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Certified Nursing Assistants' Perceptions of Nursing Home Patient Safety Culture: Is There a Relationship to Clinical or Workforce Outcomes?: A Dissertation

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Certified Nursing Assistants' Perceptions of Nursing Home Patient Safety Culture:

Is There a Relationship to Clinical or Workforce Outcomes?

A Dissertation Presented

by

Alice F. Bonner

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Dedication

This work is dedicated to my husband, who decided back in ninth grade that together, we could do great things. Luckily for me, he also stuck around to help make that happen. This work would not have been possible without his constant love, encouragement and support.

Acknowledgements

Several researchers paved the way for this dissertation study. In particular, Dr. Susan Eaton was instrumental in giving a voice to nursing home CNAs, and her work was invaluable to me. Other researchers whose work was influential include Dr. Charlene Harrington, Dr. Marilyn Rantz, Dr. Nicholas Castle, Dr. Lucian Leape, and many others.

Throughout this project, I have had the privilege of working with excellent mentors. I could not have completed this study without the guidance and encouragement of Dr. Nicholas Castle, Dr. Steven Handler, and Aiju Men at the University of Pittsburgh. They were available to discuss every stage of the process, and on several occasions welcomed me to Pittsburgh, where I now feel quite at home. Being able to work with this world class team of safety researchers is an opportunity for which I will be forever grateful.

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No dissertation can be properly completed without the skillful assistance of a reference librarian. I am deeply indebted to Judy Nordberg, MLS, who spent countless hours with me, from assisting with integrative review strategies to wrangling with Endnote. I could not have done this work without her expert coaching and guidance.

My colleagues on several projects have been incredibly patient, and have assumed additional responsibilities during my pursuit of another academic degree. Laurie Herndon, NP,

has continued with a 50-50 job share, even though she has shouldered 99% of the work. Her daily moral support was instrumental in helping me to complete this work. Dr. Jeffrey Burl and my other Fallon Clinic colleagues have been extremely generous and helpful. Ned Morse and many others at the Massachusetts Extended Care Federation have encouraged me to pursue my goals, and have done whatever it takes to provide coverage so that I could complete my studies. For their support, and the support of the MECF Board of Directors, I am truly grateful.

My family has made numerous sacrifices, and I would not have been able to finish this work without their support. Ryan kept me going with his sense of humor; our daily banter about the challenges of schoolwork created our own wonderful support group. Daniel's gentle reminders about finding balance in life were an ongoing theme in the background. And Matt's commitment to my finishing this work has been the foundation of our family life since I began the program. He kept us all going with folk music, fabulous home-cooked meals every night, tech support, and constant encouragement.

My mother and father have been supportive of my goals throughout my life, always telling me to "do what you love," and "make a difference in the world." Thanks to their love and support, I am doing what I love, and hope I can make a difference. My mother-in-law and father-in-law, my brother and our entire extended family have been sounding boards for many ideas over the years, and have also lent their love and support to this family effort.

Over the years, I have worked with many nurses, nurse practitioners, physicians, administrators and CNAs in nursing homes. Those on the frontlines work hard for little pay, and often do not get the respect that they deserve. Without those nursing home workers, frail older adults would have no one to care for them. This dissertation was possible because of nursing assistants, nurses and administrators who provided information for this research. To all the

frontline workers in nursing homes, I am truly grateful for the excellent care that they give to residents every day.

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Glossary of Terms

ADEs – adverse drug events

ADLs – activities of daily living

AHRQ – Agency for Healthcare Research and Quality

ARF – Area Resource File

CMS – Center for Medicare and Medicaid Services

CHSRA - Center for Health Systems Research and Analysis

CNA – Certified Nursing Assistant

CPS – Cognitive Performance Scale

DPH – Department of Public Health

HRSA – Health Resources and Services Administration

HSOPSC – Hospital Survey of Patient Safety Culture

JCAHO – Joint Commission on the Accreditation of Healthcare Organizations

LPN – Licensed Practical Nurse

MDS 2.0 definition of falls – fall within the past 30 days or fall within the past 31-180 days (depends on type of most recent MDS assessment, whether quarterly or annual). Further clarification from CMS instructs the nursing home to consider the following circumstances as falls: resident lost their balance, and was lowered to the floor by staff; resident fell to the floor, but there was no injury; resident was found on the floor, but the means by which he/she got to the floor was unwitnessed; resident rolled off a mattress that was on the floor.

MDS 2.0 definition of pressure ulcers – residents with pressure ulcer (state 1-4) within past 7 days on most recent assessment.

MDS 2.0 definition of restraints – residents who were restrained (trunk, limb, or chair) on a daily basis within the past 7 days on the most recent assessment.

Nursing Home Chain – Two or more facilities with a common owner

OBRA - Omnibus Budget and Reconciliation Act

OSCAR – Online Survey Certification and Reporting

PSC – patient safety culture

QI – Quality Indicator

QSEN – Quality and Safety Education in Nursing

RN – Registered Nurse

SAQ – safety attitudes questionnaire

SNF – Skilled Nursing Facility. Daily nursing home rate paid for by Medicare part A or Medicare plus choice health plan (managed care Medicare plan). This is in contrast to NF or nursing facility level of care, also called long term care (LTC). In this case, daily nursing home rate paid for by Medicaid or private pay.

Tenure – length of time (in years) that a person has been a CNA or has been a CNA at a particular facility

Turnover – the total number of staff (measured in full time equivalents or FTEs) who leave employment during a 6-month period divided by the total number of staff (measured in FTEs) who were employed during this period. This calculation should include all shifts, part-time staff, and voluntary and involuntary turnover.

Abstract

Certified Nursing Assistants' Perceptions of Nursing Home Patient Safety Culture:

Is There a Relationship to Clinical or Workforce Outcomes?

2008

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Patient safety culture (PSC) is a critical factor in creating high reliability healthcare organizations. However, few studies to date have correlated PSC measures with actual safety outcomes. In particular, nursing home studies have only recently appeared in the literature. Nursing homes differ from hospitals in that the vast majority of direct care is provided by certified nursing assistants (CNAs), not licensed nurses. Thus nursing home PSC could differ in important ways from PSC in acute care institutions.

This dissertation was a secondary data analysis that examined whether CNAs' perceptions of patient safety culture were correlated with clinical outcomes in a random sample of 74 nursing homes in five randomly selected states. This study matched CNA PSC survey data using the Hospital Survey of Patient Safety Culture (HSOPSC) with Minimum Data Set (MDS), Area Resource File (ARF) and Online Survey Certification and Reporting (OSCAR) data from those same homes during the first two quarters of 2005. In the original study, 1579 nurse aides out of 2872 completed the survey, for a 55% response rate.

In addition to clinical outcomes, this study examined the relationship between CNA PSC scores and staff turnover. The relationship between certain demographic variables, such as level of education, tenure as a CNA, and PSC scores was evaluated. The relationship between certain facility characteristics, such as profit status and bed occupancy was also assessed. An exploratory factor analysis of the original HSOPSC instrument was re-run for this nursing home CNA sample.

Data were analyzed using Poisson regression and multilevel techniques; descriptive statistics were compiled for demographic data. Major findings from the regression analyses and combined GEE models suggest that certain factors, such as CNA turnover and LPN staffing may predict CNA PSC scores. CNA PSC scores were associated with rates of falls and restraint use, but were not associated with differences in pressure ulcer rates in this sample. Few associations for CNA PSC with individual subscales were identified. The exploratory factor analysis revealed some potential differences in how items and subscales factored in this nursing home CNA population.

This dissertation represents an important step in the evaluation of CNA PSC in nursing homes and the relationship of PSC to safety outcomes. Future work on nursing home PSC and clinical and workforce outcomes is described.

Chapter I

State of the Science

Purpose

The overall purpose of this study was to examine whether nursing home certified nursing assistant (CNA) perceptions of patient safety culture (PSC) were correlated with clinical or workforce outcomes. The purpose of this chapter is to review the literature on PSC and PSC measurement in hospitals and nursing homes. While research on PSC has primarily been conducted in hospitals (see Appendix A1), in 2006-2007, six studies were published that examined PSC in nursing homes (Castle, 2006a; Castle & Sonon, 2006; Handler, Castle et al., 2006; Hughes & Lapane, 2006; Scott-Cawiezell et al., 2006; Wisniewski et al., 2007). These studies are presented in Appendix A2. This chapter will also review research on nursing home certified nursing assistant (CNA) workforce issues, and previous studies on patient safety outcomes related to CNA job responsibilities such as falls, pressure ulcers and daily restraint use in nursing homes. (Abbreviations in this manuscript that may be unfamiliar to the reader are defined in the Glossary of Terms).

Introduction and Problem

The Institute of Medicine (IOM) report, "To Err is Human," suggested that between 44-98,000 people die each year as the result of medical error, making it somewhere between the 5^{th} or 8^{th} leading cause of death in the United States (Kohn, Corrigan, & Donaldson, 2000). Since the release of the IOM report, patient safety has become a top priority for the U.S. healthcare system (Kohn et al., 2000; Stelfox, Palmisani, Scurlock, Orav, & Bates, 2006). One aspect of patient safety science has been to describe PSC, or how perceptions, behaviors, and competencies of individuals and

groups determine an organization's commitment, style, and proficiency in safety management (Lee, 1996). PSC may be a critical factor in creating high reliability healthcare organizations (Singer et al., 2003). However, few studies to date have correlated PSC measures with actual safety outcomes (Hofmann & Mark, 2006; Itoh, Abe, & Andersen, 2002; Pronovost et al., 2005). Research efforts have included the development and refinement of instruments to measure PSC (Sexton et al., 2006; Sorra & Nieva, 2004). Yet while acute and ambulatory care centers have begun to compile PSC benchmarking data (Sexton et al., 2006; Sorra & Nieva, 2004), it is significant that nursing homes lag behind in developing and implementing such measures (Castle, 2006a; Castle & Sonon, 2006). Researchers have suggested that gaining a better understanding of nursing home PSC is important in understanding how nursing home staff attitudes and behaviors relate to resident safety outcomes (Castle, 2006a).

There are approximately 16,000 nursing homes in the United States, caring for over 1.6 million frail older adults and people with disabilities (Centers for Disease Control and Prevention, 2006). Serious workforce issues have led to a series of reports describing a nursing home staffing crisis (Harahan et al., 2003; Harris-Kojetin, Lipson, Fielding, Kiefer, & Stone, 2004; Institute for the Future of Aging Services, 2003, 2007; National Commission on Nursing Workforce for Long-Term Care, 2005; Stone & Weiner, 2001; U.S. Department of Health and Human Services, 2003).This situation is predicted to worsen as the number of older individuals, especially those over age 85, grows rapidly over the next several decades (U.S. Department of Health and Human Services, 2003).

Nursing homes are staffed primarily with certified nursing assistants (CNAs) and licensed practical nurses (LPNs); registered nurses (RNs) occupy primarily administrative positions and are less involved in direct patient care (Harrington, Swan, & Carrillo, 2007; Institute for the Future of Aging Services, 2007). CNAs provide 80-90% of the care in nursing homes (Beck, Ortigara, Mercer, & Shue, 1999); yet federal law requires only 75 hours of training (Institute for the Future of Aging Services, 2007). LPNs receive one year of training in most states, but curriculum content does not include supervision or leadership skills. Despite this fact, LPNs are routinely put in charge of supervising several CNAs and other staff in the nursing home (Harris-Kojetin et al., 2004). While RNs may have ultimate accountability for the actions and practice of both LPNs and CNAs, in reality, LPNs provide most of the supervision in nursing homes.

In studies addressing why CNAs leave nursing home positions, poor supervision and lack of training are two factors that are often cited (Eaton, 2001; Stone & Weiner, 2001). Studies suggest that gaps in the education and training of the nursing home workforce may limit the ability of U.S. nursing homes to consistently deliver safe, high quality health care (Harris-Kojetin et al., 2004).

CNAs: Who are They?

Demographics

According to 2006 Bureau of Labor Statistics data, there are 1,391,430 nurses aides, orderlies and attendants working in U.S. nursing homes (Institute for the Future of Aging Services, 2007). Ninety percent of nursing home CNAs are women, with a mean age of 36.4 years; about 50% are White, 33% are African American and 15% are Hispanic or other persons of color (Institute for the Future of Aging Services, 2007).

90.9% of CNAs are U.S. citizens; 89% report English as their primary language, 3.9% report Spanish and 7.1% report “other” (Centers for Disease Control and Prevention, 2004).

Contrary to public perception, about 30% of CNAs have at least some college education (Yamada, 2002). Forty-three percent of nursing home CNAs are married, and the typical worker is described as a single mother aged 25-54 (Harris-Kojetin et al., 2004). Fifty-five percent of nursing home CNAs work full time; on average direct care workers work about 30 hours per week (Harris-Kojetin et al., 2004). The median annual wage for CNAs in 2005 was $21,480, and twenty-five percent of those workers did not have health insurance (Institute for the Future of Aging Services, 2007).

While some information on race and ethnicity is available for CNAs, there is limited national and state data on country of origin, citizenship, and primary language (P. Gruhn, American Health Care Association, personal communication, July 27, 2005). This is an important area for future research, as the link between culture, language and patient safety has been recognized in several studies (Johnstone & Kanitsaki, 2006). Lower quality of care delivery has been associated with patients who are ethnic, language or cultural minorities. The inability of healthcare workers and patients to communicate effectively in a common language has been associated with patient safety issues (Johnstone & Kanitsaki, 2006).

The Role of the Certified Nursing Assistant in Long Term Care

Eighty to ninety percent of care in nursing homes is delivered by unskilled staff (Beck et al., 1999). CNAs are required to complete less than two weeks of training; yet they are put in a position to manage the daily lives of a group of frail elders with little

supervision by nursing staff. Most charge nurses in long-term care are LPNs, who receive little, if any, training in supervision and management (Institute for the Future of Aging Services, 2007). These LPNs spend an average of twelve minutes per resident per shift, mostly on documentation and medication administration (Eaton, 2000). In contrast, CNAs spend on average 43 minutes per resident per shift, mostly in direct care (Eaton, 2000).

The role of the CNA includes assisting residents with activities of daily living (ADLs) such as bathing, dressing, toileting, ambulation, and feeding. This involves encouraging residents to do as much for themselves as possible, so an understanding of motivation, self-efficacy and other theories of human behavior is important (Resnick, Simpson, Bercovitz et al., 2006; Resnick, Simpson, Galik et al., 2006). Yet CNAs receive minimal education or training on how to encourage residents to care for themselves (Henderson & Vesperi, 1995, p.53). Instead, staff frequently step in and engage in activities for residents, often in the interest of saving time (Bowers & Becker, 1992).

In a recent qualitative study using observation and interview data, Anderson and colleagues (2005) identified two principal mental models used by nursing home CNAs. Similar to an idea or theory, a mental model is a symbolic representation of a system and its expected behavior, and may drive human behavior in some instances (Anderson et al., 2005). The mental models described by CNAs were the Golden Rule and Mother Wit. The Golden Rule guided the CNAs' approach to care in that they treated residents as they themselves (the CNAs) would want to be treated; they saw the residents as real people, despite cognitive impairment. Mother Wit was defined as job performance based on

experience gained from being a mother; thus caring for elders was seen as analogous to caring for children (Anderson et al., 2005).

These mental models engendered affection, but also resulted in infantilization and misrepresentation about some conditions such as depression and pain (Anderson et al., 2005). This study also identified the lack of communication between RNs, comprising only about 7% of nursing home nurses, and CNAs on the frontlines. CNAs are given significant responsibilities for frail, elderly residents, but may lack the clinical knowledge and skills to recognize important changes in condition, and are not adequately supervised by nurses who can collaborate with them (Anderson et al., 2005). This suggests several areas related to PSC subdomains (communication, supervision, staffing, learning environment) where nursing homes may be very different from other healthcare institutions because of the large number of unskilled staff who care for residents.

Because of the frailty of the population, acute illness, deconditioning and altered mental and physical status are common occurrences in nursing home residents (Boockvar, Brodie, & Lachs, 2000). The amount of time spent in direct resident care is greatest for CNAs when compared with nurses and other nursing home staff (Harrington et al., 2007). Also, given the intimacy of bathing and toileting activities, CNAs are in a position to recognize and report important changes in older adults during ADL care (Boockvar et al., 2000). These changes may include reddened areas that indicate a stage I pressure ulcer or early skin damage (Lake & Cheung, 2006); unsteady gait; weakness or a balance problem during ambulation indicating high fall risk (Rubenstein, 2006; Stone & Walker, 2006); increased agitation putting the resident at risk for daily restraint use (Schnelle, Bates-Jensen, Levy-Storms et al., 2004).

The CNA is often the first staff member to recognize a change in a resident's condition. In a study by Boockvar and colleagues (2000), a new instrument was developed for CNAs to document behavioral and functional status changes. In validity testing in a 409 bed nursing home, 23 CNAs used the new instrument for 4 weeks on 74 nursing home residents on three floors. The instrument had predictive validity in that residents with a recorded change were more likely to develop an acute illness within 7 days than those with no recorded change (risk ratio 4.1; 95% confidence interval 2.6, 6.3). CNAs recognized subtle changes up to five days before nurses realized that a resident was ill (Boockvar et al., 2000).

Studies have shown that communication between licensed staff and CNAs is poor at best (Jervis, 2002). Critical clinical information known by nurses is often not shared with CNAs, and in some nursing homes, CNAs may not report changes in condition consistently to nurses (Bowers, Esmond, & Jacobson, 2003). Thus individuals with the greatest potential to identify changes in condition are often not adequately trained or skilled, or encouraged to communicate those changes to staff who are able to intervene and implement changes in the plan of care.

Conceptual Definitions and Controversies in PSC Measurement

Patient safety, where safety is defined as freedom from danger, risk or injury, is considered by many to be a critical nursing issue (Scott-Cawiezell et al., 2006; Stone & Walker, 2006). This is in part because many patient and workforce outcomes related to patient safety are nurse-sensitive, such as falls, pressure ulcers (Lake & Cheung, 2006), medication errors, failure to detect change in condition, and turnover (Currie, 2006). Considerable work has been done applying basic safety and accident prevention

principles to nursing and healthcare at both the unit and organizational levels. Studies from the aerospace, manufacturing, airline and other high reliability industries have suggested that a culture of safety may be an entity in its own right that can influence outcomes within an organization (Cooper, 2000; Guldenmund, 2000; Vincent, Taylor-Adams, & Stanhope, 1998). Studies in hospitals suggest that a culture of safety may be related to outcomes such as reduced length of stay and reduced nursing turnover (Pronovost et al., 2005). The term *patient safety culture (PSC)* is often used in place of *culture of safety* when applied to healthcare.

Many definitions of PSC exist in the literature, and several authors discuss the distinctions between a safety climate and safety culture (Colla, Bracken, Kinney, & Weeks, 2005; Cooper, 2000; Sexton et al., 2006). Some believe that climate reflects attitudes and perceptions only, that it exists at the microsystem (e.g., unit) level, and that it is less stable over time (Sexton et al., 2006). By contrast, culture is considered to be a more deep-seated reflection of attitudes, perceptions, behaviors, norms, and is more stable over time. Culture is thought to take years to develop or change. Some authors consider climate and culture on a continuum, while others believe that they are two completely separate constructs (Guldenmund, 2000). Much of this work is based on principles of culture outlined by Edgar Schein (1992) and others in the anthropology and business literature in the 1990s.

How can culture best be measured? Schein's definition of culture includes three levels: basic assumptions, espoused values and artifacts (Schein, 1992; Scott, Mannion, Davies, & Marshall, 2003). Using this definition, levels of culture may be measured different ways. Artifacts (a surface manifestation of culture) may be measured using

observation; values and perceptions may be measured using a survey or questionnaire; fundamental assumptions may be ascertained using qualitative techniques such as in-depth interviews (Scott et al., 2003). Guldenmund also applies Schein's model, describing how safety culture can be assessed within this framework (Guldenmund, 2000).

Sexton and colleagues (2006) provide succinct definitions of climate and culture, and clearly state their agenda: to survey attitudes of health care workers regarding patient safety. The authors state that one person's attitude is an opinion; but several peoples' attitudes constitute climate. Attitudes, perceptions, values and behaviors that persist over a longer period of time constitute culture. Others may use the phrase *patient safety culture* to mean what Sexton terms *patient safety climate*. These authors make the point that describing what a researcher is attempting to measure (e.g., attitudes), instead of simply using the words climate or culture, is helpful to the reader.

Because this debate cannot be resolved until common definitions of climate and culture can be determined, researchers writing about patient safety culture or climate need to define these terms explicitly. In this way, readers will know which concept is being studied and how it is being defined. For the purposes of this study, safety climate is considered to include the attitudes, beliefs and perceptions about safety at the unit (and individual) level; PSC is considered to include attitudes, perceptions, beliefs, values, patterns of behaviors and competencies at the organizational level related to patient safety. Instruments that measure either culture or climate of safety are included in this review. Lee's description of patient safety culture is provided here as a guiding framework for the review:

The safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to and the style and proficiency of, an organization's health and safety management. Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measures (Lee, 1996, p. 2).

James Reason's (1997) classic text on accident theory provides the theoretical underpinnings for much of the patient safety literature. Yet only sometimes is this theoretical thread carried through in the development of instruments measuring PSC. While reviews of safety culture theories exist, they do not generally integrate various concepts or theories, but rather list them and suggest that researchers choose the one that best fits their study. While this is an acceptable practice for many studies, an integrated theoretical model to explain the relationships between individual and group factors and other aspects of PSC would also be helpful to healthcare research. Comparisons using data from various studies are difficult when a different theoretical framework has been used for each study (Stone et al., 2005). A unified theory would enhance our ability to build the science of PSC in healthcare.

To date, a standard methodology for studying PSC in healthcare has not been identified. While the association between PSC attitudes, staff behaviors and resident outcomes has been suggested (Cooper & Phillips, 2004; Vincent et al., 1998) it has not been clearly demonstrated in any of the studies reviewed here. Since survey methods measure attitudes and perceptions, but cannot directly measure behaviors, some have advocated for mixed methods research on PSC (Scott-Cawiezell et al., 2006; Singer et al.,

2003). This could include ethnographic or observational studies that would document and measure behaviors as well as perceptions and attitudes. Additional qualitative techniques such as in depth interviews would provide a rich source of data to enhance and explain survey responses among various groups (nurses, physicians, CNAs, pharmacists, non-clinical staff, administrators, and others).

Another theme in the PSC literature is the need to study patient safety climate at the unit or clinical microsystem level (Davies, Nutley, & Mannion, 2000; Mohr, Batalden, & Barach, 2004). Studies have reported greater differences between scores from units within organizations than among scores on a single unit (Huang et al., 2007; Pronovost, Weast, Holzmueller et al., 2003). This is potentially important for nursing homes that, like hospitals, have units with unique characteristics; however debate continues about whether or not unit versus facility level safety culture is most important (Gaba, Singer, & Rosen, 2007). Dementia units, subacute units and traditional long term care units could theoretically have differences in patient safety scores related to different managers, physical environments, staffing levels and resident populations. Future studies on nursing home PSC should consider large enough sample sizes to detect differences based on unit type.

A related theme is the consistently higher perception of PSC among managers versus frontline staff (Pronovost, Weast, Holzmueller et al., 2003; Singer et al., 2003). Qualitative research using in-depth interviews or focus groups could explore this finding in more detail. Future intervention research may involve studies of various ways to bridge this gap.

With increasingly limited research funding, it becomes even more important to determine the extent to which PSC is modifiable. Some researchers have suggested that PSC could be important in its own right (Colla et al., 2005); however if it is not possible to modify or improve PSC and influence outcomes, then the value of conducting research on this concept at all could be questioned. The results of early intervention studies, such as Executive Walk Rounds (Thomas, Sexton, Neilands, Frankel, & Helmreich, 2005), Comprehensive Unit-Based Safety Program (CUSP) (Pronovost et al., 2005) and others suggest that PSC may influence safety specific outcomes. In addition, specific subscales that address individual dimensions of PSC (such as teamwork or feedback on errors) may prove to be more valuable and practical in clinical practice settings than global measures of climate or culture. Testing the modifiability of specific PSC dimensions in various practice settings will be important in future studies.

PSC Instruments and Measurement Issues

While there is considerable overlap in the dimensions of PSC measured in various instruments, there are also important differences (Flin, 2007; Singla, Kitch, Weissman, & Campbell, 2006) (see Table A1). Some instruments measure job satisfaction (Sexton et al., 2006), but most do not. Some have a greater focus on leadership or teamwork (Nieva & Sorra, 2003; Singer et al., 2003). The Safety Attitudes Questionnaire (SAQ) is the only one to date with limited data on the relationship of PSC and outcomes (Colla et al., 2005; Pronovost & Sexton, 2005). The Hospital Survey on Patient Safety Culture (HSOPSC) has a focus on patient handoffs (Singla et al., 2006).

Several recent reviews of instruments used to measure PSC have concluded that there is a need to develop standard dimensions of PSC (Colla et al., 2005; Flin et al.,

2006; Singla et al., 2006). It is possible that to date, important dimensions could have been omitted and relatively less important dimensions included (Singer et al., 2003). Flin and colleagues point out in their review that a theoretical model to describe the relationship between patient safety culture and safety outcomes is rarely specified (Flin et al., 2006). Work on dimensions of PSC would further the development of a theoretical model that could be tested in future research.

Authors have commented on the questionable clinical meaningfulness of specific PSC scale scores (Castle, 2006a). Additional work could move PSC data from normative to criterion-referenced scales. This would enable healthcare organizations to go beyond benchmarking, to determine a cut point above which PSC could be said to exist.

The distinction between quality measures and safety measures deserves comment. Most researchers consider safety to be a subset of quality, and as such do not feel compelled to distinguish safety outcomes from quality outcomes (M. Rantz, personal communication, May 18, 2007). Rantz, an internationally recognized expert, has done extensive work on quality measurement in nursing homes over several decades. During this interview, she concurred with the need for more studies specific to nursing home PSC.

Many measures of quality may also have a safety component, and aspects of healthcare organizations such as staffing and management may influence both quality and safety (Stone & Walker, 2006). Whether the outcome of patient falls is considered a quality or a safety measure (or both), does not change the importance of determining the etiologies of patient falls and the relationship between PSC and patient falls or other clinical outcomes. However, education and other system-level interventions may vary

depending on whether an outcome is primarily a safety or a quality outcome, since safety interventions will be based on safety science and quality interventions will be based on quality improvement studies.

Differences in PSC Measurement between Hospitals and Nursing Homes

The distinct study of PSC in nursing homes is important for several reasons. Frail elders represent a vulnerable population at high risk for medical errors due to cognitive and sensory impairments. Individuals over age 85 are the fastest growing segment of the United States senior population (U.S. Department of Health and Human Services Administration on Aging, 2006), and most will spend at least some time in a nursing home. Studies have shown that adverse drug events (ADEs) are common in nursing homes (Gurwitz, Field, & Avorn, 2000; Gurwitz, Field, & Judge, 2005), with rates of 9.8 ADEs per hundred resident-months, and 4.1 *preventable* ADEs per hundred resident-months. ADEs are reported as 6.5 per hundred admissions in hospital studies (Bates, Cullen, Laird et al., 1995). Multiple medications, multiple disease processes, and non-specific presentation of illness all increase the risk of medical error in the nursing home population.

