Infection Control and Racial/Ethnic Disparities in Influenza and Pneumococcal Vaccination in Nursing Homes

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ABSTRACT

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Adults over the age of 65 are at increased risk for influenza and pneumococcal infections; particularly those residing in nursing homes (NHs). Despite the efficacy of influenza and pneumococcal vaccinations, vaccination receipt rates among NH residents remain well below federal recommendations and racial/ethnic disparities exist. Minority NH residents (non-Hispanic Blacks and Hispanics) are less likely to be offered either vaccination and are more likely to refuse them compared to their non-minority counterparts (non-Hispanic Whites). In the past decade, requirements have been implemented to increase vaccination coverage in NHs, but there is little documentation regarding current racial/ethnic disparities in vaccination receipt. Furthermore, activities important to resident care delivery and the prevention of care deficiencies such as infections are primarily dependent on the care provided by certified nursing assistants (CNAs). For these reasons, current research examining racial/ethnic disparities in vaccination receipt in NHs is needed and more attention directed towards CNAs is necessary to improve resident care delivery and outcomes related to infection prevention and control.

This dissertation furthers our understanding of racial/ethnic disparities in influenza and pneumococcal vaccination coverage among minority NH residents and the role racial/ethnic diverse CNAs play in infection prevention and control. Chapter One introduces the problem of health disparities in nursing homes (NHs) related to differences in preventative vaccination receipt by racial/ethnic status and the role CNAs play in infection prevention and control. Chapter Two, an integrative literature review on racial/ethnic disparities in NHs, describes racial/ethnic disparities occurring in the NH setting in the context of infection prevention and

control and influenza and pneumococcal vaccination receipt along with contributing factors and existing strategies related to policy that have been implemented to address poor care quality. In Chapter Three, facility-level factors related to the CNA's role and the barriers and facilitators they experience that contribute to infection prevention and control are discussed. In Chapter Four, a systematic review of previous research on racial/ethnic disparities related to influenza and pneumococcal vaccination in NHs, individual, community, and facility-level factors that determine these disparities in influenza and pneumococcal vaccination receipt, along with associated strategies and practices are discussed. In Chapter Five, a national quantitative analysis of vaccination receipt practices (vaccination administered) and reasons for vaccination non-receipt (i.e., not offered versus refused) are presented. The results of this dissertation will inform clinicians and NH administrators as well as future policy and public health interventions and provide evidence needed to improve racial/ethnic minority health and eliminate health disparities.

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Chapter 1: Introduction

In this chapter, I provide an introduction to the problem of health disparities in nursing homes (NHs), infections and prevention and control, and differences in preventative influenza and pneumococcal vaccination receipt by racial/ethnic status. First, I discuss the context of these problems. Following, I present the gaps in the literature and how I propose to fill those gaps. I then provide information on the significance of updated research on this topic. Next, I present the aims and organization of this dissertation and lastly, I detail the conceptual framework guiding this dissertation.

Problems

Health Disparities

Health disparities, defined as "racial or ethnic differences in the quality of health care that are not due to clinical needs, preferences, and appropriateness of intervention (Smedley, Stith, & Nelson, 2009)," are a long-term high priority problem in the United States (US). The excess burden of disease experienced primarily by African-Americans, Hispanics, and American Indian/Alaskan Natives as a result of health disparities leads to poorer health, increased mortality, and wasteful costs to the health care system (Williams, 2007). African-Americans (hereafter referred to as Blacks) have lower life expectancy and higher rates of cardiovascular disease, obesity, diabetes, human immunodeficiency virus (HIV), and cancer deaths, to name a few, compared to Whites (LaVeist, 2005; Williams, 2007). Hispanics experience higher rates of obesity, diabetes, and HIV compared to Whites (Centers for Disease Control and Prevention, n.d.). Infant mortality, pre-term births, homicide, obesity, diabetes, and unintentional injuries are

disproportionately experienced by American Indian/Alaskan Natives compared to Whites (LaVeist, 2005; Williams, 2007). Consequently, a large portion of these diseases are preventable.

In one study, a researcher estimated that the healthcare system will incur an additional 23.9 billion dollars in costs annually due to health disparities in preventable diseases (Waidmann, 2009). Medicare will incur 15.6 billion dollars of this total cost due to increased rates of chronic illness among Blacks and Hispanics (Waidmann, 2009). Unfortunately, these numbers are expected to double by 2050 as a result of the growth in racial/ethnic minority elderly (Waidmann, 2009). As such, health disparities occur widely in NHs (Cai, Mukamel, & Temkin-Greener, 2010; Cassie & Cassie, 2013; Frahm, Brown, & Hyer, 2012; Grabowski & McGuire, 2009; Li, Yin, Cai, Temkin-Greener, & Mukamel, 2011; Pourat, Andersen, & Wallace, 2001) and this dissertation focuses on disparities in infection prevention and control activities, i.e., influenza and pneumococcal vaccination receipt, among racial/ethnic minority NH residents (Blacks and Hispanics), factors associated with these disparities, and the role racial/ethnic diverse direct care staff play in infection prevention and control in NHs. While American Indian/Alaskan Natives are heavily burdened by health disparities as discussed, they will not be examined in this dissertation due to their low proportions in NHs across the nation.

Overview of NHs

There are 15,700 NHs in the US with approximately 1.4 million individuals residing in these facilities (Harris-Kojetin, 2013). Daily NH use rate is 26 per 1,000 persons; exceeding the daily use rate for residential care communities and adult day services centers (Harris-Kojetin, 2013). Individuals 65 and over comprise the majority of residents in NHs (85.1%) and the overall NH racial/ethnic proportion is as follows: White = 78.7%; Black = 14%; Hispanic = 5.1%; and Other = 2.3%. These residents require 24-hour nursing care for reasons such as

dementia, depression, activities of daily living assistance, and psychosocial and medical care (Harris-Kojetin, 2013; Wergeland, Selbæk, Bergh, Soederhamn, & Kirkevold, 2015; Zimmerman et al., 2013). NH administrators have the responsibility of minimizing resident suffering through ongoing prevention, intervention, and treatment efforts. Challenges related to communication barriers among residents, families, and staff, along with limited staffing and facility resources, and various organizational factors; however, create obstacles to providing optimal resident care (Burgio et al., 2001; Castle & Engberg, 2005).

NHs receiving Medicare and/or Medicaid payment are surveyed annually on various care performance indicators to determine compliance with federal requirements. Deficiency citations are issued in areas deemed to be lacking and they provide information to facilities on where problems that threaten care quality exist (Department of Health & Human Services, 1999). Such areas may include restraint and indwelling catheter use, falls, bowel and urinary incontinence, urinary tract infections, pressure ulcer development and management, influenza and pneumococcal vaccination administration, and infection control (Castle & Ferguson, 2010; Harrington, Zimmerman, Karon, Robinson, & Beutel, 2000). Depending on the severity, scope, and number of deficiency citations, the facility may be required to implement actions to correct the areas found to be deficient, pay a fine, and/or lose their certification all together (Centers for Medicare & Medicaid Services, 2014a).

NH Staffing

Decreased NH staffing (registered nurses and nursing assistants) has been found to be associated with an increase in total deficiencies, quality care deficiencies, quality of life deficiencies and infection prevention and control deficiencies in NHs (Castle, Wagner, Ferguson-Rome, Men, & Handler, 2011; Harrington, Zimmerman, et al., 2000; Kim, Harrington,

& Greene, 2009). Registered nurses (RNs) and licensed practical or vocational nurses (LPNs/LVNs) make up 11.7% and 22.9% of NH full time equivalents (FTEs) respectively while aides make up 65.4% (Harris-Kojetin, 2013). Further, aides, who provide the majority of care to residents in NHs, spend 2.46 hours per resident per day whereas RNs only spend 0.52 and LPNs/LVNs 0.85 hours per resident per day (Harris-Kojetin, 2013). Thus NH aides, primarily certified nursing assistants (CNAs), have the potential to make a great impact on the quality of care provided to residents. For this reason, more attention directed towards CNAs is necessary to improve resident care delivery and outcomes.

Infections, Influenza, and Pneumonia in NHs

The incidence of infections in NHs has been reported to be 1.6 to 3.8 million infections annually (Strausbaugh & Joseph, 2000). As these estimates were reported in 2000, it is likely that current incident rates are far greater. Increasing attention to infection prevention and control in long-term care facilities by many government entities and national organizations is occurring (American Medical Directors Association, 2011; Centers for Medicare & Medicaid Services, 2005; Smith, Bennett, et al., 2008; U.S. Department of Health and Human Services, 2013b). NH infections are most concerning because of their increased effects on the frail elderly residing in this setting. Mortality, morbidity, and re-hospitalization are primary issues of concern resulting from NH infections and consequently, cost the healthcare system an additional $673 million (Montoya & Mody, 2011; Teresi, Holmes, Bloom, Monaco, & Rosen, 1991; U.S. Department of Health and Human Services, 2013b). Unfortunately, detecting infections in NH residents can be quite difficult. The availability of resources (e.g., staffing, technology, and trained infection control personnel) along with guidelines to assist with infection surveillance in NHs differ from what is available in acute care settings (Cohen et al., 2015; Herzig, 2016; Smith, Bennett, et al.,

2008; Stone, 2015). Additionally, NH residents present with atypical or no signs of infection (e.g., absence of fever) creating further challenges to diagnosing and treating infections (Yoshikawa & Norman, 1996). Everyday signs and symptoms of resident confusion due to neurological deficits also limits the ability for residents to report symptoms of infection. As a result, staff have difficulty differentiating behavior related to progression of current disease from behavior related to an infection (Feng, Lepore, et al., 2011).

Influenza is one of the most commonly reported epidemic infections in NHs (Smith, Bennett, et al., 2008). During outbreaks, residents are affected at a rate of 6-28% (Bamberg et al., 2010). Sadly, influenza can lead to further complications, morbidity, and mortality which take a much greater toll among those 65 years of age and older (Gorina, Hoyert, Lentzner, & Goulding, 2005). Blacks lead all other racial/ethnic groups in mortality from Influenza (Centers for Disease Control and Prevention, 2015b).

Moreover, the most common cause of death among all NH infections and the second most frequent cause of hospitalization for NH residents is pneumonia (Koch, Eriksen, Elstrom, Aavitsland, & Harthug, 2009; Levinson, 2013). Among the estimated 0.3-2.5 cases of pneumonia per 1,000 resident days (Mylotte, 2002), mortality from pneumonia has been reported to be as much as 41% (Raghavendran, Mylotte, & Scannapieco, 2007). Additional poor outcomes resulting from pneumonia include decreased functional status and pneumonia reoccurrence (Lim & Macfarlane, 2001). Despite being largely preventable, racial/ethnic minorities are three to five times more likely to acquire pneumonia in any setting and Blacks die at an increased rate per 100,000 persons (16.9) compared to their White counterparts (15.2) (Centers for Disease Control and Prevention, 2011a; National Vaccine Advisory Committee, 2000). While Hispanics die at a

lower rate compared to Blacks and Whites, pneumonia remains one of the top 10 leading deaths for this group (Centers for Disease Control and Prevention, n.d.).

Preventative Vaccinations and Racial/Ethnic Disparities

Influenza and pneumococcal vaccination for NH residents age 65 and over are the primary prevention measure to decrease the incidence of influenza and pneumonia (Loeb, McGeer, McArthur, Walter, & Simor, 1999). The Centers for Disease Control and Prevention (CDC) recommend the influenza vaccination be given once every year during the flu season and priority given to those residing in NHs (Centers for Disease Control and Prevention, 2015d). While recommendations for the pneumococcal vaccination were traditionally to give once to those age 65 and over along with other specified groups, starting August 2014, the CDC Advisory Committee on Immunization Practices recommends two different pneumococcal vaccines be given to this age group; the pneumococcal conjugate vaccine (PCV13)[1] first at 65 years of age or older followed by the polysaccharide vaccine (PPSV23) 6 to 12 months after (Centers for Disease Control and Prevention, 2015c; Tomczyk et al., 2014).

The cost of these vaccines and its administration have been covered by Medicare and Medicaid for over two decades and should be readily available to all residents in Centers for Medicare and Medicaid Services (CMS) certified NH settings (Centers for Medicare & Medicaid Services, 2014b). However, racial and ethnic disparities among those who get vaccinated in NHs have been documented. Particularly, researchers analyzing data prior to 2010 show that racial/ethnic minority NH residents are less likely to have influenza and pneumococcal vaccinations offered (Bardenheier, Wortley, Ahmed, Hales, & Shefer, 2010; Cai, Feng, Fennell,

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[1] The PSV23 vaccination was traditionally recommended. The PCV 13 was added to current recommendations in August 2014 after findings were released of a randomized-placebo controlled trial demonstrating the vaccination's effectiveness.

& Mor, 2011) and vaccination status documented (Li & Mukamel, 2010; Marsteller et al., 2008) and more likely to refuse the influenza and pneumococcal vaccination when offered compared to non-Hispanic White NH residents (Bardenheier, 2013; Bardenheier, Wortley, et al., 2010). Overall influenza and pneumococcal vaccinations in NHs have been reported to be 70% (Bardenheier, 2011) and 79.3% (U.S. Department of Health and Human Services, 2013a) respectively with Blacks and Hispanics receiving the influenza vaccination as much as 20% less than Whites (Bardenheier, Wortley, Ahmed, Gravenstein, & Hogue, 2011) and the pneumococcal vaccination as much as 15% less over the years (Bardenheier, Shefer, McKibben, Roberts, & Bratzler, 2004; Li & Mukamel, 2010). Vaccinations have been deemed a leading health indicator and these disparities in vaccination receipt disproportionately place minority groups at increased risks for poor quality of life and health outcomes (Williams, 2007). Researchers have attributed these disparities in vaccination receipt to individual-level factors (e.g., socioeconomic status), community level-factors (e.g., minority residents residing in NHs of poorer quality and fewer resources) (Fennell, Feng, Clark, & Mor, 2010), and facility-level factors (e.g., poor staffing) (Marsteller et al., 2008); however, as stated previously, these data are old. Additional factors yet to be considered relate to the diversity and cultural differences of NH residents and staff along with barriers associated with infection control for direct care workers. To alleviate problems associated with vaccination receipt, as of 2005, CMS has required all certified-NH facilities to offer their residents both vaccinations and record residents' vaccination history (Centers for Medicare & Medicaid Services, 2005).

Gaps in the Literature and Significance

Understanding Barriers and Facilitators to Infection Control for Direct Care Staff

Activities important to resident care and the prevention of care deficiencies such as infection prevention are primarily dependent on the care provided by CNAs. For example, insufficient oral care is associated with pulmonary and systemic infections along with aspiration, weight loss, and nutrition deficits (Locker, Matear, Stephens, & Jokovic, 2002; Scannapieco, 1999; Taylor, Loesche, & Terpenning, 2000). Unfortunately, CNAs are not meeting oral hygiene delivery standards such as brushing residents' teeth for a minimum of 2 minutes, providing mouthwash to residents, and applying clean gloves during oral care (Coleman & Watson, 2006). After conducting semi-structured interviews, researchers found that CNAs reported limited knowledge about caring for residents with dysphagia and how to feed them, which deficiency in these care processes may lead to the development of infections like pneumonia (Pelletier, 2004). Lack of comprehension and limited understanding of the importance of these care processes are reasons why CNAs deliver inadequate care (Pelletier, 2004). Communication between CNAs and NH residents and attention to the knowledge and training of CNAs and their experiences (Burgio et al., 2001; Pennington, Scott, & Magilvy, 2003) is important to ensuring optimal resident care delivery. Moreover, given the amount of time CNAs spend with residents and families and providing this group with the knowledge and motivation to educate and identify signs and symptoms of resident decline is critical. Understanding infection control for CNAs may alleviate infection control challenges and improve healthcare delivery for NH residents. Further research is needed that explores barriers and facilitators related to infection prevention and control for CNAs employed in NHs.

Characterizing Current Disparities in Influenza and Pneumococcal Vaccination

While a close in the gap in vaccination receipt between racial/ethnic minorities and Whites may be expected as a result of 2005 federal requirements, the last published studies examining disparities in pneumococcal vaccination receipt used data from 2004 (Li & Mukamel, 2010; Luo, Zhang, Cook, Wu, & Wilson, 2014). There is some evidence of influenza vaccination disparities post-CMS requirements showing an influenza vaccination gap of 6 - 8% between non-Hispanic Blacks and non-Hispanic Whites, (Bardenheier, Wortley, Shefer, McCauley, & Gravenstein, 2012; Cai et al., 2011); however, these are 2008-09 data that comes from only two studies. Current findings on racial/ethnic disparities in receipt of influenza and pneumococcal vaccinations will inform policy and practice and further contribute to the reduction of health disparities in long-term care settings.

Characterizing Current Disparities in Reasons for Non-receipt of Influenza and Pneumococcal Vaccination

Current knowledge of reasons for non-receipt of influenza and pneumococcal vaccination (not offered and refused) are additionally non-existent in the literature. This information is necessary to direct policy to the areas of greatest need. For example, if disparities continue to exist as a result of not being offered influenza or pneumococcal vaccinations this might mean increased focus organizationally in areas such as vaccination programs, standing orders, audits, staffing, and the healthcare provider. Alternatively, if the problem is refusing, this points efforts to focus on the resident in areas such as increased education delivery to residents, addressing residents' health beliefs, and increasing cultural sensitivity among healthcare providers.

Understanding Factors Associated with Racial/Ethnic Disparities in Influenza and Pneumococcal Vaccination

Before conducting current research, it is necessary to review past literature to understand racial/ethnic disparities occurring in the NH setting in the context of infection prevention and control and influenza and pneumococcal vaccination receipt along with contributing factors and existing strategies related to policy that have been implemented to address poor care quality. A literature review, presented in Chapter Two, describes published studies in this area.

Summary

Influenza and pneumococcal vaccinations are efficacious in preventing influenza and pneumonia infection in NHs; however, racial/ethnic disparities are known to exist. While, policy has been implemented to increase overall vaccination receipt in NHs, few researchers have reported on updated influenza vaccination disparities and no researcher has provided updates to pneumococcal vaccination disparities post-CMS policy implementation. Further, there has been minimal to no research that addresses the role direct care staff play in infection control or research that considers intrinsic factors (cultural and historical contexts) possibly associated with disparities in vaccination receipt. Understanding contributing factors to these racial/ethnic disparities are additionally critical to eliminating differences in vaccination receipt and ensuring equitable access to quality health care for all. Therefore, the purposes of this dissertation are to:

Aims

1. Explore barriers and facilitators to infection prevention and control for a racial/ethnic diverse group of NH direct care staff. A qualitative study was performed to answer this aim.

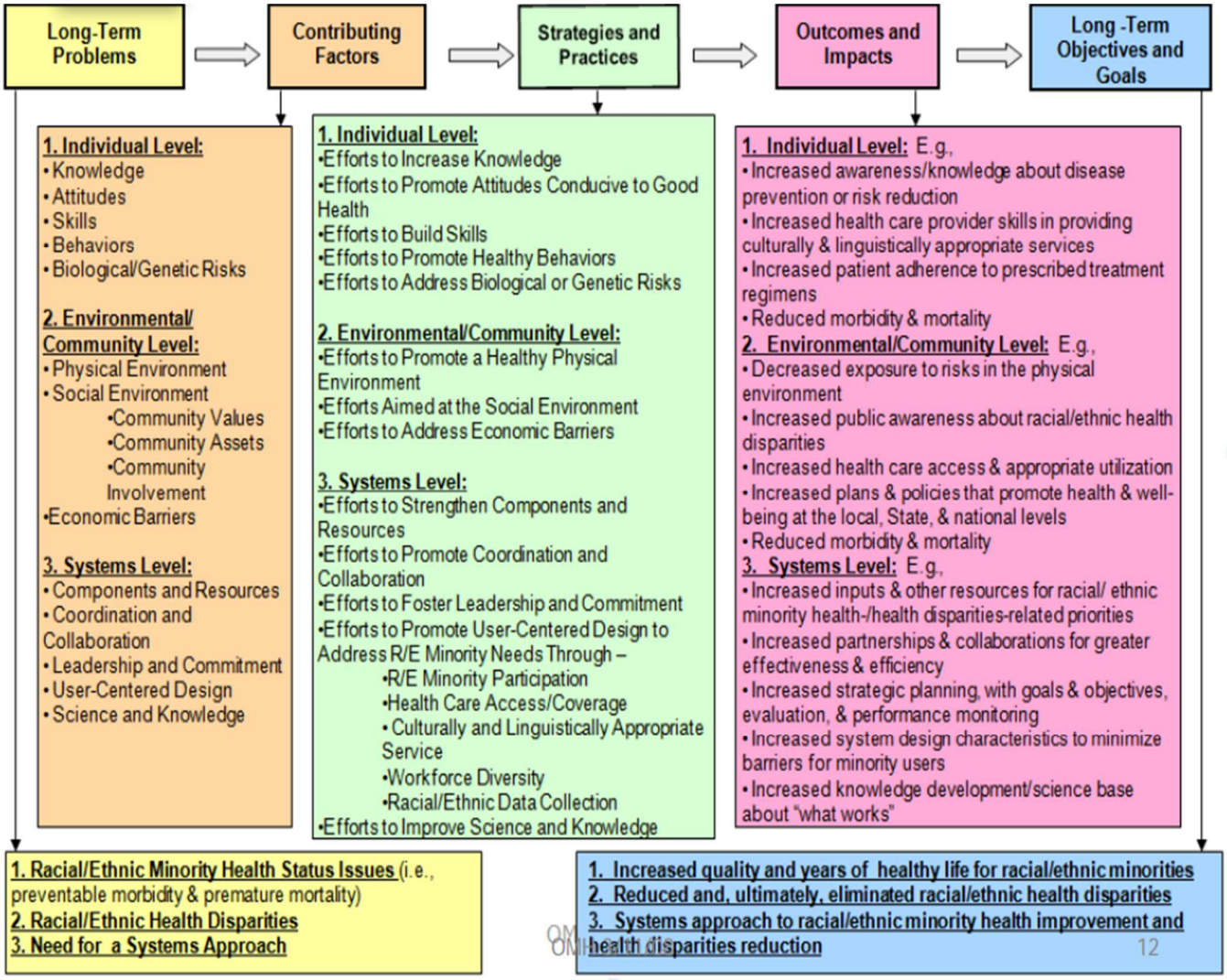
2. Review evidence on racial/ethnic disparities in influenza and pneumococcal vaccination receipt along with their contributing factors among NH residents. A systematic review was performed to answer this aim.
3. Characterize current racial/ethnic disparities in influenza and pneumococcal vaccination receipt and non-receipt among NH residents. National datasets were analyzed to answer this aim.

