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As members of the Dissertation Committee, we certify that we have read the dissertation

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entitled Measuring Nursing Care Complexity in Nursing Homes

and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy

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SIGNED: Donna Velasquez
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DEDICATION

To my mother, the first nurse in my life.
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ABSTRACT

The quality of care in nursing homes has generally improved since the implementation of the OBRA-1987; however reports of serious problems such as inadequate pain management, pressure sores, malnutrition, and urinary incontinence persist. While the primary concern remains lack of staffing, investigators have found that even the highest staffed nursing homes are deficient in some care processes. It has been suggested that a lack of effective management structure may be a contributing factor. There is theoretical and empirical evidence to suggest that effective management structure is best guided by the complexity of work performed by the organization.

The purpose of this study was to develop a reliable and valid instrument to measure nursing care complexity in nursing homes. Items were developed based on a comprehensive review of the literature and the adaptation of items from existing instruments to make them relevant to the nursing home setting. Content validity was evaluated by nurse experts with extensive knowledge of the theory and/or nursing home care. One hundred sixty-eight direct care providers from seven nursing homes located in central and southern Arizona participated in the study.

Reliability was estimated using Cronbach’s alpha. Reliabilities using individual level data were generally acceptable for a new scale, however, the alpha for the client technology subscale was low (total scale = .78, client technology = .65, operations technology = .78, and knowledge technology = .79). Exploratory factor analysis demonstrated three domains of nursing care complexity as conceptualized. Explained variance for the 3 factors was 36.19%. There was a very modest correlation of the
instrument with an established instrument of work unit technology and a modified
magnitude estimate of nursing care complexity. One subscale (knowledge technology)
discriminated between nursing subunits in the nursing home.

The instrument demonstrated modest psychometric properties in measuring
nursing care complexity in nursing homes. The strength of the instrument is its ability to
measure domains of work complexity based on theory from organizational and nursing
science. Further investigation is needed to strengthen the psychometric properties of the
instrument and to determine its usefulness in measuring nursing care complexity in
nursing homes.
CHAPTER 1: INTRODUCTION

The purpose of this research is to develop and perform initial psychometric testing of an instrument to measure nursing care complexity in nursing homes. Nursing care complexity is a latent variable that represents the work done by nursing personnel in order to care for residents in nursing homes. It is assessed by measuring aspects of client, knowledge, and operations technology. Quantifying the level of nursing care complexity may provide information needed to guide the appropriate structure of care delivery thus improving organizational performance. The following sections of this introductory chapter will review the statement of the problem, the nature of the work in nursing homes, and the structure of care delivery.

Statement of Problem

The quality of care in nursing homes has generally improved since the implementation of the Omnibus Budget Reconciliation Act of 1987 (OBRA-1987) (IOM 2001), however reports of serious problems such as inadequate pain management (Jones, et al., 2004), pressure sores (Ooi, Morris, Brandeis, Monir, & Lipsitz, 1999) malnutrition (Clarke, Wahlqvist, & Strauss, 1998; Kayser-Jones & Schell, 1997), and urinary incontinence (Schnelle & Leung, 2004) persist. While most discussions about quality of care in nursing homes center on staffing issues, Schnelle, Simmons, Harrington, Cadogan, Garcia, and Bates-Jensen (2004) found that even in the highest staffed nursing homes there were deficiencies in some care processes. They suggested that a lack of effective management structure and mechanisms to assure quality of care may be a contributing factor.
The present organizational structure in nursing homes is hierarchical and mechanistic best suited to low complexity, custodial care. However there is evidence that such a structure may not be effective for delivering flexible and individualized care necessary to achieve the care expected by the public and now mandated by law. There is theoretical and empirical evidence to suggest that designing an effective management structure is best guided by the complexity of work performed by the organization. However, no instruments to measure the complexity of nursing care in nursing homes has been found. The purpose of this study is to develop a reliable and valid instrument to measure nursing care complexity in nursing homes. This chapter will discuss the nature and complexity of work performed in nursing homes, as well as the current organizational structure found in most nursing homes.

Nature and Complexity of Work in Nursing Homes

The nature of the work in nursing homes is physically, emotionally, and mentally challenging. Care activities performed in nursing homes require personnel to spend long hours standing, walking, and lifting while completing such tasks as feeding, bathing, toileting, and transferring frail and frequently cognitively impaired residents (Gieger-Brown, Muntaner, Lipscomb, and Trinkoff, 2004).

Injuries are not uncommon with nursing home workers reporting some of the highest rates of back and shoulder injuries in the United States (Myers, Silverstein, & Nelson, 2002). However, the incidence of injury among workers in one study was found to be less related to resident characteristics and more related to the amount of “social disarray” in the nursing home. Social disarray was defined by the authors as the number
of nursing assistants hired and the number of nursing assistants who had left their job (voluntarily or were terminated) in the past 30 days (Myers, et al., 2002)

The physical demands of long hours and working with frail and often cognitively impaired residents also takes an emotional and mental toll. It has been found that long work days and working extra hours have been positively correlated with increased depressive disorders among nursing assistants working in nursing homes (Geiger-Brown, et al., 2004).

Structure in nursing homes has been modeled after the hierarchical biomedical model found in acute care settings. The biomedical model is oriented towards cure and treatment and there is little emphasis on long-term rehabilitation or maintenance of functional status of residents (Deutschman, 2001a; Maas, Buckwalter, & Specht, 1996). The predominance of this model has also greatly influenced the culture found in most nursing homes, fostering a sense of dependency on authority and feelings of powerlessness among staff (Deutschman, 2001b).

While the work in nursing homes is recognized as being physically and mentally stressful, it is viewed as being of “low complexity” suggesting a standardized approach to care (Maas et al., 1996). As such, hierarchical or mechanistic structures are thought to be most appropriate to achieve the goals of the organization (Banaszak-Holl & Hines, 1996). However, such factors as the changing demographics of residents, shorter hospital stays, and new rules and regulations have contributed significantly to a change in the overall goals and nature of the work performed in nursing homes. The mean age of residents has increased as the number of residents over the age of 85 years increased from 34% in 1980
to 42% in 1996 (Maas et al., 1996). As residents age, they are more likely to have increased levels of functional disability, cognitive impairment, frailty, and medication use (Maas et al.; Ray, 2000; IOM, 2001). And, with these increased medical and psychological problems, responses to medical and nursing interventions among residents vary widely and are often unpredictable (Banaszak-Holl & Hines, 1996).

Possibly the most significant factor contributing to the change in the goals and nature of the work in nursing homes has been the Omnibus Budget Reconciliation Act of 1987 (OBRA-87). The act defines the purpose of nursing homes “to bring each resident to the highest practicable level of mental, physical, and psychosocial well-being and to do so in an environment that emphasizes resident rights” (Wilging, 1992). The impact of OBRA-1987 on nursing homes has been significant making it no longer sufficient to provide solely routine custodial care. It is now mandated that in the absence of medical reasons, resident abilities necessary to carry out basic activities of daily living must be maintained or improved (Turnham, n.d.). There is an emphasis not only on quality of care but the quality of life experienced by the resident.

In order to meet these mandates, nursing homes must now adopt social-behavioral models which emphasize individualized care with a focus on rehabilitating and/or maintaining residents’ functional abilities. Several studies have demonstrated the effectiveness of these models towards improving care and outcomes associated with improved quality of life.

In a study to improve dressing independence among cognitively impaired (CI) nursing home residents, Beck, Heacock, Mercer, Walls, Rapp, and Vogelpohl (1997)
used an intervention of individually prescribed behavioral Strategies to Promote Independence in Dressing (SPID). The intervention consisted of a decision-making algorithm carried out by nursing assistants trained in the intervention techniques. The program allowed caregivers to develop dressing strategies best suited for individual residents rather than just following a standard routine. The study found a significant increase in dressing ability among the residents whose caregivers were able to individualize care using the intervention. Barrick, Rader, Hoeffer, and Sloane (2002) also found that when bathing care plans were individually tailored for cognitively impaired residents, commonly encountered behavioral problems such as hitting and yelling were decreased.

Another study that lends support to individualizing care for nursing home residents was performed by Wells, Dawson, Sidani, Craig, and Pringle (2000). They conducted an investigation to test the effects of an abilities-focused educational program on residents’ interaction behaviors, level of agitation, and level of function during morning care. Abilities focused care is defined as an individualized approach that assists residents in using retained abilities. Their intervention was found to decrease residents’ level of agitation and improve level of function.

However, to achieve such outcomes, person-centered, psychosocial problem-solving strategies are needed (Barrick et al., 2002). Rather than relying on standardized and routine plans of care, nursing staff must possess not only knowledge of a number of strategies for caring for residents but they must have sufficient autonomy to allow them to implement more flexible approaches to care.
Finally, nursing homes are no longer as homogeneous as they were in earlier years. Care has become more specialized with the addition of special care dementia units, skilled nursing units, and subacute units. Subacute units provide post-hospital rehabilitation, management of short-term exacerbations of chronic conditions, and an increased role in helping people manage chronic conditions on their own (Feldman & Kane, 2003). The care delivered in these units is more closely related to that delivered in acute care settings with greater emphasis on procedures and treatment than traditionally found in nursing homes.

Staffing and Skill Mix Issues

Much of the literature examining the nature of the work, organizational structure, and quality in nursing homes is focused on staffing and skill mix levels in nursing homes. Studies have demonstrated that more registered nurse (RN) hours are associated with lower mortality and improved functional status among residents in nursing homes (Braun, 1991; Linn, Gurel, & Linn, 1977). Skill mix has also been examined in relation to resident outcomes. Kolanowski (1994) found that residents on units with higher ratios of licensed personnel had fewer instances of agitated psychomotor behavior. Although the study found that residents’ personal systems (defined as resident characteristics including mood and functional, cognitive and health status) accounted for most of the explained variance, staff mix significantly increased the explanatory power of the model.

In 1998 an expert panel stated that many nursing homes were operating with inadequate staffing levels that needed to be improved substantially (Harrington et al., 2000). The panel recommended that average nursing time per resident day be increased
for registered nurses (RN) from .72 hours (hr) to 1.15 hr, licensed practical nurses (LPN) from .69 hr to .70 hr, and nursing assistants (NA) from 2.1 hr to 2.7 hr. It was further recommended that total nurse hours be increased to 4.55 hr per resident day from 3.51 hr as a minimum standard (Harrington et al.). However, increasing staffing without changing organizational structure will most likely be insufficient to improve outcomes.

As stated in a report by the Institute of Medicine about the quality of care in nursing homes, “increasing staffing without simultaneously improving management systems will most certainly result in less than expected improvement” (IOM, 2001, p. 15).

Supporting this statement is a study of 21 nursing homes performed by Schnelle and colleagues (2004) to examine staffing levels and quality of care. They found that in the more highly staffed nursing homes, residents spent more time out of bed and received better feeding and toileting assistance. However, there were no differences between better staffed nursing homes compared to those with less staff in frequency of repositioning at night, walking assistance during the day, or social interaction between residents and staff during meals. As a result of their findings, they concluded that even in the highest-staffed facilities, where there were sufficient numbers of NAs to provide 100 percent of care, some care processes were poorly implemented. They suggested that one explanation may be the lack of adequate management mechanisms necessary to assure that such care was carried out on a daily basis.

It has been suggested by Mueller (2002) that alternative solutions to increasing the number of staff, and thus cost, must be explored. Management strategies that enhance supportive and professional work environments, reduce the hierarchy in nursing homes,
and involve staff in decision-making about their practice and work environment are needed. While there is evidence that higher staff-resident ratios and greater ratios of professional nurses to other staff are important predictors of high quality care, research has not provided answers as to the best way to structure staff in order to provide and improve quality of care (IOM, 2001).

