A Cross-Sectional Study To Examine The Effects Of Nurse Work Environment On Patient And Nurse Outcomes In Nursing Homes

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A Cross-Sectional Study To Examine The Effects Of Nurse Work Environment On Patient And Nurse Outcomes In Nursing Homes

Abstract
Background: Registered nurse (RN) turnover is a significant problem in nursing homes and has been consistently linked to poor patient outcomes in this setting. Extensive evidence from hospitals has shown that work environment is an important predictor of patient care quality and nurse factors leading to turnover such as job dissatisfaction and burnout, but very little research has explored these same relationships in nursing homes.

Objectives: To study the empirical relationships between work environment and patient and nurse outcomes in nursing homes.

Design: Cross-sectional secondary data analysis linking 2015 RN4CAST four state nurse survey data; LTCfocus, a publically available data set from Brown University; and Nursing Home Compare from the Centers for Medicare and Medicaid Services (CMS).


Results: Patient outcomes: Compared to nursing homes with poor work environments, facilities with good work environments had a 3.04 higher odds of receiving an overall star rating of 4 or 5 stars versus 1 or 2 stars, 1.8% fewer high risk residents with pressure ulcers, and 0.15 fewer hospitalizations per resident year; facilities with average work environments had 2.23% fewer long-stay residents on antipsychotics. The relationships between good and poor environments for antipsychotics and 30 day readmissions were in the hypothesized direction but not statistically significant. Nurse outcomes: RNs working in nursing homes with good work environments were 89% less likely to report job dissatisfaction, 76% less likely to report intent to leave their jobs within one year, 87% less likely to experience burnout, and 73% less likely to report leaving necessary patient care undone compared to RNs working in facilities with poor work environments. RNs in good work environments were more likely to have been employed 3 years or more than RNs in poor environments, but the result was not statistically significant.

Conclusions: Nurse work environment is an important and tangible area to target for interventions to improve care quality and reduce staff turnover in nursing homes.

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A CROSS-SECTIONAL STUDY TO EXAMINE THE EFFECTS OF NURSE WORK ENVIRONMENT ON PATIENT AND NURSE OUTCOMES IN NURSING HOMES

Elizabeth M. White

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A CROSS-SECTIONAL STUDY TO EXAMINE THE EFFECTS OF NURSE WORK ENVIRONMENT ON PATIENT AND NURSE OUTCOMES IN NURSING HOMES

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ABSTRACT

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Elizabeth M. White
Matthew D. McHugh

Background: Registered nurse (RN) turnover is a significant problem in nursing homes and has been consistently linked to poor patient outcomes in this setting. Extensive evidence from hospitals has shown that work environment is an important predictor of patient care quality and nurse factors leading to turnover such as job dissatisfaction and burnout, but very little research has explored these same relationships in nursing homes.

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environments had 2.23% fewer long-stay residents on antipsychotics. The relationships between good and poor environments for antipsychotics and 30 day readmissions were in the hypothesized direction but not statistically significant. *Nurse outcomes:* RNs working in nursing homes with good work environments were 89% less likely to report job dissatisfaction, 76% less likely to report intent to leave their jobs within one year, 87% less likely to experience burnout, and 73% less likely to report leaving necessary patient care undone compared to RNs working in facilities with poor work environments. RNs in good work environments were more likely to have been employed 3 years or more than RNs in poor environments, but the result was not statistically significant. 

**Conclusions:** Nurse work environment is an important and tangible area to target for interventions to improve care quality and reduce staff turnover in nursing homes.
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CHAPTER 1: INTRODUCTION

The Problem

Quality and safety continue to be major issues of concern in nursing homes (Castle & Ferguson, 2010; Department of Health and Human Services Office of Inspector General, 2014; Werner & Konetzka, 2010; Wiener, Freiman, & Brown, 2007). In a 2008-2012 study, 1 in 5 Medicare beneficiaries receiving post-acute care in nursing homes were found to have experienced adverse events, resulting in an estimated $2.8 billion annual excess spending on hospital care (Department of Health and Human Services Office of Inspector General, 2014). Over two-thirds of these adverse events were classified as preventable due to failure or delay of necessary care, inadequate patient monitoring, or substandard treatment.

Registered nurses (RNs) are critical to each of these processes because they provide vital leadership, care coordination, and surveillance to ensure that nursing home patients receive appropriate, timely, and high quality care (Montayre & Montayre, 2017). As hospital lengths of stay shorten (Werner & Konetzka, 2018) and nursing homes take on increasingly medically complex patients (Feng, Grabowski, Intrator, & Mor, 2006), these RN roles have become even more essential. The ability of RNs to carry out these functions, however, is largely influenced by the organizational environment in which they practice (Institute of Medicine, 2004). A large body of research has shown that hospitals with better nurse work environments have better patient outcomes including lower mortality, reduced length of stay, and higher patient satisfaction (Aiken, Cimiotti, et al., 2011; Aiken, Clarke, Sloane, Lake, & Cheney, 2008; Aiken et al., 2012; Aiken,
Better hospital work environments have also been linked with better nurse outcomes including lower rates of nurse burnout and job dissatisfaction (Aiken et al., 2008; Aiken, Sloane, et al., 2011; Kelly, McHugh, & Aiken, 2011; Lake, 2007; Laschinger & Leiter, 2006; McHugh et al., 2016; Van Bogaert, Kowalski, Weeks, & Clarke, 2013).

Studies of the work environment have been much more limited in nursing homes (Anderson, Issel, & McDaniel, 2003; Anderson & McDaniel, 1999; Choi, Flynn, & Aiken, 2012; Flynn, Liang, Dickson, & Aiken, 2010; Temkin-Greener, Cai, Zheng, Zhao, & Mukamel, 2012; Temkin-Greener, Zheng, Cai, Zhao, & Mukamel, 2010; Zuniga et al., 2015a; Zuniga et al., 2015b). The relationship between RN staffing and outcomes has been studied extensively in nursing homes, but results have been mixed (Backhaus, Verbeek, van Rossum, Capezuti, & Hamers, 2014; Bostick, Rantz, Flesner, & Riggs, 2006; Castle, 2008a; Dellefield, Castle, McGilton, & Spilsbury, 2015; Grabowski, Stewart, Broderick, & Coots, 2008; Spilsbury, Hewitt, Stirk, & Bowman, 2011). There have been many methodological critiques of the staffing literature (Bostick et al., 2006; Castle, 2008a; Dellefield et al., 2015; Spilsbury et al., 2011), however, an additional explanation as to why staffing has been inconsistently associated with patient outcomes may be that staffing, alone, is not a comprehensive enough measure of nursing care organization (Aiken, Cimiotti, et al., 2011).
RNs in nursing homes report higher rates of job dissatisfaction and burnout than RNs working in any other setting, including hospitals (McHugh, Kutney-Lee, Cimiotti, Sloane, & Aiken, 2011). Turnover is a significant problem in nursing homes, with average annual RN turnover rates hovering around 50% for years (American Health Care Association, 2012; Castle, 2008b). RN turnover in nursing homes has been linked to higher use of restraints, catheters, and psychotropic medications; higher prevalence of contractures and pressure ulcers (Castle & Engberg, 2005); more survey deficiency citations (Castle & Engberg, 2005; Lerner, Johantgen, Trinkoff, Storr, & Han, 2014); worse pain management (Castle & Anderson, 2011); higher rates of infection and hospitalization (Zimmerman, Gruber-Baldini, Hebel, Sloane, & Magaziner, 2002); and overall worse quality (Castle, Engberg, & Men, 2007). Turnover also generates additional labor costs for training, recruitment, hiring, and productivity loss (Jones, 2008). This is particularly problematic for nursing homes which already function under tight budget constraints due to high dependence on Medicaid funding, and growing shortfalls between Medicaid reimbursement and actual costs of care (American Health Care Association, 2016).

Much is known about the adverse effects of RN turnover on patient outcomes in nursing homes, but turnover rates remain high and have failed to improve over time. Since job satisfaction and burnout are important contributors to turnover (Laschinger & Leiter, 2006; Leiter & Maslach, 2009), and since work environment has been extensively linked to both patient and nurse outcomes in hospitals, I hypothesized that work environment would also be associated with patient and nurse outcomes in nursing homes.
Study Overview, Specific Aims, and Hypotheses

The purpose of this study was to examine the empirical relationship between nurse work environment and patient and nurse outcomes in nursing homes, using cross-sectional data from the 2015 RN4CAST four state nurse survey, the Centers for Medicare and Medicaid Services’ (CMS) Nursing Home Compare database, and LTCfocus, a publically available data set on nursing home care from Brown University. The study had two aims:

Aim 1: To examine whether nurse work environment is associated with patient outcomes in nursing homes, using 2015 four state nurse survey data and five quality measures from Nursing Home Compare and LTCfocus (pressure ulcer prevalence, antipsychotic medication use, 30 day hospital readmissions, hospitalizations per resident year, and five-star rating).

Hypothesis 1a: Better work environments will be associated with better patient outcomes, as measured at the nursing home level.

Hypothesis 1b: Better work environments will be associated with better overall facility quality, as measured by the CMS five-star ratings.

Aim 2: To examine whether nurse work environment is associated with nurse outcomes (burnout, job satisfaction, intent to leave, retention, and missed care) in nursing homes, using 2015 four state nurse survey data.

Hypothesis 2a: RNs working in nursing homes with better work environments will report higher rates of retention, and lower rates of job dissatisfaction, burnout, and intent to leave compared to RNs in poor work environments.
Hypothesis 2b: RNs working in nursing homes with better work environments will report lower rates of missed care compared to RNs in poor work environments.

Impact

This study will be the first to use multi-state nurse survey data with the Practice Environment Scale of the Nursing Work Index (PES-NWI) (Lake, 2002), a comprehensive National Quality Forum-endorsed measure of work environment (Lake, 2002, 2007; National Quality Forum, 2004), to examine the empirical relationship between nurse work environment and both patient and nurse outcomes in nursing homes. Because characteristics of the work environment are modifiable, findings from this study will help inform whether interventions to improve work environments could improve the safety and quality of care in nursing homes.

Nursing home administrators will always be financially constrained in their capacity to increase staffing due to tight operating margins. While staffing adequacy is a key component of good work environments, interventions to improve other aspects of the work environment such as organizational leadership, nurse autonomy, nurse participation in organizational decisions, and nurse-physician relationships require less fiscal investment, yet could still potentially improve care quality. Additionally, if nursing homes could achieve cost reductions from decreased turnover, they would have more to invest in staffing and other areas affecting quality. Interventions to improve work environments reflect recommendations in the Institute of Medicine’s 2003 report Keeping Patients Safe: Transforming the Work Environment of Nurses (Institute of Medicine,
2004), and hold potential to bolster systems of care in nursing homes to help prevent adverse events and improve patient safety.
CHAPTER 2: BACKGROUND AND SIGNIFICANCE

Introduction

Registered nurses (RNs) oversee the care of nursing home patients, and thus have significant influence over safety and quality in this setting. Nursing home patients suffer a large number of preventable adverse events due to failure or delay of necessary care, inadequate patient monitoring, and substandard treatment, according to a 2008-2012 study from the Department of Health and Human Services’ Office of Inspector General (Department of Health and Human Services Office of Inspector General, 2014). These are domains which all fall under the leadership of RNs, who serve as directors of nursing, supervisors, and charge nurses. RNs in nursing homes are responsible for supervising licensed practical nurses (LPNs) and certified nursing assistants (CNAs), coordinating resident care plans, managing resources, conducting surveillance of patients’ conditions, and intervening when changes in patient condition occur. RNs also oversee wound surveillance and treatments, monitor and respond to adverse events, and direct infection control and quality improvement programs (Dever, 2018; McGilton et al., 2016; Montayre & Montayre, 2017).

The ability for RNs to carry out these many important patient care processes is largely determined by the organizational environment in which they practice (Institute of Medicine, 2004). In better work environments, RNs have strong managers, adequate staffing and resources, respect for their knowledge and judgments at the bedside, good working relationships with physicians and other colleagues, input into organizational affairs, and opportunities for advancement and growth (Lake, 2002).
Review of the Literature

Hospital Work Environment

The impact of nurse work environment on patient outcomes has been demonstrated extensively in hospitals. Hospitals with better work environments have been found to have lower 30 day mortality (Aiken, Cimiotti, et al., 2011; Aiken et al., 1994; Friese et al., 2008; Friese et al., 2015; McHugh et al., 2016; McHugh et al., 2013; Silber et al., 2016); lower failure-to-rescue (death following a complication) (Aiken, Cimiotti, et al., 2011; Aiken et al., 2008; Friese et al., 2008; Friese et al., 2015; McHugh et al., 2016; McHugh et al., 2013); higher patient satisfaction (Aiken et al., 2012; Kutney-Lee et al., 2009); decreased ICU use (Silber et al., 2016); and reduced length of stay (Silber et al., 2016).

RNs in hospitals with better work environments have been found to have less burnout (Aiken et al., 2008; Aiken, Sloane, et al., 2011; Kelly et al., 2011; Lake, 2007; Laschinger & Leiter, 2006; Van Bogaert et al., 2013); job dissatisfaction (Aiken et al., 2008; Aiken, Sloane, et al., 2011; Kelly et al., 2011; Lake, 2007; McHugh et al., 2016); and intention to leave their current jobs (Aiken et al., 2008; Kelly et al., 2011; Lake, 2007; McHugh et al., 2016; Van Bogaert et al., 2013). They are also more likely to give their hospitals good ratings on quality and safety compared to RNs in poor work environments (Aiken et al., 2008; Aiken, Sloane, et al., 2011; Lake, 2007; Van Bogaert et al., 2013). The majority of these studies have used the Practice Environment Scale of the Nursing Work Index (PES-NWI) (Lake, 2002) to measure work environment based on five elements: nurse participation in organizational affairs, use of nursing care models,
staffing and resource adequacy, nurse leadership, and collegial nurse-physician relationships.

**Nurse Turnover in Nursing Homes**

The contribution of work environment to nurse job dissatisfaction and burnout is highly relevant in nursing homes, because job dissatisfaction and burnout are important contributors to turnover (Laschinger & Leiter, 2006; Leiter & Maslach, 2009), which is a significant problem in this setting. RNs working in nursing homes report higher rates of job dissatisfaction and burnout than RNs working in any other setting, including hospitals (McHugh et al., 2011). Turnover rates for RNs in nursing homes are high, and there is significant variation across different facilities and states. Castle in 2008 found a national average annual RN turnover rate of 46.3%, however this ranged from 21% to 71% across the 50 states (Castle, 2008b). National average turnover rates for RNs have remained around 50% for years (American Health Care Association, 2012). High RN turnover has been linked to higher use of restraints, catheters, and psychotropic medications; higher prevalence of contractures and pressure ulcers (Castle & Engberg, 2005); more survey deficiency citations (Castle & Engberg, 2005; Lerner et al., 2014); worse pain management (Castle & Anderson, 2011); higher rates of infection and hospitalization (Zimmerman et al., 2002); and overall worse quality (Castle et al., 2007).

Most of the organizational characteristics that have been found to contribute to RN turnover are structural characteristics that are difficult to modify. These include: for profit ownership (Anderson, Issel, & McDaniel Jr, 1997; Castle & Engberg, 2006); bed size (Anderson, Corazzini, & McDaniel, 2004; Castle, 2008b); higher Medicaid
occupancy (Castle, 2008b); higher case mix (Anderson et al., 2004; Anderson et al., 1997); higher wage competition (Anderson et al., 1997); and lower profit margin (Anderson et al., 1997). For example, a nursing home cannot easily change its ownership structure or bed capacity. By contrast, several elements of the work environment such as organizational leadership, staff engagement, and colleague relationships are more modifiable, and thus potential areas to target to reduce turnover and improve patient safety. Other factors that have been found to contribute to RN turnover are staffing and workload (Anderson et al., 2004; Anderson et al., 1997; Castle, 2008b; Castle & Engberg, 2006), top management turnover (Castle, 2008b; Castle & Engberg, 2006), and director of nursing turnover and tenure (Castle, 2008b; Castle & Engberg, 2006).

Nursing Home Staffing

In contrast to the research that has been done in hospitals, nurse work environment has been only minimally studied in nursing homes (Anderson et al., 2003; Anderson & McDaniel, 1999; Choi et al., 2012; Flynn et al., 2010; Temkin-Greener et al., 2012; Temkin-Greener et al., 2010; Zuniga et al., 2015a; Zuniga et al., 2015b). The largest body of outcomes research that has been done around this topic in nursing homes has been on staffing, one component of the work environment. However, results have been mixed. The most common outcomes that have been studied in relation to RN staffing are survey deficiency citations (Bostick et al., 2006; Castle, 2008a; Dellefield et al., 2015; Spilsbury et al., 2011); pressure ulcers (Bostick et al., 2006; Castle, 2008a; Dellefield et al., 2015; Spilsbury et al., 2011); restraint use (Bostick et al., 2006; Castle, 2008a; Dellefield et al., 2015; Spilsbury et al., 2011); hospitalization (Bostick et al.,
and various other measures from the Minimum Data Set such as weight loss, incontinence, and functional decline (Bostick et al., 2006; Dellefield et al., 2015; Spilsbury et al., 2011). Of five systematic reviews that have examined this body of research, all found generally positive correlations between RN staffing and patient outcomes, with RN staffing having stronger effects than LPN and CNA staffing, however, all observed that there were many mixed results among the studies they reviewed (Bostick et al., 2006; Castle, 2008a; Dellefield et al., 2015; Grabowski et al., 2008; Spilsbury et al., 2011). An additional systematic review of only longitudinal studies found no consistent relationships between RN staffing and quality outcomes (Backhaus et al., 2014).