Conceptual Framework

This dissertation is guided by the Strategic Framework for Improving Racial and Ethnic Minority Health and Eliminating Racial and Ethnic Health Disparities (hereafter referred to as the Strategic Framework) (Graham, 2008). Developed by the Office of Minority Health, this framework identifies long-term problems related to health disparities and links them to contributing factors, strategies and practices, outcomes and impacts, and long-term objectives and goals (Figure 1.1) (Graham, 2008). Long-term problems include preventable morbidity and early mortality among racial/ethnic minority individuals and the availability of sufficient resources. Contributing factors consist of individual, community/environmental, and system/facility-level factors that are determined to add to poor racial/ethnic minority health. Strategies and practices seek to address the contributing factors at each level described. Outcomes and impacts are identified as the expected result of established and/or implemented strategies and practices or lack of. Long-term objectives and goals allow for the evaluation of goal attainment towards improving racial/ethnic minority health and eliminating racial/ethnic health disparities. The Strategic Framework is well-suited to guide me in my understanding of long-term problems related to infection prevention and control in NHs and racial/ethnic

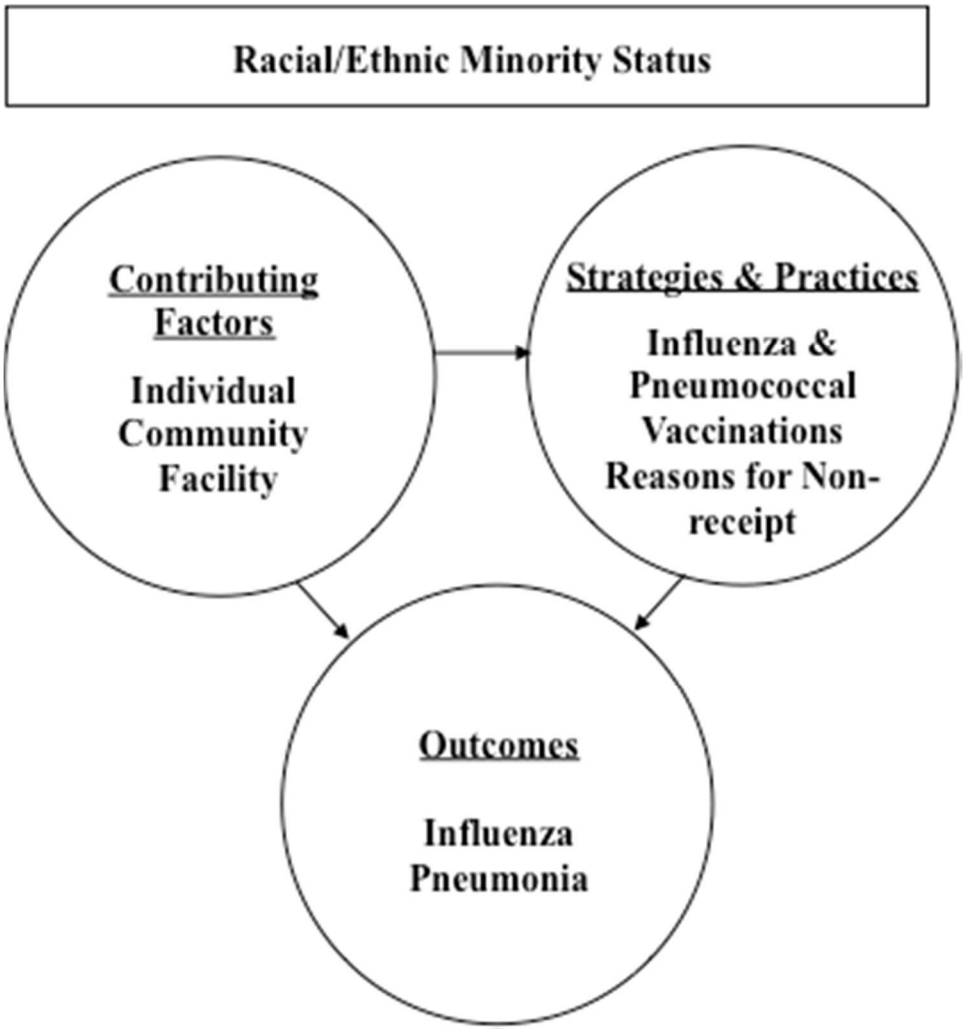
disparities in influenza and pneumococcal vaccination receipt and non-receipt among NH residents.

Figure 1.1 The Strategic Framework for Improving Racial and Ethnic Minority Health and Eliminating Racial and Ethnic Health Disparities



I have adapted this framework (Figure 1.2) to specifically guide me in identifying and controlling for contributing factors (i.e., individual, community/environmental, and system/facility-level) of vaccination-related racial/ethnic disparities so that I may better understand the relationship of racial/ethnic minority status and vaccination receipt. In Chapter Two, an integrative literature review on racial/ethnic disparities in NHs, I describe racial/ethnic disparities occurring in the NH setting in the context of infection prevention and control and influenza and pneumococcal vaccination receipt along with contributing factors and existing strategies related to policy that have been implemented to address poor care quality. In Chapter Three, I discuss facility-level factors related to the CNA's role and the barriers and facilitators they experience that contribute to infection prevention and control. In Chapter Four, a systematic review of previous research on racial/ethnic disparities related to influenza and pneumococcal vaccination in NHs, I discuss individual, community, and facility-level factors that contribute to disparities in influenza and pneumococcal vaccination receipt, along with associated strategies and practices. In Chapter Five, a national quantitative analysis, I present updated research on vaccination receipt practices (vaccination administered) and reasons for vaccination non-receipt (i.e., not offered versus refused). This dissertation does not explore the expected outcomes of addressing vaccination disparities, which are decreased influenza and pneumonia development in racial/ethnic minority NH residents and decreased hospitalization and mortality rates among this group. The results of this dissertation will inform clinicians and NH administrators as well as future policy and public health interventions and provide evidence needed to improve racial/ethnic minority health and eliminate health disparities.

Figure 1.2 Conceptual framework



Chapter 2: Racial/Ethnic Disparities in Nursing Homes in the Context of Infection Control and Influenza and Pneumococcal Vaccination: Contributing Factors, Political Strategies and Practices, and Next Steps

Introduction

Influenza and Pneumonia

Over half of the deaths caused by invasive influenza and pneumococcal disease are among those 65 and over (Centers for Medicare & Medicaid Services, 2014b; Gorina et al., 2005). In NHs, these infections have been identified as a principal infection control challenge (Herzig, 2016; Nicolle, Strausbaugh, & Garibaldi, 1996; Travers, 2016b). Because of increased age, comorbidities, and frailty among NH residents compared to those residing in the community, influenza and pneumonia prevalence is greater in NHs (Nakagawa et al., 2014; Umeki et al., 2011). While specific death rates from influenza and pneumonia are not available between racial/ethnic minorities residing in NHs, Blacks 65 years and older have been found to experience higher mortality from influenza and pneumonia infection than any other racial/ethnic group in any setting (Centers for Disease Control and Prevention, 2011a, 2015b).

Complications from influenza and pneumonia are also problematic. NH elderly are particularly at increased risk for additional comorbidities, functional decline, and hospitalization (Büla, Ghilardi, Wietlisbach, Petignat, & Francioli, 2004; Lim & Macfarlane, 2001). In a study of 377 NHs in Georgia that examined potentially avoidable hospitalizations, 20% of the admitting diagnoses were for respiratory illness (majority pneumonia and bronchitis) (Ouslander et al., 2010).

Unfortunately, identifying NH residents with a clinical presentation of influenza and pneumonia is difficult as typical signs such as fatigue, delirium, lethargy, fever, and cough are either absent or also associated with common chronic conditions of NH residents without

influenza and pneumonia (Yoshikawa & Mylotte, 2002; Yoshikawa & Norman, 1996). Communication may be difficult because of cognitive dysfunction among NH residents (Nicolle, Bentley, Garibaldi, Neuhaus, & Smith, 2000). Access to diagnostic resources such as chest x-rays and labs that are routinely available in acute care settings is limited in NHs (Bentley, 1984; Jamshed, Woods, Desai, Dhanani, & Taler, 2011). Therefore, identifying influenza and pneumonia infection depends on many other factors such as resident observations performed by direct care staff.

An expert panel has found that the quality of care by NH staff was somewhat important or important to preventing hospitalizations due to infection (Ouslander et al., 2010). Moreover, CNAs who spend the majority of time with residents are critical in identifying signs and symptoms of respiratory disease presented by residents and have been found to document signs of illness five days prior to chart documentation by other medical staff (Boockvar, Brodie, & Lacks, 2000). Thus, CNAs' increased involvement in communicating residents' health condition and sufficient training provides opportunities for earlier treatment and decreased complications related to influenza and pneumonia care.

Influenza and Pneumococcal Vaccination in NHs

There are several interventions to decrease incidences of influenza and pneumonia (e.g., hand washing, ambulation, cough and deep breathing, chest physiotherapy exercises, mouth care, and upright feeding). However, vaccinations remain the cornerstone of influenza and pneumonia prevention. Influenza and pneumococcal vaccinations have been reported to be more than 60% effective in preventing pneumonia when only one of the vaccinations is given and have increased efficacy when both vaccinations are administered (Gross, Hermogenes, Sacks, Lau, & Levandowski, 1995; Maruyama et al., 2010; Monto, Hornbuckle, & Ohmit, 2001). Further,

immunization with influenza alone is more than 50% effective in preventing hospitalization and death (Gross et al., 1995) and both vaccinations are cost-effective and safe. To this end, the federal government has set national goals for NH residents and workers to be vaccinated for influenza at 90% or greater. The Advisory Committee on Immunization Practices specifically recommends an annual influenza and one time pneumococcal vaccine (prior to 2014) for all who reside in long-term care settings 65 years and older (Tomczyk et al., 2014). Moreover, the National Vaccine Advisory Committee has developed recommendations and strategies to support Healthy People 2020 in achieving the target of 90% (National Vaccine Advisory Committee, 2013). These include developing a working group to identify challenges to vaccination (Helms et al., 2005).

To defray costs and barriers among residents and NHs to accessing and administering the vaccinations, CMS covers the expense of both influenza and pneumococcal vaccination for their beneficiaries (Centers for Medicare & Medicaid Services, 2014b). Additionally, through its final rule in 2005, CMS issued requirements that all NHs offer both vaccinations to their residents and ensure tracking and documentation of these vaccinations (Centers for Medicare & Medicaid Services, 2005). This rule also required for education delivery to residents and/or their legal representatives on the benefits and side effects of these vaccinations. The goal of the final rule is to increase influenza and pneumococcal vaccination receipt and decrease morbidity and mortality from associated diseases.

Racial/Ethnic Disparities in Vaccination

Despite the critical role influenza and pneumococcal vaccinations play in influenza and pneumonia prevention, the initiatives created to increase vaccination coverage and improve quality of care, and the availability of these vaccinations, receipt for both vaccinations still falls

below target goals and are even lower among racial/ethnic minorities (Travers, 2016a; U.S. Department of Health and Human Services, 2013a). A large gap exists in influenza and pneumococcal vaccination receipt rates between racial/ethnic minority and White NH residents (Travers, 2016a).

Efforts from the US Department of Health and Human Services to address disparities in influenza vaccination have been implemented in communities displaying racial/ethnic disparities in vaccinations (Sebelius, 2010). These efforts have increased access to influenza vaccinations by providing vouchers to underinsured and underserved individuals. Similar efforts by individual states have been implemented to decrease vaccination disparities (Flowers & Sinclair, 2007). A six-state project called READII (Racial and Ethnic Adult Disparities Immunization Initiative), conducted by the CDC and other federal agencies starting in 2002 used evidence to create community plans on how best to reach Black and Hispanic individuals, increase education for healthcare providers about standing orders, and promote adherence to vaccination reminders among healthcare providers (Flowers & Sinclair, 2007; Winston, Wortley, & Lees, 2006).

Targeted efforts to address racial/ethnic disparities in vaccinations are non-existent in NHs. It is very likely that the issue of accessing these vaccinations among racial/ethnic minority groups in NHs is related more to education and cultural barriers among staff and residents, time restraints, staffing, and other individual, community/environmental, and system/facility-level factors, as opposed to finances because the cost of the vaccinations and their administration are indeed being covered. Using the Strategic Framework, (Graham, 2008) in this review of the literature I will discuss the current state of NHs and racial/ethnic disparities existing across NHs, as well as contributing factors that may potentiate these disparities, and strategies related to policy that are in place to address such factors. The implications of these findings will be

considered in the context of infection control and prevention in NHs as related to the critical and relevant problems of influenza and pneumonia infection acquired in the NH setting and racial/ethnic disparities in influenza and pneumococcal vaccination receipt.

Demographic Shifts and Growth in NH Services

In 2010, individuals 65 years of age and over comprised 13% of the US population (The World Bank). Given that the first baby boomers reached senior citizen status in 2011 and life expectancy continues to increase steadily over the years, this age group is projected to comprise the largest segment of the US population, nearing 20% in the year 2050. Preparing for this demographic shift has become a public health priority.

Long-term care is a particular area of concern when projecting the needs of the aging population. After the age of 65, the elderly's risk for chronic illnesses (e.g., diabetes, cardiovascular disease, and arthritis), along with multiple morbidities, substantially increases (Centers for Disease Control and Prevention, 2013b). Unfortunately, racial/ethnic minority groups are at greater risk for these illnesses and have increased long-term care needs when compared to their non-Hispanic White counterparts (Cohen, Bulatao, & Anderson, 2004). The ability for elderly individuals to care for themselves independently decreases as age increases and functional status lessens (Factora, 2012), making effective support systems and access to quality healthcare an imperative.

NH care has been the most widely known form of long-term care services (Whitfield & Baker, 2013) and is critical in addressing increasing disability, declining activities of daily living, and multiple chronic conditions among the elderly population and, more critically, the racial/ethnic minority elderly population. Previously, non-Hispanic Whites accounted for the majority of the NH population (90%), while elderly racial/ethnic minorities most commonly used

informal care for their healthcare needs (Centers for Medicare Medicaid Services, 2000). There has been a large increase of racial/ethnic minorities residing in NHs, which has resulted in a 10.8% increase in NH use among Blacks, 54.9% among Hispanics, and 54.1% among Asians (Feng, Lepore, et al., 2011). Over this same time period (1998-2008), the number of White residents in NHs has declined by 10.2% (Boyington et al., 2007).

Reasons for this influx of racial/ethnic minorities may be attributed to their increased acuity needs and as a result of disparities in options (Smith, Feng, Fennell, Zinn, & Mor, 2008). For example, while utilization of NH services by Whites has declined over the years, there has been a notable increase in utilization of assisted living services by this group. Assisted living services require private payment. Due to financial restraints, a large proportion of racial/ethnic minorities receive Medicaid as their payer source for long-term care services and are therefore unable to afford assisted living. This decrease in utilization of NHs by Whites has contributed to the declining occupancy rates among NHs (Howard et al., 2002; Pruitt, 2013), allowing more NH beds to be filled with other elderly racial/ethnic groups. Because of this rapid demographic shift, immediate attention to the various cultural and diverse needs of racial/ethnic minorities and possible differences in care experienced in NHs is warranted.

Racial/Ethnic Disparities

Racial/ethnic disparities in healthcare is defined as differences that disadvantaged racial/ethnic groups experience in access, quality, treatment, and/or health outcomes (Williams, 2007). Disparities are often seen as a result of injustices, acts of discrimination, and social determinants of health (e.g., socioeconomic status, education, neighborhoods, individual behavior, and genetics) (HealthyPeople.gov, n.d.; Williams & Collins, 2001; Williams & Rucker, 2000). Moreover, disparities are pervasive in NHs. Disparities predominantly center around

quality care and health indicators, in which resident outcomes depend on the care delivered by the NH facility. Racial/ethnic disparities occurring in NHs and identified in the literature include: disparities in urinary incontinence (Boyington et al., 2007; Jones, Sonnenfeld, & Harris-Kojetin, 2009; Ouslander & Schnelle, 1995); pressure ulcers (Cai et al., 2010; Li et al., 2011; Rosen et al., 2006); advance directives (Castle, 1997; Degenholtz, Arnold, Meisel, & Lave, 2002; Kiely, Mitchell, Marlow, Murphy, & Morris, 2001; McAuley & Travis, 2003; Suri, Egleston, Brody, & Rudberg, 1999; Troyer & McAuley, 2006); restraint use (Cassie & Cassie, 2013); and influenza and pneumococcal vaccination receipt (Bardenheier, Shefer, et al., 2011; Bardenheier, Wortley, et al., 2011). Many of these racial/ethnic disparities are preventable.

I chose to focus on disparities related to influenza and pneumococcal vaccination receipt for two reasons. First, this issue has been prioritized by several government, national, and state entities and these vaccinations are important to the prevention of influenza, pneumonia, functional decline, and additional complications experienced by NH residents (Centers for Medicare & Medicaid Services, 2005; Immunization Action Coalition, 2008; National Vaccine Advisory Committee, 2013; U.S. Department of Health and Human Services, 2013b). Second, I have the opportunity to work with a research team focusing on infection prevention and control in NHs, which has made the influenza and pneumococcal vaccination data available to me.

Addressing disparities in influenza and pneumococcal vaccination in NHs is a high priority area of concern because of their implications in controlling influenza and pneumonia infection along with the mortality and morbidities associated with these infections. Additionally, every NH resident should have an equitable opportunity for receiving this standard process of care. Given that this is not reality, it is important to understand better how various individual,

community/environmental, and system/facility-level factors may contribute to disparities in processes of care, i.e., influenza and pneumococcal vaccination receipt, in NHs.

Contributing Factors to Racial/Ethnic Disparities

Many factors contribute to racial/ethnic disparities in NHs and one's ability to receive equitable care (i.e., influenza and pneumococcal vaccinations). Such factors may stem from: the individual- level, relating to the diversity of the staff and residents; the community/environment-level, relating to the location and environment in which the NH is situated; and/or the system/facility-level, relating to the structural characteristics and resources of the facility.

Individual–Level (Staff and Residents)

NH staff and residents represent a variety of cultures and speak many different languages, thereby increasing the potential for disparities in standard processes of care such as vaccination administration and issues with compliance with carrying out these processes (Mold, Fitzpatrick, & Roberts, 2005). Twenty percent of staff responsible for direct resident care are immigrants originating mainly from African, Caribbean, Asian, and Hispanic countries (Khatutsky et al., 2011; Leutz, 2007; O'Shea & Walsh, 2010). Although immigrants are found to have more education than non-immigrants, formal care for the elderly is less prominent in these countries and emphasis on care processes differs (Tate, 2009). In many foreign countries, it is believed that patient care should be approached holistically with limited use of medical interventions (Carroll et al., 2007; Periyakoil, Stevens, & Kraemer, 2013; Saunders, 1954; Tate, 2009). Further, administration of influenza and pneumococcal vaccinations is not a recommended standard process of care worldwide (Fedson, 1998). Thus, comprehension of and confidence in US standard processes of care critical to the health and well-being of residents, such as vaccination

administrations, may differ among direct care staff despite the education and training delivered by the NH facility.

While the use of the English language is also required to provide sufficient resident care in the US, proficiency in English remains inadequate among direct care staff. In a study examining organizational cultural competency and job satisfaction among nursing assistants in long-term care, one out of five non-White participants rated their English as fair or poor (Allensworth-Davies et al., 2007). Fifty-one percent of immigrants and 41% of non-immigrants in a national survey also reported communication problems between staff and residents (Khatutsky et al., 2011). Thus, challenges to educating staff with language barriers pose a concern to resident care and safety (Parker & Geron, 2007). Alternatively, improved CNA communication has been found to be associated with better performance in processes of care and care quality (Zheng & Temkin-Greener, 2010).

Along with communication, everyday encounters between diverse NH personnel and other staff and residents create further challenges. CNAs representing minority races and ethnicities report feelings of racism and discrimination from non-minority residents and staff along with increased job strain, compared to Whites (Hurtado, Sabbath, Ertel, Buxton, & Berkman, 2012; Parker & Geron, 2007), subsequently affecting their job satisfaction and health. While other personnel from the majority group have been known to witness these events, ways to support racial/ethnic minorities and understand the consequences of these discriminatory actions are described as lacking (Allensworth-Davies et al., 2007; Hurtado et al., 2012). Such oppression and lack of support in turn threatens resident care, given that job satisfaction among healthcare workers has been tied to patient care and outcomes (Aiken, Clarke, & Sloane, 2002; Aiken, Clarke, Sloane, Sochalski, & Silber, 2002).

Limited knowledge in caring for residents with diverse backgrounds presents barriers for staff to provide optimal resident care as well (Parker & Geron, 2007). Various cultural and racial/ethnic minority groups have extensive needs but, in many cases, because of frailty and/or differences in language, culture, and religion, they are unable to communicate these needs effectively (Durst & Barrass, 2014; Joyce Chan & Kayser-Jones, 2005; Morrison, 1983). Communication barriers can create feelings of isolation and difficulties with socialization among diverse residents (Joyce Chan & Kayser-Jones, 2005). However, even when these differences are communicated and documented, this important information related to the residents' needs and wishes does not reach all who provide resident care, possibly creating additional feelings of frustration and resistance among residents from diverse backgrounds (Parker & Geron, 2007).

Family involvement, standard traditions, and spirituality are important to resident decision-making and adherence to standard processes of care (Johnson, Elbert‐Avila, & Tulsky, 2005). For example, food choices differ among groups, (Evans & Crogan, 2006; Joyce Chan & Kayser-Jones, 2005) and when considering the need for food to maintain strength and recover from illness (i.e., infection), this is a vital area of concern. One researcher examining food among Hispanic residents found that by providing traditional entrees, appealing presentations, and flour tortillas, food intake among Hispanics improved (Evans & Crogan, 2006).

Further, the historical contexts of various racial/ethnic groups may also inhibit standard of care processes and/or delivery of equitable quality care. Racial profiling and perceptions of Black inferiority and inadequacy to Whites stemmed from slavery beginning four centuries ago. A US Supreme Court ruling in 1857 that legalized prejudice, stereotyping, and discrimination towards people of color gave further rise to unfair treatment beyond everyday affairs to include healthcare delivery as well (Missouri Office of the Secretary of State, n.d.). The Tuskegee study

of untreated syphilis is the prime example of government-sanctioned research in which Blacks were subjected to unethical experimentation and regarded as a "species" less important than that of Whites (Centers for Disease Control and Prevention, 2011b). Such experiences have highlighted inequities in healthcare delivery for racial minorities and continue to exacerbate feelings of mistrust towards the healthcare system among Black racial groups (Cooper-Patrick et al., 1999). Thus, it is no surprise that racial/ethnic minority elderly are more inclined to refuse care and, more so, question the care they receive. This may especially be the case in influenza and pneumococcal vaccination receipt as seen by the higher refusals among Blacks compared to Whites.

Hispanics have also had their challenges with the healthcare system. As many Hispanics immigrate to the US from other countries, feelings of isolation tend to resonate among this group (Tienda & Mitchell, 2006). Barriers related to language, education, and culture (Camarillo & Bonilla, 2001) heavily affect their ability to prosper in the US along with their ability to obtain adequate access to quality healthcare and navigate the healthcare system. These barriers further limit the jobs Hispanics typically hold which tend to lack health insurance and also limit the ability for Hispanics to accumulate wealth to pay for needed healthcare services (Tienda & Mitchell, 2006). Furthermore, Hispanics are known to rely on family and their community for healthcare needs as opposed to seeking formal methods of healthcare therefore limiting their attention to the need for preventative care such as influenza and pneumococcal vaccination (Whitfield & Baker, 2013).

Financial resources of the resident are an additional individual-level contributing factor to racial/ethnic disparities in standard processes of care and typically define whether a resident resides in an optimally or poorly performing NH (Chisholm, Weech‐Maldonado, Laberge, Lin,

& Hyer, 2013; Fennell et al., 2010). Private pay for NH care has been partially responsible for racial/ethnic minorities' disproportionate access to quality NH services. NHs prefer this private payment because reimbursement is higher than what both Medicare and Medicaid provide, and higher proportions of private payers are subsequently associated with better quality of care and increased resources (e.g., staffing) (Mor, Zinn, Angelelli, Teno, & Miller, 2004). The majority of private payers have traditionally been White residents (Boyington et al., 2007; Cai et al., 2010).

Alternatively, Medicaid source of payment for NH services has been associated with lower quality of care, decreased standard of care processes, and poorer health outcomes, which are mostly attributed to the low reimbursement associated with Medicaid (Mor et al., 2004). On average, Medicaid reimburses NHs $22 per resident per day which may be less than the actual cost of providing services (Castle, 1997). Moreover, the majority of Medicaid residents are of racial/ethnic minority background (Mor et al., 2004). This low reimbursement is of great concern when considering the viability of NHs relying on large proportions of Medicaid payment and the facility's ability to access needed resources that help to improve care quality. Differences in care seen as a result of payment source have created what has been identified as a two-tiered system, with those who are disproportionately poor and of racial/ethnic minority background predominantly residing in lower-tier facilities (Mor et al., 2004).

Community/Environmental-Level

The community/environment is another important factor in racial/ethnic disparities in NH care. Specifically, residential segregation, "the concentration of ethnic, national-origin, or socioeconomic groups in particular neighborhoods of a city or metropolitan area (Iceland, 2014)," influences the diversity and racial/ethnic mix of NH residents and staff and the care provided to residents. When NHs have less diverse residents because of increased residential

segregation of the community resulting in a high concentration of racial/ethnic minorities, the quality of care is lower. Moreover, the relative risk of NH closure among freestanding facilities has been found to be greater in zip codes with the highest percentage of Blacks, compared to zip codes with the lowest percentage of Blacks thereby decreasing access to stable long-term care services for racial/ethnic minorities and further perpetuating disparities in care (Feng, Lepore, et al., 2011). A large portion of health disparities has been attributed to segregation, and unfortunately, segregation in NHs is higher than segregation in hospitals (Smith & Fund, 2004).