Structure of Nursing Care Delivery in Nursing Homes

Structure is “the arrangement among people for getting work done” (Perrow, 1967, p. 195) or “the program it uses to govern the behavior of its members (Van De Ven, 1976, p. 65). Hollenbeck et al (2002) described structure as the “social architecture” that describes how large numbers of persons are differentiated into smaller groups and how the independent activities of the groups are coordinated.

In studies of acute care settings, Mark and colleagues (1996, 2003) characterized structure in terms of professional practice. Professional practice has been operationalized as: nurse autonomy, control over practice, and nurse-physician collaboration. However, their model is predicated on the presence of a primarily professional nursing staff and does not reflect the skill mix found in the vast majority of nursing homes. Registered nurses and LPNs account for only approximately 28% of direct care workers in LTC with RNs making up less than 7% of total FTEs in nursing homes (Maas, et al., 1996; The Future, 2003). Therefore, nursing home work or “technology” and structure must be examined using variables relevant to unskilled and semi-skilled personnel who provide the majority of the direct care.
It has been suggested that when there is little variability among patients and tasks that, “less involvement of nursing staff enhances the quality of patient care (Alexander and Mark, 1990, p.196). Thus, a hierarchical, mechanistic structure with little involvement from nursing personnel would seem appropriate for nursing homes. However, studies performed in nursing homes have not supported this notion finding that increased involvement of nursing assistants in care planning is associated with improved patient and organizational outcomes.

In a study to examine the effect of a primary care model on residents’ affect, behavior and socialization, Teresi, and colleagues (1994) formally included nursing assistants (NAs) in care planning sessions as one part of the intervention. The increased involvement of NAs in the care planning process was found to have a significant and positive effect on resident behavior and affect. In another study, Banaszak-Holl and Hines (1996) studied the effect of job design and organization structure on turnover rates among nursing home staff. They found that in nursing homes where NAs were formally involved in care planning meetings, turnover rates were 50% lower.

Significance and Implications

The structure of nursing homes is based on a traditional hierarchical biomedical model which, in theory, should be appropriate for tasks of low complexity generally used to characterize nursing home work. However, a number of studies have described positive outcomes when nursing home structure is less mechanistic (highly formalized) and more organic (less formalized) in nature. It is unknown whether these studies indicate little support for theories that hypothesize mechanistic structures are the best fit
for low complexity work in nursing home settings or if the nature of the work in nursing homes has changed with regard to level of complexity.

Since the implementation of OBRA-1987, the focus has shifted to improving and maintaining resident well-being to the “highest practicable level”. However, it may be that the traditional, hierarchical structure in place in the majority of nursing homes does not provide conditions conducive to achieving goals mandated by the public and policy makers.

There is theoretical and empirical evidence that the structure of an organization is best guided by the complexity of the work done by that organization (Perrow, 1967). Nursing care complexity is based on Perrow’s definition of technology which is the “work done in organizations” (p. 194-5). Previous studies have examined nursing complexity in acute care (Alexander & Kroposki, 2001; Overton, Schneck, & Hazlett, 1977), ambulatory care (Verran & Shaw, 1996; Verran & Reid, 1987), and public health settings (Cumbey & Alexander, 1998). However, no studies have been found that examine the concept of nursing complexity in nursing homes. Therefore, a technostructural contingency model has been developed that links the “fit” between nursing care complexity and organizational structure with outcomes important to nursing homes. The model is described in chapter 2. In order to test such a model reliable and valid instruments to measure nursing care complexity must be available.

Purpose of Research

The intent of this investigation is to develop a reliable and valid instrument to measure nursing care complexity in nursing homes. Such an instrument may provide
information necessary to guide the development of appropriate structures to achieve the
goals of nursing homes mandated by the public and policy.

Chapter Summary

This chapter reviewed the nature and complexity of the work and structure of care
delivery in nursing homes. Although the quality of care delivered has generally
improved since the implementation of OBRA-1987, there remain serious deficits even
when numbers of staff reach recommended levels.

The present hierarchical and mechanistic structure in nursing homes may have
been appropriate at a time when the goal of nursing home care was solely custodial, but
there is evidence that such a structure is not appropriate for delivering flexible,
individualized care necessary to achieve present goals. However, before interventions to
improve structure are implemented, nursing care complexity must be adequately
conceptualized and measured in order to guide the development of effective
organizational structure.
CHAPTER 2: CONCEPTUAL PERSPECTIVES

The phenomenon of interest for this study is nursing care complexity. A technostructural contingency model provides the overarching theoretical framework for this study. Constructs in the model are external environment, unit-level environment, and outcomes. The model delineates three conceptual levels. Concepts and posited links of the model with an emphasis on nursing care complexity are discussed in this chapter.

Contingency Theory

A technostructural contingency model generated from the fields of organizational analysis and nursing science provides the theoretical framework for this study. In contrast to classical management theory, in which there is only one right way to design and manage an organization (Perrow, 1967; Mark, Salyer, & Smith, 1996), contingency theories propose that organizational structure depends on such things organizational goals, the context within which the organization is attempting to meet goals, and the work or “technology” of the organization (Mark, 1988; Perrow, 1967). Several variations of contingency theories, often broadly categorized as “structural contingency theories” exist and are discussed in this section.

Perrow (1967) viewed technology as the key element on which organizational structure should be based. Two dimensions of technology were conceptualized by Perrow as directly relevant to structure: exceptional cases and the nature of the search undertaken (analyzability) when exceptional cases occurred. From Perrow’s perspective, the organization’s technology had to be adequately defined and measured before effective structures could be designed. And, even among organizations which performed similar
functions, technology could differ to the extent that different structural designs were required for organizational success.

Lawrence and Lorsch (1967) hypothesized that organizational performance was dependent on the extent to which internal structure fit the demands posed by the external environment. Although, their theory is generally considered apart from Perrow’s (1967), they described the environment in terms of subenvironments characterized in part, by terms analogous to dimensions of technology described by Perrow. Knowledge was viewed as having two dimensions: certainty of knowledge and rate of change which are congruent with analyzability and exceptional cases, respectively. The technical-economic subenvironment was characterized as having raw materials that met predetermined specifications making them amenable to accurate assessment; analogous to Perrow’s dimensions of stability and understandability.

In a model for organizational assessment developed by Van de Ven (1976), aspects of both environment and technology were included. The economic environment constitutes the context of the organization which, in turn predicts the overall structural configuration of the organization (size, horizontal differentiation, and vertical differentiation), and the nature of the work performed by individual units. Van de Ven defined the nature of the work as task difficulty (analyzability and predictability) and task variability (number of exceptions). Work units were hypothesized to directly reflect “the qualitative difficulty and variability” (p. 69) of the assigned tasks. Based on the nature of the work, certain patterns of structure were viewed as more effective than other patterns.
Mark and colleagues (1996) used structural contingency theory as the conceptual framework for their study to examine aspects of both the environment and technology in their model for nursing systems outcomes research. The context in which an organization exists is considered when making decisions about organizational structure. Context consists of hospital characteristics, including technology, and nursing unit characteristics. Three dimensions of technology delineated by Perrow (1967) are included in this model: exceptional cases, analyzability, and the nature of raw material.

Technostructural Contingency Model for Nursing Homes

A technostructural contingency model (Figure 1) developed for this study, shows the relationship between external environment, unit-level environment, and outcomes. The external environment exists outside of work unit boundaries and consists of extra-organizational and intra-organizational factors. The unit-level environment is comprised of three first-level concepts: nursing care complexity, fit, and within-group structure. It is posited that the effectiveness of a healthcare organization depends on how well its structure adapts to or “fits” the nursing care complexity found within the organization (Loveridge, 1988). Organizational effectiveness is conceptualized as being measured by organizational, staff, and resident outcomes.

Organizations are defined as “systems for getting work done, for applying techniques to the problems of altering raw materials—whether materials be people, symbols, or things” (Perrow, 1967, p. 195). Clients are the “material” in healthcare systems. The work or “technology” of nursing units has been defined as the acts performed by nursing personnel to change the status of a patient to a discharged person.
(Alexander & Mark, 1990) and from a “client requiring assistance to being self-reliant” (Alexander & Bauerschmidt, 1987).

FIGURE 1. Technostructural Contingency Model

Construct & Concept Level of Theory

These definitions of technology are too narrow for nursing home populations where discharge or self-reliance may not be realistic or obtainable for many clients. The term “nursing care complexity” is used instead, to encompass the knowledge and processes used by nursing personnel in nursing homes to transform the client to a higher level of biological, emotional, social, and/or spiritual health. Because dying is often an expected outcome in nursing homes, actions that contribute to a comfortable and dignified death are included in the definition.

External Environment

The external environment in the proposed model is conceptualized as having both extra-organizational and intra-organizational components which may exert direct
and indirect effects on the unit-level environment. Examples of extra-organizational factors relevant to nursing homes include: regulatory and reimbursement issues (Castle, 2000; Hawes et al., 1997; Wunderlich & Kohler, 2001), rural or urban setting (Morgan, 2003), supply of workers (Future, 2003; IOM, 2001), and demand created by those seeking services. Intra-organizational factors include the effect of organizational culture (Deutschman, 2001a & b), profit status (Banaszak-Holl & Hines, 1996; Weech, Maldonado, Nef, & Mor, 2003) and size (Mitchell, Teno, Jason, Kabumoto, & Mor, 2003), among others. While these factors are recognized as having an impact on outcomes, they are not the focus of this study and will not be further discussed.

**Unit-Level Environment**

The unit-level environment consists of nursing care complexity, fit, and within-group structure in the proposed model. The phenomenon of interest for this investigation is nursing care complexity based largely on Perrow’s (1967) definition of technology; the work that an organization performs. Perrow viewed technology as the “defining characteristic of the organization… the actions an individual performs upon an object…in order to make some change in that object” (Perrow, 1967, p. 195). In addition to Perrow’s theory, work by Hickson, Pugh, and Pheysey (1969) and Verran and Reid (1987) has been integrated into the Delineation of Nursing Care Complexity (Figure 2) which consists of three second-level concepts: client complexity, knowledge technology, and operations technology. Nursing care complexity is viewed as the essential element in the internal environment on which effective within-group structure is predicated and is addressed in detail later in this chapter.
Structure

Structure is “the arrangement among people for getting work done” (Perrow, 1967, p. 195) and includes staff and administrative roles, governing programs used to control personnel, how people are differentiated into work groups, and processes for integrating and coordinating work group activities (Hollenbeck et al., 2002; Van De Ven, 1976).

Different but functionally similar taxonomies of structure are described in the literature. Burns & Stalker (1961) described environments with higher degree of formalized structure as “mechanistic” and those with a lower degree of formalization as
“organic.” Drazin and Van De Ven (1985) used the terms “systematized”, “discretionary”, and “developmental” to delineate structure and process dimensions.

In systematized modes, roles are highly specialized, codified, and standardized with team members exercising little in the way of decision making. In discretionary modes, there are a number of variations and exceptions in role expectations requiring a repertoire of alternative methods for dealing with tasks, problems, and issues. Developmental modes require extensive search, evaluation, and judgment by personnel in order to handle the work.

Hollenbeck et al (2002) describe structure as functional or divisional departmentation. Functional departmentation creates narrow and specialized roles with high interdependence among departments and is most efficient in stable, relatively predictable environments. Divisional departmentation has broader capacities with increased flexibility and is better suited to unstable environments.

Common to each of these taxonomies is that when tasks have clear outcomes and can be accomplished with little variation in routine, mechanistic structures are hypothesized as most effective. However, if outcomes are uncertain and there is greater complexity of work, tasks are better addressed by employees who have greater autonomy and responsibility (Banaszak-Holl & Hines, 1996; McDaniel, Jordan, & Fleeman, 2003).