The primary criticism of the nursing home staffing literature has been the use of poor quality staffing data, because most studies have relied on facility-reported data which is subject to reporting bias (Bostick et al., 2006; Castle, 2008a; Feng, Katz, Intrator, Karuza, & Mor, 2005; Kash, Hawes, & Phillips, 2007). However, an additional explanation as to why staffing studies have produced mixed results may be that staffing, alone, is not a comprehensive enough measure of nursing care organization to show effects on patient outcomes. This notion is supported by an important interaction between staffing and work environment found by Aiken, Cimiotti, et al. (2011) in hospitals. They showed that reducing workloads by one patient per nurse in hospitals with good work environments decreased mortality by 9% and failure-to-rescue by 10%; however, they found virtually no effect in hospitals with poor work environments. This demonstrates that other elements of the work environment aside from staffing—i.e. nurse
participation in organizational affairs, use of nursing care models, nurse leadership, and collegial nurse-physician relationships—are influencing patient outcomes.

**Nursing Home Work Environment**

Aside from staffing, research linking other elements of the nurse work environment to patient outcomes in nursing homes has been much more limited. Only one other study (Flynn et al., 2010) used the full PES-NWI to examine the effects of RN work environment on patient outcomes. Flynn et al in a cross-sectional study linking Nursing Home Compare with 2006 RN4CAST survey data from 340 RNs in 63 nursing homes in New Jersey, found that nursing homes with better nurse work environments had fewer pressure ulcers and survey deficiency citations. They also found that nurse work environment fully mediated the effect of for profit status on pressure ulcer prevalence. In a related study with that same nurse sample, Choi et al. (2012) found that RNs working in nursing homes with better work environments had higher job satisfaction. These two studies are also the only two to have used a random state-wide sample of nurses, rather than surveying employees through their employers which creates the potential for response bias.

Two studies have looked at the relationship between elements of RN leadership and patient outcomes in nursing homes using other instruments. Both studies used a sample of Texas nursing homes, and one surveyed directors of nursing and nursing home administrators (Anderson & McDaniel, 1999) while the other surveyed directors of nursing and direct care nurses (Anderson et al., 2003). These studies found that having RNs involved in organizational decision making was associated with better quality
improvement over time (Anderson & McDaniel, 1999) and reduced problematic patient behaviors (Anderson et al., 2003). Anderson et al. (2003) also found that good communication and relations between RNs and their managers were associated with fewer restraints, fractures, and complications of immobility.

Other studies on nursing home work environment have been done on nursing home workers overall, with RNs making up only small proportions of the samples (Plaku-Alakbarova, Punnett, & Gore, 2018; Temkin-Greener et al., 2012; Temkin-Greener et al., 2010; Zuniga et al., 2015a; Zuniga et al., 2015b). While there are likely many overlapping features of good work environments for RNs and other staff, these broader studies are unlikely to capture elements that support RNs specifically to perform their vital clinical functions in nursing homes. Still, findings from this research have shown similar themes as has been found with RNs. Work environment elements like staffing and resource adequacy, safety climate, and teamwork have been linked with better patient outcomes (Temkin-Greener et al., 2012; Temkin-Greener et al., 2010), better worker-reported quality (Zuniga et al., 2015a) and less rationing of nursing care (Zuniga et al., 2015b). Only two of these studies looked at independently measured patient outcomes (Temkin-Greener et al., 2012; Temkin-Greener et al., 2010) and, again, all surveyed workers through their employers raising the potential for response bias.

**Outcome Measures**

The limited knowledge on nursing home nurse work environment gleaned from the above studies, coupled with the extensive existing evidence on hospital work environment and nursing home turnover, justify the need for a more comprehensive
exploration into the effects of work environment on quality and safety in nursing homes. The patient outcomes examined in this study are widely accepted measures of quality in nursing homes that have been previously linked to organizational elements of nursing such as staffing and turnover. These include: pressure ulcer prevalence (Bostick et al., 2006; Castle, 2008a; Castle & Engberg, 2005; Castle et al., 2007; Dellefield et al., 2015; Department of Health and Human Services Office of Inspector General, 2014; Spilsbury et al., 2011); antipsychotic medication use (Bostick et al., 2006; Castle & Engberg, 2005; Dellefield et al., 2015; Spilsbury et al., 2011); and two measures of hospitalization (Bostick et al., 2006; Grabowski et al., 2008; Spilsbury et al., 2011; Thomas, Mor, Tyler, & Hyer, 2012; Zimmerman et al., 2002). Additionally, I examined nursing home five-star ratings from the Centers for Medicare and Medicaid Services’ (CMS) public reporting system, which incorporates data on health inspections, staffing, and quality (Centers for Medicare and Medicaid Services, 2018). Star ratings reflect nursing home performance relative to other facilities in the same state and have been used in prior studies as a measure of overall quality (Castle & Decker, 2011; Konetzka, Grabowski, Perraillon, & Werner, 2015; Unroe, Greiner, Colón-Emeric, Peterson, & Curtis, 2012).

Job dissatisfaction, burnout, and intent to leave one’s job are important nurse outcomes because they contribute to turnover (Laschinger & Leiter, 2006; Leiter & Maslach, 2009; Steel & Ovalle, 1984) and have been linked extensively to work environment in other clinical settings (Aiken et al., 2008; Aiken, Sloane, et al., 2011; Kelly et al., 2011; Lake, 2007; Laschinger & Leiter, 2006; McHugh et al., 2016; Van Bogaert et al., 2013). Nurse retention is closely related to these and is a variable that has
often been examined concurrently with turnover (Castle, 2008b; Castle & Engberg, 2006; Donoghue, 2009; Thomas et al., 2012). Missed care refers to required patient care left undone and reflects nurses’ needs to prioritize care activities due to resource availability, staffing, patient demand, and other factors (Jones, Hamilton, & Murry, 2015; Kalisch, Landstrom, & Hinshaw, 2009). Missed care has been previously linked with several patient outcomes such as falls, readmissions, and patient satisfaction (Carthon, Lasater, Sloane, & Kutney-Lee, 2015; Jones et al., 2015; Kalisch, Tschannen, & Lee, 2012; Lake, Germack, & Viscardi, 2016). In this study, however, I examine it as a nurse outcome because it has also been found to be a predictor of turnover, intent to leave one’s job, and job dissatisfaction (Jones et al., 2015; Kalisch, Tschannen, & Lee, 2011).

**Conceptual Framework**

The Institute of Medicine in its landmark *To Err is Human* report (Institute of Medicine, 2000) identified organizational environment as a key factor influencing patient safety within healthcare systems, and specifically highlighted the role of working conditions in preventing adverse events. This study examines nurse work environment as a system characteristic that influences outcomes, and is guided by the Quality Health Outcomes Model (QHOM) (Mitchell, Ferketch, & Jennings, 1998). The QHOM is an expansion of Donabedian’s structure-process-outcomes framework (Donabedian, 1966), transforming those linear relationships into a dynamic model in which the path between interventions and outcomes are both mediated and moderated through system and individual characteristics.
In this study, the interventions are patient care processes done by RNs – i.e. providing leadership, care coordination, and patient surveillance. Because these are processes that are not easily defined by a specific set of tasks or skills, the interventions themselves are not measured. What can be measured is the association of work environment—a system characteristic—with outcomes, controlling for individual and other system characteristics. This is shown in Figure 2.1.

Figure 2.1. Quality Health Outcomes Model. Adapted from Mitchell et al. (1998)
For **Aim 1**, I was interested in the association of work environment with patient outcomes measured at the facility level, so I controlled for nursing home characteristics and patient characteristics that also influence outcomes. Since the patient outcome measures were already aggregated to the facility level, I used facility-level patient census data to control for patient characteristics where appropriate. CMS already incorporates some patient level adjustment into the two Nursing Home Compare measures (pressure ulcers and antipsychotics) prior to aggregation (RTI International, 2016) so minimal additional controls were added for those measures. The LTCfocus readmission and hospitalization per resident year measures were not adjusted, so controls were added in those models to account for a nursing home’s overall patient acuity. For **Aim 2** looking at nurse outcomes, I controlled for the same nursing home characteristics, but the individual characteristics of interest were those of the nurses, not patients. These nurse characteristics were obtained from the nurse survey.

**Innovation**

The empirical relationship between RN work environment and patient outcomes has been only minimally studied in nursing homes. The closest study for comparison is that of Flynn et al. (2010) who examined the effects of work environment on pressure ulcer prevalence and survey deficiency citations in New Jersey nursing homes using 2006 RN4CAST nurse survey data. This study expands upon that work in a number of ways. First, I used 2015 RN4CAST nurse survey data which allowed for exploration into whether similar relationships between work environment and outcomes could be found in a new dataset collected at a different point in time. This study also used a larger sample
of nursing homes across four states, in contrast to Flynn et al.’s study which was limited to New Jersey. I examined a larger number of outcomes including antipsychotic use, 30 day readmission, hospitalizations per resident year, and CMS five-star ratings; and was able to incorporate a broader set of organizational characteristics than what is in Nursing Home Compare by using LTCfocus data. This included being able to look at the relationship between Medicaid census and nurse work environment which has not been previously done. Furthermore, I completed a subscale analysis of each of the components of the PES-NWI to determine which aspects of the work environment were most significant for each outcome. Beyond Flynn et al.’s study, other researchers have examined more limited components of the work environment (Anderson et al., 2003; Anderson & McDaniel, 1999; Temkin-Greener et al., 2012; Temkin-Greener et al., 2010; Zuniga et al., 2015a; Zuniga et al., 2015b). By using the PES-NWI, a comprehensive and well-validated National Quality Forum-endorsed measure of the work environment (Lake, 2002, 2007; National Quality Forum, 2004), this study contributes a broader, more comprehensive review of the nursing home work environment to the literature.

The empirical relationship between work environment and nurse outcomes has also been only minimally studied in nursing homes. Again, I expanded upon the work done in New Jersey by Choi et al. (2012) who studied the effects of work environment on RN job satisfaction with 2006 RN4CAST nurse survey data. I used more current 2015 RN4CAST data from four states, and analyzed a broader set of nurse outcomes. In addition to job satisfaction, I examined burnout, intent to leave one’s job, retention, and missed care. These additional outcomes help to improve our understanding of how work
environment may contribute to turnover, and how turnover leads to poorer patient outcomes. By doing a subscale analysis of the PES-NWI for each of these outcomes, I was able to glean information on which areas could be best targeted for interventions to reduce turnover.

Aside from the work by Flynn et al. (2010) and Choi et al. (2012) who also used RN4CAST data, other studies of nursing home work environment have relied on surveys of nursing home leadership or samples of workers surveyed through their employers. The key problem with this approach is that it introduces response bias at the organizational level because employers self-select into or out of the study. The RN4CAST surveys, however, use a unique sampling approach in which nurses are randomly selected based on their state licensure, then contacted directly, rather than through their employers. Nurses then report the name and address of their employer so that their responses can be aggregated to the organization level. Not only does this sampling approach significantly reduce response bias at the organizational level, but it also allows for study of a larger number of healthcare organizations because it eliminates the need to seek Institutional Review Board (IRB) approval from each individual organization being surveyed.

**Clinical Implications**

The ability of nursing home operators to alter structural organizational characteristics like ownership structure or Medicaid census, which may influence their ability to retain qualified nurses and provide high quality care, is very limited. By contrast, elements of the nurse work environment, are more modifiable. And an
extensive body of research in hospitals has demonstrated that patients fare better when RNs have strong managers, input into organization affairs, opportunities for advancement and growth, respect for their knowledge and judgements at the bedside, good working relationships with physicians and other colleagues, and adequate resources. Many of these elements can be accomplished through changes in organizational culture and practices.

Nursing homes function under tight budget constraints due to heavy reliance on Medicaid, which is the primary payer of nursing home care and covers 6 out of 10 residents (Kaiser Family Foundation, 2017). The average shortfall between daily Medicaid reimbursement rates and actual cost of care has grown over time, more than doubling from $9.05 in 1999 to $22.46 in 2015 (American Health Care Association, 2016). A daily shortfall of $22.46 means that a nursing home with 100 Medicaid residents would lose over $800,000 per year just in covering cost of care. With these tight margins, nursing homes will always be constrained in their ability to increase staffing (Harrington, Swan, & Carrillo, 2007), however they could do a much better job of retaining the nurses they already have. Nurse turnover is costly for organizations because it generates additional training costs, creates demand for expensive agency staffing, hampers productivity, and compromises quality (Jones, 2008). Additionally, higher director of nursing turnover leads to higher turnover of direct care staff (Castle, 2008b; Castle & Engberg, 2006), thus multiplying costs. If nursing homes could reduce their expenditures on turnover, they would have more to invest in staffing and other areas affecting quality.
The last 15-20 years have also seen the level of acuity in nursing homes grow for both short- and long-term residents, meaning that the need for high quality care provided by RNs in this setting has become ever more important. Shortened hospital lengths of stay have created increased demand for institutional post-acute care services (Tyler et al., 2013; Werner & Konetzka, 2018). Simultaneously, less complex individuals primarily in need of long-term custodial care have increasingly sought care in the community as states have supported growth of Medicaid-reimbursed home and community-based long-term care services, leaving those who are sicker and/or have fewer social supports in the nursing home setting (Eiken, Sredl, Burwell, & Woodward, 2017). Many states have also shifted to case-mix based Medicaid reimbursement which has enabled nursing homes to take on more medically complex individuals in need of long-term care (Feng et al., 2006). Despite this growth in acuity, however, nursing homes are still largely financed and staffed as custodial facilities with federal minimum staffing requirements for RNs having remained unchanged for over 30 years (Centers for Medicare & Medicaid Services, 2016).

With this greater acuity, nursing homes are increasingly being held accountable for quality, which is also affecting them financially. For example, in New York state, the Nursing Home Compare five-star ratings are now being used in determining Medicaid reimbursement, Certificate of Need approvals, risk assessments by lenders and investors, hospital referral systems, and insurance networks (Leading Age New York, 2017). And starting in 2019, nursing homes will be subject to readmission payment penalties for their Medicare patients under the CMS Skilled Nursing Facility Value-Based Purchasing
Program (Centers for Medicare and Medicaid Services, 2017b). This makes the almost $3 billion annual excess spending on hospital care for avoidable adverse events in nursing home patients (Department of Health and Human Services Office of Inspector General, 2014) all the more relevant. Improving nursing home safety and quality is not only essential for patient care, but also vital to ensuring the financial viability of facilities. This study examined the work environment as an area of intervention that not only directly influences patient outcomes, but also serves as an avenue to improve quality and decrease turnover costs.

The evidence around nurse work environment in hospitals (Scott, Sochalski, & Aiken, 1999) led to the development of the Magnet Recognition Program® by the American Nurses Credentialing Center (ANCC) (American Nurses Credentialing Center, 2017b), a program that recognizes nursing excellence in hospitals. Hospitals that pursue Magnet® recognition have been found to have improvement in patient and nurse outcomes over time (Kutney-Lee et al., 2015). Magnet® status is now also used as a key measure of hospital quality in the US News & World Report rankings, as well as the Leapfrog Hospital Survey. A comparable recognition for non-hospital healthcare organizations, the ANCC’s Pathway to Excellence® program (American Nurses Credentialing Center, 2017a), has yet to gain significant traction in long term care, but holds potential as a mechanism for nursing homes to pursue to help improve the quality of their nursing care. This study will contribute empirical evidence to demonstrate whether such interventions to improve nurse work environment in nursing homes hold potential for similar success as has been demonstrated in hospitals.
Summary

Turnover rates for RNs in nursing homes remain high, despite considerable knowledge about how turnover adversely impacts patients and what causes it. Because elements of the work environment are more modifiable than structural organizational characteristics like ownership structure and Medicaid census, work environment may be an important and tangible area to target to reduce turnover, and improve the quality and safety of care in nursing homes. This study’s use of comprehensive survey data of nurses from four states, using the full PES-NWI and other measures, as well as multiple quality measures from Nursing Home Compare and LTCfocus, provided the unique opportunity to examine the effects of nurse work environment in nursing homes in greater depth than has been studied previously.

Nursing home patients suffer a large number of preventable adverse events due to failure or delay of necessary care, inadequate patient monitoring, or substandard treatment (Department of Health and Human Services Office of Inspector General, 2014). All of these care processes fall under the domain of RNs, who provide vital leadership, care coordination, and surveillance in nursing homes. The ability of RNs to carry out these important functions is largely influenced by the work environment in which they practice (Institute of Medicine, 2004). This study examined the nurse work environment as a modifiable system characteristic that could potentially be targeted to improve safety and quality in nursing homes, and reduce organizational costs due to turnover.
CHAPTER 3: METHODS

Design

This study was a cross-sectional secondary data analysis of the following linked datasets from 2015: (1) RN4CAST nurse survey data from California (CA), Florida (FL), New Jersey (NJ), and Pennsylvania (PA); (2) the Centers for Medicare and Medicaid Services (CMS) Nursing Home Compare; and (3) LTCfocus, a publically available dataset from the Brown University School of Public Health. The parent study for the RN4CAST nurse survey is titled Panel Study of Effects of Changes in Nursing on Patient Outcomes (NINR R01-NR014855), and is led by Dr. Linda Aiken at the University of Pennsylvania School of Nursing. The purpose of the parent study was to collect information on nurse staffing, education, work environment, skill mix, and other organizational factors to study the relationships of such elements to patient outcomes across a large number of health care organizations, including hospitals, nursing homes, and home health agencies. This is a replication of prior studies done in 1999 (Aiken, Clarke, Cheung, Sloane, & Silber, 2003; Aiken et al., 2008; Aiken, Clarke, Sloane, Sochalski, & Silber, 2002) and 2006 (Aiken, Cimiotti, et al., 2011; Aiken et al., 2010; McHugh et al., 2011). The four states were chosen because they are large, geographically diverse states representing over 20% of the US population.