In addition to unique aspects of this population, the structure of the nursing model of care is considerably different from that in acute care or outpatient institutions. Most direct care in nursing homes is provided by nursing assistants (Wunderlich & Kohler, 2001), guided by LPNs or RNs. Physicians are often not on site (Feng, Katz, Intrator, Karuza, & Mor, 2005; Levy & Kramer, 2005), therefore communication regarding change of condition or changes in medications is often accomplished via telephone. This suggests significant differences in the systems of care in nursing homes, different

potential underlying causative factors and solutions to patient safety issues, and possibly a different underlying safety culture.

Finally, nursing homes are driven in part by a punitive regulatory environment, governed by regulations from the Center for Medicare and Medicaid Services (CMS) and each state's department of public health (DPH). By comparison, hospitals are driven primarily by an accreditation process through the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO). Certain principles of PSC that apply to other industries or to hospitals, such as a fair and just culture versus a culture of blame, may not resonate with nursing homes as they are currently structured. The need to develop nursing home specific instruments to measure PSC, particularly to address the views of CNAs, has been raised by a number of researchers (Castle, 2006a; Hughes & Lapane, 2006; Sorra & Nieva, 2004).

The Hospital Survey of Patient Safety Culture

The HSOPSC is the only instrument for which reliability and validity have been previously reported and that has been used in more than one nursing home study; therefore it was selected for this dissertation. The HSOPSC, funded by the Agency for Healthcare Research and Quality (AHRQ), was developed and piloted in 2003 (Nieva & Sorra, 2003; Sorra & Nieva, 2004). The original instrument included 12 specific domains and two outcome measures. Each domain has 3-5 items. A 5 point likert scale (1-5) measures "strongly disagree" to "strongly agree," or "never" to "always." Higher scores indicate more positive attitudes toward patient safety culture.

A report detailing the development of the instrument and initial psychometric testing was reviewed (Sorra & Nieva, 2004). The authors conducted a literature review.

The psychometric properties of two existing safety culture surveys were used to inform the initial HSOPSC design and domains. Pre-testing was done with a small group (three nurses and four physicians). Subsequent cognitive testing was done, initially with eight hospital staff from different departments (nurse, respiratory therapist, clerk, risk manager, pathology resident, medical resident, director of nursing dietician). After revisions were made, a second round of testing was done with six hospital workers: pharmacist, dietician, nurse manager, medical nurse, operating room nurse food services employee. Additional changes were made to the HSOPSC instrument.

Initial testing was done in 21 hospitals across six states. A total of 1437 hospital employees out of 4983 potential respondents completed the survey for a response rate of 29%.

The authors report psychometric analysis of the data using item analysis, content analysis, exploratory and confirmatory factor analyses, reliability analysis, composite score construction, correlational analysis and analysis of variance (Sorra & Nieva, 2004). Reliability (Cronbach's alpha) is reported for each of the 12 domains (10 safety culture dimensions and 2 outcome dimensions) in the original study:

Overall perceptions of safety 0.74
Frequency of event reporting.....0.84
Supervisor/manager expectations and actions promoting safety 0.75
Organizational learning.....0.76
Teamwork within units 0.83
Communication openness 0.72
Feedback and communication about error.....0.78
Non-punitive response to error 0.79
Staffing.....0.63

Hospital management support for safety 0.83

Teamwork across hospital units.....0.80

Hospital handoffs and transitions.....0.80

Results from exploratory factor analysis revealed 14 factors with Eigenvalues greater than 1, explaining 64.5% of the variance. Almost all items loaded highly on only one factor, with factor loading greater than or equal to .40 (Sorra & Nieva, 2004). However, a few items loaded on 2 factors. Confirmatory factor analysis (CFA) was performed on 13 dimensions (one had been dropped due to low reliability and redundancy with other items). Items were dropped sequentially to determine goodness of fit with remaining dimensions. Ultimately, after CFA, the final instrument with 12 dimensions and 42 items (3-4 in each dimension) was recommended.

Validity was assessed by inter-correlations between the 12 dimensions, using dimension composite scores. All inter-correlations of the 12 final dimensions fell within the range of .2-.6 (Sorra & Nieva, 2004). Validity was also assessed by examining correlations between the outcome variables (overall perception of safety and extent of event reporting) with a single item variable (overall safety grade and number of events reported). The event reporting variable correlation was not significant. The overall safety grade and the overall perceptions composite score had a moderate correlation of $r=.66$ ($p<.001$).

Potential issues exist with the validity of PSC instruments in new populations and settings. Researchers adapting the HSOPSC for other settings or populations, such as nursing homes, have tried to optimize comparability and the potential for benchmarking by keeping the revised instruments as close to the original as possible (Handler, Castle et al., 2006).

Patient Safety Culture Domain Variables

Based on the integrative literature review, a number of themes in PSC measurement emerged. PSC domains that are specifically related to nursing home studies are reviewed here.

Staffing

Studies linking nursing home staffing levels (of RNs, LPNs and CNAs) and quality outcomes generally support the statement that higher nurse staffing levels, particularly RN staffing levels, are associated with higher resident quality of care outcomes (Anderson, Hsieh, & Su, 1998; Harrington et al., 2000; Rantz et al., 2004; Schnelle, Simmons et al., 2004; Zimmerman, Gruber-Baldini, Hebel, Sloane, & Magaziner, 2002). However, RNs with additional training related to patient safety, communication and supervisory skills are typically in administrative positions in nursing homes, and spend most of their time on documentation, not supervision of direct resident care (Harrington et al., 2007). Castle (2006a) suggests that higher PSC scores and better patient safety outcomes may be associated with higher nurse staffing as well. However, staffing measures in some studies may suffer from low reliability (Feng et al., 2005), and researchers have called for additional work on this domain to improve its predictive value (Castle, 2006a; Nieva & Sorra, 2003).

In an observational study of twenty-one California nursing homes, those with CNA staffing levels in the highest decile (over 91%) had better outcomes on sixteen care process measures than homes with lower nurse aide staffing (Schnelle, Simmons et al., 2004). Several of these CNA care process measures are related to nurse sensitive indicators of resident safety or adverse events (repositioning may relate to pressure ulcer

development; walking, exercise and toileting may relate to falls and restraints; feeding may relate to weight loss). In this study, some homes had adequate staffing, yet processes of care were not carried out. The authors contend that the absence of oversight, management and monitoring for the presence of these care processes is suggested by the data. If nursing homes are adequately staffed with CNAs, yet there is an absence of RNs, nurse leaders or adequate staff to monitor quality and safety, then it is less likely that these and other safety-related processes will be carried out (Anderson, Issel, & McDaniel, 2003). Testing this assumption related to staffing and leadership is an important area for future PSC nursing home research.

Transitions (handoffs)

Studies have documented that errors often occur during patient handoffs either within or between health care settings (Coleman, Parry, Chalmers, & Min, 2006; Coleman, Smith, Raha, & Min, 2005; Vira, Colquhoun, & Etchells, 2006). Significant problems can occur when residents are transferred from the nursing home to the hospital, from the hospital to the nursing home, from one unit to another within the same nursing home, from one nursing home to another, or from the skilled nursing facility to home (Boockvar et al., 2004). The factors contributing to errors or adverse events in each of these scenarios may be slightly different; in particular they may involve different staff, relationships and methods of communication.

Patient handoffs and communication between units or shifts are domains on several PSC measures. A lack of communication between nursing home nurses and CNAs has been described in the literature, and may contribute to confusion during handoffs (Bowers, Esmond, & Jacobson, 2000). Jervis (2002) studied the relationships

between nurses and CNAs in a 21 month ethnographic study in one Midwestern nursing home. The author observed seven staff members during various shifts; she also conducted semi-structured, audiotaped interviews with 14 residents and 16 staff members. Issues of race, class and a strongly hierarchical organizational structure limited effective communication between nurses and CNAs (Jervis, 2002). Whether a relationship exists between the PSC domain of patient handoffs and certain clinical outcomes such as re-hospitalizations, falls (Capezuti, Boltz, Renz, Hoffman, & Norman, 2006), or pressure ulcers has not yet been reported in the nursing home literature.

Communication, Teamwork, Leadership and Supervision

Communication and teamwork have been identified as important PSC domains. Evanoff and colleagues (2005) studied whether effective teamwork between hospital nurses, physicians and patient care technicians (who have a role similar to CNAs), included common goal and priority setting among team members. In an acute, tertiary care hospital, 437 patients from six nursing units were randomly selected. Staff interviews regarding patient goals and priorities identified concordance in just 17% of instances. In 53% of the interviews, partial agreement on priorities existed. In 30% of cases, no agreement could be identified (Evanoff et al., 2005). In some instances, information that would have been relevant to the patient care technicians (e.g., holding a lunch tray) was not passed on by the nurses. These findings corroborate other studies (Pronovost & Sexton, 2005; Sexton, Thomas, & Helmreich, 2000) that suggest communication between members of the health care team can be improved and may have a direct impact on patient safety.

Studies specific to communication in long term care have examined the percentage of time nurses document telephone communication and/or orders from physicians (McNabney, Andersen, & Bennett, 2004) and barriers to communication in nursing homes (Cadogan, Franzi, Osterweil, & Hill, 1999; Jervis, 2002). Cott (1997) used a self-administered survey and a social network approach to describe the teamwork and relationships among nursing staff on five units in a large Toronto nursing home. Eighty-five out of 153 respondents completed the survey (56% response rate). Results suggested that nurses and CNAs had very little interaction, and that nurses perceived their role as directing CNAs to carry out care decisions made by "higher level" staff (Cott, 1997).

Attempts to create and implement standardized templates for communication on change in condition (Winn, Cook, & Bonnel, 2004) have not been effective in previous studies. CNAs are often left out of written communication systems, such as care plans or behavior logs. Thus information that is shared among nurses and other providers often does not filter down to the CNAs on the frontlines (Bowers et al., 2003).

The construct of leadership has been examined in studies evaluating supervisory relationships between nursing management, nurses and CNAs in long term care. McGilton (2003) evaluated the psychometric properties of two leadership scales in nursing homes, the Charge Nurse Support (CNS) Scale and the Unit Manager Support (UMS) Scale, in two mid-sized Canadian nursing homes. Seventy staff members participated in the validation study, which revealed Cronbach's alphas of .81 for the CNS scale and .80 for the UMS scale. Factor analysis supported initial construct validity; however only the CNS demonstrated a correlation ($r=.42$, $p=.05$) with a relational

behavior scale of how staff relate to residents (McGilton, 2003). Further work on these and other instruments to evaluate nursing home leadership is warranted.

McGillis Hall and colleagues (2005) conducted 12 focus groups with staff and managers across six Canadian nursing homes. Thirty participants were supervisors and 26 were supervised staff, including CNAs; all focus groups were recorded and transcribed, then analyzed using a 3-stage process. Themes reflected several dimensions relevant to PSC, such as communication, feedback, knowledge/learning and supervision (McGillis Hall et al., 2005).

This work supports previous studies suggesting that nursing and administrative leadership play a critical role in clinical and workforce outcomes (Anderson et al., 2003). It seems likely that patient safety would be one of those outcomes; however leadership's impact on the CNA's role and safety-specific outcomes has not been studied within a safety science framework in long term care.

Error Reporting: Medication Errors and Adverse Drug Events

Up to fifty percent of ADEs may be preventable, and errors in the prescribing and monitoring phases of the medication use process have been identified as being most important to reducing nursing home ADEs (Gurwitz et al., 2005). Prescribing and monitoring of medications in the nursing home involves a complex interaction between the prescriber (physician, nurse practitioner, or physician's assistant), the nurses, the pharmacist, the laboratory and the resident (Field et al., 2001).

In most states, licensed nurses supervise the administration of medications; however CNAs play a critical role in the monitoring phase, reporting potential side effects such as lethargy or altered mental status (Boockvar et al., 2000). Some states have

developed programs in which CNAs can obtain 40-80 additional hours of training to become medication technicians, allowing them to administer certain medications in nursing homes (Hughes, Wright, & Lapane, 2006). These emerging medication technicians have a role in medication administration that is distinct from traditional CNAs. Most CNAs receive little training on monitoring residents for the potential side effects of medications during their 75 hours of federally mandated training (Nakhnikian, Wilner, & Hurd, 2002).

Discussions of accurate and open communication, teamwork, feedback on medication errors, adverse clinical events, and medication error reporting in the literature support the importance of those patient safety culture domains in nursing home research on medication safety (Boockvar, LaCorte, Giambanco, Fridman, & Siu, 2006; Handler, Wright, Ruby, & Hanlon, 2006; Pronovost, Weast, Schwarz et al., 2003). However the role of the CNA in monitoring residents for ADEs is often overlooked in clinical practice.

Unlike hospitals that are accredited through the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO), nursing homes are licensed and regulated by the state and federal government. An annual survey by state inspectors from the department of public health provides a score card that is publicly available in each nursing home and on the internet (Center for Medicare and Medicaid Services, 2007a). The survey process is considered to be strictly regulatory; its purpose is to identify and discipline facilities that are not meeting state and federal standards of care (Walshe, 2001). In some cases, this involves civil and monetary penalties or fines paid to the state. Considered largely punitive, remediation and education of nursing homes is not a part of this process (Cherry, Ashcraft, & Owen, 2007; Walshe & Harrington, 2002) . Efforts to

revise the survey process, to include providers and surveyors meeting together on a regular basis, are underway (Walshe & Harrington, 2002).

The negative impact of a poor state survey can be significant, particularly in a community with a competitive nursing home market (Angelelli, Mor, Intrator, Feng, & Zinn, 2003). Thus the notion of discipline for poor performance is one that is engrained into nursing home culture (Cherry et al., 2007; Ryan, Stone, & Raynor, 2004). This includes management practices where staff are often "written up" or given a written warning for lapses in performance related to care processes (e.g., leaving a resident unattended in the bathroom) as opposed to teams collaborating on why systems may have contributed to a safety issue or hazard. A culture of blame and shame is commonly found in nursing homes (Singer et al., 2007); being at the blunt end of events, CNAs are often identified as the person who "caused" the error to occur. Thus openness about errors and an environment that encourages error reporting have not been identified in nursing home studies to date (Castle, 2006a).

Resident Outcome Variables and CNA Turnover

Overview

The transformational framework known as resident-centered care is an approach that empowers staff members by valuing each person's input and the unique expertise that they bring to an individual's care (Baker, 2007, p. 214; Pioneer Network, 2007). Similar models of resident-centered care and staff empowerment that de-emphasize the hierarchy of the medical team have led to successful clinical outcomes in recent studies, such as fewer pressure ulcers (Barry, Brannon, & Mor, 2005), and lower restraint use (Rask et al., 2007). The study by Barry and colleagues surveyed 156 directors of nursing

and examined staff empowerment strategies, such as rewards for CNAs. Facility risk-adjusted pressure ulcer rates and social engagement scores were used as resident outcome measures. Results from the hierarchical regression model supported the hypothesis that as the number of rewards increased, the incidence of pressure ulcers was reduced ($B=-0.070$; $p<.10$).

Research suggests that when CNAs are empowered to participate in decision-making, they are more likely to follow the residents' plan of care (Barry et al., 2005). The rationale for the current dissertation study on the attitudes and beliefs of CNAs is based on research that suggests interventions can influence CNA behavior and performance (Hollinger-Smith & Ortigara, 2004). These changes in CNA behavior and performance may be associated with positive resident outcomes, as well as lower CNA turnover.

Falls

Injuries due to falls are a significant cause of morbidity and mortality in nursing home residents. Accidental falls are the sixth leading cause of death in people over age 65, and approximately half of all U.S. nursing home residents fall annually (Ray et al., 2005). Older adults who are hospitalized or who reside in nursing homes have an average fall rate of 1.5 falls per bed per year (Rubenstein, 2006). CNAs play a major role in preventing falls and implementing fall prevention care practices in nursing homes (Bonner, 2006).

Research findings on the effectiveness of programs to prevent falls and fall related injuries in the long term care setting have been mixed (Cumming, 2002; Gillespie et al., 2003; Hill-Westmoreland, Soeken, & Spellbring, 2002; Rubenstein & Trueblood, 2004; Shaw, 2002; Theodos, 2003, 2004; Tinetti, 2003; Vu, Weintraub, & Rubenstein, 2005).

Reasons for this may include the complex nature of the resident population and the high number of non-modifiable risk factors, such as Parkinson's disease, dementia, hemiparesis related to a stroke, or low vision (Vu et al., 2005).

Facility-based multidimensional fall prevention programs often include several components, such as risk factor modification, medication reduction, staff education, environmental modification, and specialty consultation. Some of these programs have been effective in reducing the rate of falls or fall related injuries in nursing home studies by 9-31% (Hill-Westmoreland et al., 2002). However, whether specific components of the intervention were responsible for the reduced rate of falls or injuries, or whether the combination of multiple interventions was necessary has not been determined. Most fall prevention interventions include specific aspects related to the role of the CNA in fall prevention. This may include the CNA's role in identification of change in condition, recognition of gait and balance problems or weakness, awareness of need for assistive device and proper use of that device, knowledge of proper/safe environment (free from clutter, call bell within reach, wheelchair locked when appropriate), and overall supervision of residents according to their level of risk (Taylor et al., 2007).

Environmental rounds have been identified as one important potential interdisciplinary intervention for fall and injury prevention in long term care (Ray et al., 1997). Members of the care team conduct daily walk rounds on each unit for residents who have fallen within the past 24 hours. The purpose of environmental rounds is to involve all staff (housekeeping, maintenance, CNAs) who might have valuable information to contribute about the potential risks for falls in an individual resident. The entire team can examine the environment and discuss potential environmental

modifications that could reduce fall risk (Hofmann, Bankes, Javed, & Selhat, 2003). Conducting these walk rounds emphasizes the importance of evaluating the resident in her/his own individual environment, promoting the concept of resident-centered care (Gruss, McCann, Edelman, & Farran, 2004).

In facilities that have engaged CNAs in these walk rounds, as part of a multidimensional approach, there has been a trend in reduced falls over time. A pilot study in one skilled nursing facility in Massachusetts used a multidimensional approach focusing on the development of CNA champions on each nursing unit (Bonner, Macculloch, Gardner, & Chase, 2007). Environmental rounds, staff education and reinforcement by falls champions led to a non-statistically significant trend toward lower fall rates (January 16.1%; February 12.3%; March 9.9%) in the pilot (Bonner et al., 2007). PSC domains that may be related to this intervention include communication openness, teamwork, learning environment, feedback and supervision.

Pressure Ulcers

The incidence and prevalence of pressure ulcers have been identified in many studies as indicators of quality or safety in nursing homes (Baier et al., 2003; Berlowitz & Frantz, 2007; Berlowitz et al., 2003; Hickey et al., 2005; Horn, Buerhaus, Bergstrom, & Smout, 2005). CNAs are responsible for following a turning and positioning schedule, and for reporting early changes to licensed nursing staff, such as reddened areas that could indicate pressure damage. In a descriptive, cohort study of 329 at risk residents in 16 nursing homes by Bates-Jensen and colleagues (2003), the documented MDS pressure ulcer quality indicator was not corroborated by direct clinical observation by trained researchers. CNAs documented that they were turning and repositioning residents;

however, this was not supported by direct observation (Bates-Jensen et al., 2003). This highlights the importance of a work environment with open communication, where CNAs feel comfortable informing supervisors when care practices are not being followed.

Subdomains within PSC such as communication openness, learning environment, management/supervision and staffing are relevant to pressure ulcer prevention. Pressure ulcers are a quality indicator (QI) and are publicly reported on Nursing Home Compare, the CMS consumer website that provides information to the public on various nursing home quality measures (Center for Medicare and Medicaid Services, 2007a). Nursing home administration and leadership have an incentive to address PSC domains that might influence pressure ulcer prevention. This association has not been studied to date.

Restraints

Various forms of physical restraints that have been used in nursing homes include vests, belts, mittens, wrist and ankle restraints (Capezuti, Maislin, Strumpf, & Evans, 2002; Castle, 2000). In addition, federal interpretive guidelines identify "any device that limits movement," as a restraint (U.S. General Accounting Office, 2002), which some authors consider to include full side rails. Prior to the nursing home reform legislation known as the Omnibus Budget and Reconciliation Act (OBRA) of 1987, physical and chemical restraint use was widespread in nursing homes (Evans & Strumpf, 1989). A number of factors contribute to restraint use, including facility staffing and workload, lack of restraint alternatives, belief that restraints provide a safer environment, fear of litigation, and family preferences (Medicare Quality Improvement Organization Program, 2006). The Minimum Data Set (MDS), a comprehensive nursing home resident assessment instrument, gives the definition of restraint use as "residents who were

restrained (trunk, limb, or chair) on a daily basis on the most recent assessment". This QI is not risk adjusted, and the denominator includes all nursing facility (non-skilled) residents on the most recent assessment (Center for Medicare and Medicaid Services, 1998).

Subsequent research provided evidence that higher restraint use did not lower the risk of falls or fall-related injuries, and that removing restraints did not lead to increased risk for those injuries (Capezuti, Evans, Strumpf, & Maislin, 1996; Castle, 1998; Mezey, Capezuti, & Fulmer, 2004). Capezuti and colleagues (1996) conducted a longitudinal, prospective trial to reduce side rail use. Secondary data analysis from that study of 319 residents examined falls, recurrent falls and serious injuries. Use of bilateral side rails did not reduce fall risk or recurrent falls (AOR=1.13, 95% CI= .45, 2.03 and AOR=1.25, 95% CI=.33, 4.67 respectively). A study two years later of restraint removal in three nursing homes (n=633) used survival analysis to compare various degrees of restraint reduction at the facility level (Capezuti, Strumpf, Evans, Grisso, & Maislin, 1998). In the home that had the lowest restraint reduction (11%, compared to 23% and 56%), the fall rate was 50% higher ($p<.01$) and the rate of minor fall-related injuries was twice that of the other homes ($p<.001$). In addition, multiple logistic regression was used to analyze fall/injury rates in residents who had restraints removed (n=38) versus those who did not (n=88). There was no increased risk of falls with restraint removal, and there was a reduction in the rate of minor injuries due to falls (AOR=.3; 95% CI= 0.1, 0.9, $p<.05$) (Capezuti et al., 1998).

In early studies, nursing home residents who were physically restrained were more likely to be injured during a fall or related incident such as side rail entrapment than

residents who were not restrained (Parker & Miles, 1997). Despite this research, many nursing home staff (including CNAs) still believe that if a resident is at risk for falls due to unsteady gait, poor balance, or cognitive impairment, he/she will be safer if physical restraints are used (Hantikainen & Kappeli, 2000). Administrators may mistakenly believe that using restraints will lower liability related to falls litigation (Kapp, 2003a, 2003b).

A higher facility rate of daily physical restraint use may reflect lower staffing levels, less CNA training or lack of attention to alternatives such as activity programs and adequate stimulation for dementia residents (Capezuti, 2004; Castle, 2000; Phillips, Spry, Sloane, & Hawes, 2000). More recent efforts to improve quality of life in nursing homes through transformative care practices (resident-centered care) have included major initiatives to reduce restraint use from previous levels (as high as 84%) to below 2% (Castle, 2000; Medicare Quality Improvement Organization Program, 2006).

Numerous quality improvement studies have identified facility daily physical restraint use as an important indicator for quality and safety (Morris et al., 2002; Rantz et al., 2004; Schnelle, Bates-Jensen, Levy-Storms et al., 2004; Sullivan-Marx, Strumpf, Evans, Baumgarten, & Maislin, 1999b). Daily physical restraint use is an indicator under quality of life (Center for Health Systems Research and Analysis, 2005) and is publicly reported on Nursing Home Compare for all U.S. nursing homes participating in the Medicare program (Center for Medicare and Medicaid Services, 2007a).

Physical restraint use has historically been many nursing homes' response to safety concerns such as falls, wandering, and agitation in cognitively impaired residents (Sullivan-Marx, Strumpf, Evans, Baumgarten, & Maislin, 1999a). Some studies have

revealed patterns of higher restraint use in facilities with lower nurse staffing, higher bed size and for-profit status (Castle, 2000; Harrington, O'Meara, Collier, & Schnelle, 2003; Schnelle, Bates-Jensen, Levy-Storms et al., 2004); but results have not been consistent across studies (Mor et al., 2003). Nevertheless, daily use of physical restraints is a commonly accepted measure of safety and quality in nursing homes, with a higher percentage of daily restraint use indicating lower safety and quality of care.

Staff Turnover

There is a pervasive perception that staff turnover is related to quality of nursing home care, despite limited support for this hypothesis in the literature. Qualitative studies (Bowers & Becker, 1992), small correlation studies and large multi-state studies (Anderson et al., 2003; Brannon, Zinn, Mor, & Davis, 2002; Castle, 2005; Castle, 2006b) have examined factors associated with staff turnover and the relationship between staff turnover and quality. In some cases, turnover has been the independent variable; in others the dependent variable.

Brannon and colleagues (2002) interviewed 288 directors of nursing from 360 eligible facilities (80% response rate) in eight states by telephone. These interviews were merged with data from the Online Survey Certification and Reporting (OSCAR) and Area Resource File (ARF) databases. Results suggested that four predictors of lower CNA turnover ($p<.05$) were: not having supervisors trained in management, having lower RN turnover, having a less hierarchical management structure, and presence of a union (Brannon et al., 2002). Other studies looking at turnover as an outcome have examined the influence of organizational factors such as management style, staff education, human resource issues (payscale and benefits), job characteristics and job satisfaction (Eaton,

2001). Some of those same factors have also been identified as important domains of PSC. In studies where turnover was considered as a predictor of poor quality outcomes, high turnover was thought to influence quality through reduced continuity of care, increased inexperienced workers, weaker standards of care, and increased workload (Castle & Engberg, 2005).

Issues related to the study of turnover in nursing homes in relation to quality include the complexity of this potentially non-linear relationship (Brannon et al., 2002; Halbur & Fears, 1986), multiple confounding variables (Anderson et al., 2003), confusion with other terms such as retention, and the aforementioned issues operationalizing measures of quality and safety. In addition, researchers have identified that nursing home administrators who self-report turnover use many different definitions; therefore the comparability of turnover rates from one nursing home to another is limited and may be subject to considerable measurement error (Castle, 2006b; Castle & Engberg, 2005). A standardized definition of turnover that has been proposed is "the total number of staff (measured in full time equivalents or FTEs) who leave employment during a 6-month period divided by the total number of staff (measured in FTEs) who were employed during this period. This calculation should include all shifts, part-time staff, and voluntary and involuntary turnover."(Castle, 2006b, p. 219).

It has been suggested that many CNAs want to provide good care, and one reason why CNAs may consider leaving their job could be concerns about resident safety or quality of care (Bowers et al., 2003; Castle, Engberg, Anderson, & Men, 2007; Lapane & Hughes, 2007). Important relationships may exist between PSC and staff turnover, especially turnover of CNAs.

Use of Large Data Sets to Study Outcomes in Nursing Home Research

The need for studies that address our understanding of how organizational variables influence outcomes was detailed by the American Academy of Nursing (AAN) Expert Panel on Quality in 1996 (Ryan et al., 2004). This dissertation follows their recommendation for studies that would "develop, explicate and test theory about causal relationships between the structure and process variables and the related health outcome variables" (Ryan et al., 2004, p. 39). Three large data sets, the MDS, OSCAR, and ARF have been reviewed by numerous authors, since they represent potentially rich, large data sets that are used to operationalize variables in many nursing home studies.

