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CMS Emergency Preparedness Rule: Examining the Relationship Between Nursing Home Facility Characteristics and Regulatory Deficiencies

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**CMS EMERGENCY PREPAREDNESS RULE: EXAMINING THE
RELATIONSHIP BETWEEN NURSING HOME FACILITY
CHARACTERISTICS AND REGULATORY DEFICIENCIES**

by

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ABSTRACT

CMS EMERGENCY PREPAREDNESS RULE: EXAMINING THE RELATIONSHIP BETWEEN NURSING HOME FACILITY CHARACTERISTICS AND REGULATORY DEFICIENCIES

Tihara Richardson Sommers
Old Dominion University, 2023
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The effects of Hurricane Katrina and other natural disasters have increased the focus on nursing homes, particularly nursing home emergency preparedness. Nursing home administrators and direct care employees have described the challenges faced when responding to an emergency event. Due to numerous emergency preparedness insufficiencies, requirements were implemented to protect the vulnerable population of older adults who reside in nursing homes. In 2016, the Centers for Medicare & Medicaid (CMS) added specific emergency preparedness requirements to the existing fire safety requirements for regulated nursing homes. These deficiency evaluations are the only routinely collected source of information detailing compliance with the Emergency Preparedness Rule for regulated facilities. The purpose of this study is to provide a baseline assessment of nursing home facility characteristics associated with having an Emergency Preparedness Rule deficiency citation. This study tested the Organization-Based Conceptual Framework that relates internal and organizational factors to Emergency Preparedness Rule deficiencies for CMS regulated nursing homes. This research is significant in several ways. First, examining CMS Emergency Preparedness Rule deficiencies as one measure of quality of care may provide further understanding about how complex quality issues are in nursing homes. Second, no research to date has presented a nationally representative picture of CMS Emergency Preparedness Rule deficiency citations in nursing homes. The study found that there was support for four of the five variables of interest identified in the study. The resulting

data can be used to evaluate facility compliance with the new federal guidelines and consider the overall effectiveness of the CMS Emergency Preparedness Rule on the emergency preparedness process in U.S. nursing homes.

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This dissertation is dedicated to my parents, Tim and Chante, who have always supported my pursuit of education and continue to be my biggest cheerleaders.

My wonderful husband, Jimill, who has helped to encourage me and keep me focused on completing this degree.

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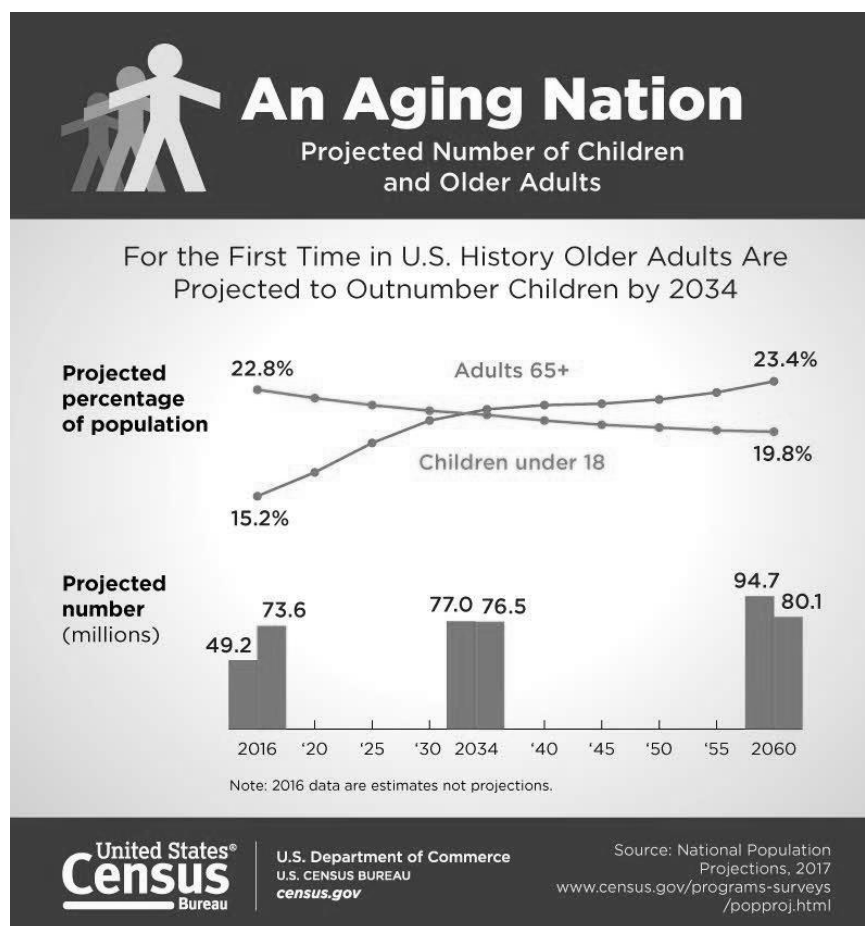
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I. INTRODUCTION

A huge demographic shift resulting in the “graying of America” is the consequence of two trends, the rise in average life expectancy in the U.S. and the declining fertility rate (Ferguson, 2013). This aging population is partly the result of people living longer, healthier lives. For instance, in 2034 the elderly population will outnumber children under the age of 18 for the first time in the country’s history (U.S. Census Bureau, 2018). Data projections for 2060 (Figure 1) anticipate older adults will outnumber children under the age of 18 by over 14 million.

Figure 1

Projected Number of Children and Older Adults



Note: From *The U.S. Joins Other Countries with Large Aging Populations*, by J. Vespa, 2018, (<https://www.census.gov/library/stories/2018/03/graying-america.html>).

The growing aging population is putting a strain on social programs like Social Security, Medicare, and Medicaid. The Medicare population is expected to increase from approximately 54 million beneficiaries to over 80 million beneficiaries by 2030 as the baby-boom generation ages into Medicare (Medicare Payment Advisory Commission, 2015). Medicare and Medicaid coverage are often used to cover long-term care services. Most long-term care services assist people with activities of daily living, such as dressing, bathing, and using the bathroom and can be provided at facilities like nursing homes, skilled nursing facilities, and assisted living facilities (Centers for Disease Control and Prevention, 2020; U.S. Department of Health and Human Services, 2020).

There are more than one million elderly persons living in approximately 15,700 nursing homes on any given day (Stone et al., 2018). Nursing homes face unique challenges when planning for emergency situations due to residents who may be immobile and/or medically fragile. Hurricane Katrina was a large-scale natural disaster in the U.S. that highlighted gaps in nursing home emergency planning. The disastrous aftermath led to numerous investigations, including those that examined policies and procedures affecting at-risk older adults. The 78 nursing home deaths discovered in the weeks following Hurricane Katrina in 2005 prompted an increased focus on the devastating impact disasters can have on older adults in nursing homes (Brown et al., 2007; Hyer et al., 2010).

Past literature has examined the response and recovery of long-term care facilities following Hurricanes Katrina and Rita in 2005 and Hurricane Sandy in 2012 (Elmore & Brown, 2007; Jiang et al., 2018; Jenkins, 2007). The effects of Hurricane Katrina and other natural disasters have increased the focus on nursing homes, particularly nursing home emergency preparedness. Nursing home administrators and direct care employees have described the

challenges faced when responding to an emergency event. When surveyed following a hurricane or earthquake, nursing home employees expressed concerns about maintaining resident health, transportation issues, staffing deficiencies, supply shortages, and facility damage (Dosa et al., 2007; Hyer et al., 2009; Mangum et al., 1989). Additionally, an Office of Inspector General (OIG) report found that nursing home administrators did not use emergency plans as practical manuals to guide them during hurricane response (Levinson, 2006). Maintaining adequate emergency preparedness plans and providing appropriate training in emergency procedures, prepares nursing home employees to respond to various types of disasters while maintaining continuity of care for residents.

Adding to the challenges identified by nursing home employees are the different state-imposed emergency preparedness requirements for nursing homes. In 2007, only Florida, Louisiana, Mississippi, and South Carolina had specific elements that had to be included in a disaster plan and only Louisiana and Florida required state-level interagency cooperation in developing the criteria (Brown et al., 2007). Differing state requirements contributed to the invocation for a comprehensive set of federal requirements.

Due to numerous emergency preparedness insufficiencies, requirements were implemented to protect the vulnerable population of older adults who reside in nursing homes. In 2016, the Centers for Medicare & Medicaid Services (CMS) added specific emergency preparedness requirements to the existing fire safety requirements for regulated nursing homes. The Emergency Preparedness Rule outlines regulations for nursing homes in four core elements: risk assessment and emergency planning; communication plan; policies and procedures; and training and testing (Centers for Medicare & Medicaid Services (CMS), 2016).

In addition to the Emergency Preparedness Rule, CMS created Emergency Preparedness Tags (E-tags) to cite non-compliance with emergency preparedness requirements. Each E-tag incorporates the applicable CMS laws and rules into a single tag number within each of the four core areas. These deficiency evaluations are the only routinely collected source of information detailing compliance with the Emergency Preparedness Rule for regulated facilities.

Statement of the Problem

Although there has been an increased focus on emergency preparedness for hospitals, nursing homes have been neglected as an important component of the health care system. The current literature has identified gaps in disaster preparedness and proposes efforts to close the gaps and improve nursing home preparedness by involving administrators, health care associations, staff members, as well as local, state, and national regulators and administrators (Elmore & Brown, 2007; Kennedy et al., 2020; Lane & McGrady, 2016). Nursing home residents are at risk of having medical conditions rapidly decline if they do not receive necessary care during and following a disaster event. Lack of support during a disaster places nursing home residents at a risk that is secondary to the disaster itself (Laditka et al., 2007). This additional risk may be mitigated through effective emergency preparedness planning at nursing home facilities.

Purpose of the Study

The purpose of this study is to provide a baseline assessment of nursing home facility characteristics associated with having an Emergency Preparedness Rule deficiency citation. This study will test the Organization-Based Conceptual Framework that relates internal and organizational factors to Emergency Preparedness Rule deficiencies for CMS regulated nursing homes. The independent variables will describe the internal operating characteristics and the

organizational characteristics of the facility. The dependent variable of interest, Emergency Preparedness Rule deficiencies, will be generally defined as a nursing home's failure to meet a federal participation requirement. The resulting data can be used to evaluate facility compliance with the new federal guidelines and consider the overall effectiveness of the CMS Emergency Preparedness Rule on the emergency preparedness process in U.S. nursing homes.

Research Question

The number and severity of nursing home deficiencies have already been examined in the literature. Specifically, previous studies have examined the relationship between various facility characteristics and deficiencies related to both quality of care (i.e., preventing a decrease in mobility and pain management for residents) and quality of life (i.e., activities of daily living and activities that meet the needs of each resident) in nursing homes (Castle & Engberg, 2005; Castle & Engberg, 2007; Cohen & Spector, 1996; Hyun Shin, 2013; Kane, 2003; Spilsbury et al., 2011). However, the relationship between internal and organizational factors and emergency preparedness deficiencies remains underexplored.

The relationship between internal and organizational factors, disaster planning activities and disaster preparedness has been examined in other industries like hospitality, offshore oil and gas, and transportation (AlBattat & Som, 2015; Manca & Brambilla, 2011; Norazahar et al., 2014). Similar to these previous studies, both internal and organizational factors will be used to examine emergency preparedness in nursing homes. To assess the overall effectiveness of the CMS Emergency Preparedness Rule on the emergency preparedness process in U.S. nursing homes, the overarching research question guides the proposed study: Is there a relationship between nursing home facility characteristics and CMS Emergency Preparedness Rule deficiency citations?

Significance of the Study

The quality of long-term care is a salient public policy issue due to increased life expectancy and declining fertility (Amirkhanyan et al., 2018; Government Accountability Office (GAO), 2015; Kinsella & Velkoff, 2001). Nursing homes are an important element of the long-term care system and a vital part of the health care system. Nursing homes also have a high degree of publicness. Amirkhanyan et al. (2018) describes a broad concept of publicness that incorporates factors such as the “oversight of political actors and influence of the public and other stakeholders” (p. 37). Local, state, and federal government agencies are involved in subsidizing and regulating nursing homes in the U.S. The introduction of the CMS Emergency Preparedness Rule stimulated the involvement of several parties in the policy arena representing “federal, state and local government interests, hospitals, other health care facilities, and various trade associations” (Myers & Bearss, 2018, p. 284).

At the time of the implementation of the CMS Emergency Preparedness Rule, there was overall support for general concepts such as planning and risk assessment; having appropriate policies and procedures in place; and the need for effective approaches to communication, training, and testing (Myers & Bearss, 2018). However, there was some disagreement about which standards to implement and the extent to which these concepts should be put into practice. Existing literature provides limited evidence to guide recommendations about how to improve disaster preparedness and response for long-term care facilities (Elmore & Brown, 2007; Hyer et al., 2009; Pierce et al., 2017). Currently, the literature fails to examine (1) whether U.S. nursing homes are meeting the federal emergency preparedness standards and (2) whether the regulatory guidelines aimed at increasing emergency preparedness in long-term care facilities (LTCFs) are sufficient.

The objective of this study is to provide a baseline assessment of nursing home facility characteristics associated with having a CMS Emergency Preparedness Rule deficiency citation. This research is significant in several ways. First, examining CMS Emergency Preparedness Rule deficiencies as one measure of resident safety may provide further understanding about how complex resident safety issues are in nursing homes. Second, no research to date has presented a nationally representative picture of CMS Emergency Preparedness Rule deficiency citations in nursing homes. The resulting data can be used to evaluate facility compliance with the new federal guidelines and consider the overall effectiveness of the CMS Emergency Preparedness Rule on the emergency preparedness process in U.S. nursing homes.

Organization of the Study

Chapter two includes a literature review which incorporates how the literature describes the vulnerable population of nursing home residents, the implementation of the CMS Emergency Preparedness Rule, the types of CMS Emergency Preparedness deficiencies that have previously been examined, and the relationship between nursing home deficiencies and quality of care. The third chapter describes the organization-based conceptual framework and presents the factors influencing CMS Emergency Preparedness deficiencies of interest in this study. The results of the study, including the description of data and statistical techniques used to analyze the data, are detailed in chapter four. The final chapter discusses the implications of the research results and details the contributions of the proposed research on emergency preparedness policy in regulated nursing homes.

II. LITERATURE REVIEW

An investigative report by the Minority Staff of the U.S. Senate Committee on Finance (2018) detailed incidents where nursing home residents were put at risk during hurricanes Irma and Harvey due to poor emergency planning and response. Considering the heightened risk that nursing home residents face during disasters, a comprehensive literature review was conducted to examine the vulnerable population of nursing home residents. Next, the literature on nursing home internal factors were examined. Additionally, the literature detailing the subsequent CMS Emergency Preparedness Rule implementation and the types of CMS Emergency Preparedness Rule deficiencies addressed in the extant literature are identified. Finally, the relationship between nursing home deficiencies and nursing home quality of care is discussed.