In this study, registered nurses (RNs) employed in CMS-certified nursing homes (i.e. nursing homes eligible for Medicare and Medicaid payment) served as informants to report on the quality of the work environment in the facilities in which they worked. I then examined the relationship between the work environment and various patient and
nurse outcomes. While the unit of observation was the nurse, the unit of analysis differed by aim. In **Aim 1**, the unit of analysis was the nursing home because the outcomes of interest were facility-level patient outcomes. In **Aim 2**, the unit of analysis was the nurse because the outcomes of interest were individual nurse outcomes.

**Data Sources**

**Patients**

**Nursing Home Compare**. The facility-level patient data for the outcome measures in this study came from two data sources. The first was Nursing Home Compare. This is a publicly available database from CMS that contains provider information and data on various quality measures for every CMS-certified nursing home in the US. Nursing Home Compare data are extracted from the Minimum Data Set (MDS), the Certification and Survey Provider Enhanced Reports (CASPER) system, and Medicare claims data. The MDS is a federally mandated clinical screening and assessment tool containing information on a variety of resident characteristics, health, and functional measures that is completed on all residents in CMS-certified nursing homes on admission and then at set time intervals. CASPER contains data collected by state survey teams during nursing homes’ initial certification and annual recertification process. It replaced the Online Survey, Certification, and Reporting (OSCAR) system in 2012.

Nursing Home Compare is updated on a quarterly basis. To ensure temporal congruency, 2015 data were used to match the time period in which the nurse survey was conducted. In 2015, there were two types of quality measures in Nursing Home
Compare: (1) MDS-based measures for short-stay residents and (2) MDS-based measures for long-stay residents. Short-stay residents are those who are receiving short-term skilled nursing care in the nursing home under a Medicare Part A benefit following a hospitalization. Long-stay residents are those not under a Medicare Part A skilled nursing benefit who reside in the nursing home long-term. Data for these measures are extracted from MDS.

The Nursing Home Compare dataset was constructed by merging the provider information file with the MDS second quarter quality measure files. Data in the MDS files were reshaped from long to wide format to organize data at the facility level. Second quarter data were used to match with LTCfocus, which calculates its prevalence estimates based on data from the first Thursday of each April. Nursing Home Compare data were downloaded from the 2015 archived files at https://data.medicare.gov.

**LTCfocus.** The second dataset used for facility-level patient outcome measures was LTCfocus, a publically available dataset from the Brown University School of Public Health. LTCfocus merges data from MDS, CASPER, Medicare enrollment and claims data, Nursing Home Compare, the Area Resource File, and a state Medicaid policy survey to generate information about nursing homes at the facility, county, and state levels (Brown University School of Public Health, 2018). It uses the Residential History File algorithm developed by Intrator, Hiris, Berg, Miller, and Mor (2011) to link MDS with Medicare claims data (Master Beneficiary Summary, Inpatient, SNF, Outpatient, and Home Health Files) in order to track individuals over time and across multiple care settings. LTCfocus offers many more variables than are available in Nursing Home
Compare, including measures of patient census characteristics, and hospitalization metrics for all nursing home residents, not just short-stay residents. The dataset has been used in multiple prior studies to examine care quality in nursing homes (Berridge, Tyler, & Miller, 2016; Berry et al., 2016; Leland et al., 2015; Mitchell, Mor, Gozalo, Servadio, & Teno, 2016; Rahman, McHugh, Gozalo, Ackerly, & Mor, 2017). Variables from this dataset were used for both covariates and primary outcome measures. The 2015 facility-level LTCfocus file was downloaded from http://ltcfocus.org for analysis.

**Nursing Homes**

**Nurse Survey.** Data collection for the parent study took place from January to December 2015. Using a modified Dillman (1978) protocol, Aiken and colleagues surveyed a 30% random sample of actively licensed RNs and a 50% random sample of actively licensed advanced practice nurses (APNs) in each of the four states, creating an initial sample of over 200,000 nurses. They both mailed and emailed surveys to nurses directly, using contact information on file with their state boards of nursing. Nurses were asked to provide their employer name and address in order to link their responses with their employer. The advantage of this sampling method is that it permits study of a large number of healthcare organizations, and eliminates both potential bias and logistical concerns that come with surveying nurses through their employers. Nurses had the option of returning either the paper or electronic survey, and were identified with unique research IDs to identify duplicate responses. They were sent a series of reminder robocalls, emails, and postcards, and given the opportunity to win one of ten iPad Airs as
incentive for completing the survey. In September, individuals who had not yet responded were additionally offered a $10 Amazon gift card as incentive.

The final response rate for the RN survey was 26%. This reflects a growing trend in survey nonresponse (National Research Council, 2013). To evaluate for potential response bias, Aiken and colleagues completed an additional non-responder survey on a random subsample of 1,400 non-responders, achieving an 87% response rate. These individuals received a shorter survey, more intensive attempts to contact participants, more reminders, and a cash incentive. This double-sample approach is considered to be the gold standard for assessing non-response bias (Valliant, Dever, & Kreuter, 2013). There were no significant differences in the work environment measures between long-term care nurse responders and non-responders.

**Figure 3.1** shows how the subset of nursing home nurses was identified for this study. Non-hospital nurses in the survey were asked to specify the setting in which they worked and write in the name and address of their employer. From this, I created a preliminary dataset of 2,036 respondents who indicated they worked in long-term care. I then reviewed each respondent’s entry to verify the employer’s name and address, and cross-matched this against a list of CMS-certified nursing homes. When the employer matched a facility on that list, I assigned the CMS provider ID number to the nurse respondent. Employer names and addresses were verified as needed by online searches and/or phone calls. Of the 2,036 preliminary respondents, 1,552 were linked to nursing homes with provider IDs. 484 respondents were excluded for reasons shown in Figure 3.1. An additional 62 respondents from the parent survey indicated that they worked
in a setting other than long-term care, but their employer was verified to be a CMS-certified nursing home. This resulted in a total of 1,614 respondents linked to nursing homes with CMS provider IDs. APNs were excluded from the sample because they received a different measure of the work environment than the Practice Environment Scale of the Nursing Work Index (PES-NWI). After duplicate research IDs were removed, the final sample consisted of a total of 1,540 RN respondents whose employers were CMS-certified nursing homes. All RNs in the nursing home were included in the sample, regardless of position, since even RNs working in non-staff nurse roles such as
supervisors, directors of nursing, and MDS coordinators (nurses who complete the MDS) have influence over direct and indirect patient care activities.

These 1,540 nursing home RNs were employed by 1,008 nursing homes across the four states, and represented 2.6% of the parent survey’s RN respondents. This is similar to the proportion of RNs who work in nursing homes across the U.S. (U.S. Department of Health and Human Services Health Resources and Services Administration, 2010). Of the 1,008 nursing homes, 245 facilities had at least two respondents who completed the PES-NWI, and those were distributed across the four states as follows: CA 23 (9.4%), FL 40 (16.3%), NJ 35 (14.3%), PA 147 (60.0%). The large concentration of nursing homes with multiple respondents in PA is likely due to three factors. First, PA had the most respondents, which may be due to some regional association since the study was conducted out of the University of Pennsylvania. Second, nursing home RN staffing requirements vary by state, and of the four states, PA has the strictest staffing requirements, and CA the least (Harrington, 2010). Third, the size and number of nursing homes vary by state. CA has many more facilities, but they tend to be smaller, whereas NJ, PA, and FL have fewer facilities that are generally larger. So CA has the fewest RNs per nursing home employed across a larger number of facilities, whereas PA has the most RNs per nursing home, employed across a smaller number of facilities. Thus, using a state-wide random sample of nurses, one is most likely to find nursing homes with multiple respondents in PA.

Of the 1,540 RN respondents, 311 did not complete the PES-NWI but still completed other portions of the survey. For the purposes of computing the nursing
home-level measure of the work environment, only nursing homes that had at least 2
respondents with complete data on the PES-NWI were used, for a total of 245 nursing
homes. Respondents who did not complete the PES-NWI were slightly older, less likely
to report English as their primary language, and more likely to work in a position other
than staff RN or nurse manager/administrator compared to respondents who did complete
the PES-NWI. No statistically significant differences in the nurse outcomes of interest
were found between respondents with and without missing PES-NWI data, however.
This suggests that, despite minor demographic difference between the two groups, there
was no response bias to suggest that missingness was related to the primary variables of
interest.

**Nursing home data.** Nursing home organizational characteristics were obtained
from LTCfocus, which pulls data from MDS and CASPER. This included information
on ownership structure, chain membership, staffing, Medicare and Medicaid census, case
mix, and provided services. **Table 3.1** shows a comparison of organizational
characteristics for nursing homes in the study sample compared to all CMS-certified
nursing homes in the four states. Sample nursing homes tended to be larger, which was a
function of larger facilities employing more nurses and therefore having a higher
probability of their employees being selected in a random state-wide sample of nurses.
Sample nursing homes were also less likely to be for profit, which may be due to the
sample being dominated by facilities in PA, where for profit facilities are less common
than in the three other states. There was a slight difference in average Medicare census
between sample nursing and all nursing homes, but no difference in overall case mix, and
no difference in average Medicaid census. There was no difference in average RN staffing, but sample nursing homes did have slightly lower staffing of licensed practical nurses (LPNs) and certified nursing assistants (CNAs). Again, this appeared to be a function of state: CA facilities on average employ the highest number of LPNs and second-to-highest number of CNAs across the four states, but are only minimally represented in the sample. When LPN and CNA staffing for sample nursing homes was

<table>
<thead>
<tr>
<th></th>
<th>Sample nursing homes (N=245)</th>
<th>All nursing homes (N=2,913)</th>
<th>p-value¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership, n(%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For profit</td>
<td>124 (50.6%)</td>
<td>2,105 (72.3%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Non profit or government</td>
<td>121 (49.4%)</td>
<td>808 (27.7%)</td>
<td></td>
</tr>
<tr>
<td>Member of a chain, n(%)</td>
<td>132 (53.9%)</td>
<td>1,551 (53.2%)</td>
<td>.85</td>
</tr>
<tr>
<td>Bed size, n(%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small (&lt; 100 beds)</td>
<td>66 (26.9%)</td>
<td>1,308 (44.9%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Mid-size (100-200 beds)</td>
<td>130 (53.1%)</td>
<td>1,396 (47.9%)</td>
<td></td>
</tr>
<tr>
<td>Large (&gt; 200 beds)</td>
<td>49 (20.0%)</td>
<td>209 (7.2%)</td>
<td></td>
</tr>
<tr>
<td>State, n(%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California</td>
<td>23 (9.4%)</td>
<td>1,183 (40.6%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Florida</td>
<td>40 (16.3%)</td>
<td>680 (23.3%)</td>
<td></td>
</tr>
<tr>
<td>New Jersey</td>
<td>35 (14.3%)</td>
<td>358 (12.3%)</td>
<td></td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>147 (60.0%)</td>
<td>692 (23.8%)</td>
<td></td>
</tr>
<tr>
<td>Payer mix, mean (SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% primary payer Medicaid</td>
<td>56.2 (25.1)</td>
<td>56.8 (25.7)</td>
<td>.75</td>
</tr>
<tr>
<td>% primary payer Medicare</td>
<td>13.7 (12.1)</td>
<td>17.6 (16.2)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Average RUG score (case mix)</td>
<td>1.2 (0.3)</td>
<td>1.2 (0.3)</td>
<td>1.00</td>
</tr>
<tr>
<td>Staffing measures, mean (SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RN hours per resident day</td>
<td>0.64 (0.37)</td>
<td>0.60 (0.64)</td>
<td>.13</td>
</tr>
<tr>
<td>LPN hours per resident day</td>
<td>0.82 (0.40)</td>
<td>0.93 (0.49)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CNA hours per resident day</td>
<td>2.46 (0.53)</td>
<td>2.57 (0.67)</td>
<td>.003</td>
</tr>
</tbody>
</table>

¹For categorical variables (ownership, chain, bed size, and state), the p-value of the Pearson chi-squared statistic is shown. For continuous variables (payer mix, case mix, and staffing measures), the p-value of a two sample two-sided t-test comparing means for good vs. poor work environments is shown.
compared to all facilities in FL, PA, and NJ only (CA excluded), there were no statistically significant differences.

**Sample**

For Aim 1, the final sample consisted of 245 CMS-certified nursing homes in CA, FL, NJ, and PA. Nursing homes were included in the sample if there were at least 2 RN respondents for the facility who had completed the PES-NWI on the nurse survey. Sample size varied by outcome based on availability of reported outcomes data for facilities (pressure ulcers = 222; antipsychotics = 230; readmissions = 245; hospitalizations per resident year = 244; five-star rating = 245).

For Aim 2, the sample included 692 RNs employed in the above 245 CMS-certified nursing homes. All RN respondents employed by the facility were included in the nurse sample, regardless of whether they completed the PES-NWI, as long as they provided data on the outcome of interest. Again, sample size varied by outcome based on availability of nurse-reported outcome & covariate data (job dissatisfaction = 656 RNs in 244 nursing homes; intent to leave = 663 RNs in 245 nursing homes; retention = 674 RNs in 245 nursing homes; burnout = 577 RNs in 245 nursing homes; missed care = 674 RNs in 245 nursing homes).

**Major Study Variables**

**Nurse Work Environment**

Work environment, the primary independent variable, was measured with the 31 item PES-NWI (Lake, 2002, 2007). This instrument contains 5 subscales: (1) nurse participation in organizational affairs; (2) nursing foundations for quality of care; (3)
nurse manager ability, leadership, and support of nurses; (4) staffing and resource adequacy; and (5) collegial nurse-physician relationships. Nurses were asked to report the degree to which various organizational features were present in their work setting, using a 4 point Likert scale ranging from strongly disagree to strongly agree. Mean scores for each subscale were determined, and then these were averaged to create a composite measure. Scores ranged from 1 to 4, with higher scores indicating better work environments. Nurses’ responses on the 5 subscales were aggregated to the nursing home level to create a continuous organizational-level measure of the work environment (Rousseau, 1985; Verran, Gerber, & Milton, 1995). The continuous measure was then transformed into a 3 category variable such that nursing homes in the bottom 25 percent were categorized as having “poor” work environments, the middle 50 percent “average” work environments, and the upper 25 percent “good” work environments.

The PES-NWI has been previously validated in the nursing home setting, with internal consistency coefficients (Cronenbach’s α) found to be highly internally consistent for both the composite score (α = 0.95), as well as each of the 5 subscales (α = 0.83-0.89) (Flynn et al., 2010). Additionally, intraclass correlation coefficients demonstrated good agreement among nurses within nursing homes for both the composite score (0.68) and the subscales (0.55-0.75). This validation process was repeated for the current study and is discussed in the analytic approach section. The PES-NWI can be found under Section D, Question 1 in the nurse survey.
**Patient Outcomes (Aim 1)**

The dependent variables in Aim 1 were facility-level patient outcomes extracted from Nursing Home Compare and LTCfocus. The pressure ulcer, antipsychotic, and five-star measures came from Nursing Home Compare (Centers for Medicare and Medicaid Services, 2017a; RTI International, 2016) while the 30 day hospital readmission and hospitalizations per resident year measures came from LTCfocus (Brown University School of Public Health, 2018). CMS began reporting a 30 day hospital readmission measure in Nursing Home Compare in April 2016 (Abt Associates, 2016), but since this was after the time period in which the nurse survey was completed, I opted to use the LTCfocus readmission measure which was available for 2015. The key difference between the two hospitalization measures is that the 30 day readmission measure only captures rehospitalization for new admissions to the nursing home, whereas the hospitalizations per resident year measure captures all hospitalizations from the facility for both short- and long-stay residents. The latter gives a better indication of how the facility is able to manage acute illness for its general patient population. **Table 3.2** contains a summary of how each of these measures is reported in the two datasets. More detailed descriptions of the methodology can be found in the Nursing Home Compare technical user’s guides (Abt Associates, 2016; RTI International, 2016) and in the LTCfocus data dictionary available at [http://ltcfocus.org/](http://ltcfocus.org/).
<table>
<thead>
<tr>
<th>Variable</th>
<th>Data Source</th>
<th>Details</th>
<th>Variable type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nursing Home Compare Measures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of high-risk long-stay residents with pressure ulcers</td>
<td>MDS</td>
<td>Stage II-IV pressure ulcers in residents who are impaired in bed mobility or transfer, who are comatose, or who suffer from malnutrition. Clinical exclusions: pressure ulcer first observed on admission or readmission to the nursing home</td>
<td>Continuous</td>
</tr>
<tr>
<td>Percent of long-stay residents who received an antipsychotic medication</td>
<td>MDS</td>
<td>Antipsychotic medication received within the target assessment period Clinical exclusions: resident has a diagnosis of schizophrenia, Tourette’s syndrome, or Huntington’s disease</td>
<td>Continuous</td>
</tr>
<tr>
<td>Five-Star rating (overall rating)</td>
<td>Computed by CMS using MDS &amp; CASPER</td>
<td>CMS determines an overall quality rating of 1 to 5 stars annually based on facility performance on 3 domains, each of which has its own five-star rating: (1) Health inspections: based on number, scope, &amp; severity of deficiencies identified during 3 most recent annual inspection surveys, as well as substantiated findings from most recent 36 months of complaint investigations (2) Staffing: based on case-mix adjusted RN hours per resident day and total staffing hours (RN+LPN+CNA) as reported in CASPER. Facilities must achieve at least 4 stars for both RN and total staffing measures to receive an overall star rating of 4 or higher. (3) Quality Measures: based on facility performance on 11 short-stay and long-stay quality measures</td>
<td>Categorical: 1-5 stars Ratings were grouped into 3 categories for analysis: 1/2 = poor, 3 = average, 4/5 = good</td>
</tr>
<tr>
<td><strong>LTCfocus Measures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of new admissions readmitted to a hospital within 30 days of nursing home admission</td>
<td>MDS</td>
<td>Percent of total admissions discharged to an acute hospital within 30 days of nursing home admission. Total admissions were defined as the total number of admissions to the facility for persons age 55 and older who entered from a hospital and did not have an MDS assessment from another facility in the previous 100 days. Converted from proportion to percent for analysis. Unadjusted observed rate.</td>
<td>Continuous</td>
</tr>
<tr>
<td>Hospitalizations per resident Year</td>
<td>MDS</td>
<td>MDS assessments were used to determine the number of nursing home days for all residents in the facility during the calendar year. This number of nursing homes days was then divided by 365 to establish the number of resident years. MDS discharge assessments were used to count how many hospitalizations occurred directly from the nursing home during the calendar year.</td>
<td>Continuous</td>
</tr>
</tbody>
</table>
The above MDS measures are all unadjusted, meaning that they reflect the facility-level observed outcome rate without any adjustment with patient-level covariates. CMS has built a limited number of clinical exclusions into the pressure ulcer and antipsychotic measures so that nursing homes are not held accountable for outcomes that are out of their control (e.g. outcomes that are present on admission to the facility or clinically unavoidable). These exclusions are detailed in the table above. CMS also excludes residents who have missing data on any of MDS items used to construct the measures (RTI International, 2016).