System/Facility-Level

System/facility-level factors contributing to racial/ethnic disparities include racial/ethnic resident composition of the NH, ownership, and staffing. In regards to NH racial/ethnic resident composition, Chang and colleagues found that 90% of Black residents in Missouri were concentrated in 20% of the state's NHs and the more segregated the NH, the lower the quality of care indicators (e.g., pressure ulcers and influenza and pneumococcal vaccinations) (Chang, 2012). Chisolm and colleagues further reported that NHs with greater proportions of Blacks have higher rates of low- and high-risk pressure ulcers, activities of daily living decline, quality of care deficiencies, and harm citations, compared with facilities that had no Blacks (Chisholm et al., 2013). Grabowski and colleagues concluded that Blacks are disproportionately admitted to NHs with a greater number of deficiencies that surpassed the mean state deficiency level (Grabowski, 2004). Last, hospitalization and end-of-life hospitalization have been found to be increased among Blacks compared to Whites, with this likelihood for each being greater among Blacks residing in NHs with higher proportions of Blacks as well as among Blacks who were older and had more functional limitations (Mor, Papandonatos, & Miller, 2005).

Conversely, Fennell and colleagues found that all-White NHs had lower deficiency scores, greater percentages of restraint-free facilities, and higher staffing levels related to direct care and registered nursing staff, as compared to NHs with any percentage of Hispanics (Fennell et al., 2010). Measuring performance indicators (deficiency citations, staffing levels, and financial viability of the NH), Hispanics were also more likely to reside in poorly performing NHs when compared to Whites (Fennell et al., 2010).

NH ownership play significant roles in racial/ethnic disparities in access to quality NH care and standard processes of care. For-profit/chain NHs are more diverse when compared to for-profit/independent and nonprofit independent NHs (Davis, 2014). All-White NHs, nonprofit, and independent NHs perform better when compared to NHs with racial/ethnic minority residents or NHs that are chain or for-profit. Unfortunately, 82% of racial/ethnic minorities reside in for-profit NH facilities, compared to 70% of Whites; placing minorities at higher risk for poor quality care (Centers for Medicare Medicaid Services, 2013). Moreover, CNAs in for-profit facilities reported less staffing and more in-services focused on government inspection preparations as opposed to improving clinical care. CNAs in private-pay facilities reported lower resident ratios, increased connection to RN staff and leadership, and more practice-focused programs (Lucy Takesue Fisher PhD, 2008).

NH staffing is another system/facility factor associated with care quality and health outcomes among NH residents (Hyer et al., 2011; Mold et al., 2005). Higher CNA staffing levels are associated with lower total deficiency scores and quality deficiency scores along with improved CNA care processes (e.g., feeding, toileting assistance and resident influenza and pneumococcal vaccination rates) (Harrington, Zimmerman, et al., 2000; Hyer et al., 2011; Schnelle et al., 2004; Singleton, Santibanez, & Wortley, 2005). Increased RN and LPN/LVN

staffing levels are also associated with better resident care and lower deficiencies that are considered serious (Kim et al., 2009). As such, recommended total direct care staffing levels are 4.55 hours per resident day (Harrington, Kovner, et al., 2000) in which anything below 4.1 hours suggests potential harm to residents. Meeting these recommended staffing levels have been problematic in for-profit facilities, however (Harrington, Olney, Carrillo, & Kang, 2012). While agency use of RNs and CNAs is important to fill gaps in care brought on by staffing and turnover issues, high agency use has been found to be associated with low quality of care as well (Castle & Engberg, 2007).

In summary, many factors have the potential to contribute to the inequitable delivery of standard processes of care and more specifically, influenza and pneumococcal vaccination receipt. These factors take into account cultural, historical, and financial issues occurring on an individual-level, segregation and NH location issues occurring on a community/environmental-level, and racial/ethnic minority resident composition, ownership, and staffing issues occurring on a system/facility-level. While many of these contributing factors have been well discussed in the literature (system-level factors) others have been minimally discussed (individual-level factors). Addressing these contributing factors at each level is critical to alleviate disparities in standard processes of care.

Policy Levers

Federal initiatives to increase standard care processes and improve quality care in NHs, but not specific to decreasing disparities include the Omnibus Budget Reconciliation Act (OBRA) and NH Compare. Under OBRA, also known as the NH Reform Act of 1987, residents must be provided with certain services to ensure that reimbursements continue to NHs certified by CMS and that quality care improves. These services include completing assessments and care

plans for residents; providing social, rehabilitative, pharmaceutical, and dietary services; decreasing the use of antipsychotic drugs and restraints; monitoring inappropriate use of indwelling urinary catheters; and maintaining accurate and complete resident records (Klaube, 2001). Starting in 2002, a reporting of clinical quality measures was made available to the public through the CMS NH Compare initiative (https://www.medicare.gov/nursinghomecompare/search.html). This initiative's purpose was to empower consumers while incentivizing NHs to provide high quality care.

Summary

Infection prevention and control are significant areas of concern when considering threats to quality care processes and disparities in influenza and pneumococcal vaccination receipt that are heightened by challenges in addressing diverse cultural, economic, and structural differences among residents, staff, and/or facilities. Infections in NHs are the leading cause of death and hospital transfers for residents and they are indicators of poor quality care (Montoya & Mody, 2011; U.S. Department of Health and Human Services, 2013b). As such, at any given time, 12% of residents are likely to have an infection (Dwyer et al., 2013). Increased frailty, immobility, incontinence, comorbidities, and altered mental status of NH residents places this group at increased risk for acquiring infections in the NH (e.g., influenza, pneumonia, urinary tract infections, *C. difficile*, multidrug resistant organisms, skin and soft tissue infections, and gastrointestinal infections) (Nicolle et al., 1996; Smith & Bradley, 1999; Strausbaugh, Crossley, Nurse, & Thrupp, 1996). In addition, the failure for staff and residents to comply with specific infection control processes for various reasons and/or as a result of influences from the facility's structure and processes also places NH residents at increased risk for acquiring infections (Nicolle et al., 1996; Smith & Bradley, 1999; Strausbaugh et al., 1996).

Fortunately, a majority of NH infections are largely preventable, despite posing considerable threat to the residents' health and well-being. For these reasons, cultural competency among staff; staff participation in education and training initiatives; staff and resident compliance with care processes; comprehension of preventive care measures among staff and residents; and implementation and enforcement of policies, programs, and practices are key to infection prevention and control.

Conclusion

Providing high quality care to NH residents has been an ongoing pursuit and mandate from federal and state agencies. However, ensuring equitable quality care delivery to racial/ethnic minorities remains an obvious challenge. Receiving standard processes of care such as influenza and pneumococcal vaccinations is critical to reducing high mortality, morbidity, and costs associated with influenza and pneumonia acquired in the NH and its complications. Nevertheless, it is possible that factors related to the culture and diversity of the staff and residents (individual-level), location of the NH (community/environmental-level), and characteristics and resources of the facility (system/facility-level) may disproportionately place racial/ethnic minorities at increased risk for not receiving necessary vaccinations.

Despite the implications for influenza and pneumonia prevention and the clear disparities in who gets vaccinated, no literature has yet examined disparities in pneumococcal vaccination receipt between racial/ethnic minorities and Whites in NHs after CMS requirements implemented in 2005; this research is critical. Research on influenza vaccination disparities was last conducted using 2009 data. Understanding the current magnitude of these disparities and how best to address them is necessary to eliminate racial/ethnic disparities in care. Thus, the following chapters of this dissertation will explore the barriers and facilitators to infection

prevention and control among a diverse group of frontline direct care staff; review previous current evidence on contributing factors to racial/ethnic disparities in influenza and pneumococcal vaccination among NH residents; and characterize current disparities in influenza and pneumococcal vaccination receipt and non-receipt among NH residents.

Chapter 3: Perceived Barriers to Infection Prevention and Control for NH Certified Nursing Assistants: A Qualitative Study

This chapter addresses aim one of this dissertation: Explore barriers and facilitators to infection prevention and control for a racial/ethnic diverse group of NH direct care staff. To meet this aim, qualitative data collected through the Prevention of Nosocomial Infections and Comparative Effectiveness in NHs (PNICE-NH) Study was used. The findings from this manuscript have been published in *Geriatric Nursing*.

Abstract

Healthcare-associated infections, while preventable, result in increased morbidity and mortality in NH (NH) residents. Frontline personnel, such as certified nursing assistants (CNAs), are crucial to successful implementation of infection prevention and control (IPC) practices. The purpose of this study was to explore barriers to implementing and maintaining IPC practices for NH CNAs as well as to describe strategies used to overcome these barriers. We conducted a multi-site qualitative study of NH personnel important to infection control. Audio-recorded interviews were transcribed verbatim and transcripts were analyzed using conventional content analysis. Five key themes emerged as perceived barriers to effective IPC for CNAs: 1) language/culture; 2) knowledge/training; 3) per-diem/part-time status; 4) workload; and 5) accountability. Strategies used to overcome these barriers included: translating in-services, hands on training, on-the-spot training for per-diem/part-time staff, increased staffing ratios, and inclusion/empowerment of CNAs. Understanding IPC barriers and strategies to overcome these barriers may better enable NHs to achieve infection reduction goals.

Keywords

NHs, Infection Prevention and Control, Certified Nursing Assistants, Healthcare-Associated Infections

Introduction

Healthcare-associated infections (HAIs) in NHs (NHs) are an increasingly important concern resulting in increased hospital admissions, morbidity, and mortality among NH residents (Koch et al., 2009). There are an estimated 1.4 to 5.2 infections per 1,000 resident-care days in NHs and skilled nursing facilities (Koch et al., 2009; Pennsylvania Patient Safety Authority, 2009), costing the US healthcare system an additional $673 million (Pennsylvania Patient Safety Authority, 2009; U.S. Department of Health and Human Services, 2013b). The Department of Health and Human Services has declared HAI prevention in NHs a national priority (U.S. Department of Health and Human Services, 2013b), and the Centers for Disease Control and Prevention provides toolkits to reduce the number of HAIs occurring in this vulnerable population (Blumenstock, 2011). HAIs are thought to be largely avoidable through adherence to infection prevention and control (IPC) practices (HealthyPeople.gov, 2014). Furthermore, education and training of frontline personnel is key to ensuring compliance and successful implementation of those practices (Smith, Bennett, et al., 2008).

Certified nursing assistants (CNAs) comprise the majority of frontline personnel in NHs (U.S. Bureau of Labor Statistics) and are increasingly responsible for the identification and reporting of residents presenting with signs and symptoms of infection (American Medical Directors Association; Department of Health and Health Protection Agency, 2013). When not performed effectively, activities primarily performed by CNAs such as feeding, hydrating, hygienic care, toileting, ambulation, and resident turning and positioning, may increase the risk of infection transmission (U.S. Department of Health and Human Services, 2013b).

Despite the potentially significant role CNAs play in reducing infection transmission, to our knowledge, there are no studies that explore the challenges to IPC compliance for NH CNAs.

Therefore, the purposes of this study were to explore barriers to instituting and maintaining IPC practices for NH CNAs as well as to describe strategies utilized by NH personnel to overcome these barriers.

Material and Methods

Study Sample & Design

This study was part of a larger, mixed-method, multi-site study designed to describe the phenomenon of infection control in NHs (NINR R01 NR013687). The methods utilized in this study are described in detail elsewhere (Stone, 2015). Briefly, NHs were purposively sampled to obtain variation in geographic distribution, bed size, and ownership status. At each NH, we interviewed personnel important to IPC including: CNAs, infection preventionists (IP), directors and assistant directors of nursing, NH administrators, advanced clinicians, environmental services workers, staff development/risk managers/quality improvement coordinators, minimum data set (MDS) coordinators, and staff nurses. Participants were English-speaking staff that worked in the facility for approximately one year or longer. Written informed consent was obtained from all participants. The Institutional Review Boards of Columbia University Medical Center, University of Pittsburgh, and the RAND Corporation approved the study.

Data Collection & Analysis

Between May and September 2013, we enrolled facilities and conducted site visits at 10 NHs located across the country (Northeast: n = 3; South: n= 4; West/Midwest: n= 3). NH size ranged from approximately 40 to 200 beds. Additional details about NH demographics are described elsewhere (Stone, 2015). Semi-structured in-person interviews were conducted by a team of eight interviewers. All interviewers used topic guides tailored to the respondents' roles and interview methods were reviewed to ensure consistent data collection procedures. The

interview guides (available upon request) were informed by Donabedian's conceptual framework of healthcare quality, that includes structures, processes, and outcomes (Donabedian, 1966), and published guidelines for infection prevention in NHs (Smith, Bennett, et al., 2008). Questions were open-ended and specific to infection prevention. Specific questions that were the focus of this sub-study included, "What are some of the barriers to effective infection control in your facility?", "What are the facilitators in your facility that have helped you prevent or control infections?", and "Tell me about the challenges related to infection control in your facility."

All interviews were digitally recorded, transcribed verbatim, and de-identified. Data were coded using a conventional content analysis in NVivo 10 software (Hsieh & Shannon, 2005). This analysis allows for codes to flow from the data and is ideal when exploring a phenomenon that is poorly understood. Three members of the research team (PKS, RIB, CCC) coded all transcripts and, subsequently, data specific to the CNA's role were analyzed for themes related to barriers and facilitators of IPC. Coding discrepancies were reconciled during weekly team meetings. Emerging themes were also discussed in these meetings to ensure consensus of all interpretations. Analysis concluded when no new themes emerged from the data.

Results

In total, 73 interviews were conducted (Table 3.1) and averaged approximately 45 minutes in length. Many of the personnel interviewed had multiple roles (Stone P, 2015). For example, a participant may have been interviewed as a director of nursing, but may have also served as the administrator, IP, and/or MDS coordinator. Five key themes emerged describing perceived barriers to implementing and maintaining IPC practices for CNAs: 1) language and culture; 2) knowledge and training; 3) per-diem and part-time staff; 4) workload; and 5)

accountability. Descriptions of each theme with exemplar quotes of the barriers and strategies used to overcome the barriers can be found in Table 3.2.

Table 3.1 Personnel interviewed from a national sample of nursing homes

Participant Role	N
Administrator	9
Staff Development/Risk Manager/Quality Improvement Coordinator	4
Advanced Clinician	3
Infection Preventionist	9
Director/Assistant Director of Nursing	8
Staff Nurse	10
Environmental Services	10
Certified Nurse Aide	9
Minimum Dataset Coordinator	11
Total	**73**

Table 3.2 Key themes of barriers to effective IPC and exemplar quotes of IPC barriers and strategies

Theme	Description	Exemplar Quotes
Language and Culture	CNAs were often described as non-native English speakers with diverse cultural backgrounds and this impacted the manner in which IPC information was delivered.	Barrier: "…when you're dealing with elderly people and the majority of the elderly people are [native English speakers]… there is a big language barrier… I think that's something we could really improve." Admin NH 2 Strategy: "We also use symbols that alert the CNA…We use little yellow smileys on the door and yellow armbands if someone is at risk for aspiration…If you look on the inside of the armoire, you will see aspiration precautions with pictures." RM NH 3
Knowledge and Training	Education and training of CNAs impeded information delivery and the implementation and adherence to IPC processes.	Barrier: "… one of the things I want to add [is] having an actual orientation [for new personnel], and in that orientation I would like to have a [session] for infection control where … talk about hand washing …and educate on the flu.... So that's something that I am working towards because if you're a new CNA or a new nurse you really don't know because you haven't been taught and you haven't been educated." IP NH 5 Strategy: "… when [we] first get hired we go through a big orientation, and we go through more orientation then [other NH staff] because we deal more with the residents…[we are taught] how we do it at this facility. This is how we want our aides to work." CNA NH4
Per-Diem and Part-Time Staff	The infrequent work schedules of per-diem and part-time staff posed difficulties for IPC communication and resulted in IPC breakdown	Barrier: "…we do brief infection control, but again if it's once a year it's very hard ...there's such an influx of private duty aides and it could be three private duty aides per one resident because of the different shifts and the times. So, it's very hard to isolate…and catch everybody." IP NH 2

		Strategy: "Once I can identify [per-diem and part-time staff] … and in-service them, there's more compliance." Nurse NH 2
Workload	Time constraints and understaffing impeded effective IPC practices	Barrier: "I think a lack of staff and a lack of time… make you cut corners. I'm not saying that the aides don't want to do it right or don't know how to do it right. They don't have the time to do it right." Nurse NH 8 Strategy: "…the only real way that [the state addresses] inadequate staffing is if they come in and see that there is… just a total lack of care…If they see that the patients are being taken care of, even though there are seventeen [residents] for one [CNA], then they kind of overlook it and say it's okay." Nurse NH 8
Accountability	Lack of ownership of IPC created breakdown in practices and ineffective communication	Barrier: "When we talk about [CNAs and infection control] …sometimes [CNAs] think [it doesn't relate to them]. For example, [CNAs] wear gloves when they shouldn't. When we talk about [IPC] just [in] general, [CNAs] think they [don't do anything]." DON NH 10 Strategy: "I think when you empower people, when you really make people realize that it's so important what they're doing, and you give praise to people. …the person that you see taking off their robe before leaving the room, washing their hands and coming out…you tell them 'You know… I can always count on you.' ." QIC NH 1

Note: CNA= Certified Nursing Assistant; IPC= Infection Prevention and Control; NH= NH; Admin= Administrator; RM= Risk Manager; IP = Infection Preventionist; DON= Director of Nursing; QIC= Quality Improvement Coordinator

Language and culture

Language and culture were perceived as common barriers to ensuring effective implementation of IPC practices. Participants noted that many of the CNAs came from diverse cultural backgrounds and were often non-native English speakers. These characteristics were perceived to limit the CNAs' ability to understand and, therefore, effectively adhere to routine IPC practices. For example, a risk manager responsible for resident and staff safety at NH 3 realized that a tool developed to help CNAs care for the resident,

> *"really was not effective because some of [the CNAs] could not read it."*

In addition to language, the diverse cultures of CNAs were perceived to present challenges to IPC practices. An administrator from NH 2 described this as an issue of particular importance:

> *"if you come from a culture where you don't really discuss medical issues… sometimes that could be a barrier."*

To address barriers associated with language and culture, NHs provided translated in-services and rules and regulations. The same administrator from NH 2 stated that because of "an overwhelming number of nursing staff that [are non-native English speakers]… when you do education in both languages, we're making sure that everyone is grasping the concept." Pictures and color-coding of messages were also described by participants as beneficial when working with diverse languages and cultures.

Knowledge and training

Lack of knowledge and training were perceived by participants to impede information delivery and limit the CNA's ability to effectively implement and adhere to IPC processes. Specifically, the lower educational requirements of CNAs, compared to those of other health professions, were perceived as a barrier when providing instruction on IPC practices. While

discussing in-service trainings at the facility, a participant responsible for quality improvement from NH 1 noted,

> *"I'm very aware that I'm sitting with a graduate person and I may be talking in the same session to somebody who has a GED [General Education Development certification]. Both people need what I have to say. Both people are going to view it differently, but the outcome must be the same. So I have to hope that the [graduate] person recognizes I'm certainly not talking down, but I'm putting it in language that can be understood. And that's my challenge*."

A registered nurse in charge of staff development at NH 4 discussed the varying educational levels of NH personnel and the importance of stressing the process of hand washing to the CNAs because

> *"when you're talking blood borne pathogens and things like that, sometimes that's not well-understood, but hand-washing is."*

In other circumstances, even if it was perceived that CNAs were educated appropriately on IPC practices, lapses still existed when it came to CNAs applying what they had learned to their everyday resident care. An administrator from NH 6 noted,

> *"It could be that we're trying to roll out a certain program and we educate; we in-service [the CNAs]. Thirty days later, there is one person always in the group that still does it the old way."*

Barriers in IPC knowledge and training were also described as being influenced by the length of time a CNA had been employed at the facility or tenure in the profession. In particular, a CNA from NH 5 described the challenges of knowledge and training as it relates to newer staff,

> *"…we have new staff that come in and they're maybe not aware of certain things when they first start."*

One suggested solution to overcoming these barriers was to examine how infection control policies and practices were taught to CNAs. A nurse from NH 3 noted,

> "*[The CNAs] learned the procedure, but not necessarily the why. [Those in charge of IPC education are] going to teach you how to do it and maybe the emphasis is not*

enough on the why and the consequences of what could happen [if you do not comply]. And I think once you know that, then you can think a little more. "

A CNA from NH 6 reported signs outside the residents' room as helping to provide knowledge about infection control,

"Because …10 years ago we didn't have signs. I mean, we did, but it wasn't like it is today, because anybody could be on isolation for a cold now…Now you know going in that this resident has a cold, and you didn't have any information 10 years ago, "

Participants also reported the use of many techniques to address issues related to training including hands on training with CNAs as a way to ensure comprehension. Dedicating specific trainings for the CNAs and education on urinary tract infection and pneumonia prevention (e.g., perineal care, providing adequate hydration, and hand washing) were additional approaches offered. Personnel from several facilities described the importance of alerting CNAs if they were not doing something correctly as the circumstance occurred, as opposed to after the fact. Tenure of the CNAs was described as a facilitator to overcoming barriers created by lack of training and constant reiterations of the policies and reminders were described as key to ensuring compliance.

Per-diem and part-time staff

Participants reported a reliance on per-diem and part-time CNA staff to fill the voids created by sick calls, turnover, and staffing shortages. However, they also reported limited opportunities to educate this group on IPC practices, thus creating barriers to effective IPC. An IP from NH 2 explained this barrier as being,

"…really tricky. It's not like I can schedule an in-service and gather everybody together because the next day I could have more private duty aides."

Additionally, after surveillance revealed unacceptable practice patterns (e.g., poor trash disposal habits), the same IP stated,

> *"I'll identify very quickly that it's not necessarily our [permanent] staff… [per-diem staff] are putting things in the garbage [inadvertently], for instance. So I need to stop the private duty aides and in-service them as well."*

Participants described various approaches to training per-diem and part-time CNA staff on IPC policies and practices. These included utilizing current staff to intervene and educating individuals who were unfamiliar with the facility's protocols. Additional approaches were annual meetings with per-diem and part-time staff, identifying and in-servicing those staff when they first started working at the facility, and providing one-on-one in-services when feasible. Having more permanent staff, lower turnover, and an infection control coordinator at the NH facility were described as facilitators to IPC compliance.

Workload

Many discussed how workload prevented CNAs from effectively carrying out every day IPC practices. A director of nursing from NH 10 described that, despite CNAs' awareness of IPC practices, adherence was low because of increased workload and being in a hurry to finish one task and move on to another. When asked for reasons why CNAs might not follow an infection control policy a CNA from NH 1 stated, "I would say multitasking." An IP from NH 10 discussed an example of workload resulting in inadequate perineal care or poor hydration,

> *"…if a CNA is in a hurry … maybe they get to work late, they have an extra [resident] today, so now they have nine [residents] instead of eight. And they came late so they're a little bit rushed… Or if they don't offer enough fluids and then the urine just gets concentrated… "*

Solutions to overcoming barriers created by increased workload involved hiring more staff. However, respondents noted that this approach would likely not result from a state inspection as a nurse from NH 8 stated,

> *"the only real way that [the state addresses] inadequate staffing is if they come in and see that there is… just a total lack of care…If they see that the [residents] are being*

taken care of, even though there are seventeen [residents] for one [CNA], then they kind of overlook it and say it's okay."

Accountability

Gaps in CNA accountability related to IPC were reported by many participants. A director of nursing from NH 8 indicated that CNAs have the ability to effectively implement IPC, however, she went on to say: "I think you have to stay on top of the CNAs, making sure that they're providing their care… because they [are not] used to accounting for their behavior." Additionally, an IP from NH 2 noted issues related to teamwork and being accountable for communicating about IPC,

"I think [CNAs] have to understand that everybody is here to complement each other, but I don't see them communicating. I know my charge nurses will communicate to environmental [services]. I'd like to see my nurse's aide communicate a little bit more. I think they rely on the uppers to do that…"

In order to increase accountability, empowerment and inclusion activities were frequently discussed as key approaches to ensure that CNAs felt they were part of IPC initiatives. For instance, an administrator from NH 2 described the importance of providing CNAs with the tools and training to execute IPC practices,

"from an administrative standpoint you want your staff to know what your policy and your system is so that they can put it into play when your nursing management is not in the building."

Additionally, a physician assistant from NH 1 discussed the importance of including CNAs in IPC "… because they're the ones that are doing the hands on care."

Discussion

In this study, CNAs were described as a diverse group whose challenges to implementing IPC effectively centered on language and culture, lack of knowledge and training, an abundance of per-diem and part-time staff, increased workload, and decreased accountability. While

existing studies have described barriers to implementing quality care practices and maintaining compliance among CNAs (Crogan & Shultz, 2000; Lekan-Rutledge, Palmer, & Belyea, 1998; Mather & Bakas, 2002; Resnick et al., 2008), none have examined barriers to IPC. Our work explored IPC barriers qualitatively, allowing participants to give an account of the barriers they encountered and the strategies participants were using.