The MDS, OSCAR and ARF databases

The MDS is a comprehensive patient assessment tool with 18 domains and 400 individual items (Ryan et al., 2004). A licensed nurse completes the MDS on admission, quarterly, and with any significant change in condition. The MDS drives the development of an individualized care plan for each resident. In addition to the resident level data, information from each MDS is aggregated into 24 QIs. These QIs provide benchmarking data about each nursing home, and give consumers information intended to help them evaluate or choose a nursing home. Some QIs are risk adjusted, many are not. For example, the skin care (pressure ulcer) QI is risk adjusted for immobility, poor nutrition and end stage disease (Center for Health Systems Research and Analysis, 2005).

The reliability and validity of the MDS is generally considered to be acceptable for most research studies (Mor et al., 2003; Morris, Nonemaker et al., 1997), although limitations, such as ascertainment variability, do exist. In a 1999 study by Snowden and colleagues, several MDS outcome measures (cognitive performance scale, behavior

domain scores and activities of daily living or ADL scores) were compared with standard measures such as the mini-mental state examination, physician behavior checklist scale and dementia rating scale, respectively. This was a cross sectional study of 140 residents admitted to nursing homes in Washington State. Spearman correlation coefficients for each of the three MDS scales with the more traditional measures were .45 for cognition, .50 for behavior and .59 for ADL functioning, suggesting a moderate correlation and support for criterion validity of the MDS for certain measures (Snowden et al., 1999).

The OSCAR system, required by nursing homes participating in the Medicare program, transmits information on staffing, facility characteristics and state survey results to the Centers for Medicare and Medicaid Services (CMS) at the time of each facility's annual state survey. Because it relies on self-report for many of the measures, issues of ascertainment bias and lack of uniform data have been reported (Feng et al., 2005). Nevertheless, studies can link OSCAR and MDS data, and this may be useful in studying the relationship between structure such as staffing, and outcomes (Ryan et al., 2004).

In addition to the MDS and OSCAR data, the ARF provides information on a variety of factors that have been associated with nursing home quality in previous studies (Bourbonniere et al., 2006; Castle, Degenholtz, & Engberg, 2005; Mor, Zinn, Angelelli, Teno, & Miller, 2004). The ARF is a county-specific database maintained by the Health Resources and Services Administration (HRSA) that includes over 6,000 variables of interest, and can be linked through geographic codes to other relevant databases.

Facility-level Characteristics

A number of facility-level characteristics have been considered in previous studies on nursing home quality and safety outcomes. Studies on staff turnover have

suggested that counties with a high unemployment rate may have lower turnover because of the difficulty finding another position in the job market (Brannon et al., 2002). Similarly, rural regions with very few nursing homes may have low turnover, because there are very few other nursing homes in which to work (Harrington & Swan, 2003). Poor counties and counties with low Medicaid reimbursement rates, low bed occupancy and low private pay census have been associated with poor quality outcomes (Mor et al., 2004), lower RN staffing (Harrington et al., 2007) and in some cases higher turnover (Castle, Engberg, Anderson et al., 2007). Studies that have examined the relationship between profit/not-for-profit or chain versus non-chain status and quality have been mixed (Castle, Engberg, Anderson et al., 2007; O'Neill, Harrington, Kitchener, & Saliba, 2003). In one large study, quality was associated with higher private pay occupancy (fewer Medicaid residents), regardless of not-for-profit or proprietary status (Mor et al., 2004). Generally, larger bed size (both unit and facility) has been associated with lower quality outcomes (Wan, Zhang, & Unruh, 2006); however this has not been consistent across all studies (Anderson et al., 2003).

Summary

Studies from acute care hospitals reviewed here suggest that PSC can be measured, although researchers still disagree about the most accurate way to do this. Surveys that measure PSC may include different subdomains, and opportunities to improve conceptual clarity around safety climate and culture exist. Adaptations of various surveys to other settings (clinic, outpatient, or nursing home) are fairly recent, and more work needs to be done to determine whether existing surveys will be reliable and valid in these new settings.

The role of the CNA in nursing homes is critical because CNAs provide the vast majority of direct resident care. Accurately measuring CNA PSC is likely to be important in assessing differences in safety and quality outcomes across nursing homes. There are currently only six studies that have been conducted on PSC in nursing homes, and to date, none has demonstrated a correlation between PSC and clinical or workforce outcomes. Therefore, the overall purpose of this dissertation is to examine the relationship between CNA PSC scores and clinical outcomes (incidence of falls, pressure ulcers, and restraint use) and one workforce outcome (nursing staff turnover).

Chapter II

Conceptual Framework

Conceptual frameworks propose relationships among variables that may be important to the problem of interest. The conceptual framework of patient safety culture in nursing homes presented here provides the theoretical underpinnings for this dissertation study.

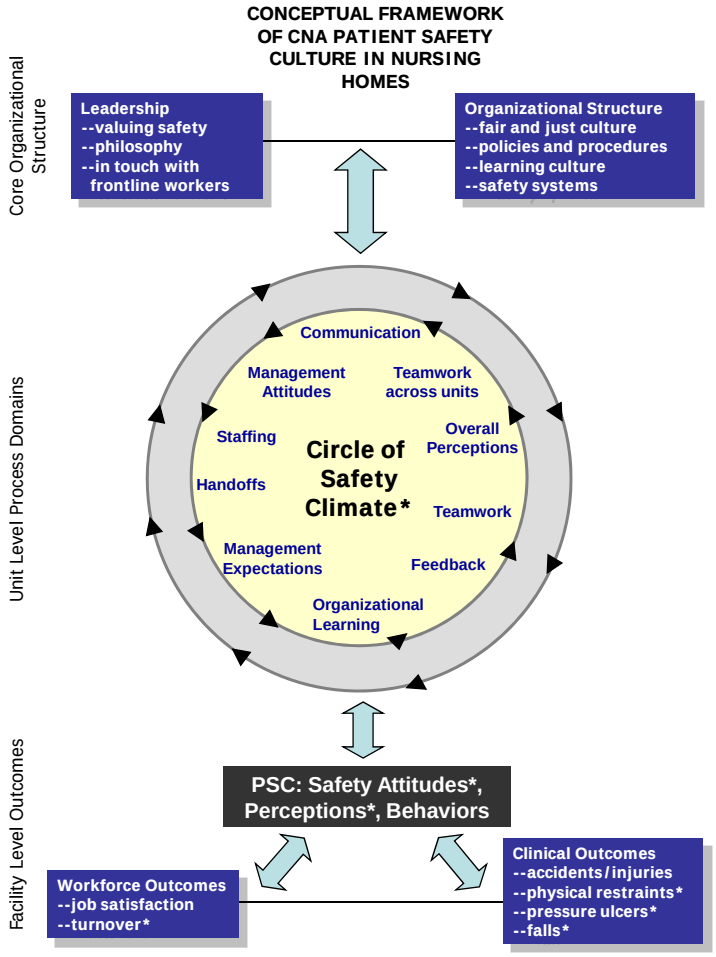
The conceptual framework that guides this study (see Figure 1) is based on work by Donabedian (2003) and Stone and colleagues (2005). Donabedian describes healthcare organizations in terms of structure, process and outcomes. Structure is defined as the conditions under which care is provided (materials, human resources, organizational characteristics). Process includes the activities that are done to provide healthcare. Outcomes are results or changes that can be attributed to healthcare (Donabedian, 2003, p.46). This broad, comprehensive framework has been widely applied in healthcare systems research, including nursing home studies (Mor, 2005; Wan et al., 2006).

Stone and colleagues performed reliability testing and item analysis on several instruments of organizational culture, and applied Donabedian's framework based on structure, process and outcomes to patient safety in healthcare organizations (Stone et al., 2005). The new model presented in this dissertation goes beyond previous models, in that it considers dynamic, inter-relationships between unit and facility factors.

A significant contribution to the science of nursing home PSC would be a consensus statement by an expert panel, of the variables that should be included in nursing home studies. This would permit greater comparability across studies, and would standardize definitions of PSC across settings. In an attempt to begin this process,

dimensions from PSC instruments from over fourteen studies were examined and compared for this dissertation. Variables reflected in those dimensions, as well as aspects of Stone's integrative model, were included in the development of the new conceptual framework presented here.

Figure 1: Conceptual Framework of CNA Patient Safety Culture in Nursing Homes. Adapted from Stone, P. et al. (2005). Organizational Climate of Staff Working Conditions and Safety - An Integrative Model.



*Denotes concept or relationship examined in dissertation study.

Relationships in this model that will be tested in this dissertation study are marked with an asterisk. The PSC model in Figure 1 builds on Donabedian and Stone's work;

however fundamental differences are depicted, particularly in the process domain or unit level. Ten dimensions of patient safety climate represent those variables consistently measured in multiple PSC studies that are most relevant to the CNA role (there is less emphasis on medication management practices in this model). Also, some dimensions are not pictured separately, as they are considered to be a subset of those represented here. For example, technology is considered to fall under communication, learning environment, or both. Job satisfaction is considered an outcome, not a dimension of patient safety climate or culture. Individual CNA PSC factors such as motivation, knowledge, self-efficacy, and skills could be conceptualized within certain organizational dimensions such as learning environment or communication. Human factors such as stress and fatigue, and workload/ job demands may also fall within multiple dimensions in this model (e.g., staffing and supervision). The potential integration of human factors and job demands into this model represents the next phase of theoretical development.

In this framework, the unit level processes or dimensions are considered dynamic and interactive. They are not linear, but rather move in a circular pattern, so that all dimensions at some point have the potential to interact with one another. These interactions, as well as the unique aspects of each dimension, may influence safety outcomes. This framework depicts the actual complexity and dynamism of PSC in healthcare organizations that is thought to exist based on the literature. Ultimately, a more streamlined model may be necessary in order to be able to test the theoretical underpinnings through structural equation modeling or path analysis.

This framework considers the transactional nature of structure, process and outcomes. Positive safety outcomes can reinforce CNA behaviors at the unit level, as

well as leadership and management levels within the organization's core structure. Positive CNA PSC scores can also reinforce leadership's commitment to patient safety as a priority. The concept that patient safety climate (attitudes, perceptions, values, beliefs) leads to CNA safety behaviors is depicted in this framework, but needs further empiric support.

The transactional aspects of the framework are illustrated in the feedback arrows between the outcomes, safety behaviors, and the organizational core structure, building on the integrative model of organizational climate and safety (Stone et al., 2005). When positive outcomes happen, this leads to greater CNA PSC, and reinforces the leadership team and their commitment to safety. Similarly, when positive outcomes happen, care practices by unit level frontline staff and managers are reinforced, leading to improved safety climate and behaviors. Further work on this conceptual framework is necessary to test those hypothesized relationships.

Specific Aims

Patient safety is an issue critical to nursing (Scott-Cawiezell et al., 2006; Stone & Walker, 2006). Many patient and workforce outcomes related to patient safety are nurse-sensitive, such as falls, pressure ulcers, medication errors, failure to detect change in condition, and turnover (Anderson et al., 1998; Currie, 2006; Mor, 2006). Considerable work has been done applying basic safety and accident prevention principles to nursing. Studies from the aerospace, manufacturing and airline industries have suggested that a culture of safety may be an entity in its own right that can influence or be reflective of outcomes within an organization (Cooper, 2000; Guldenmund, 2000; Vincent et al.,

1998). However to date, no nursing home study has demonstrated a consistent relationship between patient safety scores and specific clinical or workforce outcomes.

PSC instruments have only recently been evaluated in nursing home staff populations (Handler, Castle et al., 2006; Hughes & Lapane, 2006; Scott-Cawiezell et al., 2006). Because nursing homes have different reimbursement and organizational structures than acute care institutions, researchers have postulated that principles of PSC may be different in the nursing home setting (Castle, 2006a; Handler, Castle et al., 2006). In fact, early studies reflect that nursing home PSC scores are significantly lower than similar scores for acute care institutions in domains such as non-punitive response to error, teamwork, communication openness, feedback about error, and organizational learning (Castle, 2006a; Castle & Sonon, 2006; Handler, Castle et al., 2006). Because CNAs provide most of the direct care in nursing homes, understanding the perceptions of CNAs is vital to understanding and promoting resident safety.

The overall purpose of this dissertation was to examine the relationship between CNA PSC scores and clinical (incidence of falls, pressure ulcers, and restraint use) and workforce (nursing staff turnover) outcomes.

The specific aims were to:

1. examine the relationship between CNA PSC scores, domain subscores and clinical outcomes (including incidence of falls, pressure ulcers and restraint use) and a workforce outcome (licensed nurse and CNA turnover) at the facility level
2. examine the relationship between CNA PSC scores, domain subscores and nursing staffing levels (RN/LPN/CNA) and turnover (RN/LPN/CNA) at the facility level

3. examine whether certain CNA characteristics such as education and tenure are correlated with CNA PSC scores
4. examine whether certain facility level characteristics such as rural county, bed occupancy, bed size, private pay occupancy and profit or chain status are correlated with CNA PSC scores

To accomplish these aims, the researcher performed a secondary data analysis.

Based on previous studies, the following hypotheses related to these specific aims were proposed:

1. Nursing homes with higher CNA PSC total scores and domain subscores will have lower rates of falls, pressure ulcers and daily restraint use, and lower staff turnover (RN/LPN/CNA)
2. Nursing homes with higher CNA PSC total scores and domain subscores will have higher staffing levels (RN/LPN/CNA) and lower turnover (RN/LPN/CNA)
3. CNAs with more total years of education (in addition to CNA training), more years of experience and longer tenure in the nursing home will have higher average PSC scores than less educated, less experienced CNAs
4. Nursing homes with higher CNA PSC scores will be located in non-rural counties, have higher bed occupancy, have lower bed size, have higher private pay occupancy and will have either not-for-profit status or will be members of a chain.

Summary

The conceptual framework developed for this study adapts work from previous studies on hospital and nursing home PSC and organizational culture, and focuses on the role of the CNA and CNA PSC scores. The synthesis presented here needs to be tested in future nursing home PSC studies, not only with CNAs but also with other members of the healthcare team. The specific aims include previously described predictors and potential outcome variables related to CNA practice, quality and safety measurement and nursing home PSC, and will guide the analyses of the relationships in this dissertation.

Chapter III

Methods

Introduction

This study is the first to describe the relationship between CNA PSC scores and clinical and workforce outcomes in nursing homes. In order to accomplish this, secondary data analysis using the MDS, OSCAR and ARF databases was conducted. This methodology was selected because previous studies suggest that a relationship may exist between PSC scores and clinical outcomes such as falls and pressure ulcers, and workforce outcomes such as turnover. Several large data sets have been used to measure quality and safety in long term care (Mor et al., 2003; Ryan et al., 2004). Secondary data analysis permitted the use of available clinical and workforce outcome measures available for the nursing homes in the parent study.

Description of Parent Study

The original survey study was conducted in 2005 in five randomly selected states (selected using random numbers table and procedures). The purpose was to 1) compare CNA PSC survey scores with hospital benchmark PSC scores and 2) to see how nursing home PSC varied by certain facility-level and market characteristics such as bed size, profit or chain status, or average occupancy. All nursing homes that are certified to accept either Medicare and/or Medicaid payment were invited by mail to participate in the study. About 97% of U.S. nursing homes are certified by either Medicare or Medicaid (Castle, 2006a).

Sample

In the five randomly selected states (New York, Oregon, Michigan, Colorado, and Florida), a random sample of about 10% (*n*=240 nursing homes) was identified. Hospital-based facilities and homes with fewer than 40 beds were excluded from the sample. Demographic characteristics of the CNA sample are described in the results chapter.

Eligible homes were invited by mail to participate in the study. Out of 240 homes, 72 agreed to participate, for an overall nursing home response rate of 30%. Facility response rates may have been low due to fear that a survey on patient safety culture would raise new safety issues that the nursing home would then need to address. To assess for potential selection bias, the author compared facility characteristics of responder and non-responder facilities in the sample states, and found no differences between the two groups (Castle, 2006a). In those 72 homes, 1579 CNAs out of 2872 completed the survey, for a 55% response rate.

Procedures

In the original study, a letter was sent to the CNAs by the research team, explaining the survey and the purpose of the study. The anonymity of the respondents' answers was outlined. Surveys were mailed directly to the CNAs' homes, to reduce any chance of subtle coercion at the workplace. A self-addressed stamped envelope was included; CNAs mailed surveys back to the researchers directly. CNAs were not asked for written consent, since return of the survey was considered to be their agreement to participate in the study. The CNAs' supervisors and administrators were not informed of whether CNAs completed the survey or not, and only aggregate data was shared with facility administrators. (See Appendix B for sample survey).

Human Subjects

The majority of CNAs are women and many are minorities, therefore women and minorities were adequately represented in the study. All full and part-time CNAs at each participating nursing home were invited to participate; there were no exclusion criteria.

Measures

The HSOPSC has been used in several other studies (Castle & Sonon, 2006; Handler, Castle et al., 2006; Sorra & Nieva, 2004). Subscale reliabilities in the parent study were all within the range of .70-.81, except for the subscales for *frequency of events reported* and *management expectations and actions promoting safety* at .62 and .67 respectively. Reliabilities for those two subscales were somewhat lower than those described in the original hospital study (see chapter one for original subscales).

Validity of the HSOPSC has been assessed in previous studies (Sorra & Nieva, 2004) in a number of ways. Content experts were used in the development of the original hospital instrument. A content validity index (CVI) was not calculated for the original HSOPSC; however, an expert panel did provide input and assisted with the development of the original instrument in hospitals (Sorra & Nieva, 2004). Researchers modified the instrument for use in the nursing home setting, obtaining input from geriatric and long term care specialists in the process (Handler, Castle et al., 2006; Sorra & Nieva, 2004).

Cognitive testing and read aloud techniques were used to assess validity with diverse hospital staff, including physicians, nurses and ancillary staff, including patient care assistants and technicians. In preliminary work on the adaptation of the HSOPSC for nursing home use, cognitive testing with 12-15 nursing home CNAs included mostly minority staff and several staff with English as a second language, for whom

reading/comprehension level were assessed (J. Sorra, unpublished data, September 12, 2006). Since there is currently no "gold standard" of patient safety culture measurement, criterion validity has not been reported.

Facility-level variables

Facility bed size has been associated with quality outcomes in prior nursing home studies (Bourbonniere et al., 2006; Mor, 2006; Rantz et al., 2004), with larger facilities generally associated with poorer quality outcomes. In some studies, nursing homes located in rural areas had lower quality measures than those located in non-rural areas (Harrington & Swan, 2003). For-profit status and chain membership have both been linked to lower quality outcomes in some, but not all studies (Castle & Banaszak-Holl, 1997; Harrington, Woolhandler, Mullan, Carrillo, & Himmelstein, 2001; Rantz et al., 2004). Total facility occupancy and private pay occupancy have both been linked to outcomes, with higher occupancy and higher private pay occupancy associated with lower rates of restraints and lower turnover (Castle et al., 2005; Castle & Engberg, 2005).

Turnover was calculated by facility administrators, for both units and entire facilities for six months and then multiplied by two to annualize the rate (Castle & Engberg, 2005). Turnover rates do not include agency staff, but do include all full and part time staff. Turnover is the number of staff at the beginning of the month compared with the number of staff at the end of the month, divided by the total number of filled positions (not open ones) for that facility. Turnover rates were calculated for the year prior to the original study.

Data Collection

Some elements in the primary data collection were self-reported by the CNAs (demographic information on the survey and survey questions), some elements were self-reported by the nursing home administrator (occupancy, private pay occupancy and turnover calculations), for which the administrator was compensated for his/her time. Only private versus non-private pay was collected; information on Medicare versus other payers was not collected.

Staffing data were obtained from the OSCAR system, which provides self-reported staffing information from each nursing home. OSCAR data reports staffing as FTEs per 100 residents, and is obtained for a two week period. The shift worked (7-3, 3-11, 11-7) was not collected, therefore differences in CNA PSC scores cannot be evaluated based on shift differences.

While CNA PSC surveys were collected from individual units, the type of unit in each case (skilled nursing facility, nursing facility, dementia or special care) was not collected. In addition, the unit identifier on the MDS is known to have poor reliability (N. Castle, personal communication, January 10, 2007) therefore individual patient level data could not be linked back to a specific unit using the MDS. In the parent study, unit level data were not examined.

Dissertation Study

This study used a correlation design to examine associations between CNA PSC total scores (and domain subscores), clinical outcomes and nursing staff turnover. In order to assess the relationship, I conducted a secondary data analysis using data from an already completed study adapting the HSOPSC instrument for nursing homes (Castle,

2006a). This secondary data analysis merged data from the MDS, OSCAR system, ARF and the HSOPSC database from the parent study. Access to the data was granted by Dr. Nicholas Castle, principal investigator (PI) on the original study, and Dr. Joanne Sorra (permission to perform factor analysis on original instrument).

Secondary Data Analysis Methodological Issues

An important issue in secondary data analysis is guarding against fishing for data (Castle, 2003; Magee, Lee, Giuliano, & Munro, 2006). This can lead to type 1 errors, and may be tempting to researchers when a large data set is available to them. To guard against this, researchers are encouraged to work from a conceptual framework (Shepard et al., 1999), and to propose a priori hypotheses for testing, rather than looking at the data and then deciding which relationships to assess (Burns & Grove, 2005). This preliminary work was done during an independent study with Dr. Sybil Crawford from January through May, 2007. The goal was to evaluate the adequacy of the available data for testing a number of proposed relationships, and narrowing the focus of the dissertation work based on that preliminary analysis.

Another issue with secondary data analysis is that the researcher must work with whatever data the primary team collected (Castle, 2003; Magee et al., 2006). For example, for the race/ethnicity variable, researchers collected data on Caucasian and non-Caucasian race, but no further distinctions. Latino/a ethnicity data were not available. In addition, language issues may be distinct from cultural ones (Brislin, 1970). Information on CNA country of origin and primary language were not available.

The amount of missing data must be evaluated in secondary data analysis. Furthermore, assessing the randomness of missing data is an important factor when

deciding on techniques for treating the missing data, such as multiple versus mean imputation (Crawford, Tennstedt, & McKinlay, 1995). Data can be missing completely at random (MCAR) or missing at random (MAR). Distinctions are important for samples with significant amounts of missing data, as different techniques can lead to different results (Wang, Sedransk, & Jinn, 1992). The amount of missing data in the parent study was less than 0.1% (Castle, 2006a).

Methodological rigor of this secondary data analysis was accomplished by structured data collection, management and reporting techniques. Potential hypotheses and relationships to be examined were outlined a priori, to guard against type 1 error (Magee et al., 2006).

Procedures

The PI obtained approval (criteria were met for exempt status) from the institutional review board (IRB) at both the University of Pittsburgh and the University of Massachusetts. An R drive was purchased, so that de-identified survey data could be transferred from the University of Pittsburgh to the University of Massachusetts Worcester over a secure server. The original study reported data for 72 nursing homes. Data from four additional homes became available after publication of that study; therefore the file of HSOPSC surveys for this dissertation study included data from 76 nursing homes.

Some data elements from the survey were not used in the original study; those data had not previously been cleaned or analyzed (e.g., the *tenure as a nurse's aide*, variable). Those data elements were cleaned and prepared for the purposes of this study.

The items that required reverse coding were reverse coded by the analyst prior to sharing the data set.

An HSOPSC survey/ARF/OSCAR merged file was sent in an excel format, and then converted to SPSS version 15.0. This file merged the MDS data, matching that data for 74 of the 76 nursing homes for the same 2005 time period (two homes could not be matched due to issues related to the OSCAR ID variable). The matching and merging process was completed by the analyst at the University of Pittsburgh; all data were de-identified before it was sent to the principal investigator at the University of Massachusetts Worcester. Reliabilities were rerun for the new sample of HSOPSC surveys in the current study. Domain subscores in the range from 0.71-0.85 were included (see Appendix C).

A power analysis was conducted to determine the ability to detect facility level differences between group means (the sample included 74 nursing homes with approximately 7500 residents, 1761 CNA respondents). Using the Graphpad Statmate 2.00 program, I assumed a standard deviation of 1, equal groups of 37 homes each, and set alpha=0.05. At 80% power, this resulted in an ability to detect a difference between group means of 0.65 (moderate to large effect).

Ethical Considerations

Statistical data from this study will be maintained for five years; after that time, all hard and electronic copies will be destroyed. Data will be stored at the PI's office in a locked file drawer. All data is de-identified and no names of individual respondents or facilities will be known to the researcher.

Data Analysis

The relationship between CNA HSOPSC scores, turnover and clinical outcomes was assessed using poisson regression, linear regression, multivariate analyses and generalized estimating equations (GEE). A regression model was constructed that included variables such as licensed nurse and CNA staffing, licensed nurse and CNA turnover, and other covariates. A description of the type of data for each variable and further detail on data analysis for each specific aim is presented in Table 1.

Table 1. Variable Data Type by Specific Aim.

SPECIFIC AIM	ITEM DESCRIPTION	DATA TYPE
1-4	CNA PSC score	Continuous
3	Tenure as a nurse's aide (years)	Continuous
3	Tenure in that facility (years)	Continuous
3	Age	Continuous, categorical
3	Gender	Nominal (dichotomous)
3	Race	Nominal
3	Education	Categorical
1, 4	Facility bed number	Continuous, categorical
1, 2, 4	Staffing level (LPN, RN, CNA)	Continuous (ratio)
1, 4	Facilities per county	Continuous, categorical
1, 4	Profit status	Nominal
1, 4	Chain status	Nominal
1, 4	Private pay occupancy	Continuous
1-4	Bed occupancy	Continuous
1, 4	Rural county	Nominal
1, 4	County unemployment	Continuous (rate)
1	Facility fall rate	Continuous (percentage)
1	Facility pressure ulcer rate	Continuous (percentage)
1	Facility rate of daily restraints	Ordinal
1,2,4	Turnover rate (LPN, RN, CNA)	Continuous (percentage)
1, 4	Proportion of residents on Medicare	Continuous (percentage)
1, 4	Mean Activities of Daily Living (ADL) scores	Continuous
1, 4	Mean Cognitive Performance Scale (CPS) scores	Continuous
1, 4	Mean number of medications	Continuous
1, 4	Mean number of residents with Alzheimer's diagnosis	Continuous
1, 4	Mean number of residents with MDS behaviors checked	Continuous

Factor Analysis for Original Instrument

Exploratory factor analysis (EFA) has been described for the HSOPSC in hospitals (Sorra & Nieva, 2004), but has not been reported in nursing home studies to date. Results from the original EFA revealed 14 factors with Eigenvalues greater than 1, explaining 64.5% of the variance. Almost all items loaded highly on only one factor, with factor loadings greater than or equal to .40 (Sorra & Nieva, 2004). However, a few items loaded on 2 factors.

Confirmatory factor analysis (CFA) was performed on 13 dimensions (one dimension, positive event reporting norms, had been dropped due to low reliability and redundancy with other dimensions). Items were dropped sequentially to determine goodness of fit with remaining dimensions. Ultimately, after CFA, the final instrument with 12 dimensions and 42 items (3-4 in each dimension) was recommended.

Although both exploratory and confirmatory factor analyses have been reported in the hospital staff population, none of the studies on nursing homes using the HSOPSC have reported additional factor analysis. Therefore an exploratory factor analysis was run using data from the current sample.