The methodology used by CMS to determine five-star ratings does incorporate risk adjustment within the 3 domains used to calculate the overall rating. Health inspection scores are based on relative performance of facilities within a state, such that nursing homes with the top 10 percent scores receive 5 stars, the middle 70 percent receive 2, 3, or 4 stars with an equal number in each category, and the bottom 20 percent receive 1 star. The staffing score is based on case-mix adjusted staffing ratios where

\[
\text{Hours adjusted} = \left( \frac{\text{Hours reported}}{\text{Hours expected}} \right) \times \text{Hours national average}
\]

The quality measure score is based on several quality measures that are similarly adjusted by the national average so that:

\[
\text{Rate adjusted} = \left( \frac{\text{Rate observed}}{\text{Rate expected}} \right) \times \text{Rate national average}
\]

The pressure ulcer and antipsychotic measures are used in calculating the quality measure score, but those measures are unadjusted. CMS uses risk adjustment as a way to level the playing field among providers for the purposes of rating them. However, the critique of this risk adjustment method is that a measure becomes a function of not just the facility’s
own metric, but also a national average. This approach assumes that all facilities are similar with the same average performance (Mukamel, Glance, Dick, & Osler, 2010), but what has been found is that adjusted rates for providers with small volumes of patients have disproportionate shrinkage to the national average, and significantly underestimate observed rates in these instances (Mukamel et al., 2010; Silber et al., 2010). That is, for small volume providers, the adjusted rate becomes more a function of the national average than the provider’s own performance. With these limitations known, the five-star rating system is still the best global measure available currently to measure overall quality in nursing homes (Castle & Ferguson, 2010).

**Nurse outcomes (Aim 2)**

The dependent variables in Aim 2 were individually reported nurse outcomes from the nurse survey. **Table 3.3** shows each of the nurse outcomes with the corresponding question(s) on the survey. Nurse outcomes were determined from all nurses employed in sample nursing homes who responded to the corresponding question, regardless of whether they completed the PES-NWI.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Corresponding question(s) on the nurse survey</th>
<th>Value</th>
<th>Variable format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job dissatisfaction</td>
<td>How satisfied are you with your primary job?</td>
<td>4 point Likert scale ranging from 1=very satisfied to 4=very dissatisfied</td>
<td>Dichotomous 0 = satisfied (1 or 2) 1 = dissatisfied (3 or 4)</td>
</tr>
<tr>
<td>Intent to leave</td>
<td>Do you plan to be with your current employer one year from now?</td>
<td>Yes/No</td>
<td>Dichotomous 0 = Yes 1 = No</td>
</tr>
</tbody>
</table>

(continued)
Table 3.3. Nurse outcome measures (continued)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Corresponding question(s) on the nurse survey</th>
<th>Value</th>
<th>Variable format</th>
</tr>
</thead>
</table>
| Burnout        | Emotional Exhaustion subscale of the Maslach-Burnout Inventory, a highly validated and widely cited measure of burnout (Maslach & Jackson, 1981). Respondents are asked to rate how often they experience 9 different feelings of emotional exhaustion. | 9 items each asked on a 7 point Likert scale ranging from 1=never to 7=every day. Higher total composite scores correspond with higher burnout. Nurses are classified as burned out if their score is equal to or greater than 27, the published average for workers in health professions (Maslach & Jackson, 1986). | Dichotomous 0 = no burnout (score < 27)  
1 = burnout (score ≥ 27)                                    |
| Retention      | How many years have you worked in your current employer?                                                         | Real number                                                                                                                                                                                         | Dichotomous 0 = employed less than 3 years  
1 = employed 3 or more years                                             |
| Missed care    | On the most recent shift/day you worked, which of the following activities were necessary but left undone because of time constraints? (Mark all that apply) | 14 items: 1) adequate patient surveillance; 2) oral hygiene/mouth care; 3) comfort/talk with patients; 4) adequately document nursing care; 5) administer medications on time; 6) treatments & procedures; 7) prepare patients & families for discharge; 8) develop or update patient plan of care; 9) skin care; 10) pain management; 11) teach/counsel patients & family; 12) coordinate patient care; 13) ambulation or range of motion; 14) participate in team discussions of patients’ care | Dichotomous 0 = 0 tasks left undone  
1 = 1 or more tasks left undone  
Sub-analysis done with clinical tasks (items 1, 2, 5, 6, 9, 10, 13)  
0 = 0 of these tasks left undone  
1 = 1 or more of these tasks left undone |

Covariates

Nursing home organizational characteristics (Aims 1 & 2). Organizational characteristics were chosen to be included in the final models based on review of the literature and examination of bivariate regressions and correlations to determine which
Table 3.4. Covariates – measurement of nursing home organizational characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariates for all regression models</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For profit status</td>
<td>CASPER</td>
<td>Dichotomous variable indicating whether the nursing home was for profit where 0 = not for profit or government and 1 = for profit</td>
</tr>
<tr>
<td>Chain membership</td>
<td>CASPER</td>
<td>Dichotomous variable indicating whether the nursing home was owned or leased by a multi-facility (chain) organization, where 0 = not part of a chain and 1 = part of a chain</td>
</tr>
<tr>
<td>Medicaid census</td>
<td>CASPER</td>
<td>Continuous variable indicating the proportion of facility residents whose primary support was Medicaid at the time of annual survey</td>
</tr>
<tr>
<td>Medicare census</td>
<td>CASPER</td>
<td>Continuous variable indicating the proportion of facility residents whose primary support was Medicare at the time of annual survey</td>
</tr>
<tr>
<td>RN skill mix</td>
<td>CASPER</td>
<td>Continuous variable indicating the ratio of the number of RN full time equivalents (FTEs) divided by the number of RN FTEs plus LPN FTEs. Data are cleaned in LTCfocus when the reported FTEs are implausible, and verified against facility data from prior years.</td>
</tr>
<tr>
<td>Additional covariate used for pressure ulcers, antipsychotics, and five-star rating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CNA staffing</td>
<td>CASPER</td>
<td>Continuous variable indicating CNA hours per resident day. LTCfocus computes this by converting FTEs into hours, and then dividing the total number of CNA hours by the number of residents in the facility. Data are cleaned in LTCfocus when the reported FTEs are implausible, and verified against facility data from prior years.</td>
</tr>
</tbody>
</table>

variables were most consistently associated with the primary independent and dependent variables of interest. Table 3.4 contains a summary of these covariates. All regression models in Aims 1 and 2 controlled for the following core set of organizational covariates: for profit status, chain membership, Medicaid census, Medicare census, and RN skill mix (proportion of total licensed nursing hours provided by RNs). Sensitivity analyses were done to test for differences between controlling for RN and LPN staffing hours separately compared to RN skill mix as a single covariate (a function of the two staffing measures). No significant differences were found across models and thus it was decided to use RN skill mix as a single covariate as it was more parsimonious. Additionally, CNA staffing was controlled for in the models for pressure ulcers and antipsychotics because
conceptually, CNAs play significant roles in pressure ulcer prevention and behavior management in nursing homes. In the analysis, however, CNA staffing showed poor correlation with both outcomes (r < 0.1), though it was significantly associated with antipsychotics in the bivariate regressions. CNA staffing was also controlled for in the five-star rating models because that measure is used along with RN and LPN staffing to compute the five-star staffing subscale, which factors into the overall rating for a nursing home.

**Nursing home patient characteristics (Aim 1).** In addition to the structural organizational characteristics above, additional covariates reflecting patient census characteristics were incorporated into models for three outcomes. These variables are summarized in Table 3.5. The pressure ulcer measure was already restricted by CMS to high risk residents with no wound present on admission to the facility, so no further nursing home level adjustment was made for that outcome. The antipsychotic measure

| Table 3.5. Covariates — measurement of nursing home patient characteristics |
|-----------------------------|-----------------|--------------------------------------------------|
| Variable                  | Data Source | Description                                                                 |
| Five-star rating & pressure ulcers |               | No patient characteristics added |
| Antipsychotics            |              |                                    |
| Presence of Alzheimer’s unit | CASPER   | Dichotomous variable indicating whether the nursing home had an Alzheimer’s special care unit where 0 = no unit and 1 = unit |
| Hospital readmissions & hospitalizations per resident year | | |
| Case mix index               | MDS          | Continuous variable representing the average Resource Utilization Group Nursing Case Mix Index, (a measure of the relative intensity of care of different nursing home populations) for all residents present on the 1st Thursday in April. |
| Accepts ventilator-dependent residents | MDS | Dichotomous variable indicating whether the nursing home had any residents present on the 1st Thursday in April who were on a ventilator, based on the most recent MDS assessment. 0 = no ventilator-dependent residents, 1 = one or more ventilator residents present |
was similarly limited by CMS to a select population of residents without schizophrenia, Tourette’s syndrome, or Huntington’s disease, however I did add an additional covariate in that model indicating whether the facility had an Alzheimer’s special care unit. This was to account for the fact that nursing homes with these units are likely to accept individuals with dementia who have more severe symptoms of psychosis. For both of the hospitalization measures, I incorporated two covariates to control for overall facility patient acuity. These covariates were overall case-mix using the average Resource Utilization Group Nursing Case Mix Index (RUGS NCMI), and an indicator of whether the facility accepted ventilator-dependent patients.

**Nurse characteristics (Aim 2).** Nurse characteristics came from the nurse survey and are summarized in Table 3.6. Again, these were chosen based on a review of the literature and were determined through examination of correlations and bivariate regressions to be related to the independent and dependent variables of interest.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>RN4CAST</td>
<td>Discrete variable (integer)</td>
</tr>
<tr>
<td>Gender</td>
<td>RN4CAST</td>
<td>Dichotomous variable indicating 0 = female, 1 = male</td>
</tr>
<tr>
<td>Race</td>
<td>RN4CAST</td>
<td>Dichotomous variable indicating 0 = white, 1 = non-white</td>
</tr>
<tr>
<td>Native language is English</td>
<td>RN4CAST</td>
<td>Dichotomous variable indicating 0 = native language is not English, 1 = native language is English</td>
</tr>
<tr>
<td>Position</td>
<td>RN4CAST</td>
<td>Dichotomous variable indicating 0 = position other than direct care staff RN, 1 = direct care staff RN</td>
</tr>
<tr>
<td>Years of RN experience</td>
<td>RN4CAST</td>
<td>Discrete variable (integer)</td>
</tr>
</tbody>
</table>
Summary. A summary of all covariates for the five patient outcomes and five nurse outcomes is shown in Table 3.7.

<table>
<thead>
<tr>
<th>Table 3.7. Summary of covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>Aim 1: Patient outcomes</td>
</tr>
<tr>
<td>Five-star rating (overall rating)</td>
</tr>
<tr>
<td>Percent of high-risk long-stay residents with pressure ulcers</td>
</tr>
<tr>
<td>Percent of long-stay residents who received an antipsychotic medication</td>
</tr>
<tr>
<td>Percent of new admissions readmitted to a hospital within 30 days of nursing home admission</td>
</tr>
<tr>
<td>Hospitalizations per resident year</td>
</tr>
<tr>
<td>Aim 2: Nurse outcomes</td>
</tr>
<tr>
<td>Job dissatisfaction</td>
</tr>
<tr>
<td>Intent to leave</td>
</tr>
<tr>
<td>Burnout</td>
</tr>
<tr>
<td>Retention</td>
</tr>
<tr>
<td>Missed care</td>
</tr>
</tbody>
</table>

Analytic Approach

Aim 1

The unit of analysis in Aim 1 was the nursing home. Cross-sectional data were used to examine the association of nurse work environment with each of the five nursing home-level patient outcomes, controlling for organizational and patient census characteristics. Nurse survey data were merged with Nursing Home Compare and
LTCfocus using common CMS provider IDs. This resulted in a dataset with facility-level measures of quality outcomes, nursing factors, patient census data, and organizational characteristics. Variable distributions were examined and it was determined that no transformation of the variables was required (Emerson & Stoto, 1983).

The number of RN respondents with complete data on the PES-NWI ranged from 2 to 8 in the 245 nursing homes with multiple respondents, with a mean of 2.51 respondents (SD 0.91) per facility. Compared to total RN FTEs per nursing home reported in CASPER, this represented between a 4.0% and 78.7% sample of total employed RNs per nursing home, with a mean of 20.4% (SD 11.3%). Intraclass correlation coefficients (ICC) of both the composite PES-NWI score and each of its subscales were computed to examine internal consistency among the nurse respondents and determine the minimum threshold for number of nurse respondents per nursing home. The ICC(1) measures the perceptual agreement of the individual nurse’s PES-NWI score with the aggregated nursing home score (Glick, 1985) and the ICC(2) measures the likelihood of obtaining similar mean scores if more nurse samples were drawn repeatedly from the same facility (Shrout & Fleiss, 1979). A summary of computed ICC(1) and ICC(2) for samples limited to nursing homes with 2, 3, and 4 respondents is shown in Table 3.8.

<table>
<thead>
<tr>
<th>Minimum Number of RN respondents</th>
<th>Number of nursing homes</th>
<th>ICC(1)</th>
<th>ICC (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>245</td>
<td>0.11</td>
<td>0.24</td>
</tr>
<tr>
<td>3</td>
<td>77</td>
<td>0.11</td>
<td>0.31</td>
</tr>
<tr>
<td>4</td>
<td>33</td>
<td>0.03</td>
<td>0.11</td>
</tr>
</tbody>
</table>
Regardless of where the minimum threshold of respondents was set, the ICC statistics were below established criteria designating coefficients of 0.60 and higher as having good clinical significance (Cicchetti, 1994). This was primarily due to the small number of respondents per nursing home. Thus, I decided to use all nursing homes with at least 2 respondents (n=245), since restricting to more respondents significantly reduced the nursing home sample size, without any improvement in mean rater reliability. To compensate for the low internal consistency, I weighted the aggregated work environment score in regression models based on the number of respondents per nursing home, giving greater weight to facilities with more respondents (StataCorp, 2013; Winship & Radbill, 1994). This was accomplished using analytic weights which are inversely proportional to the variance of an observation, i.e., the variance of the \( i \)th nursing home is assumed to be \( \sigma^2/w_i \), where \( w_i \) are the weights (StataCorp, 2013).

Additionally I controlled for the number of respondents with complete data on the PES-NWI in all models.