There is a growing national trend toward diversity among CNAs and, compared to what was seen in the 1990s, this group is now less likely to be US-born (Priester & Reinardy, 2003; Yamada, 2002). Furthermore, the demographics of CNAs have shifted from primarily non-Hispanic White to primarily Black, Hispanic, or other (Squillace et al., 2009). Our findings suggest that NHs are not fully equipped to accommodate the needs of this increasingly diverse workforce to ensure the provision of quality care to their residents. Steps that NH administrators have taken to respond to these challenges (i.e., translation of in-services and educational material) align with recommendations by the American Medical Directors Association (AMDA) (Young, Inamdar, Dichter, Kilburn, & Hannan) to implement teaching methods that are sensitive to language and culture (American Medical Directors Association, 2011), yet such methods may still fall short of ensuring that CNAs understand IPC processes. In most states CNAs are required to hold a high school diploma or pass a General Education Development (GED), equivalency exam as well as to take an exam for CNA certification and to participate in on the job CNA training that covers infection control and the importance of hand washing; these credentials requires reading and writing in English (Nursing Assistant Resources On The Web, 2012). However, based on what was described by participants in this study, a deficit still remains in regards to language and culture when CNAs are placed in NH settings. A review of current

minimum educational requirements for CNAs may be warranted to ensure that CNAs are best prepared educationally, linguistically, and culturally to satisfy the requirements of their position.

Further, it is important to take into account the variations of terminology and meanings across different cultures and the challenges that accompany comprehension of foreign terms and practices. This is critical, particularly as effective infection control also involves delivering communication (e.g., relaying health concerns to the correct personnel and addressing resident concerns) (U.S. Bureau of Labor Statistics). The reiteration of important messages to CNAs was described as an important strategy to overcome such challenges. This may take the form of posting important reminders and messages in areas where CNAs can see them, providing CNAs with information cards that can be placed in work ID holders, and incorporating CNAs into team huddles. While these extended activities can assist with CNAs' ability to assess and deliver important information appropriately, addressing the CNAs' communication responsibilities was only minimally discussed in this study. Therefore, additional research is needed to better understand the mechanisms CNAs can use to communicate resident assessments and needs.

Lack of knowledge and training can also impact IPC practices among all NH personnel (Stone, 2015). In this study, knowledge was influenced not only by how much experience one had working in a particular facility, but also by the educational requirements of the position. Providing effective education for personnel who have differing educational backgrounds was a challenge. In another study investigating the educational needs of licensed NH nursing staff and CNAs in end-of-life care, lack of knowledge and skills and communication difficulties were also two major needs areas for CNAs to provide end-of-life care at high levels (Ersek, Kraybill, & Hansberry, 1999). AMDA recommends employing teaching methods that are sensitive to workforce personnel with varying educational levels (American Medical Directors Association,

2011). Because IPs are key players in IPC education, including these personnel in cultural competency and sensitivity activities may be beneficial in addressing challenges in CNA knowledge and training. Additionally, IPC compliance related to training was particularly problematic when CNA staff were newer to the facility. In some studies, CNAs reported that initial training only provided them with half of what they needed to know and they learned the remainder informally on the job (Centers for Medicare Medicaid Services, 2001). Therefore, it may be beneficial for IP staff to develop CNA-focused IPC programs that span longer periods of time. However, despite reported IPC training that did focus on CNAs, compliance was said to have varied in this study, suggesting the need for further research on which mode(s) of teaching and preparation would be most effective for this group.

Inability to maintain adequate staffing levels also affected CNA IPC practices. Unfortunately, limited staffing is a prevalent issue in the nursing professions and is only expected to worsen in the future (Castle & Engberg, 2005; Harrington, 2010). This is particularly true in long-term care settings. Individuals over the age of 65 will make up 20% of the US population by the year 2050 (Congressional Budget Office, 2013) compared to 13.7% in the year 2012. Therefore, the need for long-term care services is expected to grow with the increasingly large elderly population, thereby increasing the demand for more CNAs. CNAs who do not hold full-time status within NH facilities are instrumental in filling staffing gaps. However, providing this group with the tools, knowledge, and training necessary to carry out expected IPC practices has been a challenge. One strategy for connecting with per-diem and part-time CNAs includes engaging them when they first start work. For instance, per-diem and part-time staff may be provided with IPC updates, in-services, and trainings 15 minutes prior to the start of their shift at a central place (e.g., nursing office). Another important finding in our study was the suggestion

to equip other staff with the ability to deliver IPC education as opposed to having IPs be primarily responsible for this task. This approach can be particularly useful as IPs regularly work hours that do not fully align with the start of the CNA shift and those CNAs working off-shift. Moreover, additional attention to meeting the needs of CNAs and reaching them despite their sporadic schedules is necessary, as is holding per-diem and part-time staff to the same standards of full-time CNAs. These strategies are important for maintaining consistent IPC practices.

Without adequate staffing and sufficient per-diem and part-time personnel to fill staffing gaps, CNAs work in less than optimum conditions with increasing workloads. Given this reality, it is important to acknowledge that overworked staff pose a threat to resident safety and quality of care delivery as the attention of CNAs can be diverted from some of the most pressing care areas related to infection control. Studies have shown that inadequate CNA staffing is associated with poorer quality measures such as increased infection rates (Zimmerman, Gruber‐Baldini, Hebel, Sloane, & Magaziner, 2002), increased deficiency citations (Hyer et al., 2011), and decreased rates of resident influenza and pneumococcal vaccination (Hutt et al., 2008). Despite quality care concerns found both in our study and others (Hutt et al., 2008; Hyer et al., 2011; Zimmerman et al., 2002), minimum staffing ratios for direct care staff are present in only 36 states (Harrington, 2010) and still fall short of Centers for Medicare and Medicaid Services recommended staffing ratios (Centers for Medicare Medicaid Services, 2001).

Strengths and Limitations

NHs were purposefully sampled to achieve geographic variation in our participant selection. However, transferability of our results to other NHs must be made with caution because of the small sample size. Confirmability was achieved through documentation of field notes during and upon completion of interviews. Moreover, credibility was achieved through

peer debriefings and reflexivity, thus increasing the rigor and trustworthiness of our results (Jeanfreau & Jack, 2010). Last, CNA responses to questions about barriers and facilities to effective IPC were limited compared with how other NH personnel responded. Despite being informed that all responses would remain confidential, reluctance to discuss IPC barriers by the CNA may have been due to fears of repercussions. Because this was a secondary data analysis and the purpose of the primary study was to explore the overall phenomenon of IPC, and not just as it relates to the CNAs, we were limited to the methods and design of the primary study and the study guides were not piloted with CNAs. Future researchers investigating this phenomena more fully may want to consider piloting interview guides with CNAs and/or incorporating focus groups to facilitate CNA responses to questions about barriers of IPC."

Conclusions

These findings provide necessary information to guide the implementation of successful IPC policies and programs in NHs. CNAs are in the frontlines of providing direct care in NHs, therefore, they are key to implementing effective IPC activities in practice. CNAs in our study were described as being an exceptionally diverse group. High turnover and understaffing increased the need for per-diem and part-time staff and also increased CNA workload. Furthermore, holding CNAs accountable for IPC was deemed important. It is necessary to implement strategies designed for this diverse workforce to improve CNA work performance and overcome IPC barriers. Our findings provide information to guide the implementation of IPC policies and programs in NHs. Further research is needed to optimize understanding of the barriers to IPC facing CNAs in NHs and what strategies are available to overcome these barriers. Such studies will enable NHs to achieve reduction in HAI among their residents.

Chapter 4: Racial/Ethnic Disparities in Influenza and Pneumococcal Vaccinations among NH Residents: A Systematic Review

This chapter addresses aim two of this dissertation: Review evidence on racial/ethnic disparities along with their contributing factors to influenza and pneumococcal vaccination receipt among NH residents. This manuscript has been accepted to *The Gerontologist.*

Abstract

This systematic review analyzes research examining racial/ethnic disparities in influenza and pneumococcal vaccination coverage between White and racial/ethnic minority (Black and Hispanic) nursing home residents. A review of the literature for years 1966 -2014 using Medline, Web of Science, and PubMed was conducted. The Epidemiological Appraisal Instrument was used to appraise the quality of the thirteen included studies. Overall, articles were strong in reporting and data analysis, but weak in sample selection and measurement quality. Disparities between vaccination coverage among racial/ethnic minorities versus Whites ranged from 2-20% for influenza and 6-15% for pneumococcal vaccination. Researchers reported racial/ethnic minorities were more likely to refuse vaccinations and less likely to have vaccinations offered and their vaccination status tracked compared to Whites. Policies/strategies that focus on ensuring racial/ethnic minorities are offered influenza and pneumococcal vaccinations and their vaccination status are tracked in nursing homes are warranted. Updated evaluation on vaccination disparities is also needed.

Keywords: Vaccines, Health Disparities, Long-Term Care, Immunization, Policy

Introduction

Several government agencies have prioritized influenza and pneumococcal vaccinations for adults 65 years of age and older (Johnson, Elbert-Avila, Kuchibhatla, & Tulsky, 2012; Poland et al., 2003; U. S. Department of Health and Human Services, n.d.-a). In Healthy People 2020, an initiative to improve the nation's health, the Federal government specifically set target goals of influenza and pneumococcal vaccination receipt among this group at 90 percent or greater (U.S. Department of Health and Human Services, 2013a). Centers for Medicare and Medicaid Services (CMS) certified nursing homes, which are more than 95 percent of facilities, are required to offer influenza and pneumococcal vaccinations to each resident and provide documentation of vaccination status (Centers for Medicare & Medicaid Services, 2005). Therefore, vaccines should be readily available to all residents.

Despite this, vaccination receipt rates remains low (U. S. Department of Health and Human Services, 2014, n.d.-b). In the most recent vaccination data for nursing homes using Minimum Data Set data and reported by the U.S. Department of Health and Human Services, only 62.3% of residents were protected by the influenza vaccination (2005-2006) and 75.4% were protected by the pneumococcal vaccination (2013); while this is an increase from previous years, it is still short of the federal goal (U. S. Department of Health and Human Services, 2014, n.d.-b). Moreover, vaccination receipt percentages were far lower among racial/ethnic minority nursing home residents (Gorina, Kelly, Lubitz, & Hines, 2008; U. S. Department of Health and Human Services, 2014).

New Contribution

Currently, 1.5 million persons reside in nursing homes, and this number is expected to increase substantially because of the growing elderly population (Centers for Medicare Medicaid

Services, 2013; Congressional Budget Office, 2013). The largest increases will be among those of racial/ethnic minority status (Blacks and Hispanics) as more individuals from this group move into nursing homes and Whites increasingly opt for other care settings (e.g., assisted living) (Feng, Fennell, Tyler, Clark, & Mor, 2011).

As a result of population increases in racial/ethnic minorities and the elderly, gaps in vaccination receipt are likely to widen if appropriate action is not taken (U.S. Census Bureau, 2012). These gaps can potentially exacerbate disparities in diseases such as influenza and pneumonia, which can be prevented. The purpose of this systematic review is to understand the magnitude of the disparity in influenza and pneumococcal vaccination receipt between Blacks and Hispanics compared to Whites over time (Gorina et al., 2008; U. S. Department of Health and Human Services, 2014). To do this, we examine disparities in vaccination receipt between elderly non-Hispanic White and racial/ethnic minority (Black and Hispanic) nursing home residents. We also identify contributing factors to these disparities. A systematic review of this evidence does not presently exist.

Conceptual Framework

The Strategic Framework for Improving Racial and Ethnic Minority Health and Eliminating Racial and Ethnic Health Disparities (The Strategic Framework), developed by the Office of Minority Health, guided this review conceptually (Graham, 2008). The model identifies long-term problems related to health disparities and links them to contributing factors, strategies and practices, and outcomes. Contributing factors consist of individual, community, and systems-level factors (hereafter referred to as facility-level factors) that are determined to add to poor racial/ethnic minority health. Strategies and practices are initiatives that may address the contributing factors at each level described. Outcomes are identified as the expected result of

established and/or implemented strategies and practices (e.g., improved health for all and decreased disparities in care) or the lack thereof. Examining contributing factors and strategies and practices of vaccination administration (i.e., vaccination receipt and reasons for non-receipt) related to racial/ethnic disparities is necessary to address long-term problems of preventable morbidity and mortality among racial/ethnic minority nursing home residents.

Methods

The preferred reporting items for systematic review and meta-analysis (PRISMA) guidelines were followed in each phase of this systematic review and its reporting (Moher, Liberati, Tetzlaff, & Altman, 2009).

Search Strategy

Databases were searched in December 2015 and included Medline, Web of Science, and PubMed using the following keywords: (immunization/ or immunization or vaccin* or vaccine/) AND (pneumonia/ or pneumoni* or pneumococ* or influenza or flu vaccination rate or vaccination rates) AND (nursing home/ or long-term care/) AND (racial disparit* or health disparit* or racial difference* or socioeconomic status/ or Blacks/ or Hispanics/ or minorit*/ or minority health/ or Medicaid or rac* or characteristic* or difference* or predictor* or gap*). No limit was placed on the years searched.

Racial/ethnic disparities were defined as differences in care explained by race and/or ethnicity. Minority was defined as being of Black or Hispanic racial/ethnic background. Studies were included if they examined racial/ethnic disparities in pneumococcal and influenza vaccinations in U.S. nursing home setting(s); were written in the English language; and included a sample of nursing home residents who were 65 years of age or older. Studies were excluded if they were reviews or editorials; took place in another setting (i.e., residential care, skilled

nursing, or subacute facility); focused on the vaccination of healthcare workers, children, or adults younger than 65 years of age; focused on other vaccinations; or focused on infection rates. Facilities that were solely skilled nursing and subacute were excluded because they may behave differently from free-standing nursing homes as a result of their focus on post-acute care. Residential care was excluded because of its potential to differ greatly from nursing home care with respect to the resident's care requirements. Other races/ethnicities were not included (i.e., American Indian/Alaska Native, Asian, and Native Hawaiian/Pacific Islander) because combined, they make up less than 5% of residents residing in nursing homes and are too few to make meaningful interpretations (Harris-Kojetin et al., 2016).

Methodological Quality Assessment of Identified Studies

The Epidemiological Appraisal Instrument (EAI), developed by Grenaidy et al. (2007), was used to assess the quality (i.e., reporting and methodology) of the eligible studies. This 43-item instrument is rooted in epidemiological principles and validated for use in cohort, cross-sectional, intervention, hybrid, and case-control studies (Genaidy et al., 2007). The EAI was derived from well-known instruments such as the checklist created by Downs & Black, but lends itself further to the evaluation of cross-sectional studies as opposed to primarily randomized controlled trials (Downs & Black, 1998). The former comprised the majority of this review.

The EAI consists of five sections: (a) reporting (17 items); (b) subject/sample selection (7 items); (c) measurement quality (10 items); (d) data analysis (7 items); and (e) generalization of results (2 items). Reporting falls under the study description domain while the remaining sections assess the study execution. Response to items include: yes (information is described); partial (information is partially described); no (information is not described but should have been provided); or unable to determine. The scores associated with each response are as follows: 2 for

yes, 1 for partial, or 0 for no and unable to determine. A "not applicable" response is given to areas that do not pertain. Overall scores are computed by averaging the total scores for each section after excluding the "not applicable" responses. In another review using the EAI, studies were considered of high quality if the overall score was ≥ 60% (Veenhof, Huisman, Barten, Takken, & Pisters, 2012). The studies were categorized as "good" if the score was 1.4 or greater (≥ 70%), "average" if between 1.1 and 1.4 (55%-69%), or "poor" if less than 1.1 (< 55%). Two researchers (JT, KS) assessed each eligible article individually; they then met to discuss their findings and resolve any discrepancies.

Data Abstraction

Data that were further abstracted from the articles included: (a) author; (b) study design; (c) sample size; (d) study years; (e) data source; (f) outcome measure; (g) vaccination coverage percentage by race/ethnicity; and (h) contributing factors to vaccination disparities.

Results

Four hundred seventy-nine potentially eligible articles were retrieved. After removing duplicates, 310 articles remained, from which 271 were then excluded following title and abstract screening. The remaining 39 full-text articles were assessed against the defined eligibility criteria, 27 were deemed ineligible, and one article was identified through article references. The final sample consisted of 13 studies. Figure 4.1 details the article selection process and reasons for exclusion.

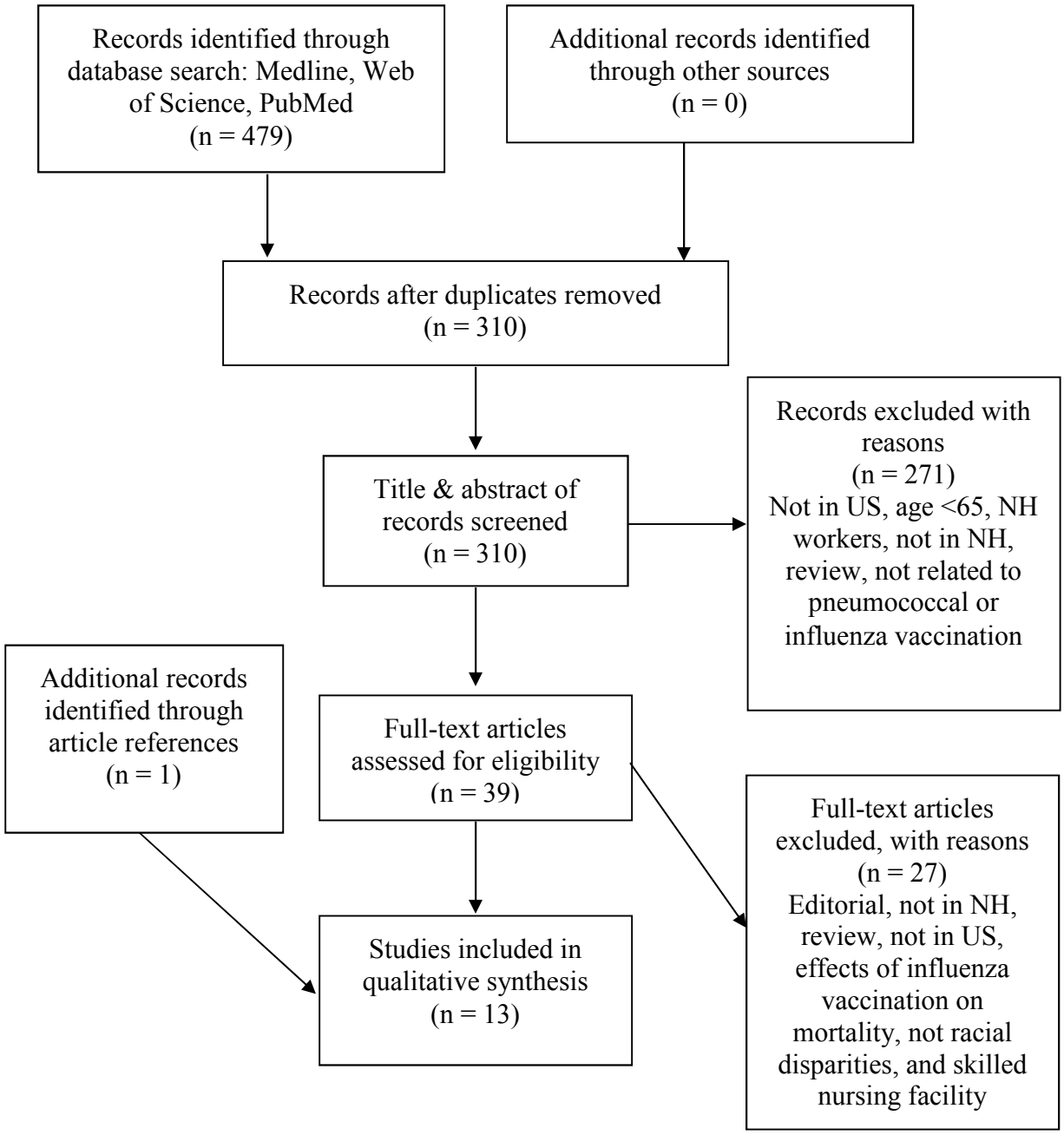


Figure 4.1 PRISMA flow diagram of article selection process

NH = Nursing home, PRISMA= Preferred Reporting Items for Systematic Reviews and Meta-Analyses

Characteristics of the included studies are provided in Table 4.1. Racial/ethnic disparities in influenza vaccination receipt were solely evaluated in eight studies and racial/ethnic disparities in pneumococcal vaccination receipt were solely evaluated in two. Three studies evaluated racial/ethnic disparities in both. Over two-thirds (69%) of the studies were either led or co-authored by the same author. Study years ranged from 1995 to 2009.

Data Sources

In all eligible studies, the investigators used large administrative data sets and performed secondary data analysis, although one group of researchers also corroborated their methods with a developed survey and chart reviews (Bardenheier et al., 2004). In five studies, researchers used the Minimum Data Set (MDS) along with the Online Survey Certification and Reporting (OSCAR) database (Bardenheier, 2013; Bardenheier et al., 2004; Bardenheier, Wortley, et al., 2011; Bardenheier, Wortley, et al., 2010; Cai et al., 2011), in one study the researcher used only the MDS (Bardenheier et al., 2012), and in seven studies the researchers used the National Nursing Home Survey (NNHS) (Bardenheier, Shefer, et al., 2011; Bardenheier, Shefer, Tiggle, Marsteller, & Remsburg, 2005; Li & Mukamel, 2010; Luo et al., 2014; Marsteller, Tiggle, Remsburg, Shefer, & Bardenheier, 2006; Marsteller et al., 2008; Strully, 2011). Each data source is described below along with the variables used in the studies reviewed.

Table 4.1 Description of included studies

Author	Study Design	Sample Size	Study Years	Data Source	Outcome Measure	Vaccination coverage	Quality Score
Bardenheier et al. 2013	Secondary Cross-sectional Michigan	66, 895	October 2005-March 2006	MDS OSCAR	Influenza Vaccination	Whites vs. Blacks 59.9% vs. 42.6 %	1.52
Bardenheier et al. 2012	Secondary Cross-sectional	2,359,321	October 2008-March 2009	MDS	Influenza Vaccination	Whites vs. Blacks 74.1% vs. 66.0% (reported as medians)	1.26
Bardenheier, Shefer et al. 2011	Secondary Cross-sectional	12,857	2004	NNHS	Influenza Vaccination	Whites vs. Blacks 64.1% vs. 54.9%	1.41
Bardenheier, Wortley et al. 2011	Secondary Cross-sectional	85,534	October 2005-March 2006	MDS OSCAR	Influenza Vaccination	Whites vs. Blacks 63.5% vs. 43%	1.55
Bardenheier et al. 2010	Secondary Cross-sectional	1,851,676	October 2005-March 2006	MDS OSCAR	Influenza Vaccination	Whites vs. Blacks vs. Hispanics 73.4% vs. 65.1% vs. 66.5%	0.93
Bardenheier, et al. 2005	Secondary Cross-sectional	7,374 7,399 7,383	1995, 1997, 1999	NNHS	Pneumococcal Vaccination	Whites vs. Blacks 24.3% vs. 23.2 29.3% vs. 23.9% 39.9% vs. 30.2	1.55
Author	Study Design	Sample Size	Study Years	Data Source	Outcome Measure	Vaccination coverage	Overall Quality

							Score
Bardenheier et al. 2004	Secondary Cross-sectional	20, 516	November 2000 January 2001	OSCAR MDS Chart Review Survey Instrument	Influenza and Pneumococcal Vaccination	Whites vs. Blacks vs. Hispanics (Influenza) 59% vs. 51% vs. 49% (Pneumococcal) 34% vs. 24% vs. 19%	1.63
Cai et al. 2011	Secondary Cross-sectional	886,786 872, 592 857,740	2006-7 2007-8 2008-9	MDS OSCAR	Influenza Vaccination	Whites vs. Blacks 82.6% vs. 75.4% 83.3% vs. 77.3% 83.5 vs. 77.8%	1.35
Li et al. 2010	Secondary Cross-sectional	Influenza 10,562 Pneumococcal 12,134	2004	NNHS	Influenza and Pneumococcal Vaccination	Whites vs. Blacks (Influenza) 78.0% vs. 64.7% (Pneumococcal) 50.5% vs. 35.2%	1.4
Luo et al. 2014	Secondary Cross-sectional	13,507	2004	NNHS	Influenza and Pneumococcal Vaccination	Whites vs. Blacks vs. Others* (Influenza) 77.0% vs. 67.8% vs. 73.9% (Pneumococcal) 56.2% vs. 43.2% vs. 54.9%	1.31
Marsteller et al. 2008	Secondary Cross-sectional	14,303	Merged years 1997 1999	NNHS	Pneumococcal Vaccination	Whites vs. Blacks 34.0% vs. 27.0%	1.50

Author	Study Design	Sample Size	Study Years	Data Source	Outcome Measure	Vaccination coverage	Overall Quality Score
Marsteller et al. 2006	Secondary Cross-sectional	7,194	1999	NNHS	Influenza Vaccination	Whites vs. Blacks vs. Other 67.0% vs. 65.0 vs. 61.0%	1.35
Strully 2011	Secondary Cross-sectional	12,501	2004	NNHS	Influenza Vaccination	Whites vs. Blacks 69.0% vs. 62.0%	1.38

MDS= Minimum Data Set; OSCAR= Online Survey, Certification and Reporting; NNHS= National Nursing Home Survey
*Others consisted of any racial group not categorized as White or Black

MDS. MDS is a database of nursing home resident assessment data. All CMS-certified nursing homes are required to collect resident assessment data upon resident admission as well as quarterly, annually, and whenever there is a significant change in resident status (i.e., decline or improvement in a resident's health) (Institute of Medicine, 2001). The data from the MDS provide individual resident assessments and characteristics. Variables abstracted from the MDS included racial/ethnic status, health information, physical functioning, vaccination administration, and reasons for not receiving vaccinations (resident not in facility during season, received outside of facility, not eligible, offered and declined, not offered, or facility unable to obtain vaccination). MDS data were used for the years 2005 to 2009.