Building a Regression Model

Multilevel analysis techniques, also known as random effects or hierarchical analysis, may be more accurate than traditional multivariate methods in analyzing multilevel data (Adewale et al., 2007; Austin, Vu, & Alter, 2003). First, traditional multivariate techniques treat observations as though they were *independent*, when in fact they are not; they are clustered or nested within hierarchical structures such as nursing home units or entire nursing homes (Austin et al., 2003). Second, traditional techniques

treat all variables as characteristics of the individual respondent, not the unit or organization (Austin et al., 2003). Failure to recognize a hierarchical structure may lead the researcher to overestimate the statistical significance of organizational factors, and underestimate the statistical significance of unit level or individual factors (age, tenure as a nurse's aide, education). The researcher could make inferences about the organization that might result in a type 1 error.

A number of PSC studies raise the statistical issue of potential for aggregation bias (Sexton et al., 2006). Reporting aggregate results for individual surveys, for a single unit within a healthcare institution, and for one or several healthcare institutions is common (Colla et al., 2005; Flin, Burns, Mearns, Yule, & Robertson, 2006). In part, this is due to a desire for larger sample sizes to establish benchmarks that organizations can use for comparison. While this is valuable, the meaningfulness of this type of aggregate data can be questioned, and some researchers (Sexton et al., 2006) have advocated for multilevel analysis to minimize aggregation bias (Austin et al., 2003).

The statistical technique of general estimating equations (GEE) is a method of analysis that can account for clustering effects in hierarchical organizations (Burton, Gurrin, & Sly, 1998; Dickinson & Basu, 2005; Hanley, Negassa, deB. Edwardes, & Forrester, 2003). Given the scope of this project, it was decided that GEE analysis would be an appropriate statistical method for this study.

A regression model was developed, building on predictors such as differences in demographic characteristics of CNAs (total years of education in addition to CNA training, tenure as a CNA, age, gender), and possible differences in HSOPSC scores at the facility level. ANOVA statistics were used to examine the unadjusted associations in

this analysis. Then facility-level predictors such as private pay occupancy, bed size, CNA, LPN and RN turnover, profit status, rural county and facility staffing were analyzed. Additional covariates such as the individual HSOPSC factors, plus random effects such as which facilities or states were included in the sample were examined. These were inputs into the model determining clinical and workforce outcomes. A separate multivariate model was developed with turnover as the workforce outcome. Initial correlations (correlation matrix) guided the development of the regression model by suggesting potential bivariate correlations that helped to prioritize covariates for the model. Collinearity diagnositics were run as part of the data analysis.

Data Analysis by Specific Aim

Specific aim 1: Examine the relationship between CNA PSC scores, domain subscores and clinical outcomes (including incidence of falls, pressure ulcers and restraint use) and a workforce outcome (CNA/LPN/RN turnover) at the facility level.

Hypothesis 1: Nursing homes with higher CNA PSC total scores and domain subscores will have lower rates of falls, pressure ulcers and daily restraint use, and lower CNA/LPN/RN turnover.

Standard MDS 2.0 definitions for falls, pressure ulcers and restraints are used by all nursing homes that participate in the Medicare and Medicaid programs (Center for Medicare and Medicaid Services, 1998). Previous studies have used SPSS or SAS code to derive the rates of falls, pressure ulcers and daily restraint use from MDS data sets (Rantz, Popejoy, Zwygart-Stauffacher, Wipke-Tevis, & Grando, 1999; Schnelle, Bates-Jensen, Levy-Storms et al., 2004; Teigland, Gardiner, Hailing, & Byrne, 2005). Permission to use SAS code that pulls relevant variables from the MDS for risk

adjustment was obtained from Dr. Marilyn Rantz, Sinclair School of Nursing, University of Missouri at Columbia; additional code is also available on the website for the Center for Health Systems Research and Analysis (CHSRA) quality indicators for nursing homes (CHSRA, 2005). SAS code excluded admission MDS assessments, so that falls and pressure ulcers that occurred during the hospital stay were not included. MDS data that were matched and merged was from the same period of time (first two quarters 2005) as the survey distribution in those nursing homes, as well as the preceding two quarters. Poisson regression was used to analyze those relationships.

Specific Aim 2: Examine the relationship between CNA PSC scores, domain subscores, and CNA/LPN/RN staffing levels and CNA/LPN/RN turnover at the facility level.

Hypothesis 2: Nursing homes with higher CNA PSC total scores and domain subscores will have higher staffing levels and lower turnover for CNAs, LPNs and RNs.

Staffing may be a predictor of PSC and may also be a predictor of clinical and workforce outcomes. Correlations were used for preliminary analyses of these continuous variables; GEE models were developed and analyzed.

Specific Aim 3: Examine whether certain CNA characteristics such as education and tenure are correlated with CNA PSC scores.

Hypothesis 3: CNAs with more total years of education (in addition to CNA training), more years of experience and longer tenure in the nursing home will have higher average PSC scores than less educated, less experienced CNAs.

Differences in selected CNA demographic characteristics, such as age, gender, and race were examined using ANOVA statistics and GEE models. Descriptive statistics were used to summarize the characteristics of the sample.

Specific Aim 4: Examine whether certain facility level characteristics such as rural county, bed occupancy, bed size, private pay occupancy and profit status or chain membership are correlated with CNA PSC scores.

Hypothesis 4: Nursing homes with higher CNA PSC scores will be located in non-rural counties, have higher bed occupancy, have lower bed size, have higher private pay occupancy and will have either not-for-profit status or will be members of a chain.

These relationships were examined using ANOVA statistics and GEE models. A combined GEE model including variables from specific aims two, three and four was constructed.

Risk Adjustment

The percentage of patients who are post-acute (Medicare; Skilled Nursing Facility or SNF level of care) can be identified at the facility level using OSCAR data. The analysis was run adjusting for the percentage of SNF patients at the facility level. This was done to determine if the relationship of HSOPSC scores to outcomes differed for facilities with a higher percentage of SNF patients.

SNF patients are generally more acute (recently transferred from the hospital, many are fresh post-operative patients) and less medically stable. However, the SNF population also includes younger, less complex surgical patients who plan on returning home. Some have argued that a higher percentage of Medicare patients may not reflect higher acuity in all cases. Whether CNAs perceive different patient safety issues in

working with SNF residents could be important, and might reflect different intervention strategies (Ganz, Simmons, & Schnelle, 2005).

Composite activities of daily living (ADL) scores from the MDS are often used as a proxy for resident acuity in nursing home studies examining a variety of clinical outcomes (Snowden et al., 1999). ADL scores were averaged for each facility, and mean, median and $25^{th}/75^{th}$ percentiles were calculated. Additional patient-specific data that could be obtained from the MDS or OSCAR, such as diagnosis of dementia, number of medications, presence of behaviors, and cognitive performance scale (CPS) were considered along with facility-level data in potential risk adjustment for falls, restraints and pressure ulcers based on previous studies (Chen & Kane, 2001; Lake & Cheung, 2006; Morris et al., 1994).

Previous research on falls and physical restraints has included risk adjustment for dementia, cognitive impairment, number of medications, and presence of dementia-related behaviors (Castle, Fogel, & Mor, 1997; Rubenstein & Josephson, 2002; Sullivan-Marx et al., 1999a). Risk adjustment for impaired nutrition is included in the calculation of high and low pressure ulcer rates in the quality indicator methodology (CHSRA, 2005). Studies on clinical outcomes and workforce issues such as staffing and turnover have included facility-level variables such as county unemployment rate, number of homes in the county, bed size, private pay and total bed occupancy, profit status and chain membership (Harrington et al., 2007; O'Neill et al., 2003; Rantz et al., 2004), therefore those factors from the original study were included.

Missing Data

Minimum, maximum values and skewness were examined as part of the data cleaning process during the independent study for the HSOPSC, ARF and OSCAR datasets. A few potential errors were identified with values coded that were outside the 1-5 range on the likert scale. These responses were removed from the analysis. The total amount of missing data in this sample was about 0.1%, which was similar to the parent study. This resulted in 18 cases being removed in preliminary analyses. Submitting OSCAR data is required under nursing home regulation, therefore the percentage of missing data was negligible, although information bias may occur. MDS data were also analyzed for missing data; however, since nursing home reimbursement is based on submission of this data to CMS, the percentage of missing data is typically very low.

Summary

The methods in this study were used to examine whether a relationship could be demonstrated between CNA PSC scores and clinical or workforce outcomes. If no relationship can be demonstrated, then it raises the question of whether earlier studies may have overestimated the statistical significance of PSC. Is PSC truly important in its own right, or have scientists been intrigued by this construct, despite a relative lack of data demonstrating a link with clinical outcomes? It is critical to answer this question, since dedicating limited funding for PSC research should only continue if there is reason to believe it will be clinically meaningful.

If a relationship does exist between CNA PSC scores and clinical or workforce outcomes, then measurement of PSC in nursing homes may provide a feasible method for assessing important safety constructs such as communication, staffing, supervision, error

reporting, learning environment and handoffs. Providing nursing home leaders with the skills and tools to impact these areas may lead to better patient safety outcomes and lower staff turnover. This chapter described the use of secondary data analysis to address the gap in our understanding of PSC among nursing home CNAs. Understanding and measuring the PSC of these frontline workers is critical both for U.S. policy, and for best practices to address patient safety in America's nursing homes.

Chapter IV

Results

Introduction

This Chapter presents the results of the exploratory factor analysis (EFA), descriptive data and frequencies, and regression analyses. GEE models for the specific aims and a combined GEE model are also presented.

Factor Analysis in Current Nursing Home Sample

One subscale from the original instrument, Frequency of Events Reported, was not included in the analysis. In discussions with content experts, this subscale was considered to be potentially problematic in a CNA sample, since it reflects assessment about event reporting that is generally done by licensed nursing staff and might be unfamiliar to CNAs. In addition, the language and wording were more complex than the rest of the survey, requiring discrimination between levels of event or error reporting that involve more evaluative skills and judgment than many CNAs would have. The validity of the subscale in this sample was questionable, based on limited cognitive testing with CNAs in previous hospital studies (Sorra & Nieva, 2004)**,** somewhat lower reliability (alpha=.62) than the other survey measures in this sample (Castle, 2006a), and content experts' opinion (Personal communication, Dr. Steven Handler, January, 2007); thus it was not included here.

The 39 items from the eleven remaining subscales were analyzed. Initially, the correlation matrix for an unrotated solution was examined, followed by varimax rotation. The varimax rotation revealed the existence of ten factors with Eigenvalues greater than one, explaining 72.5% of the variance (see Appendix C for principal component analysis,

scree plot, and rotated component matrix). Most factors loaded highly on one variable, with factor loadings ranging from .46-.86, therefore no items were dropped from the analysis.

The majority of items loaded together as they did in the original subscales. However, there were a few differences. Some items from the subscale for non-punitive response to error loaded with items related to working relationships. The item, "we are actively doing things to improve resident safety" loaded with "management seriously considers staff suggestions for improving resident safety." The question "when one area in this facility gets really busy, others help out" loaded with two staffing questions. Some staffing questions loaded with the management support subscale, including staff working longer hours and working in crisis mode.

Cronbach's alpha for the revised HSOPSC instrument was .77. Reliabilities for the revised subscales are included in Appendix C.

Descriptive Data

CNA demographic characteristics are presented in Table 2. The majority of CNAs in this sample were Caucasian women, around 30 years of age, with at least a high school education. On average, they had worked in the facility for 4.6 years, and had been a CNA for 7.8 years.

Facility level characteristics and distribution of the outcome variables for the 74 facilities are presented in Table 3. Most facilities were in non-rural areas; 58% were not-for-profit and about 62% were non-chain members. The average bed size was 102 beds. In building the regression models for each of the specific aims, random effects such as which states were included were considered. Examination of total CNA PSC scores

revealed no state-level differences, therefore the state variable was not included in further analyses.

Table 2. CNA Characteristics (N = 1761)

Variable	N	%	Mean	SD
Education				
High School Degree	1619	91.9		
Associate Degree	31	1.8		
Bachelors Degree or Higher	107	6.1		
Missing	4	0.2		
Gender				
Female	1728	98.1		
Male	31	1.8		
Missing	2	0.1		
Race				
Caucasian	1457	82.7		
Non-Caucasian	302	17.1		
Missing	2	0.1		
Total CNA PSC Scores			118.9	15.9
Age (years)			30.0	8.4
Tenure in the Facility (years)			4.6	4.5
Tenure as a CNA (years)			7.8	6.1

Table 3. Facility Characteristics (N=74)

Variable	N	%	Mean	SD
Rural Location				
Non-rural	61	82.4		
Rural	13	17.6		
Profit Status				
Not for Profit	43	58.0		
For Profit	31	41.9		
Chain Membership				
Non-chain Member	46	62.2		
Chain Member	28	37.8		
County Unemployment Rate			4.4	1.1
Number of Homes in County			25.6	13.9
ADL Scores			2.4	0.4
Cognitive Performance Scale (CPS) Scores			2.7	0.5
Facility Bed Size			102.5	62.9
Facility Pressure Ulcer Rate			8.2	4.6
Facility Fall Rate			12.3	5.3
Facility Restraint Rate			6.7	6.5
CNA Turnover Rate			33.6	27.4
LPN Turnover Rate			28.2	22.7
RN Turnover Rate			24.1	22.7
CNA Staffing*			28.5	3.7
LPN Staffing*			9.3	3.9
RN Staffing*			11.0	2.8

*Staffing is full time equivalents per 100 residents

Specific Aim 1

Specific aim 1: Examine the relationship between CNA PSC scores, domain subscores and clinical outcomes (including incidence of falls, pressure ulcers and restraint use) and a workforce outcome (licensed nurse and CNA turnover).

Hypothesis 1: Nursing homes with higher CNA PSC total scores and domain subscores will have lower rates of falls, pressure ulcers and daily restraint use, and lower staff turnover (RN/LPN/CNA).

Poisson regression was chosen for the clinical outcome variables in this study because it is robust and was appropriate for the distribution of the data. It is also useful when evaluating infrequent events or counts in a population, such as falls and pressure ulcers.

Falls

In a poisson regression model including total CNA PSC, profit status, chain membership, rural location, CNA, LPN or RN staffing, bed size, facility occupancy, facility private pay occupancy, CNA turnover, CPS score, ADL score, Alzheimer's disease rate, behavior rate, number of medications and proportion Medicare, the following associations are reported with mean fall rate for four quarters (see Table 4).

Table 4. Poisson Regression Model for Mean Facility Fall Rate (N=74)

Variable	B	SE	P-Value
Not for profit	0.063	0.052	0.231
Profit	0[a]		
Non-chain member	-0.012	0.045	0.783
Chain member	0[a]		
Non-rural location	0.114	0.065	0.080
Rural location	0[a]		
Total CNA patient safety culture score	0.015	0.003	0.000**
Bed size	-0.001	0.000	0.028**
Average facility occupancy	0.004	0.007	0.497
Average facility private pay occupancy	0.001	0.004	0.905
LPN staffing	0.023	0.007	0.001**
CNA turnover	0.009	0.016	0.586
Average cognitive performance scale	0.182	0.062	0.003**
Percentage of residents with diagnosis of Alzheimer's dementia	0.011	0.005	0.017**
Percentage of residents with behaviors	-0.001	0.000	0.227
Average number of medications per resident	0.014	0.014	0.284
Proportion of facility residents on Medicare	-0.013	0.003	0.000**
Average ADL scale	-0.182	0.066	0.006**

Dependent Variable: Mean Facility Fall Rate

[a] Set to zero because this parameter is redundant.

**p<.05

A higher total CNA PSC score is associated with a higher rate of falls (B=.015; p=.000). In addition:

- Higher rate of falls is associated with fewer beds (B=-.001; p=.028)
- Higher rate of falls is associated with higher CPS scores (more cognitively impaired residents) (B=.182; p=.003)
- Higher rate of falls is associated with lower ADL scores (more functionally independent residents) (B=-.182; p=.006)
- Higher rate of falls is associated with a higher rate of Alzheimer's disease in the facility (B=.011; p=.017)
- Higher rate of falls is associated with a lower proportion of Medicare residents in the facility (B=-.013; p=.000).

In subscale analyses, only the staffing subscale showed significant associations. The following associations are reported for that subscale poisson model:

- Higher scores on the staffing subscale are associated with a higher rate of falls (B=.070; p=.000). In other words, when CNAs rated facility staffing more positively, falls were higher in those facilities.
- Higher rate of falls is associated with fewer beds (B=-.002; p=.000)
- Higher rate of falls is associated with higher CPS scores (B=.243; p=.000)
- Higher rate of falls is associated with lower ADL scores (B=.000; p=.027)
- Higher rate of falls is associated with lower proportion of Medicare residents (B=-.012; p=.000).

Poisson analyses do not report an R square statistic. Five out of ten variables entered were statistically significant, suggesting a good model fit.

Preliminary analyses were run using linear regression, to insure that similar results to the poisson model could be demonstrated. In those models, there was also a significant relationship between total CNA PSC and fall rates (B=.224; p=.044). The adjusted R square for the model was .091.

Pressure Ulcers

In a poisson regression model including total CNA PSC, profit status, chain membership, rural location, CNA, LPN or RN staffing, bed size, facility occupancy, private pay occupancy, CNA turnover, CPS score, ADL score, Alzheimer's disease rate, behavior rate, number of medications and proportion Medicare, the following associations are reported with mean pressure ulcer rate for four quarters (see Table 5).

Table 5. Poisson Regression Model for Mean Facility Pressure Ulcer Rate (N=74)

Variable	B	SE	P-Value
Not for profit	-0.121	0.062	0.052
Profit	0[a]		
Non-chain member	-0.043	0.052	0.402
Chain member	0[a]		
Non-rural location	-0.139	0.076	0.067
Rural location	0[a]		
Total CNA patient safety culture	-0.001	0.004	0.807
Average facility occupancy	-0.003	0.007	0.694
Average facility private pay occupancy	-0.009	0.006	0.121
Bed Size	0.002	0.001	0.000**
LPN staffing	-0.012	0.009	0.190
CNA turnover	0.007	0.019	0.723
Average cognitive performance scale (CPS)	-0.209	0.081	0.010**
Percentage of residents with diagnosis of Alzheimer's dementia	0.008	0.006	0.144
Percentage of residents with behaviors	-0.000	0.001	0.707
Average number of medications per resident	0.038	0.019	0.038**
Proportion of facility residents on Medicare	0.007	0.003	0.029**
Average ADL scale	0.548	0.095	0.000**

Dependent Variable: Mean Facility Pressure Ulcer Rate

[a] Set to zero because this parameter is redundant.

**p<.05

Total CNA PSC did not have a statistically significant association with pressure ulcer rates in the poisson model (B=-0.001; p=0.807). In addition, none of the subscales were associated with differences in pressure ulcer rates. The following associations were identified:

- Higher pressure ulcer rates were associated with higher facility beds (B=.002; p=.000)
- Higher pressure ulcer rates were associated with lower CPS scores (less cognitively impaired residents) (B=-.209; p=.010)
- Higher pressure ulcer rates were associated with higher ADL scores (more functionally dependent residents) (B=.548; p=.000)
- Higher pressure ulcer rates were associated with higher number of medications per resident (B=.038; p=.038)
- Higher pressure ulcer rates were associated with higher proportion of Medicare residents (B=.007; p=.029).

In a preliminary linear regression model including profit status, chain membership, rural location, total CNA PSC, CNA, LPN or RN staffing, bed size, facility occupancy, private pay occupancy, CNA turnover, CPS score, ADL score, Alzheimer's disease rate and proportion Medicare, similar associations with mean pressure ulcer rates for four quarters were identified. Higher pressure ulcer rates were associated with higher ADL scores (more functional dependency) (B=.023; p=.004). The relationship between CNA PSC scores or individual PSC subscores and pressure ulcer rates was not significant. No other independent variables in the model were significant.

The adjusted R square for this linear regression model was .278. In this sample, homes with a higher fall rate had a lower pressure ulcer rate (see Table 6).

Table 6. Correlation between Fall Rate and Pressure Ulcer Rate (N=74)

Variable	Fall Rate	Pressure Ulcer Rate
Fall Rate	1	
Pressure Ulcer Rate	-0.357**	1

** Correlation is significant at the 0.01 level (2-tailed).

Restraints

Since 13 out of 74 homes reported zero restraints, the variable was not normally distributed and therefore this assumption for linear regression was not met. Multinomial logistic regression was used for this analysis, with restraints modeled as categorical (low 0-2%; moderate 2.1-5%; high >5%). In this model including total CNA PSC, profit status, chain membership, rural location, CNA, LPN or RN staffing, bed size, facility occupancy, private pay occupancy, CNA turnover, CPS score, ADL score, Alzheimer's disease rate, behavior rate, number of medications and proportion Medicare, the following associations with three restraint categories are reported for four quarters (see Table 7).

Table 7. Nominal Regression for Facility Restraint Rate (N=74)

Variable*	B	SE	P-Value
Low restraints			
Total CNA patient safety culture	-0.030	0.047	0.521
LPN staffing	0.101	0.108	0.353
Bed size	0.008	0.007	0.279
Average facility occupancy	0.052	0.088	0.552
Average facility private pay occupancy	-0.095	0.063	0.130
County unemployment rate	0.150	0.317	0.636
Number of nursing homes in the county	-0.041	0.031	0.190
Average cognitive performance scale (CPS)	-0.455	0.836	0.586
Average ADL scale	-0.001	0.001	0.350
CNA turnover	-0.120	0.249	0.631
Proportion of facility residents on Medicare	0.000	0.039	0.994
Average number of medications per resident	0.198	0.226	0.381
Percentage of residents with diagnosis of Alzheimer's dementia	-0.039	0.071	0.585
Percentage of residents with behaviors	0.001	0.007	0.863
Not for profit	0.476	0.842	0.572
Profit	0[b]		
Non-chain member	-1.343	0.751	0.074
Chain member	0[b]		
Non-rural location	-0.589	1.013	0.561
Rural location	0[b]		
Moderate Restraints			
Total CNA patient safety culture	0.172	0.072	0.017**
LPN staffing	-0.109	0.143	0.446
Bed size	0.008	0.008	0.335
Facility occupancy	0.219	0.135	0.104
Facility private pay occupancy	-0.037	0.079	0.636
County unemployment rate	-0.315	0.473	0.505
Number of nursing homes in the county	0.043	0.038	0.262
Average cognitive performance scale (CPS)	1.230	1.213	0.311
Average ADL scale	-0.003	0.001	0.028**
CNA turnover	0.633	0.363	0.082
Proportion of facility residents on Medicare	0.060	0.048	0.208
Average number of medications per resident	0.895	0.394	0.023**
Percentage of residents with diagnosis of Alzheimer's dementia	0.059	0.105	0.573
Percentage of residents with behaviors	-0.009	0.008	0.287
Not for profit	0.618	0.988	0.532
Profit	0[b]		
Non-chain member	-0.242	0.068	0.794
Chain member	0[b]		
Non-rural location	-0.353	1.368	0.796
Rural location	0[b]		

Dependent Variable: Facility Restraint Rate
*The reference category is High Restraints (not shown).
[b] This parameter is set to zero because it is redundant.
**p<.05

Facilities with higher total CNA PSC scores were more likely to report moderate restraint use, whereas facilities with lower CNA PSC scores were more likely to report high restraint use (B=.172; p=.017). In addition:

- Facilities reporting moderate restraints had more medications per resident than those reporting high restraints (B=.895; p=.023)
- Facilities reporting moderate restraints had slightly lower ADL scores (more functionally independent) than facilities reporting high restraints (B=-.003; p=.028)
- Facilities reporting moderate versus high restraints were not associated with differences in CNA turnover at the .05 level of significance (B=.633; p=.082).

In earlier models including RN staffing, facilities reporting moderate restraints had higher RN staffing than those reporting high restraints (B=.459; p=.033). In subscale analyses for this same model, facilities with moderate restraints had higher scores on the staffing subscale than those with high restraints (B=.810; p=.013). In this sample, there were no differences in fall rates based on restraint use (see Table 8).

Table 8. Analysis of Variance for Differences in Fall Rates based on Low, Moderate and High Restraint Use (N=74)

	Sum of Squares	*df*	Mean Square	F	P-Value
Between Groups	86.6	2	43.3	1.59	.210
Within Groups	1927.9	71	27.2		
Total	2014.5	73			

Bonferroni Post Hoc Tests

Variable	Restraint Rate Category			Mean Difference	SE	P-Value
	Low	Moderate	High			
Low restraints		X		-3.09819	1.76640	0.251
			X	-1.57745	1.38366	0.774
Moderate restraints	X			3.09819	1.76640	0.251
			X	1.52074	1.63507	1.000
High restraints	X			1.57745	1.38366	0.774
		X		-1.52074	1.63507	1.000

CNA, LPN and RN Turnover

Poisson regression could not be performed for this outcome variable, because the data must be non-zero integers and not entered as a rate; the data were not available in that format. Instead, linear regression was used, as the assumptions for this model were satisfied.

In a linear regression model including total CNA PSC, profit status, chain membership, facility occupancy, private pay occupancy, bed size, rural location, county unemployment, behavior rate, ADL scale, and LPN staffing, with CNA turnover as the dependent variable, the following associations are reported (see Table 9).

Table 9. Linear Regression Model for CNA Turnover (N=74)

Variable	B	SE	P-Value
Profit Status	1.446	0.404	0.001**
Chain membership	-0.504	0.390	0.201
Average facility occupancy	-0.188	0.044	0.000**
Average facility private pay occupancy	0.010	0.035	0.770
Rural Location	0.560	0.477	0.245
County unemployment rate	-0.022	0.169	0.897
Total CNA patient safety culture score	-0.052	0.023	0.030**
Percentage of residents with behaviors	0.002	0.003	0.489
Bed size	0.002	0.004	0.510
Average ADL scale	0.000	0.000	0.377
LPN staffing	-0.179	0.055	0.002**

Dependent Variable: CNA Turnover

Adjusted R square = 0.639

**p<.05

Lower CNA PSC scores were associated with higher CNA turnover (B=-.052; p=.030). In addition:

- Higher CNA turnover was associated with for profit status (B=1.446; p=.001)
- Higher CNA turnover was associated with lower facility occupancy (B=-.188; p=.000)
- Higher CNA turnover was associated with lower LPN staffing (B=-.179; p=.002).

Adjusted R square for this model was .639. The same model was run for each of the subscales with CNA turnover as the dependent variable. No significant associations with subscales were found.

In a preliminary model, RN/LPN/CNA staffing and RN/LPN turnover were all included; however significant correlations were noted for most staffing and turnover variables (see Table 10). In regression analyses, collinearity was noted for most staffing and turnover variables, except for CNA turnover and LPN staffing. Therefore only those variables were included in Table 9 and subsequent models for CNA turnover.

Table 10. Pearson Correlation Coefficients for Staff and Turnover Variables (N=74)

Variable	Staffing			Turnover		
	CNA	LPN	RN	CNA	LPN	RN
Staffing						
CNA	1					
LPN	0.059	1				
RN	0.601**	0.515**	1			
Turnover						
CNA	-0.524**	-0.556**	-0.430**	1		
LPN	-0.560**	-0.491**	-0.405**	0.963**	1	
RN	-0.589**	-0.437**	-0.412**	0.941**	0.976**	1

** Correlation is significant at the 0.01 level (2-tailed).

Similar models were run for LPN turnover and RN turnover as the dependent variables. These models were examined using facility-level variables alone (e.g. bed size, occupancy, etc.), then including resident level risk adjustment as well (percentage of behaviors, ADL status). Preliminary models including all staffing and turnover variables were revised due to collinearity. There were no associations between total CNA PSC and either LPN or RN turnover as the dependent variables, in models including total CNA PSC or any of the subscales. Adjusted R square for those models ranged from .602 to .769.