Structure is a deliberate choice made by the organization’s administration (Lawrence & Lorsch, 1967; Van de Ven, 1976. However, factors such as management belief and preference, organizational culture, and tradition most often underpin an
organization’s choice of structure rather than systematic or scientific evidence (Langfred & Maye, 2004).

*Fit*

Fit is viewed as the critical concept in contingent propositions and how one defines fit guides theory development, data collection, and methods of analysis (Drazin & Van De Ven, 1985). However, there is little consensus about conceptual or operational definitions of fit which has been a limiting factor to testing the fit/match hypothesis (Mark, Salyer, & Wan, 2003; Schoonhaven, 1981).

Van de Ven (1979) described four different conceptual meanings of fit. The first states that “characteristics of environmental niches and organizational forms must be joined together in a particular configuration” (p. 323). Fit is likened to connecting puzzle pieces to complete an image. In the second definition, fit is interpreted an interaction effect between environment and structure on organizational survival. Through theory, fit is linked to covariations among factors that lead to survival or effectiveness of the organization. In these first two definitions, no direct causation is implied.

A third definition describes fit in terms of organizational adaptation to the environment for survival. In this definition, Van de Ven states that a causative relationship is implied, “…‘fit’ is either an unquestioned axiom or an inductive generalization in a causal model that asserts that organizational environment determines structure” (p. 323). Because structure is viewed as a choice made by management in order to accomplish the goals of the organization, those organizations that survive do so because they adopted structures that fit their environment. The fourth definition, views
fit as simply “a spurious result of a third set of factors that explain the observed
covariations among environment and structure” (p. 323).

Two nursing studies have been found that specifically examined the concept of
fit. Fit in these studies most closely reflects the first two definitions described by Van de
Ven (1979). Alexander and Randolph (1985) used a simplified measure of fit between
technology and structure to examine the relationship to quality of care. For each value of
technology, the authors proposed that there is an appropriate value of structure that
determines organizational effectiveness. They hypothesized that fit would be a better
predictor of quality of care than technology, structure, or technology and structure
together.

Technology was measured using an instrument developed by Leatt and Schneck
(1981) modified from an earlier instrument by Overton, Schneck, and Hazlett (1977)
developed to measure technology in acute care organizations. Both instruments
conceptualize three dimensions of technology: uncertainty, instability, and variability. To
measure structure, an instrument adapted by Alexander for nursing was used. The items
are rated on a 5-point scale ranging from mechanistic to organic. The results generally,
supported their hypothesis, however they unexpectedly found that that nursing subunits
with more complex nursing problems required more rules and procedures to provide
quality of care.

A study by Alexander and Bauerschmidt (1987) examined the fit between
technology and structure on quality of care using a similar research design but utilized the
earlier instrument developed by Overton et al. (1977) to measure technology. While the
results supported their hypotheses that effective structure depends on technology and that one type of structure is not appropriate for all nursing units, they found limited support for the idea that nonroutine technology should be matched with an organic structure. They suggested that a possible explanation for this finding was that the interaction between technology and structure on nursing units may differ from that which occurs in other types (non-nursing) of organizations.

Organizational Outcomes

Van De Ven (1976) conceptualized organizational performance as consisting of efficiency, morale, and effectiveness. In nursing and health services research, effectiveness is generally translated into organizational and client outcomes (Mark, Salyer, & Smith, 1996). Three levels of outcomes are conceptualized as relevant to nursing homes: organizational, staff, and patient outcomes.

Organizational and staff level outcomes

Examples of organizational and staff outcomes of interest to nursing homes are staff turnover and staff satisfaction. Staff turnover is an important outcome linked to quality of care and cost to the organization (Schnelle, et al., 1981). High turnover rates interfere with continuity of care (Johnson, Cowles, & Simmens, 1996) and are important in terms of cost to recruit and train replacements.

In nursing homes, turnover rates among NAs have been reported as high as 100% to 400% with turnover among RNs and LPNs as high as 51% (IOM, 1996). High turnover among NAs has been shown to have a negative impact on resident care in nursing homes and has been related to several factors including the nature of the work
and structural aspects of the organization (Flesner & Rantz, 2004; Riggs & Rantz, 2001). Although it is unknown to what extent improved staff satisfaction results in improved client outcomes (Verran, 1996), staff satisfaction has been shown to be inversely related to turnover and for this reason is of continued importance to nursing home administrators (Hinshaw, Smeltzer, & Atwood, 1987; Lucas, Atwood, & Hagaman, 1993; Mark, Salyer, & Smith, 1996.

Client level outcomes

In most nursing home literature, client outcomes are primarily measured in terms of negative indicators such as use of physical restraints (Castle, 2000), episodes of disturbed behavior (Kolanowski et al., 1994), use of antipsychotic medication (Hughes, Lapane & Mor, 2000), and feeding tube use (Mitchell, Teno, Roy, Kabumoto, & Mor, 2003). Client outcomes of interest are based on the American Academy of Nursing Expert Panel on Quality Health Care (Mitchell, Ferketich, & Jennings, 1998) recommendations. These outcomes are proposed as being the “result of care structures and processes that integrate functional, social, psychological, physical, and physiologic aspects of peoples’ experience in health and illness” (Mitchell, et al., p.44) and are thought to be sensitive to nursing care.

The outcomes include five categories: achievement of appropriate self-care, demonstration of health-promoting behaviors, health-related quality of life (HRQOL), perception of being well-cared-for, and symptom management (Mitchell et al., 1998). However, before their usefulness for evaluating interventions in nursing homes can be
determined, operational definitions and measures appropriate to the nursing home population must be developed.

Nursing Care Complexity

Nursing care complexity is the phenomenon of interest for this study. The term nursing care complexity is adapted from definitions of technology by Perrow (1967), Hickson, et al. (1969), Verran (1986) and Verran and Reid (1987). Perrow’s definition of technology includes the concepts of material technology (knowledge of raw material) and knowledge technology. Verran (1986) and Verran and Reid later adapted the constructs for nursing. Operations technology was based on work by Hickson, Pugh, and Phesey. Each of the concepts is discussed in the following section.

Client Technology

Perrow (1967) proposed that in order to determine the appropriate technology for an organization there had to be an understanding of the organization’s raw material. From Perrow’s perspective, it is the perceived nature of the raw material rather than its actual characteristics that determine the extent of technological routinization (Perrow; Glisson, 1978). Dimensions of client technology have to do with how well the direct care provider “knows” and “understands” the client rather than objective observations, such as acuity ratings, meant to categorize patients for the purpose of allocating resources rather than guiding organizational structure (Crist-Grundman; Marsee, Lovett, & McMillan, 1995).

The importance of considering perceptual measures rather than only relying on objective measures was supported in a study by Schoonhoven (1981). In her study to
examine problems with contingency theory, Schoonhoven studied data from the operating suites of 17 acute care hospitals in the U.S. In this study, an objective measure of technology was utilized. An unexpected finding was that when one measure of technology (workflow uncertainty) was low, increased professionalism decreased organizational effectiveness. To explain this finding, the author suggested that regardless of results from objective measures, it was the perception of the nurses (that there was high workflow uncertainty) that determined their actions.

Dimensions of client complexity are derived from Perrow’s (1967) and Verran and Reid’s (1987) dimensions of raw or basic material. Clients are the “raw material” in healthcare organizations. Two dimensions of client complexity are conceptualized: understandability and standardized treatment. Understandability is how well the client and their problems are known to the direct care provider and the extent to which client responses to such interventions are predictable. Standardized treatment is the extent to which treatment can be addressed by set protocols or procedures or whether continuous adjustments in the intervention are necessary.

*Knowledge Technology*

Knowledge technology is the work that an organization performs and is the “defining characteristic of the organization”...it is the actions an individual performs upon an object...in order to make some change in that object” (Perrow, 1967, p. 195). The two dimensions of knowledge technology are number of exceptional cases and analyzability. Exceptional cases are defined as the variety of events that occur throughout the work day and the degree to which each is perceived as familiar or
unfamiliar (Perrow, 1967). When there are few exceptional cases, there is considerable
certainty about the outcome of tasks or activities. Greater numbers of exceptional cases
are associated greater uncertainty and less ability to predict outcomes (Daft & Macintosh,

Analyzability has to do with the nature of the search that must be taken by an
Search processes may be classified on a continuum from highly analyzable to
unanalyzable. Problems that are analyzable involve search processes which “can be
conducted on a logical analytical basis” (Perrow, p. 196). Objective, computational
procedures can be followed and a “correct response” can generally be identified for
analyzable problems (Daft & Macintosh). Unanalyzable problems are “vague and poorly
conceptualized” (Perrow, p. 196) and personnel may have to spend considerable time
thinking about or searching for solutions beyond normal procedure (Daft & Macintosh).

*Operations Technology*

Operations technology consists of two of the dimensions described by Hickson,
automation is the amount and sophistication of biomedical equipment utilized by nursing
personnel in the course of caring for the client. Sequence rigidity is the extent to which
tasks must be completed in a specific order (with or without biomedical equipment).
Operations technology was added to the theory as the result of inconsistencies noted in
the literature between theory and empirical findings with regard to the structural
dimension of formalization and resultant organizational effectiveness and job satisfaction.
Alexander and Randolph (1985) found that in acute care nursing units where there were more complex problems, greater formalization positively impacted quality of care. In a study of ambulatory care clinics, Verran and Reid (1987) also found that when there was greater clinic variability (presentation of client problems atypical to the setting) measures of complexity were lower. They hypothesized that when clients present problems not usually handled by the clinic, personnel must rely on established procedures and standardized care is more likely to be delivered.

Higher levels of formalization have also been linked to higher levels of job satisfaction among public health nurses (Cumbey & Alexander, 1998). It has been hypothesized that when problems are out of the ordinary or very complex, step by step procedures (sequence rigidity) and rules provide clarity of expectations thus improving job satisfaction and outcomes (Loveridge, 1988).

It is expected that operations technology in most subunits in nursing homes will be low. In general, long-term care and behavioral/dementia units use little automated equipment and procedures are not generally dependent on high sequence rigidity. It may be that on these units, increased flexibility and a less rigid approach to care may enhance individualized resident care. However, post acute units use more specialized equipment and perform more procedures in which set steps and protocols may be perceived as necessary. The significance of operations technology and structure may be that as operations technology increases, structures which have higher levels of formalization may provide a better fit and as a result, better outcomes.
Measuring Nursing Care Complexity

Nursing care complexity is conceptualized as a latent variable which can be assessed by measuring client technology, knowledge technology, and operations technology. Although several instruments have been used to measure Perrow’s constructs of technology in other settings (Lynch, 1974; Withey et al., 1983), few instruments have been found which are specific to nursing, and no instruments have been found that are appropriate for use in nursing homes. In addition, none of the instruments found measure all three constructs (client complexity, knowledge technology, and operations technology) as conceptualized in this model. Nursing research examining technology and structure and the instruments utilized in each to measure technology are summarized in Table 1. Each instrument is discussed in terms of strengths and limitations in this section.

Overton, Schneck, and Hazlett (1977) developed an instrument to measure nursing tasks and their rationale, in acute care settings. The goal of their study was to empirically specify dimensions of technology and to examine the extent to which nursing units could be differentiated based on technology. They based their instrument on two concepts described by Perrow (1967): raw material and knowledge technology. In addition, they added a third concept of task interdependence based on work by Hickson et al (1969). Task interdependence was defined as the extent to which nursing subunits were dependent upon others and that nurses in the subunit were required to work as a team in order to accomplish tasks.
Factor analysis revealed a three factor solution that did not support the hypothesized dimensions of raw material, technology, and task interdependence. Instead, the factor groupings were much more general than hypothesized and there was considerable overlap of items representing the original conceptualization onto each factor. The factors were labeled as uncertainty, instability, and variability with a total explained variance of 61%.