Multivariate and multilevel linear regression models were used to examine the effect of nurse work environment on each of the four primary patient outcomes (pressure ulcers, antipsychotics, hospital readmissions, and hospitalizations per resident year). First, unconditional models were created to predict each outcome solely as a function of nursing homes, in order to determine baseline variation for comparison to later models. Second, simple bivariate models were generated to estimate the relationship between nurse work environment and each of the outcome measures. Finally, subsequent models
incorporating nursing home patient and organizational characteristics were built, until the final model was achieved:

\[ y_i = \alpha + k_i x_{ki} + H_i' \beta_H + P_i' \beta_P + \varepsilon_i, \quad \varepsilon_i \sim N(0, \sigma^2/w_i) \]

where \( y_i \) represents the percentage of patients with the outcome for nursing home \( i \) (except for hospitalizations per resident year in which \( y_i \) is the hospitalizations per resident year for nursing home \( i \)), \( \alpha \) is the intercept term in the regression, \( k_i \) is the effect of the composite PES-NWI, \( x_{ki} \) is the composite PES-NWI score for nursing home \( i \), \( H'_i \) is a vector of structural organizational characteristics for nursing home \( i \), \( \beta_H \) is a vector of coefficients representing the effect of structural organizational characteristics for nursing home \( i \), \( P'_i \) is a vector of patient census characteristics for nursing home \( i \), \( \beta_P \) is a vector representing the effect of patient census characteristics for nursing home \( i \), \( \varepsilon_i \) is a residual error for unobserved nursing home characteristics of nursing home \( i \), and \( w_i \) is the weight. Models were estimated using ordinary least squares, and repeated for each outcome with both the overall PES-NWI and each of its subscales. Weighted models were compared against unweighted models at each interval, and were found to be qualitatively similar. Weighted models are reported as the final outputs.

Multinomial logistic regression models were used to examine the effect of work environment on five-star rating. The 5 star categories were collapsed into 3 categories for ease of interpretation: 1/2 stars (poor), 3 stars (average), and 4/5 stars (good). The 1/2 star (poor) category was used as the base outcome to compare the other two categories against. The same iterative model building process as above was used until the following final set of equations were reached:
\[
\log\left(\frac{\pi_{istar45}}{\pi_{istar12}}\right) = \alpha_{istar45|star12} + k_{istar45|star12}x_{ki} + H'_{i}\beta_{H|istar45|star12} + P'_{i}\beta_{P|star45|star12}
\]

\[
\log\left(\frac{\pi_{istar3}}{\pi_{istar12}}\right) = \alpha_{istar3|star12} + k_{istar3|star12}x_{ki} + H'_{i}\beta_{H|istar3|star12} + P'_{i}\beta_{P|star3|star12}
\]

where \(\pi_{istar}\) is the probability that nursing home \(i\) falls into a specified star category, \(\alpha\) is the intercept term in the regression for the comparison star category vs. the base category, \(k\) is the effect of the composite PES-NWI for the comparison star category vs. the base category, \(x\) is the composite PES-NWI score for nursing home \(i\) for the comparison star category vs. the base category, \(H'\) is a vector of structural organizational characteristics for nursing home \(i\) for the comparison star category vs. the base category, \(\beta\) is a vector of coefficients representing the effect of structural organizational characteristics for nursing home \(i\) for the comparison star category vs. the base category, \(P'\) is a vector of patient census characteristics for nursing home \(i\) for the comparison star category vs. the base category, and \(\beta\) is a vector representing the effect of patient census characteristics for nursing home \(i\) for the comparison star category vs. the base category.

**Aim 2**

In Aim 2, robust multivariate logistic regression models were used with the same cross-sectional dataset to examine the effects of nurse work environment on nurse burnout, job satisfaction, intent to leave, retention, and missed care controlling for nurse characteristics and nursing home organizational characteristics. The unit of analysis was the nurse. Preliminary models were generated to examine the overall work environment, using the composite PES-NWI score. First, unconditional models were generated to predict each of the nurse outcomes as solely a function of the nurses themselves, to determine baseline variation for comparison to subsequent models. Next, simple
bivariate models were generated to estimate the relationship between overall work environment and each of the nurse outcomes. Finally, subsequent models incorporating nurse characteristics and nursing home organizational characteristics were created, until the final model was achieved:

\[
\log \left( \frac{P_{ij}}{1-P_{ij}} \right) = \alpha + k_j x_{kj} + H' \beta H + R' \beta R
\]

where \( P \) is the probability of a binary outcome for nurse \( i \) in nursing home \( j \), \( \alpha \) is the intercept term in the regression, \( k_j \) is the effect of the composite PES-NWI, \( x_{kj} \) is the composite PES-NWI score for nursing home \( j \), \( H'j \) is a vector of structural organizational characteristics for nursing home \( j \), \( \beta H \) is a vector of coefficients representing the effect of structural organizational characteristics for nursing home \( j \), \( R'i \) is a vector of nurse characteristics for nurse \( i \) in nursing home \( j \), and \( \beta R \) is a vector representing the effect of nurse characteristics. This process was repeated with each nurse outcome for both the overall PES-NWI and each of its subscales.

**Power**

**Aim 1**

The minimum detectable effect (MDE) calculation for the linear multiple regression analysis of this study assumed 0.80 power, alpha=0.05, and two-sided tests. For Aim 1, the sample size was the number of nursing homes with at least 2 RN respondents and complete data on the outcome measure. The number of facilities with complete data on the patient outcome measures ranged from 222 (pressure ulcers) to 245 (readmissions and five-star ratings). For the purposes of calculating the MDE, the smallest sample size was used. The largest number of covariates across the 4 outcome
measures was 8, so this was used to calculate the MDE. With a sample size of 222 nursing homes, the study had 80% power to detect a Cohen’s $f^2$ of 0.037, representing a small to medium effect size (Cohen, 1988).

**Aim 2**

For Aim 2, the MDE was calculated on the basis of the job dissatisfaction variable because this outcome had the most information from the literature to support its calculation. Based on prior work by Choi et al. (2012), I assumed that the nursing home organizational characteristics and nurse characteristics would account for 24% of the variance in the nurse outcome measure. McHugh et al. (2011) previously found job dissatisfaction rates of 27% among nursing home nurses. With a sample size of 692 nurses – the number of nurses employed in nursing homes with at least 2 respondents who completed the PES-NWI, the study had 80% power to detect an odds ratio of 1.32, which represents a small effect size (Hsieh, Bloch, & Larsen, 1998). Power analysis was done using PASS 11 (Hintze, 2011).

**Human Subjects**

This study was a secondary analysis of data that had been stripped of all identifying information. There was no primary data collection. No names, licensure information, social security numbers, or other personally identifiable information were available to the researcher. While nurse participants in the parent study were selected based on state nurse licensure status, and contacted via mail address and email provided from their state’s board of nursing database, their returned surveys were identifiable only
by unique research ID numbers, and are available to the researcher only in this de-
identified form.

Nurses were asked to provide their employer’s name and address, however this
information was only used to aggregate their responses with those of other nurses
working for the same organization. The purpose of this was so that the researcher could
identify the organizations’ CMS provider ID numbers in order to link to Nursing Home
Compare to obtain data on patient outcomes. Since the parent study surveyed RNs only,
and nursing homes may only staff a small number of RNs, it is possible that a nurse could
be inadvertently identified just by completing the survey. However, all data has been
maintained on confidential and secure servers maintained by the University of
Pennsylvania School of Nursing, and results are being published in aggregate form only,
with no identifiable employer information. Also, nurses were randomly selected from
their state’s board of nursing registry, not through their employer. So employers have no
knowledge of whether any of their employees received or participated in the survey.
Also, the request to provide employer information was voluntary, so nurses had the
option of leaving this question blank if they chose. Patient outcomes data are reported in
aggregate at the facility level in Nursing Home Compare and LTCfocus, so no protected
health information was available to the researcher.

The parent study, Panel Study of Effects of Changes in Nursing on Patient
Outcomes (IRB protocol 819470) received approval by the University of Pennsylvania
IRB. This study continues to undergo continuing review and was most recently approved
on January 3, 2018. Additional IRB approval for this secondary data analysis (IRB
protocol 829203) was obtained on February 12, 2018. The study was classified as exempt (category 4) for non-human subjects research.

**Summary**

This study explored the empirical relationships between nurse work environment and patient and nurse outcomes in nursing homes. Nursing homes continue to struggle with issues of care quality and safety, and RNs have significant influence over these domains. But staff turnover is high in many nursing homes, resulting in fragmented care that only further contributes to poor quality. This study brought together unique and comprehensive multistate nurse survey data with Nursing Home Compare and LTCfocus, in order to explore whether nurse work environment is an organizational characteristic that influences quality outcomes in nursing homes. I then explored the association of the work environment with nurse job satisfaction, burnout, intent to leave one’s job, retention, and missed care. In developing a better understanding of these relationships, I hope to learn how the work environment could be targeted for interventions to reduce turnover and improve the quality and safety of care provided in nursing homes.
CHAPTER 4: RESULTS

Introduction

The purpose of this study was to examine the empirical relationship between nurse work environment and both patient and nurse outcomes in nursing homes. In Aim 1, I explored the effects of work environment on four nursing-home level patient outcomes: pressure ulcer prevalence among high-risk long-stay residents, antipsychotic medication use among long-stay residents, 30 day hospital readmission for new admissions to the nursing home, and hospitalizations per resident year for all residents in the nursing home. Additionally, I looked at the relationship of work environment with the Centers for Medicare and Medicaid Services’ (CMS) five-star rating, a measure of overall quality for nursing homes. In Aim 2, I examined the effects of work environment on four primary nurse outcomes: job dissatisfaction, burnout, intent to leave one’s job, and retention. I also looked at how work environment influences nurses’ likelihood of reporting that they were unable to complete necessary tasks of patient care (missed care). This chapter presents the results of these analyses. First I will describe the nursing home sample characteristics and regression results for Aim 1, then the nurse sample characteristics and regression results for Aim 2.

Aim 1

Nursing Home Sample Characteristics

Table 4.1 depicts organizational characteristics of the 245 nursing homes in the sample and shows the distribution of poor, average, and good work environments across the different organizational features. Work environments varied by ownership structure,
where for profit nursing homes were more likely to have poor work environments, and less likely to have good work environments compared to non-profit or government nursing homes, but these differences were not statistically significant. Similarly, nursing
homes that were members of a chain were more likely to have poor work environments and less likely to have good work environments compared to independently owned facilities but again, these differences were not statistically significant. Smaller facilities (< 100 beds) were more likely to have good work environments, and larger facilities (> 200 beds) were more likely to have poor work environments compared to each other, though the majority of facilities were classified as mid-size (100-200 beds). No statistically significant differences in work environments were observed across states, or based on acuity or Medicare census. Medicaid census was significant, however, with poor work environment nursing homes on average having almost 10% more Medicaid patients than good work environment homes. Staffing measures of registered nurse (RN) hours, licensed practical nurse (LPN) hours, certified nursing assistant (CNA) hours, and RN skill mix (percent of total licensed hours provided by RNs) were all on average better in nursing homes with better work environments, though CNA hours was the only measure where the differences were statistically significant.

Table 4.2 shows variation in the four primary patient outcomes across the same organizational characteristics and work environment. Pressure ulcer prevalence varied significantly across work environment and chain membership, where facilities with better work environments had fewer pressure ulcers, and chain facilities had fewer pressure ulcers compared to non-chain facilities. No other organizational characteristics were significant. Antipsychotic use varied significantly across work environment, bed size, Medicaid census, and RN skill mix. Higher antipsychotic use was found in nursing homes with poorer work environments, larger bed size, higher Medicaid census, and
Table 4.2. Variation in patient outcome measures by nursing home organizational characteristics

<table>
<thead>
<tr>
<th></th>
<th>% of long-stay high risk residents with pressure ulcers</th>
<th>% of long-stay residents who received antipsychotics</th>
<th>% of residents readmitted to a hospital within 30 days of nursing home admission</th>
<th>Number of hospitalizations per resident year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N=222)</td>
<td>(N=230)</td>
<td>(N=245)</td>
<td>(N=244)</td>
</tr>
<tr>
<td><strong>Work environment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>5.6 (3.6) .02</td>
<td>17.5 (7.3) .03</td>
<td>17.5 (6.0) .11</td>
<td>1.1 (0.5) .47</td>
</tr>
<tr>
<td>Average</td>
<td>5.2 (4.4)</td>
<td>14.9 (6.6)</td>
<td>17.4 (5.8)</td>
<td>1.1 (0.6)</td>
</tr>
<tr>
<td>Good</td>
<td>4.3 (2.7)</td>
<td>14.7 (6.5)</td>
<td>15.6 (6.9)</td>
<td>1.0 (0.6)</td>
</tr>
<tr>
<td><strong>Ownership</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For profit</td>
<td>5.5 (4.5) .07</td>
<td>15.5 (6.8) .93</td>
<td>18.4 (6.2) &lt;.001</td>
<td>1.2 (0.6) &lt;.001</td>
</tr>
<tr>
<td>Non profit or government</td>
<td>4.6 (3.0)</td>
<td>15.5 (7.0)</td>
<td>15.6 (5.8)</td>
<td>0.9 (0.5)</td>
</tr>
<tr>
<td><strong>Chain</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>4.6 (3.5) .05</td>
<td>14.8 (6.9) .09</td>
<td>17.1 (5.8) .85</td>
<td>1.2 (0.6) .004</td>
</tr>
<tr>
<td>No</td>
<td>5.7 (4.2)</td>
<td>16.3 (6.7)</td>
<td>16.9 (6.6)</td>
<td>1.0 (0.5)</td>
</tr>
<tr>
<td><strong>Bed size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small (&lt; 100 beds)</td>
<td>5.0 (5.8) .37</td>
<td>13.4 (6.5) &lt;.001</td>
<td>15.2 (7.2) .06</td>
<td>1.1 (0.7) .01</td>
</tr>
<tr>
<td>Mid-size (100-200 beds)</td>
<td>4.8 (3.0)</td>
<td>14.9 (6.7)</td>
<td>17.7 (5.5)</td>
<td>1.2 (0.5)</td>
</tr>
<tr>
<td>Large (&gt; 200 beds)</td>
<td>5.9 (3.5)</td>
<td>19.2 (6.2)</td>
<td>17.5 (5.9)</td>
<td>0.8 (0.3)</td>
</tr>
<tr>
<td><strong>Medicaid census</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High3</td>
<td>5.1 (3.2) .91</td>
<td>16.7 (7.4) .002</td>
<td>18.5 (6.4) &lt;.001</td>
<td>1.0 (0.4) .13</td>
</tr>
<tr>
<td>Low</td>
<td>5.1 (4.5)</td>
<td>14.0 (5.8)</td>
<td>15.2 (5.2)</td>
<td>1.1 (0.7)</td>
</tr>
<tr>
<td><strong>Medicare census</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High3</td>
<td>5.0 (4.1) .93</td>
<td>14.5 (5.6) .12</td>
<td>17.0 (4.8) .99</td>
<td>1.4 (0.6) &lt;.001</td>
</tr>
<tr>
<td>Low</td>
<td>5.1 (3.8)</td>
<td>15.9 (7.2)</td>
<td>17.0 (6.7)</td>
<td>0.9 (0.5)</td>
</tr>
<tr>
<td><strong>Average RUG score (case mix)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High3</td>
<td>4.9 (4.0) .34</td>
<td>15.4 (6.4) .69</td>
<td>17.2 (6.0) .60</td>
<td>1.2 (0.6) &lt;.001</td>
</tr>
<tr>
<td>Low</td>
<td>5.4 (3.6)</td>
<td>15.7 (7.5)</td>
<td>16.7 (6.3)</td>
<td>0.9 (0.4)</td>
</tr>
<tr>
<td><strong>RN hours per resident day</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High3</td>
<td>5.2 (4.3) .56</td>
<td>14.7 (7.1) .06</td>
<td>16.4 (6.8) .11</td>
<td>1.1 (0.6) .07</td>
</tr>
<tr>
<td>Low</td>
<td>4.9 (3.3)</td>
<td>16.4 (6.4)</td>
<td>17.7 (5.2)</td>
<td>1.0 (0.4)</td>
</tr>
<tr>
<td><strong>LPN hours per resident day</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High3</td>
<td>5.1 (3.7) .98</td>
<td>16.1 (7.3) .30</td>
<td>16.9 (6.6) .82</td>
<td>1.1 (0.6) .80</td>
</tr>
<tr>
<td>Low</td>
<td>5.1 (3.9)</td>
<td>15.1 (6.5)</td>
<td>17.1 (5.8)</td>
<td>1.1 (0.5)</td>
</tr>
<tr>
<td><strong>CNA hours per resident day</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High3</td>
<td>5.0 (4.0) .76</td>
<td>14.8 (6.1) .09</td>
<td>16.2 (6.6) .03</td>
<td>1.1 (0.6) .44</td>
</tr>
<tr>
<td>Low</td>
<td>5.2 (3.7)</td>
<td>16.3 (7.5)</td>
<td>17.9 (5.5)</td>
<td>1.1 (0.5)</td>
</tr>
<tr>
<td><strong>% of total licensed nurse (RN+LPN) hours per resident day provided by RNs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High3</td>
<td>5.4 (4.4) .14</td>
<td>14.7 (7.0) .03</td>
<td>16.7 (6.3) .37</td>
<td>1.1 (0.6) .15</td>
</tr>
<tr>
<td>Low</td>
<td>4.7 (2.8)</td>
<td>16.7 (6.5)</td>
<td>17.4 (5.8)</td>
<td>1.0 (0.5)</td>
</tr>
</tbody>
</table>

1 Sample sizes vary across outcomes based on availability of reported outcomes data
2 P-value of a two sample two-sided t-test is shown. For work environment, the p-value represents the difference in means between good vs. poor environments. For bedsize, the p-value represents the difference in means between large and small nursing homes.
3 "High" defined as at or above the national mean. "Low" defined as below the national mean.
National means are determined from LTCFocus data.
lower RN skill mix. Ownership structure was significant for both hospitalization measures, with for profit facilities having higher readmission rates and more hospitalizations per resident year compared to non-profit and government facilities.