OSCAR. OSCAR is a federal administrative database containing aggregated resident characteristics, survey deficiencies, and facility-level data (Chisholm et al., 2013; Veenhof et al., 2012). Data are collected annually and are part of the nursing home CMS certification and recertification process. Variables abstracted in these studies included staffing, bed type, ownership status, source of payment, and location. OSCAR data were used for the years 2005 to 2008 and were typically merged with the MDS.

NNHS. The NNHS involves a probabilistic sample of 1,174 nursing homes in 2004 and a random sample of up to 12 residents from each nursing home (Centers for Disease Control and Prevention, 2008). Administration of this survey occurred in 1995, 1997, 1999, and 2004, and was delivered to nursing home personnel to complete on behalf of the nursing home residents. Variables on the survey that were of focus in the studies reviewed included racial/ethnic status, health information, vaccination administration and reasons for not receiving vaccinations which included: (a) unknown vaccination status; (b) resident offered but refused the vaccination; (c) resident not offered the vaccination; (d) medical contraindication; and (e) resident not in the

nursing home during the most recent influenza season. One of the reviewed studies (Bardenheier B, 2011) included the following strategies to increase vaccination: (a) standing, preprinted, advance, and personal physician orders; (b) written vaccination policy; (c) primary care provider immunization reminder program; (d) centralized tracking system for facility-wide influenza vaccination coverage; (e) facility-wide recommendation for healthcare workers to receive the influenza vaccine; and (f) facility-wide provision of free vaccine to healthcare workers. All four years of NNHS data were used.

Sample

Sample sizes ranged from 7,194 to 2,359,321 nursing home residents. The majority of the studies (n = 9; 69%) examined only non-Hispanic Black residents and compared them with non-Hispanic White residents. Two studies examined an "Other" group in addition to non-Hispanic Black residents and non-Hispanic White residents (Luo et al., 2014; Marsteller et al., 2006). "Other" consisted of all residents who were not classified as Black or White. In two studies, researchers examined only Hispanics (Bardenheier et al., 2004; Bardenheier, Wortley, et al., 2010)**.**

Data Analysis Methods

The most common methods used to analyze the data were hierarchal modeling and multinomial logistic regressions. Hierarchal modeling allows examination of factors on multiple levels (e.g., resident, facility) as well as within and between facility characteristics (e.g., racial composition). Multinomial logistic regression allows examination of the effect of race on more than two different outcomes (e.g., receiving vaccination, not receiving vaccination, having unknown vaccination status) while comparing within subgroups. Researchers also used multivariate logistic regression, conditional fixed-effects logit, and general descriptive statistics.

Multivariate logistic regression allows researchers to assess the likelihood of receiving either the influenza or pneumococcal vaccination while considering race/ethnicity as the independent variable and controlling for selected covariates. Conditional fixed-effects are similar to multilevel modeling in that they allow researchers to examine how much of the racial inequality in vaccination receipt was attributable to differences within facilities.

Quality Appraisal

Variations in the quality of the 13 studies are presented in Table 4.2. Overall quality scores ranged from an average of 0.9 (Bardenheier, Wortley, et al., 2010) to 1.6 (Bardenheier et al., 2004) out of 2 possible points. When divided into sections, the lowest scores were found in the area of sample selection (0.7 [(Bardenheier, Wortley, et al., 2010; Li & Mukamel, 2010; Luo et al., 2014; Marsteller et al., 2008; Strully, 2011)] to 2.0 [(Bardenheier et al., 2004)]) and measurement quality (0.0 [(Bardenheier et al., 2004) to 1.1 (Bardenheier, Shefer, Tiggle, et al., 2005; Bardenheier, Wortley, et al., 2011; Bardenheier et al., 2012; Bardenheier, Wortley, et al., 2010; Cai et al., 2011; Li & Mukamel, 2010; Luo et al., 2014; Marsteller et al., 2006; Marsteller et al., 2008; Strully, 2011)]), with a total average score of 1.1 and 1.0, respectively.

In regards to sample selection, while there were differences in the racial/ethnic groups compared, most researchers did control for this by adjusting for resident characteristics (e.g., age, gender, health status, and physical functioning). However, many of the authors did not account for attrition or unavailable records after entry into the study. In addition, related to measurement quality, although the methods for assessing the exposure (race/ethnicity) and outcome (vaccination status) variables were similar for each racial/ethnic group and observations were taken over the same time for all groups in all studies, the reliability and validity of the race/ethnicity categorization were not discussed in the studies. This is also true for the reliability

of vaccination status. The study that received a 0 score in measurement quality was purely a descriptive study (Bardenheier, Wortley, et al., 2010). Findings from this study were used when reporting overall ranges in vaccination disparities.

Table 4.2 Quality assessment of included studies using the Epidemiological Appraisal Instrument

	Reporting	Sample Selection	Measurement Quality	Data Analysis	Generalization of Results	Overall*
Bardenheier et al. 2013	1.63	1.50	0.80	2.00	N/A	1.52
Bardenheier et al. 2012	1.19	1.50	1.14	1.50	N/A	1.26
Bardenheier, Wortley, et al. 2011	1.63	1.50	1.14	2.00	N/A	1.55
Bardenheier, Abigail, et al. 2011	1.60	1.50	0.85	1.67	N/A	1.41
Bardenheier et al. 2010	1.00	0.67	1.14	0.50	N/A	0.93
Bardenheier et al. 2005	1.73	1.50	1.14	1.67	N/A	1.55
Bardenheier et al. 2004	2.00	2.00	0	1.33	2.0	1.63
Cai et al. 2011	1.44	0.75	1.43	2.00	N/A	1.35
Li et al. 2010	1.69	0.67	1.14	2.00	N/A	1.40
Luo et al. 2014	1.47	0.67	1.14	1.50	N/A	1.31
Marsteller et al. 2006	1.81	1.33	1.14	1.60	N/A	1.50
Marsteller et al. 2008	1.50	0.67	1.14	1.60	N/A	1.35
Strully et 2011	1.60	0.67	1.14	1.50	N/A	1.60

*Studies were considered “good” if they were 1.4 or greater (≥ 70%), “average” if between 1.1 and 1.4 (55%-69%), or “poor” if less than 1.1 (< 55%).

The highest possible scores were found in reporting (1.0 [(Bardenheier, Wortley, et al., 2010) to 2.0 (Bardenheier et al., 2004)]) and data analysis (0.5 [(Bardenheier, Wortley, et al., 2010) to 2.0 (Bardenheier, 2013; Bardenheier, Wortley, et al., 2011; Cai et al., 2011)]), with a total average score of 1.6 and 1.5, respectively. Many aspects of the studies were clearly reported (e.g., aim, exposure and outcome variables, source of sample population, covariates, statistical methods, study findings, and estimates of statistical parameters). The majority of the studies analyzed the data by exposure levels, outcome levels, and/or subgroups (e.g., race, vaccination status, and racial/ethnic composition of the nursing home).

Vaccination Disparities

All studies reported racial/ethnic minorities less likely to receive vaccinations—either influenza, pneumococcal, or both—when compared to Whites or "Others." The disparity in vaccination receipt varied between racial/ethnic minorities and Whites, with a range of 2-20% for influenza vaccinations and 6-15% for pneumococcal vaccinations.

Studies using identical data sources and years reported different vaccination receipt percentages due to varying sample selection criteria. For example, four studies used 2004 NNHS data (Bardenheier, Shefer, et al., 2011; Li & Mukamel, 2010; Luo et al., 2014; Strully, 2011) to analyze coverage of either influenza or pneumococcal vaccinations or both; none of these four used identical sample sizes. Overall, these four studies reported influenza vaccination receipt ranging from 64.1-78% for Whites and 54.9-67.8% for Blacks; only two of the four studies reported similar influenza vaccination receipt percentages (78% Whites vaccinated vs. 64.7% Blacks vaccinated, and the other showing 77% Whites vaccinated vs. 67.8% Blacks vaccinated) (Li & Mukamel, 2010; Luo et al., 2014). In the same two studies reporting similar influenza vaccination receipt percentages, pneumococcal vaccination receipt differed with 50.5% Whites

vaccinated vs. 35.2% Blacks vaccinated, compared to 56.2% Whites vaccinated vs. 43.3% Blacks vaccinated (Li & Mukamel, 2010; Luo et al., 2014). Studies by Luo et al. (2014) and Strully (2011) had an overall quality score that fell in the "average" range while Bardenheier, Shefer, et al. (2011) and Li & Mukamel (2010) had an overall quality score that fell in the "good" range. All studies except for Bardenheier, Shefer, et al. (2011) received a poor score in sample selection.

Similar heterogeneity was reported in two separate studies that used 1999 NNHS data to examine pneumococcal vaccination receipt (Bardenheier, Shefer, Tiggle, et al., 2005; Marsteller et al., 2008). There was a difference of 481 residents between the two studies. The study conducted by Marsteller et al. (2008) only used residents residing in the nursing homes between the months of July and December. Both studies had an overall score that fell in the "good" range, but Marsteller et al.'s (2008) study was weakest in the sample selection. When reviewing two other studies led by Bardenheier, fairly consistent influenza vaccination receipt percentages between Whites and Blacks were reported (60% Whites vaccinated vs. 43% Blacks vaccinated, compared to 64% Whites vaccinated vs. 43% Blacks vaccinated) (Bardenheier, 2013; Bardenheier, Wortley, et al., 2011). Both of these studies used MDS 2005-2006 data and had a "good" overall quality rating score but were both weaker in measurement quality.

Contributing Factors to Racial/Ethnic Disparities

Contributing factors were found to add to racial/ethnic disparities in vaccination receipt and were examined in 11 of the 13 studies; significant findings were only reported in nine of these studies. Contributing factors were categorized as: not offered or offered and refused

(offering of vaccinations and refusal of vaccinations), population served[2] (racial composition, nursing home ownership, nursing home setting, physical functioning, and source of payment), and interventions to increase vaccinations (tracking vaccination status and vaccination strategies).

Not offered and refused. Not being offered vaccinations and/or refusing vaccinations when offered were both found to be individual-level contributing factors to racial/ethnic disparities in vaccination coverage. Four studies (Bardenheier, 2013; Bardenheier, Wortley, et al., 2011; Bardenheier, Wortley, et al., 2010; Cai et al., 2011) identified Blacks as less likely to be offered influenza vaccinations compared to Whites. Bardenheier et al.'s (2010) study was the only one of the four to examine Hispanics and found both Hispanics and Blacks less likely to be offered the influenza vaccination when compared to Whites (79%, 79%, 84%, respectively).

Researchers found that Blacks were also more likely to refuse influenza vaccinations compared to Whites in four studies (Bardenheier, 2013; Bardenheier, Wortley, et al., 2011; Bardenheier, Wortley, et al., 2010; Cai et al., 2011). In addition to Blacks, Bardenheier et al. found Hispanics refused the influenza vaccination more often than Whites (11.9% vs. 9.7% vs. 9.2%, respectively) (Bardenheier, Wortley, et al., 2010). Two of the studies found a 4% difference in refusals of influenza vaccinations between Blacks and Whites (Bardenheier, 2013; Cai et al., 2011), with a higher proportion of Blacks refusing the vaccine. Another research team found a 2-3% difference between these two racial groups (Bardenheier, Wortley, et al., 2011).

Population served. In six studies, researchers found the nursing home population served to be an individual and facility-level contributing factor to racial/ethnic disparities in vaccination receipt between racial/ethnic minorities and Whites (Bardenheier et al., 2012; Li & Mukamel,

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[2] Nursing home ownership and physical functioning were used as proxies for population served

2010; Marsteller et al., 2008). In four studies (Bardenheier, 2013; Bardenheier, Wortley, et al., 2011; Bardenheier et al., 2012; Cai et al., 2011), researchers found that increased racial/ethnic minority composition of the nursing home was associated with decreased vaccination receipt among Blacks compared to Whites. Three of these studies specifically found the largest disparities in influenza vaccination coverage among Blacks in nursing homes, with greater than 50% Blacks (Bardenheier, 2013; Bardenheier, Wortley, et al., 2011; Bardenheier et al., 2012). These disparities were also most prominent in states with the highest overall disparities in influenza vaccination receipt between racial/ethnic minorities and Whites (> 10%) (Bardenheier et al., 2012). Cai et al. (2011) found a consistent disparity in influenza vaccination receipt between Blacks and Whites over the years 2006-2009; this disparity was also very similar across quintiles[3] in the last two years of that time period (2007-2009). In nursing homes with no Whites, the proportion of Blacks vaccinated for influenza was the lowest; by contrast, in nursing homes with no Blacks, the proportion of Whites vaccinated for influenza was the highest (Cai et al., 2011).

Researchers examined nursing home ownership status and the setting in which the nursing home was located to identify disparities in vaccination receipt. Li and Mukamel (2010) reported for-profit ownership status as positively associated with increased racial disparities (unvaccinated and undocumented [Blacks compared to Whites]) in influenza (OR = 2.11, $p < .001$; OR = 1.94, $p < .001$, respectively) and pneumococcal vaccination (OR = 1.64, $p = .001$; OR = 2.01, $p < .001$, respectively). Marsteller et al. (2008) found similar findings regarding proprietary status; however, the associations were only significant in the bivariate analysis, not in the multivariate analysis.

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[3] Quintiles ranged from the lowest proportion of Black residents to the highest proportion.

When stratified, Blacks residing in nursing homes in non-rural settings (metropolitan and micropolitan) were associated with an increased likelihood of being unvaccinated or undocumented for influenza and pneumococcal compared to Whites in the same settings (OR = 1.78, $p \leq .001$; OR = 1.71 [unvaccinated], $p \leq .001$; OR = 1.83, $p = .002$; OR = 1.94, $p \leq .001$ [undocumented], respectively) (Li & Mukamel, 2010). In rural settings, the odds ratio of Black nursing home residents being unvaccinated for influenza was 3.31, $p \leq .001$ and having no documentation of pneumococcal vaccination receipt was 2.49, $p = .016$, compared to Whites (Li & Mukamel, 2010).

Bardenheier et al.'s (2013) study aimed to understand if frailty (physical functioning) modified the effect of race on influenza vaccinations. Frailty was operationalized using the MDS cognitive performance scale, activities of daily living, and the changes in health end-stage disease and symptoms and signs scale (Bardenheier, 2013). Frailty of the residents increased disparities in influenza vaccination receipt between Blacks and Whites in nursing homes where fewer than 5% of the residents were Black.

Compared to Whites, Marsteller et al. (2008) found Blacks less likely to be vaccinated for pneumonia and more likely to have unknown vaccination status for pneumonia in Medicaid-only and dually-certified facilities. Similarly, Li & Mukamel (2010) reported Black Medicaid residents were less likely to receive both vaccinations and have both vaccinations documented, compared to White Medicaid residents. Among non-Medicaid residents (Medicare, private, other), Blacks were still less likely to receive the influenza vaccination or have either the influenza or pneumococcal vaccination documented, compared to non-Medicaid White residents.

Interventions to increase vaccinations. Interventions to increase vaccinations were facility-level contributing factors to racial/ethnic disparities in vaccination receipt and

operationalized as: tracking of vaccinations and vaccination strategies. Two studies (Li & Mukamel, 2010; Marsteller et al., 2008) reported Blacks were less likely to have their vaccination status tracked. In the Marsteller et al. (2008) study, both Hispanics and Blacks lacked pneumococcal vaccination receipt status more than Whites (3.9%, 3.5%, and 2.4%, respectively), while in the Li & Mukamel (2010) study, Blacks were 1.85 times less likely to have their influenza vaccination receipt status tracked and 1.95 times less likely to have their pneumococcal vaccination receipt status tracked, compared to Whites.

Adjusting for resident, facility, state, and regional-level characteristics, Bardenheier et al. (2011) found the lack of vaccination-promoting strategies (e.g., standing orders, permissibility of verbal consent, seasonal influenza vaccination campaigns, centralized tracking systems, and routine review of facility-wide influenza vaccination receipt rates) significantly increased the racial gap in influenza vaccination between Black and White nursing home residents. Additionally, when less than 40% of healthcare personnel were vaccinated for influenza, the gap in vaccination receipt between Blacks and Whites significantly increased. Marsteller et al. (2008) similarly found the lack of organized vaccination programs to be associated with fewer Blacks being vaccinated for pneumonia and more Blacks having an unknown vaccination status, compared to Whites. However, in an earlier study led by the same author (Marsteller et al., 2006), the researchers found that staff vaccination requirements had no relationship to resident influenza vaccination status.

Discussion

Racial/ethnic disparities in influenza and pneumococcal vaccination receipt experienced by Blacks and/or Hispanics, compared to Whites, were evident in all of the reviewed studies. Not offering and refusing vaccinations (individual-level), the population served (community/facility-

level), and lack of interventions to increase vaccinations (facility-level) were found to be overall contributing factors to disparities in vaccination receipt. The largest disparities (> 10% difference in vaccination receipt) were seen as the result of the following contributing factors: increased racial/ethnic minority composition of the nursing home (nursing homes with no Whites compared to nursing homes with no Blacks), lack of vaccination strategies/policies in nursing homes, and/or nursing home location in a non-urban setting.

The population served by nursing homes greatly influences disparities in vaccination receipt between racial/ethnic minorities and Whites. When Blacks were largely concentrated in nursing homes, vaccination receipt decreased substantially for this racial group while higher concentrations of Whites resulted in a substantial increase in vaccination receipt. Overall, vaccination receipt was the lowest among Black residents in nursing homes with > 50% Blacks. Findings from other studies confirm that racial/ethnic composition directly influences receipt of care. For example, Haas et al. (2004) reported that a high proportion of Blacks (> 40%) in a county were more likely to report difficulty obtaining care (e.g., not receiving healthcare they thought they needed), compared to a low proportion of Blacks (< 6%) in a county. Similar results in Haas et al.'s (2004) study were reported with respect to Hispanic proportions.

Additionally, racial/ethnic minorities more commonly pay for their nursing home stay with Medicaid and reside in Medicaid-serving facilities and for-profit facilities (Centers for Medicare Medicaid Services, 2013; Mor et al., 2004). Medicaid and for-profit facilities have been associated with poorer performance, increased deficiencies, and decreased quality (Mor et al., 2004). This review revealed that Blacks were less likely to receive vaccinations in Medicaid-only facilities and dually-certified facilities (Medicare and Medicaid) along with for-profit facilities (Marsteller et al., 2006). It is plausible that facility resources are unevenly distributed

when considering these disparities in care associated with location of nursing homes, proportions of racial/ethnic minorities in nursing homes (Blacks), primary source of payment, and ownership status of the nursing home (Chang, 2012). Lower staffing and increased workload in these nursing homes, for example, can affect healthcare providers' perceptions of time to offer vaccinations and to educate residents on the benefits and efficacy of influenza and pneumococcal vaccinations, thus affecting quality of care.

Social and cultural factors may also explain a portion of the disparities in vaccination receipt, particularly related to higher refusals of vaccinations among racial/ethnic minorities compared to Whites. Historically, African Americans and Hispanics have had limited to no access to formal health care leading them to depend on traditional remedies to treat illness and injury (Kennedy, Mathis, & Woods, 2007). Because of this acquired disengagement with formal healthcare services, it is no surprise that in a national telephone survey of 3,875 adults ≥ 65 years of age, Blacks and Hispanics were found to be less likely to believe the influenza vaccine was very effective in the prevention of illness when compared to Whites, less likely to report susceptibility to illness if not vaccinated, and more likely to attribute the influenza vaccine to influenza-like side effects (Wooten, Wortley, Singleton, & Euler, 2012). Additionally, these researchers found that high vaccination receipt were associated with positive beliefs about the vaccine. These individual-level findings support the need to address negative beliefs and attitudes along with disengagement with the healthcare system among racial/ethnic minority elderly to close gaps in vaccination receipt and improve overall vaccination receipt rates.

Discrimination towards racial/ethnic minority residents and provider mistrust must additionally be considered when examining racial/ethnic disparities in care processes such as vaccination administration. In this review, Blacks were less likely to be offered vaccinations

compared to Whites and more likely to refuse vaccinations when offered them. Prior research has shown that providers perceived racial/ethnic minority patients as less engaged in their care and, as a result, spent less time in communication and education activities with them (Cohen et al., 2012; Ferguson & Candib, 2002). Subjection to medical experimentation and acts of deception in the past; however, may explain a majority of non-compliance and mistrust Black nursing home residents portray towards health care providers and the healthcare system (Spector, 2002). Blacks have been found, by contrast, to have increased compliance with care and be more likely to accept recommendations when they are informed (Harris, Miller, & Davis, 2003). These individual-level findings emphasize the need to involve racial/ethnic minorities fully in their care plans, provide appropriate education, and identify targeted interventions to address racial/ethnic bias among healthcare providers. Additionally, activities to increase cultural and linguistic competence among healthcare providers are needed to meet the needs of this growing diverse racial/ethnic elderly group effectively.

Interventions to increase vaccination coverage have been important in addressing challenges associated with vaccination adherence in nursing homes. Vaccination mandates have been instrumental in increasing the compliance of healthcare workers (Babcock, Gemeinhart, Jones, Dunagan, & Woeltje, 2010), and standing orders have increased vaccination receipt among nursing home residents (Bardenheier, Shefer, Lu, Remsburg, & Marsteller, 2010; Stevenson, McMahon, Harris, Hillman, & Helgerson, 2000). One study in this review found certain facility-level vaccination policies (i.e., standing order, centralized tracking systems, vaccination campaigns) decreased disparities among racial/ethnic groups (Bardenheier, Shefer, et al., 2011), while a second study found general organized immunization programs increased vaccination receipt and decreased disparities (Marsteller et al., 2008). Thus, vaccination policies

and programs in all nursing homes remain critical because of their efficacy in increasing overall vaccination receipt and closing gaps in care among racial/ethnic groups. All nursing home facilities should also consider implementation of such strategies to assist with challenges in meeting federally recommended healthcare worker and resident vaccination receipt rates.

To note, all pneumococcal vaccination data in this review were over a decade old and all influenza vaccination data were over five years old. The majority of the studies were appraised to be average or good quality. Studies were weakest in measurement quality and sample selection. This finding was mainly due to no researchers from any of the studies discussing the reliability and validity of the main exposure variables and reliability of the main outcome variables: race/ethnicity and influenza and pneumococcal vaccination, respectively. We did find evidence showing these variables from the MDS to be reliable and valid with high percent agreement ranging from 0.993-1.000 for race/ethnicity and 0.978-0.994 for the influenza and pneumococcal vaccination (Grosholz et al., 2014; Hawes et al., 1997; Saliba & Buchanan, 2008). We found no information that clearly describes the reliability and validity of these variables for the NNHS. Because the NNHS is based on a sample; however, the statistics presented in the results are expected to be different than what would have been presented if the entire population was surveyed (Jones, Dwyer, Bercovitz, & Strahan, 2009).