Leatt and Schneck (1981) attempted to replicate the technology study by Overton, et al. (1977) and revised the instrument using 21 items from the original questionnaire. They examined 157 nursing units located in 24 hospitals in Canada. The level of analysis was the unit level with data measured at the individual level; 1,265 nurses participated in the study.

Alpha coefficients for the three scales were: instability .90, uncertainty .82, and variability .82. Factor analysis using orthogonal extraction and varimax rotation showed generally the same pattern as in the Overton et al. (1977) study. However, 6 of the 21 items cross-loaded onto two factors with loadings of >.30, the total amount of explained variance was 66.5%.

These instruments have been used in a number of nursing studies examining technology (Alexander & Bauerschmidt, 1987, Alexander & Randolph, 1987; Alexander & Kroposki, 2001; Cumbey & Alexander, 1998). While it has been suggested that the interaction between technology and structure may be different on nursing units than found in other types of organizations (Alexander and Bauerschmidt; Cumbey & Alexander), it may be that the instruments used to measure technology in these studies
are not consistent with the theoretical framework used in other settings. And, it has been stated that there is a need for “clarification of the conceptualization of technology and refinement of the measurement process” (Cumbey & Alexander, p. 45)

Verran and Reid (1987) used Perrow’s constructs of basic material and technology to replicate an earlier study by Verran & Shaw (1986). Their work was based on the Nursing Technology Model (NTM), adapted from Perrow’s Technology Model by Verran (1982) for the purpose of describing complexity of nursing care in ambulatory care settings. The NTM proposed that “clients attending a specific clinic were the raw material upon which techniques, in the form of nursing care activities, were applied with the purpose of altering their state (Verran, 1982, p. 17).

Two instruments were used in the study: the Ambulatory Care Client Classification Instrument (ACCCI) and the Ambulatory Care Organizational Analysis Scale (ACOAS) to measure complexity. The ACCCI was developed to measure complexity and is meant to reflect the range of responsibilities and activities used to provide care to outpatients (Verran, 1986). The ACOAS is a 20 item questionnaire that indexes the concepts represented in the NTM. Reliability estimates for the specific subscales were reported using coefficient theta and were: Knowledge .92, Analysis .82, Variability .63, and Standardized Care .62. Factor analysis substantiated the existence of the four scales consistent with the model. However, when each scale was constrained to one factor, two aspects emerged from the Workflow Variability Scale: client response variability and clinic variability.
<table>
<thead>
<tr>
<th>Author and Date Published</th>
<th>Sample, Setting, and Level of Analysis</th>
<th>Type of Technology Measure</th>
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</table>
| Overton, P., Schneck, R., & Hazlett, C. B. (1977) | 5 nursing staff randomly selected from each unit (RNs, LPNs, CNAs, nursing orderlies, and nursing assistants)  
71 acute care and psychiatric nursing units in Canada  
Unit level of analysis | 34-item questionnaire developed for study. Factor analysis (orthogonal solution with varimax rotation) revealed a 3-factor: Uncertainty, Instability, and Variability. Total explained variance = 61%.  
Reliabilities not reported |
| Leatt, P. & Schneck, R. (1981) | 1,265 nurses working on 7 types of nursing subunits in 24 hospitals in Canada  
Unit level of analysis | 21 items from the Overton, Schneck, & Hazlett (1977) study reflecting dimensions of uncertainty, instability, and variability. Total explained variance = 66.5%.  
Alpha coefficients: instability .90, uncertainty .82, variability .82 |
Acute care hospital operating suites in 17 hospitals  
Unit level of analysis | Objective measure of the proportion of additions and cancellations to the operating room schedule. Meant to reflect variation in workflow. |
| Alexander, J.W. & Randolph (1985) | 151 nursing personnel (registered nurses, licensed practical nurses, and other nursing personnel)  
27 nursing acute care subunits in 3 hospitals  
Unit level of analysis. | 21-item instrument developed by Leatt and Schneck (1981)  
Reliability estimates: Instability .86, variability .77, uncertainty .62 |
<table>
<thead>
<tr>
<th>Study</th>
<th>Authors</th>
<th>Sample Description</th>
<th>Measures and Details</th>
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<tr>
<td>Verran, J. A. &amp; Reid, P.J. (1987)</td>
<td>Two ambulatory care clinics, one university-hospital based and the other community-hospital based clinic</td>
<td>clients rated by staff members caring for clients and trained raters who received reports from the staff member</td>
<td>Ambulatory Care Organizational Analysis Scale (ACOAS). Consists of 20 items indexing the concepts of: Knowledge of Client, Standardized Treatment, Workload Variability, and Analysis of Intervention Strategies. Coefficient theta: Knowledge .92, Variability .63, Analysis .82, Standardized .62</td>
</tr>
<tr>
<td>Mark, B.A., Salyer, J., &amp; Wan, T.T.H. (2005)</td>
<td>136 medical-surgical units in 68 acute care hospitals with more than 150 beds in 10 southeastern states, Texas, and District of Columbia</td>
<td>Individual level of analysis.</td>
<td>Objective measure of technological complexity indexed by the number of 16 possible high-technology services offered by the hospital.</td>
</tr>
</tbody>
</table>
The strengths and weaknesses of subjective instruments used to measure technology in nursing studies, with regard to their appropriateness for this study, have been discussed. While the Overton, et al (1977) and Leatt and Schneck (1981) instruments have been used most often in nursing studies and have demonstrated good reliability and explained variance, the concepts measured are not congruent with theory most often used in other settings. The instruments developed and used by Verran and colleagues (1986 & 1987) are a conceptual fit but were developed for ambulatory care and many items are not applicable to the nursing home setting.

Specific Aims

The specific aims of this study are to:

1) Develop and test an instrument that will reliably measure nursing complexity in the nursing home setting.

2) Demonstrate conceptual congruence with theory used in other settings in order to better perform cross-study comparisons.

3) Support initial construct validity of the instrument.

Chapter Summary

Previous studies have measured technology in acute care, public health, and ambulatory care settings. No studies have been found that measure technology in nursing homes. In addition, with the exception of the studies of ambulatory care clinics by Verran and Shaw (1986) and Verran and Reid (1987), the instruments used to measure technology are inconsistent with technology dimensions as delineated by Perrow (1967).
Results of studies examining fit between technology and structure on nursing units have been inconsistent with studies performed in other settings which have generally used measures of technology more congruent with Perrow’s theory. While it is possible that there is something inherently different in the interaction between technology and structure in nursing settings, it may be that the difference in the delineation of technology dimensions better explains the inconsistent results. Therefore, the aim of this study is to develop a reliable and valid instrument to measure technology in nursing homes with the goal of demonstrating dimensions of technology described by Perrow with the addition of operations technology.
CHAPTER 3: METHODOLOGY

Nursing care complexity is a latent variable conceptualized as consisting of three second-level concepts: client technology, knowledge technology, and operations technology. Scales have been developed to measure the underlying concepts and form an index of nursing care complexity. This chapter discusses the research questions, hypotheses, and the methodology utilized for the development of the Nursing Care Complexity Questionnaire-Nursing Home (NCCQ-NH).

Research Questions, Hypotheses and Strategies for Analysis

1. To what extent does the NCCQ-NH reliably measure nursing care complexity in nursing homes?

   H1. The NCCQ-NH will demonstrate internal consistency and test-retest reliability acceptable for a new scale.

2. Can the first-level concepts (client technology, knowledge technology, and operations technology) be empirically demonstrated using exploratory factor analysis?

   H2. Three second-level concepts (client technology, knowledge technology, and operations technology) will be demonstrated by exploratory factor analysis.

3. To what extent does the NCCQ-NH total instrument and/or subscales discriminate between nursing subunits (behavioral/dementia, skilled care, subacute, and long-term care) within nursing homes?

   H3. The NCCQ-NH total scale and/or subscales will differentiate between nursing subunits within the nursing home.
4. To what extent does the NCCQ-NH demonstrate convergence with established measures of knowledge technology and nursing care complexity?

H4. There will be a positive correlation between the NCCQ-NH total scale and knowledge subscale with an established measure of knowledge technology (Work Unit Technology Scale).

H5. There will be a positive correlation between the NCCQ-NH total scale and subscales with a modified magnitude estimate of nursing care complexity.

Statistical analyses for this study were computed using the statistical computer package SPSS Graduate Pack 13.0. Alpha was preset at $<0.05$. Theoretical considerations took precedence over any decisions to eliminate or retain items.

Data Cleaning and Missing Values

All data were directly entered into SPSS by the researcher from the questionnaires. Frequencies were checked for any out-of-limit entries and corrected. Ten percent of the questionnaires were randomly selected for comparison with entered data and errors were corrected. Frequencies were also checked for number of missing values. Because no item on the NCCQ-NH had greater than 5% of missing data, computer generated mean substitution was used in all analyses.

Analysis Strategies for Research Questions and Hypotheses

The analysis for the first question consisted of estimating reliability of the instrument using tests of internal consistency (Cronbach’s Alpha) and temporal stability (test-retest). Underlying the concept of internal consistency is the assumption that responses to a scale of items should be equivalent and the extent to which a single
construct is measured (Meek & Verran, 1998). Item analysis was performed to examine the “fit of individual items with other items and the total scale” (Meek & Verran, p. 484). The goal was to achieve a minimum alpha of .70 which Nunnally (1978) describes as sufficing in the early stages of development.

A 2-week test-retest was used to measure temporal stability. During a 10-year longitudinal study, it was found that aspects of nursing care technology changed over time. The authors concluded that nursing technology indeed changes over the long run (Alexander & Kroposki, 2001) however, it is expected that nursing care complexity and its components are a relatively stable phenomenon unless the goals of the unit change. Test-retest is meant to provide evidence regarding short-term consistency and is not concerned with long-term consistency (Knapp, 1985). Test-retest differences of the total scale and subscales between time 1 and time 2 measures were computed using Pearson’s zero order correlations.

Exploratory factor analysis was performed to evaluate construct validity. The first step in performing factor analysis was to determine the theoretical model that in turn, drove the statistical model (Ferketich & Muller, 1990). The choice was based on the investigator’s philosophical stance regarding the nature of measurement error. Random error is defined as all of the “chance factors that confound the measurement of any phenomenon” (Carmines & Zeller, 1979), whereas, systematic is nonrandom error which is a result of consistent characteristics of the measurement process which interfere with the accuracy of the measurement. The investigator assumes that both random and
nonrandom error may occur during measurement, therefore, the neoclassic model, which recognizes both types of measurement error, was selected.

As a measure of convergent construct validity to answer research question 3, the instrument was compared to other instruments purported to measure the same concept (Streiner & Norman, 1995). Convergent validity was tested by evaluating linkages to other measures by the use of hypotheses statements (Streiner & Norman, 1995). Pearson zero order correlations were used to test the relationship between the NCCQ-NH and established measures of knowledge technology and nursing care complexity.

The analysis for question 4 consisted of using a one-way analysis of variance (ANOVA) to determine whether nursing subunit group means significantly differed from each other. Lilliefors Significance Correction to test normality and Levene’s Test of Homogeneity of Variances were performed to evaluate the appropriateness of parametric or nonparametric approaches for this analysis.

Study Definitions

Client- The recipient of nursing care in the nursing home. The term client includes the individual, family, group, or community.

Nursing Care Complexity- A latent variable assessed by measuring client technology, operations technology, and knowledge technology.

Client Technology - Two dimensions are conceptualized based on work by Perrow (1967) and Verran and Reid (1987).
Understandability – the extent to which the client and their problems are known by the direct care provider and the extent to which client responses are perceived as known and predictable.