Nursing homes with a higher Medicaid census had more readmissions, but there were no significant differences in hospitalizations per resident year. Facilities with a higher Medicare census and higher case mix had more hospitalizations per resident year, but no significant differences in readmissions. Neither of the hospitalization measures varied significantly across staffing measures except that nursing homes with lower CNA staffing had more readmissions.

Variation in organizational characteristics across the five-star categories is summarized in Table 4.3. Overall, nursing homes with better star ratings had better work environment, n(%)

<table>
<thead>
<tr>
<th>Work environment, n(%)</th>
<th>1 star (n=29)</th>
<th>2 stars (n=38)</th>
<th>3 stars (n=46)</th>
<th>4 stars (n=70)</th>
<th>5 stars (n=62)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>13 (44.8%)</td>
<td>16 (42.1%)</td>
<td>9 (19.6%)</td>
<td>13 (18.6%)</td>
<td>11 (17.7%)</td>
</tr>
<tr>
<td>Average</td>
<td>13 (44.8%)</td>
<td>15 (39.5%)</td>
<td>18 (39.1%)</td>
<td>41 (58.6%)</td>
<td>35 (56.5%)</td>
</tr>
<tr>
<td>Good</td>
<td>3 (10.3%)</td>
<td>7 (18.4%)</td>
<td>19 (41.3%)</td>
<td>16 (22.9%)</td>
<td>16 (25.8%)</td>
</tr>
<tr>
<td>For profit, n(%)</td>
<td>19 (65.5%)</td>
<td>18 (47.4%)</td>
<td>29 (63.0%)</td>
<td>35 (50.0%)</td>
<td>23 (37.1%)</td>
</tr>
<tr>
<td>Member of a chain, n(%)</td>
<td>18 (62.1%)</td>
<td>20 (52.6%)</td>
<td>22 (47.8%)</td>
<td>40 (57.1%)</td>
<td>32 (51.6%)</td>
</tr>
<tr>
<td>Bed size, mean (SD)</td>
<td>195.7 (96.8)</td>
<td>174.6 (147.5)</td>
<td>183.9 (124.6)</td>
<td>151.1 (102.0)</td>
<td>119.9 (73.3)</td>
</tr>
<tr>
<td>Payer mix, mean (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% primary payer Medicaid</td>
<td>65.2 (16.5)</td>
<td>62.4 (24.7)</td>
<td>63.4 (17.6)</td>
<td>55.3 (24.0)</td>
<td>44.1 (29.9)</td>
</tr>
<tr>
<td>% primary payer Medicare</td>
<td>9.7 (5.2)</td>
<td>11.1 (10.3)</td>
<td>12.8 (9.5)</td>
<td>13.7 (11.6)</td>
<td>17.7 (16.1)</td>
</tr>
<tr>
<td>Acuity measures, mean (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admissions per bed</td>
<td>2.01 (1.01)</td>
<td>2.07 (1.35)</td>
<td>2.29 (1.35)</td>
<td>2.33 (1.50)</td>
<td>2.81 (2.04)</td>
</tr>
<tr>
<td>Average RUG score (case mix)</td>
<td>1.19 (0.07)</td>
<td>1.17 (0.10)</td>
<td>1.24 (0.21)</td>
<td>1.24 (0.32)</td>
<td>1.24 (0.34)</td>
</tr>
<tr>
<td>Staffing measures, mean (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RN hours per resident day</td>
<td>0.47 (0.18)</td>
<td>0.57 (0.26)</td>
<td>0.65 (0.53)</td>
<td>0.65 (0.35)</td>
<td>0.75 (0.34)</td>
</tr>
<tr>
<td>LPN hours per resident day</td>
<td>0.90 (0.22)</td>
<td>0.74 (0.25)</td>
<td>0.81 (0.31)</td>
<td>0.85 (0.47)</td>
<td>0.81 (0.51)</td>
</tr>
<tr>
<td>CNA hours per resident day</td>
<td>2.22 (0.36)</td>
<td>2.35 (0.34)</td>
<td>2.40 (0.73)</td>
<td>2.53 (0.52)</td>
<td>2.61 (0.50)</td>
</tr>
<tr>
<td>% of total licensed nurse (RN+LPN) hours per resident day provided by RNs</td>
<td>33.9 (11.9)</td>
<td>43.3 (15.6)</td>
<td>43.3 (17.6)</td>
<td>44.3 (19.5)</td>
<td>49.0 (16.3)</td>
</tr>
</tbody>
</table>

Table 4.3. Variation in five-star ratings by nursing home organizational characteristics (N=245)
environments, and the largest concentration of poor work environments was found in facilities with 1 and 2 stars. Nursing homes with higher star ratings were also generally smaller, had a lower Medicaid census, higher Medicare census, and more admissions per bed. The 1 star category had the highest concentration of for profit facilities, and the 5 star category had the lowest concentration of for profit facilities, but for profit status varied across the 2, 3, and 4 star categories. All staffing measures except for LPN staffing improved with higher star ratings, but the star ratings are determined based on these measures, so this was to be expected.

**Analysis of Aim 1**

Table 4.4 depicts the results of bivariate and fully adjusted linear regression models showing the effects of nurse work environment on each of the four primary patient outcomes. Linear regression (β) coefficients represent the effect of good work environments on the outcome compared to poor work environments. Models are shown for the full Practice Environment Scale of the Nursing Work Index (PES-NWI), as well as for each of its subscales. Adjusted models control for nursing home organizational characteristics and, where appropriate, patient census characteristics.

**Pressure ulcers.** In adjusted models, nursing homes with good work environments had 1.8% fewer high risk residents with pressure ulcers than nursing homes with poor work environments (β = 1.80, standard error (SE) = 0.75). Collegial nurse-physician relationships had the strongest effect of the five subscales (β = -3.19, SE = 0.86), followed by nursing foundations for quality of care and nurse leadership. The staffing and resource adequacy subscale was significant only at the $p < 0.1$ level, and
Table 4.4. Effects of nurse work environment on nursing home-level patient outcomes in good vs. poor work environments, as measured with the Practice Environment Scale of the Nursing Work Index (PES-NWI)

<table>
<thead>
<tr>
<th>Coefficient (standard error)²</th>
<th>Bivariate</th>
<th>Adjusted</th>
<th>Bivariate</th>
<th>Adjusted</th>
<th>Bivariate</th>
<th>Adjusted</th>
<th>Bivariate</th>
<th>Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of long-stay high risk residents with pressure ulcers (N=222)¹</td>
<td>-1.75 (.75)**</td>
<td>-1.80 (.75)**</td>
<td>-2.73 (1.26)**</td>
<td>-2.07 (1.24)*</td>
<td>-2.21 (1.15)*</td>
<td>-1.59 (1.08)</td>
<td>-.11 (.10)</td>
<td>-.15 (.08)**</td>
</tr>
<tr>
<td>% of long-stay residents who received antipsychotics (N=230)</td>
<td>-1.75 (.77)</td>
<td>-1.19 (.77)</td>
<td>-2.63 (1.28)**</td>
<td>-1.69 (1.26)</td>
<td>-1.61 (1.17)</td>
<td>-.99 (1.09)</td>
<td>-.02 (.10)</td>
<td>-.07 (.08)</td>
</tr>
<tr>
<td>% of residents readmitted to a hospital within 30 days of nursing home admission (N=245)</td>
<td>-1.52 (.75)**</td>
<td>-1.57 (.74)**</td>
<td>-2.42 (1.26)*</td>
<td>-1.90 (1.23)</td>
<td>-1.66 (1.13)</td>
<td>-1.21 (1.06)</td>
<td>-.08 (.10)</td>
<td>-.11 (.08)</td>
</tr>
<tr>
<td>Number of hospitalizations per resident year (N=244)</td>
<td>-1.40 (.79)*</td>
<td>-1.55 (.81)*</td>
<td>-2.64 (1.31)**</td>
<td>-2.14 (1.33)</td>
<td>-3.30 (1.17)**</td>
<td>-1.89 (1.15)</td>
<td>-.26 (.10)**</td>
<td>-.22 (.08)**</td>
</tr>
</tbody>
</table>

¹ Sample sizes vary across outcomes based on availability of outcomes data

² Linear regression coefficients representing the difference between good and poor work environments are shown. All work environment models, including bivariate models, are adjusted for and weighted by (using analytic weights) the number of respondents per nursing home. Models for all outcomes are adjusted for ownership type, chain membership, Medicare census, Medicaid census, and RN skill mix. Additional covariates per outcome are as follows: (1) pressure ulcer: CNA staffing; (2) antipsychotics: CNA staffing and presence of Alzheimer's unit; (3) readmissions and (4) hospitalizations per resident year: average resource utilization group (RUG) score, and an indicator for whether the facility accepts ventilator-dependent patients.

*** p ≤.01, ** p ≤.05, * p ≤.1
nurse participation in organizational affairs was not significant. No significant interactions of work environment with RN skill mix, for profit status, chain membership, or Medicaid census were found.

**Antipsychotic medications.** Nursing homes with good work environments had 2.07% fewer long-stay residents receiving an antipsychotic than facilities with poor work environments, but this was significant only at the $p < 0.1$ level in the adjusted model ($\beta = -2.07, \ SE = 1.24$). Nursing homes with average work environments had 2.23% fewer long-stay residents receiving an antipsychotic than facilities with poor work environments ($\beta = -2.23, \ SE = 1.04$), and this was significant at the $p < 0.05$ level (*result not shown in table*). Medicaid census and presence of an Alzheimer’s special care unit were the most significant covariates in the model, with both being associated with higher use of antipsychotics and contributing to the loss of statistical significance in the good vs. poor work environment relationship. Nurse participation in organizational affairs, nursing foundations for quality of care, and staffing resource and adequacy had the strongest effects on antipsychotic use in the bivariate models, but none of the subscales were significant in the adjusted models except for nursing foundations for quality of care in the average vs. poor comparison. No significant interactions of work environment with RN skill mix, for profit status, chain membership, or Medicaid census were found.

**Hospital readmissions.** The effect of work environment on 30 day hospital readmissions among new admissions to the nursing home was again in the hypothesized direction, in that nursing homes with good work environments had 1.59% fewer readmissions than facilities with poor work environments ($\beta = -1.59, \ SE = 1.08$), but the
result was not statistically significant. In bivariate models, the staffing and resource adequacy and collegial nurse-physician relationships subscales were highly significant, but that significance went away once other organizational characteristics were controlled for. None of the other subscales were significant in bivariate or adjusted models. Medicaid census, Medicare census, and whether the facility accepted ventilator-dependent patients had the strongest covariate effects in the models. No significant interactions of work environment with RN skill mix, for profit status, chain membership, Medicaid or Medicare census were found.

**Hospitalizations per resident year.** Nursing homes with good work environments had 0.15 fewer hospitalizations per resident year than nursing homes with poor work environments (β = -0.15, SE = 0.08) in adjusted models. Like the readmission measure, the subscales with the strongest effects were staffing and resource adequacy (β = -0.22, SE = 0.08) and collegial nurse-physician relationships (β = -0.23, SE = 0.09). Also like the readmission measure, the strongest covariates in the model were Medicaid census, Medicare census, and whether the facility accepted ventilator-dependent patients.

A significant interaction was found between work environment and Medicare census for this outcome measure, where the effect of work environment decreased as Medicare census increased (**Figure 4.1**). To account for this interaction, I analyzed an additional model with the interaction term incorporated to examine the effects of work environment at varying proportions of Medicare patients. Based on this model, I found that among nursing homes with no Medicare patients, those facilities with good work environments would be expected to have 0.34 fewer hospitalizations per resident year.
than those with poor work environments ($\beta = -0.34$, SE = 0.11). Among nursing homes with a 10% Medicare census, however, facilities with good work environments would be expected to have 0.19 fewer hospitalizations per resident year compared to those with poor work environments. Medicare census among sample nursing homes ranged from 0 to 85% with a median of 10.4%, so the latter estimate approximates the effect of work environment in a nursing home with an average Medicare census. To help put this result into context, this suggests that a nursing home with 100 residents, a 10% Medicare census, and good work environment would have 19 fewer expected hospitalizations per year compared to a facility of the same size and Medicare population with poor work environment. No significant interactions with work environment were found for RN skill mix, for profit status, chain membership, or Medicaid census.

Figure 4.1. Predicted hospitalizations per resident year at varying levels of Medicare census and work environment
**Five-star rating.** Table 4.5 depicts the results of bivariate and fully adjusted multinomial logit models showing the effects of nurse work environment on the odds of achieving a 4 or 5 star (good) rating compared to a 1 or 2 star (poor) rating. Odds ratios represent the effect of good work environments as compared to poor work environments. Controlling for organizational characteristics, the odds of nursing homes with good work environments achieving 4 or 5 stars was 3.04 times higher than nursing homes with poor work environments (OR = 3.04, SE 1.49). The strongest subscales contributing to this effect were nursing foundations for quality of care, nursing leadership, and staffing and resource adequacy, with the latter having the largest effect. No significant interactions with work environment were found for profit status, chain membership, Medicaid or Medicare census, or RN skill mix.

<p>| Table 4.5. Effects of nurse work environment on five-star rating in nursing homes with good vs. poor work environments, as measured with the Practice Environment Scale of the Nursing Work Index (PES-NWI) (n=245) |</p>
<table>
<thead>
<tr>
<th>Odds ratio (standard error)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Work environment (Full PES-NWI)</td>
</tr>
<tr>
<td>subscales of the PES-NWI</td>
</tr>
<tr>
<td>Nurse participation in organizational affairs</td>
</tr>
<tr>
<td>Nursing foundations for quality of care</td>
</tr>
<tr>
<td>Nurse manager ability, leadership, &amp; support of nurses</td>
</tr>
<tr>
<td>Staffing &amp; resource adequacy</td>
</tr>
<tr>
<td>Collegial nurse-physician relationships</td>
</tr>
</tbody>
</table>

¹ Odds ratios indicate the difference in probability of a nursing home achieving a 4 or 5 star (good) rating compared to a 1 or 2 star (poor) rating in facilities with good vs. poor work environments in multinomial logit models. Models are adjusted for ownership type, chain membership, Medicare census, Medicaid census, CNA staffing, and RN skill mix.

*** p ≤ .01, ** p ≤ .05, * p ≤ .1
Aim 1 Summary

A visual summary of the effects of the full PES-NWI and each of its subscales on overall five-star rating and the four primary patient outcomes is shown with forest plots in Figures 4.2, 4.3, and 4.4. Figure 4.2 shows adjusted odds ratios representing the effects of the PES-NWI and each of its subscales on five-star ratings relative to the null effect with 95% confidence intervals. Figures 4.3 and 4.4 depict the adjusted linear regression effects of the PES-NWI and each of its subscales relative to the null effect, with 95% confidence intervals, for each of the four primary patient outcomes. One can see that, despite variation in statistical significance, all effect sizes for both the full PES-NWI and its subscales (with the exception of one subscale for antipsychotics) were in the hypothesized direction, with better work environments being associated with better quality outcomes.

Figure 4.2. Forest plot showing odds of achieving 4/5 stars vs. 1/2 stars in nursing homes with good vs. poor work environments
Figure 4.3. Forest plots showing percent change in pressure ulcers, antipsychotics, and readmissions in nursing homes with good vs. poor work environments.
Aim 2

Nurse Sample Characteristics

Table 4.6 shows characteristics of the 692 nurses employed across the study’s 245 nursing homes. There were no significant differences in age, years of experience, sex, race, primary language, country of training, or highest level of education across nurses employed in nursing homes with poor, average, or good work environments. The only nurse characteristic that varied significantly across work environment was position, with a greater proportion of nurses in poor environments identifying as direct care staff RNs, and a greater proportion of nurses in good environments identifying as managers, administrators, and in other nursing roles. Further investigation was done to determine whether these differences were a factor of direct care nurses systematically reporting
lower scores on the PES-NWI than nurses in other roles, and thus, causing nursing homes with more nurse respondents in direct care roles to have a greater likelihood of being classified as having poor work environments. Mean PES-NWI scores did vary by position with direct care nurses on average reporting the lowest scores (direct care staff nurse: \( \bar{x} = 2.60 \), other nursing role: \( \bar{x} = 2.69 \), nurse manager or administrator: \( \bar{x} = 2.86 \)), and these differences were statistically significant in a one-way ANOVA test \((p < .001)\). To test the degree to which these differences influenced the nursing home-level measure of the work environment, aggregated PES-NWI measures were computed based solely on direct care nurses and nurse managers/administrators separately, and then those measures
were compared to the aggregated PES-NWI measure of all nurses combined. The aggregated nursing home level measure of the PES-NWI for all nurses combined was highly correlated with the aggregated PES-NWI for both direct care nurses \( (r = 0.77) \) and nurse managers/administrators \( (r = 0.76) \). Thus, despite variation in nurse PES-NWI scores across different positions, this did not appear to systematically impact the nursing home level measure of the work environment.