Vulnerable Population of Nursing Home Residents

Reports published by the US Department of Health and Human Services (DHHS), Office of Inspector General (OIG) illuminated the need for improvements in nursing homes' emergency preparedness and response (Lane & McGrady, 2016). Implementation of the emergency planning rule was an effort to close the gap identified in nursing home preparedness and increase protection for the vulnerable residents. The Centers for Disease Control and Prevention (CDC) (2012) identify older adults as a particularly vulnerable group during emergencies. Although there is no uniform definition for a vulnerable population, one expert defined the group as follows:

People who cannot comfortably or safely access or use the standard resources offered in disaster preparedness, relief, and recovery. They may include people with sensory impairments (blind, deaf, hard-of-hearing); cognitive disorders; mobility limitations; limited English comprehension or non-English speaking; as well as people

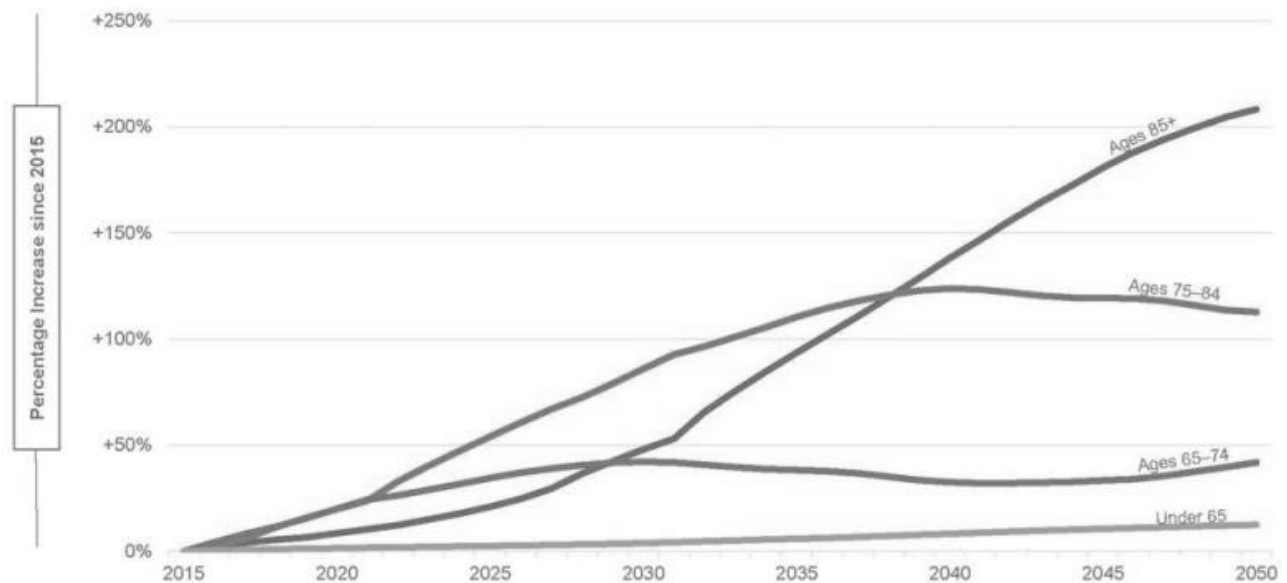
who are geographically or culturally isolated, medically, or chemically dependent, or homeless (CDC, 2012, p. 4).

Essentially, any older adult who may need additional assistance during an emergency is considered a member of this larger vulnerable population. Some of the most vulnerable older adults during a natural disaster include those who have difficulty walking or require medical equipment (McGuire et al., 2007). The last National Study of Long-Term Care Providers indicated that 83.5% of nursing home residents were aged 65 or older, meaning that many nursing home residents are a part of this most vulnerable group of older adults (Howley, 2020). Additionally, the aged 85+ population is expected to almost triple between 2015 and 2050 (Houser et. al., 2018). Figure 2 illustrates the projected population growth among what is considered the oldest age group.

Studies have found that vulnerable populations are less likely to undertake self-protective actions before, during or after disasters (Marshall et al., 2020). Recognizing the vulnerabilities of older adults during disasters following Hurricane Katrina, the Administration on Aging created the *Emergency Assistance Guide* designed specifically for providers of services to aging populations. The Administration on Aging is the principal agency designated to carry out the provisions of the Older Americans Act (1965) and promoting the well-being of older individuals (U.S. Department of Health and Human Services, 2017). While the *Emergency Assistance Guide* and other literature typically acknowledges the vulnerability of older adults, and some studies explore protective factors or resilience among older adults, the research does not really consider the additional complications experienced by nursing home residents during disasters.

Figure 2

Projected Population Growth by Age Group, 2015–2050



Note: From *Across the States 2018: Profiles of Long-Term Services and Supports*, by A. Houser, W. Fox-Grage, and K. Ujvari, 2018, (<https://www.aarp.org/content/dam/aarp/ppi/2018/08/across-the-states-profiles-of-long-term-services-and-supports-full-report.pdf>).

Focus on U.S. Nursing Homes

There has been an increase in both the frequency and severity of billion-dollar natural disasters over the past four decades (National Oceanic and Atmospheric Administration, National Centers for Environmental Information [NOAA-NCEI], 2022). Nursing home facilities have not been immune to the destruction caused by these natural disasters. Walshe (2001) found that in the 1970s and 1980s, researchers presented compelling evidence that the frail and vulnerable recipients of nursing home care were too often neglected, mistreated, or abused and that the system of nursing home regulation and licensure was largely ineffectual (see e.g., King, 1981; Mendelson, 1974; and Vladeck, 1980). While many states undertook major reforms to

improve the “quality of care” and “quality of life” for residents, emergency preparedness measures were not specifically addressed (Vladeck & Feuerberg, 1985).

Recognizing the nursing home emergency preparedness concerns in several states, two reports from the Office of the Inspector General (OIG) documented gaps in emergency preparedness in long-term care facilities (Kennedy et al., 2021; Lane & McGrady, 2016). The initial OIG report in 2006 found that nursing homes plans lacked many of the provisions recommended by experts, while the 2012 OIG report identified the “same gaps in nursing home preparedness and response” that were found in the 2006 report (Levinson, 2012, p. 2). Additional research was initiated following major emergency events. The disaster literature has examined the response and recovery of long-term care facilities following Hurricanes Katrina and Rita in 2005 and Hurricane Sandy in 2012 (Elmore & Brown, 2007; Jiang et al., 2018; Jenkins, 2007). Despite the research, emergency preparedness concerns in nursing homes continued to exist, contributing to the call for universal emergency preparedness regulations.

Nursing Home Internal Factors

This study will examine several factors of interest including staffing levels, nursing home quality, Medicaid occupancy rates, and total occupancy rates. This section of the literature review describes how these factors have been explored in extant literature. The sections also identifies how the research using these factors can be extended to examine emergency preparedness in nursing homes.

Staffing Levels

Nursing home staffing levels have been explored throughout the nursing home literature. Staffing is an important quality measure used to compare nursing homes on the Nursing Home

Compare website. Many studies have indicated that staff to resident ratios are inadequate even though staffing levels in certified nursing homes are set by Medicare/Medicaid regulations (Castle, 2008; Mueller et al., 2006). The concern with inadequate staffing levels is that it can negatively impact the overall quality of care in a nursing home facility. However, Castle and Engberg (2008) argued that only weak empirical evidence exists that connects staffing levels to quality of care in nursing homes.

The commonly used measurements for nurse staffing in the literature are the number of full-time equivalent (FTE) staff per bed or resident or the number of staff hours per resident (Akinci & Krolikowski, 2005; Castle, 2002; Mueller et al., 2006). The Nursing Home Reform Act of 1987 required nursing homes to have one registered nurse (RN) on duty for eight hours a day, one licensed nurse on the day and evening shift and sufficient staff to meet the needs of residents (Harrington et al., 2016). Since nursing homes must comply with both federal and state staffing standards to participate in Medicare and Medicaid, the use of these staffing hours are a standard measurement across all regulated nursing facilities.

Other studies have departed from the use of these typical measurements arguing that simply adding more staff may be a necessary but not sufficient means of improving quality (Bowers et al., 2000; Castle & Engberg, 2008). Kane (2004) asserts that “staffing is more complex than common measures might suggest ... assessment of staffing levels requires more than counting the number of bodies reporting to work each shift” (p. 251). There is a call for researchers to move beyond just examining staffing levels to examining care processes which may lead to broader policy debate over staffing issues rather than staffing levels in nursing homes (Castle & Engberg, 2008).

In the study by Mueller et al. (2006), it was determined that a majority of the quality indicators used for analysis in the studies analyzed were retrieved from the Online System for Certification and Administrative Reporting (OSCAR). The OSCAR reporting system is the precursor to the Data.CMS.gov data reporting website. The study by Mueller et al. (2006) also determined that 45% of the quality indicators had significant positive associations with staffing levels. Some researchers question the completeness and accuracy of staffing level data because it is rarely audited and is facility-reported (Feng, 2005; Geng, 2019; Harrington et al., 2000; Kash, 2007). While there is no uniform way to measure staffing levels, a majority of the extant literature has found correlations between nursing home quality and nursing home staffing.

Case-Mix

Scholars often include case-mix when considering staffing in nursing homes. Harrington and Swan (2003) assert that case-mix must also be taken into account because a higher case mix should require facilities to provide higher nurse staffing hours to care for residents. Additionally, several studies use case-mix to predict the use of resources.

Case-mix is a measurement of the types of assistance required of nursing staff for each resident. Several studies have examined how these resident needs, also referred to as activities of daily living (ADLs) can impact a facility's resource requirements (Fries & Cooney, 1985; Harrington et al., 2000). ADLs, like toileting, getting dressed or eating, cannot be avoided without impacting the health and/or safety of a resident. Additionally, the resident case-mix may increase the number of deficiencies that a facility receives (Harrington et al., 2000).

Resident case-mix, a measure of residents' need for care, was considered one of the most important factors in studies predicting staffing levels in nursing homes (Fries, 1994; Zimmerman

et al., 2000; Harrington & Swan, 2003). Additionally, a recent study used case-mix to determine nursing home resident acuity, or the priority in which residents should receive care. However, the study examined case-mix payment methods instead of examining the impact on facilities with higher case-mix totals (Feng et al., 2006).

Other recent literature examines case-mix in the context that is outside of this study. Several studies examine the implications of resident care case-mix levels in Korea (Shin & Shin, 2019; Shin et al., 2021; Song & Song, 2019). Case-mix totals were also used to classify patients outside of the nursing home, including people living at home (de Alameida Mello et al., 2020), facilities that exclude nursing homes (Lendon et al., 2021; Rhodes et al., 2022; Tran et al., 2019).

Fries (1990) compared case-mix systems for nursing home payments. Authors assert that long-term care facilities do not explicitly recognize the differences between residents and the amount of resources that are utilized in their care (Schneider et al., 1988; Fries, 1990). Case-mix has been considered as a factor for payment and reimbursements in nursing homes using case-mix systems (Arling & Daneman, 2002; Costa et al., 2015; Turcotte et al., 2019). In much of the prior literature, case-mix has been applied to examine the cost effectiveness of a nursing home rather than its correlation to quality of care within facilities.

Quality Rating

Quality concerns in nursing homes have been examined for many years. CMS has made improvements to the certification process like greater consistency of inspections and more attention to resident quality issues (Castle et al., 2009; GAO, 1999). Certification continues to be a requirement for nursing homes to receive reimbursement for Medicare and/or Medicaid residents. This certification process occurs approximately yearly and consists of an on-site

inspection by a team of surveyors who assess whether the facility meets standards for certification (Castle et al., 2007; Castle & Ferguson, 2010).

By 1987, certification consisted of 136 health and safety standards, including 98 structural quality indicators and 38 process quality indicators (Institute of Medicine, 1986; Castle & Ferguson, 2010). However, the amendments to nursing home standards and improvements to the certification requirements in the 1980's were insufficient due to the increasingly complicated medical needs of nursing home residents.

The Quality of Patient Care Star Ratings were introduced in July 2015 (CMS, n.d.). Huang and Hirth (2016) analyzed the rollout of the current CMS five-star quality rating system of nursing homes and suggested that consumers are more responsive to quality reporting when they found the prices of top-ranked facilities increased by 4.8 to 6.0 percent over the lower ranked facilities. In 2019, Steffanacci discussed the updates to the existing quality rating system: Nursing Home Compare has a quality rating system that gives each facility a rating between 1 and 5 stars. Those with 5 stars are considered to have above-average care quality, and those with 1 star are considered to have below-average care quality. There is one overall 5-star rating for each facility, and also a separate star rating for each of the following 3 factors:

Health Inspections. Inspections include the findings on compliance to Medicare and Medicaid health and safety requirements from onsite surveys conducted by state survey agencies at LTCFs.

Staffing Levels. The staffing levels are the numbers of nurses available to care for patients in an LTCF at any given time.

Quality Measures. The quality of resident care measures is based on resident assessment and Medicare claims data (Steffanacci, 2019, para. 2).

Recent literature examined the connection between quality ratings and COVID-19 outcomes. Studies associated higher quality ratings with lower COVID-19 incidence and mortality (Williams et al., 2021). However, another recent study comparing the CMS star rating system to nursing home recertifications suggests that a revision of the quality rating system may be warranted to reflect the perspectives of consumers (Peterson & Bowblis, 2023). Quality ratings have been a factor considered when examining nursing home quality since their implementation in 2015.

Occupancy Rates

Nursing homes that serve predominantly Medicaid residents tend to have lower occupancy rates (Mor et al., 2004). Additionally, lower occupancy rates in nursing facilities may result in lower revenue, reduced quality of care, and more deficiencies (Harrington et al., 2004). However, some of the extant literature examines how higher occupancy rates can impact the quality of care in a nursing home. High occupancy rates may result in low-quality care because when facilities have high occupancy resources may be stretched and oversight may be reduced (Castle & Engberg, 2005; Castle & Engberg, 2008; Hughes et al., 2000). Higher occupancy rates are also associated with higher nursing home prices (Huang et al., 2021).

Occupancy rates have been found to have an inverse relationship with nursing home staffing levels. Facilities with lower occupancy rates may be expected to have higher staffing levels in order to meet state and federal staffing standards, however RN staffing levels were not related (Harrington & Swan, 2004).

Some studies correlated nursing home occupancy rates with the amount of regulation on the facility. When considering the enforcement of CMS requirements, it was found that states

with lower facility occupancy rates gave citations to a higher number of facilities for substandard care and appear to be more active in regulation (Harrington et al., 2004). This study will extend the current research on the connection between occupancy rates and nursing home regulation.

Medicaid Occupancy

Nursing homes with high Medicaid occupancy were found more likely to close as these facilities also provide care to a greater proportion of disadvantaged residents (i.e., nonwhite populations living in poor communities (Mor et al., 2004; Castle et al., 2009). Facilities with high Medicaid occupancy may also be associated with low quality. It may be difficult for facilities that have high numbers of residents using Medicaid to provide adequate services because Medicaid provides lower reimbursement to nursing homes than other sources of payment (Bourbonniere et al., 2006; Castle & Engberg, 2008; Decker, 2006; O'Neill et al., 2003).

Studies have also found a relationship between Medicaid occupancy rates and deficiency citations for abuse (Castle 2011). This finding supports the with the belief that the Medicaid system is influential on the provision of care and that the most disadvantaged and vulnerable elders are also most likely to be subject to abuse. (Grabowski et al., 2004; Castle, 2011). This study will extend the research on abuse deficiencies to also consider emergency preparedness deficiencies.

CMS Emergency Preparedness Rule Implementation

Emergency management was historically considered a responsibility of the fire department or law enforcement. Public health agencies or the Federal Emergency Management Agency (FEMA) would become involved in the event of a large-scale emergency. Emergency

management literature asserts that multi-agency coordination is required in order to build resilience through effective disaster management policies (Kapucu et al., 2013). Collaboration among community organizations is also identified as a critical aspect in enhancing resilience. However, a lack of collaboration between government and regulated entities can have a detrimental effect on emergency planning.

In response to the lack of collaboration between government and regulated entities, the CMS Emergency Preparedness Rule implemented requirements that apply to 17 health care provider types, including hospitals, critical access hospitals, and long-term care facilities (LTCFs). The Emergency Preparedness Rule addresses four core competency areas of risk assessment and emergency planning; policies and procedures; communication plan; and training and testing (Myers & Bearss, 2018; Sloan & Obisesan, 2020). Prior to the implementation of the CMS Emergency Preparedness Rule, only Florida, Louisiana, Mississippi and South Carolina had specific elements that had to be included in a disaster plan and only Louisiana and Florida required state-level interagency cooperation in developing the criteria (Brown et al., 2007). A comprehensive set of federal requirements is beneficial since emergencies affect aspects of the medical care and public health sectors.

Although many facilities have emergency plans, an OIG report found that nursing home administrators did not use emergency plans as practical manuals to guide them during hurricane response (Levinson, 2006). Previous CMS regulation required facilities to train all employees on the facility emergency procedures at the start of employment, regularly review the procedures with existing staff and perform unannounced drills using the established procedures. Despite these requirements, an OIG report found that nursing homes were cited for deficiencies on numerous occasions when employees were unable to “demonstrate knowledge of procedures to

surveyors” or when the facility could not produce records showing the required trainings were conducted (Brown et al., 2007, p. 661). Ensuring appropriate training in emergency procedures prepares employees to respond to various types of disasters while maintaining continuity of care for residents.