Standardization- the extent to which client care can be addressed by set protocols or procedures.

Operations Technology- Consists of the dimensions, level of equipment automation, and sequence rigidity that describe the extent to which work activities are automated and/or highly sequenced or linked in a series (Hickson, et al., 1969)

Equipment automation includes quantity of automated equipment and level of sophistication of equipment as measured by such characteristics as frequency of calibration, amount of additional training required to operate equipment, and amount of “troubleshooting” that is required.

Sequence rigidity is the extent to which procedures must be completed in a predetermined step by step manner and the extent to which there are adverse consequences if procedures are not completed in the prescribed manner.

Knowledge Technology- The “knowledge used in the workflow” (Hickson et al., 1969, p. 380). Two dimensions are conceptualized based on Perrow (1967) and Verran and Reed (1987):

Number of exceptional –client problems or events related to patient care that occur throughout the work day not perceived as usual or routine by the direct care provider.
Analyzability, the degree of analytical thought, knowledge or search processes necessary to deal with the client problems or events that occur while caring for clients.

Expert- Colleagues who have extensive knowledge of the theory and/or constructs of interest or who have significant nursing home experience (DeVellis, 1991).

Direct care provider- Any professional, semi-skilled, or unskilled nursing personnel assigned to routinely deliver any aspect of nursing care to residents. Care activities include medication or treatment administration, assessment procedures, and assistance with mobility or activities of daily living.

Nursing home subunit- A geographic area within the nursing home which has specifically designated beds, a regularly assigned nursing staff, shared goals, and an identifiable hierarchical structure.

Setting, Sample Selection, and Recruitment of Subjects

Setting

Nursing homes located in Arizona were contacted about their interest in participating in the study. Information such as type of ownership, size, and quality data were obtained from the Medicare website. Information about number of direct-care personnel was obtained from nursing home administrators and directors of nursing.

Sample

The sample population should be reflective of the population for which the instrument is intended (Ferketich, 1991). Therefore, subjects who provided direct patient care in nursing homes were recruited for this study. Eligibility criteria included that
subjects were 18 years of age or older and had worked on the same nursing unit for at least six weeks. The goal was to obtain a minimum of 150 to 200 subjects for this initial pilot study. This number was based on the recommendation for factor analysis, that at least one tenth of the size of the sample for a major study be used for the initial pilot study (Pett, Lackey, & Sullivan, 2003).

**Human Subjects and Sample Recruitment**

Following approval by the Human Subjects Protection Program at the University of Arizona, nursing home administrators and directors of nursing were contacted to explain the study and request permission to contact direct-care staff. Once site approval was obtained and submitted to the Human Subjects Protection Program, meetings with direct-care staff in groups or individually were held for the purpose of explaining the study, obtaining informed consent, and distributing study packets. However, at the request by the administration of one nursing home, packets were delivered to the site for distribution by the director of nursing and no on-site information meetings were held.

Each study packet contained explicit instructions regarding informed consent, purpose of the study, questionnaire directions, as well as the e-mail and phone number of the investigator for any questions. Two copies of the informed consent, a demographic information sheet, and the questionnaires were also included. For individuals who preferred to mail their questionnaire to the investigator, a stamped envelope addressed to the investigator was supplied. An incentive of a $5 gift card to a local department store was given to each participant who completed and returned the demographic sheet and questionnaire to the investigator. The gift card was intended to partially reimburse the
participant for their time and was not expected to create undue influence or pressure to complete the questionnaire.

For participants who wished to return their questionnaire by mail, follow-up reminders based on a modification of Dillman’s (1978) Total Design Method were used if the questionnaire was not received after 1 week. The first reminder was mailed approximately 1 week after the initial questionnaire was distributed. A second reminder containing a duplicate questionnaire and demographic sheet was mailed approximately 3 weeks after the initial questionnaire was distributed and a final reminder, if necessary, was mailed 2 weeks (week 5) after that. For questionnaires received by mail, gift cards were mailed to those participants.

Research Procedures to Establish Content Validity

Content validity, defined as content representativeness or relevance was determined by a two-stage procedure for affective instruments described by Lynn (1986). The first stage was the development stage and consisted of three steps: domain identification, item generation, and instrument formation. The second stage consisted of a judgment-qualification process performed by experts.

Domain Identification

A comprehensive review of the literature provided the basis for the delineation of concept levels as described in chapter 2. Nursing care complexity is conceptualized as consisting of three second-level concepts each of which is comprised of two third-level concepts: client technology (understandability and standardization), operations
technology (automation and sequence rigidity), and knowledge technology (exceptional cases and analyzability) (Figure 2).

*Item Generation*

The next step was to generate items for all of the dimensions identified in the first step. After obtaining permission (Appendix A), items from existing instruments developed to measure technology were revised to make them relevant to the nursing home setting. Additional items were generated by the investigator based on review of theoretical and nursing home literature.

*Assimilation of Items*

The third step in the development stage was to reword items and arrange them into a suitable sequence (Lynn, 1986). Because the instrument is being developed for use in nursing homes, professional, as well as skilled, and semi-skilled personnel will be surveyed. Therefore, the goal was to develop an instrument with a reading level of fifth to seventh grade level recommended for the general population (DeVellis, 1991). The Flesch Reading Ease score and the Flesch-Kincaid Grade Level score generated by Microsoft Word (2003) were used to estimate readability levels. However, in order to maintain meaning and adequately address knowledge and tasks performed in nursing homes, a reading level of eighth grade was the lowest level achieved.

*Judgment-Quantification*

A structured procedure for the expert reviewers was developed using items from the proposed instrument categorized by concept (Appendix C). Operational definitions of each concept were provided. The reviewers were asked to rate each item using a 4-point
Likert scale described by Lynn (1986): 1= not relevant, 2= unable to assess relevance without item revision, 3= relevant but needs minor alteration, 4= very relevant and succinct. Experts were asked to identify any areas that might have been omitted and to make suggestions about any items they judged as needing revision.

The item content validity index (CVI) is the proportion of items rated as a 3 or 4 by the expert reviewer and the instrument CVI is the proportion of total items judged as content valid for the entire instrument (Lynn). Six nurses (all PhD prepared or doctoral students) with extensive knowledge of the theory and/or nursing homes comprised the expert panel. With the use of six experts, five of six had to rate an item as a 3 or 4 for a significance of .83 to meet the “required minimum agreement” recommended by Lynn (p. 384).

Of 60 items submitted to the expert panel, 52 were rated as relevant (3 or 4). Minor adjustments were made in the wording of items as recommended when judged by the investigator as having merit in clarifying the item or making the item more relevant for use in nursing homes. Eight items that were rated as not relevant or needing revision (1 or 2) were deleted. None of the eight were considered by the investigator as critical to the theory. An additional six items were deleted because they were redundant. While considerable redundancy is desirable at this early stage (Devellis, 1991), the wording was so trivial that participants may have been disinclined to answer a question perceived the same as a previously answered question. No theoretical areas were judged by the experts as having been omitted and the entire instrument was evaluated as having sufficient content validity.
Scaling of Responses

A 4-point Likert scale was used to measure item response. The 4-point scale was selected to avoid the use of a neutral position and because of some evidence that suggests a 4-point scale causes less confusion among Hispanic and African-American populations (Bernal, Wooley, & Schensul, 1997; Lee, Jones, Mineyama, & Zhang, 2002; Skelly, Samuel-Hodge, Elasy, Ammerman, Headen, & Keyserling, 2000). Scales were end-anchored to pull responses to the ends to avoid “end-aversion bias” and produce greater variability (Streiner & Norman, 1995). Furthermore, to avoid agreement bias, the tendency of respondents to agree with items regardless of their content, approximately one-half of the items were reverse worded (DeVellis, 1991).

Pretesting

After initial item revision as the result of the judgment-quantification state, the instrument was pre-tested with nine subjects. Although the final instrument has been designed so that individuals can self-administer the questionnaire, during pretesting the investigator administered the instrument and demographic information sheet using the method of cognitive pretesting. Cognitive pretesting encourages the respondent to verbalize any thoughts that come to mind while answering the questions and allowing the researcher insight as to how the respondent comprehends and approaches answering each item (Krosnick, 1999). The purpose of pretesting was to identify questions that respondents had difficulty understanding or interpreted differently than intended by the researcher. As a result of the pretesting, one item was reworded and one item was eliminated because confusing wording and excessive redundancy. After testing
approximately 30 individuals, the directions were expanded to a separate page with more explicit directions and examples to circle the numbers 1, 2, 3, or 4 rather than circling than words “Never” or “Frequently”. By circling the anchor words, the scale became a 6-point Likert scale rather than the intended 4-point scale and the scales were not comparable.

Study Instruments

*Nursing Care Complexity Questionnaire-Nursing Home (NCCQ-NH)*

The initial Nursing Care Complexity Questionnaire (Appendix D) consisted of 45 items measuring three domains of nursing care complexity (client technology, knowledge technology, and operations technology). Responses were rated on a 4-point, end-anchored Likert scale. Response categories ranged from 1 = “Never” to 4 = “Frequently.”

*Participant Demographic Information Sheet*

The demographic information sheet (Appendix D) consisted of eight questions. Included were: name of the facility, type of unit, and information about the participant such as, educational level and age group. Subjects were also asked about whether they worked full-time or part-time and which shift they worked.

Research Procedures to Estimate Reliability

The SPSS reliability program was used to compute alpha and statistics for item analysis. Inter-item correlations correlate the item with the entire set of scale items, including the candidate item (DeVellis, 1991). Correlations above .30 are generally considered good (Nunnally, 1978), however a level above .20 is acceptable (Streiner & Norman, 1995). Inter-item correlations were examined for coefficients above .30 and
relationship to theory. Sets of items with next highest item-total correlations were then added to increase scale length to improve reliabilities.

Inter-item correlation means, corrected item-to-total coefficients, and information about alpha if the item was deleted were also examined. If inter-item correlation means remain greater than .20, it is possible to achieve an alpha of .71 provided test length is greater than 10 items (Ferketich, 1991). Corrected item-to-total coefficients correlate the item with scale items excluding the candidate item, coefficients of between .30 and .70 are desired (DeVellis, 1991; Ferketich, 1991). Items were also included if they significantly increased alpha by ≥ .05 (Verran, 2005, personal communication).

Test-retest was used to examine stability of the NCCQ-NH and each of the subscales. The goal was to obtain a subset of 25% of subjects to measure temporal stability. However, just 20% (N=34) of retest questionnaires were returned. Test-retest differences between time 1 and time 2 were measured using Pearson’s zero-order correlations.

Research Procedures to Establish Construct Validity

*Exploratory Factor Analysis*

Following the neoclassic model, common factor analysis (CFA) was used for factor extraction. Common factor analysis separates out variance that items share in common from unique variance, because CFA focuses on common variance shared among items, items do not correlate perfectly with themselves so initial communality values of less than 1.00 will appear on the main diagonal of the correlation matrix (Ferketich & Muller, 1990; Nunnally & Bernstein, 1994; Pett et al., 2001). There are a number of
approaches determining which communalities should be placed on the diagonal. For this study, principal axis factoring (PAF) which places the squared multiple correlations ($R^2$) on the diagonal was used. A disadvantage of CFA is that total explained variance will be less than if Principal Component Analysis (PCA) is used. However, Nunnally and Bernstein (1994) point out that part of the explained variance using PCA is “spurious” (p. 522-523).