Specific Aim 2

Specific Aim 2: Examine the relationship between CNA PSC scores, domain subscores, and CNA/LPN/RN staffing levels and CNA/LPN/RN turnover at the facility level.

Hypothesis 2: Nursing homes with higher CNA PSC total scores and domain subscores will have higher staffing levels and lower turnover for CNAs, LPNs and RNs.

The Pearson correlation for total CNA PSC score and CNA turnover was significant (-.074; p=.002). Facilities with higher CNA PSC scores had lower CNA turnover. The Pearson correlations for LPN and RN turnover with total CNA PSC score were not significant. In linear regression, the unadjusted model for CNA turnover and total CNA PSC was significant (B=-.571; p=.002). Unadjusted associations for LPN and RN turnover with total CNA PSC were not significant.

In GEE analyses, in a model with independent variables including only CNA turnover, CNA staffing, and controlling for profit status, CNA turnover was associated with scores on the PSC staffing subscale (B=-.243; p=.009) and with total CNA PSC

(B=-2.421; p=.029).When LPN and RN staffing and turnover were added to the model (see Table 11), LPN staffing was also associated with total CNA PSC scores (B=-.938; p=.002) and CNA turnover remained significant (B=-2.390; p=0.029). In this model, RN staffing, RN turnover, CNA staffing, and LPN turnover did not show significant associations with total CNA PSC. Additionally, in the revised model with LPN and RN staffing and turnover, the relationship between CNA turnover and the staffing subscale was no longer significant at the .05 level (B=-.528; p=.060). As previously noted, there is some collinearity in this model when turnover for all job classes is included. There is also a significant correlation between staffing and turnover for each job class (higher staffing is associated with lower turnover).

Table 11. GEE Model for Staffing, Turnover and Total CNA PSC (N=1761)

Variable	B	SE	P-Value
CNA staffing	-0.555	0.353	0.116
LPN staffing	-0.938	0.295	0.002**
RN staffing	0.540	0.447	0.227
CNA turnover	-2.390	1.094	0.029**
LPN turnover	-0.173	1.386	0.901
RN turnover	0.842	1.373	0.540

Dependent Variable: Total CNA Patient Safety Culture Score
Staffing is FTEs per 100 residents
**p<.05

Subscale analyses for the combined model revealed some expected relationships between staffing, turnover and CNA PSC subscale scores. The hypothesis that homes with higher CNA PSC subscale scores would have higher CNA/LPN/RN staffing and lower CNA/LPN/RN turnover was supported for the following subscales:

- Higher LPN and CNA staffing were associated with higher scores on the subscale for management expectations and actions promoting safety (B=.195; p=.044 and B=.352; p=.003)
- Higher CNA staffing was associated with higher scores on the organizational learning subscale (B=.113; p=.047)
- Lower LPN turnover was associated with higher scores on the teamwork subscale (B=-.708; p=.018)
- Lower CNA turnover was associated with higher scores on the subscale for feedback about errors (B=-.434; p=.019)
- Higher RN staffing was associated with higher scores on subscales for management attitudes and support for safety (B=.318; p=.044) and teamwork across units (B=.276; p=.007).

In some cases, results were not as hypothesized. Those associations were:

- Lower RN staffing was associated with higher scores on the subscale for management expectations and actions promoting safety (B=-.392; p=.001)
- Higher RN turnover was associated with higher scores on the overall safety subscale (B=.545; p=.012)
- Lower LPN staffing was associated with higher scores on the communication openness subscale (B=-.165; p=.002)
- Lower CNA and LPN staffing were associated with higher scores on subscales for management attitudes and support for safety (B=-.322; p=.017 and B=-.262; p=.037) and teamwork across units (B=-.310; p=.011 and B=-.380; p=.000).

- Lower LPN staffing was associated with higher scores on the subscale for handoffs (B=-.258; p=.006).

Specific Aim 3

Specific Aim 3: Examine whether certain CNA characteristics such as education and tenure are correlated with CNA PSC scores.

Hypothesis 3: CNAs with more total years of education (in addition to CNA training), more years of experience and longer tenure in the nursing home will have higher average PSC scores than less educated, less experienced CNAs.

In GEE analyses, no significant associations were found for models including age, education, gender, race, tenure in the facility and tenure as a nurse's aide with total CNA PSC. In a GEE model including age, education and gender (see Table 12), only age showed a significant association with total CNA PSC (B=-.087; p=.025). Younger CNAs had slightly higher total PSC scores than older CNAs. Analyses were run using both continuous and categorical data for those variables.

Table 12. GEE Model for CNA Demographic Characteristics Table (N=1761)

Variable	B	SE	P-Value
Gender			
Female	4.868	3.254	0.135
Male	0[a]		
Education			
High School Degree	2.040	1.763	0.247
Associates Degree	-3.167	3.062	0.301
Bachelors Degree or Higher	0[a]		
Age	-0.087	0.039	0.025**

Dependent Variable: Total CNA Patient Safety Culture Score
[a.] Set to zero because this parameter is redundant.
**p<.05

Specific Aim 4

Specific Aim 4: Examine whether certain facility level characteristics such as rural county, bed occupancy, bed size, private pay occupancy and profit status or chain membership are correlated with CNA PSC scores.

Hypothesis 4: Nursing homes with higher CNA PSC scores will be located in urban counties, have higher bed occupancy, have lower bed size, have higher private pay occupancy and will have either not-for-profit status or will be members of a chain (lowest CNA PSC will be in independent, for-profit nursing homes).

In a GEE model including profit status, chain membership, rural location, bed size, bed occupancy, private pay occupancy, unemployment and number of homes in the county, CNA, LPN and RN staffing and CNA, LPN and RN turnover, CNA turnover had a statistically significant association with total CNA PSC (B=-3.679; p=.000). Homes with lower CNA turnover had higher CNA PSC scores. There were also significant associations for LPN staffing (B=-1.159; p=.000) and bed size (B=-.028; p=.042). Due to collinearity among the staffing and turnover variables, the analysis was re-run (see Table 13), including only CNA turnover and LPN staffing, which are not collinear. Associations remained for CNA turnover and total CNA PSC (B=-1.296; p=013), and LPN staffing and total CNA PSC (B=-.792; p=.000). Profit status and chain membership were not significant in either model.

Table 13. GEE Model for Facility Level Variables and Total CNA PSC (N=1761)

Variable	B	SE	P-Value
CNA turnover	-1.296	0.519	0.013**
Not for profit	-1.870	1.761	0.288
Profit	0[a]		
Non-chain member	-1.718	1.645	0.296
Chain member	0[a]		
Non-rural location	-1.692	2.633	0.521
Rural location	0[a]		
Bed size	-0.023	0.014	0.096
Average facility occupancy	-0.021	0.216	0.922
Average facility private pay occupancy	0.001	0.162	0.995
County unemployment rate	1.252	0.829	0.131
Number of nursing homes in county	-0.042	0.091	0.649
LPN staffing	-0.792	0.209	0.000**

Dependent Variable: Total CNA Patient Safety Culture Score

[a] Set to zero because this parameter is redundant.

**p<.05

Combined GEE Model (Specific aims 2, 3 and 4)

In a combined GEE Model for specific aims 2, 3 and 4, including: education, age, rural location, chain membership, profit status, CNA, LPN and RN staffing, CNA, LPN and RN turnover, number of homes in the county, county unemployment rate, facility private pay occupancy, bed occupancy, bed size, tenure as a nurse's aide and tenure in the facility, the only statistically significant predictors for total CNA PSC score were CNA turnover (B=-3.616; p=.000) and LPN staffing (B=-1.179; p=.000). The analysis was revised due to the noted collinearity of the staffing and turnover variables in specific aim 1, to include CNA turnover and LPN staffing (see Table 14). Similar associations were noted for CNA turnover and total CNA PSC (B=-1.337; p=.009) and LPN staffing (B=-.801; p=.000). Other variables in the revised model were not significant.

Table 14. Combined GEE Model for Facility level and CNA Demographic Characteristics (N=1761)

Variable	B	SE	P-Value
Not for profit	-1.771	1.755	0.313
Profit	0[a]		
Non-chain member	-1.524	1.645	0.354
Chain member	0[a]		
Non-rural location	-1.537	2.684	0.567
Rural location	0[a]		
High School Degree	1.963	1.769	0.267
Associate Degree	-3.576	2.950	0.225
Bachelors Degree or higher	0[a]		
CNA turnover	-1.337	0.515	0.009**
Age	-0.049	0.068	0.469
Tenure as a CNA	-0.058	0.100	0.559
Tenure in the facility	0.009	0.135	0.946
County unemployment rate	1.297	0.838	0.122
Number of nursing homes in the county	-0.052	0.091	0.571
Average facility occupancy	-0.010	0.217	0.964
Average facility private pay occupancy	-0.006	0.162	0.970
Bed size	-0.020	0.014	0.134
LPN staffing	-0.801	0.211	0.000**

Dependent Variable: Total CNA Patient Safety Culture Score

[a] Set to zero because this parameter is redundant.

**p<.01

This same model was run for each of the subscales. A number of statistically significant associations were noted, not all in the same direction. Pearson correlations and unadjusted analyses suggested relationships that were non-significant or very small. Gender was associated with differences in some subscale scores, but this was not felt to be significant due to small sample size for males. There were also small numbers of non-white respondents in this sample.

Summary

This chapter reported results for a factor analysis of the HSOPSC, and analyses examining total CNA PSC and clinical outcomes. Associations between total CNA PSC, CNA turnover and LPN staffing were also described. Associations between individual subscales, clinical outcomes and turnover were included in this chapter.

Chapter V

Discussion

Introduction

Overall, results suggest that a relationship exists between CNA PSC scores and clinical outcomes including falls and restraints. In multiple analyses, relationships between CNA PSC scores, LPN staffing and CNA turnover were consistently identified. Exploratory factor analysis revealed some potential differences in the factor structure, suggesting that more work adapting the HSOPSC in this CNA population may be needed. The data supported the complex, transactional nature of PSC within nursing home structure, process and outcomes as depicted in the conceptual framework.

Discussion of Findings

CNAs in this sample reflected U.S. CNA demographics in terms of gender and age. However, more CNAs were white (83% versus 50%) and fewer may have had education beyond high school when compared with national trends (Institute for the Future of Aging Services, 2007; Yamada, 2002). This difference could be a reflection of the states that were included in this random sample (Florida, Colorado, Michigan, Oregon, New York) or the intrastate regions from which the 74 homes were randomly identified. Homes that volunteered to participate in a PSC research study may have had different demographic characteristics than other homes. However, in the original study, responder facilities were compared with non-responders in the five states, and no differences in facility characteristics were noted (Castle, 2006a).

The hypothesis that nursing homes with higher CNA PSC scores would have lower fall rates was not supported. However, the significant positive relationship between

PSC and falls suggests an ascertainment bias, which has previously been reported in the literature (Mor, 2006). Facilities with a more developed PSC learn to report errors more frequently and more often. Most fall prevention programs stress improved error reporting (Rask et al., 2007; Wagner, Capezuti, & Ouslander, 2006), and the implementation of fall prevention programs often results in a higher rate of fall reports when those programs are instituted. This creates an evaluation dilemma for quality and safety improvement programs, since homes that are developing an improved PSC may appear to have more adverse events due to improved reporting systems. Including process measures, observational and qualitative data in the evaluation, as well as conducting longitudinal studies, may be useful approaches to this problem, and are supported by the relationships between attitudes, perceptions and behaviors in the conceptual framework.

Consistent with the literature (Castle, Fogel & Mor, 1997; Rubenstein, 2002), more falls occurred in nursing homes with more cognitively impaired residents, residents with moderate, but not total functional impairment, and a higher percentage of residents with Alzheimer's dementia. Thus certain resident characteristics could have influenced the relationship between falls and CNA PSC in this population. In this sample, a lower Medicare rate was associated with more falls. This could be due to Medicare residents being younger, or skilled nursing units having higher staffing ratios, more RN staff or fewer dementia residents.

In subscale analyses, only the staffing subscale was associated with falls. Higher scores on the staffing subscale (reflecting a more positive impression of facility staffing) were associated with a higher fall rate, which is consistent with the association noted for the total CNA PSC scores. Facilities with a more developed PSC may be facilities where

staff members have a more positive view of staffing levels. In those same facilities, error reporting and reporting of near-miss events, as noted above, are likely to be higher; therefore documented fall rates could be higher (Mor, 2006). Staff perception of staffing adequacy is a complex issue (Harrington, Swan & Carrillo, 2007; Rantz et al., 2004), where the number of staff, the training and quality of staff, and staff mix may all be important elements of patient safety and PSC. A more positive view of staffing may reflect how CNAs and nurses work together (teamwork and communication) rather than the number of staff in a facility.

Homes in this sample that had higher fall rates had lower pressure ulcer rates (see Table 6). This most likely reflects differences in the patient population; homes with more Medicare residents may have more medically compromised patients, less likely to be up and around and more likely to be at risk for pressure ulcers. Higher rates of pressure ulcers were associated with larger bed size, more functional dependency, a higher number of medications and slightly less cognitive impairment. Differences in nutritional status were included in the risk adjustment calculation (CHSRA, 2005); however the number of low risk patients in the sample was too low for differences to be detected between high and low risk groups.

There was no significant association between pressure ulcer rates and total CNA PSC or PSC subscales in this sample. Pressure ulcers may not be considered a safety outcome by nursing home staff (Berlowitz & Frantz, 2007). It is possible that CNAs perceive pressure ulcers as an unavoidable part of aging and dying, and not as a preventable event. This presents an opportunity for staff education, since identifying

pressure ulcers as a preventable adverse event could influence staff behaviors toward processes of skin care (Bates-Jensen et al., 2003; Berlowitz et al., 2003).

It appears that the relationship between bed size and outcomes may vary depending on the clinical outcome. For example, a higher number of beds was associated with a higher number of pressure ulcers. This is consistent with previous studies suggesting that a larger number of beds in a facility or unit may be associated with worse quality or safety outcomes (Rantz 2004). Smaller units may be more cohesive and have a more defined safety culture. However, in some studies, lower quality was associated with smaller bed size (Anderson et al., 2003).

In this study, smaller bed size was associated with a higher rate of falls. I speculate that some smaller homes may lack the infrastructure or staff development support for comprehensive fall prevention programs (Rask et al., 2007). Also, smaller homes may be more traditional, with higher numbers of residents with dementia, as opposed to younger, less cognitively impaired SNF residents. Larger homes with a higher percentage of SNF residents may attract nurses with more acute care experience and knowledge of fall risk assessment and prevention.

These results support previous work suggesting that different quality and safety indicators do not necessarily move in the same direction (Mor, 2006). In this sample, pressure ulcer rates and fall rates in the nursing homes demonstrated an inverse relationship. A facility-level variable, such as bed size, was positively associated with pressure ulcers, but negatively associated with falls. These complex relationships have made the search for a standardized or composite safety index for nursing homes an

elusive goal. More work to determine specific clinical outcome measures and their associations with PSC is warranted.

Facilities reporting moderate restraint use had higher total CNA PSC scores than facilities reporting high restraint use. A high level of restraint use suggests that staff may be using restraints instead of providing more direct care or using behavioral interventions with residents. Moderate restraint homes had higher CNA PSC scores than facilities with few or no restraints. This suggests that in facilities with very low or zero restraints, CNAs may see the lack of any restraints as a factor that negatively impacts resident safety; this view of a restraint as a safety device has been reported in other studies (Hantikainen & Kappeli, 2000; Sullivan-Marx et al., 1999a)**.** In this sample, there was no difference in fall rates in homes with low, moderate or high restraint use, supporting earlier studies that suggest restraints do not prevent falls (Capezuti et al., 1998).

Consistent with previous studies (Castle et al., 1997), facilities with moderate restraints had higher RN staffing than those reporting high restraint use. More RNs could reflect leadership committed to a lower restraint use policy, or better staff education with regard to restraint alternative policies. Residents in moderate restraint facilities were on more medications than those in high restraint facilities, suggesting a potential shift from physical to chemical restraint use. Residents in moderate restraint homes were more functionally independent, suggesting that they may be up and around more and attempting self-care. Those residents may have been assessed as being at lower risk for falls than those in high restraint homes, despite their ADL status.

In subscale analyses, facilities with moderate restraints had higher scores on the staffing subscale than facilities with high restraints. This suggests that CNAs in homes

with a less developed PSC have lower opinions of staffing adequacy and that those homes also have a higher rate of restraint use. Restraints may be used to compensate for lower staffing ratios (Sullivan-Marx et al., 1999a) or an environment lacking teamwork and cooperation. As with falls, only the staffing subscale showed significant associations with this clinical outcome.

Lower CNA PSC scores predicted higher CNA turnover in the regression models in this study. This suggests that PSC may be a useful predictor of CNA turnover in nursing homes, as outlined in this study's conceptual framework. As with other studies (O'Neill et al., 2003), higher CNA turnover was associated with facility factors such as for profit status and lower facility occupancy in several models.

An interesting finding was that facilities with higher CNA PSC scores and lower CNA turnover also had lower LPN staffing. Since CNA turnover was not similarly associated with RN or CNA staffing, it could be that lower LPN ratios could empower CNAs and enable them to be more involved in the care planning and direct care processes, including PSC, in the nursing home. It is also possible that homes with fewer LPNs provided more opportunities for CNAs to interact directly with the few RNs in the nursing home (Anderson et al., 2005), providing better communication and supervision around issues of patient safety. Previous studies have suggested the importance of RN staffing in determining clinical outcomes in nursing homes (Anderson et al., 2003; Harrington et al., 2007); staffing models with fewer LPNs could influence that relationship. In homes using staffing models with fewer LPNs, RNs may delegate more to CNAs, and may provide more meaningful and rewarding job opportunities. Those

CNAs may be more cognizant of PSC issues, and because of having more responsibility and involvement in resident care, may be less likely to leave for another position.

In the GEE model using total CNA PSC as the dependent variable, the association of CNA turnover and PSC was also significant. In models including only CNA variables, the staffing subscale was the only subscale with a significant association with turnover (higher staffing subscale scores were associated with lower CNA turnover). This suggests once again that CNA perceptions of staffing may influence a workforce outcome such as CNA turnover.

CNA PSC did not predict RN or LPN turnover in this study, which may have reflected the small numbers of RNs and LPNs in the turnover data. Due to the lower numbers of LPNs and RNs, those staffing and turnover statistics may have been less reliable and less stable than those for CNAs. It is possible that the models presented here with CNA turnover alone are more stable and fit the data better than the combined models, which show some collinearity as well.

Younger CNAs had higher PSC scores than older CNAs. One possible explanation is that younger CNAs have less experience and cannot recognize patient safety issues. In addition, they may be more prone to social desirability bias in a new position, with older supervisors and coworkers (Bowers & Becker, 1992). Similar results were expected for the *tenure in the facility* and *tenure as a nurse's aide* variables, but significant associations were not detected. Small sample size may have been a factor in interpreting results for gender (few male respondents) and race (few non-white respondents).

The relationship between education and CNA PSC scores may be confounded by the lack of information about the cultural background and English literacy of the respondents. Many CNAs who have more education come from countries other than the U.S. (Yamada, 2002). This suggests two possible explanations for the lack of association between education and PSC in this sample. There could be differences in the cultural definition of safety, or what is considered part of safe care in individuals from other cultures (Brislin, 1970). This would require more than translation and back translation to identify; a concept analysis comparing different cultural aspects of safety and safety culture would be useful. Second, those with higher education could be recent immigrants to the U.S., and have had difficulty with the language aspects of the survey. While preliminary validity testing by AHRQ did not reveal issues related to language with this survey, it is possible that in this population, a larger number of individuals with limited English literacy were included.

In GEE models with multiple facility-level variables, only CNA turnover and LPN staffing were associated with CNA PSC scores. In a combined model with CNA demographic characteristics and facility-level variables, the same relationships were noted. Homes with lower CNA turnover and lower LPN staffing had higher CNA PSC scores. Once again, it would appear that homes with fewer LPNs may provide opportunities for CNAs to be more involved with the residents and possibly with RN staff, and therefore develop more skills and knowledge related to patient safety.

Other variables were not significant, including profit status, chain membership, number of homes in the county, county unemployment rate and rural location. This is consistent with some previous studies (Mor et al., 2004; Rantz et al., 2004) but different

from others (Castle, 2006a)**,** and may have been a function of sample size or differences in statistical techniques. Some studies have found nursing home quality differences to be associated with U.S. regions, such as the South (Wan et al., 2006) or per capita income (Mor et al., 2004) rather than rural status. Those variables were not examined in this study. In subscale analyses, consistent associations were not identified, the few associations noted could have been spurious due to small sample size for some variables (e.g., rural or gender variables).

Collinearity statistics were examined in the linear regression models. While collinearity among most variables was generally low, in some of the models, variables were somewhat collinear (CNA/LPN/RN staffing and CNA/LPN/RN turnover). This suggests that while CNA PSC appeared to be associated with certain outcomes, there was some overlap with other independent variables. Partitioning out the significance of each specific variable in predicting the outcomes, given the complexity of nursing home safety, may not have been possible using the statistical techniques presented here. Future studies with larger samples could use partial correlations or hierarchical linear models and would be powered to detect smaller individual effects.

While the association between safety and workforce outcomes and total CNA PSC is significant in some of the analyses presented here, the coefficients are generally small, as are some of the adjusted R square values. This suggests that while CNA PSC scores may be associated with clinical outcomes in some nursing homes, other factors play a significant role in those outcomes as well. In addition, since clinical outcomes such as falls and pressure ulcers may vary significantly within the same home (high fall rates and low pressure ulcer rates may exist within the same facility) it may be difficult to draw

conclusions about the relationship of CNA PSC and overall clinical outcomes. Process outcomes (demonstration of good communication, teamwork, handoffs) evaluated in observational studies may provide useful information about PSC to complement PSC measurement using survey design alone. Such research is also likely to inform and refine aspects of the conceptual framework introduced in this dissertation study.

With regard to CNA turnover, the results here suggest that higher CNA PSC is associated with lower CNA turnover. Some authors have proposed that the relationship between turnover and quality may not be linear (Castle, Engberg, & Men, 2007). Very low turnover may be associated with low quality and safety, because poor job performers continue to stay in their jobs. Whether an ideal rate of turnover exists that optimizes quality and safety in nursing homes is not known. Several factors are likely to contribute to turnover rates in long term care. However, PSC may be another metric to add to job satisfaction (Castle, Engberg, Anderson et al., 2007) and others when considering CNA turnover and potential ways to address turnover in nursing facilities. Prospective studies to examine causality and more qualitative research regarding this relationship are needed.

The results here suggest that specific definitions of safety and a concept analysis of what CNAs consider “safe” practices and what constitutes a “safe” environment according to CNAs would be helpful. For example, despite the literature on restraint reduction, many nurses and CNAs still believe that residents are safer if they are restrained (Hantikainen & Kappeli, 2000). Thus, while some CNAs may perceive improved safety in a restraint-free or minimal restraint environment, other staff may not. Furthermore, state surveyors may still convey the message that if a resident is a recurrent faller, or has sustained any injury, they should be restrained. This perpetuates the notion

that recurrent fallers or residents with significant cognitive impairment are safer if they are restrained. A basic understanding of what CNAs consider a “safe” environment is crucial to the further development of PSC research in long term care.

Since no criterion or benchmark has been established for nursing home PSC, one cannot determine what constitutes a “meaningful unit change” in PSC scores or a meaningful coefficient size in the regression or GEE results here. Prospective studies should examine changes in clinical or workforce outcomes after PSC interventions have been implemented. Also, prospective studies measuring PSC scores at baseline and after a reduction in CNA turnover would be useful, to determine how much change in CNA turnover is required for a measurable change in PSC. Finally, newer models with fewer LPNs and more RNs and CNAs could be studied prospectively, to examine changes in CNA PSC scores at baseline, and after an intervention to empower CNAs and enhance their role in resident care.

Contrary to previously published work (Castle, 2006a), many facility-level differences were small or non-significant in this data set. Sample size may have played a role, particularly with regard to LPN and RN staffing and turnover. Also, differences in statistical techniques (using GEE instead of partial correlations; using mean CNA PSC scores instead of averaging 4s and 5s on the likert scale as “positive responses”) could have been factors in the results reported here. Finally, differences in the revised factor structure could have contributed to fewer subscale relationships being identified in this study.

In the factor analysis, items from the subscale for non-punitive response to error loaded with other items related to working relationships. Specifically, some items loaded

with management attitudes (blame) and some loaded more with coworker attitudes/ teamwork (blame and shame). The distinction between blame and shame has been raised by other researchers (Singer et al., 2007). Since teamwork and relationships with other coworkers could be particularly important to CNAs, it is possible that CNAs' interpretation of the *response to error* questions led them to consider how their coworkers would view their mistakes, and how that might influence staff relationships on or between units. This raises a potential future research issue with respect to how non-punitive response to error may influence not just error reporting, but staff working relationships between units as well.

The item, "we are actively doing things to improve resident safety" loaded with "management seriously considers staff suggestions for improving resident safety." In a smaller home, it is possible that there is less of a distinction between "we" and "management," since management may be more decentralized, and individual units may have more empowerment over safety decisions. This may be particularly true in nursing homes working within a culture change framework (Stone & Weiner, 2001). In the original survey, the term management was not specifically defined; conceptual clarity could be improved in future surveys by providing definitions for management, supervisor, and unit.

The question "when one area in this facility gets really busy, others help out" loaded with two other staffing questions. This suggests an interpretation by frontline staff of the inability to get help from others in the facility as a staffing issue (no one is available because of poor staffing ratios) as opposed to a teamwork issue (no one helps

because we don't work well together as a team). However, it also raises the issue of some overlap between the teamwork and staffing domains.

Some staffing questions loaded with the management support subscale, including staff working longer hours and working in crisis mode. It appears that these were seen more as a management support issue, in terms of how the staff is required to work, as opposed to just the number of staff or use of agency staff, which loaded on a different factor. This could be an important distinction, since the number of staff, the quality of staff, and the support for/training of staff could all be unique constructs within the staffing domain.

The EFA suggests that a revised structure may be reliable in a CNA population. However, more work and validity testing needs to be done, given the potential overlap of some dimensions, and the potential omission of other. Work stress, fatigue, personal issues (Singer et al., 2007), and other dimensions may be particularly important to CNAs and their perception of PSC. Providing clear definitions of certain terms on the survey such as "management" will improve conceptual clarity. More detailed items about staffing and teamwork may be valuable in clarifying safety issues that are particularly important to CNAs. Further work adapting the event reporting dimension to specific populations, such as CNAs, is indicated.

The conceptual framework was useful in modeling the complexity and dynamism of several PSC domains. The model was supported in that the data suggested interaction and potential overlap between constructs of staffing, management attitudes and expectations, teamwork, and communication. Further work on potential relationships between unit (safety climate) variables, as well as distinctions between unit and facility

level variables is planned. As previously mentioned, additional clinical and workforce outcomes can be integrated into this model. Based on the results of this study, further development using this conceptual framework appears warranted.

Limitations

Sample size limited some analyses, including gender and racial differences, and differences in level of education. However, since the process of improving PSC occurs at the facility level and involves all staff, small demographic distinctions may be less important than an overall facility or unit level assessment of PSC.