Along with the Emergency Preparedness Rule, CMS created Emergency Preparedness tags (E-tags) to cite non-compliance with emergency preparedness requirements. Each E-tag incorporates the applicable CMS laws and rules into a single tag number within each of the four core areas (Table 1). Of the 26 E-tags that relate to nursing homes, five were related to risk assessment and emergency planning, nine were related to policies and procedures, seven were related to the communication plan, and five were related to training and testing (CMS, 2019).

CMS Emergency Preparedness Rule Deficiencies

The literature describing CMS Emergency Preparedness Rule deficiencies discussed topics related to the implementation of emergency preparedness requirements. Topics identified include planning and all-hazards risk assessment; staff education and training exercises; evacuation and shelter in place plans; emergency supplies and coordination with emergency management agencies. The articles discuss the steps LTCFs, including nursing homes, have taken to comply and some of the challenges they have faced implementing the Emergency Preparedness Rule requirements.

Planning and all-hazards risk assessment

Myers and Bearrs (2018) noted that prior to the adoption of the final version of the Emergency Preparedness Rule, there was diverse support for the concept of all-hazards preparedness, which calls for response plans addressing a variety of catastrophic events.

Kennedy et al. (2020) identified the CMS requirements that reinforced and extended state requirements, like “detailed written plans and procedures” and “an ‘all-hazards’ plan for direct and indirect hazards” (p. 3). The literature also identified planning resources available to LTCF staff. The Florida Long Term Care Emergency Preparedness Portal was rated as a good LTCF emergency preparedness planning resource by three fourths of survey respondents (Blake et al., 2018). The purpose of the CMS E-Tags associated with planning and all-hazards risk assessment is to close the gaps that investigators identified in LTCF emergency preparedness planning efforts and to improve collaboration with professionals for disaster planning, despite being mentioned sparingly in the current literature.

Staff education and training exercises

Participation in classroom tabletop training exercises, facility drills, and full-scale exercises has the potential to minimize communication barriers detrimental to ways of working, encourage engagement and involvement, and can build emergency response and behavior skills among staff members (Evans et al. 2018; Lane & McGrady, 2018). Some stakeholders argued that these training exercises take up considerable time and effort and place undue stress on patients at the facility, particularly in the case of nursing homes and mental health care centers (Myers & Bearss, 2018). However, Kennedy et al (2020) supported extending the training exercises to LTCFs noting that the facilities should be leveraging community resources by conducting drills and engaging local partners. Despite the concerns about additional patient stress, the research asserts that staff members who regularly participate in LTCF and community emergency preparedness training and drills can build knowledge of emergency preparedness processes (Brown et al., 2007; Labrague et al., 2018; Walsh, 2020).

Table 1*E-tags by Category*

Category: Risk Assessment and Emergency Planning	
E-Tag	Description
E-0001	Establishment of the Emergency Preparedness Program
E-0004	Develop and Maintain EP Program
E-0006	Maintain and Annual EP Updates
E-0007	EP Program Patient Population
E-0009	Process for EP Collaboration
Category: Policies and Procedures	
E-Tag	Description
E-0013	Development of EP Policies and Procedures
E-0015	Subsistence Needs for Staff and Patients
E-0018	Procedures for Tracking of Staff and Patients
E-0020	Policies and Procedures Including Evacuation
E-0022	Policies and Procedures for Sheltering
E-0023	Policies and Procedures for Medical Docs.
E-0024	Policies and Procedures for Volunteers
E-0025	Arrangement with Other Facilities
E-0026	Roles Under a Waiver Declared by Secretary
Category: Communication Plan	
E-Tag	Description
E-0029	Development of Communication Plan
E-0030	Names and Contact Information
E-0031	Emergency Officials Contact Information
E-0032	Primary/Alternate Means for Communication
E-0033	Methods for Sharing Information
E-0034	Sharing Information on Occupancy/Needs
E-0035	LTC and ICF/IID Family Notifications
Category: Training and Testing	
E-Tag	Description
E-0036	Emergency Prep Training and Testing
E-0037	Emergency Prep Training Program
E-0039	Emergency Prep Testing Requirements
E-0041	Hospital CAH and LTC Emergency Power
E-0042	Integrated Health Systems

Evacuation and shelter in place plans

Several studies highlighted the need to identify an internal person responsible for deciding whether to shelter in place or initiate and implement an evacuation (Kennedy et al., 2020; Lane & McGrady, 2018; Walsh, 2020). Existing evacuation and shelter in place plans were reviewed for facilities. Kennedy et al. (2020) found that while 98 percent of the LTCFs examined had evacuation plans, many did not report having agreements with hospitals or transportation providers or have specific shelter in place plans. The CMS Emergency Preparedness Rule calls for LTCFs to consider methods for evacuation and patient care and treatment during disasters.

Emergency supplies

Walsh (2020) suggested that LTCFs partner with local and regional stakeholders to ensure that sufficient resources are available during emergencies. Kennedy et al. (2020) discussed differences in emergency supplies at LTCFs. Among the facilities examined, less than half of the facilities reported having seven or more days of generator fuel and at least seven days of pharmacy stocks of common medications (Kennedy et al., 2020). Evans et al. (2018) argued that having adequate supplies was key to ensuring patient safety during an evacuation. The CMS Emergency Preparedness Rule specifies the importance of subsistence needs that include, but are not limited to, food, water, medical, and pharmaceutical supplies.

Coordination with emergency management agencies

The CMS Emergency Preparedness Rule requires LTCFs to coordinate with federal, state, tribal, regional, and local emergency preparedness systems. However, Walsh (2020) argues that this may be a daunting challenge for LTCFs because staff members may be unfamiliar with

emergency preparedness concepts, principles, theories, and terminology. The complexity of the Emergency Preparedness Rule requirements makes it imperative that federal, state, and local responders coordinate efforts to succeed (Myers & Bearss, 2018). It is important to note that as of November 2019, CMS no longer requires LTCFs to document efforts to coordinate with local, tribal, regional, State, and Federal emergency preparedness officials as a part of the “Process for EP Collaboration” requirements (ASPR, 2019).

Relationship Between Nursing Home Deficiencies and Quality of Care

Deficiencies have been used to assess nursing home quality for over 30 years. A report by the Institute of Medicine used nursing home deficiencies as a criterion for whether nursing home staffing was adequate in U.S. nursing homes (Grabowski, 2004). State surveyors issue deficiencies to nursing home facilities as a part of the federal survey process (Harrington et al., 2000). The survey process is designed to regulate quality of care in nursing homes (Castle & Myers, 2006; Harrington et al., 2000; Kim et al., 2009; Park & Stearns, 2009). Essentially, the deficiencies cited during a survey represent an assessment about the type of quality problems that exist. These survey deficiencies differ from complaint deficiencies, which are conducted in response to consumer complaints (Stevenson, 2005). The survey reports are the only external source of information about quality for all regulated facilities that are routinely collected.

Previous studies examined deficiencies in the discontinued reporting system, On-line Survey Certification and Reporting system (OSCAR). Deficiencies are now reported in Data.CMS.gov, with studies connecting variables to the categories reported in the current surveys. There are over 180 deficiencies that can be cited against a nursing home. Several studies associate nursing home quality of care with federal survey categories listed on the survey, including resident assessment, quality of care, nursing services, and infection control (Harrington

et al., 2000; Lerner et al., 2014). Quality of care deficiencies have been associated with high licensed nurse turnover (Lerner et al. 2014),

Concerns about poor quality of care and ineffective regulation of nursing facilities have been documented since the 1970's (U.S. Senate Special Committee on Aging, 1974; Weiner, 2003). Harrington et al. (2000) asserts that "the [deficiency] data also accurately reflect problems that exist in the facilities because deficiencies are subject to extensive review by state officials and facilities and are subject to appeal by providers through an administrative or judicial process" (p. S279). However, regulators are accused of being inconsistent in citing deficiencies, resulting in a systematic variation across states in the strictness of enforcement (Harrington et al., 2000; Weiner, 2003). Examining emergency preparedness deficiencies in this study is an extension of ensuring the quality of care for nursing home residents.

Conclusion

Concerns regarding nursing home quality and regulation of nursing facilities have been discussed for over 50 years. Deficiency data is used to regulate quality of care in nursing homes, but there are concerns about the inconsistency of state level regulators. Emergency preparedness survey reports detailing deficiencies are publicly available but have not been thoroughly discussed in the literature.

Overall, the literature discussed the implementation of the Emergency Preparedness Rule in several ways, including acquiring necessary emergency supplies and coordination with local emergency management agencies. The current literature has begun to examine the implementation of Emergency Preparedness Rule requirements in nursing homes in a few of the key areas. The topics discussed were correlated with 13 CMS E-Tag deficiencies. However,

there were 13 CMS E-Tags related to topics including policies and procedures for volunteers, arrangements with other facilities, and methods for sharing information that the literature fails to address. The Emergency Preparedness Rule requirements were implemented to increase patient safety during emergencies and establish a more coordinated response to natural and human-caused disasters among healthcare providers participating in Medicare and Medicaid (ASPR, 2019). Focusing on just half of the applicable E-Tags may leave nursing homes and other LTCFs at risk for deficiencies related to the E-Tags that are not currently being discussed.

A further issue of concern is the lack of a more representative examination of nursing homes in the U.S. Most of the articles examined a sample of facilities in a single state, with only one study in the literature examining facilities in four states (Sun et al., 2020) and one study that included 3,357 facilities in 25 states (White et al., 2020). There are more than one million elderly persons living in approximately 15,700 nursing homes on any given day (Stone et al., 2018). Additional research on the execution of the Emergency Preparedness Rule across various states might uncover best practices that could result in a more comprehensive Emergency Preparedness Rule implementation.

Public administration was previously limited to a crisis-reactive management approach, resulting in little being accomplished to understand public problems related to emergency management and find solutions from a public policy or public management perspective (Petak, 1985). Implementing the CMS Emergency Preparedness Rule is an effort to implement aspects of emergency management from a policy perspective. The established requirements are an effort to address the identified emergency preparedness shortcomings within nursing homes and other healthcare facilities receiving funding through Medicare and Medicaid.

III. METHODOLOGY

Existing literature documents the gaps in emergency preparedness for nursing homes in the U.S. The CMS Emergency Preparedness rule was introduced to address some of the gaps. However, the impact of the newly implemented rule has not adequately been examined. This research will examine the success and difficulties nursing homes have experienced after implementing the CMS emergency preparedness rule.

Organization-Based Conceptual Framework

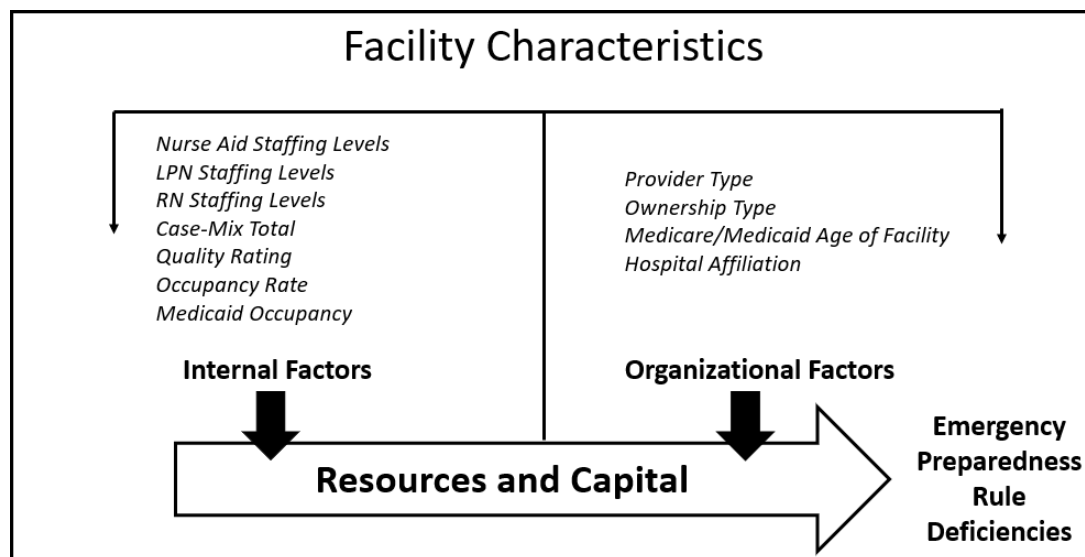
This study was guided by an organization-based conceptual framework. Castle, Enberg, Lave and Fisher (2009) presented a conceptual framework contending that external, organizational, and internal factors influence resident safety deficiency citations. The enriched framework, refined from a framework initially introduced by Castle (2005), illustrates how organizational factors and internal factors can impact nursing home operation. For example, an internal factor like a high occupancy rate can help improve the revenue of a facility, while an organizational factor like chain membership can provide resources needed to maintain nursing home facility operations (Castle et al., 2009). An adapted version of the organization-based conceptual framework (Figure 3) guided this study examining how specific internal and organizational factors impact Emergency Preparedness Rule deficiencies in U.S. nursing homes.

As shown in Figure 3, facility characteristics are conceptualized as Internal or Organizational factors. Internal factors include staffing levels, case-mix, quality rating, and occupancy. Organizational factors include bed size, ownership type, facility age, and hospital affiliation. Using the organization-based conceptual framework for nursing home Emergency Preparedness Rule deficiency analysis is consistent with previous studies that have used the

framework to analyze deficiency citations related to resident safety, infection control, and resident abuse in nursing homes (Castle, 2010; Castle, 2011; Castle et al., 2011).

Figure 3

Organization-Based Conceptual Framework



Note: Nursing home facility characteristics impacting Emergency Preparedness Rule deficiencies.

Adapted from “Factors Associated with Increasing Nursing Home Closures,” by N.G. Castle, J. Engberg, J. Lave, and A. Fisher, 2009, *Health Services Research*, 44(3), p. 1091. Copyright 2009 by Health Research and Educational Trust.

Factors Influencing CMS Emergency Preparedness Deficiencies

The conceptual framework suggests that several internal and organizational factors are associated with deficiency citations for emergency preparedness. In this study, the factors of interest include staffing levels, nursing home quality, Medicaid occupancy rates, and total occupancy rates. The following sections describe the factors of interest that were examined in this study in further detail.

Staffing Levels

Nursing home staffing levels continue to be an issue of concern examined in the existing literature. Nursing homes must comply with federal and state staffing standards to participate in Medicare and Medicaid. The Nursing Home Reform Act of 1987 required nursing homes to have one registered nurse (RN) on duty for eight hours a day, one licensed nurse on the day and evening shift and sufficient staff to meet the needs of residents (Harrington et al., 2016). Several studies found that facilities with lower staffing levels were positively associated with deficiencies related to infection control, resident health, and quality of care (Harrington et al., 2000; Park & Stearns, 2009; Schnelle et al., 2004).

Considering the established association with other nursing home deficiencies, it would be reasonable to expect that staffing levels will have an association with CMS Emergency Preparedness deficiencies. Staffing levels were operationalized in this study using nurse aid, licensed practical nurse (LPN) and registered nurse (RN) staffing levels. The hypothesis being examined in this research is as follows:

Hypothesis 1: Lower nursing home staffing levels will be associated with CMS Emergency Preparedness deficiencies and an increase in emergency preparedness deficiencies cited.

Resident Case-Mix

The types of assistance required of nursing staff varies from resident to resident. Several studies have examined how these resident needs, also referred to as activities of daily living (ADLs) can impact a facility's resource requirements (Fries & Cooney, 1985; Harrington et al., 2000). ADLs, like toileting, getting dressed or eating, cannot be avoided without impacting the

health and/or safety of a resident. Additionally, the resident case-mix may increase the number of deficiencies that a facility receives (Harrington et al., 2000). Resident case mix was operationalized in this study using the case-mix total, which measures three ADLs and reports the total across the three staffing levels. It is hypothesized as follows:

Hypothesis 2: Nursing homes operating with higher resident case-mix totals will be associated with CMS Emergency Preparedness deficiencies and an increase in emergency preparedness deficiencies cited.