A similar systematic review examining factors associated with influenza and pneumococcal vaccination in the general elderly community population across the world was conducted in 2005. The researchers found vaccination receipt varied across studies, and factors for not being vaccinated included lack of recommendation or information, absence of risk perception, costs, disbelief in efficacy, and fear of side effects. Increased age, presence of chronic disease, and doctor's recommendation were found to be predictors for receipt of

vaccinations (Kohlhammer, Schnoor, Schwartz, Raspe, & Schäfer, 2007). Both the Kohlhammer et al. review as well as the present review reported that vaccination receipt differed among studies, and lack of recommendation/offering of vaccination to specific racial groups was a contributing factor.

In 2005, the Federal government issued requirements for all CMS-certified nursing homes to offer influenza and pneumococcal vaccinations to each resident; documentation of vaccination receipt and non-receipt was also mandated (Centers for Medicare & Medicaid Services, 2005). Because of this recommendation, one might expect the gap in vaccination receipt to close between racial/ethnic minorities and Whites while overall vaccination receipt to increase. Influenza receipt post-CMS requirements examined in two studies in this review did show an increase in vaccination receipt and a decrease in the gap among groups vaccinated between 2006 and 2009 (Bardenheier et al., 2012; Cai et al., 2011). These results suggest possible progress towards meeting CMS requirements in the area of improving influenza vaccination. However, the data examined in this review are either old (influenza) or prior to CMS policy (pneumococcal); therefore, can only be used as comparison data to needed updated research examining the effects of CMS policy.

Strengths and Limitations

The use of the PRISMA guidelines strengthened this review and helped to ensure methodological rigor, careful planning, and clear reporting (Moher et al., 2015). Additionally, the EAI used to appraise the quality of the studies in this review was comprehensive, developed exclusively to evaluate epidemiological studies, and has been determined valid and reliable (Genaidy et al., 2007). Further, it allowed for the evaluation of important areas specific to epidemiological studies (e.g., sample selection, comparison groups).

When performing the literature search, the researchers made every attempt to ensure its completeness, but some studies may have been missed. Additionally, publication bias must be considered because results of negative findings may have not been published and more than half of the studies reviewed were authored or co-authored by the same researcher.

Recommendations

This review exposed important gaps in racial/ethnic disparities related to receipt of vaccinations among nursing home residents. Critically, little to no information exists that provides evaluation of the effectiveness of the 2005 CMS vaccination mandate and a majority of the studies reviewed were weaker in sample selection and measurement quality. Without current evidence, strategies and practices developed to improve vaccination receipt and preventable illness may be poorly directed. It is necessary for researchers to examine trends of vaccination receipt post-CMS requirements along with reasons for vaccination non-receipt and the consequential outcomes of decreased vaccination receipt among racial/ethnic minorities (e.g., influenza, pneumonia, hospitalization, mortality).

Furthermore, only two studies in this review examined Hispanics. This group warrants additional attention because their residency status in nursing homes is increasing and the need to understand disparities occurring among Hispanics is more urgent compared to a decade ago. Even more so, American Indians and Alaskan Natives were not included in the existing research because of their low representation in nursing homes, but necessitate further inquiry as they lead all racial/ethnic groups in pneumonia mortality (Centers for Disease Control and Prevention, 2015a). Finally, implementing and increasing the number of vaccination policies/strategies in nursing homes—particularly focused on racial/ethnic minorities and among facilities that are for-profit, located in rural settings, and/or house a large proportion of racial/ethnic minority

residents—may help to close gaps in vaccination care processes among vulnerable racial/ethnic minority groups.

Conclusion

Across all studies examined in this review, racial/ethnic minorities received influenza vaccinations as much as 20% less and pneumococcal vaccinations as much as 15% less than Whites; no group had a vaccination receipt of > 84%. While decreasing, disparities still exist in influenza vaccination receipt post-CMS requirements (2005). Nothing is known about pneumococcal vaccination receipt after this time. Eliminating disparities among racial/ethnic minorities and increasing influenza and pneumococcal vaccination coverage to ≥ 90% among nursing home residents are two national priorities (U. S. Department of Health and Human Services, n.d.-a; Williams, 2007). Several contributing factors on an individual, community, and facility-level have been identified that may be addressed to alleviate these disparities and improve overall vaccination receipt. Yet, without updated data on vaccination receipt we are unable to gauge where our nation stands in confronting inequities in care. Immediate research is warranted that reports on the status of these priorities and shortfalls.

Chapter 5: Racial/Ethnic Disparities in NH Influenza and Pneumococcal Vaccination Receipt and Non-Receipt

This chapter addresses aim three of this dissertation: Characterize current racial/ethnic disparities in influenza and pneumococcal vaccination receipt and non-receipt in NHs. The manuscript of this work will be submitted to *American Journal of Public Health.*

Abstract

Efforts to increase influenza and pneumococcal vaccinations among nursing home (NH) residents have been prioritized. However, the lack of evidence on current racial/ethnic disparities presents barriers to effectively addressing previously reported inequities in care. Using the most recent resident assessment, facility, and community data available, this study characterizes current disparities in influenza and pneumococcal vaccination receipt and non-receipt among residents. Study findings indicate that Blacks remain less likely than Whites to receive both vaccinations; within the same NHs, Hispanics are more likely to receive both vaccinations than Whites. The likelihood of not being offered the influenza vaccination was greater for Blacks and not being offered the pneumococcal was greater for Hispanics than Whites. NHs highly concentrated with Blacks account for a large proportion of the disparity seen in vaccination receipt. Focused strategies towards these racially segregated facilities are of critical importance to improve vaccination delivery and eliminate disparities in care.

Keywords: Vaccines, Health Disparities, Older Adults, Long-Term Care, Immunization, Policy

Introduction

Influenza and pneumococcal infections are the eighth leading cause of death in the United States (Centers for Disease Control and Prevention, 2014, 2015a). Nearly half of these deaths occur among individuals who are 65 years of age and older and among the frail elderly residing in nursing homes (NHs) (Centers for Disease Control and Prevention, 2015a). Effective interventions for preventing influenza and pneumonia are influenza and pneumococcal vaccinations (Govaert et al., 1994; Loeb et al., 1999; Monto et al., 2001; Vila-Corcoles et al., 2010).

Because of the efficacy of these vaccinations, policies have been developed to encourage their use for vulnerable populations including residents living in NHs (Centers for Medicare & Medicaid Services, 2005; Kroger, 2011; US Department of Health Human Services, 2013). Specifically, in 2005, the federal government issued requirements for all Centers for Medicare and Medicaid Services (CMS)-certified NHs to offer influenza and pneumococcal vaccinations to each resident and mandated the documentation status of these vaccinations (Centers for Medicare & Medicaid Services, 2005). Moreover, CMS reimburses NHs for the cost of influenza and pneumococcal vaccinations and their administration. Strategies developed on a facility level to improve vaccination receipt have included standing orders (McKibben, Stange, Sneller, Strikas, & Rodewald, 2000), written and verbal consent, immunization tracking systems, and vaccination mandates for residents (Immunization Action Coalition, 2008).

Healthy People 2020 set target goals of influenza and pneumococcal vaccinations at 90% or greater (Centers for Disease Control and Prevention, 2013a; U.S. Department of Health and Human Services, 2013a). However, in 2013 only 79.3% of NH residents received the

pneumococcal vaccination, and during the 2008-09 flu season only 70% received the influenza vaccination (Bardenheier, 2011; U.S. Department of Health and Human Services, 2013a).

Racial and ethnic minority status (i.e., non-Hispanic Black or Hispanic) has been found to be a strong predictor of NH resident vaccination status (Lindley, Wortley, Winston, & Bardenheier, 2006; Winston et al., 2006). In particular, previous researchers have found racial/ethnic minority residents have been less likely to receive influenza and pneumococcal vaccinations because they are not offered the vaccinations or refuse them altogether, compared to Whites (Bardenheier, 2013; Bardenheier, Wortley, et al., 2011; Bardenheier, Wortley, et al., 2010; Cai et al., 2011). Using data from the 1995 to 2004 National Nursing Home Surveys (NNHS) and 1999 to 2009 Minimum Data Sets (MDS), the disparity in receipt of the influenza vaccination ranged from 2 to 20% (Bardenheier, 2013; Bardenheier, Shefer, et al., 2011; Bardenheier et al., 2004; Bardenheier, Wortley, et al., 2011; Bardenheier, Wortley, et al., 2010; Cai et al., 2011; Li & Mukamel, 2010; Luo et al., 2014; Marsteller et al., 2006; Strully, 2011) and 6 to 15% for the pneumococcal vaccination (Bardenheier et al., 2004; Bardenheier, Shefer, Tiggle, et al., 2005; Li & Mukamel, 2010; Luo et al., 2014; Marsteller et al., 2008); this was a 7% disparity in influenza vaccination receipt between Blacks and Whites in the 2008-2009 influenza season and 7% disparity between Hispanics and Whites in the 2005-2006 influenza season (Bardenheier et al., 2012; Cai et al., 2011). The disparity in pneumococcal vaccination receipt was approximately 14% between Blacks and Whites in 2004 and 15% between Hispanics and Whites in 2000 (Bardenheier et al., 2004; Li & Mukamel, 2010; Luo et al., 2014).

Minority mistrust of healthcare providers and treatment as well as inadequate patient education by providers may explain a portion of the disparity in vaccination receipt (Cai et al., 2011). The largest disparity in vaccination receipt has been found; however, among residents

residing in facilities that serve a high minority population (> 50% Black residents) (Bardenheier, Wortley, et al., 2011; Bardenheier et al., 2012; Cai et al., 2011; Strully, 2011). These NHs are primarily compensated by Medicaid and are known to have fewer resources, lower staffing, and poorer quality of care (Cai et al., 2010; Fennell et al., 2010; Mor et al., 2004).

The goal of this study was to examine current disparities between racial/ethnic minorities and non-minorities. Recent national data available were used to: a) describe and compare current influenza and pneumococcal vaccination receipt rates and reasons for non-receipt (i.e., not offered versus refused) between racial/ethnic minority and White NH residents; and b) characterize disparities in influenza and pneumococcal vaccination receipt and non-receipt across and within NH facilities.

Methods

This retrospective study analyzed cross-sectional data from three national datasets, which were cleaned and linked as part of a larger study (R01 NR013687). The unit of analysis was the resident. All data were de-identified prior to analyses. The Institutional Review Board at the Columbia University Medical Center approved the methods of this study.

Data Sources

MDS. MDS version 3.0 data from October 2010 to December 2013 were available for use. The MDS includes NH resident assessment data. All CMS-certified NHs are required to collect the resident assessment data upon admission as well as quarterly, annually, and whenever there is a significant change in resident status (i.e., a decline or improvement in a resident's health) (Institute of Medicine, 2001). These data provide individual resident characteristics including racial/ethnic minority status, vaccination administration, and when applicable reasons for not receiving vaccinations. The data are completed and/or approved by a licensed healthcare

professional employed by the NH. Researchers have found that the MDS is a valid and reliable tool for NH resident assessments (Frederiksen, 1996; Morris, 1997). Percent agreement and Kappa are high for the influenza and pneumococcal vaccination items on the MDS 3.0 (range of 0.978-0.994 % agreement) (Saliba & Buchanan, 2008).

To account for multiple assessments from one resident, analyses were limited to the last non-admission assessment completed during the influenza season, October 1 through May 31, for each observed year. While the influenza season varies from year to year dependent on the span of the previous year's outbreaks, the majority of influenza disease occurs from October through May (Centers for Medicare & Medicaid Services, 2015). Using data obtained from the non-admission MDS 3.0 assessments allowed for the exclusion of those who were short-stay (< 101 days), and have been found to be less likely to receive vaccinations (U.S. Department of Health and Human Services, 2013b).

Unlike influenza, pneumococcal vaccinations can be administered at any time of the year. Therefore, for pneumococcal vaccination receipt, data were retrieved from the last non-admission MDS 3.0 assessment performed for each resident for each year of full data (i.e., 2011-2013).

OSCAR/CASPER. The Online Survey, Certification and Reporting (OSCAR)/ Certification and Survey Provider Enhanced Reporting (CASPER) system is a federal administrative database containing aggregated resident characteristics, survey deficiencies, and facility-level data. Data are collected annually as part of the NH CMS-certification and recertification process. The 2010-2013 facility-level data (e.g., staffing and ownership status) were used to develop control variables.

AHRF. The Area Health Resource Files (AHRF) dataset contain over 50 sources of primarily county-level health data resources including: the number of health facilities, environmental and population characteristics, and economic and expenditures data (Health Resources and Services Administration, n.d.). These data provide information on characteristics of the community in which the NHs were located. The 2010-2013 AHRF data were used to develop community-level control variables that may contribute to health disparities.

Study Sample

A 5% random sample of NHs was selected. Residents in these NHs included non-Hispanic White, non-Hispanic Black (hereafter referred to as White and Black), and Hispanic NH residents age 65 and over who had a non-admission MDS assessment during the study years. Residents who resided in hospital-affiliated NHs were excluded because these facilities have different populations and resources, which do not make them generalizable to the vast majority of community-based NHs. Asians, American Indian/Alaskan Natives, and/or Native Hawaiian/Pacific Islanders were not included in this study because these groups represent a combined total of 2.3% of the entire NH resident population (Centers for Medicare Medicaid Services, 2012), which is too small for making meaningful comparisons.

Variables

Conceptual Framework. The Strategic Framework for Improving Racial and Ethnic Minority Health and Eliminating Racial and Ethnic Health Disparities (the Strategic Framework) in conjunction with past literature was used to guide variable selection (Graham, 2008). The Strategic Framework posits that disparities based on racial/ethnic minority status are proliferated by a variety of contributing factors. These disparities can be mitigated through appropriate delivery of strategies and practices leading to the prevention of poor outcomes and improved

racial/ethnic minority health. A full operational description of the variables included in this study and linked to the Strategic Framework are listed in Appendix A; an overview of each variable is provided below.

Primary independent variable of interest. Racial/ethnic minority status (i.e., Black or Hispanic race/ethnicity compared to White) was the primary independent variable of interest.

Secondary independent variable of interest. Black concentration was the secondary independent variable of interest. This variable was created to reflect the percentage of Blacks in a facility so that the lower and higher categories were proportional with six categories (0% to 4.9%, 5.0% to 19.9%, 20.0% to 49.9%, 50% to 79.9%, 80% to 94.9%, and 95% to 100%) (Bardenheier, 2013; Bardenheier, Shefer, et al., 2011; Bardenheier et al., 2012; Cai et al., 2011).

Contributing factors. Resident characteristics derived from the last MDS 3.0 assessment that were controlled for included age, gender, and assessment of dementia, asthma, respiratory failure, and behavior (i.e., a positive assessment for any of the following behaviors: verbal behavior, physical behavior, risk to injure self, interferes with care, interferes with participation, risk to injure others, intrudes on privacy of others, disrupts care or living environment, rejects care, wanders, or other) (Bardenheier, Shefer, Tiggle, et al., 2005; Dwyer et al., 2013; El-Solh, Niederman, & Drinka, 2010; Haviland, Elliott, Hambarsoomian, & Lurie, 2011; Yoshikawa & Mylotte, 2002).

Facility characteristics derived from OSCAR/CASPER that were controlled for included: bed count, percent occupancy, staffing (i.e., certified nursing assistant [CNA], licensed practical nurse [LPN]/licensed vocational nurse [LVN], and registered nurse [RN] hours per resident per day [HRD]), ownership (i.e., for-profit, government, and nonprofit), setting (i.e., metropolitan, rural, and nonmetropolitan with urban population), and percent of residents who use Medicaid as

their source of payment (Bardenheier, 2013; Bardenheier et al., 2012; Cai et al., 2011; Davis, 2014; Mor et al., 2004).

Community characteristics derived from AHRF data that were controlled for included: percent poverty in the county (i.e., categorized by quartiles), number of federally qualified health centers in the county (i.e., categorized by quintiles), and NH market competition (i.e., county Herfindahl index defined as the number of beds, compared to the total number of NH beds in the county and categorized by quintiles).

Strategies and practices (dependent variables). Vaccination receipt for both influenza and pneumococcal vaccination were dichotomous. For influenza, the MDS (item O0301A) asks, "Did the resident receive the Influenza vaccine in this facility for this year's Influenza season?" For pneumococcal, the MDS (item O0300A) asks, "Is the resident's Pneumococcal vaccination up to date?" Reasons for non-receipt included not being offered the vaccination and refusing the vaccination.

A dichotomous variable was developed for not being offered the vaccinations versus other (refused and vaccinated). Similar to NH compare, this variable excluded those who appropriately did not receive the vaccination (i.e., not in the facility during the current year's flu season, received outside of the facility, not eligible-medically contraindicated, and inability for facility to obtain vaccination due to a declared shortage) (National Quality Measures Clearinghouse, n.d.-a, n.d.-b).

Data Analyses

Prior to conducting all analyses, descriptive statistics of each variable were computed and distributions examined to ensure statistical assumptions were met (e.g., normal distribution and adequate cell size [> 5]) (See Appendix B). Bivariate analyses were performed to determine

differences in resident/facility/community characteristics and vaccination status by race/ethnicity. T-tests and chi-square tests were used for continuous and categorical variables, respectively.

Logistic regression was used to examine the influence of race/ethnicity and Black concentration on vaccination status. Conditional on variation in vaccination status within NHs, four separate resident-level logit models for each outcome were estimated: 1) an unadjusted model, 2) a facility fixed-effects unadjusted model, 3) a model controlling for resident/facility/community characteristics, and 4) a facility fixed-effects model controlling for resident/facility/community characteristics. Examining the models in this manner allowed for the investigation of disparities in vaccinations across and within NHs (models 1 and 3, facility fixed-effect models 2 and 4, respectively). Because individual residents in a community may not be independent, Huber-White robust standard errors were used with clustering at the community level (Williams, 2000).

Sensitivity analyses were performed to determine the robustness of results and consider other explanations for disparities in vaccination receipt. First, models were estimated using state fixed effects as opposed to facility fixed effects. Second, because sample sizes changed across the four models due to variation in vaccination status, the results were compared to models estimated using the smallest sample that had equal sample sizes across the four models. Third, to determine the impact of Black-concentrated NHs, two adjusted logit models (with and without fixed effects) were estimated that included the interaction term race/ethnicity and Black concentration; and an adjusted logit model without fixed effects and without an indicator variable for Black concentration was also specified. Last, two adjusted logit models (with and

without fixed effects) were estimated and included a Hispanic concentration variable to determine the role Hispanic concentration played in disparities.

To characterize racial/ethnic disparities in those not offered vaccinations, a similar approach was used estimating the four models for each vaccination separately. Because the number of residents not being offered the vaccinations in a facility were low, a new variable was created to identify small NHs (< 125 observations). Similar sensitivity analyses were also conducted. Variables with a p-value < .05 were considered associated with the outcomes of interest. All analyses were performed using STATA© Version 13.

Results

The final sample consisted of 107,874 unique residents in 742 NH facilities across the nation. Residents had different demographic characteristics and resided in NHs with different facility and county characteristics based on racial/ethnic minority status (all p-values < .0001, see Table 1). White residents made up 83.8% (n = 90,451) of the population, Blacks made up 11.7% (n = 12,647), and Hispanics made up 4.4% (n = 4,776). Compared to Whites (29.5%), Blacks and Hispanics were more likely to be male (37.4% and 40.0%, respectively) and younger than 85 years old. Residence in for-profit NHs was most likely among Blacks (82.2%) and Hispanics (85.4%) compared to Whites (62.1%). Blacks and Hispanics were also more likely to reside in NHs with > 20% of Blacks as well as reside in communities with high poverty, an increased number of federally qualified health centers, and more market competition. Black residents were in NHs with fewer CNA staffing HRD (< 2.26 HRD) compared to Whites and Hispanics.

Overall, influenza vaccination receipt was 80.9% and pneumococcal was 81.2%. Among those who were not vaccinated, 70.6% of residents refused the influenza vaccination, while

29.4% were not offered. For pneumococcal, 81.7% of residents refused the vaccination and 18.3% were not offered (data not shown).

Racial/Ethnic Differences and Vaccination Receipt- Bivariate Analysis

Differences were also found in vaccination receipt rates and reasons for non-receipt by race and ethnicity (Table 5.1, all p values < .0001, except influenza vaccination refused/not offered, p value = .05). Blacks, when compared to Whites, had a 10% lower rate of influenza vaccination receipt, 1% lower rate of influenza vaccination refusals, and 1% higher rate of not being offered the influenza vaccination. Hispanics, when compared to Whites had a 6% lower rate of influenza vaccination receipt, 3% higher rate of influenza vaccination refusals, and 2% lower rate of not being offered the influenza vaccination. For pneumococcal, Blacks had a 10% lower vaccination receipt rate, 7% lower refusal of vaccinations, and 7% higher rate of not being offered the vaccination compared to Whites; Hispanics had a 7% lower rate of pneumococcal vaccination receipt, 5% lower rate of refusal of pneumococcal vaccinations, and 5% higher rate of not being offered the pneumococcal vaccination.