As previously discussed, the accuracy of MDS data is debated in the geriatric literature (Mor, 2006; Mor et al., 2003; Morris, Fries et al., 1997; Schnelle, Bates-Jensen, Chu, & Simmons, 2004; Schnelle, Wood, Schnelle, & Simmons, 2001). However, the MDS does provide a large data set for benchmarking patient and facility level data from the majority of U.S. nursing homes, and is generally accepted as a valid data source for many types of nursing home research (Rantz et al., 2001; Ryan et al., 2004). While individual chart review and observation of staff-patient interactions may add validity to the MDS measures, these methods are time and labor intensive; the cost of this type of research is generally prohibitive.

Studies have suggested that while some measures in the OSCAR database are fairly accurate, others related to nurse staffing patterns may have limitations related to ascertainment bias (Feng et al., 2005). While these limitations are acknowledged, the validity of other methods can also be questioned, since most rely to some degree on nursing home administrator self-report. Nevertheless, conclusions about the lack of a

relationship between total CNA PSC scores and RN and LPN staffing and turnover in this sample should be interpreted with caution.

While reliability and validity of the HSOPSC have been reported for hospital staff and nursing home administrators/physicians/nurses and pharmacists, only limited data exist for nursing home CNAs. Minimal validity testing of this instrument in the nursing home staff population is a potential limitation of this study, and current work to adapt the instrument is underway. The author of this dissertation study is currently participating in a funded study to validate a revised version of the HSOPSC for all nursing home staff in a sample of nine randomly selected nursing homes in Massachusetts.

Despite limitations, the HSOPSC was selected because of the large amount of benchmarking data available on the AHRQ website for hospitals and other health care institutions, and because the HSOPSC has been used more than any other instrument in nursing home studies to date. In terms of future research, AHRQ also has a study underway to validate a revised instrument in 44 nursing homes in eight states.

Survey responses from 74 nursing homes are aggregated in this data set, resulting in several levels of data (individual CNA scores, facility level data where multiple units exist within each facility, aggregate data). Because of these issues, controlling for aggregation bias and accounting for cluster effects was an important statistical concern and potential limitation of this study. The GEE analysis used here is one way to approach the data conservatively, minimizing the risk of type 1 error (Austin et al., 2003).

Survey data provides one type of information about PSC in health care institutions. However, ethnographic and qualitative methods may be important in identifying important details related to causality. Collecting this type of data may impact

the design of effective interventions (Gaba et al., 2007; Huang et al., 2007), and should be considered in future studies.

The shift worked (7-3, 3-11, 11-7) was not collected, therefore differences in CNA PSC scores based on shift differences could not be evaluated. There is less nursing staff on 3-11 and 11-7, and fewer support staff, such as therapists, pharmacists, administrative staff and others. Staff perceptions of facility safety could vary depending on the shift worked; this data was not available for this study.

There were limitations related to other data elements that were not collected in the parent study. These include ethnicity, country of origin, primary language, non-Medicare private payers, unit type (dementia, skilled) and resident acuity by unit. Future studies should include such data elements, and should be large enough to detect unit-level, as well as facility-level differences in PSC scores.

Negative findings (such as the absence of a relationship between pressure ulcers and PSC scores) could indicate that PSC was not related to the specific clinical outcomes selected for this study. It is possible that PSC scores would be related to other clinical outcomes that were not included here. While resident and facility-level risk adjustment in similar types of nursing home studies is described in the literature, achieving a model that controls for the possibility of spurious results due to extraneous variables is difficult (Mor et al., 2003). While associations and relationships may be described, the ability to identify causality was not possible in this study. However, information regarding associations and correlations may help to direct researchers in the next phases of research on PSC instruments and patient safety processes in long term care.

Practice and Policy Implications

Results of this study support a relationship between CNA turnover and CNA PSC, and suggest that public policy efforts should focus on management models and other interventions to enhance CNA PSC and reduce CNA turnover. Recent studies (Castle & Engberg, 2006) support previous work linking turnover to clinical outcomes. Studies examining the relationship between staffing and resident outcomes continue to be mixed (Arling, Kane, Mueller, Bershadsky, & Degenholtz, 2007), suggesting that staffing numbers alone may not be as important as the type of staff model and the way that it is implemented in individual homes. The association of lower LPN staffing with higher total CNA PSC scores may be an example of how less hierarchical nursing models may promote empowerment of CNAs and may enhance CNA PSC.

Previous studies have shown that consistent leadership and retention of administrators and directors of nursing in key leadership positions influence a variety of workplace factors such as staffing and turnover (Anderson et al., 2003; Castle & Shugarman, 2005). Retention of key leaders may be an important factor influencing CNA PSC as well.

One aspect of this study highlights a discrepancy between the state survey process and nursing home PSC. While the new CMS guidance for surveyors on accidents and supervision instructs surveyors to look for a culture of safety in nursing homes (Center for Medicare and Medicaid Services, 2007b), in general the survey process remains punitive and discourages error reporting. It is not clear that surveyors receive training in how to assess facilities for safety culture, nor that those facilities know where to go for resources or education on this topic. Further policy work should involve collaboration

between CMS, state departments of public health, the nursing home community, and safety educators and researchers, such as those working on the Quality and Safety Education in Nursing (QSEN) framework (Cronenwett et al., 2007). Ultimately, federal regulatory changes may require a process for PSC training and sustainability, both for nursing homes and surveyors.

Future Implications

Quantitative results from this dissertation study will guide the researcher in future qualitative and ethnographic studies related to the role of the CNA and nursing home PSC. The principal investigator is currently a co-investigator on a study funded through the Boston based Rx Foundation to examine nursing home PSC, including focus groups and key informant interviews with nursing home leadership and staff. This ongoing study includes revising the PSC domains on the HSOPSC instrument and testing the revised instrument in nine randomly selected Massachusetts nursing homes. In addition to CNAs, nursing home staff such as nurses, physicians, physical therapists and social workers will be included in that study.

Future qualitative work may include observational studies that would describe actual CNA PSC behaviors and relate them to PSC survey scores and resident outcomes. Future studies should consider additional clinical and workforce outcomes beyond falls, pressure ulcers, restraints and turnover. Important variables to measure might include weight loss, recognition of change in resident condition, work stress, empowerment, and others.

While not sufficient by itself, nursing home staff education is a critical component to improved PSC. Practical education strategies for adult learners and staff from diverse

cultural backgrounds are needed. Studies that have evaluated the use of simulation for teaching safety principles to health care professionals, as well as computer-based curricula and training programs for nursing assistants have been reported (Irvine, Bourgeois, Billow, & Seeley, 2007; Paparella, Mariani, Layton, & Carpenter, 2004). Innovative teaching strategies for patient safety should be developed, implemented and evaluated.

Summary

Despite some methodological limitations, the results here suggest that PSC may be an important factor related to clinical outcomes and workforce issues. Regression analyses and combined GEE models suggest that certain factors, such as CNA turnover and LPN staffing may predict CNA PSC scores. CNA PSC scores were associated with fall and restraint rates, but were not associated with differences in pressure ulcer rates in this sample. Few associations for CNA PSC with individual subscales were identified.

Study Conclusion

This is the first study to report associations between nursing home CNA PSC scores and clinical and workforce outcomes. The exploratory factor analysis in this population revealed potential differences between CNA beliefs and attitudes and those of other clinical staff surveyed in previous studies; this warrants further work on a reliable and valid PSC instrument targeting CNAs and potentially other ancillary nursing home staff as well.

In this study, facilities with higher CNA turnover had lower CNA PSC scores. This adds to the literature on nursing home turnover, suggesting that CNA turnover is not only associated with differences in quality, as in previous studies, but safety and safety

culture as well. Because education and system-wide interventions to improve safety and quality may be different (some based on safety science, some based on quality improvement literature) the study of both safety and quality outcomes is important. The results here support the measurement of PSC using an evidence-based instrument as a means of identifying one important predictor of CNA turnover.

Future studies should evaluate interventions targeting PSC, and whether or not they can reduce CNA turnover and improve clinical outcomes. This study supports the recommendation of previous scientists that nursing home PSC should be measured and programs implemented to help nursing homes improve PSC. Patient safety and workforce stability are likely to benefit from such efforts.

References

Adewale, A. J., Hayduk, L., Estabrooks, C. A., Cummings, G. G., Midodzi, W. K., & Derksen, L. (2007). Understanding hierarchical linear models: applications in nursing research. *Nursing Research, 56*(4 Suppl), S40-46.

Anderson, R. A., Ammarell, N., Bailey, D., Jr., Colon-Emeric, C., Corazzini, K. N., Lillie, M., et al. (2005). Nurse assistant mental models, sensemaking, care actions, and consequences for nursing home residents. *Qualitative Health Research, 15*(8), 1006-1021.

Anderson, R. A., Hsieh, P. C., & Su, H. F. (1998). Resource allocation and resident outcomes in nursing homes: comparisons between the best and worst. *Research in Nursing and Health, 21*(4), 297-313.

Anderson, R. A., Issel, L. M., & McDaniel Jr, R. R. (2003). Nursing homes as complex adaptive systems: relationship between management practice and resident outcomes. *Nursing Research, 52*(1), 12-21.

Angelelli, J., Mor, V., Intrator, O., Feng, Z., & Zinn, J. (2003). Oversight of nursing homes: pruning the tree or just spotting bad apples? *Gerontologist, 43 Spec No 2*, 67-75.

Arling, G., Kane, R. L., Mueller, C., Bershadsky, J., & Degenholtz, H. B. (2007). Nursing effort and quality of care for nursing home residents. *Gerontologist, 47*(5), 672-682.

Austin, P. C., Vu, J. V., & Alter, D. A. (2003). Comparing hierarchical modeling with traditional logistic regression analysis among patients hospitalized with acute

myocardial infarction: Should we be analyzing cardiovascular outcomes data differently? *American Heart Journal, 145*(1), 27-35.

Baier, R. R., Gifford, D. R., Lyder, C. H., Schall, M. W., Funston-Dillon, D. L., Lewis, J. M., et al. (2003). Quality improvement for pressure ulcer care in the nursing home setting: the Northeast Pressure Ulcer Project. *Journal of the American Medical Directors Association, 4*(6), 291-301.

Baker, B. (2007). *Old Age in a New Age: The Promise of Transformative Nursing Homes*. Nashville, TN: Vanderbilt University Press.

Barry, T. T., Brannon, D., & Mor, V. (2005). Nurse aide empowerment strategies and staff stability: effects on nursing home resident outcomes. *Gerontologist, 45*(3), 309-317.

Bates, D.W., Cullen, D.J., Laird, N., Petersen, L.A., Small, S.D., Servi, D., Laffel, G., Sweitzer, B.J., Shea, B.F., Hallisey, R., Vander Vliet, M., Nemeskal, R., Leape, L. (1995). Incidence of Adverse Drug Events and Potential Adverse Drug Events: Implications for Prevention. *Journal of the American Medical Association, 274*(1); 29-34.

Bates-Jensen, B. M., Cadogan, M., Osterweil, D., Levy-Storms, L., Jorge, J., Al-Samarrai, N., et al. (2003). The minimum data set pressure ulcer indicator: does it reflect differences in care processes related to pressure ulcer prevention and treatment in nursing homes? *Journal of the American Geriatrics Society, 51*(9), 1203-1212.

Beck, C., Ortigara, A., Mercer, S., & Shue, V. (1999). Enabling and empowering certified nursing assistants for quality dementia care. *International Journal of Geriatric Psychiatry, 14*(3), 197-211; discussion 211-192.

Berlowitz, D., & Frantz, R. A. (2007). Implementing Best Practices in Pressure Ulcer Care: The Role of Continuous Quality Improvement. *Journal of the American Medical Director's Association, March*(Supplement), S37-S41.

Berlowitz, D. R., Young, G. J., Hickey, E. C., Saliba, D., Mittman, B. S., Czarnowski, E., et al. (2003). Quality improvement implementation in the nursing home. *Health Services Research, 38*(1 Pt 1), 65-83.

Bonner, A. (2006). Falling Into Place: A Practical Approach to Interdisciplinary Education on Falls Prevention in Long-Term Care. *Annals of Long Term Care: Clinical Care and Aging, 14*(6), 21-29.

Bonner, A., Macculloch, P., Gardner, T., & Chase, C. W. (2007). A student-led demonstration project on fall prevention in a long-term care facility. *Geriatric Nursing, 28*(5), 312-318.

Boockvar, K., Brodie, H. D., & Lachs, M. (2000). Nursing assistants detect behavior changes in nursing home residents that precede acute illness: development and validation of an illness warning instrument. *Journal of the American Geriatrics Society, 48*(9), 1086-1091.

Boockvar, K. S., Fishman, E., Kyriacou, C. K., Monias, A., Gavi, S., & Cortes, T. (2004). Adverse events due to discontinuations in drug use and dose changes in patients transferred between acute and long-term care facilities. *Archives of Internal Medicine, 164*(5), 545-550.

Boockvar, K. S., LaCorte, H. C., Giambanco, V., Fridman, B., & Siu, A. (2006). Medication Reconciliation for Reducing Drug-Discrepency Adverse Events. *The American Journal of Geriatric Pharmacotherapy, 4*(3), 236-243.

Bourbonniere, M., Feng, Z., Intrator, O., Angelelli, J., Mor, V., & Zinn, J. S. (2006). The use of contract licensed nursing staff in U.S. nursing homes. *Medical Care Research and Review, 63*(1), 88-109.

Bowers, B., & Becker, M. (1992). Nurse's Aides in Nursing Homes: The Relationship Between Organization and Quality. *The Gerontologist, 32*(3), 360-366.

Bowers, B. J., Esmond, S., & Jacobson, N. (2000). The relationship between staffing and quality in long-term care facilities: exploring the views of nurse aides. *Journal of Nursing Care Quality, 14*(4), 55-64; quiz 73-55.

Bowers, B. J., Esmond, S., & Jacobson, N. (2003). Turnover reinterpreted CNAs talk about why they leave. *Journal of Gerontological Nursing, 29*(3), 36-43.

Brannon, D., Zinn, J. S., Mor, V., & Davis, J. (2002). An exploration of job, organizational, and environmental factors associated with high and low nursing assistant turnover. *Gerontologist, 42*(2), 159-168; discussion 157-158.

Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology, 1*(3), 185-216.

Burns, N., & Grove, S. K. (2005). *The Practice of Nursing Research: Conduct, Critique and Utilization* (Fifth ed.). St Louis, MO: Elsevier Saunders.

Burton, P., Gurrin, L., & Sly, P. (1998). Extending the Simple Linear Regression Model to Account for Correlated Responses: An Introduction to Generalized Estimating

Equations and Multi-Level Mixed Modelling. *Statistics in Medicine, 17*, 1261-1291.

Cadogan, M. P., Franzi, C., Osterweil, D., & Hill, T. (1999). Barriers to effective communication in skilled nursing facilities: differences in perception between nurses and physicians. *Journal of the American Geriatrics Society, 47*(1), 71-75.

Capezuti, E. (2004). Minimizing the use of restrictive devices in dementia patients at risk for falling. *Nursing Clinics of North America, 39*(3), 625-647.

Capezuti, E., Boltz, M., Renz, S., Hoffman, D., & Norman, R. G. (2006). Nursing home involuntary relocation: clinical outcomes and perceptions of residents and families. *Journal of the American Medical Directors Association, 7*(8), 486-492.

Capezuti, E., Evans, L., Strumpf, N., & Maislin, G. (1996). Physical restraint use and falls in nursing home residents. *Journal of the American Geriatrics Society, 44*(6), 627-633.

Capezuti, E., Maislin, G., Strumpf, N., & Evans, L. K. (2002). Side rail use and bed-related fall outcomes among nursing home residents. *Journal of the American Geriatrics Society, 50*(1), 90-96.

Capezuti, E., Strumpf, N. E., Evans, L. K., Grisso, J. A., & Maislin, G. (1998). The relationship between physical restraint removal and falls and injuries among nursing home residents. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 53*(1), M47-52.

Castle, J. E. (2003). Maximizing Research Opportunities: Secondary Data Analysis. *Journal of Neuroscience Nursing, 35*(5), 287-290.

Castle, N., & Shugarman, L. (2005). The Effects of Top Management Professional Development on Administrator Turnover. *Journal of Applied Gerontology, 24*(5), 404-418.

Castle, N. G. (1998). The use of physical restraints in nursing homes: pre- and post-Nursing Home Reform Act. *Journal of Health and Social Policy, 9*(3), 71-89.

Castle, N. G. (2000). Deficiency Citations for Physical Restraint Use in Nursing Homes. *Journal of Gerontology: Social Sciences, 55B*(1), S33-S40.

Castle, N. G. (2005). Turnover begets turnover. *Gerontologist, 45*(2), 186-195.

Castle, N. G. (2006a). Nurse Aides' ratings of the resident safety culture in nursing homes. *International Journal for Quality in Health Care, 18*(5), 370-376.

Castle, N. G. (2006b). Measuring staff turnover in nursing homes. *Gerontologist, 46*(2), 210-219.

Castle, N. G., & Banaszak-Holl, J. (1997). Top management team characteristics and innovation in nursing homes. *Gerontologist, 37*(5), 572-580.

Castle, N. G., Degenholtz, H., & Engberg, J. (2005). State Variability in Indicators of Quality of Care in Nursing Facilities. *Journal of Gerontology: Medical Sciences, 60A*(9), 1173-1179.

Castle, N. G., & Engberg, J. (2005). Staff turnover and quality of care in nursing homes. *Medical Care, 43*(6), 616-626.

Castle, N. G., & Engberg, J. (2006). Organizational characteristics associated with staff turnover in nursing homes. *Gerontologist, 46*(1), 62-73.

Castle, N. G., Engberg, J., Anderson, R., & Men, A. (2007). Job satisfaction of nurse aides in nursing homes: intent to leave and turnover. *Gerontologist, 47*(2), 193-204.

Castle, N. G., Engberg, J., & Men, A. (2007). Nursing home staff turnover: impact on nursing home compare quality measures. *Gerontologist, 47*(5), 650-661.

Castle, N. G., Fogel, B., & Mor, V. (1997). Risk factors for physical restraint use in nursing homes: pre- and post-implementation of the Nursing Home Reform Act. *Gerontologist, 37*(6), 737-747.

Castle, N. G., & Sonon, K. E. (2006). A culture of patient safety in nursing homes. *Quality and Safety in Health Care, 15*(6), 405-408.

Center for Health Systems Research and Analysis. (2005, June 14, 2005). Nursing Home QI Domains and Descriptions. Retrieved July 8, 2007, 2007, from http://www.chsra.wisc.edu/chsra/qi/domaindesc.htm

Center for Medicare and Medicaid Services. (1998). Minimum Data Set 2.0. Second Edition.

Center for Medicare and Medicaid Services. (2007a, March 22, 2007). Nursing Home Compare. Retrieved July 8, 2007, from http://www.medicare.gov/NHCompare/home.asp

Center for Medicare and Medicaid Services. (2007b). State Operations Manual, Publication 100-07. Retrieved November 13, 2007, 2007, from http://www.cms.hhs.gov/manuals

Centers for Disease Control and Prevention. (2004, March 27, 2007). National Nursing Assistant Survey. Retrieved July 20, 2007, 2007, from http://www.cdc.gov/nchs/nnas2004.htm

Centers for Disease Control and Prevention. (2006, January 24, 2007). National Center for Health Statistics Fast Facts. Retrieved July 19, 2007, 2007, from http://www.cdc.gov/nchs/data/hus/hus06.pdf#116

Chen, Q., & Kane, R. L. (2001). Effects of using consumer and expert ratings of an activities of daily living scale on predicting functional outcomes of postacute care. *Journal of Clinical Epidemiology, 54*(4), 334-342.

Cherry, B., Ashcraft, A., & Owen, D. (2007). Perceptions of job satisfaction and the regulatory environment among nurse aides and charge nurses in long-term care. *Geriatric Nursing, 28*(3), 183-192.

Coleman, E. A., Parry, C., Chalmers, S., & Min, S.-J. (2006). The care transitions intervention: results of a randomized controlled trial. *Archives of Internal Medicine, 166*(17), 1822-1828.

Coleman, E. A., Smith, J. D., Raha, D., & Min, S. (2005). Posthospital Medication Discrepencies: Prevalence and Contributing Factors. *Archives of Internal Medicine, 165*, 1842-1847.

Colla, J. B., Bracken, A. C., Kinney, L. M., & Weeks, W. B. (2005). Measuring patient safety climate: a review of surveys. *Quality & Safety in Health Care, 14*(5), 364-366.

Cooper, M. (2000). Towards a Model of Safety Culture. Retrieved 9-16, 2006, from http://www.behavioral-safety.com/articles/Towards_A_Model_Of_Safety_Culture/

Cooper, M., & Phillips, R. (2004). Exploratory analysis of the safety climate and safety behavior relationship. *Journal of Safety Research, 35*, 497-512.

Cott, C. (1997). "We decide, you carry it out": a social network analysis of multidisciplinary long-term care teams. *Social Science and Medicine, 45*(9), 1411-1421.

Crawford, S. L., Tennstedt, S. L., & McKinlay, J. B. (1995). A Comparison of Analytic Methods of Non-Random Missingness of Outcome Data. *Journal of Clinical Epidemiology, 48*(2), 209-219.

Cronenwett, L., Sherwood, G., Barnsteiner, J., Disch, J., Johnson, J., Mitchell, P., et al. (2007). Quality and Safety Education for Nurses. *Nursing Outlook, 55*(3), 122-131.

Cumming, R. G. (2002). Intervention strategies and risk-factor modification for falls prevention. A review of recent intervention studies. *Clinics in Geriatric Medicine, 18*(2), 175-189.

Currie, L. (2006). Fall and Injury Prevention. In P. Stone & P. Walker (Eds.), *Annual Review of Nursing Research: Focus on Patient Safety* (Vol. 24, pp. 350). New York: Springer Publishing Company.

Davies, H., Nutley, S., & Mannion, R. (2000). Organizational culture and quality of health care. *Quality & Safety in Health Care, 9*, 111-119.

Dickinson, L. M., & Basu, A. (2005). Multilevel Modeling and Practice-Based Research. *Annals of Family Medicine, 3*(1), S52-S60.

Donabedian, A. (2003). *An Introduction to Quality Assurance in Health Care*. New York, NY: Oxford University Press.

Eaton, S. C. (2000). Beyond 'unloving care': linking human resource management and patient care quality in nursing homes. *International Journal of Human Resource Management, 11*(3), 591-616.

Eaton, S. C. (2001). *What a difference management makes! Nursing staff turnover variation within a single labor market* (No. Centers for Medicare and Medicaid Services Subcontract No. 500-95-0062, T.O. #3). Cambridge, MA: Abt Associates

Evanoff, B., Potter, P., Wolf, L., Grayson, D., Dunagan, C., & Boxerman, S. (2005). Can We Talk? Priorities for Patient Care Differed Among Health Care Providers. *Advances in Patient Safety: From Research to Implementation, 1*, 5-14.

Evans, L. K., & Strumpf, N. E. (1989). Tying down the elderly. A review of the literature on physical restraint. *Journal of the American Geriatrics Society, 37*(1), 65-74.

Feng, Z., Katz, P., Intrator, O., Karuza, J., & Mor, V. (2005). Physician and Nurse Staffing in Nursing Homes: The Role and LImitations of the Online Survey Certification and Reporting (OSCAR) System. *Journal of the American Medical Director's Association, 6*, 27-33.

Field, T. S., Gurwitz, J. H., Avorn, J., McCormick, D., Jain, S., Eckler, M., et al. (2001). Risk factors for adverse drug events among nursing home residents.[see comment]. *Archives of Internal Medicine, 161*(13), 1629-1634.

Flin, R. (2007). Measuring safety culture in healthcare: A case for accurate diagnosis. *Safety Science, 45*, 653-667.

Flin, R., Burns, C., Mearns, K., Yule, S., & Robertson, E. M. (2006). Measuring safety climate in health care. *Quality & Safety in Health Care, 15*(2), 109-115.

Gaba, D. M., Singer, S. J., & Rosen, A. K. (2007). Safety culture: is the "unit" the right "unit of analysis"? *Critical Care Medicine, 35*(1), 314-316.

Ganz, D. A., Simmons, S. F., & Schnelle, J. F. (2005). Cost-effectiveness of recommended nurse staffing levels for short-stay skilled nursing facility patients. *BMC Health Services Research, 5*(1), 35.

Gillespie, L. D., Gillespie, W. J., Robertson, M. C., Lamb, S. E., Cumming, R. G., & Rowe, B. H. (2003). Interventions for preventing falls in elderly people. *Cochrane Database Syst Rev*(4), CD000340.

Guldenmund, F. (2000). The nature of safety culture: a review of theory and research. *Safety Science, 34*, 215-257.

Gurwitz, J., Field, T., & Avorn, J. (2000). Incidence and preventability of adverse drug events in nursing homes. *American Journal of Medicine, 109*, 87-94.

Gurwitz, J., Field, T., & Judge, J. (2005). The incidence of adverse drug events in two large academic long-term care facilities. *American Journal of Medicine, 118*, 251-258.

Halbur, B. T., & Fears, N. (1986). Nursing personnel turnover rates turned over: potential positive effects on resident outcomes in nursing homes. *Gerontologist, 26*(1), 70-76.

Handler, S. M., Castle, N. G., Studenski, S. A., Perera, S., Fridsma, D. B., Nace, D. A., et al. (2006). Patient safety culture assessment in the nursing home. *Quality & Safety in Health Care, 15*(6), 400-404.

Handler, S. M., Wright, R. M., Ruby, C. M., & Hanlon, J. T. (2006). Epidemiology of Medication-Related Adverse Events in Nursing Homes. *The American Journal of Geriatric Pharmacotherapy, 4*(3), 264-272.

Hanley, J. A., Negassa, A., deB. Edwardes, M. D., & Forrester, J. E. (2003). Statistical Analysis of Correlational Data Using Generalized Estimating Equations: An Orientation. *American Journal of Epidemiology, 157*(4), 364-375.

Hantikainen, V., & Kappeli, S. (2000). Using restraint with nursing home residents: a qualitative study of nursing staff perceptions and decision-making. *Journal of Advanced Nursing, 32*(5), 1196-1205.

Harahan, M. F., Kiefer, K. M., Johnson, A. B., Guiliano, J., Bowers, B., & Stone, R. I. (2003). *Addressing Shortages in the Direct Care Workforce: The Recruitment and Retention Practices of California's Not-for-Profit Nursing Homes, Continuing Care Retirement Communities and Assisted Living Facilities*: California Association of Homes and Services for the Aging

Harrington, C., Kovner, C., Mezey, M., Kayser-Jones, J., Burger, S., Mohler, M., et al. (2000). Experts recommend minimum nurse staffing standards for nursing facilities in the United States. *Gerontologist, 40*(1), 5-16.

Harrington, C., O'Meara, J., Collier, E., & Schnelle, J. F. (2003). Nursing indicators of quality in nursing homes. A Web-based approach. *Journal of Gerontological Nursing, 29*(10), 5-11.

Harrington, C., & Swan, J. H. (2003). Nursing home staffing, turnover, and case mix. *Medical Care Research and Review, 60*(3), 366-392; discussion 393-369.

Harrington, C., Swan, J. H., & Carrillo, H. (2007). Nurse staffing levels and Medicaid reimbursement rates in nursing facilities. *Health Services Research, 42*(3 Pt 1), 1105-1129.