Nursing Home Quality

Nursing home quality has been significantly influenced by federal and state oversight bodies (Castle & Ferguson, 2010). Quality concerns in nursing homes are a persistent issue. CMS has made improvements to the certification process like greater consistency of inspections and more attention to resident quality issues (Castle et al., 2009; GAO, 1999). Nursing homes that provide generally poor quality of care based on previous standards may have difficulty complying with stricter emergency preparedness rules and regulations. Nursing home quality was operationalized in this study using the CMS five-star quality rating system. It is hypothesized as follows:

Hypothesis 3: Poor nursing home quality ratings will be associated with CMS Emergency Preparedness deficiencies and an increase in emergency preparedness deficiencies cited.

Medicaid Occupancy

The Medicaid program is the United States' largest purchaser of nursing home services. Despite the considerable variation in Medicaid's per diem payment rates from state to state, these

rates are usually lower than others and may even be below the actual cost of providing care (Mor et al., 2004; Strahan, 1997). Low Medicaid reimbursement rates may have a greater impact in facilities with a high Medicaid occupancy, like facilities with a high proportion of residents with Medicaid reimbursement for care (Castle, 2011). Medicaid occupancy was operationalized in this study using the number of certified beds, which is based on the number of Medicaid and/or Medicare certified beds in the facility. The hypothesis examines the following:

Hypothesis 4: Nursing homes with higher Medicaid and/or Medicare occupancy will be associated with CMS Emergency Preparedness deficiencies and an increase in emergency preparedness deficiencies cited.

Total Occupancy Rates

Researchers have examined the declining occupancy rates in nursing homes. Prior studies noted that nursing home occupancy rates decreased over 10% during a 13-year period, but it was not clear why nursing homes were unable to attract sufficient residents (Caro & Kaffenberger, 2001; Frolik & Gallo, 2003). Facilities with lower occupancy rates may experience difficulties operating due to the depletion of resources and reserves (Castle et al., 2009). Total occupancy was operationalized in this study using the total occupancy rate, which measures the average number of beds occupied by residents. It is hypothesized as follows:

Hypothesis 5: Nursing homes operating with lower total occupancy rates will be associated with CMS Emergency Preparedness deficiencies and an increase in emergency preparedness deficiencies cited.

Other Variables

The additional organizational factors: provider type, ownership type, Medicare/Medicaid age of the facility, and hospital affiliation, will be measured in a manner consistent with previous studies (Castle et al., 2009; Lane & McGrady, 2016). Provider type was operationalized by coding the nursing homes as accepting both Medicare and Medicaid (0) or accepting Medicare only (1). Ownership type was operationalized in this study by coding the nursing home as having either for-profit ownership (1) or not (0). The age of facility was operationalized by determining if the facility was approved to provide Medicaid and Medicare Services prior to 2017 (1) or not (0). A facility was also coded as being affiliated with a hospital (1) or not (0).

Research Design

A quantitative research design was utilized to investigate the relationship between nursing home facility characteristics and Emergency Preparedness Rule deficiencies. The quantitative method involves “identifying a sample and population, specifying the strategy of inquiry, collecting and analyzing data, presenting the results, making an interpretation” (Creswell & Creswell, 2017). This study incorporated secondary data not previously collected for research purposes. This was determined to be an appropriate research design because similar studies examining nursing home deficiencies at the facility level have used this approach (Castle, 2010; Castle, 2011; Castle et al., 2011).

Study Population

According to the Centers for Disease Control and Prevention, there are approximately 15,600 nursing homes in the United States with 1.7 million licensed beds, occupied by 1.4

million patients (CDC, 2021). The population for the study includes CMS regulated nursing homes. The unit of analysis is the nursing home facility.

The total population sampling method was used in the study. Total population sampling is a type of purposive sampling technique where the entire population (i.e., the total population) with a particular set of characteristics is examined (Laerd Dissertation, 2012). According to Laerd Dissertation (2012), total population sampling makes it possible to “gain deeper insight on the phenomenon being examined” while also reducing the risk of “missing potential insights from members that are not included” (para. 17). This was determined to be the best sampling method because there was access to all CMS regulated nursing homes that were operating between November 2017 and November 2019.

Data Collection

Data used in this study was obtained from Data.CMS.gov. The publicly available data comes from the Medicare and/or Medicaid certification process and the data is maintained by CMS. Deficiency records from a two-year period (November 2017 through November 2019) were combined for this analysis. The information was merged to create a hybrid dataset organized by federal provider number, provider name, and provider address. The following sources were used to obtain information to operationalize the variables for the study:

CMS – Provider Information (Open Data File). This source provided general information on currently active nursing homes, including ownership and provider types, number of certified beds, quality measure scores, staffing levels, occupancy rates, case mix totals and other information used in the Five-Star Rating System. The unit of analysis for this dataset is the nursing home facility.

CMS – Fire Safety Deficiencies (Open Data File). This source provided a list of nursing home fire safety citations, including the nursing home that received the citation, the associated inspection date, citation tag number and description, scope and severity, the status of the citation, and the correction date. Information was verified using the provider's name, provider address, and federal provider number prior to merging the file. The unit of analysis for this dataset is the nursing home facility.

Data Cleaning

The data cleaning process was started by downloading the file from CMS.data.gov that reported Fire Safety deficiencies. This file contained the fire safety deficiencies and emergency preparedness deficiencies for all CMS certified nursing home facilities between November 14, 2014 to December 18, 2020. Since this study is only examining the emergency preparedness deficiencies, the data was sorted so that the fire safety deficiencies could be removed. Additionally, the study is only examining deficiencies prior to any of the COVID-19 cases announced in the U.S. A two-year timeframe (November 2017 to November 2019) was used to examine the nursing home deficiencies before the COVID-19 pandemic cause unanticipated effects that could not be controlled.

Data transformation was required on the remaining files to calculate the total number of deficiencies for each facility based on the current system which reported one deficiency per line. The data transformation allowed me to report the number of deficiencies in each of the four core areas and the total number of deficiencies for each facility between November 2017 and November 2019.

The file that reported the additional variables specific to the nursing homes was downloaded from the Data.CMS.gov website on February 22, 2020. Data transformations were conducted for the analysis to support the way the variables were operationalized in the study. Additional variables were kept in the dataset for analysis at a later date. Variables like the number of fines and payment denials remain in the dataset but were not used in the current study.

Files were deleted if the Federal Provider Number was corrupted during the download process. It would have taken an immense amount of time to go through each file by hand to verify the provider number by matching each facility name and address. Additionally, facilities from Puerto Rico and the Virgin Islands were deleted. In total, 312 files were deleted from the data set that was initially downloaded.

The two data files were then merged based on federal provider number, provider name, and provider address to create a hybrid dataset. There were 558 files with at least one zero value for a variable related to a nursing home characteristic. Several of these cases only had one reported zero value.

There is no agreed upon procedure for missing data and the literature is less clear about questionable data (Enders, 2022, Langkamp et al., 2010). The code book associated with the original data did not indicate what may be truly “missing data” or if any of the values could be a true zero. A decision had to be made on whether to delete or keep the data with the reported zeros. This was the first time this hybrid data was analyzed, the questionable data represented a small portion of the total population, and the threshold for missing data examples were much higher than the data that could potentially be deleted in the current study. Due to these factors, the only data that was discarded was during the data cleaning process and 15,142 files were used in all of the models for analysis.

Operationalization of Variables

This section describes how the study turned abstract concepts, like staffing levels and quality ratings, into a variable that is defined and measurable. The operational definitions for the study variables are detailed in Table 2.

Table 2

Dependent and Independent Variables

Variable	Operational Definition
Dependent Variables	
<i>Number of CMS Emergency Preparedness Deficiencies</i>	Deficiency citations for any of the 26 identified E-tags.
<i>Number of CMS Risk Assessment and Emergency Planning Deficiencies</i>	Deficiency citations for the following E-tags: 0001, 0004, 0006, 0007, 0009
<i>Number of CMS Policies and Procedure Deficiencies</i>	Deficiency citations for the following E-tags: 0013, 0015, 0018, 0020, 0022, 0023, 0024, 0025, 0026
<i>Number of CMS Communication Plan Deficiencies</i>	Deficiency citations for the following E-tags: 0029, 0030, 0031, 0032, 0033, 0034, 0035
<i>Number of CMS Training and Testing Deficiencies</i>	Deficiency citations for the following E-tags: 0036, 0037, 0039, 0041, 0042
Independent Variables	
<u>Internal Factors</u>	
<i>Nurse Aid Staffing Level</i>	FTE Nurse Aids per 100 residents
<i>Licensed Professional Nurse (LPN) Staffing Level</i>	FTE LPNs per 100 residents
<i>Registered Nurse (RN) Staffing Level</i>	FTE RNs per 100 residents

Variable	Operational Definition
<i>Case-Mix Total</i>	The score for three ADLs (eating, toileting, and transferring). Constructed by giving a score of 1 for low assistance, 2 for moderate assistance, and 3 for high need for assistance summed for each ADL. Variable is the total across the three staffing levels.
<i>Quality Rating</i>	CMS Quality of Resident Care Rating (Scale of 1-5)
<i>Total Occupancy Rate</i>	Average number of beds occupied by residents per day
<i>Medicaid Occupancy</i>	Number of Medicaid-certified beds in the facility
<u>Organizational Factors</u>	
<i>Provider Type</i>	Does the facility accept Medicaid and Medicare or Medicare only
<i>Ownership Type</i>	For-profit ownership or not
<i>Medicare/Medicaid Age</i>	Facility approved to provide Medicaid and Medicare Services prior to 2017
<i>Hospital Affiliation</i>	Facility hospital based or not

Method of Analysis

The dependent variable in this analysis is the count of CMS Emergency Preparedness deficiencies. Various models will include either the total number of deficiencies or the number of deficiencies within one of the four core areas as the dependent variable. The independent variables of interest are the internal and organizational factors discussed above. There is no general agreement on the best way to measure and analyze deficiencies, so this study employed multiple approaches. The quantitative analysis approaches are described below:

Descriptive Statistics – Raw Variables: Descriptive statistics for the variables used in the regression are shown in the table below. These variables include NA, LPN and RN staffing levels, nursing home quality, Medicaid occupancy rates, and total occupancy rates. The variables measuring ownership type (for profit own) and Medicare/Medicaid age (2017 service) were

coded as dummy variables. For the dummy variables, the mean should be interpreted as the proportion of the sample that is coded as 1. For example, 29 percent of the facilities have non-profit ownership and two percent of the facilities were operating after 2017. The mean, standard deviation, minimum values, and maximum values for the variables used in the regression are shown in Table 3.

Table 3.

Descriptive Statistics

Variable	Min	Max	Mean	Std. Dev
For Profit Own	0	1	.29	.455
Medicaid Occupancy	0	1389	106.86	60.56
Occupancy Rate	0	753.10	85.99	52.96
Prov Type	0	2	1.04	.21
Hosp Based	0	1	.04	.19
2017 Service	0	1	.02	.14
Qual Rate	0	5	3.58	1.31
NA Staff	0	7.97	2.23	.67
LPN Staff	0	4.95	.84	.39
RN Staff	0	7.65	.67	.53
Case Mix Total	0	5.56	3.11	.64
EP Def	0	8	.27	.68
PP Def	0	12	.48	1.18
Com Def	0	10	.27	.81
TT Def	0	7	.39	.81
CMS Def	0	31	1.40	2.84

Multicollinearity

A correlation matrix was developed to examine correlations among the independent variables. The correlation matrix (Table 4) did not reveal any perfect correlations among the independent variables. However, the Medicaid occupancy and the occupancy rate revealed a 92% correlation. This is reasonable because the variables measure the number of beds in the facility versus the number of beds that are occupied in the facility. In most cases, these numbers

are very close. For example, Burns Nursing Home in Alabama reports a Medicaid occupancy of 57 and an occupancy rate of 52.4. Similarly, Carillon Nursing and Rehabilitation Center in New York reports a Medicaid occupancy 315 and an occupancy rate of 290.7. The correlation between these two measures will be considered in the final analysis. This visual inspection of the correlation matrix of independent variables was the first step in diagnosing multicollinearity (Schroeder et al., 1990).

Another tool for assessing multicollinearity is tolerance. Several experts have also advised that variables with a low tolerance level should be discarded. Some used a threshold of $<.01$ (Schroeder et al., 1990) while others state that variables with tolerance levels less than $<.40$ (Adeboye et al., 2014) should be discarded. This study will use a threshold of less than $<.40$. The variables measuring Medicaid occupancy and occupancy rates both had tolerance levels of .14, below the tolerance threshold of .40.

Finally, multicollinearity will be assessed using the variance inflation factor (VIF) for each independent variable, with a larger VIF factor indicating a greater degree of collinearity (Schroeder et al., 1990). Most of the collinearity statistics for VIF ranged from 1.05 to 2.01, when tests were run using the dependent variables measuring CMS emergency preparedness deficiencies (Table 5). Similar to the other tests for multicollinearity, the statistics for VIF for Medicaid occupancy and occupancy rates were 7.01 and 7.16. A high degree of correlation between these two predictor variables is indicated because the statistics for VIF are greater than 5.

Table 4*Correlation Matrix*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. FORPROFITOWN														
2. MEDICAID OCCUPANCY	-.08													
3. OCCUPANCYRATE	-.05	.92												
4. PROVTYPE	.12	-.18	-.18											
5. HOSPBASD	.24	-.11	-.10	.14										
6. 2017SERVICE	-.03	-.06	-.10	.09	.00									
7. QUALRATE	.13	.01	.08	.12	.04	-.11								
8. NASTAFF	.24	-.06	-.02	.14	.07	-.03	.17							
9. LPNSTAFF	-.06	.05	.04	.10	.03	.04	.01	.32						
10. RNSTAFF	.24	-.21	-.19	.38	.33	.05	.23	.38	-.04					
11. CASEMIXTOTAL	-.04	.08	.13	.08	-.01	-.06	.16	.55	.48	.33				
12. EPDEF	-.06	-.04	-.06	-.02	-.02	-.02	-.05	-.03	.00	-.06	-.07			
13. PPDEF	.00	-.04	-.05	-.01	.00	-.02	-.01	.01	.01	-.02	-.04	.56		
14. COMDEF	-.01	-.04	-.04	-.01	.01	-.02	.00	.01	.01	-.01	-.03	.52	.66	
15. TTDEF	-.06	-.05	-.06	-.04	-.04	-.02	-.02	-.01	.02	-.07	-.03	.50	.52	.51

Table 5.*Collinearity Statistics*

<u>Variable</u>	<u>Tolerance</u>	<u>VIF</u>
For Profit Own	.83	1.20
Medicaid Occupancy	.14	7.01
Occupancy Rate	.14	7.16
Prov Type	.81	1.23
Hosp Based	.84	1.19
2017 Service	.96	1.05
Qual Rate	.89	1.13
NA Staff	.60	1.69
LPN Staff	.67	1.49
RN Staff	.54	1.84
Case Mix Total	.50	2.01

When considering the effects of multicollinearity, Daoud (2017) states “when two or more predictors are highly correlated, the relationship between the independent variables and the dependent variables is distorted by the very strong relationship between the independent variables, leading to the likelihood that our interpretation of relationships will be incorrect” (p.5). One suggestion to resolve the issue of multicollinearity is to combine highly correlated variables through principal component analysis or omitting the variable from an analysis including other

correlated variables (Daoud, 2017). Instead of omitting or combining the highly correlated variables, the collinearity statistics were reanalyzed using recoded variables.

Table 6.

Collinearity Statistics – Recoded Variables

<u>Variable</u>	<u>Tolerance</u>	<u>VIF</u>
For Profit Own	.83	1.20
High Medicaid Occupancy	.96	1.04
Low Occupancy Rate	.86	1.16
Prov Type	.80	1.25
Hosp Based	.84	1.19
2017 Service	.96	1.04
Qual Rate	.91	1.10
NA Staff	.59	1.69
LPN Staff	.67	1.49
RN Staff	.54	1.85
Case Mix	.50	1.99

Descriptive Statistics – Recoded Variables

After reviewing the initial results and verifying that there were some correlations between the variables, additional collinearity statistics were run with the recoded variables. The recoded

data examines a high level of Medicaid certified beds and low occupancy rates. Although the raw values are highly correlated, the study considers the reported values at opposite ends of the spectrum. Reanalyzing the correlations between these variables was essential to this study since both variables are internal factors being considered within the Organization-Based Conceptual Framework. The collinearity statistics for tolerance and VIF were rerun, and the multicollinearity concerns were resolved based on the previously established thresholds for tolerance and VIF (Table 6).