The final step was to select the method of rotation to achieve a more interpretable factor structure. Varimax rotation was selected for this study based on the assumption that the factors are uncorrelated” (Ferketich, 1991)

The correlation matrix was tested for sampling adequacy and the presence of a sufficient number of correlations. Barlett’s test of sphericity was significant ($X^2 = 883.136, p < .001$). Therefore, the null hypothesis stating that the matrix was an identity matrix, indicating no relationship among items, was rejected.

The Kaiser-Meyer-Olkin (KMO) compares the magnitude of the calculated correlated coefficient to the magnitude of the partial correlation coefficients. Smaller values indicate diffusion in the pattern of correlations and proceeding with factor analysis may not be appropriate (Field, 2000; Pett, et al., 2001). The KMO was .79 considered “middling” and deemed satisfactory for analysis using Kaiser’s (1974) criteria. Both Bartlett’s test of sphericity and the KMO supported continuing to proceed with factor analysis.

Only eigenvalues greater than 1 were considered for further evaluation. In addition, the scree plot was examined to further support the factor solution. Based on
eigenvalues and the scree plot, a 3-factor solution was used. Factor loadings of 0.30 or higher were considered significant (Nunnally, 1978). If an item loaded significantly on more than one factor, theory was relied upon to determine placement of the item. Full results of the factor loadings are included in the next chapter.

Convergent Construct Validity

Two instruments were used to evaluate convergent construct validity. Pearson’s zero order correlations were used to compute the association between the NCCQ-NH total scale and the knowledge technology subscale with the Work Unit Technology Scale. The knowledge technology subscale was selected because the Work Unit Technology Scale purports to measure Perrow’s (1967) concepts of exceptional cases and analyzability which are conceptualized as knowledge technology in this study.

Pearson’s zero order correlations were also used to test the association between the NCCQ-NH total scale and subscales with The Modified Magnitude Estimate of Nursing Care Complexity adapted from Verran (1986). A detailed description of both items follows.

Work Unit Technology Scale

The Work Unit Technology Scale (Appendix E) was derived from six technology scales by Withey and colleagues (1983) for the purpose of improving fit between theoretical constructs described by Perrow (1967) and their empirical measures. Three criteria were used by the authors to develop the scale: face validity, factor structure, and the ability to differentiate work units. However, regardless of how well items differentiated among work units, items were eliminated if they were not relevant to the
defined domains of technology. Factor loadings ranged from .67 to .86 for the exceptions scale and .57 to .79 for the analyzability scale.

The final Work Unit Technology Scale consists of 10-items which measure domains of knowledge technology (exceptions and analyzability) as theorized by Perrow. Stems are negatively worded, the higher the response, the lower are levels of exceptions and analyzability. Responses are rated on a 4-point, end-anchored scale and range from 1 = “To a small extent” to 4 = “To a great extent.” Internal consistency for the Work Unit Technology Scale subscales were: exceptions, \( r = .81 \) and analyzability, \( r = .85 \). As a measure of construct validity, the scale was found to discriminate between work units better than most of the six with which it was compared.

This instrument was selected for this study because of the general nature of the questions and congruence with theory used to underpin this study. Although, the instrument has only been tested among government workers in Canada, it is expected that there will be a positive correlation between this instrument and the NCCQ-NH. The instruments used most frequently in nursing studies (Overton, et al., 1977; Leatt & Schneck, 1981) were viewed as too specific to acute care settings and conceptually, did not fit as well with the NCCQ-NH

*Modified Magnitude Estimation of Nursing Care Complexity*

A technique of modified magnitude estimation described by Verran (1986) was used to estimate Nursing Care Complexity (Appendix E). The definition was also derived from Verran but reworded for easier readability and relevance to the nursing home setting. Subjects were provided with a definition of nursing care complexity and asked to
indicate on a 100 mm line whether they thought their work was 0 = “very simple” to 100 = “very complex.”

**Discrimination among Nursing Subunits**

Three nursing subunits (Skilled, LTC, and Subacute) were selected to test the ability of the NCCQ-NH to discriminate among units. Combined LTC and skilled units and the “float” pool were eliminated because of the heterogeneity of clients served by these groups. The behavioral/dementia unit was also eliminated because there were only eight respondents in this group.

Lilliefors Significance of Correction and Levene’s Test of Homogeneity were significant indicating the assumptions of normal distribution and homogeneity of variance were violated for the total scale, client technology subscale, and operations technology subscale. Therefore a non-parametric method (Kruskall-Wallis one way ANOVA) was used evaluate these scales.

However, tests for normality and homogeneity of variance were non-significant for the knowledge technology subscale. Because there is an increased chance of a Type II error (accepting the null hypothesis that there is no difference between groups when a difference exists), the parametric one-way ANOVA was used to test the knowledge technology subscale. Post hoc testing using Scheffe was performed for any significant findings.

**Chapter Summary**

This chapter described the steps that were followed to develop and perform initial psychometric testing of an instrument to measure nursing care complexity in nursing
homes. Step 1 consisted of two stages described by Lynn (1986) and includes two stages. Stage I was the development stage which includes processes of item generation and assimilation. Stage II was the judgment-quantification of individual items and the entire instrument by experts. Step 2 consisted of pretesting the instrument on a small number of subjects followed by field testing of the instrument. Step 3 was the psychometric testing performed to determine reliability and validity. The full results of each step are described in chapter 4.
CHAPTER 4: STUDY RESULTS

The purpose of this study was to develop and perform initial psychometric testing of an instrument to measure nursing care complexity in nursing homes. Full results of the study are presented in this chapter. The first section of the chapter is a discussion of the time frame, response rate, and a description of the study setting and sample. Results of the psychometric analysis of the NCCQ-NH are included in the second section.

Time Frame and Response Rate

Data collection for the study began after approval by the Human Subjects Protection Committee at the University of Arizona. Administrators and nursing directors of nine nursing homes were contacted regarding their interest in participating in the study. One nursing home did not respond after expressing initial interest and one nursing home had a weather related emergency and was unable to participate during the desired time frame. Data were collected from the remaining seven nursing homes over a two month period from mid-July to the middle of September, 2005.

The investigator met with nursing home administrators and nursing directors of each nursing home to develop a recruitment plan acceptable to each nursing home setting. The percentage of subjects from each nursing home participating in the study ranged from 12% to 44% (Table 2). The highest response rate (58%, N=29) was accomplished by the investigator attending three staff meetings arranged by the DON for the specific purpose of recruiting participants for the study. The fewest number of responses (N=10, 12%) occurred where there was no on-site recruitment.
A convenience sample of 168 nursing personnel who met the eligibility criteria participated in the study. The majority of questionnaires and demographic forms were completed and returned while the investigator was on site. An additional 13 (8%) were received by mail.

Fifty-five subjects agreed to complete a questionnaire for retest (time 2). Ten questionnaires for retest were completed and turned into the investigator during a second visit to one of the larger nursing homes. An additional 45 subjects supplied their name and address to the investigator during time 1 to receive a second questionnaire for retest by mail. Dillman’s (1978) Total Design Method was modified for questionnaires not received after specified time intervals as described in chapter 3. Twenty-four of 45 questionnaires for retest were returned by mail for a 76% response rate.

Description of Study Setting and Sample

Setting

Nursing home characteristics and number of respondents from each are reported in Table 2. The seven nursing homes participating in this study were located primarily in two large urban areas of Arizona with one facility located in rural Arizona. Three of the seven were owned by non-profit corporations while the remaining four were for-profit. None of the nursing homes were located in a hospital. Size ranged from 60 to 312 Medicare certified beds. Medicare certification is defined as the payment for some “nursing home care in specific situations and for no more than 100 days for each
TABLE 2. Nursing Home Characteristics (N= 7)

<table>
<thead>
<tr>
<th>Nursing Home</th>
<th>Total Number of Medicare Certified Beds</th>
<th>Profit Status</th>
<th>Multi-Home or “Chain” Ownership?</th>
<th>Type of Units</th>
<th>Total Number of Direct-Care Staff</th>
<th>Number of Respondents N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>312</td>
<td>For profit</td>
<td>Yes</td>
<td>Behavioral/ Dementia, LTC, Subacute, &amp; Skilled</td>
<td>221</td>
<td>62 (28)</td>
</tr>
<tr>
<td>2</td>
<td>80</td>
<td>Non-profit</td>
<td>Yes</td>
<td>Combined LTC &amp; Skilled</td>
<td>43</td>
<td>19 (44)</td>
</tr>
<tr>
<td>3</td>
<td>112</td>
<td>For profit</td>
<td>Yes</td>
<td>Behavioral/Dementia, LTC, &amp; Skilled</td>
<td>55</td>
<td>17 (31)</td>
</tr>
<tr>
<td>4</td>
<td>102</td>
<td>For profit</td>
<td>No</td>
<td>Behavioral/Dementia, Combined LTC &amp; Skilled</td>
<td>40</td>
<td>13 (33)</td>
</tr>
<tr>
<td>5</td>
<td>93</td>
<td>For profit</td>
<td>No</td>
<td>Combined LTC &amp; Skilled</td>
<td>50</td>
<td>29 (58)</td>
</tr>
<tr>
<td>6</td>
<td>157</td>
<td>Non-profit</td>
<td>Yes</td>
<td>Behavioral/Dementia, LTC, &amp; Skilled</td>
<td>83</td>
<td>10 (12)</td>
</tr>
<tr>
<td>7</td>
<td>60</td>
<td>Non-profit</td>
<td>Yes</td>
<td>Combined LTC &amp; Skilled</td>
<td>60</td>
<td>18 (30)</td>
</tr>
</tbody>
</table>
benefit period” (Medicare NHCompare, 2005). Clients admitted to subacute or skilled/Medicare units often are admitted with a plan for discharge home. Long-term care (LTC) is used to refer to residents not admitted to specific subacute or skilled/Medicare units. Clients admitted for LTC generally have chronic conditions and are often admitted without a plan for discharge home. For this study, behavioral/dementia units were categorized separately. Four of the nursing homes had behavioral/dementia units while only one had a separate subacute unit. Four of the nursing homes had combined skilled/Medicare and LTC units. The total number of direct-care staff for each nursing home ranged from 43 and 221.

Study Sample

Demographic results of the total sample and retest subsample are reported in Table 3. The largest number of the 168 subjects was employed on combined skilled and long-term care units while only 8 respondents reported they worked on behavioral/dementia units. Thirty-six percent (N=69) of the subjects reported having worked more than 1 year but less than 5 years on their unit. Only 12.6% (N=24) of the respondents reported working on the unit for more than 5 years.