Harrington, C., Woolhandler, S., Mullan, J., Carrillo, H., & Himmelstein, D. U. (2001). Does investor ownership of nursing homes compromise the quality of care? *American Journal of Public Health, 91*(9), 1452-1455.

Harris-Kojetin, L., Lipson, D., Fielding, J., Kiefer, K., & Stone, R. I. (2004). *Recent Findings on Frontline Long-Term Care Workers: A Research Synthesis 1999-2003* (No. #HHS-100-01-0025): Office of Disability, Aging and Long-Term Care Policy

Henderson, J. N., & Vesperi, M. D. (1995). *The Culture of Long Term Care: Nursing Home Ethnography*. Westport, CT: Bergin & Garvey.

Hickey, E. C., Young, G. J., Parker, V. A., Czarnowski, E. J., Saliba, D., & Berlowitz, D. R. (2005). The effects of changes in nursing home staffing on pressure ulcer rates. *Journal of the American Medical Director's Association, 6*(1), 50-53.

Hill-Westmoreland, E. E., Soeken, K., & Spellbring, A. M. (2002). A meta-analysis of fall prevention programs for the elderly: how effective are they? *Nursing Research, 51*(1), 1-8.

Hofmann, D., & Mark, B. (2006). An investigation of the relationship between safety climate and medication errors as well as other nurse and patient outcomes. *Personnel Psychology, 59*, 847-869.

Hofmann, M. T., Bankes, P. F., Javed, A., & Selhat, M. (2003). Decreasing the incidence of falls in the nursing home in a cost-conscious environment: a pilot study. *Journal of the American Medical Director's Association, 4*(2), 95-97.

Hollinger-Smith, L., & Ortigara, A. (2004). Changing Culture: Creating a Long-Term Impact for a Quality Long-Term Care Workforce. *Alzheimer's Care Quarterly, 5*(1), 60-70.

Horn, S. D., Buerhaus, P., Bergstrom, N., & Smout, R. J. (2005). RN staffing time and outcomes of long-stay nursing home residents: pressure ulcers and other adverse outcomes are less likely as RNs spend more time on direct patient care. *American Journal of Nursing, 105*(11), 58-70; quiz 71.

Huang, D. T., Clermont, G., Sexton, J. B., Karlo, C. A., Miller, R. G., & Weissfeld, L. B. (2007). Perceptions of safety culture vary across the intensive care units of a single institution. *Critical Care Medicine, 35*(1), 165-176.

Hughes, C. M., & Lapane, K. L. (2006). Nurses' and nursing assistants' perceptions of patient safety culture in nursing homes. *International Journal for Quality in Health Care, 18*(4), 281-286.

Hughes, C. M., Wright, R. M., & Lapane, K. L. (2006). Use of medication technicians in US nursing homes: part of the problem or part of the solution? *Journal of the American Medical Director's Association, 7*(5), 294-304.

Institute for the Future of Aging Services. (2003). *Keeping Frontline Workers in Long-Term Care: Results of an Intervention*. Washington, D.C.: Institute for the Future of Aging Services (IFAS). An applied research institute of AAHSA

Institute for the Future of Aging Services. (2007). *The Long-Term Care Workforce: Can the Crisis be Fixed? Problems, Causes and Options*. Washington, D.C.: Institute for the Future of Aging Services. An applied research institute of AAHSA.

Irvine, A. B., Bourgeois, M., Billow, M., & Seeley, J. R. (2007). Internet training for nurse aides to prevent resident aggression. *Journal of the American Medical Director's Association, 8*(8), 519-526.

Itoh, K., Abe, T., & Andersen, H. (2002). *A survey of safety culture in hospitals including staff attitudes about incident reporting*. Paper presented at the Workshop on the Investigation and Reporting of Incidents and Accidents.

Jervis, L. L. (2002). Working in and around the 'chain of command': power relations among nursing staff in an urban nursing home. *Nursing Inquiry, 9*(1), 12-23.

Johnstone, M. J., & Kanitsaki, O. (2006). Culture, language, and patient safety: making the link. *International Journal for Quality in Health Care, 18*(5), 383-388.

Kapp, M. B. (2003a). "At least Mom will be safe there": the role of resident safety in nursing home quality.[see comment]. *Quality & Safety in Health Care, 12*(3), 201-204.

Kapp, M. B. (2003b). Resident safety and medical errors in nursing homes: reporting and disclosure in a culture of mutual distrust. *Journal of Legal Medicine, 24*(1), 51-76.

Kho, M. E., Carbone, J. M., Lucas, J., & Cook, D. J. (2005). Safety Climate Survey: reliability of results from a multicenter ICU survey.[see comment]. *Quality & Safety in Health Care, 14*(4), 273-278.

Kohn, L., Corrigan, J., & Donaldson, M. (2000). *To err is human: building a safer health system*. Washington, D.C.: National Academy Press.

Lake, E. T., & Cheung, R. B. (2006). Are patient falls and pressure ulcers sensitive to nurse staffing? *Western Journal of Nursing Research, 28*(6), 654-677.

Lapane, K. L., & Hughes, C. M. (2007). Considering the employee point of view: perceptions of job satisfaction and stress among nursing staff in nursing homes. *Journal of the American Medical Director's Association, 8*(1), 8-13.

Lee, T. (1996). Perceptions, attitudes and behaviour: the vital elements of a safety culture. *Health and Safety, October*, 1-15.

Levy, C. R., & Kramer, A. M. (2005). Physician Practice Patterns in Nursing Homes. *Long Term Care Interface, December*, 17-23.

Magee, T., Lee, S. M., Giuliano, K. K., & Munro, B. (2006). Generating new knowledge from existing data: the use of large data sets for nursing research. *Nursing Research, 55*(2 Supplement), S50-56.

McGillis Hall, L., McGilton, K. S., Krejci, J., Pringle, D., Johnston, E., Fairley, L., et al. (2005). Enhancing the quality of supportive supervisory behavior in long-term care facilities. *Journal of Nursing Administration, 35*(4), 181-187.

McGilton, K. S. (2003). Development and psychometric evaluation of supportive leadership scales. *Canadian Journal of Nursing Research, 35*(4), 72-86.

McNabney, M. K., Andersen, R. E., & Bennett, R. G. (2004). Nursing documentation of telephone communication with physicians in community nursing homes. *Journal of the American Medical Directors Association, 5*(3), 180-185.

Medicare Quality Improvement Organization Program. (2006). *Framework for Reducing Physical Restraints in Nursing Facilities*: Center for Medicare and Medicaid Services

Mezey, M., Capezuti, E., & Fulmer, T. (2004). Care of older adults. *Nursing Clinics of North America, 39*(3), xiii-xx.

Mohr, J., Batalden, P., & Barach, P. (2004). Integrating patient safety into the clinical microsystem. *Quality & Safety in Health Care, 13*(suppl II), ii34-ii38.

Mor, V. (2005). Improving the quality of long-term care with better information. *Milbank Quarterly, 83*(3), 333-364.

Mor, V. (2006). Defining and Measuring Quality Outcomes in Long-term care. *Journal of the American Medical Director's Association, 7*, 532-540.

Mor, V., Berg, K., Angelelli, J., Gifford, D., Morris, J., & Moore, T. (2003). The quality of quality measurement in U.S. nursing homes. *Gerontologist, 43 Spec No 2*, 37-46.

Mor, V., Zinn, J., Angelelli, J., Teno, J. M., & Miller, S. C. (2004). Driven to tiers: socioeconomic and racial disparities in the quality of nursing home care. *Milbank Quarterly, 82*(2), 227-256.

Morris, J. N., Fries, B. E., Mehr, D. R., Hawes, C., Phillips, C., Mor, V., et al. (1994). MDS Cognitive Performance Scale. *Journal of Gerontology, 49*(4), M174-182.

Morris, J. N., Fries, B. E., Steel, K., Ikegami, N., Bernabei, R., Carpenter, G. I., et al. (1997). Comprehensive clinical assessment in community setting: applicability of the MDS-HC. *Journal of the American Geriatrics Society, 45*(8), 1017-1024.

Morris, J. N., Moore, T., Jones, R., Mor, V., Angelelli, J., & Berg, K. (2002). *Validation of long-term cand post-acute care quality indicators (executive summary of report to CMS)* (Unpublished Report No. 500-95-0062/TO#2). Cambridge, MA: Abt Associates, Inc.

Morris, J. N., Nonemaker, S., Murphy, K., Hawes, C., Fries, B. E., Mor, V., et al. (1997). A commitment to change: revision of HCFA's RAI. *Journal of the American Geriatrics Society, 45*(8), 1011-1016.

Nakhnikian, E., Wilner, M. A., & Hurd, D. (2002). Nursing assistant training and educaiton: Recommendations for change. *Nursing Homes Long Term Care Management, 51*(8), 44-46.

National Commission on Nursing Workforce for Long-Term Care. (2005). *Act Now for Your Tomorrow: Final Report of the National Commission on Nursing Workforce for Long-Term Care*

Nieva, V. F., & Sorra, J. (2003). Safety culture assessment: a tool for improving patient safety in healthcare organizations. *Quality & Safety in Health Care, 12 Suppl 2*, ii17-23.

O'Neill, C., Harrington, C., Kitchener, M., & Saliba, D. (2003). Quality of care in nursing homes: an analysis of relationships among profit, quality, and ownership. *Medical Care, 41*(12), 1318-1330.

Paparella, S. F., Mariani, B. A., Layton, K., & Carpenter, A. M. (2004). Patient safety simulation: learning about safety never seemed more fun. *Journal for Nurses in Staff Development, 20*(6), 247-252; quiz 253-244.

Parker, K., & Miles, S. H. (1997). Deaths caused by bedrails. *Journal of the American Geriatrics Society, 45*(7), 797-802.

Phillips, C. D., Spry, K. M., Sloane, P. D., & Hawes, C. (2000). Use of Physical Restraints and Psychotropic Medications in Alzheimer Special Care Units in Nursing Homes. *American Journal of Public Health, 90*(1), 92-96.

Pioneer Network. (2007). Our Vision: Who We Are. Retrieved July 2, 2007, from http://www.pioneernetwork.net/

Pronovost, P., & Sexton, B. (2005). Assessing safety culture: guidelines and recommendations.[comment]. *Quality & Safety in Health Care, 14*(4), 231-233.

Pronovost, P., Weast, B., Holzmueller, C. G., Rosenstein, B. J., Kidwell, R. P., Haller, K. B., et al. (2003). Evaluation of the culture of safety: survey of clinicians and managers in an academic medical center. *Quality and Safety in Health Care, 12*, 405-410.

Pronovost, P., Weast, B., Rosenstein, B., Sexton, B., Holzmueller, C., Paine, L., et al. (2005). Implementing and Validating a Comprehensive Unit-Based Safety Program. *Journal of Patient Safety, 1*(1), 33-40.

Pronovost, P., Weast, B., Schwarz, M., Wyskiel, R. M., Prow, D., Milanovich, S. N., et al. (2003). Medication reconciliation: a practical tool to reduce the risk of medication errors. *Journal of Critical Care, 18*(4), 201-205.

Rantz, M. J., Hicks, L., Grando, V., Petroski, G. F., Madsen, R. W., Mehr, D. R., et al. (2004). Nursing home quality, cost, staffing, and staff mix. *Gerontologist, 44*(1), 24-38.

Rantz, M. J., Popejoy, L., Petroski, G. F., Madsen, R. W., Mehr, D. R., Zwygart-Stauffacher, M., et al. (2001). Randomized clinical trial of a quality improvement intervention in nursing homes. *Gerontologist, 41*(4), 525-538.

Rantz, M. J., Popejoy, L., Zwygart-Stauffacher, M., Wipke-Tevis, D., & Grando, V. T. (1999). Minimum Data Set and Resident Assessment Instrument. Can using

standardized assessment improve clinical practice and outcomes of care? *Journal of Gerontological Nursing, 25*(6), 35-43; quiz 54-35.

Rask, K., Parmelee, P. A., Taylor, J. A., Green, D., Brown, H., Hawley, J., et al. (2007). Implementation and evaluation of a nursing home fall management program. *Journal of the American Geriatrics Society, 55*(3), 342-349.

Ray, W. A., Taylor, J. A., Brown, A. K., Gideon, P., Hall, K., Arbogast, P., et al. (2005). Prevention of fall-related injuries in long-term care: a randomized controlled trial of staff education. *Archives of Internal Medicine, 165*(19), 2293-2298.

Ray, W. A., Taylor, J. A., Meador, K. G., Thapa, P. B., Brown, A. K., Kajihara, H. K., et al. (1997). A randomized trial of a consultation service to reduce falls in nursing homes. *JAMA, 278*(7), 557-562.

Reason, J. (1997). *Managing the Risks of Organizational Accidents*. Aldershot, Hants: Ashgate Publishing, Ltd.

Resnick, B., Simpson, M., Bercovitz, A., Galik, E., Gruber-Baldini, A., Zimmerman, S., et al. (2006). Pilot testing of the Restorative Care Intervention: impact on residents. *Journal of Gerontological Nursing, 32*(3), 39-47.

Resnick, B., Simpson, M., Galik, E., Bercovitz, A., Gruber-Baldini, A. L., Zimmerman, S., et al. (2006). Making a difference: nursing assistants' perspectives of restorative care nursing. *Rehabilitation Nursing, 31*(2), 78-86.

Rubenstein, L. Z. (2006). Falls in older people: epidemiology, risk factors and strategies for prevention. *Age and Ageing, 35 Suppl 2*, ii37-ii41.

Rubenstein, L. Z., & Josephson, K. R. (2002). The epidemiology of falls and syncope. *Clinics in Geriatric Medicine, 18*(2), 141-158.

Rubenstein, L. Z., & Trueblood, P. R. (2004). Gait and balance assessment in older persons. *Annals of Long Term Care: Clinical Care and Aging, 12*(2), 39-45.

Ryan, J., Stone, R. I., & Raynor, C. R. (2004). Using large data sets in long-term care to measure and improve quality. *Nursing Outlook, 52*(1), 38-44.

Schein, E. (1992). *Organizational Culture and Leadership* (Second ed.). San Francisco: Jossey-Bass.

Schnelle, J. F., Bates-Jensen, B. M., Chu, L., & Simmons, S. F. (2004). Accuracy of nursing home medical record information about care-processes delivery: implications for staff management and improvement. *Journal of the American Geriatrics Society, 52*(8), 1378-1383.

Schnelle, J. F., Bates-Jensen, B. M., Levy-Storms, L., Grbic, V., Yoshii, J., Cadogan, M., et al. (2004). The minimum data set prevalence of restraint quality indicator: does it reflect differences in care? *Gerontologist, 44*(2), 245-255.

Schnelle, J. F., Simmons, S. F., Harrington, C., Cadogan, M. P., Garcia, E., & M Bates-Jensen, B. (2004). Relationship of nursing home staffing to quality of care. *Health Services Research, 39*(2), 225-250.

Schnelle, J. F., Wood, S., Schnelle, E. R., & Simmons, S. (2001). Measurement Sensitivity and the Minimum Data Set Depression Quality Indicator. *Journal of the American Geriatrics Society, 41*(3), 401-405.

Scott-Cawiezell, J., Vogelsmeier, A., McKenney, C., Rantz, M., Hicks, L., & Zellmer, D. (2006). Moving from a culture of blame to a culture of safety in the nursing home setting. *Nursing Forum, 41*(3), 133-140.

Scott, T., Mannion, R., Davies, H., & Marshall, M. (2003). The quantitative measurement of organizational culture in health care: a review of the available instruments. *Health Services Research, 38*(3), 923-945.

Sexton, J. B., Helmreich, R. L., Neilands, T. B., Rowan, K., Vella, K., Boyden, J., et al. (2006). The Safety Attitudes Questionnaire: psychometric properties, benchmarking data and emerging research. *BMC Health Services Research* Retrieved September 13, 2006, from www.biomedcentral.com/1472-6963/6/44

Sexton, J. B., Thomas, E. J., & Helmreich, R. L. (2000). Error, stress, and teamwork in medicine and aviation: cross sectional surveys. *BMJ, 320*(7237), 745-749.

Shaw, F. E. (2002). Falls in cognitive impairment and dementia. *Clinics in Geriatric Medicine, 18*(2), 159-173.

Shepard, M. P., Carroll, R. M., Mahon, M. M., Moriarty, H. J., Feetham, S. L., & Deatrick, J. A. (1999). Conceptual and pragmatic considerations in conducting a secondary analysis. An example from research of families. *Western Journal of Nursing Research, 21*(2), 154-167.

Singer, S., Meterko, M., Baker, L., Gaba, D., Falwell, A., & Rosen, A. (2007). Workforce perceptions of hospital safety culture: development and validation of the patient safety climate in healthcare organizations survey. *Health Services Research, 42*(5), 1999-2021.

Singer, S. J., Gaba, D. M., Geppert, J. J., Sinaiko, A. D., Howard, S. K., & Park, K. C. (2003). The culture of safety: results of an organization-wide survey in 15 California hospitals.[see comment]. *Quality & Safety in Health Care, 12*(2), 112-118.

Singla, A. K., Kitch, B. T., Weissman, J. S., & Campbell, E. G. (2006). Assessing Patient Safety Culture: A Review and Synthesis of the Measurement Tools. *Journal of Patient Safety, 2*(3), 105-115.

Snowden, M., McCormick, W., Russo, J., Srebnik, D., Comtois, K., Bowen, J., et al. (1999). Validity and responsiveness of the Minimum Data Set. *Journal of the American Geriatrics Society, 47*(8), 1000-1004.

Sorra, J. S., & Nieva, V. F. (2004). *Hospital survey on patient safety culture* (No. AHRQ No. 04-0041). Rockville, MD: Agency for Healthcare Research and Quality

Stelfox, H., Palmisani, S., Scurlock, C., Orav, E., & Bates, D. (2006). The "To Err is Human" report and the patient safety literature. *Quality & Safety in Health Care, 15*, 174-178.

Stone, P., Harrison, M. I., Feldman, P., Linzer, M., Peng, T., Roblin, D., et al. (2005). Organizational Climate of Staff Working Conditions and Safety - An Integrative Model. *Advances in Patient Safety: From Research to Implementation* volume 1. Retrieved October 1, 2006, from http://www.ahrq.gov/downloads/put/advances/vol1/Stone.pdf

Stone, P. W., & Walker, P. H. (Eds.). (2006). *Annual Review of Nursing Research: Focus on Patient Safety* (Vol. 24). New York: Springer Publishing Company.

Stone, R. I., & Weiner, J. M. (2001). *Who Will Care for Us? Addressing the Long-Term Care Workforce Crisis*: The Urban Institute

Sullivan-Marx, E. M., Strumpf, N. E., Evans, L. K., Baumgarten, M., & Maislin, G. (1999a). Initiation of physical restraint in nursing home residents following restraint reduction efforts. *Research in Nursing and Health, 22*(5), 369-379.

Sullivan-Marx, E. M., Strumpf, N. E., Evans, L. K., Baumgarten, M., & Maislin, G. (1999b). Predictors of continued physical restraint use in nursing home residents following restraint reduction efforts. *Journal of the American Geriatrics Society, 47*(3), 342-348.

Taylor, J. A., Parmelee, P., Brown, H., Strothers, H. S., 3rd, Capezuti, E., & Ouslander, J. G. (2007). A model quality improvement program for the management of falls in nursing homes. *Journal of the American Medical Director's Association, 8*(3 Suppl), S26-36.

Teigland, C., Gardiner, R., Hailing, L., & Byrne, C. (2005). Clinical Informatics and Its Usefulness for Assessing Risk and preventing Falls and Pressure Ulcers in Nursing Home Environments. *Advances in Patient Safety, Volume 3*, 69-85.

Theodos, P. (2003). Fall prevention in frail elderly nursing home residents: a challenge to case management: part I. *Lippincott's Case Management, 8*(6), 246-251.

Theodos, P. (2004). Fall prevention in frail elderly nursing home residents: a challenge to case management: part II. *Lippincott's Case Management, 9*(1), 32-44.

Thomas, E. J., Sexton, J. B., Neilands, T. B., Frankel, A., & Helmreich, R. L. (2005). The effect of executive walk rounds on nurse safety climate attitudes: A randomized trial of clinical units. *BMC Health Services Research, 5*(28).

Tinetti, M. E. (2003). Clinical practice. Preventing falls in elderly persons. *New England Journal of Medicine, 348*(1), 42-49.

U.S. Department of Health and Human Services. (2003). *The Future Supply of Long-Term Care Workers in Relation to the Aging Baby Boom Generation: Report to Congress*: Office of the Assistant Secretary for Planning and Evaluation (ASPE)

U.S. Department of Health and Human Services Administration on Aging. (2006, 3/1/06). A Statistical Profile of Older Americans Age 65+. Retrieved 11/26, 2006, from http://www.aoa.dhhs.gov/PRESS/fact/pdf/Attachment_1304.pdf

U.S. General Accounting Office. (2002). *Report to Congressional Requesters. Nursing homes: Federal efforts to monitor resident assessment data should complement state activities* (No. GAO-02-279). Washington, D.C.

Vincent, C., Taylor-Adams, S., & Stanhope, N. (1998). Framework for analysing risk and safety in clinical medicine. *British Medical Journal, 316*, 1154-1157.

Vira, T., Colquhoun, M., & Etchells, E. (2006). Reconcilable differences: correcting medication errors at hospital admission and discharge. *Quality & Safety in Health Care, 15*(2), 122-126.

Vu, M. Q., Weintraub, N., & Rubenstein, L. Z. (2005). Falls in the nursing home: Are they preventable? *Journal of the American Medical Director's Association, 6*(3 Suppl), S82-87.

Wagner, L. M., Capezuti, E., & Ouslander, J. G. (2006). Reporting near-miss events in nursing homes. *Nursing Outlook, 54*(2), 85-93.

Walshe, K. (2001). Regulating U.S. nursing homes: are we learning from experience? *Health Affairs, 20*(6), 128-144.

Walshe, K., & Harrington, C. (2002). Regulation of nursing facilities in the United States: an analysis of resources and performance of state survey agencies. *Gerontologist, 42*(4), 475-487.

Wan, T. T., Zhang, N. J., & Unruh, L. (2006). Predictors of resident outcome improvement in nursing homes. *Western Journal of Nursing Research, 28*(8), 974-993.

Wang, R., Sedransk, J., & Jinn, J. H. (1992). Secondary Data Analysis When There Are Missing Observations. *Journal of the American Statistical Association, 87*(420), 952-961.

Winn, P., Cook, J. B., & Bonnel, W. (2004). Improving communication among attending physicians, long-term care facilities, residents, and residents' families.[see comment]. *Journal of the American Medical Directors Association, 5*(2), 114-122.

Wisniewski, A. M., Erdley, W. S., Singh, R., Servoss, T. J., Naughton, B. J., & Singh, G. (2007). Assessment of Safety Attitudes in a Skilled Nursing Facility. *Geriatric Nursing, 28*(2), 126-136.

Wunderlich, G., & Kohler, P. (Eds.). (2001). *Improving the Quality of Long-Term Care*. Washington, D.C.: National Academy Press.

Yamada, Y. (2002). Profile of home care aides, nursing home aides, and hospital aides: historical changes and data recommendations. *Gerontologist, 42*(2), 199-206.

Zimmerman, S., Gruber-Baldini, A. L., Hebel, J. R., Sloane, P. D., & Magaziner, J. (2002). Nursing home facility risk factors for infection and hospitalization: importance of registered nurse turnover, administration, and social factors. *Journal of the American Geriatrics Society, 50*(12), 1987-1995.

Appendix A

Matrix of PSC Measurement Studies

Table A1. Matrix of Ten General Studies Measuring Patient Safety Culture or Climate.

Author(s), date of publication	Design	Methods	Selected findings	Comments
(Flin et al., 2006)	Review in MEDLINE, PsychINFO, EBSCO and Web of Science. Search terms: health care workers, hospital safety, patient safety, safety climate and safety culture.	29 studies located. 12 assessed psychometric properties (content and criterion validity, reliability, factor structure). Two industrial psychologists independently rated dimensions (inter-rater reliability).	Theoretical or conceptual models rarely identified. Standard psychometrics missing for some surveys. Where available, some tools had limitations. HSOPSC met more criteria than other instruments. 3 core dimensions across surveys: management/supervisor commitment, safety system, work pressure. Definitions for SC used were from industry.	Consistent with Colla review (see below). States larger studies being done now on psychometrics of tools.
(Sexton et al., 2006)	Six cross sectional survey administrations from 2000-2003 across 203 sites. SAQ administered in 106 UK ICUs; 20 New Zealand ICUs. 11 USA inpatient settings, 2 USA OR settings, 11 USA ambulatory clinics and 53 USA ICUs.	203 clinical settings total. Multilevel analysis for both respondent and unit effects, to minimize aggregation bias. Used Raykov's n instead of Cronbach's alpha for reliability for multilevel analysis.	10,843 respondents (67% response rate). Six factor solution (teamwork climate, job satisfaction, perceptions of management, safety climate, working conditions, stress recognition). Raykov's n=.90	Discussion on validity detailed. Used Reason's CAIR tool for convergent validity. SAQ open ended questions also correlated with scores. Multilevel model demonstrated more variability between than within units. Unit level climate is important. References executive walk rounds study (Thomas, 2005) linking SAQ scores to outcomes (another form of validity). Makes a strong case for using this instrument – benchmarking data available.

Author(s), date of publication	Design	Methods	Selected findings	Comments
(Colla et al., 2005)	Review in Medline, Web of Science.	13 studies located. 9 included. Psychometrics reviewed. 3 independent reviewers identified domains.	Psychometrics "comprehensive and sound" for VA PSCQ, HTSSCS, HSOPSC and SAQ. Only two (CSS and SAQ) looked at process measures. Only one (SAQ) looked at outcomes. SAQ favorable scores were associated with lower LOS, fewer med errors, lower ventilator associated pneumonia, bloodstream infection rates and lower risk adjusted mortality.	Considerable variability in surveys. May consider using surveys already tested in a particular setting. May want to use SAQ if studying relationship between PSC and outcomes (has been tool used most often for this). Compares focus of PSC dimensions (job satisfaction, teamwork, leadership) in various tools. Considers PSC important in its own right, and potentially modifiable.
(Pronovost & Sexton, 2005)	Quasi-experimental crossover design. CUSP 8 step program was the intervention. Pre and post measurement of safety culture using Safety Climate Scale (SCS). Measures attitudes toward stress, status hierarchies, leadership and interpersonal skills.	Two ICUs (crossover design). Started MICU; 3 months later SICU. CUSP involves: measuring safety climate, educating staff on safety science, identifying staff concerns, senior leadership adopts a unit; implement improvements, document results, share stories, re-measure safety culture.	SCS has good reliability, validity, replicable factor structure (references previous studies). 84-89% response rate. N=66 staff in MICU; 23 in SICU. Safety attitudes improved in several domains on post test. Trend toward lower nurse turnover (not statistically significant). Some clinical outcomes improved.	Recommends SAQ as having more detailed information on job satisfaction, perceptions of management, teamwork climate, safety climate, stress recognition and working conditions. Cautions cannot conclude causality. Numbers small. PSC may be modifiable.
(Thomas et al., 2005)	Quasi-experimental intervention study of executive walk rounds. EWRs instituted in 23 randomly selected units in a teaching hospital. Hypothesized that SCSur scores would improve after intervention.	Measured SCSur before and after. Used 21 item SCSur survey (not 10 item SCS version).	1119 respondents pre and 1000 post (67% and 55% response rates). Nurses who actually participated in the rounds (versus those who worked on the units) improved their SCSur scores.	EWRs can improve safety climate scores among nurses. Scores did not improve for ALL nurses – just for those on the rounds. Dose response not established. No physicians included.