Negative Binomial Regression

Negative binomial regression modeling will be used to examine factors associated with the number of CMS Emergency Preparedness deficiencies issued to each facility. Specifically, the independent variables will be used to predict (1) CMS Emergency Preparedness deficiencies associated with internal factors and (2) total CMS Emergency Preparedness deficiencies associated with organizational factors. Negative binomial regression is used to test for connections between predictor variables on a count outcome variable when the mean of the count is less than the variance of the count (Simplilearn, 2022). In the preliminary statistical analysis, the mean of the count is less than the variance of the count for total CMS deficiencies and each of the key areas. The mean of the count for each of the four key areas (emergency planning; policies and procedures; communication plan; and training and testing) are more than double the variance count.

Negative binomial regression is a method that is quite similar to multiple regression but is most commonly used to model over-dispersed count outcome variables (Simplilearn, 2022). More specifically, negative binomial regression can be used for modeling count variables with excessive zeros. The histogram reflecting the distribution of nursing homes with CMS

deficiencies by key areas (Figure 4), illustrates the excessive zeros for the dependent variables. Of the 15,142 nursing homes included in the analysis, 9,105 nursing homes had no deficiencies in any of the four key areas (No CMSDEF). Over 60% of the facilities in this analysis report a zero for the dependent variable. This further supports the use of negative binomial regression for analysis.

Similar to Aeberhard et al. (2014), this analysis will consider the following:

“a general linear model featuring n independent response variables Y_1, \dots, Y_n , where each Y_i , for $i = 1, \dots, n$, is linked with a vector of covariates $\mathbf{x}_i \in \mathbb{R}^p$ through its conditional mean:

$$g(E[Y_i|\mathbf{x}_i]) = g(\mu_i) = \eta_i = \mathbf{x}_i^T \boldsymbol{\beta},$$

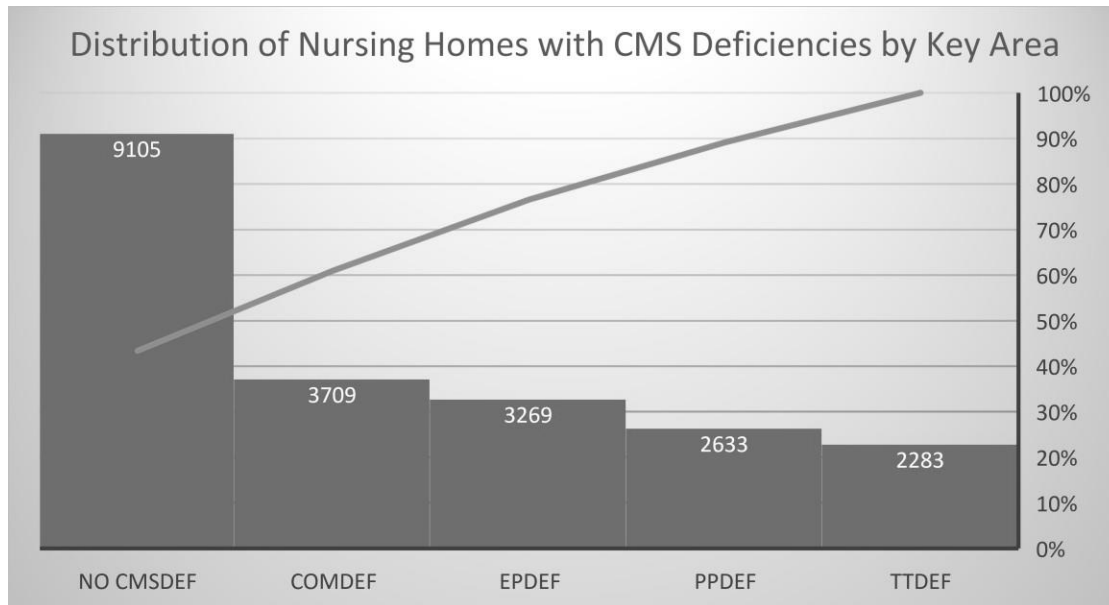
where $g(\cdot)$ is a link function and $\boldsymbol{\beta} = (\beta_0, \dots, \beta_{p-1})^T$ is the vector of regression parameters. The support of $Y_i|\mathbf{x}_i$ consists of the non-negative integers and we choose, without loss of generality, to use a logarithmic link function $g(\cdot) = \log(\cdot)$. We assume a NB distribution with mean parameter $\mu_i > 0$ and overdispersion parameter $\sigma > 0$, denoted as $NB(\mu_i, \sigma)$, yielding the following probability mass function:

$$f(y_i; \mu_i, \sigma) = \frac{\Gamma(y_i+1/\sigma)}{\Gamma(1/\sigma)\Gamma(y_i+1)} (\sigma\mu_i + 1)^{-1/\sigma} \left(\frac{\sigma\mu_i}{\sigma\mu_i + 1} \right)^{y_i}.$$

Under this parameterization, which is based on Lawless (1987) and denoted as ‘NB2’ by Hilbe (2011), the conditional variance is $\text{Var}[Y_i|\mathbf{x}_i] = V(\mu_i) = \mu_i + \sigma\mu_i^2$, so that the Poisson distribution with mean μ_i is the limiting case when $\sigma \rightarrow 0$. We choose to use this parameterization over the other common one involving $\kappa = \sigma^{-1}$ because of the greater numerical stability of the estimation of its overdispersion parameter, as noted by Clark and Perry (1989) and Piegorsch (1990)” (p. 921).

Figure 4

Distribution of Nursing Homes with CMS Deficiencies by Key Area



Limitations

This study is subject to limitations including research bias and threats to validity (both internal and external). Similar to other probability sampling techniques, total population sampling requires the researcher to obtain a list indicating the sampling frame (Laerd Dissertation, 2012). The ability of the researcher to make generalizations based on the total population sample can be compromised if the sampling frame is incomplete. Additionally, the study examines deficiency citations related to CMS Emergency Preparedness and not actual resident, employee or volunteer harm sustained during a disaster event.

Research Bias

Research bias is defined as a systematic error introduced into sampling or testing by selecting or encouraging one outcome or answer over others (Pannucci & Wilkins, 2010). The following methods was employed to control bias in the study:

1. Total population sample: The study sample will include all CMS regulated facilities that comply with the requirements detailed in the data cleaning procedures (Appendix A).
2. Replication: The study will employ secondary data that can be obtained and replicated to confirm results.
3. Statistical tools: Statistical tests will be used to help check the validity of the research.

Threats to Validity

Threats to internal validity include confounding, maturation, and the impact of current events (McDermott, 2011). The results could be confounded if an unidentified variable caused a change in the dependent variable. Since the Emergency Preparedness Rule had only been cited for approximately two implementation years prior to the COVID-19 pandemic, the variables may be impacted by time. The current event, the COVID-19 pandemic, could have unanticipated effects on the variables because it has affected aspects of life beyond emergency preparedness.

Threats to external validity include population features and population validity (McDermott, 2011). If a specific feature of the population of US nursing homes is responsible for an effect, the study may have limited generalizability. The findings can only be generalized with populations that share characteristics with the study population. For example, the study

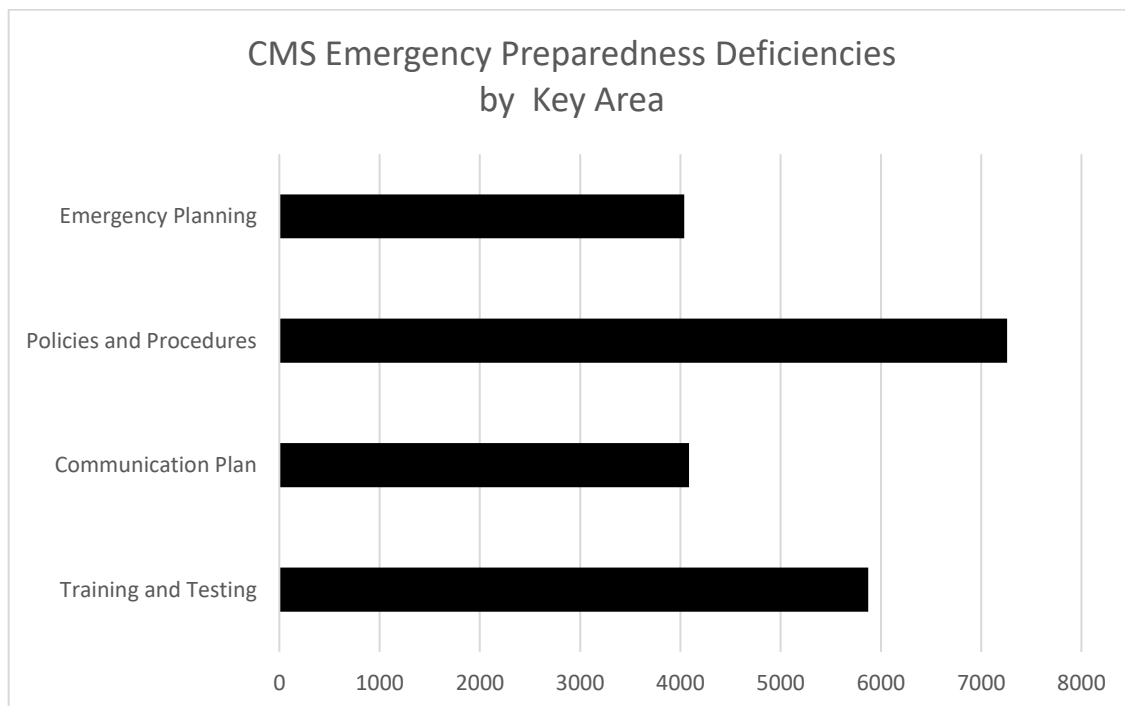
results may not be generalizable to nursing homes that are not regulated by CMS or facilities outside of the US.

IV. DATA ANALYSIS AND RESULTS

The purpose of this study is to identify any relationship between internal and organizational factors and emergency preparedness deficiencies in CMS regulated nursing homes. After the data cleaning procedures described in Appendix A, the final sample included 15,142 CMS regulated facilities. Among those regulated facilities, a total of 21,258 emergency preparedness deficiencies were recorded across the four key areas.

Figure 5

CMS Emergency Preparedness Deficiencies by Key Area



Each negative binomial regression model in this analysis and a regression results summary are detailed below. An analysis summary for each model is also provided. Results will be further discussed based on the internal and organizational factors presented in the organization-based conceptual framework.

Initial Negative Binomial Regression Model and Analysis

The initial negative binomial regression model was run to examine initial correlations between CMS Emergency Preparedness deficiencies and the independent variables. Running the full model is advantageous as the correlations between the independent and dependent variables used in this study have yet to be examined or reported. The model summary and analysis are detailed below.

Model 1 – CMS Emergency Preparedness Deficiencies – Full Model

The full negative regression model included all 15,142 cases in the data set. The Pearson Chi-Square goodness of fit reported a value of 2.41. Since the goodness of fit value is greater than .05, then the model fits the data well and results can be interpreted (Heidel, 2023). A p-value of .00 was reported in the Omnibust Test. This value being less than .05 indicates a statistically significant model and supports the results being interpreted (Heidel, 2023). Additionally, a log likelihood of -24488.52 was reported.

The exponentiated coefficients were utilized rather than the raw coefficients. Each exponentiated coefficient is the ratio of two odds, or the change in odds in the multiplicative scale for a unit increase in the corresponding predictor variable holding other variables at certain value (UCLA: Statistical Consulting Group, 2021). Based on the variables that were statistically significant, an increase in total CMS Emergency Preparedness deficiencies are associated with for-profit ownership (21%); a high Medicaid occupancy (23%), a Medicaid/Medicare provider type (12%); being in operation after 2017 (85%); a lower NA staff hours (14%); lower LPN staff hours (21%). Based on the variables that were statistically significant, a decrease in total CMS Emergency Preparedness deficiencies are associated with low total occupancy rates (-24%);

Table 7

Negative Binomial Regression Analysis Summary for Predicting CMS Emergency Preparedness Deficiencies

Variable (n=15,142)	SE	Wald 95% CI		p-value	Exp(B)	Wald 95% CI for Exp(B)	
		Lower	Upper			Lower	Upper
For Profit Own	.03	.14	.24	<.001***	1.21	1.15	1.27
High Medicaid	.05	.11	.31	<.001***	1.23	1.12	1.36
Occupancy							
Low Occupancy Rate	.02	-.32	-.22	.00**	.76	.73	.80
Provider Type	.06	-.00	.23	.05*	1.12	1.00	1.25
Hospital Based	.06	-.05	.21	.21	1.08	.96	1.23
2017 Service	.09	.43	.79	<.001***	1.85	1.56	2.20
Low Quality Rating	.03	-.08	.02	.24	.97	.92	1.02
NA Staffing	.02	.09	.17	<.001***	1.14	1.10	1.19
LPN Staffing	.03	.13	.25	<.001***	1.21	1.13	1.29
RN Staffing	.03	-.21	-.10	<.001***	.86	.81	.91
Case Mix Total	.02	-.26	-.17	.00**	.81	.77	.84

SE – Standard Error, CI – Confidence Interval

*= $P \leq 0.05$, **= $P \leq 0.01$, ***= $P \leq 0.001$

low RN staff hours (-14%); and high case mix totals (-23%).

As displayed in Table 7, the variables *For Profit Own*, *High Medicaid Occupancy*, 2017 *Service*, *NA Staffing*, *LPN Staffing*, and *RN Staffing* were statistically significant at the $<.001$ level. The variables *Low Occupancy Rate* and *Case Mix Total* were statistically significant at the $<.01$ level. The variable *Provider Type* was statistically significant at the $<.05$ level. The variables *Hospital Based* and *Low Quality Rating* were not statistically significant.

Analysis of Internal Facility Characteristics

A second negative binomial regression model was run to examine the correlations between the CMS Emergency Preparedness deficiencies and the internal factor variables. The internal factor variables are also the variables of interest associated with the previously identified study hypotheses. The model summary and analysis are detailed below.

Model 2 – CMS Emergency Preparedness Deficiencies – Internal Factors

The negative regression model with internal factors included all 15,142 cases in the data set. The Pearson Chi-Square goodness of fit reported a value of 2.40. A p-value of .00 was reported in the Omnibus Test. A log likelihood of -24545.24 was reported.

The exponentiated coefficients were utilized rather than the raw coefficients to examine the correlation between nursing home internal factors and the total CMS Emergency preparedness deficiencies. Based on the variables that were statistically significant, an increase in total CMS Emergency Preparedness deficiencies is associated with high Medicaid occupancy (25%), low NA staff hours (11%); and low LPN staff hours (18%). Based on the variables that

were statistically significant, a decrease in total CMS Emergency Preparedness deficiencies is associated with low RN staff hours (-20%) and high case-mix totals (-15%).

As displayed in Table 8, the variables *High Medicaid Occupancy*, *NA Staffing*, *LPN Staffing*, and *Case Mix Total* were statistically significant at the <.001 level. The variables *Low Occupancy Rate* and *Case RN Staffing* were statistically significant at the <.01 level. The variable *Low Quality Rating* was not statistically significant.

Analysis of Organizational Facility Characteristics

A third negative binomial regression model was run to examine the correlations between the CMS Emergency Preparedness deficiencies and the organizational factor variables. The organizational factor variables are other factors being considered within the Organization-Based Conceptual Framework. The model summary and analysis are detailed below.

Model 3 – CMS Emergency Preparedness Deficiencies – Organizational Factors

The negative regression model with internal factors included all 15,142 cases in the data set. The Pearson Chi-Square goodness of fit reported a value of 2.41. A p-value of .00 was reported in the Omnibus Test. A log likelihood of -24670.39 was reported.