Greater than one-half (52.1%) of the respondents were certified nursing assistants (CNAs) or nursing assistants (NAs). Of the 168 respondents, only 21 (11.1%) were registered nurses (RNs) and 41 (21%) were licensed practical nurses (LPNs). Registered nurses and LPNs together comprised 32% of the sample which is only slightly higher than the 28% of combined RNs and LPNs working in LTC reported nationally. Although the sample size of RNs small, additional analyses were performed to see if the instrument
<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Initial N (%)</th>
<th>Retest N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Unit</strong></td>
<td>Behavioral/Dementia</td>
<td>8 (4.8)</td>
<td>4 (11.8)</td>
</tr>
<tr>
<td></td>
<td>Long-term Care (LTC)</td>
<td>31 (18.5)</td>
<td>6 (17.6)</td>
</tr>
<tr>
<td></td>
<td>Skilled</td>
<td>22 (13.1)</td>
<td>4 (11.8)</td>
</tr>
<tr>
<td></td>
<td>Subacute</td>
<td>17 (10.1)</td>
<td>2 (5.9)</td>
</tr>
<tr>
<td></td>
<td>Combined Skilled/LTC</td>
<td>70 (42.7)</td>
<td>11 (32.4)</td>
</tr>
<tr>
<td></td>
<td>Float Pool</td>
<td>18 (10.7)</td>
<td>7 (20.6)</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>2 (1.2)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Length on Unit</strong></td>
<td>6 weeks to 3 months</td>
<td>35 (20.8)</td>
<td>5 (14.7)</td>
</tr>
<tr>
<td></td>
<td>4 months to 1 year</td>
<td>37 (22.0)</td>
<td>4 (11.8)</td>
</tr>
<tr>
<td></td>
<td>&gt;1 year &lt; 5 years</td>
<td>69 (41.1)</td>
<td>11 (32.4)</td>
</tr>
<tr>
<td></td>
<td>Greater than 5 years</td>
<td>24 (14.3)</td>
<td>13 (38.2)</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>3 (1.8)</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td><strong>Job Title</strong></td>
<td>CNA/NA</td>
<td>99 (58.9)</td>
<td>20 (58.8)</td>
</tr>
<tr>
<td></td>
<td>Healthcare Aide</td>
<td>1 (.0)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Licensed Practical Nurse</td>
<td>41 (24.4)</td>
<td>8 (23.5)</td>
</tr>
<tr>
<td></td>
<td>Registered Nurse</td>
<td>21 (12.5)</td>
<td>6 (17.6)</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>3 (1.8)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>3 (1.8)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Education Level</strong></td>
<td>Some High School</td>
<td>3 (1.8)</td>
<td>2 (5.9)</td>
</tr>
<tr>
<td></td>
<td>GED</td>
<td>14 (8.3)</td>
<td>3 (8.8)</td>
</tr>
<tr>
<td></td>
<td>High School Graduate</td>
<td>31 (18.5)</td>
<td>4 (11.8)</td>
</tr>
<tr>
<td></td>
<td>Some College</td>
<td>63 (37.5)</td>
<td>12 (35.3)</td>
</tr>
<tr>
<td></td>
<td>Associate Degree</td>
<td>31 (18.5)</td>
<td>6 (17.6)</td>
</tr>
<tr>
<td></td>
<td>Bachelor’s Degree</td>
<td>10 (6.1)</td>
<td>3 (8.8)</td>
</tr>
<tr>
<td></td>
<td>Master’s Degree</td>
<td>2 (1.2)</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>7 (4.2)</td>
<td>2 (5.9)</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>2 (1.2)</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td><strong>Age Group</strong></td>
<td>18-25 years</td>
<td>30 (17.9)</td>
<td>6 (17.6)</td>
</tr>
<tr>
<td></td>
<td>26-35 years</td>
<td>38 (22.6)</td>
<td>4 (11.8)</td>
</tr>
<tr>
<td></td>
<td>36-45 years</td>
<td>36 (21.4)</td>
<td>8 (23.5)</td>
</tr>
<tr>
<td></td>
<td>46-55 years</td>
<td>38 (22.6)</td>
<td>10 (29.4)</td>
</tr>
<tr>
<td></td>
<td>56-65 years</td>
<td>26 (15.5)</td>
<td>6 (17.6)</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>22 (13.1)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Work Status</strong></td>
<td>Full-time</td>
<td>147 (87.5)</td>
<td>28 (82.4)</td>
</tr>
<tr>
<td></td>
<td>Part-time</td>
<td>18 (10.7)</td>
<td>5 (14.7)</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>3 (1.8)</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td><strong>Shift Worked</strong></td>
<td>Days</td>
<td>103 (61.3)</td>
<td>20 (58.8)</td>
</tr>
<tr>
<td></td>
<td>Evenings</td>
<td>34 (20.2)</td>
<td>5 (14.7)</td>
</tr>
<tr>
<td></td>
<td>Nights</td>
<td>9 (5.4)</td>
<td>3 (8.8)</td>
</tr>
<tr>
<td></td>
<td>Rotating</td>
<td>18 (10.7)</td>
<td>5 (14.7)</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>4 (2.4)</td>
<td>1 (2.9)</td>
</tr>
</tbody>
</table>
performed differently with RNs. Results from these analyses are discussed in this chapter under the subheading “additional analyses”.

One third of respondents (N = 63, 33.2%) reported having attended some college as the highest education level achieved and another 25% (N=43) reported having completed a college degree. Only 6.4% (N= 12) reported having a Bachelor’s degree or beyond.

There was a fairly equal distribution of subjects among each of the age ranges: 18 to 25 years (N=30, 15.8%), 26 to 35 years (N=38, 20%), 36 to 45 years (N=36, 18.9%), 46 to 55 years (N=38, 20%), and 56 to 65 years (N=26, 13.7%). No one reported being in the age range “66 years or older.” However, this question had the greatest amount of missing data with 22 (11.6%) of the respondents not answering. The majority of respondents reported working full-time (N=147) and most worked the day shift (N=103, 54.2%). Almost 10% of the respondents reported working rotating shifts.

Demographic characteristics of the retest subpopulation were similar to the initial sample (Table 3). However, in the retest subsample, there were a greater percentage of respondents from the behavioral/dementia unit (11.8% compared to 4.8%) and fewer from the subacute unit (5.9% compared to 10.2%). There were also a greater number of respondents who had worked on the unit for more than 5 years in the retest group (38.2% compared to 12.6% in the original sample).

Reliability

Internal consistency reliability (Cronbach’s alpha) was estimated by using the SPSS 13.0 reliability analysis. Item analysis, as described in Chapter 3, was performed
for the NCCQ-NH total scale and each of the subscales (client technology, operations technology, and knowledge technology), to determine how well each item “fit” within the conceptualized scale. Criteria for item inclusion included: an inter-item correlation of >.20, an item to total correlation of >.30, an increase in alpha if included >.05, and conceptual relevance. As discussed in chapter 3, items with low correlations were retained if deemed to have conceptual value.

Stability was estimated with a 2-week test-retest using Pearson’s zero order correlations. The goal was to retest 25% (N=42) of the original respondents. However, just 20% (N=34) were returned. In addition, using the mail-in process to obtain retest data resulted in questionnaires being received from 2 weeks up to 5 weeks after time 1 data were collected. Reliability results for the total subscale and subscales are reported in Table 4.

**TABLE 4. Item Analysis and Alpha Coefficients for NCCQ-NH Total Scale and Subscales (N=168)**

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Means (Possible Range 1 to 4)</th>
<th>SD</th>
<th>Inter-item Correlations Mean</th>
<th>Inter-Item Correlations</th>
<th>Alpha</th>
<th>Test-Retest (N=34)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Scale (19 Items)</td>
<td>1.70 to 3.34</td>
<td>.73 to .89</td>
<td>.16</td>
<td>-.22 to .66</td>
<td>.78</td>
<td>.67</td>
</tr>
<tr>
<td>Client Technology (4 Items)</td>
<td>1.70 to 1.98</td>
<td>.76 to .85</td>
<td>.32</td>
<td>.20 to .43</td>
<td>.65</td>
<td>.05</td>
</tr>
<tr>
<td>Operations Technology (6 Items)</td>
<td>2.40 to 3.34</td>
<td>.80 to 89</td>
<td>.38</td>
<td>.22 to .51</td>
<td>.78</td>
<td>.31</td>
</tr>
</tbody>
</table>
Total Scale

The NCCQ-NH total scale (Appendix F) consists of 19 items after item elimination. Eliminated items and the rationale for not including them in the final instrument are reported in Table 5. The item “How often do your patients need different or unknown types of care?” met the initial criteria for item analysis but was later eliminated because it failed to significantly load on any of the primary factors. The scales were scored so that the higher the score, the greater the level of nursing care complexity.

Cronbach’s alpha for the NCCQ-NH total scale was .78. Inter-item correlation ranged from -.22 to .66 with an inter-item correlation mean of .16. Forty-four percent (N=151) of the inter-item correlations were .20 or greater. Test-retest reliability for the total scale was .67 (time 1 mean =49.06, SD = 6.76; time 2 mean = 48.62, SD = 6.10; possible range 19 to 76).
<table>
<thead>
<tr>
<th>Item</th>
<th>Subscale</th>
<th>Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do your patients have many different health problems?</td>
<td>Client</td>
<td>X</td>
</tr>
<tr>
<td>How often do your patients have complicated problems (problems that are hard to understand)?</td>
<td>Client</td>
<td>X</td>
</tr>
<tr>
<td>How often do you care for the same patients day-to-day? (R)</td>
<td>Client</td>
<td>X</td>
</tr>
<tr>
<td>How often do you know your patients well enough so that it is easy to tell when there is a change in their health? (R)</td>
<td>Client</td>
<td>X</td>
</tr>
<tr>
<td>How well do you understand your patient’s health problems? (R)</td>
<td>Client</td>
<td>X</td>
</tr>
<tr>
<td>How often do you feel that you don’t know your patients well enough to tell if their condition changes?</td>
<td>Client</td>
<td>X</td>
</tr>
<tr>
<td>How often is the care you give individualized or specific for that patient?</td>
<td>Client</td>
<td>X</td>
</tr>
<tr>
<td>How often do your patients require different or new types of treatments or care?</td>
<td>Client</td>
<td>X</td>
</tr>
<tr>
<td>How often do you use equipment such as suction machines, monitors, IV pumps, or automatic blood pressure machines to give patient care?</td>
<td>Operations</td>
<td>X</td>
</tr>
<tr>
<td>How often do you get special training for the equipment you use for patient care?</td>
<td>Operations</td>
<td>X</td>
</tr>
</tbody>
</table>
Table 5. Deleted Items *continued*

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Inter-Item Correlations</th>
<th>Corrected Item-to-Total</th>
<th>Alpha Increased if Deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Operations</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Operations</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

*(R) Indicates items that are reversed scored.*
Client Technology Subscale

The client technology subscale consists of 4 items with an alpha of .65. Inter-item correlations ranged from .20 to .43. All of the items correlated ≥ .20 with a mean inter-item correlation of .32. Test-retest reliability was .05 (time 1 mean=7.21, SD =2.38; time 2 mean = 7.43, SD= 1.97; possible range 4-24).

Operations Technology Subscale

Cronbach’s alpha for the 6-item operations technology subscale was .78. Inter-item correlations ranged from .22 to .51 with all coefficients exceeding .20. The inter-item correlation mean was .38. Test-retest reliability was .31 (time 1 mean = 18.12, SD = 3.19; time 2 mean = 17.09, SD= 2.93; possible range 6-24).

Knowledge Technology Subscale

The knowledge technology subscale consists of 9 items with an alpha of .79. Inter-item correlations range from .13 to .66 with 86% (N=88) of the coefficients greater than .20. The inter-item correlation mean was .29. Test-retest reliability was .70 (time 1 mean =23.89, SD= 4.64; time 2 mean= 24.04, SD= 3.89; possible range 9-36).

Stability: Analysis by Item and Nursing Subunit

Conceptually, the complexity of client technology or operations technology would not be expected to change over a short period of time. Therefore, test-retest coefficients for the operations and client subscales were examined item-by-item and by individual unit to try and discern the reason for the low stability estimates.

Item-by item coefficients for the client technology subscale are reported in Table 6. When individual items were examined for the 4-item client technology subscale, only
one item “How often is the care you give for one patient the same as you give to most of your other patients?” had an acceptable retest value of .63. The remaining three items had very low values with one item “How often can you use established or set procedures or guidelines to care for your patients?” having a negative test-retest coefficient (-.17). However, dropping the item would have decreased alpha to .59.