Table 4.7 shows variation in nursing outcomes across nursing homes with poor, average, and good work environments. Across all measures, facilities with poor work environments had the highest proportions of nurses with poor nurse outcomes. The differences for all the outcomes except for 3 year retention were statistically significant. Despite the lack in statistical significance, facilities with good work environments still

<table>
<thead>
<tr>
<th>Table 4.7. Variation in nurse outcomes across nursing homes with different work environments</th>
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</thead>
<tbody>
<tr>
<td>Work Environment</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>n (%)</td>
</tr>
<tr>
<td>Job dissatisfaction</td>
</tr>
<tr>
<td>Intent to leave job within 1 year</td>
</tr>
<tr>
<td>Employed 3 years or more at current employer</td>
</tr>
<tr>
<td>Burnout</td>
</tr>
<tr>
<td>Tasks left undone (missed care)</td>
</tr>
<tr>
<td>Any task</td>
</tr>
<tr>
<td>Any clinical task</td>
</tr>
<tr>
<td>Adequate patient surveillance</td>
</tr>
<tr>
<td>Give medications on time</td>
</tr>
<tr>
<td>Treatments and procedures</td>
</tr>
<tr>
<td>Skin care</td>
</tr>
<tr>
<td>Comfort/talk with residents</td>
</tr>
<tr>
<td>Frequently unable to complete necessary patient care due to time constraints</td>
</tr>
</tbody>
</table>

¹ The p-value of the Pearson chi-squared statistic is shown.
had the largest proportion of nurses who had been employed by that same employer for 3 or more years. This variation in nursing outcomes across different work environments is summarized in Figures 4.5 and 4.6.

**Figure 4.5.** Percentage of nurses reporting various nurse outcomes across nursing homes with different work environments (N=692)

**Figure 4.6.** Percentage of nurses reporting that necessary care tasks were left undone on last shift due to time constraints across nursing homes with different work environments (N=692)
Analysis of Aim 2

Odds ratios (OR) representing the effects of work environment on each of the nurse outcomes in bivariate and adjusted logistic regression models are shown in Table 4.8. These depict the odds of nurses reporting the outcome in good vs. poor work environments. All adjusted models control for the same set of organizational and nurse characteristics. RN sample size varied by outcome based on availability of nurse reported outcome and covariate data.

Job dissatisfaction, intent to leave, burnout, and missed care were all strongly associated with both the overall PES-NWI and each of its subscales. Controlling for nurse and organizational characteristics, RNs working in nursing homes with good work environments were 89% less likely to report job dissatisfaction (OR = 0.11, SE = .04), 76% less likely to report intention to leave their job within one year (OR = 0.24, SE = 0.07), 87% less likely to experience burnout (OR = 0.13, SE = 0.04), and 73% less likely to report having left necessary patient care undone due to time constraints (OR = 0.27, SE = 0.07) compared to RNs working in nursing homes with poor work environments.

Across these four outcomes, all PES-NWI subscales were strongly associated and statistically significant at the $p < .05$ level, with almost all significant at the $p < .001$ level. Controlling for nurse and organizational characteristics, RNs were 53% more likely to have been employed by the same employer for 3 or more years if they worked in a good vs. poor work environment, but this result was not statistically significant (OR = 1.53, SE = 0.48). The nursing foundations for quality of care and staffing resource and adequacy subscales were statistically significant for this outcome, but the other subscales were not.
Table 4.8. Effects of nurse work environment on nurse outcomes in good vs. poor work environments, as measured with the Practice Environment Scale of the Nursing Work Index (PES-NWI)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Dissatisfied with job (N=656)</th>
<th>Intent to leave job within 1 year (N=663)</th>
<th>Employed at current employer 3 or more years (N=674)</th>
<th>Burnout (N=577)</th>
<th>Missed care (any task left undone) (N=674)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bivariate Adjusted</td>
<td>Bivariate Adjusted</td>
<td>Bivariate Adjusted</td>
<td>Bivariate Adjusted</td>
<td>Bivariate Adjusted</td>
</tr>
<tr>
<td>Work environment (Full PES-NWI)</td>
<td>.10 (.03)*** .11 (.04)***</td>
<td>.21 (.06)*** .24 (.07)***</td>
<td>1.46 (.42) .13 (.48)</td>
<td>.14 (.04)*** .13 (.04)***</td>
<td>.24 (.06)*** .27 (.07)***</td>
</tr>
<tr>
<td>Nurse participation in organizational affairs</td>
<td>.13 (.04)*** .14 (.05)***</td>
<td>.19 (.06)*** .19 (.06)***</td>
<td>1.61 (.49) 1.88 (.66)</td>
<td>.23 (.07)*** .21 (.06)***</td>
<td>.37 (.10)*** .38 (.10)***</td>
</tr>
<tr>
<td>Nursing foundations for quality of care</td>
<td>.15 (.04)*** .17 (.05)***</td>
<td>.18 (.05)*** .21 (.06)***</td>
<td>2.03 (.61)* 2.30 (.77)*</td>
<td>.17 (.04)*** .16 (.04)***</td>
<td>.27 (.08)*** .32 (.09)***</td>
</tr>
<tr>
<td>Nurse manager ability, leadership, &amp; support of nurses</td>
<td>.14 (.04)*** .15 (.04)***</td>
<td>.24 (.07)*** .26 (.08)***</td>
<td>1.00 (.27) .93 (.28)</td>
<td>.21 (.06)*** .21 (.06)***</td>
<td>.29 (.07)*** .31 (.08)***</td>
</tr>
<tr>
<td>Staffing &amp; resource adequacy</td>
<td>.10 (.04)*** .11 (.04)***</td>
<td>.22 (.06)*** .26 (.08)***</td>
<td>2.28 (.66) 2.51 (.80)**</td>
<td>.17 (.05)*** .16 (.05)***</td>
<td>.22 (.06)*** .26 (.07)***</td>
</tr>
<tr>
<td>Collegial nurse-physician relationships</td>
<td>.30 (.12)*** .33 (.13)**</td>
<td>.45 (.15)* .53 (.17)*</td>
<td>1.79 (.50)* 1.64 (.51)</td>
<td>.22 (.07)*** .21 (.07)**</td>
<td>.39 (.12)*** .46 (.14)**</td>
</tr>
</tbody>
</table>

1 Sample sizes vary across outcomes based on availability of nurse-reported outcomes data. Nurses are clustered within 245 nursing homes for all outcomes except for job satisfaction, in which the number of nursing homes is 244.

2 Odds ratios representing the difference between good and poor work environments are shown. All models, including bivariate models, control for the number of respondents per nursing home. Adjusted models control for organizational characteristics (ownership type, chain membership, Medicare census, Medicaid census, and RN skill mix) and nurse characteristics (age, sex, race, position, years of experience, and whether English is the nurse's primary language), and account for clustering within nursing homes.

*** p ≤.001, ** p ≤.01, * p ≤.05
Table 4.9 shows a further breakdown of the missed care outcome by specific tasks of care left undone. Only the effects for the overall PES-NWI are shown here, not the subscales. Controlling for nurse and organizational characteristics, RNs working in nursing homes with good work environments were 70% less likely to report leaving clinical tasks undone than nurses working in facilities with poor work environments (OR = 0.30, SE = 0.07). Clinical tasks included: patient surveillance, oral hygiene, on-time medication administration, treatments and procedures, skin care, pain management, and ambulation and/or range of motion of patients. Compared to RNs in poor work environments, RNs in good work environments were also 66% less likely to miss opportunities to comfort and talk with patients (OR = 0.34, SE = 0.08), and 86% less
likely to report frequently being unable to complete necessary patient care due to time constraints (OR = 0.14, SE = 0.05).

**Aim 2 Summary**

Better nursing home work environments were strongly associated with better nurse outcomes across all measures except for 3 year retention. The relationship between work environment and retention was also in the hypothesized direction, but that result did not achieve statistical significance for the overall PES-NWI. **Figure 4.7** shows a visual summary of these relationships using forest plots. These graphs show, with 95% confidence intervals, odds ratios representing the effects of the overall PES-NWI and its subscales on each of the nurse outcomes in nursing homes with good vs. poor work environments. These graphs help to demonstrate the overall trend that nursing homes with good work environments had lower odds of the negative nurse outcomes (job dissatisfaction, intent to leave, burnout, and missed care) and a higher odds of the favorable nurse outcome (3 year retention) compared to nursing homes with poor work environments, even if the latter outcome failed to achieve statistical significance.
Figure 4.7. Forest plots showing odds ratios of nurse outcomes in nursing homes with good vs. poor work environments

Odds ratios for job dissatisfaction in nursing homes with good vs. poor work environments

Odds ratios for intent to leave in nursing homes with good vs. poor work environments

Odds ratios for burnout in nursing homes with good vs. poor work environments

(continued)
Figure 4.7. (continued) Forest plots showing odds ratios of nurse outcomes in nursing homes with good vs. poor work environments

- Odds ratios for missed care in nursing homes with good vs. poor work environments
- Odds ratios for 3 year retention in nursing homes with good vs. poor work environments
CHAPTER 5: DISCUSSION

Key Findings

This study sought to determine whether better registered nurse (RN) work environments could help to improve the quality of care in nursing homes and reduce poor nurse outcomes that contribute to high turnover. Across multiple quality measures, better work environments were associated with better patient outcomes as measured at the facility level. Compared to nursing homes with poor work environments, nursing homes with good work environments had a 3.04 higher odds of receiving an overall star rating of 4 or 5 stars versus 1 or 2 stars, 1.8% fewer high risk residents with pressure ulcers, and 0.15 fewer hospitalizations per resident year. All of these relationships were statistically significant at the $p \leq 0.05$ level. Additionally, nursing homes with good work environments had 2.07% fewer long-stay residents on antipsychotic medications than nursing homes with poor work environments, but this relationship was significant only at the $p \leq 0.1$ level in adjusted models. Facilities with average work environments had 2.23% fewer long-stay residents on antipsychotics compared to facilities with poor work environments, and this relationship was significant at the $p \leq 0.05$ threshold. The relationship between work environment and 30 day hospital readmissions was not statistically significant, but was still in the hypothesized direction where nursing homes with better work environments had fewer readmissions.

All nurse outcomes were strongly and significantly associated with work environment except for 3 year retention. RNs working in nursing homes with good work environments were 89% less likely to report job dissatisfaction, 76% less likely to report
intention to leave their job within one year, 87% less likely to experience burnout, and 73% less likely to report having left necessary patient care undone due to time constraints compared to RNs working in nursing homes with poor work environments. These effect sizes reflect marked descriptive differences between nurses in the poor versus good work environment facilities. In nursing homes with poor environments, 44.4% of RNs were dissatisfied with their jobs (vs. 7.7% in good environments); 33.3% intended to leave their job within 1 year (vs. 10.3% in good environments); and 45% experienced burnout (vs. 12.8% in good environments).

Nurses working in nursing homes with poor work environments also reported substantially higher rates of missed care due to time constraints, with 83% reporting missing at least one care task (vs. 53.2% in good environments); 38% lacking time to provide adequate patient surveillance (vs. 11.5% in good environments); 23.4% unable to give medications on time (vs. 6.4% in good environments); 18.1% unable to provide skin care (vs. 3.8% in good environments); and 61.4% lacking time to offer comfort or talk with residents (vs. 30.8% in good environments). The proportion of nurses reporting that they were frequently unable to complete necessary patient care due to time constraints was more than five times higher in nursing homes with poor work environments (32.7%) versus good work environments (5.8%). Three year retention was the only nurse outcome where the relationship with work environment was not statistically significant, but it was still in the hypothesized direction, with facilities with good work environments having greater proportions of nurses employed for 3 or more years.
Components of the Work Environment

No one subscale of the work environment was universally dominant across all outcomes in this study. This suggests that all aspects of the work environment are important to quality care, not just staffing. It may also help to explain why the staffing literature in nursing homes to date has produced mixed results – because staffing is only one component of nursing care organization, and other components of the work environment are necessary to help support nurses in providing high quality care.

Non-Staffing Components

Collegial nurse-physician relationships had the strongest subscale effect on pressure ulcers, hospitalizations per resident year, and readmissions. This finding supports an existing literature that has demonstrated that effective nurse-physician communication serves as an important factor in maintaining patient safety and preventing avoidable hospitalizations from the nursing home (Buchanan et al., 2006; Kayser-Jones, Wiener, & Barbaccia, 1989; Ouslander, Bonner, Herndon, & Shutes, 2014; Ouslander et al., 2011; Young, Barhydt, Broderick, Colello, & Hannan, 2010). Many nursing homes have mostly part-time medical staff, meaning that physicians and other advanced practice clinicians are only in house for limited hours during the day, and rarely present after hours or on the weekends. Thus, the responsibility falls to the nursing staff to assess patients, recognize changes in condition, intervene appropriately, and communicate by phone with the covering medical provider to ensure that appropriate plans of care are implemented. When the quality of the communication and relationship between nursing
and medical staff is poor, patients may be unnecessarily hospitalized for conditions that could be treated more appropriately in the nursing home.

Nursing foundations for quality of care had significant subscale effects for both pressure ulcers and overall five-star rating. This subscale captures whether the work environment is characterized by a clear philosophy of nursing to guide patient care, active quality assurance programs, appropriate mentorship and continuing education of nurses, and generally high standards of nursing care provided by clinically competent nurses (Lake, 2002). Multiple nursing care processes are integral to the prevention of pressure ulcers such as risk assessment, skin surveillance, preventative skin care, nutrition interventions, incontinence management, mobilization, and positioning with appropriate support surfaces (National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel, & Pan Pacific Pressure Injury Alliance, 2014). RNs are usually in charge of wound management programs in nursing homes and responsible for ensuring that such interventions take place. It is thus logical that work environments which have strong underlying foundations for nursing care would in turn facilitate the implementation of such interventions to reduce pressure ulcers.

Nurse manager ability, leadership, and support of nurses was also significantly associated with both pressure ulcers and overall-five star rating. While RNs do not perform as much direct care as licensed practical nurses (LPNs) and certified nursing assistants (CNAs) in nursing homes, one of their key functions is providing leadership. RNs in nursing homes plan and coordinate care provided by LPNs, CNAs, and other staff; act as managers and supervisors; provide surveillance; oversee practical nursing
procedures and medication management; perform chart reviews; and manage resources (Dever, 2018; Montayre & Montayre, 2017). For RNs to provide effective leadership, staff nurses must have support from their supervisors, supervisors must have support from their director(s) of nursing, and the director(s) of nursing must have support from other senior level administrative staff. This subscale effect also supports previous findings in the literature showing that lower director of nursing turnover is associated with lower turnover of RNs, LPNs, and CNAs (Castle, 2008b). That is, strong and consistent senior nursing leadership helps to support other nursing staff in the facility.

All subscales of the work environment were strongly and significantly associated with nurse job dissatisfaction, intent to leave, burnout, and missed care. Job dissatisfaction and burnout are important contributors to turnover (Laschinger & Leiter, 2006; Leiter & Maslach, 2009), thus these findings provide evidence that comprehensive interventions to improve work environments could provide opportunities to counter turnover in nursing homes. Figure 5.1 shows the frequency with which nurses across different work environments reported dissatisfaction with various job aspects. Four of the most prominent areas of dissatisfaction were with salary and benefits. As prominent as those, however, was dissatisfaction with opportunities for advancement. Almost four times as many nurses in poor environments (61%) were dissatisfied with opportunities to advance compared to nurses in good environments (16%). This finding is mirrored in the strong effect of the nurse participation in organizational affairs subscale across multiple nurse outcomes, as this subscale measures nurses’ opportunities for career development and involvement in internal governance within their organization.
Interestingly, the impact of overall work environment on 3 year retention was not statistically significant in this study despite its strong effects on the other nursing outcomes. This may have been because there was not enough variation in the nurse sample since over 73% of respondents were employed 3 or more years with the same employer. Another potential explanation is that nurses are remaining in their jobs despite being unhappy, likely due to external factors that were not accounted for in this study. This hypothesis is supported by previous studies which have shown that RN staffing and lengths of employment in nursing homes fluctuate with macroeconomic factors including unemployment rates and economic recessions (Baughman & Smith, 2012; Konetzka, Lasater, Norton, & Werner, 2017).
Figure 5.2. Variation in years worked with current employer across nurses with different educational levels (N=664)

Another reason nurses might remain in their jobs despite high levels of job dissatisfaction and burnout could be education-related. RNs with diplomas and associate degrees of nursing (ADN) may have limited mobility within the labor market to move to other settings. As hospitals have shown increasing preference for hiring RNs with bachelor of science in nursing (BSN) degrees, the number of ADN nurses in hospitals has decreased, and more ADN nurses have shifted into long-term care settings (Auerbach, Buerhaus, & Staiger, 2015). Data from this study, shown in Figure 5.2, support this hypothesis by showing that diploma and ADN nurses on average work longer for the same nursing home than BSN nurses. Because diploma and ADN nurses may be less

ADN = Associate Degree in Nursing;  BSN = Bachelor of Science in Nursing
competitive in the labor market for acute care jobs compared to BSN nurses, they may be more confined to remain in the same positions for longer, even when unhappy.

**Staffing and Resource Adequacy**

The final component of the work environment measured by the Practice Environment Scale of the Nursing Work Index (PES-NWI) was staffing and resource adequacy. The positive contributions of the non-staffing work environment components to multiple outcomes in this study do not negate the importance of nursing homes having sufficient staffing. Staffing and resource adequacy had the strongest subscale effect on overall nursing home quality measured by five-star rating, and was also significantly associated with hospitalizations per resident year, as well as all of the nurse outcomes. Also, it had the strongest subscale effect on 3 year nurse retention, even though the overall work environment was not statistically significant for this outcome. RNs working in nursing homes with good staffing and resource adequacy were 2.5 times more likely to have worked for the same nursing home for 3 or more years compared to facilities with poor staffing and resource adequacy. This supports findings from the turnover literature which have shown that staffing and workload are important predictors of RN turnover (Anderson et al., 2004; Anderson et al., 1997; Castle, 2008b; Castle & Engberg, 2006).