The exponentiated coefficients were utilized rather than the raw coefficients to examine the correlation between nursing home organizational factors and the total CMS Emergency preparedness deficiencies. Based on the variables that were statistically significant, an increase in total CMS Emergency Preparedness deficiencies are associated with the variables of for

Table 8

Negative Binomial Regression Analysis Summary for Predicting CMS Emergency Preparedness Deficiencies with Internal Factors

Variable (n=15,142)	SE	Wald 95% CI		p-value	Exp(B)	Wald 95% CI for Exp(B)	
		Lower	Upper			Lower	Upper
High Medicaid	.05	.13	.32	<.001***	1.25	1.14	1.38
Occupancy							
Low Occupancy Rate	.24	-.29	-.20	.00**	.78	.75	.82
Low Quality Rating	.03	-.08	.02	.26	.97	.92	1.02
NA Staffing	.02	.07	.14	<.001***	1.11	1.07	1.15
LPN Staffing	.03	.11	.23	<.001***	1.18	1.11	1.26
RN Staffing	.03	-.28	-.18	.00**	.80	.76	.84
Case Mix Total	.02	-.21	-.13	<.001***	.85	.81	.88

SE – Standard Error, CI – Confidence Interval

*= $P \leq 0.05$, **= $P \leq 0.01$, ***= $P \leq 0.001$

profit ownership (17%) and were in operation after 2017 (85%). There were no statistically significant organizational factors associated with a decrease in total CMS Emergency Preparedness deficiencies.

As displayed in Table 9, the variables *For Profit Own* and *2017 Service* were statistically significant at the $<.001$ level. The variables *Hospital Based* and *Provider Type* were not statistically significant.

Analysis of Key Areas of CMS Emergency Preparedness Deficiencies

The initial negative binomial regression model and subsequent models revealed several statistically significant correlations between CMS Emergency Preparedness deficiencies and the variables used in this study. Additional models were run to see if these correlations were also specific to the key areas previously identified. The four models included each of the key areas as dependent variables and the identified independent variables. Model summary tables and analyses are included below.

Model 4 – Risk Assessment and Emergency Planning Deficiencies

The negative regression model analyzing correlations with risk assessment and emergency planning deficiencies included all 15,142 cases in the data set. The Pearson Chi-Square goodness of fit reported a value of 1.32. A p-value of .00 was reported in the Omnibus Test. A log likelihood of -9704.98 was reported.

The exponentiated coefficients were utilized rather than the raw coefficients to examine the correlation between the independent variables and risk assessment and emergency planning deficiencies. Based on the variables that were statistically significant, an increase in risk assessment and emergency planning deficiencies are associated with for profit ownership (44%);

Table 9

Negative Binomial Regression Analysis Summary for Predicting CMS Emergency Preparedness Deficiencies with Organizational Factors

Variable (n=15,142)	SE	Wald 95% CI		p-value	Exp(B)	Wald 95% CI for Exp(B)	
		Lower	Upper			Lower	Upper
For Profit Own	.02	.11	.21	<.001***	1.17	1.12	1.23
Provider Type	.05	-.03	.19	.15	1.65	1.40	1.95
Hospital Based	.06	-.05	.18	.26	1.07	.95	1.20
2017 Service	.09	.43	.79	<.001***	1.85	1.56	2.20

SE – Standard Error, CI – Confidence Interval

*= $P \leq 0.05$, **= $P \leq 0.01$, ***= $P \leq 0.001$

having high Medicaid occupancy (30%); were in operation after 2017 (112%); had lower NA staffing hours (15%); and had lower LPN staffing hours (28%). Based on the variables that were statistically significant, a decrease in risk assessment and emergency planning deficiencies are associated with low total occupancy rates (-25%); low quality rating (-13%); low RN staffing levels (-22%); and high case-mix totals (-27%).

As displayed in Table 10, the variables *For Profit Own*, *2017 Service*, *Low Occupancy Rate*, *Low Quality Rating*, *NA Staffing*, *LPN Staffing*, *RN Staffing* and *Case Mix Total* were statistically significant at the $<.001$ level. The variable *High Medicaid Occupancy* was statistically significant at the $<.01$ level. The variables *Provider Type* and *Hospital Based* were not statistically significant.

Model 5 – Policies and Procedures Deficiencies

The negative regression model analyzing correlations with policies and procedures deficiencies included all 15,142 cases in the data set. The Pearson Chi-Square goodness of fit reported a value of 1.93. A p-value of .00 was reported in the Omnibus Test. A log likelihood of -14004.34 was reported.

The exponentiated coefficients were utilized rather than the raw coefficients to examine the correlation between the independent variables and policies and procedures deficiencies. Based on the variables that were statistically significant, an increase in policies and procedures deficiencies are associated with facilities that were in operation after 2017 (90%); had low NA staffing levels (16%); and had low LPN staffing levels (20%). Based on the variables that were statistically significant, a decrease in policies and procedures deficiencies are associated with

Table 10

Negative Binomial Regression Analysis Summary for Predicting Risk Assessment and Emergency Planning Deficiencies

Variable (n=15,142)	SE	Wald 95% CI		p-value	Exp(B)	Wald 95% CI for Exp(B)	
		Lower	Upper			Lower	Upper
For Profit Own	.05	.28	.46	<.001***	1.44	1.32	1.58
High Medicaid	.09	.08	.44	.00**	1.30	1.09	1.55
Occupancy							
Low Occupancy Rate	.04	-.37	-.22	<.001***	.75	.69	.81
Provider Type	.10	-.17	.22	.81	1.02	.84	1.25
Hospital Based	.11	-.14	.30	.48	1.08	.87	1.35
2017 Service	.16	.44	1.06	<.001***	2.12	1.55	2.90
Low Quality Rating	.04	-.23	-.06	<.001***	.87	.80	.94
NA Staffing	.03	.07	.21	<.001***	1.15	1.08	1.24
LPN Staffing	.06	.13	.35	<.001***	1.28	1.14	1.42
RN Staffing	.06	-.36	1.14	<.001***	.78	.70	.87
Case Mix Total	.04	-.38	-.24	<.001***	.73	.68	.79

SE – Standard Error, CI – Confidence Interval

*= $P \leq 0.05$, **= $P \leq 0.01$, ***= $P \leq 0.001$

facilities that had low occupancy rates (-25%); had low RN staffing levels (-8%); and had low case-mix totals (-20).

As displayed in Table 11, the variables *2017 Service*, *Low Quality Rating*, *NA Staffing*, *LPN Staffing*, *RN Staffing* and *Case Mix Total* were statistically significant at the <.001 level. The variable *Low Occupancy Rate* was statistically significant at the <.01 level. The variables *For Profit Own*, *Provider Type*, *High Medicaid Occupancy*, *Low Quality Rating*, and *Hospital Based* were not statistically significant.

Model 6 – Communication Plan Deficiencies

The negative regression model analyzing correlations with communication plan deficiencies included all 15,142 cases in the data set. The Pearson Chi-Square goodness of fit reported a value of 1.92. A p-value of .00 was reported in the Omnibust Test. A log likelihood of -9877.98 was reported.

The exponentiated coefficients were utilized rather than the raw coefficients to examine the correlation between the independent variables and communication plan deficiencies. Based on the variables that were statistically significant, an increase in communication plan deficiencies are associated with for profit ownership (20%); high Medicaid occupancy (26%); being in operation after 2017 (111%); low NA staffing levels (15%); and low LPN staffing levels (24%). Based on the variables that were statistically significant, a decrease in communication plan deficiencies are associated with low occupancy rates (-18%) and a high case mix totals (-22%).

Table 11

Negative Binomial Regression Analysis Summary for Predicting Policies and Procedures Deficiencies

Variable (n=15,142)	SE	Wald 95% CI		p-value	Exp(B)	Wald 95% CI for Exp(B)	
		Lower	Upper			Lower	Upper
For Profit Own	.03	-.02	.12	.14	1.05	.98	1.13
High Medicaid	.07	-.04	.23	.15	1.10	.97	1.26
Occupancy							
Low Occupancy Rate	.03	-.34	-.22	.00**	.75	.71	.80
Provider Type	.08	-.05	.25	.19	1.11	.95	1.28
Hospital Based	.08	-.11	.21	.54	1.05	.90	1.24
2017 Service	.12	.40	.88	<.001***	1.90	1.49	2.41
Low Quality Rating	.04	-.09	.04	.48	.98	.91	1.05
NA Staffing	.03	.09	.20	<.001***	1.16	1.10	1.22
LPN Staffing	.04	.09	.26	<.001***	1.20	1.10	1.30
RN Staffing	.04	-.17	-.02	.01**	.91	.84	.98
Case Mix Total	.03	-.29	-.17	<.001***	.80	.75	.85

SE – Standard Error, CI – Confidence Interval

*= $P \leq 0.05$, **= $P \leq 0.01$, ***= $P \leq 0.001$

As displayed in Table 12, the variables *For Profit Own*, *Low Occupancy Rate*, 2017 *Service*, *NA Staffing*, *LPN Staffing*, and *Case Mix Total* were statistically significant at the $<.001$ level. The variable *High Medicaid Occupancy* was statistically significant at the $<.01$ level. The variables *Provider Type*, *Low Quality Rating*, *Hospital Based*, and *RN Staffing* were not statistically significant.

Model 7 – Training and Testing Deficiencies

The negative regression model analyzing correlations with training and testing deficiencies included all 15,142 cases in the data set. The Pearson Chi-Square goodness of fit reported a value of 1.24. A p-value of .00 was reported in the Omnibus Test. A log likelihood of -12299.62 was reported.

The exponentiated coefficients were utilized rather than the raw coefficients to examine the correlation between the independent variables and training and testing deficiencies. Based on the variables that were statistically significant, an increase in training and testing deficiencies are associated with for profit ownership (33%); high Medicaid occupancy (33%); Medicaid and Medicare provider type (31%); hospital affiliation (43%); being in operation after 2017 (53%); low NA staffing levels (12%); and had low LPN staffing levels (16%). Based on the variables that were statistically significant, a decrease in training and testing deficiencies are associated with low occupancy rates (-26%); low RN staffing levels (-26%); and a high case mix totals (-22%).

Table 12

Negative Binomial Regression Analysis Summary for Communication Plan Deficiencies

Variable (n=15,142)	SE	Wald 95% CI		p-value	Exp(B)	Wald 95% CI for Exp(B)	
		Lower	Upper			Lower	Upper
For Profit Own	.04	.09	.26	<.001***	1.20	1.10	1.30
High Medicaid	.09	.06	.40	.01**	1.26	1.06	1.50
Occupancy							
Low Occupancy Rate	.04	-.27	-.12	<.001***	.82	.76	.89
Provider Type	.09	-.07	.30	.24	1.12	.93	1.35
Hospital Based	.10	-.32	.07	.21	.88	.73	1.07
2017 Service	.16	.43	1.07	<.001***	2.11	1.54	2.91
Low Quality Rating	.04	-.07	.10	.73	1.02	.93	1.11
NA Staffing	.03	.07	.20	<.001***	1.15	1.08	1.23
LPN Staffing	.05	.12	.32	<.001***	1.24	1.12	1.38
RN Staffing	.05	-.10	.08	.81	.99	.91	1.08
Case Mix Total	.04	-.33	-.18	<.001***	.78	.72	.83

SE – Standard Error, CI – Confidence Interval

*= $P \leq 0.05$, **= $P \leq 0.01$, ***= $P \leq 0.001$

As displayed in Table 13, the variables *For Profit Own*, *High Medicaid Occupancy*, *Hospital Based*, *2017 Service*, *NA Staffing*, *RN Staffing*, and *Case Mix Total* were statistically significant at the $<.001$ level. The variables *Low Occupancy Rate*, *Provider Type*, and *LPN Staffing* were statistically significant at the $<.01$ level. The variable *Low Quality Rating* was not statistically significant.

Table 13

Negative Binomial Regression Analysis Summary for Training and Testing Deficiencies

Variable (n=15,142)	SE	Wald 95% CI		p-value	Exp(B)	Wald 95% CI for Exp(B)	
		Lower	Upper			Lower	Upper
For Profit Own	.04	.21	.36	<.001***	1.33	1.23	1.30
High Medicaid	.08	.14	.44	<.001***	1.33	1.15	1.55
Occupancy							
Low Occupancy Rate	.03	-.36	-.23	.00**	.74	.70	.80
Provider Type	.09	.08	.45	.00**	1.31	1.09	1.56
Hospital Based	.11	.15	.67	<.001***	1.43	1.12	1.77
2017 Service	.13	.17	.68	<.001***	1.53	1.19	1.96
Low Quality Rating	.04	-.04	.11	.35	1.04	.96	1.12
NA Staffing	.03	.05	.17	<.001***	1.12	1.06	1.19
LPN Staffing	.05	.05	.25	.00**	1.16	1.05	1.28
RN Staffing	.05	-.41	-.21	<.001***	.74	.67	.81
Case Mix Total	.03	-.19	-.06	<.001***	.88	.83	.94

SE – Standard Error, CI – Confidence Interval

*= $P \leq 0.05$, **= $P \leq 0.01$, ***= $P \leq 0.001$

V. DISCUSSION AND CONCLUSION

The purpose of this qualitative study was to provide a baseline assessment of nursing home facility characteristics associated with having an Emergency Preparedness Rule deficiency citation. The problem addressed in this study was that although there has been an increased focus on emergency preparedness for hospitals, nursing homes have been neglected as an important component of the health care system. The results of the study can be used to inform decision making at the nursing home level which could mitigate additional risk to nursing home residents through effective emergency preparedness planning.

Correlation Between CMS Emergency Preparedness Deficiencies and Variables

An initial negative binomial regression model was run to examine initial correlations between CMS Emergency Preparedness deficiencies and the independent variables. Running the full model provided a starting point for analysis as the correlations between the independent and dependent variables used in this study have yet to be examined or reported. Due to high collinearity between the *Medicaid Occupancy* and *Total Occupancy Rate* variables, this test could not be run using the raw variables. The variables were recoded to reflect *High Medicaid Occupancy* and *Low Occupancy Rate*. Recoding the variables resolved the collinearity concerns, allowing the variables to be used in the same model.

The initial model reported a statistically significant relationship between CMS Emergency Preparedness deficiencies and all independent variables except *Hospital Based* and *Low Quality Rating*. Although the nursing home being associated with a hospital was not a variable of interest when considering CMS Emergency Preparedness deficiencies, the lack of a relationship with *Low Quality Rating* was interesting. The overall quality rating in a nursing

home has been found to be significant in studies examining nursing home satisfaction (Nadash et al., 2019), COVID-19 incidence (Williams et al., 2021), and COVID-19 mortality (Das Gupta et al., 2021). However, the results from this study are aligned with other studies that did not find a significant relationship between quality rating and the adoption of health technology systems (Murray, 2015) or adverse events developing in the 45 days following discharge back to long-term care (Field et al., 2021).

Organization-Based Conceptual Framework and Variables of Interest

The conceptual framework that guided the study suggested several internal and organizational factors that are associated with deficiency citations for emergency preparedness. In this study, these factors of interest included staffing levels, resident case-mix, nursing home quality, Medicaid occupancy rates, and total occupancy rates. The following hypotheses were examined in this study:

Hypothesis 1: Lower nursing home staffing levels will be associated with CMS Emergency Preparedness deficiencies and an increase in emergency preparedness deficiencies cited.

Hypothesis 2: Nursing homes operating with higher resident case-mix totals will be associated with CMS Emergency Preparedness deficiencies and an increase in emergency preparedness deficiencies cited.

Hypothesis 3: Poor nursing home quality ratings will be associated with CMS Emergency Preparedness deficiencies and an increase in emergency preparedness deficiencies cited.

Hypothesis 4: Nursing homes with higher Medicaid and/or Medicare occupancy will be associated with CMS Emergency Preparedness deficiencies and an increase in emergency preparedness deficiencies cited.

Hypothesis 5: Nursing homes operating with lower total occupancy rates will be associated with CMS Emergency Preparedness deficiencies and an increase in emergency preparedness deficiencies cited.

The following table (Table 14) describes how the various negative binomial regression models that include the variables of interest support the hypotheses.