Author(s), date of publication	Design	Methods	Selected findings	Comments
(Kho, Carbone, Lucas, & Cook, 2005)	Cross sectional survey design. Purpose was to determine reliability for 3 instruments: SCSurvey (21 items); SCS scale (10 items); SCMean (7 items).	Surveys distributed to all staff in 4 ICUs in Canadian teaching hospital.	74% response rate. Nurses, allied health, non-clinical staff, physician, management. Cronbach's alpha .86 (SCsurvey), .80, (SCS scale) .51 (SCM). Test-retest was .92 SCSur and SCS.	Small number of managers. Managers had higher evaluations of safety. SCSur and SCS had better psychometrics than SCM.
(Singer et al., 2003)	Design and distribution of patient safety culture instrument. Goals were to measure attitudes in entire hospitals (not individual units) and among all hospital personnel and evaluate variation among administrators, physicians, nurses, ancillary staff.	Adapted 5 existing surveys (OR management, anesthesia work environment, naval command assessment, risk management questionnaire, safety orientation in medical facilities). 30 questions. Measured "problematic responses" – those not reflective of safety culture. 15 hospitals. 6312 accessible respondents; 2989 respondents. Over 1000 physicians. Some sampled 100%; some 10% random of employees. Weighted non-responders.	47% response rate. 5 Factors: organization, department, production, reporting/seeking help, shame/self-awareness. 33% were not rewarded for quick action; 28% feared discipline if mistake they made was discovered. Pressure to produce impacted patient care. 52% loss of experienced personnel impacts safety. 39% witnessed coworker do something unsafe; 8% did something unsafe themselves. Clinicians had more problematic responses than non-clinicians.; senior managers had fewer problematic responses than frontline clinicians. Discussed non-response bias, especially for physicians.	When problematic attitudes exceed 10% (they averaged 18% here) a working safety culture may not be achieved. If this is true, it suggests testing this for criterion validity. Individual interventions such as CPOE may be good but not enough if safety culture is not a priority of the leadership and the institution. Mixed method research (additional qualitative research) may be helpful.

Author(s), date of publication	Design	Methods	Selected findings	Comments
(Pronovost, Weast, Holzmueller et al., 2003)	Cross sectional survey distribution at Johns Hopkins Hospital to evaluate safety attitudes of staff and leadership using separate instruments for each.	Used SCSurvey to evaluate staff and Strategies for Leadership Survey (SLS) to evaluate clinical leaders.	395 surveys (82% response rate) including physicians, nurses, pharmacists, others. 17/22 patient safety committee members (77%) and 6/12 management committee members (50%).	Fewer physicians than nurses perceived that safety was a priority, knew how to report errors, felt encouragement to report errors. Scores between units greater than among staff on one unit. Did not recheck psychometrics of instruments in this population. No randomization. Small numbers. Senior leaders had higher scores than frontline workers, and need to be more visible.
(Nieva & Sorra, 2003)	Cross sectional survey design across multiple sites. "Pilot" to evaluate psychometric properties of HSOPSC.	21 hospitals. 1437 respondents. Not randomized. Mixed sampling strategies. Aggregated data. Used survey itself as "model" for CFA. Low response rate (29%). Expert panel for content validity but no CVI reported. Cognitive interviews, read aloud in initial development.	Cronbach's alpha of individual domains .63-.84. FA –14 factors with eigenvalues over 1- each item loaded on only one of the 14 factors. Validity assessed by intra-item correlations and 2 outcome variables.	Needs replication. Needs to be studied with outcomes (construct validity limited). Use other tools for convergent validity. Would benefit from conceptual framework or model.

Author(s), date of publication	Design	Methods	Selected findings	Comments
(Sexton et al., 2000)	Cross sectional surveys in 12 hospitals. Comparison of OR and ICU staff attitudes with airline cockpit crew attitude scores.	4 questionnaires: flight management attitudes Q, cockpit management attitudes Q; ORMAQ, ICUMAQ. 1033 MDs, nurses, residents (45% response rate) and over 30,000 cockpit crews (59% response rate).	Pilots less likely to deny fatigue; 97 and 94% of pilots and ICU docs rejected hierarchies but only 55% of OR surgeons did. MDs reported higher levels of teamwork than nurses. Only 1/3 of hospital staff reported errors handled appropriately at their hospital. 1/3 ICU staff did not acknowledge that they made errors. Over ½ of ICU staff said it was hard to discuss mistakes.	Highly effective cockpit crews spend 33% of their time discussing threats and errors, compared to only 5% spent by ineffective, poor performers. Medical staff feels error is handled poorly in hospitals, barriers to open discussion exist. They deny the effects of stress and fatigue on performance.

Table A2. Matrix of Six Nursing Home Specific Studies.

Author(s), date of publication	Design	Methods	Selected findings	Comments
(Castle, 2006a)	Cross sectional survey of nurse's aides in 5 randomly selected states (72 nursing homes). Purpose was to compare NH scores with hospital benchmark scores for PSC. Only NAs were surveyed. HSOPSC instrument adapted for nursing home.	230 homes were eligible – 72 responded for 30% response rate. Within homes, 10% random sample of staff unless home was so small – sampled 100%. Factor analysis not redone. Reliabilities run. Validity references original HSOPCS work.	Reliabilities .66-.84. Facility characteristics associated with differences in PSC scores (bed size, percent Medicaid, for profit). NH PSC scores were significantly lower in virtually all categories compared to hospital scores.	Need for NH specific instrument or further modification of existing instruments for nursing home identified. Need to determine clinical meaningfulness of scores, to move toward a criterion-referenced scale.
(Handler, Castle et al., 2006)	Cross sectional survey of 4 Pittsburgh non-profit nursing homes. Purpose was to compare NH scores with hospital benchmark scores for PSC. HSOPSC adapted for nursing home.	104/151 surveys returned (68.9% response rate). 13 physicians, 8 pharmacists, 5 APNs, 78 nurses were surveyed. Few modifications in tool were made to insure comparability with hospitals.	NH PSC scores were lower than hospital benchmarks. Few differences between professions were identified. Cronbach's alphas were .50-.84.	Small numbers of APNs and MDs. No nurse aides. Validity not reassessed in this study – outcomes not studied.
(Hughes & Lapane, 2006)	Cross sectional survey of 26 Ohio nursing homes (nested in another study). Nurses and nurse aides. Non-random. HSOPSC adapted for nursing home.	Did not report changes to survey - stated "minimally adapted". 367 nurses; 636 nurse's aides.	40% said "it is difficult to make change"; 50% reported discussions with management to prevent mistakes. 20% reported feeling punished for mistakes; 2/5 reporting of errors as a personal attack.	Interventions are needed to improve patient safety in nursing homes.

Author(s), date of publication	Design	Methods	Selected findings	Comments
(Scott-Cawiezell et al., 2006)	Mixed methods. Staff member surveys about perceptions of critical elements necessary for safe medication practices (part of larger AHRQ study) in 5 Midwest nursing homes. Quality improvement intervention with staff to improve medication safety practices and report of findings as a case study.	Adaptation of Shortell Organization and Management Survey. Researchers worked with nursing home staff in QI model.	Culture of blame persisted despite the CQI project and committed administrator with good staff rapport. Communication, leadership and relationship issues were important, supporting the conceptual framework.	Application of principles of organizational culture to patient safety culture in nursing homes was useful to engage participants. Future research should include qualitative techniques and possibly participatory action techniques as well.
(Castle & Sonon, 2006)	Cross sectional survey of administrators in 4000 randomly selected nursing homes across the U.S. Purpose was to compare NH scores with hospital benchmark scores for PSC. Only administrators were surveyed. HSOPSC instrument adapted for nursing home.	4000 homes were eligible – 2840 responded for 71% response rate. Factor analysis not redone. Reliabilities run. Validity references original HSOPCS work.	Subscale reliabilities .63-.84. Facility characteristics comparable to those in nationally representative nursing home survey. NH PSC scores were significantly lower in virtually all categories compared to hospital scores. 70% of respondents rated NH safety as either acceptable or poor. NH leaders are concerned about PSC, but do not always put thoughts into action.	Need for NH specific instrument or further modification of existing instruments for nursing home identified. Using a survey to ascertain PSC scores from administrators and other nursing home staff appears useful in guiding care practices and quality improvement programs.

Author(s), date of publication	Design	Methods	Selected findings	Comments
(Wisniewski et al., 2007)	Pilot study in one nursing home to test feasibility of using the SAQ survey in a SNF to assess PSC and ascertain differences in PSC scores among various job types (nurses, CNAs, supervisors, NPs, MDs)	Convenience sample. A 250-bed, not-for-profit SNF in Western New York; not affiliated with any teaching institutions. 51/290 employees returned surveys=18% response rate.	SAQ reliability referenced from previous studies (Raykov's n=.90). Minimal adaptation of ICU tool for SNF (wording changed). Less than 40% of respondents had a positive attitude for 5/6 safety constructs.	Low response rate, especially from CNAs (13%). Convenience sample. Reliability of instrument not tested in this population (nursing home) versus ICU (previous studies). SAQ includes many questions about job satisfaction, thus there is potential lack of conceptual clarity. More work needs to be done on this instrument in nursing homes.

Appendix B

Survey Instrument from Original Study

Background Information

This section of the survey asks for some information about your background and work experience.

Q1.1 Gender:

Female Male

Q1.2 Age:

____ years

Q1.3 Highest level of education:

High School Associates degree Bachelors degree Masters degree

Other _____

Q1.4 How long have you been working in this facility:

_____ years

Q1.5 How long have you been a Nurse Aide:

_____ years

Resident Safety

This section of the survey asks for your opinions about resident safety issues, medical error, and event reporting in your facility.

An "event" is defined as any type of error, mistake, incident, accident, or deviation, regardless of whether or not it results in patient (resident) harm.

"Resident safety" is defined as the avoidance and prevention of patient injuries or adverse events resulting from the processes of health care delivery.

SECTION A: Your Facility

Think about your facility	**Strongly Disagree ▼**	**Disagree ▼**	**Neither ▼**	**Agree ▼**	**Strongly Agree ▼**
1. People support one another in this facility	①	②	③	④	⑤
2. We have enough staff to handle the workload	①	②	③	④	⑤
3. When a lot of work needs to be done quickly, we work together as a team to get the work done	①	②	③	④	⑤
4. In this facility, people treat each other with respect	①	②	③	④	⑤
5. Staff in this facility work longer hours than is best for resident care	①	②	③	④	⑤
6. We are actively doing things to improve resident safety	①	②	③	④	⑤
7. We use more agency / temporary staff than is best for resident care	①	②	③	④	⑤
8. Staff feel like their mistakes are held against them	①	②	③	④	⑤
9. Mistakes have led to positive changes here	①	②	③	④	⑤
10. It is just by chance that more serious mistakes don't happen around here	①	②	③	④	⑤
11. When one area in this facility gets really busy, others help out	①	②	③	④	⑤
12. When an event is reported, it feels like the person is being written up, not the problem	①	②	③	④	⑤

Think about your facility	Strongly Disagree ▼	Disagree ▼	Neither ▼	Agree ▼	Strongly Agree ▼
13. After we make changes to improve resident safety, we evaluate their effectiveness	①	②	③	④	⑤
14. We work in "crisis mode" trying to do too much, too quickly	①	②	③	④	⑤
15. Resident safety is never sacrificed to get more work done	①	②	③	④	⑤
16. Staff worry that resident safety mistakes they make are kept in their personnel file	①	②	③	④	⑤
17. We have resident safety problems in this facility	①	②	③	④	⑤
18. Our procedures and systems are good at preventing resident safety errors from happening	①	②	③	④	⑤

SECTION B: Your Supervisor/Manager

Think about your supervisor / manager	Strongly Disagree ▼	Disagree ▼	Neither ▼	Agree ▼	Strongly Agree ▼
1. My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	①	②	③	④	⑤
2. My supervisor/manager seriously considers staff suggestions for improving patient safety	①	②	③	④	⑤
3. Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts	①	②	③	④	⑤
4. My supervisor/manager overlooks patient safety problems that happen over and over	①	②	③	④	⑤

SECTION C: Communications

Think about your facility	Never ▼	Rarely ▼	Some-times ▼	Most of the time ▼	Always ▼
1. We give feedback about changes put into place based on event report	①	②	③	④	⑤
2. Staff will freely speak up if they see something that may negatively affect resident care	①	②	③	④	⑤
3. We inform staff about errors that happen in this facility	①	②	③	④	⑤
4. Staff feel free to question the decisions or actions of those with more authority	①	②	③	④	⑤
5. In this facility, we discuss ways to prevent errors from happening again	①	②	③	④	⑤
6. Staff are afraid to ask questions when something does not seem right	①	②	③	④	⑤

SECTION D: Frequency of Events Reported

	Never ▼	Rarely ▼	Some-times ▼	Most of the time ▼	Always ▼
1. When a mistake is made, but is *caught and corrected before affecting the resident*, how often is this reported?	①	②	③	④	⑤
2. When a mistake is made, but has *no potential to harm the resident*, how often is this reported?	①	②	③	④	⑤

SECTION F: Your Facility

Think about your facility	Strongly Disagree ▼	Disagree ▼	Neither ▼	Agree ▼	Strongly Agree ▼
1. Management provides a work climate that promotes resident safety	①	②	③	④	⑤
2. Units do not coordinate well with each other	①	②	③	④	⑤
3. Things "fall between the cracks" when transferring residents from one unit to another	①	②	③	④	⑤
4. There is good cooperation among units that need to work together	①	②	③	④	⑤
5. Important resident care information is often lost during shift changes	①	②	③	④	⑤
6. Staff find it unpleasant to work with staff from other units	①	②	③	④	⑤
7. Problems often occur in the exchange of information across units	①	②	③	④	⑤
8. The actions of management show that resident safety is a top priority	①	②	③	④	⑤
9. Management seems interested in resident safety only after an adverse event happens	①	②	③	④	⑤
10. Units work well together to provide the best care for residents	①	②	③	④	⑤
11. Shift changes are problematic for residents in this facility	①	②	③	④	⑤

Thank you for your participation

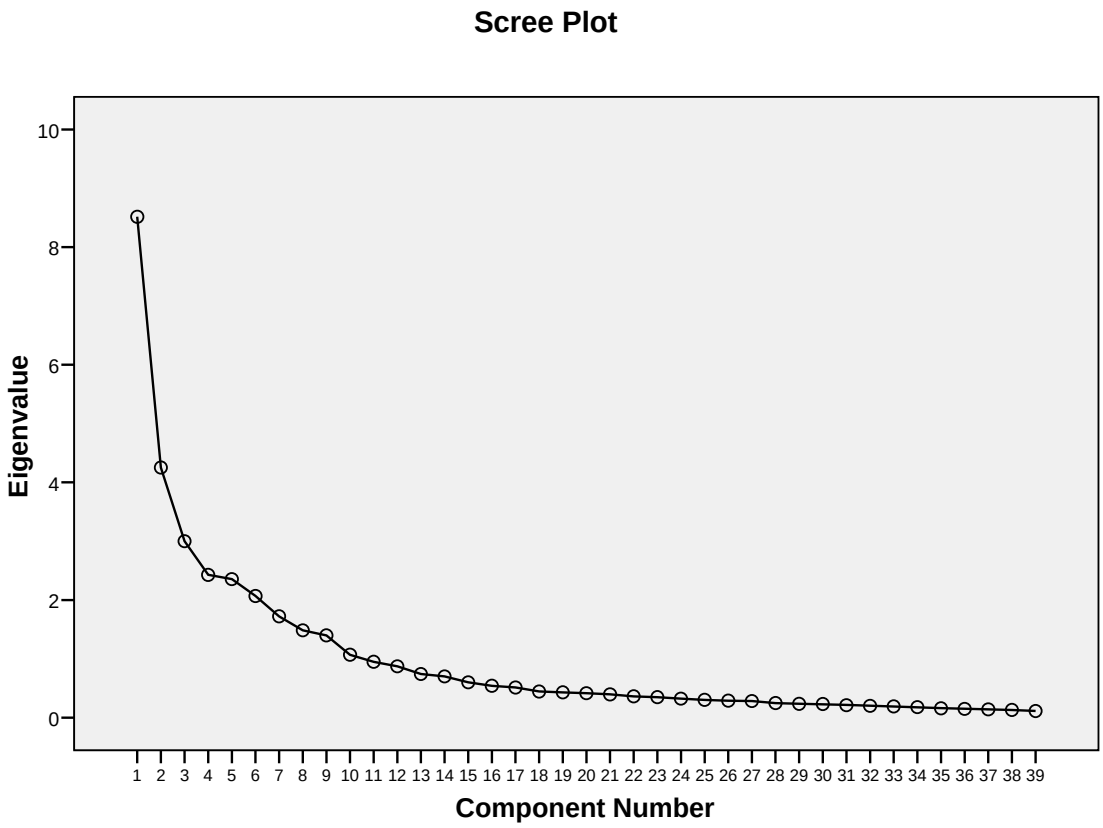
Appendix C

Table C1. Principal Component Analysis.

	Initial Eigenvalues			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.516	21.836	21.836	4.218	10.815	10.815
2	4.252	10.901	32.738	3.116	7.990	18.804
3	3.000	7.693	40.431	3.087	7.915	26.720
4	2.428	6.225	46.655	3.006	7.709	34.428
5	2.356	6.041	52.696	2.593	6.650	41.078
6	2.068	5.303	57.999	2.521	6.464	47.542
7	1.722	4.417	62.416	2.488	6.380	53.922
8	1.484	3.805	66.221	2.472	6.339	60.261
9	1.398	3.584	69.804	2.428	6.226	66.487
10	1.070	2.742	72.547	2.363	6.059	72.547
11	.950	2.435	74.981			
12	.872	2.237	77.218			
13	.742	1.902	79.120			
14	.702	1.800	80.919			
15	.601	1.542	82.462			
16	.542	1.390	83.851			
17	.514	1.317	85.168			
18	.445	1.140	86.308			
19	.430	1.102	87.411			
20	.415	1.065	88.475			
21	.396	1.015	89.490			
22	.362	.929	90.419			
23	.348	.892	91.311			
24	.324	.831	92.142			
25	.303	.776	92.918			
26	.289	.740	93.658			
27	.282	.723	94.381			
28	.247	.634	95.015			
29	.236	.605	95.620			
30	.232	.595	96.215			
31	.212	.545	96.759			
32	.200	.514	97.273			
33	.192	.491	97.764			
34	.179	.458	98.223			
35	.159	.407	98.630			
36	.149	.382	99.012			
37	.141	.360	99.372			
38	.132	.338	99.710			
39	.113	.290	100.000			

Extraction Method: Principal Component Analysis.

Figure C2: Scree Plot for Principal Component Analysis.



Component Matrix
10 components extracted.

Table C2. Rotated Component Matrix(a).

	Component									
	1	2	3	4	5	6	7	8	9	10
Q1.1	-.081	-.010	-.017	.001	.131	.067	-.181	.773	-.031	-.152
Q1.2	.151	.085	.011	.119	.121	.081	.072	.664	.153	-.413
Q1.3	.036	.167	.091	-.092	-.314	.063	.110	.634	-.020	.245
Q1.4	-.169	.153	-.097	-.139	-.093	.019	-.075	.755	-.013	.204
Q3.1	-.182	.164	-.012	-.116	.802	-.065	.027	-.057	.006	.176
Q3.2	.055	-.309	-.393	-.096	.667	-.026	.069	.062	.162	-.135
Q3.3	-.179	.199	.297	.004	.508	-.006	-.236	.053	-.291	.370
Q3.4	-.110	-.354	-.141	-.124	.718	-.063	-.029	-.041	-.194	.198
Q4.1	-.448	-.112	-.227	-.106	.502	-.127	-.178	.002	-.144	.459
Q4.2	-.190	-.024	-.248	-.162	.198	.199	-2.13E-005	.238	.070	.685
Q4.3	.030	.035	-.079	-.012	.157	.187	-.190	-.136	.044	.782
Q5.1	.357	-.172	.731	-.005	-.222	-.068	.124	.105	-.163	.062
Q5.2	-.067	.250	.635	.076	-.110	.135	.018	-.004	.324	-.176
Q5.3	.002	.172	.814	.016	-.008	.057	.024	-.074	.118	-.139
Q5.4	.107	.518	.494	-.017	-.045	.096	.024	.052	.421	-.141
Q6.1	.463	-.244	.393	.061	-.091	-.031	.025	.114	.521	.054
Q6.2	-.070	.388	.085	-.015	.011	.312	-.003	.043	.740	-.013
Q6.3	.178	.132	.033	.044	-.084	.375	.072	-.026	.761	.091
Q7.1	-.002	.239	-.039	.087	-.064	.763	.023	.115	.389	.242
Q7.2	.267	-.107	-.015	.076	-.063	.804	.000	.036	.224	.124
Q7.3	.083	.281	.227	.040	-.046	.781	.016	.059	.055	-.002
Q8.1	.322	.068	.488	.033	-.044	.204	.049	-.405	-.229	-.175
Q8.2	.315	.248	.262	-.003	-.211	.129	.459	-.103	-.040	-.364
Q8.3	.673	.138	.266	.008	-.111	.173	.128	-.074	-.072	-.200
Q9.1	.139	.760	.086	-.135	-.092	.161	.160	.168	.109	-.059
Q9.2	.641	.560	.127	.085	-.157	.122	.109	.037	.116	.016
Q9.3	.294	.768	.138	.224	-.018	.126	.016	.161	.178	.133
Q9.4	.739	.114	.213	.056	-.097	-.018	-.025	-.013	.016	-.023
Q10.1	.711	.101	-.139	.326	-.080	.085	-.102	.067	.170	-.044
Q10.2	.799	.003	-.102	.113	-.014	.126	.034	-.198	.046	-.004
Q10.3	.402	.278	-.037	.132	-.030	.031	.263	.015	.335	-.201
Q11.1	-.298	.139	-.048	.133	.162	-.023	.679	-.114	.128	.117
Q11.2	-.027	.072	-.042	.052	-.010	.027	.805	.005	.004	-.048
Q11.3	.269	-.170	.120	.010	-.100	-.135	.703	-.060	.023	-.218
Q11.4	.214	.151	.201	.299	-.086	.279	.542	.019	-.030	-.158
Q12.1	.087	.235	.186	.772	-.155	.092	.123	.000	.017	-.191
Q12.2	-.050	.225	.108	.855	-.042	.106	.079	.016	-.022	.011
Q12.3	.263	-.154	-.146	.797	-.089	.037	.048	-.047	.144	-.010
Q12.4	.234	-.344	-.050	.756	-.014	-.074	.095	-.153	-.057	-.010

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 15 iterations.

Revised Factor Structure for Dissertation Study

Cronbach's alpha for Revised HSOPSC=.77

Subscale 1=Overall resident safety (alpha=.71)

Resident safety is never sacrificed to get more work done

Our procedures and systems are good at preventing errors from happening

It is just by chance that more serious mistakes don't happen around here

We have patient safety problems in this facility (R)

Subscale 2=Management expectations and actions promoting safety (alpha=.78)

Management says a good word when he/she sees a job done according to established resident safety procedures

Management seriously considers staff suggestions for improving resident safety

We are actively doing things to improve resident safety

Whenever pressure builds up, my manager wants us to work faster, even if it means taking shortcuts (R)

My manager overlooks resident safety problems that happen over and over (R)

Subscale 3=Organizational Learning (alpha=.72)

Mistakes have led to positive changes here

After we make changes to improve resident safety, we evaluate their effectiveness

Subscale 4= Staff working relationships (Teamwork) (alpha=.74)

People support one another in this facility

When a lot of work needs to be done quickly, we work together as a team to get the work done

In this facility, people treat each other with respect

Staff feel like their mistakes are held against them (R)

Subscale 5=Communication Openness (alpha=.73)

Staff will freely speak up if they see something that may negatively affect resident care

Staff feel free to question the decisions or actions of those with more authority

Staff are afraid to ask questions when something does not seem right (R)

Subscale 6=Feedback about Errors (alpha=.84)

We are given feedback about changes put into place based on event reports

We are informed about errors that happen in the units

In this facility, we discuss ways to prevent errors from happening again

Subscale 7=Staffing (alpha=.78)

When one area in this facility gets really busy, others help out

We have enough staff to handle the workload

We use more agency/temporary staff than is best for resident care (R)

Subscale 8=Management attitudes and support for resident safety (alpha=.84)

Staff worry that mistakes they make are kept in their personnel file (R)

Staff in this facility work longer hours than is best for resident care (R)

We work in “crisis mode” trying to do too much, too quickly (R)

Management provides a work climate that promotes resident safety

The actions of management show that resident safety is a top priority

Management seems interested in resident safety only after an adverse event happens (R)

Subscale 9=Working relationships across units (Teamwork) (alpha=.73)

There is good cooperation among units that need to work together

Units work well together to provide the best care for residents

Units do not coordinate well with each other (R)

When an event is reported, it feels like the person is being written up, not the problem (R)

It is often unpleasant to work with staff from other units (R)

Subscale 10=Handoffs (alpha=.85)

Things “fall between the cracks” when transferring residents from one unit to another (R)

Important resident care information is often lost during shift changes (R)

Problems often occur in the exchange of information across units (R)

Shift changes are problematic for residents in this facility (R)

Key

(R) = Reverse coded

Appendix D

Code Book

Gender

1=female

2=male

Race

1=White

2=Non-white

Highest level of education

1=high school

2=associate degree

3=bachelors degree or masters degree or higher

Age

Age in years

Tenure in facility

Tenure in the facility as a CNA (in years)

Tenure as a nurse's aide (CNA)

Tenure as a nurse's aide (in years)

Survey questions 1.1-12.4 See survey. Most responses:

1=strongly disagree

2=disagree

3=neither

4=agree

5=strongly agree

Some are:

1=never

2=rarely

3=sometimes

4=most of the time

5=always

reverse coded by analyst where necessary

Facility # (identifier)

74= facility number 74

NA, LPN, RN turnover by unit

Castle formula:

Administrator report for six months and multiplied by 2 for annualized rate

Does not include agency

Includes full and part time, weighted equally

Number at beginning of month compared with number at end of month

Divided by total number of filled positions (not open ones) for that unit

Self report by administrators.

CNA, LPN, RN staffing

FTEs per 100 residents

MDS activities of daily living (ADL) scale scores

Higher scores reflect more functional dependency

MDS cognitive performance scale (CPS) scores

Higher scores reflect lower cognitive functioning

Bed Size

Total number of beds in the facility

For profit

1=for profit

0=not for profit

Chain (two or more facilities with a common owner)

1=chain

0=not in a chain

Facility occupancy

Average daily facility census

Facility private pay occupancy

Average daily facility private pay census

Rural location

1=rural by Area Resource File (ARF) definition

0=not rural

Unemployment rate

ARF definition of unemployment rate by county

Number of nursing homes in county

Alzheimer's disease rate

Percentage of residents in facility with MDS diagnosis of Alzheimer's dementia

Behavior rate

Percentage of residents in facility with MDS measure for behaviors checked off for that assessment period

Number of medications

Average number of medications for residents in that facility for that assessment period

Proportion Medicare

Proportion of residents in facility on Medicare part A for that assessment period