeed, our results indicate that DoS decisions variously impact operational outcomes. For example, customer mix should be standardized across all belonging units for an improved operating margin, yet service delivery should be customized to achieve the same goal.

Third, we use customer-recognizable nursing home chain names as our chain identifiers. Unlike most chain hotels and restaurants, many chain-belongs nursing homes do not carry the chain name in their facility names, making it difficult for customers to recognize the chain affiliations. When belonging facilities bear the chain name, their reputations are shared, but otherwise the chain may not even consider standardization strategies. Most published nursing home studies only use the actual chain affiliations as chain identifiers, thus ignoring the “spillover” effects between customer-recognizable chains.

Lastly, the data we use is very inclusive, covering all nursing homes in the United States certified by Medicare and Medicaid. Thus, we are able to identify all chains that meet our analysis standards and study the DoS effect across these chains.

5.2. Managerial Insights

Our results provide important implications for nursing home practitioners. Our finding that the DoS of chain-belonging facilities significantly influences nursing home operational outcomes invites chain owners' attention to the dispersion of practices across belonging facilities and alerts each facility to use chain norms as a benchmark to better position itself.

Chain-belonging nursing homes should standardize customer mix relative to the chain norm. By doing so, facilities can improve financial performance and clinical outcome without hurting resident welfare. Also, chain-belonging nursing homes should customize service delivery to better fit local market and focal facility conditions. This strategy can enhance the facility's financial performance and resident welfare; no evidence suggests it negatively influences facilities' clinical outcomes. Several nursing home practitioners point out that our results provide valuable guidance in chain investment strategies: when chains acquire new properties, they can choose facilities with similar or differentiated customer mix, service offering, and service delivery practices compared to the existing chain norms. Also, since merge and acquisition is still the dominant approach for nursing home chain expansion, managing the newly acquired facilities becomes an issue (Banaszak-Holl et al. 2006). Our findings can help corporate chain managers establish protocols regarding post-acquisition strategies, in terms of whether to standardize or customize new facilities' operating practices.

Our findings also urge nursing home chain operators to consider standardization strategies in times of crisis. During the outbreak of COVID-19, CMS and the CDC have established a series of standardized procedures to prevent infection in healthcare facilities. This policy, in a way, confirmed our result that standardization across units could improve clinical outcomes. Learning from this experience, operators can initiate chain-level guidelines to prepare for a public crisis.

It is also crucial to discuss whether our findings can be generalized to other service chains. Nursing homes provide long-term, sticky services with high switching costs; hence, customers often tend not to switch between providers. Also, the establishment and operations of each facility are associated with high fixed costs; once a property is facilitated, its structure and infrastructure do not frequently change. Moreover, nursing homes have high labor costs yet alarmingly high staff turnovers, especially among registered nurses. We believe our findings are generalizable to service chains with similar characteristics, such as hotel chains: many customers who participate in hotel loyalty programs, especially those with hotel-associated credit cards, tend to stick with one hotel brand. The operations of hotel facilities are also associated with high fixed costs and labor costs and a high turnover rate.

5.3. Limitations and Future Research

One limitation of our study is that small chains with only 2 facilities are not in our scope, as we believe these chains are less likely to face the strategic decisions of within-chain standardization.

Essentially, we examine three operation aspects of a service chain organization: the who (target customers and their demands), what (services offered), and how (methods to deliver the services) (Armistead 1990). If available, additional information could complement our measure of these three dimensions. For example, a nationwide government-monitored list of all services provided by each nursing home may better construct the variable service offering. Our analysis uses the most distinguished service, special care units, to measure service offering; additional single-sourced, uni-format, government-certified information of all types of services offered by each nursing home would complement our current analysis. However, the only annual publicly-available nationwide data on nursing homes does not contain this information. Service offering information may be available on each facility's website, but the data reliability is questionable.

Further, an annual monitored and single-sourced measure of staff engagement may contribute to the measure of service delivery. In our analysis, we use the staffing ratio to construct this measure. Although this is the common practice adopted by various published nursing home studies, we believe adding staff engagement information to our original measure can capture a more comprehensive picture of service delivery. Some facilities may use internal surveys to measure staff engagement, but unfortunately, a uni-sourced, nation-wide standard measure of staff engagement does not exist. Ideally, the percent of private pay revenue and the percent of long-term residents both help in constructing the customer mix measure. Adding this information to our current variable could increase the accuracy of the customer mix measure, better conveying the aggregated information of payment structure with residents' acuity level and length of stay. When the data is available, another plausible path for future studies may explore the relationship between within chain DoS and response efficiency to public crises such as COVID-19.

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