Table 5.1 Descriptives of unique residents in nursing homes between October 2010-2013 by race/ethnicity

	White (n=90,451)	Black (n=12,647)	Hispanic (n=4,776)	P-value
	% (n)	% (n)	% (n)	
Resident Characteristics				
Gender				< .0001
Male	29.5 (26,715)	37.4 (4,726)	40.0 (1,911)	
Female	70.5 (63,736)	62.6 (7,921)	60.0 (2,865)	
Age				
65-74	14.2 (12,857)	28.6 (3,614)	23.6 (1,125)	< .0001
75-84	30.5 (27,619)	34.7 (4,385)	38.9 (1,859)	
85+	55.3 (49,975)	36.8 (4,648)	37.5 (1,792)	
Behavior	46.1 (20,587)	42.0 (2,367)	45.5 (976)	< .0001
Dementia	48.9 (44,254)	49.4 (6,243)	52.4 (2,503)	< .0001
Asthma	22.3 (20,127)	18.7 (2,363)	20.9 (999)	< .0001
Respiratory Failure	1.6 (1,420)	3.2 (408)	2.2 (104)	< .0001
Facility Characteristics				
Setting				< .0001
Metropolitan	76.41 (69,111)	89.0 (11,260)	95.6 (4,565)	
Rural	4.0 (3,604)	1.7 (219)	0.8 (38)	
Nonmetropolitan with urban population	19.6 (17,736)	9.2 (1,168)	3.6 (173)	
Bed Count				< .0001
<100	31.6 (28,620)	18.7 (2,360)	21.8 (1,043)	
100-199	51.7 (46,730)	56.3 (7,117)	41.1 (1,965)	
200+	16.7 (15,101)	25.1 (3,170)	37.0 (1,768)	
Ownership				< .0001
For profit	62.1 (56,158)	82.2 (10,395)	85.4 (4,079)	
Government	6.2 (5,565)	2.8 (354)	3.4 (161)	
Non profit	31.8 (28,728)	15.0 (1,898)	11.2 (536)	
Black Concentration				< .0001
<5.0%	63.1 (57,050)	6.0 (760)	38.6 (1,841)	
5.0-19.9%	27.3 (24,688)	24.0 (3,040)	36.8 (1,757)	
20.0-49.9%	7.4 (6,725)	30.6 (3,866)	18.7 (892)	
50.0-79.9%	2.1 (1,873)	28.7 (3,632)	5.4 (257)	
80.0-94.9%	0.1 (112)	7.5 (942)	0.6 (28)	
95.0-100%	0.0 (3)	3.2 (407)	0.0 (1)	
Chain	52.7 (47,671)	57.9 (7,323)	38.1 (1,821)	< .0001
Occupancy				< .0001
<80%	26.5 (23,952)	23.8 (3,006)	24.0 (1,147)	
80-90%	25.0 (22,622)	28.0 (3,539)	24.1 (1,153)	
90-93%	24.1 (21,780)	24.5 (3,099)	35.3 (1,687)	
94-100%	24.4 (22,097)	23.7 (3,003)	16.5 (789)	
CNA HRD				< .0001
0-2.01	17.6 (15,897)	29.6 (3,749)	25.8 (1,231)	
2.01-2.259	19.4 (17,516)	26.5 (3,352)	14.6 (698)	
2.26-2.519	20.8 (18,807)	16.4 (2,078)	16.6 (793)	
2.52-2.859	20.9 (18,898)	15.0 (1,891)	19.2 (917	
2.86-5.10	21.4 (19,333)	12.5 (1,577)	23.8 (1,137)	
LPN/LVN HRD				< .0001
0-0.569	21.5 (19,480)	12.5 (1,582)	19.8 (946)	
0.57-0.729	17.9 (16,218)	19.4 (2,448)	25.9 (1,238)	

0.73-0.869	19.7 (17,795)	19.2 (2,426)	15.6 (746)	
0.87-1.039	21.3 (19,268)	22.5 (2,844)	12.8 (613	
1.04-2.05	19.6 (17,690)	26.5 (3,347)	25.8 (1,233)	
RN HRD				< .0001
0-.43	16.1 (14,551)	26.1 (3,298)	34.8 (1,664)	
0.43-0.569	20.3 (18,366)	25.6 (3,239)	22.6 (1,078)	
0.57-0.679	19.9 (18,011)	18.2 (2,300)	14.6 (699)	
0.68-0.839	20.5 (18,571)	16.0 (2,018)	11.5 (547)	
0.84-2.47	23.2 (20,952)	14.2 (1,792)	16.5 (788)	
Percent Medicaid				
Community Characteristics				
Percent in Poverty				< .0001
≤11.9%	29.0 (18,278)	11.8 (1,052)	9.5 (308)	
12-15.2%	26.5 (16,700)	11.9 (1,056)	14.3 (465)	
15.3-18.8%	24.7 (15,549)	31.4 (2,795)	27.1 (880)	
18.9-45.0%	19.7 (12,428)	44.9 (3,996)	49.1 (1,593)	
Federally Qualified Health Centers				< .0001
0	24.4 (22,044)	6.8 (854)	4.8 (230)	
1-2	24.4 (22,067)	21.2 (2,682)	10.0 (475)	
3-5	19.8 (17,922)	17.1 (2,157)	8.7 (416)	
6-13	17.0 (15,402)	19.9 (2,512)	14.3 (682)	
14-40	14.4 (13,016)	35.1 (4,442)	62.3 (2,973)	
Market Competition				< .0001
.84-29.9	16.7 (15,067)	28.9 (3,654)	46.1 (2,202)	
30-59.9	21.1 (19,042)	24.3 (3,076)	16.9 (806)	
60-94.9	18.9 (17,062)	19.0 (2,403)	11.9 (566)	
95-149.9	22.6 (20,441)	15.7 (1,987)	12.5 (597)	
150-10,000	20.8 (18,839)	12.1 (1,527)	12.7 (605)	
Vaccination Strategies				
Vaccinated for Influenza	82.5 (91,382)	71.3 (11,372)	76.2 (4,178)	< .0001
Vaccinated for Pneumococcal	82.9 (122,998)	75.2 (15,448)	74.6 (5,910)	< .0001
Among those not Vaccinated				
Influenza				.050
Vaccination refused	70.7 (13,397)	69.6 (3,096)	73.1 (889)	
Not offered	29.3 (5,542)	30.4 (1,355)	27.0 (328)	
Pneumococcal				< .0001
Vaccination refused	83.2 (19,958)	76.4 (4,185)	78.4 (1,421)	
Not offered	16.8 (4,037)	23.6 (1,291)	21.6 (392)	

*p < .05, **p < .01, ***p < .001; CNA = Certified nursing assistant, HRD = Hours per resident per day, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse

Racial/Ethnic Disparities and Vaccination Receipt- Logit Analyses

Table 5.2 presents the results of the four models of influenza vaccination receipt. In all models, Blacks were less likely to receive the vaccination compared to Whites with odds ratios

(ORs) ranging from 0.53 - 0.78 (all p-values < .001). Hispanics were more likely to receive the vaccination, compared to Whites in Models 2 and 4 (OR = 1.18, OR = 1.22, all p-values < .01, respectively). When including covariates (Models 3 and 4), residents in facilities with a 50% or greater concentration of Blacks were less likely to receive the vaccination compared to residents in facilities with < 5% Blacks (ORs = 0.29 - 0.84, all p-values < .05).

Table 5.2 Four sets of models estimating the effect of race/ethnicity and Black concentration on influenza vaccination receipt between October 2010-2013
The final regression sample included (1) 132,179 observations, (2) 132,007 observations, (3) 59,339 observations, (4) 58,872 observations

	Model 1 **Unadjusted**	**Model 2** **Unadjusted Fixed Effects**	**Model 3** **Adjusted**	**Model 4** **Adjusted Fixed Effects**
	OR	OR	**OR**	**OR**
Race				
White [a]	--	--	--	--
Black	0.53***	0.78***	0.75***	0.76***
Hispanic	0.68	1.18**	0.96	1.22**
Black Concentration				
<5.0% [a]				
5.0-19.9%			0.87	0.26*
20.0-49.9%			0.83	0.15**
50.0-79.9%			0.60***	0.15***
80.0-94.9%			0.59*	0.10***
95.0-100%			0.29***	0.11**

[a] Referent group, *p < .05, **p < .01, ***p < .001
Adjusted for resident- gender, age, behavior, dementia, asthma, respiratory failure; facility- setting, bed count, ownership, chain, occupancy, staffing HRD (CNA, LPN/LVN, RN), percent Medicaid; and community characteristics- percent in poverty, federally qualified health centers, market competition
OR = Odds ratio, HRD = Hours per resident per day, CNA = Certified nursing assistant, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse

Table 5.3 presents the results of the four models of pneumococcal vaccination receipt. Very similar patterns were seen for the pneumococcal vaccination in regards to Blacks being less likely to be vaccinated compared to Whites in all models with odds ratios ranging from 0.54 - 0.89 (all p-values < .05). In Model 1, Hispanics were also less likely to be vaccinated compared to Whites (OR = 0.61, p < .05); however, Hispanics were found to be more likely to be vaccinated in Models 2 and 4 (OR = 1.17, OR = 1.34, respectively, all p-values < .001).

Table 5.3 Four sets of models estimating the effect of race/ethnicity and Black concentration on pneumococcal vaccination receipt between 2011-2013
The final regression sample included (1) 177,772 observations, (2) 176,759 observations, (3) 56,963 observations, (4) 55,729 observations

	Model 1 Unadjusted	**Model 2** Unadjusted Fixed Effects	**Model 3** Adjusted	**Model 4** Adjusted Fixed Effects
	OR	**OR**	**OR**	**OR**
Race				
White [a]	--	--	--	--
Black	0.54***	0.89***	0.81***	0.85*
Hispanic	0.61*	1.17***	0.83	1.34***
Black Concentration				
<5.0% [a]				
5.0-19.9%			0.75**	0.16**
20.0-49.9%			0.78	0.22***
50.0-79.9%			0.48***	2.55*
80.0-94.9%			0.50	0.36*
95.0-100%			0.20***	0.16***

[a] Referent group, *p < .05, **p < .01, ***p < .001
Adjusted for resident- gender, age, behavior, dementia, asthma, respiratory failure; facility- setting, bed count, ownership, chain, occupancy, staffing HRD (CNA, LPN/LVN, RN), percent Medicaid; and community characteristics- percent in poverty, federally qualified health centers, market competition
OR = Odds ratio, HRD = Hours per resident per day, CNA = Certified nursing assistant, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse

Greater Black concentration was associated with a decreased likelihood of vaccination receipt (Model 3).

Racial/Ethnic Disparites in Vaccination Not Offered- Logit Analyses

Table 5.4 presents results of the influenza vaccination not offered models. In Model 1, Blacks were more likely to not be offered the influenza vaccination when compared to Whites (OR = 1.77, p = .001). This effect remained, but decreased when adding fixed effects and adjusting for resident, community, and facility characteristics across Models 2-4. There were no disparities in not being offered the influenza vaccination among Hispanics.

Table 5.5 presents results of the pneumococcal vaccination not offered models. Blacks were found to be more likely to not be offered the vaccination, compared to Whites in only Model 1 (OR = 2.33, p < .001) and Model 2 (OR = 1.17, p = .02). Hispanics were more likely to not be offered the pneumococcal vaccination in Model 1 (OR = 1.89, p = .04) and Model 3 (OR = 1.65, p = .04).

Table 5.4 Four sets of models estimating the effect of race/ethnicity and Black concentration on influenza vaccination not offered between October 2010-2013
The final regression sample included (1) 131,539 observations, (2) 104,635 observations, (3) 59,050 observations, (4) 44,744 observations

	Model 1 Unadjusted	Model 2 Unadjusted Fixed Effects	Model 3 Adjusted	Model 4 Adjusted Fixed Effects
	OR	**OR**	**OR**	**OR**
Race				
White [a]	--	--	--	--
Black	1.77**	1.28**	1.25**	1.27**
Hispanic	1.22	1.17	0.88	1.08
Black Concentration				
<5.0% [a]			--	--
5.0-19.9%			1.17	1.50
20.0-49.9%			1.21	1.14
50.0-79.9%			2.14**	2.61**
80.0-94.9%			1.69	1.03
95.0-100%			7.35***	2.328E-06***

[a] Referent group, *p< .05, **p< .01, ***p< .001
Adjusted for resident- gender, age, behavior, dementia, asthma, respiratory failure; facility- setting, bed count, ownership, chain, occupancy, staffing HRD (CNA, LPN/LVN, RN), percent Medicaid; and community characteristics- percent in poverty, federally qualified health centers, market competition OR = Odds ratio, HRD = Hours per resident per day, CNA = Certified nursing assistant, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse

Table 5.5 Four sets of models estimating the effect of race/ethnicity and Black concentration on pneumococcal vaccination not offered between 2011-2013
The final regression sample included (1) 175,640 observations, (2) 120,657 observations, (3) 56,386 observations, (4) 32,481 observations

	Model 1 Unadjusted	Model 2 Unadjusted Fixed Effects	Model 3 Adjusted	Model 4 Adjusted Fixed Effects
	OR	**OR**	**OR**	**OR**
Race				
White [a]	--	--	--	--
Black	2.33***	1.17*	1.18	1.05
Hispanic	1.89*	1.00	1.65*	0.77
Black Concentration				
<5.0% [a]				
5.0-19.9%			1.69*	1.18
20.0-49.9%			0.90	0.57
50.0-79.9%			3.17*	2.19
80.0-94.9%			1.55	3.472E-07***
95.0-100%			21.00***	4.334E-07***

[a] Referent group, *p < .05, **p < .01, ***p < .001
Controlled for resident- gender, age, behavior, dementia, asthma, respiratory failure; facility- setting, bed count, ownership, chain, occupancy, staffing HRD (CNA, LPN/LVN, RN), percent Medicaid; and community characteristics- percent in poverty, federally qualified health centers, market competition
OR = Odds ratio, HRD = Hours per resident per day, CNA = Certified nursing assistant, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse

Sensitivity Analyses

The results were generally robust in the sensitivity analyses (see Appendix C-J)**.** When state fixed effects models were estimated results were similar as in the facility fixed-effects analyses, except that Hispanics were no longer more likely to receive either vaccination compared to Whites but were more likely to not be offered the pneumococcal vaccination. With all outcomes the results were robust when estimating the smaller but equal sample sizes. When examining the interaction of race/ethnicity and Black concentration, Hispanics were more likely than Whites to receive the influenza or pneumococcal vaccination in highly concentrated NHs. Additionally, the disparity effects in not receiving both vaccinations and not being offered them among Blacks were much greater when removing the Black concentration variable. Adjusting for Hispanic concentration did not change the results.

Discussion

This national study provides the first evidence on pneumococcal vaccination disparities after the 2005 CMS policy mandating all NH residents be offered vaccinations. It also updates previous evidence on influenza vaccination disparities. AHRF data were additionally used to control for community characteristics not previously considered.

It was found that no racial/ethnic group was meeting the national vaccination targets of 90% or greater between the years 2010 and 2013. Furthermore, racial and ethnic health disparities persisted. Across facilities, Blacks and Hispanics continued to receive both vaccinations less than Whites and the likelihood of not being offered the influenza vaccination was greater for Blacks and not being offered the pneumococcal vaccination was greater for Hispanics. Compared with reports prior to 2005, which found differences in vaccination receipt among both Blacks and Hispanics compared to Whites to be as much as 20%, the differences

have decreased (Travers, 2016a). However, in 2009 the differences in influenza vaccination receipt between Blacks and Whites was reported to be approximately 7%; in the 2010 to 2013 MDS data presented in this study, the difference was 10% suggesting that the effects of CMS policy may be diminishing and not be sufficient to close disparities in vaccination care long term (Bardenheier et al., 2012; Cai et al., 2011). Positively, a new finding was that Blacks and Hispanics experienced either no difference in vaccination refusals compared to Whites (influenza) or a lower percentage of vaccination refusals (pneumococcal) compared to Whites. , This may suggest progress on efforts directed towards educating Black and Hispanic residents on the importance of both vaccinations.

Facility fixed effects allowed for the examination of whether unmeasured facility characteristics impacted vaccination disparities. The decreased likelihood of Blacks receiving either vaccination declined but persisted in the fixed-effects models. These findings suggest that Blacks are residing in poorer performing facilities compared to Whites but remain less likely to receive either vaccination compared to Whites when residing in the same facility. Factors reported in the past such as discrimination and bias among healthcare providers and cultural and personal beliefs may be contributing to these within facility racial differences (Fiscella, 2005). Similar results have been found previously and support the need for better understanding of healthcare provider vaccination practices related to potential biases (Cai et al., 2011).

Given the same resources within a NH, Hispanics were more likely to receive both vaccinations than Whites. These results remained consistent in high Black minority-concentrated NHs. The Hispanic minority group is known to have better health outcomes than Whites despite their lower socioeconomic status and decreased access to care; this notion has been referred to as the “Hispanic Paradox” (Ribble, PhD, & Keddie, 2001). Hispanics receiving better care

compared to Whites; however, is new and not explained in this Paradox. Within states, Hispanics were similar to Blacks with being less likely to receive both vaccinations. Further research is warranted to understand the characteristics of the Hispanic population and the NHs in which they reside.

Consistent with previous research, it was found that residents in high Black concentration facilities (> 50% Black residents) were less likely to receive either vaccination (Li & Mukamel, 2010; Marsteller et al., 2008). However, Blacks and Hispanics reside in these NHs in greater numbers than White residents, placing them at increased risk for disparities in care (Luo et al., 2014). Highly Black concentrated NHs have been found to have inadequate resources, poorer quality of care, and increased attention to profitable interventions as opposed to quality improvement (Fennell, Miller, & Mor, 2000; Harrington, Woolhandler, Mullan, Carrillo, & Himmelstein, 2001).

When removing the Black concentration variable from the analysis, there was a sizable increase in both influenza and pneumococcal vaccination receipt and not offered disparities among Blacks. This increase implies that the NH system itself that many Blacks reside in, contributes greatly to the disparities found. This critical finding has important policy implications. Federal, state, and local governments must direct efforts towards high Black concentration NHs to ensure that these facilities have the necessary resources (e.g., revenue, training, staffing, technology, leadership, and feedback) to encourage, enable, and empower healthcare providers to offer vaccinations and educate residents on the importance of their receipt. With appropriate support and efforts targeted towards more poorly-performing facilities it is possible to improve overall vaccinations and decrease racial/ethnic disparities. For example, between the years 1999-2002, Quality Improvement Organizations (QIOs) set out to provide a

variety of interventions aimed at improving influenza and pneumococcal vaccinations among a select group of NH facilities (Bardenheier, Shefer, McKibben, et al., 2005). NHs that received the intervention were compared to NHs that did not to determine if vaccination improved as a result. When QIOs promoted preprinted vaccine orders, contacted NH facilities to discuss improving immunization programs, and provided resource materials to improve immunization, the facilities were more likely to have at least a 10% point increase in vaccination coverage, compared to those that did not receive these interventions. The same research team found that when QIOs provided NH facilities with various resources (e.g., informational workbooks, samples of protocols and policies, patient education materials, and provider reminders), these sites were more likely to adopt recommended changes in their immunization protocols (Bardenheier, Shefer, McKibben, et al., 2005). Interventions such as these deserve further attention and research on their effectiveness in resource-poor facilities.

Strengths and Limitations

This study has several strengths. First, no prior studies have used the MDS 3.0, the most reliable and valid NH resident assessment data available to date, to examine racial/ethnic disparities in influenza and pneumococcal vaccination receipt and non-receipt. Second, this study is a large representative sample of all CMS-certified NHs in the US and uses large administrative data; thereby, increasing the generalizability of its findings. Third, several sensitivity analyses were performed to ensure the robustness of the final results.

This study has limitations to be considered as well. It is also possible that important characteristics related to vaccination status may have not been included. This potential limitation was addressed by using facility fixed-effect models as well as controlling for known confounders. Additionally, only differences in not receiving either the influenza or

pneumococcal vaccination, refusing, and not being offered either of the vaccinations were examined. Disparities have also been reported related to lack of documentation of these vaccinations. Additional research is needed to characterize these disparities post CMS policy implementation. Last, caution is needed when comparing the results of this study to previous research. In this study, those who appropriately did not receive the vaccination e.g., received outside of the current facility, were excluded from the analysis. Other researchers and government entities have kept these observations in the analysis as not receiving the vaccination according to MDS definitions (U.S. Department of Health and Human Services, 2013a). As a result, these researchers and entities report lower vaccination receipt rates than those reported in this study.

Conclusion

Disparities in racial and ethnic vaccination receipt and not offered among NH residents continue to exist. Minority residents are receiving vaccinations less and this is associated with the NHs they reside in as well as being Black. Hispanics were found to have lower vaccination receipt rates compared to Whites, but were more likely to receive both vaccinations within the same facility as White residents. Although the gap has decreased since the 2005 CMS policy, current initiatives seem to lack the weight, specificity, consistency, and support needed to sustain a continued reduction in differences in racial and ethnic vaccination rates and meet target goals. From these findings, focused strategies to eliminate differences in vaccinations among NH older adults may be developed. Prioritizing such strategies for NHs with a high concentration of Black minority residents and healthcare professionals employed in these NHs is of critical importance. Redefining vaccination receipt and ensuring its consistency across platforms is also necessary to

better quantify vaccination coverage and assess progress towards promoting high vaccination rates for all NHs residents.

Chapter 6: Integration of Studies

This dissertation: 1) identified barriers and facilitators to infection prevention and control for a racial/ethnic diverse group of NH direct care staff (CNAs) by analyzing available qualitative data; 2) assessed the previous current evidence on racial/ethnic disparities in influenza and pneumococcal vaccination receipt among NH residents along with their contributing factors by performing a systematic review of the literature; and 3) developed the most current evidence of racial/ethnic disparities in influenza and pneumococcal vaccination receipt and non-receipt among NH residents using multiple national datasets. These studies support the need to develop policy, strategies, and practices focused on improving care specific to infection prevention and control in NHs with consideration of the diverse CNA workforce and racial/ethnic disparities in influenza and pneumococcal vaccination receipt.

Summary of Results

The qualitative study identified the following barriers to infection prevention and control: 1) language/culture; 2) knowledge/training; 3) per-diem/part-time staff; 4) workload; and 5) accountability. Strategies that facilitated infection prevention and control included: translating in-services, hands on training, on-the-spot training for per-diem/part-time staff, increased staffing ratios, and inclusion/empowerment of CNAs. These findings highlight a critical need to include CNA's in infection prevention and control activities and ensure that they have the proper training, skills, resources, and presence to support the efficacy of infection prevention and control activities in NH settings.

The systematic review provided information on wide-spread gaps in influenza and pneumococcal vaccination receipt between racial/ethnic minorities and Whites. Contributing factors to these disparities were related to resident, community, and facility-level factors and

included: residents not being offered the vaccinations or residents refusing the vaccinations, decreased physical functioning among residents, increased racial/ethnic minority composition of NHs, residents residing in rural and urban settings, increased proportion of residents paying with Medicaid, lack of vaccination strategies in the NH, and decreased tracking of vaccinations by the NH. There was no evidence on racial/ethnic disparities in pneumococcal vaccinations and/or their contributing factors past 2004 and none on influenza past 2009. Overall, the quality of the studies reporting these disparities and their contributing factors were appraised as average or good. This is the first systematic review to my knowledge to examine evidence on racial/ethnic disparities in influenza and pneumococcal vaccinations.

The quantitative analysis of cross-sectional national data revealed that racial/ethnic disparities continue to exist in influenza and pneumococcal vaccination receipt and these disparities appear to be related to the NHs in which racial/ethnic minority groups are residing. All residents in NHs with a high concentration of Blacks had a decreased odds of receiving both vaccinations. Within the same NH, Hispanics were more likely to be vaccinated with both the influenza and pneumococcal vaccination compared to Whites. More information is needed on where Hispanics are residing. In regards to not being offered the vaccinations, Blacks were more likely than Whites to not be offered the influenza vaccination and Hispanics were more likely to not be offered the pneumococcal vaccination. Disparities appear to no longer exist with Blacks and Hispanics refusing vaccinations more than Whites. This is the first study to provide new evidence on pneumococcal vaccination disparities post 2005 CMS policy implementation and update evidence on influenza vaccination disparities past 2009.

Strengths and Limitations

There are several strengths to this dissertation. Through the use of multiple methods, I considered two different aspects of infection prevention to gain a comprehensive understanding of this phenomenon. First, the role of CNAs in infection prevention is understudied and underappreciated despite their primary contact with residents in the NH setting. The qualitative study in this dissertation is the first to my knowledge to highlight the important role this racially/ethnic diverse group of CNAs play in infection prevention and control, explore barriers to infection and prevention control faced by this group of healthcare workers, and offer strategies to facilitate the CNA process of preventing and controlling resident infections.

Second, influenza and pneumococcal vaccinations are critical to preventing and controlling infection outbreaks in NHs; however disparities were found to exist in who receives highly recommended vaccinations. The systematic review and quantitative study in this dissertation provides the first review of evidence on where disparities were prior to policy implementation and new evidence on where disparities are after policy implementation. Both considered aspects of this infection prevention phenomenon revealed a system level breakdown in regards to the manner in which racially/ethnic diverse groups (staff and residents) are treated and the conditions in which they work and live under. Both staff and residents receive less optimal treatment in NHs affecting the efficacy of infection prevention and control activities and are generally not provided with the resources and care as those among the non-minority race would receive.

Next, because a large representative sample of White, Black, and Hispanic NH elderly residents in the US were examined in my cross-sectional analysis, my findings related to current racial/ethnic disparities in influenza and pneumococcal vaccinations are generalizable to all NHs

in the US. When performing this analysis, I also had access to National data that has been deemed highly reliable and valid thereby strengthening the robustness of my results.

There are also limitations to note. Other racial groups such as American Indians/Alaskan Natives experience disparities in alarming rates. For this dissertation; however, I chose to only examine racial/ethnic disparities among Blacks and Hispanics compared to Whites because of the low number of American Indians/Alaskan Natives residing in NHs. Next, because my qualitative study included only 10 NHs out of the 15,700 NHs in the US and were located in 3 regions, my findings from this study may not be generalizable to all NHs. Additionally, my qualitative study was a secondary analysis; therefore, I was limited to data that had previously been collected. For my quantitative study, it is possible that I may not have included important confounders to vaccination receipt; however, including facility fixed effects does account for unmeasured facility characteristics. While unlikely, it is also possible that I may have missed studies that met the inclusion criteria for my systematic review.

Recommendations

Future Research

Future research on barriers and facilitators to infection prevention and control from the CNA's perspective is needed to validate current findings presented in this study and direct future efforts. It is also necessary to gain more information on the initial and routine training in infection prevention control for CNAs and the efficacy of this training.

Research on racial/ethnic disparities in influenza and pneumococcal vaccinations among NH older adults that concentrates on Hispanic residents is additionally needed to gain a better understanding of the NHs where this group reside. While I did find that NHs in which Hispanics live are more likely to be for-profit and in communities of high poverty, compared to Whites, my

results also indicate that Hispanics are faring better than Whites within the same NH in regards to vaccination receipt suggesting other unmeasured factors may be contributing to this unexpected finding.

Increased concentration of Blacks in a NH was responsible for a majority of the disparities seen in vaccination receipt among Blacks. Studies that survey these specific NHs are needed to identify facility needs, facilitators, and challenges to adhering to vaccination upkeep for residents. Such findings will inform comparative effectiveness research that aims to close gaps in care between racial/ethnic minority and White residents. Moreover, gaining a greater understanding of subsequent outcomes (i.e., hospitalization, morbidity, mortality, and influenza, and pneumococcal infection) as a result of these disparities will also impact future policy work.

Policy

My qualitative findings support the need to implement and enforce policy related to CNA staffing levels and routine training related to infection prevention and control for the CNA. Working in less than optimal conditions related to understaffing and inadequate or ineffective training compromises the CNAs ability to provide safe quality care to residents.