Table 14

Negative Binomial Regression Model and Hypotheses Support

	Negative Binomial Regression Models					
	CMS EP	Internal Factors	EP DEF	PP DEF	COM DEF	TT DEF
Hypothesis 1 (Staffing Levels)	Supports (NA, LPN)	Supports (NA, LPN)	Supports (NA, LPN)	Supports (NA, LPN)	Supports (NA, LPN)	Supports (NA, LPN)
	Partially Supports (RN)	Partially Supports (RN)	Partially Supports (RN)	Partially Supports (RN)	Does Not Support (RN)	Partially Supports (RN)
Hypothesis 2 (Case-Mix)	Partially Supports	Partially Supports	Partially Supports	Partially Supports	Partially Supports	Partially Supports
Hypothesis 3 (Quality Ratings)	Does Not Support	Does Not Support	Partially Supports	Does Not Support	Does Not Support	Does Not Support
Hypothesis 4 (Medicaid Occupancy)	Supports	Supports	Supports	Does Not Support	Supports	Supports
Hypothesis 5 (Total Occupancy)	Partially Supports	Partially Supports	Partially Supports	Partially Supports	Partially Supports	Partially Supports

Staffing Levels

All of the negative regression models presented support a statistically significant relationship between emergency preparedness deficiencies and an increase in emergency preparedness deficiencies cited for NA and LPN staffing levels. The RN staffing level was partially supported in five of the six models. A statistically significant relationship was found between emergency preparedness deficiencies and RN staffing levels, but the models reported a decrease in emergency preparedness deficiencies cited. The RN staffing level was not supported in the model examining the relationship with communication plan deficiencies. Further research is required to determine why that specific type of deficiency was not connected to RN staffing in nursing homes. The hypothesis regarding nurse staffing level (*Hypothesis 1*) was partially supported.

Despite what was found in the current literature, a slight increase in low staffing levels for NA and LPN staff was correlated with an increase in emergency preparedness deficiencies. However, a decrease in low staffing levels for RN staff are correlated with an increase in emergency preparedness deficiencies.

Nursing home staffing levels continue to be a topic of concern. The results regarding NA and LPN low staffing levels support the call for an increase in overall nurse staffing. The correlation between low staffing levels among RN employees may be related to the responsibilities RNs provide within nursing homes. For example, RN duties include overseeing the delivery of residents' overall care; while LPNs care for residents under an RNs direction; and NAs work under the direction of LPNs and provide most of the day-to-day care for residents (OIG, 2020). Since RNs operate in a "middle manager" type of role within the nursing home, the

impact of low RN staffing levels is not the same as the impact of low NA and LPN staffing levels.

Table 15

Study Adjustments – Staffing Levels

Current Study	Study Adjustments Based on Baseline Data
The current study determined the numerical values for “low” staffing levels for NA, LPN and RN staff based on the descriptive statistics.	Now that we have data reporting the staffing hours for NA, LPN, and RN staff in 15,142 facilities, the staffing hours in each category should be examined carefully. With so much variation in the range for each nursing level (NA: 0 – 7.97; LPN: 0 – 4.95; RN: 0 – 7.65), defining a “low” staffing level will require additional analysis of the data.

Case-Mix Total

All of the negative regression models presented partial support for the relationship between emergency preparedness deficiencies and case-mix totals. A statistically significant relationship was found between emergency preparedness deficiencies and case-mix total, but the models all reported a decrease in emergency preparedness deficiencies cited. The hypotheses related to case-mix totals (*Hypothesis 2*) was partially supported.

The literature predicted that higher case-mix totals would be associated with CMS emergency preparedness deficiencies. Based on previous studies it was predicted that the resident case-mix may increase the number of deficiencies that a facility receives because

residents with higher case-mix totals require more assistance with ADLs like toileting, getting dressed or eating and will require more direct assistance from staff members. However, in each of the negative regression models a decrease in case-mix totals were associated with more CMS emergency preparedness deficiencies.

The results indicating that decreased case-mix totals are associated with CMS emergency preparedness deficiencies may point to an association between the impact of providing moderate assistance for ADL's can impact staff members ability to comply with CMS emergency preparedness requirements. This variable was examined across all three staffing levels. Examining the impact of case-mix totals among individual staffing levels may provide more insight into how the variable impacts emergency preparedness deficiencies.

Table 16

Study Adjustments – Case-Mix Totals

Current Study	Study Adjustments Based on Baseline Data
The current study hypothesized that the demands of higher case-mix totals would be associated with an increase in CMS emergency preparedness deficiencies.	Since the study is over dispersed, with over 60% of the facilities reporting no deficiencies, a closer examination of case-mix totals and facilities with deficiencies is needed. Also, since the negative regression models reported correlations at the <.001 level, the case-mix levels for each staffing category (NA, LPN, RN) should be examined.

The results with total staffing may be skewed because the staff responsibilities related to ADLs are not equally shared among all staff levels. For instance, RN nurses may provide services for patients with high need levels, while a NA would be assisting several low needs patients, bringing the average case-mix total for the facility down. Although the residents' needs do not change, the direct assistance provided by each staff level may vary greatly.

Quality Rating

A relationship between CMS emergency preparedness deficiencies and nursing homes with low quality ratings was not statistically significant in five out of the six models. The hypothesis related to quality ratings (*Hypothesis 3*) was only partially supported in the model examining the relationship with risk assessment and emergency preparedness deficiencies and a decrease in emergency preparedness deficiencies was predicted.

The E-tags in the risk assessment and emergency preparedness category are related to developing, implementing, and maintaining a comprehensive emergency preparedness plan in a nursing home facility. A facility with a low CMS quality rating has been evaluated by a team of surveyors who have determined that the facility is not meeting the established CMS quality standards. Since these facilities are not meeting the established CMS quality standards, staff members at the facility may not have the capacity to focus on the new requirements in the CMS emergency preparedness rule. The responsibility for creating and implementing the emergency preparedness plan would likely fall on a nursing home director and administrator, not the staff members directly caring for patients.

The CMS implemented the Five-Star Quality Rating System to help consumers, families, and caregivers compare nursing homes more easily (CMS, 2023). The quality ratings are based

on factors like health inspections (i.e., nursing home health inspection surveys for the past 3 years) and quality measures (i.e. ADL decline, mobility decline, resident falls, resident ulcers) to calculate a score between 1 and 5 stars (CMS, n.d.). This variable is associated with the day-to-day nursing home activities. The lack of connection between quality rating to CMS Emergency Preparedness deficiencies could be related to the lack of connection to daily nursing home activities that comprise the quality of care in the facility.

Table 17

Study Adjustments – Quality Rating

Current Study	Study Adjustments Based on Baseline Data
The current study hypothesized that lower overall quality rating scores would be associated with CMS emergency preparedness deficiencies.	Quality rating was statistically significant in only one of the negative regression models. The impact of nursing home quality and staff member capacity (especially among management staff) should be explored.

Medicaid Occupancy

Five out of the six negative regression models presented support for the relationship between emergency preparedness deficiencies with Medicaid occupancy. The statistically significant regression models also reported a correlation between high Medicaid occupancy and an increase in emergency preparedness deficiencies cited. The hypothesis related to Medicaid Occupancy (*Hypothesis 4*) was supported. The negative regression model examining the

relationship between Medicaid occupancy and policy and procedures deficiencies was not statistically significant.

The policy and procedures E-tags include requirements for nursing homes to create procedures for tracking of staff and patients, policies and procedures for sheltering, and policies and procedures for medical documentation. This key area of the CMS Emergency Preparedness requirements includes E-tags that are specific to nursing home residents. It is encouraging that deficiencies in this specific key area do not have a relationship with a nursing home having a high Medicare/Medicaid occupancy. Since the Medicaid program is the United States' largest purchaser of nursing home services, a relationship between this variable and CMS Emergency Preparedness deficiencies could have a monumental negative impact on nursing home residents.

Total Occupancy Rates

All of the negative regression models presented partial support for the relationship between CMS emergency preparedness deficiencies and total occupancy rates. The statistically significant regression models also reported a correlation between low total occupancy rates and a decrease in emergency preparedness deficiencies cited. The hypotheses related to total occupancy rates (*Hypothesis 5*) was partially supported in the models presented.

This result from this study aligns with the previous research presented regarding other types of nursing home deficiencies. Since facilities with lower total occupancy rates may experience difficulties related to normal operation, some of this strain may impact a nursing home's ability to appropriately comply with CMS Emergency Preparedness requirements. In general, the literature regarding high versus low occupancy rates was mixed, but lower

Additionally, a facility being in operation before 2017 was highly significant ($<.001$) across all six models. Being in operation prior to 2017 was considered to examine whether newly certified facilities (those in operation after 2017) experienced difficulty complying with all CMS requirements. Existing facilities (those in operation before 2017) only had to comply with the new emergency preparedness requirements. For profit ownership was highly significant ($<.001$) in five of the six negative binomial regression models. Specific types of for-profit ownership could be examined more carefully as the recoded category includes four types of for-profit owners. Adjustments to the current study to incorporate these findings are described in Table 19.

Facility Characteristics and CMS Emergency Preparedness Rule Deficiencies

The overarching research question that guided the study asked: Is there a relationship between nursing home facility characteristics and CMS Emergency Preparedness Rule deficiency citations? The results confirmed that there is a strong relationship between overall CMS emergency preparedness rule deficiencies and facility characteristics like for profit ownership; high Medicaid occupancy; NA and LPN staffing levels; and the facility being in operation prior to 2017. The study also found significant relationships between overall CMS emergency preparedness rule deficiencies and facility characteristics like low occupancy rates; RN staffing levels; and case mix totals. Some of these relationships were stronger when the relationship between the facility characteristics and deficiencies in the four CMS core areas were examined. Some of these relationships were stronger when the relationship between the facility characteristics and deficiencies in the four CMS core areas were examined. Some of these relationships were stronger when the relationship between the facility characteristics and deficiencies in the four CMS core areas were examined. Although significant

Table 19*Study Adjustments – Other Variables*

Current Study	Study Adjustments Based on Baseline Data
<p data-bbox="293 625 589 657">For Profit Ownership</p> <p data-bbox="217 699 672 951">In the current study ownership type was operationalized by coding the nursing home as having either for-profit ownership (1) or not (0).</p>	<p data-bbox="727 625 1403 1020">Based on the baseline data, for profit ownership may have a significant impact on CMS emergency preparedness deficiencies. The CMS data reports 11 different types of ownership types. These ownership types can be examined individually instead of classifying facilities as either for profit or non-profit.</p>
<p data-bbox="358 1142 524 1173">2017 Service</p> <p data-bbox="217 1215 672 1610">In the current study the age of facility was operationalized by determining if the facility was approved to provide Medicaid and Medicare Services prior to 2017 (1) or not (0).</p>	<p data-bbox="727 1142 1403 1755">Based on the baseline data, 2017 service may have a significant impact on CMS emergency preparedness deficiencies. The CMS data reports the exact date that the facility becomes eligible to provide service to Medicare and Medicaid patients. These service dates could be examined with different groupings (i.e. by decades) individually instead of classifying facilities based on whether or not they were approved to provide Medicaid and Medicare Services prior to 2017.</p>

relationships were found between the variables and CMS Emergency Preparedness deficiencies, many also predicted a decrease in the total number of emergency preparedness deficiencies cited. The negative relationship with variables like RN staffing levels, case-mix and total occupancy rates indicate a difference in the type of relationship these variables have with deficiencies related to emergency preparedness.

Implications

The study has identified internal and organizational factors associated with CMS Emergency Preparedness deficiencies and deficiencies in the four key areas identified by CMS. This is a research area that has not been thoroughly explored, so information gained in the study could be applied in several ways. This section will discuss some of the implications for the owners of nursing home facilities and employees. Implications for policy makers and the larger health care community will also be discussed.

Most Cited Key Area for CMS Emergency Preparedness Deficiencies

The initial data set analysis revealed the most cited key areas for deficiencies. As previously indicated in Figure 5, policies and procedures was the most cited key area. E-tags listed under policies and procedures had over 1,300 more citations than the next highest category, training and testing. Deficiencies in the key areas of policies and procedures and training and testing were responsible for almost two-thirds of the deficiencies examined in this study. This is important for various groups involved in nursing home operations. Nursing home owners can use this information to make decisions about where to direct limited resources. Employees can ensure that the training and testing regulations specific to CMS Emergency Preparedness are being offered and documented according to requirements. Nursing home

administrators and other employees responsible for nursing home supervision can also apply this information when making decisions that affect nursing home compliance.

Internal and Organizational Factors Impacting Deficiencies

Identifying internal and organizational factors that have a relationship with CMS Emergency Preparedness deficiencies provides a baseline for this research area. Prior to this study, no known national level analysis of CMS Emergency Preparedness deficiencies had been conducted. This study supported the modified Organization-Based Conceptual Framework could be applied to research examining CMS Emergency Preparedness deficiencies in the way that it has been applied to studies analyzing deficiency citations related to resident safety, infection control, and resident abuse in nursing homes (Castle, 2010; Castle, 2011; Castle et al., 2011). The relationships identified can be examined to see if they remain in nursing homes post COVID-19.

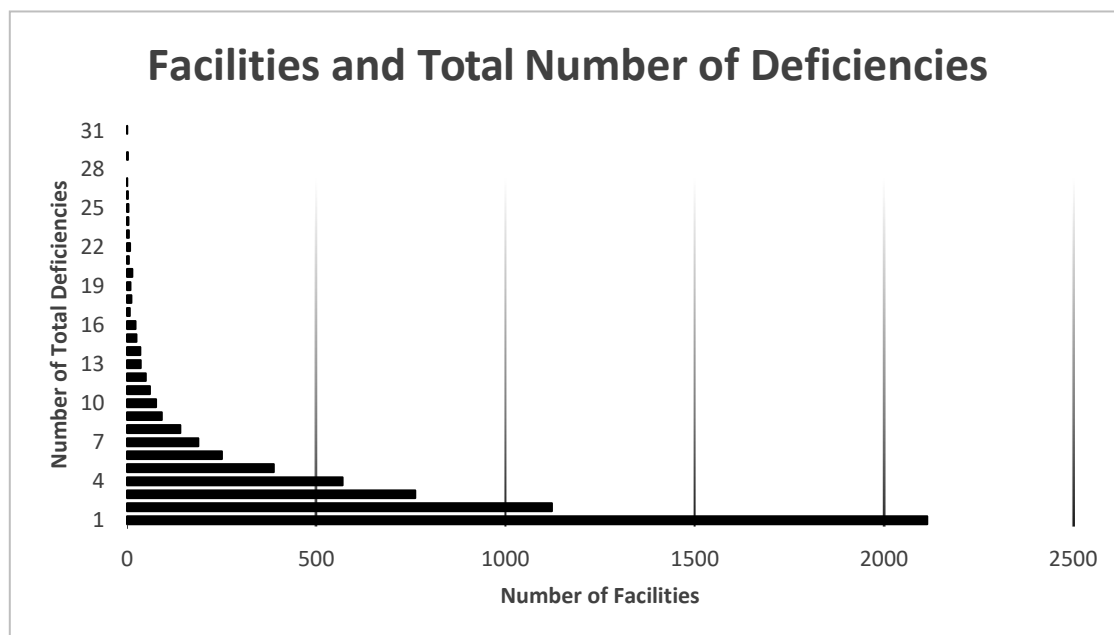
Broader Implications for US Nursing Homes

More broadly, this study will add to the conversation regarding (1) whether US nursing homes are meeting the federal emergency preparedness standards and (2) whether the regulatory guidelines aimed at increasing emergency preparedness in LTCFs are sufficient. Since the implementation of the CMS Emergency Preparedness requirements in 2016, researchers have not examined the nationwide impact of these federal regulations. Additionally, there is no research probing whether the federal requirements have increased emergency preparedness in LTCFs as a whole.

As discussed earlier, the data reported that 60% of the CMS regulated nursing homes did not have any emergency preparedness deficiencies. After further examination, 82% of the facilities that reported emergency preparedness deficiencies had between 1-5 deficiencies in a two-year period (see Figure 6). Conversely, facilities reporting 15 or more deficiencies in the same two-year period represent less than one percent of the facilities reporting emergency preparedness deficiencies. Most of the facilities are meeting the federal emergency preparedness standards based on the number of deficiencies cited.

Figure 6

CMS Regulated Facilities and Total Number of Deficiencies



The increase in emergency preparedness within LTCF's is still unclear. While nursing homes are considered the largest sub-set of LTCFs, other factors should be considered when

determining if there was an increase in overall emergency preparedness. One additional factor that should be considered to answer this question is the weight of the deficiencies. A deficiency for the E-tag that requires facilities to maintain and annually update emergency could be considered low-risk if it three weeks beyond the required update because it could potentially cause minimal harm to residents. On the other hand, a facility cited for failing to implement an emergency prep training program for employees could be considered high-risk requiring immediate correction. Examining both the number and severity of the deficiencies cited could provide a clearer picture of how LTCFs have increased preparedness.