The importance of staffing and resource adequacy is reflected in the missed care findings as well. Large proportions of RNs reported that they do not have enough time to complete necessary care. Of RNs working in poor work environments, almost 2/3rds reported that they did not have time to complete at least one necessary clinical task on their last shift, and over 1/3rd reported frequently missing care due to time constraints.
Figure 5.3 depicts the total number of tasks RNs reported leaving undone across nursing homes with varying scores on the PES-NWI staffing and resource adequacy subscale. This shows that in facilities with lower (worse) scores, RNs were likely to report leaving more necessary care tasks undone. This could have significant negative implications for patient care quality.

Despite strong performance of the staffing and resource adequacy subscale, the objective measures of staffing from the Certification and Survey Provider Enhanced Reports (CASPER) system used in this study were not significantly associated with the outcomes examined. RN skill mix did not have a statistically significant covariate effect in any of the patient or nurse outcome models, except for overall five-star rating (which is...
in part derived from the CASPER staffing measures). No significant interaction effects were found between work environment and staffing in any models. And RN staffing and RN skill mix both had weak correlations with the primary nurse and patient outcomes.

The accuracy of CASPER staffing data has been critiqued at length, but it is still the only uniform staffing data source available for nursing homes (Bostick et al., 2006; Castle, 2008a; Feng et al., 2005; Kash et al., 2007). The primary criticism is that these data are subject to reporting bias since they are based on facility report from a two week window prior to the annual survey and are usually not independently audited. Since the data only capture a two week period, it gives nursing home operators the opportunity to increase staffing when they know they are in their survey window to artificially inflate their numbers. Use of CASPER data has been one of the primary explanations as to why the staffing literature in nursing homes has produced inconsistent results (Bostick et al., 2006; Castle, 2008a; Feng et al., 2005; Kash et al., 2007). In response to these criticisms, the Centers for Medicare and Medicaid Services (CMS) changed its reporting system so that nursing homes now have to electronically submit auditable payroll data throughout the year. Mandatory reporting for this began July 1, 2016, but these data were still too new to be incorporated into the present study. However, this new data source will likely allow for more robust nursing home staffing studies moving forward.

Limitations

A few key limitations of this study should be noted. First, the use of cross-sectional data prevented examination of causal relationships between work environment and the outcomes of interest. Since this is a nascent area of research, the cross-sectional
design is appropriate for helping us to gain a preliminary understanding of the relationships between the variables. This lays the groundwork for future work to examine these relationships longitudinally, which will allow for study of cause and effect.

Second, because I used facility-level patient outcome measures, I was limited in the amount of comorbid risk adjustment that could be incorporated into the models. For example, CMS only excludes patients with schizophrenia, Tourette’s syndrome, and Huntington’s disease from its antipsychotic measure in Nursing Home Compare. Patient level data would allow for more robust risk adjustment to account for patients with other conditions where antipsychotics might be appropriate such as bipolar disorder and major depression with psychosis. Additional patient-level comorbid adjustment would also allow for more robust analysis of the pressure ulcer and hospitalization measures. Again, I view this study as preliminary work to help begin to understand the relationships between nurse work environment and patient outcomes. The next step is to replicate this study with patient-level data, so that models can be refined with better measurement and adjustment for patient characteristics.

Nursing homes in the study sample had some significant differences from nursing homes overall in the four states which may limit generalizability. For reasons discussed in chapter 3, the sample had an overrepresentation of Pennsylvania (PA) facilities and an underrepresentation of California (CA) facilities relative to the number of nursing homes in each state. Sample nursing homes were on average larger, less likely to be for profit, and had slightly fewer Medicare patients compared to all nursing homes in the four states. The size differences were largely due to study design, because one can only
generate a facility-level measure of work environment when there are multiple RN respondents from the facility to report on it. Since I used a random state-wide sample of nurses, larger facilities employing more RNs had a higher probability of having their employees represented in the sample. Despite slight differences in Medicare census, there were no significant differences in average case mix or Medicaid census. The differences in for profit status appeared due to the sample being dominated by facilities in PA, where for profits are less common than in the other states. Sample nursing homes had slightly lower average LPN and CNA staffing compared to facilities in all four states, but those differences were largely attributed to facilities in CA, where average LPN and CNA staffing was higher (and average RN staffing lower). There were no statistically significant differences in mean LPN and CNA staffing across nursing homes in the three other states. Despite these sample differences which may limit generalizability of results, this was still the first study to use a random multistate sample of nursing homes to study the effects of RN work environment, a major advantage over prior work.

A final limitation of the study was that the PES-NWI measure was based on a small number of RNs per nursing home. This was the trade-off of using a state-wide random sample of RNs rather than surveying RNs directly through their employers. The former approach offers a clear advantage of reduced response bias at the organizational level compared to the latter, but it also makes it more challenging to find nursing homes with multiple respondents. PES-NWI scores in this study had low internal consistency within nursing homes due to the small number of RN respondents per facility. To account for this, I both controlled for and weighted the models by the number of
respondents per nursing home to give the nursing home-level measure of the PES-NWI greater weight in facilities with more respondents. Because the facility-level measure of the work environment was not as “clean” as it would have been with many more respondents, this made it more difficult to find significant effects. Even with this limitation, however, I was still able to find significant and consistent effects of the work environment across multiple patient and nurse outcomes.

**Implications and Potential Interventions**

The findings from this study demonstrate that multiple components of the work environment — including, but not limited to, staffing — are necessary to support RNs in providing high quality care in nursing homes. This provides evidence to counter a prior argument that efforts to address turnover, management, and clinical competency in nursing homes are unlikely to succeed without first addressing staffing (Harrington, Schnelle, McGregor, & Simmons, 2016). Staffing improvements likely must be made in conjunction with improvements to other aspects of the work environment. But nursing homes undoubtedly face real and significant financial constraints when it comes to staffing, and it would be imprudent to delay less cost-intensive interventions to fix other problems in the work environment to retain nurses who are already employed. If nursing homes could reduce labor costs associated with turnover, they would have more to invest in staffing.

Interventions to help nursing homes improve their work environments must be cost-conscious. **Figure 5.4** shows variation in median Medicaid census across sample nursing homes with poor, average, and good measures of three nursing characteristics:
work environment, RN staffing, and RN skill mix. One sees that, on average, nursing homes with poorer nursing characteristics also have more Medicaid patients, suggesting that these facilities are under greater financial constraints. There is also a significant literature which has previously linked Medicaid reimbursement policy and rates with nursing home staffing levels (Harrington et al., 2007) and care quality (Cai, Miller, Nelson, & Mukamel, 2015; Grabowski, Feng, Intrator, & Mor, 2010; Gruneir, Miller, Feng, Intrator, & Mor, 2008; Intrator, Schleinitz, Grabowski, Zinn, & Mor, 2009; Kang-Yi, Mandell, Mui, & Castle, 2011; Miller, Cohen, Lima, & Mor, 2014; Miller, Gozalo, Lima, & Mor, 2011). It is important to note, however, that while nursing characteristics on average are worse in nursing homes with higher Medicaid census, there is still significant variation among facilities. In my sample, there were nursing homes with high
Medicaid census that had good work environments, and there were nursing homes with low Medicaid census that had poor work environments. So while Medicaid census is not an absolute predictor of worse nursing characteristics, it is an important indicator of a facility’s overall financial health, which is something that must be accounted for when considering interventions to improve work environments.

The most well-established, comprehensive, and evidenced-based intervention for improving work environments within healthcare systems is the Magnet Recognition Program® administered by the American Nurses Credentialing Center (ANCC) (American Nurses Credentialing Center, 2017b). This program recognizes hospitals that, through an extensive review and survey process, meet a series of eligibility criteria demonstrating their abilities to attract and retain nurses, and provide high quality nursing care. Hospitals that pursue Magnet® recognition have been found to have improved patient and nurse outcomes over time (Kutney-Lee et al., 2015), and Magnet® status is now used as an indicator of quality for both the US News & World Report hospital rankings, as well as the Leapfrog Hospital Survey. The Magnet® certification and recertification process is time and resource-intensive, with hospitals on average taking 4.25 years to achieve recognition and spending anywhere from $100,000 to $600,000 annually to build up their organizations, hire program managers and other staff, pay consultant fees, and prepare for application submission and site visits (Russell, 2010). The parallel recognition for non-hospital healthcare organizations is ANCC’s Pathway to Excellence® program (American Nurses Credentialing Center, 2017a; Dans, Pabico, Tate, & Hume, 2017), but this has yet to gain significant traction in long-term care. Of
the more than 15,000 nursing homes in the US, only 5 facilities currently hold Pathway to Excellence in Long Term Care® designation (Pabico, 2018, April 10).

One reason for the slow adoption of the Pathway to Excellence® program in nursing homes is likely the cost. Application and appraisal fees alone for a nursing home with 150 beds are currently $32,500 for a four year designation, not including other fees or costs a facility would incur investing in resources to meet criteria (American Nurses Credentialing Center, 2018). Again, considering the tight operating margins most nursing homes face, particularly those with higher reliance on Medicaid, this may prove a significant barrier. There is a business case to be made for hospitals pursuing Magnet® Recognition, because Magnet® status has been associated with increased net inpatient revenue, thus potentially offsetting the costs of applying for recognition (Jayawardhana, Welton, & Lindrooth, 2014). Yet, there simply are not enough nursing homes that have pursued Pathway to Excellence® designation to date to conduct a similar cost-effectiveness analysis for that program.

The other reason the Pathway to Excellence® program has not yet gained traction is likely lack of incentive or familiarity with the program for nursing homes to apply. Hospitals are held accountable for the quality of their work environments through the US News & World Report and Leapfrog Hospital Survey ratings. The only organizational nursing characteristic nursing homes are held publicly accountable for at present is staffing, because CASPER staffing measures are reported in Nursing Home Compare. One of the advantages of CMS switching to the payroll-based reporting system for staffing data is that it will provide a uniform source across all US nursing homes for
turnover data. And if nursing homes operators start being held accountable for turnover, they may become much more interested in interventions to improve work environments.

An alternative more cost-conscious interventional approach could be to partner with nursing home corporate chains to assist them in developing and individualizing systematic changes based on core tenets of good work environments for their own organizations. Because chains have substantial oversight of structural and cultural organizational characteristics of individual facilities, they may be best positioned to implement change. While only about 50% of nursing homes in the US are owned by a chain (Grabowski et al., 2016), the biggest chains own hundreds of facilities a piece, providing a prime experimental setting to test interventions and develop approaches that could be then be replicated or tailored to other chains or independently-owned nursing homes. If one chain bought on to a research partnership where they helped develop and pilot interventions that would work within their organization, and then permitted researchers to study outcomes longitudinally, it could both help that organization and produce new knowledge that could benefit other organizations. And having intervention models generated from within the industry might allow for more successful dissemination than would a more prescriptive approach from an external body. Industry groups like the American Health Care Association and Leading Age could also be approached to aid in dissemination of interventions and knowledge.

Since the 1980s, a substantial “culture change” movement has grown across the nursing home industry to shift facilities from medically-focused institutions to more home-like settings that emphasize person-centered care (Miller et al., 2013; Rahman &
The six core principles of culture change are: resident direction; homelike atmosphere; close relationships between residents, families and staff; staff empowerment; collaborative decision making; and quality-improvement processes (Koren, 2010). The latter four principles overlap directly with the core features of good work environments. Implementation of culture change has varied widely, from development of formal innovative care models in newly-constructed facilities to partial implementation of specific principle-guided interventions based on individual facility characteristics and needs (Miller et al., 2013; Sterns, Miller, & Allen, 2010; Zimmerman, Shier, & Saliba, 2014). Some state Medicaid programs have also introduced pay-for-performance incentives that reward culture change practice implementation – these programs and higher Medicaid reimbursement rates have been linked with greater success in nursing homes achieving improvements in culture change performance measures (Miller et al., 2013).

Interventions to improve RN work environments would likely be best sold to nursing home operators by piggy-backing onto this pre-existing culture change movement, since this is the framework and “language” already widely used and recognized across the industry. The work environment elements in the culture change framework apply generally across all nursing home staff (as has much of the prior literature on nursing home work environments), but there is a strong argument to be made for strengthening elements that apply specifically to RNs. As nursing homes take on the care of more medically complex individuals and face increasing accountability for the quality of their clinical care, the roles of RNs have become ever more important. To
provide sufficient clinical oversight and leadership, RNs must be well supported by their managers, have adequate resources to do their jobs, be actively involved in quality assurance and improvement processes, have close working relationships with physicians and other coworkers, and be empowered to participate in decisions and advance within their organization. How to best implement these core tenets of good work environments may look different from facility to facility. But the first step is to convince nursing home operators that work environment is an important and tangible area for interventions to improve care quality and reduce staff turnover. Couching those arguments within the broader culture change movement probably holds the most potential for success.

**Future Research**

Many opportunities exist for future research relating to RN work environment, retention, and nursing care quality in nursing homes. One of my first priorities is to replicate Aim 1 of this study using patient-level administrative data. Because of the complexity of nursing home financing, this would require merging multiple Medicare claims files with the Minimum Data Set and CASPER data. This would allow for more robust risk adjustment with patient characteristics, and permit study of a broader range of outcomes than what is available in Nursing Home Compare or LTCfocus.

Implementation and intervention research would also be a priority. There will be opportunity as the Pathway to Excellence in Long Term Care® model grows to study outcomes in Pathway® versus non-Pathway® facilities and track progress over time. There is also the potential, as discussed in the prior section, to partner directly with a corporate chain or industry group to assist in development and testing of interventions.
across multiple sites. While nursing homes would possess the expertise in their own organizational culture and structural constraints, researchers could provide the methodological expertise in studying outcomes, making for a productive relationship.

CMS’s release of the payroll-based nursing home staffing data in late 2017 signaled what will likely be the start of a series of new staffing studies. It will take time for these data to be validated and for nursing homes to fine-tune their reporting, but hopefully this system will provide more accurate measures of staffing than exist presently. More robust staffing studies could provide better evidence as to what RN staffing levels should be in nursing homes, and would hopefully provide more consistent results than have been found in the literature to date. The payroll-based reporting system should also provide a uniform source for turnover data, so it will be possible in the future to look at the direct relationship between work environment and turnover, rather than looking at proxy variables like intent to leave.

There is also much to be learned about macroeconomic factors affecting RN retention and turnover in nursing homes. A large body of research to date has shown that Medicaid policy and reimbursement is closely linked with quality of care in nursing homes. From just preliminary review in this dissertation, it appears that Medicaid is also a significant factor affecting the quality of work environments. Further examination of this relationship would help to add context to consider when designing and implementing interventions. Labor market factors affecting job mobility, wage competition, and staffing shortages also hold potential for a number of interesting research questions. Does educational level play a role in RN job mobility and competitiveness within the
labor market? Are diploma and ADN nurses staying in long-term care jobs where they are unhappy because they cannot find jobs elsewhere, as hospitals show preference for hiring BSN nurses? What strategies do nursing homes use to recruit nurses in geographical areas of shortage and how do they compete against hospitals?

Finally, the topic of missed care deserves considerable more exploration in nursing homes. This has been studied at length in hospitals, but not in long-term care. Missed care provides a conceptual linkage between staffing, work environment, and patient outcomes that can be difficult for policy makers and nursing home operators to understand otherwise. I looked at missed care as an outcome in this study, but it would be worthwhile to examine it as an independent variable to see how missed care relates to patient outcomes. Finding significant linkages between missed care and patient outcomes would help to demonstrate concretely to stakeholders what RNs contribute to care in nursing homes, and provide evidence to support calls for staffing improvements.

**Conclusions**

This study demonstrated that work environment is significantly associated with multiple measures of care quality and factors contributing to staff turnover in nursing homes. These findings affirm previous work linking better RN work environments with lower rates of pressure ulcers (Flynn et al., 2010) and higher RN job satisfaction (Choi et al., 2012) in nursing homes. I also found additional linkages of work environment with hospitalization rates, antipsychotic medication use, CMS five star rating, nurse burnout, intent to leave, and missed care. Future research will need to continue to build this
evidence and explore ways in which the core components of good work environments can be better integrated and disseminated across the nursing home industry.

The landscape of long-term care is changing. As the population ages and healthcare systems face the rising challenges of caring for individuals with significant comorbidity and disability, nursing homes are increasingly being held accountable for the quality of care they provide. Simultaneously, the level of acuity in nursing homes has grown as hospitals stays shorten and more stable individuals with sufficient social support show preference for receiving custodial long-term care services in the community. This means that the role of RNs in overseeing the safety and quality of care in nursing homes has become vitally important. The fact that large numbers of nursing home residents suffer preventable adverse events as a result of failure or delay of necessary care, inadequate patient monitoring, and substandard treatment (Department of Health and Human Services Office of Inspector General, 2014) shows that there are very real systemic problems affecting the delivery of appropriate nursing care in this setting.

Nursing homes face challenging fiscal constraints that are only likely to worsen as states continue to try to reign in their Medicaid budgets. Nursing home operators will always be constrained in their abilities to increase staffing, but they can and must do a better job at retaining and supporting the RNs they already employ. The findings of this study show that work environment is an important and tangible area for interventions to improve the quality of care in nursing homes and reduce turnover. The next step is to figure out to translate core tenets of good work environments into pragmatic interventions that can be replicated and disseminated across the nursing home industry.
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