Moreover, my quantitative findings suggest that current influenza and pneumococcal vaccination policies lack the specificity to ensure equal care across races and ethnicities. Efficiently addressing these disparities are becoming even more important as an additional pneumococcal vaccination is now recommended (Centers for Disease Control and Prevention, 2015c; Tomczyk et al., 2014). Implementing policy that not only mandates the offering of these vaccinations, but provides meaningful support to ensure these vaccinations are appropriately administered is critical. This dissertation's systematic review of the literature did find evidence that standing order programs and tracking systems decreased racial/ethnic disparities in

vaccinations among NH older adults. However; it is important that poorer performing facilities (i.e., for-profit and high Black minority concentrated) are provided the resources to implement recommended and required practices.

Clinical

A common thread of how racially/ethnic diverse groups in NHs are treated was revealed in this dissertation warranting a change in the clinical environment. CNAs must be included in infection prevention control activities and their associated decision-making, adequately trained in this area of care delivery, and equipped with culturally appropriate resources and the manpower to limit the transmission of infections in the NH setting.

Additionally, decreasing disparities in vaccination receipt to prevent and control the spread of infections depends on the clinician's ability to confront biases about residents who make up diverse backgrounds and provide equally sensitive care to all residents despite their racial or cultural background. Current federal recommendations call for an increase in diversity among healthcare workers, but as it stands, the majority of the diversity in NH staff is seen among CNAs and Environmental Care Workers (Smedley, Butler, & Bristow, 2004; Sullivan, 2004). Meeting these recommendations are important to creating a culture of health that does not see race and ethnicity in the healthcare setting but sees the individual (Cohen, Gabriel, & Terrell, 2002; Robert Wood Johnson Foundation, 2014; US Department of Health & Human Services, 2006).

Moreover, mandates exist from the 1987 Omnibus Reconciliation Act for the presence of infection control programs in NHs to support the prevention and control of infections. However, how these programs are utilized change from NH to NH due to varying regulatory expectations, resources, training, and available personnel committed to these programs (Hall, Halton, Macbeth,

Gardner, & Mitchell, 2015; Herzig, 2016; Smith, Bennett, et al., 2008; Stone, 2015). As a result, highly recommended activities to prevent and control infections such as surveillance, audits, standing orders, and tracking systems are lacking and/or poorly executed in the NH setting, i.e., poor-performing NHs. It is imperative that NH administrators view infection prevention and control as a priority and leverage outside support to effectively utilize the many benefits that properly executed infection control programs offer.

In conclusion, this dissertation has identified barriers and facilitators to infection prevention control for NH direct care staff, reported on evidence describing racial/ethnic disparities in influenza and pneumococcal vaccination, and provided new and updated knowledge on the status of racial/ethnic disparities in influenza and pneumococcal vaccination receipt and non-receipt. Federal and government entities, policymakers, researchers, administrators, and clinicians may use this information to direct efforts at eliminating racial/ethnic disparities and improving overall care for NH residents.

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Appendices

Appendix A. Variables with operational definitions categorized by domains from the Strategic Framework

Appendix B. Distribution check of continuous variables

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Appendix F. Sensitivity analysis: Limited sample

Appendix G. Sensitivity analysis: Limited sample

Appendix H. Sensitivity analysis: Race/ethnicityXblack_concentration interaction

Appendix I. Sensitivity analysis: Black concentration variable exclusion

Appendix J. Sensitivity analysis: Hispanic concentration

Appendix A. Variables with operational definitions categorized by domains from the Strategic Framework

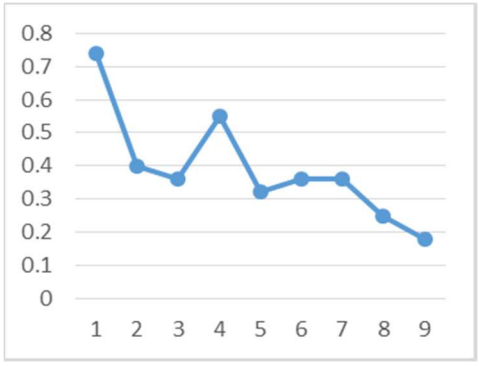
Variable	Operational Definition (Data Source)	Factor Level
Independent Variable of Interest		
Racial/ethnic minority status	Resident non-Hispanic Black or Hispanic, White (MDS 3.0 code A1000A, D, F)	Individual
Contributing Factors - Resident Characteristics		
Demographics	Age, gender (MDS 3.0 Code 0900, 0800)	Individual
Poor cognition	Assessment of dementia, behavior (MDS 3.0 codes I4800, E0200A-C, E0500A-C, E0600A-C, E0800, E0900)	Individual
Respiratory disease	Asthma or COPD, respiratory failure (MDS 3.0 code I6200, O0100E2)	Individual
Contributing Factors – Facility and Community Characteristics		
Staffing	CNA, LPN/LVN and RN hours per resident per day (OSCAR Codes F43, F42, F41)	Facility
Bed count	Total number of certified beds in the nursing home (TOTBEDS)	Facility
Percent Occupancy	Ratio of occupied beds versus the total number in the facility	Facility
Nursing Home Ownership/Affiliation	Type of organization that controls and operates the facility i.e., for-profit, government, nonprofit, chain (OSCAR Variable F12, F13),	Facility
Percent Medicaid	Percent of residents whose primary payer is Medicaid (as reported in resident census) Medicaid 608 cnsus_mdcd_cnt	Facility
Setting	OSCAR Metropolitan/Rural/Nonmetropolitan with urban population	Community
Black concentration	0% to 4.9%, 5.0% to 19.9%, 20.0% to 49.9%, 50% to 79.9%, 80% to 94.9%, and 95%-100% Blacks MDS 3.0 code A1000A-F)	Facility
Poverty	AHRF Percent of individuals in the county living in poverty	Community
Federally Qualified Health Centers	AHRF Number of Federally Qualified Health Centers in a county	Community
Herfindahl Index	AHRF Nursing home market competition	Community
Strategies and Practices		
Influenza vaccination	Received influenza vaccine (MDS 3.0 codes O0301A, O0250A)	Individual
Reason influenza vaccination not received	Not offered, refused (MDS 3.0 codes O0301B, O0250C)	Individual
Pneumococcal vaccination	Received pneumococcal vaccine (MDS 3.0 Code O0300A)	Individual
Reason pneumococcal vaccination not received	Not offered, refused (MDS 3.0 Code O0300B)	Individual

* MDS = Minimum Data Set, COPD = Chronic obstructive pulmonary disease, CNA = Certified nursing assistant, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse, OSCAR = Online Survey, Certification and Reporting, AHRF = Area Health Resource Files

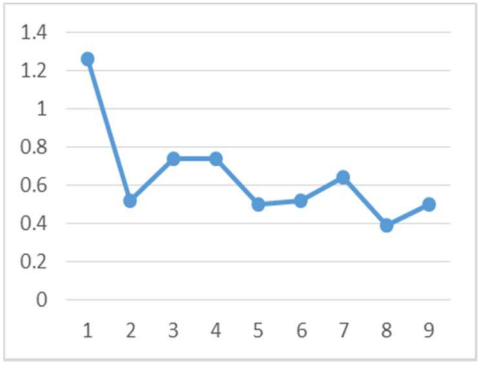
Appendix B. Distribution check of continuous variables

Percent Medicaid

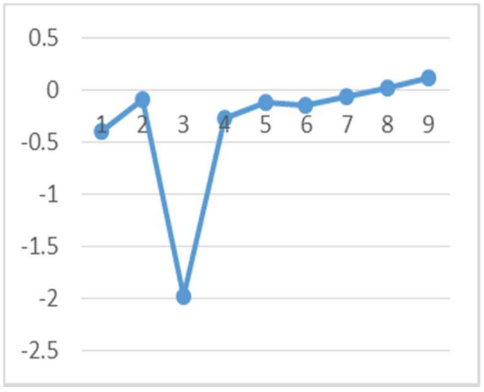
Influenza Receipt



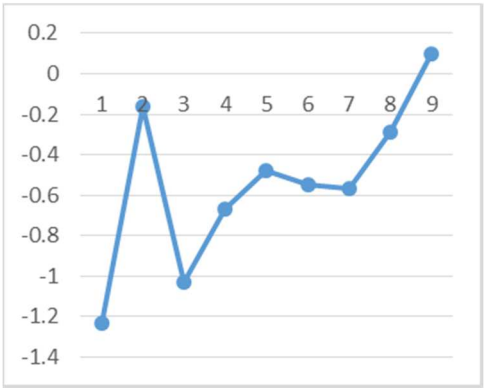
Pneumococcal Receipt



Influenza Not Offered



Pneumococcal Not Offered



Appendix C. Sensitivity analysis: State Fixed Effects

Dependent Variable (Outcome): (1) Influenza Vaccination Receipt, (2) Pneumococcal Vaccination Receipt, (3) Influenza Vaccination Not Offered, (4) Pneumococcal Vaccination Not Offered

	Outcome 1 Unadjusted Fixed Effects	Outcome 1 Adjusted Fixed Effects	Outcome 2 Unadjusted Fixed Effects	Outcome 2 Adjusted Fixed Effects	Outcome 3 Unadjusted Fixed Effects	Outcome 3 Adjusted Fixed Effects	Outcome 4 Unadjusted Fixed Effects	Outcome 4 Adjusted Fixed Effects
	OR	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**
Race								
White [a]	--	--	--	--	--	--	--	--
Black	0.53***	0.75***	0.58***	0.84***	1.89***	1.23**	2.38***	1.17
Hispanic	0.89	1.11	0.83*	1.00	1.12	0.88	1.67*	1.53*
Black Concentration								
<5.0% [a]								
5.0-19.9%		0.81**		0.74***		1.38		2.05**
20.0-49.9%		0.76**		0.77*		1.49*		1.42
50.0-79.9%		0.53***		0.47***		2.56***		3.20*
80.0-94.9%		0.50***		0.46*		1.92		1.39
95.0-100%		0.31***		0.27***		7.87***		17.68***

[a] Referent group, *p < .05, **p < .01, ***p < .001

Controlled for resident- gender, age, behavior, dementia, asthma, respiratory failure; facility- setting, bed count, ownership, chain, occupancy, staffing HRD (CNA, LPN/LVN, RN), percent Medicaid; and community characteristics- percent in poverty, federally qualified health centers, market competition; OR = Odds ratio, HRD = Hours per resident per day, CNA = Certified nursing assistant, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse

Interpretation: Hispanic race is no longer associated with influenza or pneumococcal vaccination receipt; the negative association of Black concentration and influenza and pneumococcal vaccination receipt has weakened. Residents in nursing homes with 20-49% of Blacks became associated with not being offered the influenza vaccination. Residents in nursing homes with 2-19.9% and 50-79.9% became associated with not being offered the pneumococcal vaccination while nursing homes with 80-94.9% and 95-100% of Blacks is no longer negatively associated with not being offered the pneumococcal vaccination

Appendix D. Sensitivity analysis: Limited sample
Dependent Variable: Influenza vaccination receipt

	Model 1 Unadjusted	Model 2 Unadjusted Fixed Effects	Model 3 Adjusted	Model 4 Adjusted Fixed Effects
	OR	**OR**	**OR**	**OR**
Race				
White [a]	--	--	--	--
Black	0.47***	0.76***	0.75***	0.76***
Hispanic	0.70*	1.21**	0.97	1.22**
Black Concentration				
<5.0% [a]				
5.0-19.9%			0.86	0.26*
20.0-49.9%			0.82	0.15**
50.0-79.9%			0.60***	0.15***
80.0-94.9%			0.59*	0.10***
95.0-100%			0.29***	0.11**

[a] Referent group, *p < 0.05, **p < 0.01, ***p < 0.001
Controlled for resident- gender, age, behavior, dementia, asthma, respiratory failure; facility- setting, bed count, ownership, chain, occupancy, staffing HRD (CNA, LPN/LVN, RN), percent Medicaid; and community characteristics- percent in poverty, federally qualified health centers, market competition
OR = Odds ratio, HRD = Hours per resident per day, CNA = Certified nursing assistant, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse

Interpretation: Hispanics became negatively associated with influenza vaccination receipt in the unadjusted model.

Appendix E. Sensitivity analysis: Limited sample
Dependent Variable: Pneumococcal vaccination receipt

	Model 1 Unadjusted	Model 2 Unadjusted Fixed Effects	Model 3 Adjusted	Model 4 Adjusted Fixed Effects
	OR	**OR**	**OR**	**OR**
Race				
White [a]	--	--	--	--
Black	0.47***	0.84**	0.81***	0.85*
Hispanic	0.68*	1.31***	0.83	1.34***
Black Concentration				
<5.0% [a]				
5.0-19.9%			0.76**	0.16**
20.0-49.9%			0.76*	0.22***
50.0-79.9%			0.47***	2.55*
80.0-94.9%			0.50	0.36*
95.0-100%			0.20***	0.16***

[a] Referent group, *p < 0.05, **p < 0.01, ***p < 0.001
Controlled for resident- gender, age, behavior, dementia, asthma, respiratory failure; facility- setting, bed count, ownership, chain, occupancy, staffing HRD (CNA, LPN/LVN, RN), percent Medicaid; and community characteristics- percent in poverty, federally qualified health centers, market competition
OR = Odds ratio, HRD = Hours per resident per day, CNA = Certified nursing assistant, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse

Interpretation: Residents in nursing homes with 20-49.9% Blacks became negatively associated with pneumococcal vaccination receipt.

Appendix F. Sensitivity analysis: Limited sample
Dependent Variable: Influenza vaccination not offered

	Model 1 Unadjusted	Model 2 Unadjusted Fixed Effects	Model 3 Adjusted	Model 4 Adjusted Fixed Effects
	OR	**OR**	**OR**	**OR**
Race				
White [a]	--	--	--	--
Black	1.95**	1.36***	1.24**	1.27**
Hispanic	1.13	1.13	0.94	1.08
Black Concentration				
<5.0% [a]				
5.0-19.9%			1.13	1.50
20.0-49.9%			1.09	1.14
50.0-79.9%			2.02**	2.61**
80.0-94.9%			1.44	1.03
95.0-100%			6.47***	2.328E-06***

[a] Referent group, *p < 0.05, **p < 0.01, ***p < 0.001
Controlled for resident- gender, age, behavior, dementia, asthma, respiratory failure; facility- setting, bed count, ownership, chain, occupancy, staffing HRD (CNA, LPN/LVN, RN), percent Medicaid; and community characteristics- percent in poverty, federally qualified health centers, market competition
OR = Odds ratio, HRD = Hours per resident per day, CNA = Certified nursing assistant, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse

Interpretation: The positive association between Black concentration and influenza vaccination not offered weakened.

Appendix G. Sensitivity analysis: Limited sample
Dependent Variable: Pneumococcal vaccination not offered

	Model 1 Unadjusted	Model 2 Unadjusted Fixed Effects	Model 3 Adjusted	Model 4 Adjusted Fixed Effects
	OR	**OR**	**OR**	**OR**
Race				
White [a]	--	--	--	--
Black	2.50**	1.06	1.15	1.05
Hispanic	1.88	0.81	1.49	0.77
Black Concentration				
<5.0% [a]				
5.0-19.9%			1.73**	1.18
20.0-49.9%			1.02	0.57
50.0-79.9%			2.84*	2.19
80.0-94.9%			1.43	3.47E-07***
95.0-100%			17.83***	4.33E-07***

[a] Referent group, *p < 0.05, **p < 0.01, ***p < 0.001
Controlled for resident- gender, age, behavior, dementia, asthma, respiratory failure; facility- setting, bed count, ownership, chain, occupancy, staffing HRD (CNA, LPN/LVN, RN), percent Medicaid; and community characteristics- percent in poverty, federally qualified health centers, market competition
OR = Odds ratio, HRD = Hours per resident per day, CNA = Certified nursing assistant, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse

Interpretation: Blacks became no longer associated with pneumococcal vaccination in the unadjusted fixed effects models. Hispanics became no longer associated with pneumococcal vaccination not offered in the unadjusted and adjusted models. The positive association between Black concentration and pneumococcal vaccination not offered weakened.

Appendix H. Sensitivity analysis: Race/ethnicityXblack_concentration interaction
Dependent Variable (Outcome): (1) Influenza vaccination receipt, (2) Pneumococcal vaccination receipt, (3) Influenza vaccination not offered, (4) Pneumococcal Vaccination Not Offered

	Outcome 1 W/O Fixed Effects	Outcome 1 Fixed Effects	Outcome 2 W/O Fixed Effects	Outcome 2 Fixed Effects	Outcome 3 W/O Fixed Effects	Outcome 3 Fixed Effects	Outcome 4 W/O Fixed Effects	Outcome 4 Fixed Effects
	OR	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**
Race								
White [a]	--	--	--	--	--	--	--	--
Black	0.89	0.92	0.78	0.82	--	--	0.35	0.47
Hispanic	0.62*	1.03	0.60	1.23	--	--	1.15	1.03
Black Concentration								
<5.0% [a]								
5.0-19.9%	0.83*	0.26*	0.72***	0.16**	--	--	1.57	1.20
20.0-49.9%	0.80*	0.15**	0.77	0.23***	--	--	0.92	0.53
50.0-79.9%	0.63**	0.16***	0.44***	2.47*	--	--	3.13*	2.23
80.0-94.9%	0.51*	0.08***	0.49	0.39	--	--	0.63	5.48E-07***
95.0-100%	0.16	0.05*	0.21***	0.17***	--	--	70.78***	3.89E-06***
Race/ethnicityXblack concentration								
Less than 5.0% # White	--	--	--	--	--	--	--	--
Less than 5.0% # Black	--	--	--	--	--	--	--	--
Less than 5.0% # Hispanic	--	--	--	--	--	--	--	--
5.0%-19.9% # White	--	--	--	--	--	--	--	--
5.0%-19.9% # Black	0.91	0.88	1.11	1.11	--	--	3.62*	2.26
5.0%-19.9% # Hispanic	1.99**	1.35	1.61	1.18	--	--	1.87	0.64
20%-49.9% # White	--	--	--	--	--	--	--	--
20%-49.9% # Black	0.85	0.79	1.01	0.93	--	--	3.03	2.77
20%-49.9% # Hispanic	1.94*	1.18	1.49	0.91	--	--	1.05	1.38
50%-79.9% # White	--	--	--	--	--	--	--	--
50%-79.9% # Black	0.75	0.73	1.12	1.07	--	--	3.41	1.98
50%-79.9% # Hispanic	1.73*	0.95	2.61***	1.47	--	--	0.56	0.45
80%-94.9% # White	--	--	--	--	--	--	--	--
80%-94.9% # Black	0.95	0.93	1.02	0.94	--	--	8.26**	4.97*
80%-94.9% # Hispanic	--	--	1.80	0.46			5.27	21.69***
95%-100% # White	--	--	--	--	--	--	--	--
95%-100% # Black	1.52	1.81	--	--	--	--	--	--

95%-100% # Hispanic	--	--	--	--	--	--	--	--

[a] Referent group, *p < 0.05, **p < 0.01, ***p < 0.001

Controlled for resident- gender, age, behavior, dementia, asthma, respiratory failure; facility- setting, bed count, ownership, chain, occupancy, staffing HRD (CNA, LPN/LVN, RN), percent Medicaid; and community characteristics- percent in poverty, federally qualified health centers, market competition

OR = Odds ratio, HRD = Hours per resident per day, CNA = Certified nursing assistant, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse

Interpretation: Blacks were no longer negatively associated with influenza vaccination and pneumococcal vaccination receipt. Hispanics became negatively associated with influenza vaccination receipt across nursing homes but were no longer positively associated within nursing homes for both influenza and pneumococcal vaccination receipt. Hispanics were no longer positively associated with the pneumococcal vaccination across nursing homes. Across nursing homes, Hispanics were more likely to receive the influenza and pneumococcal vaccinations in high Black concentration nursing homes compared to Whites and residents in nursing homes with < 5% Blacks. Blacks were more likely to not be offered the influenza and pneumococcal vaccinations in high Black concentration nursing homes compared to Whites and residents in nursing homes < 5% Blacks.

Appendix I. Sensitivity Analysis: Black Concentration variable exclusion
Dependent Variable (Outcome): (1) Influenza Vaccination Receipt, (2) Pneumococcal Vaccination Receipt, (3) Influenza Vaccination Not Offered, (4) Pneumococcal Vaccination Not Offered

	Outcome 1 w/ Black Concentration	Outcome 1 w/o Black Concentration	Outcome 2 w/ Black Concentration	Outcome 2 w/o Black Concentration	Outcome 3 w/ Black Concentration	Outcome 3 w/o Black Concentration	Outcome 4 w/ Black Concentration	Outcome 4 w/o Black Concentration
	OR	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**
Race								
White [a]	--	--	--	--	--	--	--	--
Black	0.75***	0.60***	0.81***	0.62***	1.25**	1.79***	1.18	1.91***
Hispanic	0.96	0.99	0.83	0.88	0.88	0.81	1.65*	1.33

[a] Referent group, *p < 0.05, **p < 0.01, ***p < 0.001
Controlled for resident- gender, age, behavior, dementia, asthma, respiratory failure; facility- setting, bed count, ownership, chain, occupancy, staffing HRD (CNA, LPN/LVN, RN), percent Medicaid; and community characteristics- percent in poverty, federally qualified health centers, market competition
OR = Odds ratio, HRD = Hours per resident per day, CNA = Certified nursing assistant, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse

Interpretation: Removing Black concentration makes residents of Black race even less likely to receive either the influenza or pneumococcal vaccination and even more likely to not be offered either vaccination compared to Whites.

Appendix J. Sensitivity analysis: Hispanic concentration
Dependent Variable (Outcome): (1) Influenza vaccination receipt, (2) Pneumococcal vaccination receipt, (3) Influenza vaccination not offered, (4) Pneumococcal vaccination not offered

	Outcome 1 W/O Fixed Effects	Outcome 1 Fixed Effects	Outcome 2 W/O Fixed Effects	Outcome 2 Fixed Effects	Outcome 3 W/O Fixed Effects	Outcome 3 Fixed Effects	Outcome 4 W/O Fixed Effects	Outcome 4 Fixed Effects
	OR	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**
Race								
White [a]	--	--	--	--	--	--	--	--
Black	0.77***	0.76***	0.84**	0.85*	1.27**	1.26**	1.10	1.03
Hispanic	1.20**	1.22**	1.19**	1.34***	1.05	1.03	0.93	0.71**
Black Concentration								
<5.0% [a]								
5.0-19.9%	0.86*	0.26*	0.72***	0.16**	1.21	1.50	1.78*	1.41
20.0-49.9%	0.82*	0.15**	0.75*	0.22***	1.21	1.16	0.98	0.76
50.0-79.9%	0.56***	0.15***	0.41***	2.89	1.98*	2.69**	4.34***	7.89**
80.0-94.9%	0.54**	0.79	0.42	0.36*	1.61	1.09	2.07	3.21E-07***
95.0-100%	0.25***	0.11**	0.15***	0.16***	6.06***	1.66E-06***	35.45***	9.28E-07***
Hispanic Concentration								
<5.0% [a]								
5.0-19.9%	0.77**	0.12**	0.86	0.88	1.00	1.03	0.93	0.26
20.0-49.9%	0.73*	0.83	0.60	0.08***	0.77	1.02	2.58*	1.06
50.0-79.9%	1.02	1.40	0.56*	1.89	0.18***	0.12	4.52*	4.13E-07***
80.0-94.9%	0.36*	0.07***	0.34*	0.11***	7.36***	44.33***	7.02*	143.01***
95.0-100%	0.17***	0.05***	0.14***	0.09***	1.00	1.00	1.00	1.00

[a] Referent group, *p < 0.05, **p < 0.01, ***p < 0.001
Controlled for resident- gender, age, behavior, dementia, asthma, respiratory failure; facility- setting, bed count, ownership, chain, occupancy, staffing HRD (CNA, LPN/LVN, RN), percent Medicaid; and community characteristics- percent in poverty, federally qualified health centers, market competition
OR = Odds ratio, HRD = Hours per resident per day, CNA = Certified nursing assistant, LPN/LVN = Licensed practical nurse/Licensed vocational nurse, RN = Registered nurse

Interpretation: Hispanics became positively associated with influenza and pneumococcal vaccination receipt. More ranges of Black concentration were positively associated with influenza and pneumococcal vaccination receipt. Hispanics were no longer associated with pneumococcal not offered across facilities but became negatively associated within facilities. Residents in high Hispanic concentration nursing homes were less likely to receive influenza and pneumococcal vaccinations and more likely to not be offered both compared to residents in < 5% Hispanic concentration in nursing homes.