The CMS emergency preparedness guidelines were compared to the whole of community goals presented by FEMA. The National Preparedness Goal identifies five mission areas intended to assist everyone who has a role in achieving the elements in the goal (FEMA, 2020). The FEMA goals related to protection and mitigation align with the CMS emergency preparedness guidelines. It is unclear if I facility could be considered prepared for emergencies while focusing on two out of the five mission areas presented by FEMA.

Opportunities for Further Research

In a quantitative research study, characteristics of people and communities cannot be meaningfully reduced to numbers or adequately understood without reference to the local context (Choy, 2014). The benefit of this study is that it provides some direction for areas to further explore and incorporate aspects of qualitative or mixed methods research. Some opportunities for additional research are detailed below.

- *Nursing Home CMS Emergency Preparedness Deficiencies After COVID-19:* The impact of COVID-19 on the day-to-day operation of nursing homes is likely to have an impact

for years to come. This study was limited to deficiencies cited prior to any COVID-19 closures. Additional research could compare the results pre- and post-COVID-19.

- *Examining State Level Influence:* The CMS Emergency Preparedness requirements were implemented at the federal level. There are also requirements at the state level that are not uniform. A study could examine the impact of different state level requirements on compliance with federal level requirements. Specifically, determine whether stringent state level requirements increase federal level compliance.
- *Influence of Regional Disasters:* CMS Emergency Preparedness requirements are designed to encourage nursing homes to prepare for all disasters with a focus on the types of disasters that may impact their specific area. Examining nursing homes by FEMA regions may illuminate some factors impacting nursing homes that are at risk of experiencing similar disasters.
- *Implementing Zero-Inflated Negative Binomial Regression:* This study employed negative binomial regression for analysis in SPSS Statistics. Accessing this package in statistical software can allow researchers to conduct zero-inflated negative binomial regression analysis. This type of analysis, which specifically accounts for the overdispersion of zeros in a data set, may report more sensitive results.
- *Nursing Home Best Practices:* Over 60% of the regulated nursing home facilities do not have any CMS Emergency Preparedness deficiencies. Some best practices could be compiled to assist facilities with deficiencies, especially facilities that are repeatedly cited for certain deficiencies.

Conclusion

Nursing homes have experienced several emergency events which have resulted in loss of lives, damage to facilities, and disruption of social structures over the past decades. The devastation experienced due to natural disasters has confirmed the importance of emergency management as a role of federal, state, and local governments. CMS requirements were intended to set a base level of regulation at the federal level for all regulated facilities.

A key finding of the study was that there was support for four of the five variables of interest identified in the study. This has set the stage for further research to examine other factors impacting the relationship between CMS Emergency Preparedness deficiencies and nursing home staffing levels, case-mix totals, Medicaid occupancy and total occupancy rates. The relationship between these variables and CMS Emergency Preparedness deficiencies is also aligned with research examining other nursing home deficiencies.

The study also highlighted that almost two-thirds of US nursing homes do not have any CMS Emergency Preparedness deficiencies. This creates an opportunity for regulatory officials to share best practices from facilities who are complying with the CMS regulations. The study results also highlight facilities that may need additional assistance to come into compliance and resolve CMS Emergency Preparedness deficiencies. Increasing nursing home compliance with the CMS rule for emergency preparedness is supporting a policy implemented to provide appropriate care for aging Americans.

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APPENDIX A

DETAILED DATA CLEANING PROCEDURES

The NH_FireSafetyCitations file was downloaded from the Data.CMS.gov website on February 16, 2021, and saved to a Google Drive file called Data Control. This file contained the fire safety deficiencies and emergency preparedness deficiencies for all CMS certified nursing home facilities between 11/14/2014 to 12/18/2020. Since this study is only examining the emergency preparedness deficiencies, the data was sorted so that the fire safety deficiencies could be removed. Additionally, the study is only examining deficiencies prior to any of the COVID-19 cases announced in the U.S. A two-year timeframe (November 2017 to November 2019) was used to examine the nursing home deficiencies before the COVID-19 pandemic cause unanticipated effects that could not be controlled.

Data transformation was required on the remaining files to calculate the total number of deficiencies for each facility (Figure 2) based on the current system which reported one deficiency per line (Figure 1). The data transformation allowed me to report the number of deficiencies in each of the four core areas and the total number of deficiencies for each facility between November 2017 and November 2019.

Figure 7*Example of Deficiencies Reported One Per Line*

7201	165601	MANORCARE HEALTH SERVICES - WEST DES MOINES	5010 GRAND RIDGE DRIVE	WEST DES MOIN IA	50265
7202	165601	MANORCARE HEALTH SERVICES - WEST DES MOINES	5010 GRAND RIDGE DRIVE	WEST DES MOIN IA	50265
7203	165601	MANORCARE HEALTH SERVICES - WEST DES MOINES	5010 GRAND RIDGE DRIVE	WEST DES MOIN IA	50265
7204	165601	MANORCARE HEALTH SERVICES - WEST DES MOINES	5010 GRAND RIDGE DRIVE	WEST DES MOIN IA	50265
7205	165601	MANORCARE HEALTH SERVICES - WEST DES MOINES	5010 GRAND RIDGE DRIVE	WEST DES MOIN IA	50265
7206	165601	MANORCARE HEALTH SERVICES - WEST DES MOINES	5010 GRAND RIDGE DRIVE	WEST DES MOIN IA	50265
7207	165601	MANORCARE HEALTH SERVICES - WEST DES MOINES	5010 GRAND RIDGE DRIVE	WEST DES MOIN IA	50265
7208	165601	MANORCARE HEALTH SERVICES - WEST DES MOINES	5010 GRAND RIDGE DRIVE	WEST DES MOIN IA	50265

Figure 8

Example of Deficiencies Merged for the Facility

Federal Provider Number	Provider Name	Provider Address	Provider City	Provider State	Provider Zip Cc
165601	MANORCARE HEALTH SERVICES -WEST DES MOINES	5010 GRAND RIDGE DRIVE	WEST DES MOINES	IA	50265

Federal Provider Number	Risk Assessment + Planning	Policies + Procedures	Communication Plan	Training + Testing	Total Deficiencies
165601	2	1	1	4	8

The NH_ProviderInfo file was downloaded from the Data.CMS.gov website on February 22, 2020, and saved to a Google Drive file called Data Control. The provider information is recorded for each facility. Data transformations were required for the following variables used in the analysis:

- **Ownership type** – Transformed into a dichotomous variable.
- **Provider type** – Transformed into two categories: Medicare and Medicaid and Medicaid Only.
- **Medicare/Medicaid Age** – Transformed into a dichotomous variable.

Additional variables were kept in the dataset for additional analysis. Variables like the *number of fines* and *payment denials* remain in the dataset but were not used in the current study.

Files were deleted if the Federal Provider Number was corrupted during the download process. It would have taken an immense amount of time to go through each file by hand to verify the provider number by matching each facility name and address. Additionally, facilities from Puerto Rico and the Virgin Islands were deleted. In total, 312 files were deleted.

Figure 9*Example of Corrupted Federal Provider Number*

8.00E+29	GOVERNOR BACON HEALTH CENTER	2546 COLTER ROAD
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The two data files were then merged based on federal provider number, provider name, and provider address to create a hybrid dataset. The code book for this hybrid dataset is included in Appendix B.

APPENDIX B

CODE BOOK

*CMS – Centers for Medicare and Medicaid Services

Variable Code	Description	Source
PROVNUM	<i>Federal Provider Number</i>	CMS Provider Information
PROVNAME	<i>Provider Name</i>	CMS Provider Information
PROVSTREET	<i>Provider Street Address</i>	CMS Provider Information
PROVCITY	<i>Provider City</i>	CMS Provider Information
PROVSTATE	<i>Provider State</i>	CMS Provider Information
PROVZIP	<i>Provider Zip Code</i>	CMS Provider Information
PROVPHONE	<i>Provider Phone Number</i>	CMS Provider Information
OWNTYPE	<i>Ownership Type - All</i> <ul style="list-style-type: none"> (1) For Profit Corporation, (2) Non-profit Corporation, (3) Non-profit Church Related, (4) For Profit Limited Liability Company, (5) For Profit Partnership, (6) For Profit Individual, (7) Government-City/County, (8) Government-State, (9) Government – Federal (10) Government-Hospital District, (11) Non-profit Other 	CMS Provider Information
FORPROFITOWN	<i>Ownership Type – Coded</i> <ul style="list-style-type: none"> (0) For Profit Owner – YES, (1) For Profit Owner – NO 	Author
MEDICAIDOCCUPANCY	<i>Certified Beds</i> <ul style="list-style-type: none"> Number of beds in Medicare and/or Medicaid certified areas within a facility 	CMS Provider Information
HIGHMEDICAIDOCCUPANCY	<i>Certified Beds</i> <ul style="list-style-type: none"> Are there more than 200 certified beds in the facility? (0) – NO, (1) – YES	Author
OCCUPANCYRATE	<i>Total Occupancy Rate</i> <ul style="list-style-type: none"> Average number of beds occupied by residents per day 	CMS Provider Information
LOWOCCUPANCYRATE	<i>Total Occupancy Rate</i> <ul style="list-style-type: none"> Is the occupancy rate lower than 60 beds? (0) – NO, (1) – YES	Author

Variable Code	Description	Source
PROVTYPE	<i>Provider Type</i> - (0) Medicare and Medicaid, (1) Medicare Only	CMS Provider Information
HOSPBASD	<i>Hospital Affiliation</i> - (0) Facility hospital based - NO, (1) Facility hospital based - YES	CMS Provider Information
SERVAPPDATE	<i>Service Approval Date</i> - Date first approved to provide Medicare and Medicaid services	CMS Provider Information
2017SERVICE	<i>Medicare/Medicaid Age</i> - (0) Medicare/Medicaid Service Provider Prior to 2017 – YES, (1) Medicare/Medicaid Service Provider Prior to 2017 – NO	Author
QUALRATE	<i>Quality Rating</i> - CMS Quality of Resident Care Rating (Scale of 1-5)	CMS Provider Information
LOWQUALRATE	<i>Quality Rating</i> - Is the facility quality rating 2 stars or below? (0) – NO, (1) – YES	Author
NASTAFF	<i>Nurse Aid Staffing Level</i> - Reported Nurse Aide Staffing - Hours per Resident per Day	CMS Provider Information
NALOWSTAFF	<i>Nurse Aid Staffing Level</i> - Is the nurse aid staffing level 1.5 hours or below? (0) – NO, (1) – YES	
LPNSTAFF	<i>Licensed Professional Nurse (LPN) Staffing Level</i> - Reported LPN Staffing - Hours per Resident per Day	CMS Provider Information
LPNLOWSTAFF	<i>Licensed Professional Nurse (LPN) Staffing Level</i> - Is the LPN staffing level .50 hours or below? (0) – NO, (1) – YES	
RNSTAFF	<i>Registered Nurse (RN) Staffing Level</i> - Reported RN Staffing - Hours per Resident per Day	CMS Provider Information
RNLOWSTAFF	<i>Registered Nurse (RN) Staffing Level</i> - Is the RN staffing .30 or below? (0) – NO, (1) - YES	

Variable Code	Description	Source
NACASEMIX	<i>Nurse Aid Case-Mix</i> <ul style="list-style-type: none"> - Case-Mix NA: The score for three ADLs (eating, toileting, and transferring). Constructed by giving a score of 1 for low assistance, 2 for moderate assistance, and 3 for high need for assistance summed for each ADL. Score is for the Nurse Aid staffing level only. 	CMS Provider Information
LPNCASEMIX	<i>Licensed Professional Nurse (LPN) Case-Mix</i> <ul style="list-style-type: none"> - Case-Mix: The score for three ADLs (eating, toileting, and transferring). Constructed by giving a score of 1 for low assistance, 2 for moderate assistance, and 3 for high need for assistance summed for each ADL. Score is for the LPN staffing level only. 	CMS Provider Information
RNCASEMIX	<i>Registered Nurse (RN) Case-Mix</i> <ul style="list-style-type: none"> - Case-Mix: The score for three ADLs (eating, toileting, and transferring). Constructed by giving a score of 1 for low assistance, 2 for moderate assistance, and 3 for high need for assistance summed for each ADL. Score is for the RN staffing level only. 	CMS Provider Information
CASEMIXTOTAL	<i>Case-Mix Total</i> <ul style="list-style-type: none"> - The score for three ADLs (eating, toileting, and transferring). Constructed by giving a score of 1 for low assistance, 2 for moderate assistance, and 3 for high need for assistance summed for each ADL. Variable is the total across the three staffing levels. 	CMS Provider Information
CASEMIXHIGH	<i>Case-Mix Total</i> <ul style="list-style-type: none"> - Is the case mix total 3.5 or higher? (0) – NO, (1) – YES 	Author
FACILITYCITATION	<i>Number of Facility Reported Incidents</i> <ul style="list-style-type: none"> - Number of times in the past 3 years that a facility-reported issue resulted in a citation 	CMS Provider Information

Variable Code	Description	Source
COMPCITATION	<i>Number of Substantiated Complaints</i> - Number of Complaints in the past 3 years that resulted in a citation	CMS Provider Information
NUMFINES	<i>Number of Fines</i> - Number of CMS fines issued	CMS Provider Information
FINETOTAL	<i>Total Fines</i> - Total Amount of CMS Fines in Dollars	CMS Provider Information
PYMTDENY	<i>Payment Denials</i> - Total number of payment denials	CMS Provider Information
PENALTY	<i>Penalties</i> - Total Number of Penalties	CMS Provider Information
EPDEF	<i>Number of CMS Emergency Planning Deficiencies</i> - Deficiency citations for the following E-tags: 0001, 0004, 0006, 0007, 0009	CMS Fire Safety Deficiencies
PPDEF	<i>Number of CMS Policies and Procedure Deficiencies</i> - Deficiency citations for the following E-tags: 0013, 0015, 0018, 0020, 0022, 0023, 0024, 0025, 0026	CMS Fire Safety Deficiencies
COMDEF	<i>Number of CMS Communication Plan Deficiencies</i> - Deficiency citations for the following E-tags: 0029, 0030, 0031, 0032, 0033, 0034, 0035	CMS Fire Safety Deficiencies
TTDEF	<i>Number of CMS Training and Testing Deficiencies</i> - Deficiency citations for the following E-tags: 0036, 0037, 0039, 0041, 0042	CMS Fire Safety Deficiencies
CMSDEF	<i>Number of CMS Emergency Preparedness Deficiencies</i> - Deficiency citations for any of the 26 identified E-tags.	CMS Fire Safety Deficiencies

VITA

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EDUCATION

Master of Public Policy <i>George Mason University</i>	2019
Master of Public Administration <i>University of Texas at Arlington</i>	2008
B.S., Journalism (Concentration: Public Relations) <i>Florida A & M University</i>	2004

TEACHING EXPERIENCE

Tulane University

2022 MPAD 6110 – Data Informed Leadership

Old Dominion University

2022 PAS 408 – Public Service Films

2021 PAS 300 – Foundations of Public Service (Instructor)
PADM 708 - Urban and Regional Economic Development
PADM 746 - Capstone Seminar: Public Administration
PADM 671 - Public Budgeting and Financial Management

2020 PADM 746 - Capstone Seminar: Public Administration

PEER-REVIEWED PUBLICATIONS

Whytlaw, J. L., Hutton, N., Yusuf, J. E. W., **Richardson, T.**, Hill, S., Olanrewaju-Lasisi, T., ... & Diaz, R. (2021). Changing Vulnerability for Hurricane Evacuation during a Pandemic: Issues and Anticipated Responses in the Early Days of the COVID-19 Pandemic. *International Journal of Disaster Risk Reduction*, 102386.

Yusuf, J.E., Hill, S., Feo, E.L., Whytlaw, J.L., **Richardson, T.** (2020). The compound threat of COVID-19 and hazards: Public management and policy issues from a stakeholder perspective. *International Journal of Policy Studies*, 11(2), 149-181.