**TABLE 6. Individual Item Correlations for Time 1 (N= 168) with Time 2 (N=34) Scores for Client Technology Subscale: Pearson’s Zero Order Correlations**

<table>
<thead>
<tr>
<th>Item</th>
<th>( r )</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often is the care you give for one patient the same as you give to most of your other patients?</td>
<td>.63</td>
</tr>
<tr>
<td>How often can you use established or “set” procedures or guidelines to care for your patients?</td>
<td>-.17</td>
</tr>
<tr>
<td>How much of the time is the care you give to patients routine or automatic?</td>
<td>.12</td>
</tr>
<tr>
<td>How often is there a standard or usual way to treat your patient’s health problems?</td>
<td>.22</td>
</tr>
</tbody>
</table>

Item by item examination of the 6-item operations technology (Table 7) also revealed generally low correlation coefficients. One item “How often do you perform patient care procedures that must be completed in a certain order” also had a negative test-retest coefficient (-.28). But again, dropping the item would have decreased alpha to .73 and, deleting the item only increased test-retest to .34.

Unit-by-unit analysis was somewhat more revealing with regard to the low retest reliability of the client and operations technology subscales (Table 8). One unit
(subacute) could not be examined individually because there were only two respondents in the retest subsample from this unit. Of the remaining units, two (LTC and combined skilled and LTC) had very low test-retest correlations. The client technology coefficient for the combined unit was .02 and .14 for the operations technology subscale. The coefficients for LTC were negative (client technology= -.64, operations technology = -.59).

TABLE 7. Individual Item Correlations for Time 1 (N= 168) with Time 2 (N=34) Scores for Operations Technology Subscale: Pearson’s Zero Order Correlations

<table>
<thead>
<tr>
<th>Item</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often is it necessary that patient care be given in a certain order?</td>
<td>.08</td>
</tr>
<tr>
<td>How often would there be a bad outcome if patient care was not given in a certain order?</td>
<td>.51</td>
</tr>
<tr>
<td>How often do you perform patient care procedures that must be completed in a certain order?</td>
<td>-.28</td>
</tr>
<tr>
<td>How often do your patients require that you care for them in a certain way?</td>
<td>.31</td>
</tr>
<tr>
<td>How often do patient care procedures have better results if you do them in a certain order?</td>
<td>.19</td>
</tr>
<tr>
<td>How often is it necessary for you to follow patient care procedures step-by-step?</td>
<td>.15</td>
</tr>
</tbody>
</table>
TABLE 8. Nursing Subunit Correlations between Time 1 with Time 2 for Client Technology and Operation Technology Subscales: Pearson’s Zero Order Correlations

<table>
<thead>
<tr>
<th>Unit (N)</th>
<th>Client Technology Subscale $r$</th>
<th>Operation Technology Subscale $r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral/Dementia (4)</td>
<td>.89</td>
<td>.83</td>
</tr>
<tr>
<td>Combined LTC &amp; Skilled (11)</td>
<td>.02</td>
<td>.14</td>
</tr>
<tr>
<td>Float Pool (7)</td>
<td>.57</td>
<td>.71</td>
</tr>
<tr>
<td>LTC (6)</td>
<td>-.64</td>
<td>-.59</td>
</tr>
<tr>
<td>Skilled (4)</td>
<td>.87</td>
<td>.50</td>
</tr>
<tr>
<td>Subacute (2)</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

*Could not be computed

If LTC and combined Skilled and LTC units were deleted from the analysis, test-retest reliability was .51 for the client technology subscale and .72 for the operations technology subscale. This finding indicates that some characteristic of care delivered in LTC is not as stable as found in the other subunits. Possible explanations for the finding will be discussed in Chapter 5.

Validity

Construct Validity

Exploratory factor analysis was performed to answer the second research question: “To what extent can the three second-level constructs (client technology, operations technology, and knowledge technology) be demonstrated by factor analysis?” Common factor analysis was performed using principal axis factoring (PAF) with varimax rotation. Examination of the rotated matrix revealed significant factor loadings
ranging from .33 to .69 (Table 9). Only one item “‘How often is the care you give for one patient the same as you give to most of your other patients’’ loaded significantly >|.30| on more than one factor. However, it loaded slightly higher on the factor with other items originally conceptualized as forming one scale. The total amount of variance explained by the three factors was 36.19%. When individual subscales were constrained to a single factor, all factor loadings were greater than .30, supporting that each functions as a separate subscale (Table 10).

Because each of the second-level concepts (client technology, operation technology, and knowledge technology) were conceptualized as each consisting of two third-level concepts, factor analysis was performed for each scale without constraining the number of factors extracted. Both the client technology and operation technology subscales loaded onto only one factor each. While, the knowledge subscale split into two factors, four of the items failed to load cleanly (the absolute difference between the dominant and next highest loading greater than .20) or significantly (Table 11).
TABLE 9. Factor Loadings from Rotated Matrix for the NCCQ-NH: Principal Axis Factoring with Varimax Rotation

<table>
<thead>
<tr>
<th>Item and Source</th>
<th>Knowledge</th>
<th>Operation</th>
<th>Client</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often is the care you give for one patient the same as you give to most of your other patients? (N)</td>
<td>.32</td>
<td>-.13</td>
<td>.40</td>
</tr>
<tr>
<td>How often can you use established or set procedures or guidelines to care for your patients? (O)</td>
<td>.08</td>
<td>-.14</td>
<td>.47</td>
</tr>
<tr>
<td>How much of the time is the care you give to patients routine or automatic? (V)</td>
<td>.08</td>
<td>-.03</td>
<td>.69</td>
</tr>
<tr>
<td>How often is there a standard or usual way to treat your patient’s health problems? (N)</td>
<td>-.13</td>
<td>-.07</td>
<td>.67</td>
</tr>
<tr>
<td>How often is it necessary that patient care be given in a certain order? (N)</td>
<td>.16</td>
<td>.69</td>
<td>-.20</td>
</tr>
<tr>
<td>How often would there be a bad outcome if patient care was not given in the same order? (N)</td>
<td>.23</td>
<td>.47</td>
<td>.05</td>
</tr>
<tr>
<td>How often do you perform patient care procedures that must be completed in a certain order? (N)</td>
<td>.15</td>
<td>.68</td>
<td>-.22</td>
</tr>
<tr>
<td>How often do your patients require that you care for them in a certain way? (N)</td>
<td>.21</td>
<td>.53</td>
<td>-.00</td>
</tr>
<tr>
<td>How often do patient care procedures have better results if you do them in a certain order? (N)</td>
<td>.12</td>
<td>.59</td>
<td>-.24</td>
</tr>
<tr>
<td>How often is it necessary for you to follow patient care procedures step-by-step? (N)</td>
<td>.03</td>
<td>.60</td>
<td>.00</td>
</tr>
<tr>
<td>How often do you come across new or different kinds of problems while giving patient care? (N)</td>
<td>.55</td>
<td>.21</td>
<td>-.11</td>
</tr>
<tr>
<td>How often does your work change because of a patient’s condition or mood? (O)</td>
<td>.45</td>
<td>.16</td>
<td>.11</td>
</tr>
<tr>
<td>How often do you encounter unfamiliar or unexpected events while caring for patients? (N)</td>
<td>.53</td>
<td>.02</td>
<td>.23</td>
</tr>
<tr>
<td>How often do things happen on your unit that makes it necessary to change the way you give patient care? (N)</td>
<td>.62</td>
<td>.19</td>
<td>.16</td>
</tr>
<tr>
<td>How often is there something “new” happening on your job that affects how you give patient care? (L)</td>
<td>.66</td>
<td>.20</td>
<td>.17</td>
</tr>
<tr>
<td>How often do you have to think about how to solve problems that happen while you are giving patient care? (N)</td>
<td>.54</td>
<td>.19</td>
<td>.09</td>
</tr>
<tr>
<td>How often do your patient care actions require extra thought rather than just being able to rely on standard procedures or guidelines? (V)</td>
<td>.41</td>
<td>.27</td>
<td>.02</td>
</tr>
<tr>
<td>When there is more than one way to perform a patient care procedure (feeding, bathing, dressing, etc) how often can you choose the method or way you think is best for the patient? (O)</td>
<td>.45</td>
<td>.08</td>
<td>-.18</td>
</tr>
<tr>
<td>How often does the patient care you give rely on intuition (your “gut feeling”) rather than on set procedures or routines? (O)</td>
<td>.45</td>
<td>-.01</td>
<td>-.09</td>
</tr>
</tbody>
</table>

Note: Underlined values indicate cross-loading on two factors. Loadings in bold indicate the factor on which the item was placed.

TABLE 10. Factor Loadings for NCCQ-NH Subscales When Constrained to One Factor: Principal Axis Factoring

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Client Technology Subscale</strong></td>
<td></td>
</tr>
<tr>
<td>How often is the care you give for one patient the same as you give to most of your other patients?</td>
<td>.42</td>
</tr>
<tr>
<td>How often can you use established or set procedures or guidelines to care for your patients?</td>
<td>.56</td>
</tr>
<tr>
<td>How much of the time is the care you give to patients routine or automatic?</td>
<td>.68</td>
</tr>
<tr>
<td>How often is there a standard or usual way to treat your patient’s health problems?</td>
<td>.62</td>
</tr>
<tr>
<td><strong>Operations Technology Subscale</strong></td>
<td></td>
</tr>
<tr>
<td>How often is it necessary that patient care be given in a certain order?</td>
<td>.74</td>
</tr>
<tr>
<td>How often would there be a bad outcome if patient care was not given in the same order?</td>
<td>.49</td>
</tr>
<tr>
<td>How often do you perform patient care procedures that must be completed in a certain order?</td>
<td>.72</td>
</tr>
<tr>
<td>How often do your patients require that you care for them in a certain way?</td>
<td>.57</td>
</tr>
<tr>
<td>How often do patient care procedures have better results if you do them in a certain order?</td>
<td>.63</td>
</tr>
<tr>
<td>How often is it necessary for you to follow patient care procedures step-by-step?</td>
<td>.55</td>
</tr>
<tr>
<td><strong>Knowledge Technology Subscale</strong></td>
<td></td>
</tr>
<tr>
<td>How often do you come across new or different kinds of problems while giving patient care?</td>
<td>.57</td>
</tr>
<tr>
<td>How often does your work change because of a patient’s condition or mood?</td>
<td>.50</td>
</tr>
<tr>
<td>How often do you encounter unfamiliar or unexpected events while caring for patients?</td>
<td>.52</td>
</tr>
<tr>
<td>How often do things happen on your unit that makes it necessary to change the way you give patient care?</td>
<td>.67</td>
</tr>
<tr>
<td>How often is there something “new” happening on your job that affects how you give patient care?</td>
<td>.75</td>
</tr>
<tr>
<td>How often do you have to think about how to solve problems that happen while you are giving patient care?</td>
<td>.57</td>
</tr>
<tr>
<td>How often do your patient care actions require extra thought rather than just being able to rely on standard procedures or guidelines?</td>
<td>.48</td>
</tr>
<tr>
<td>When there is more than one way to perform a patient care procedure (feeding, bathing, dressing, etc) how often can you choose the method or way you think is best for the patient?</td>
<td>.40</td>
</tr>
<tr>
<td>How often does the patient care you give rely on intuition (your “gut feeling”) rather than on set procedures or routines?</td>
<td>.40</td>
</tr>
</tbody>
</table>
### TABLE 11. Factor Loadings for NCCQ-NH Subscales When Not Constrained to One Factor: Principal Axis Factoring with Varimax Rotation

<table>
<thead>
<tr>
<th>Factor Loadings</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Client Technology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often is the care you give for one patient the same as you give to most of your other patients?</td>
<td>.42</td>
<td></td>
</tr>
<tr>
<td>How often can you use established or set procedures or guidelines to care for your patients?</td>
<td>.56</td>
<td></td>
</tr>
<tr>
<td>How much of the time is the care you give to patients routine or automatic?</td>
<td>.68</td>
<td></td>
</tr>
<tr>
<td>How often is there a standard or usual way to treat your patient’s health problems?</td>
<td>.62</td>
<td></td>
</tr>
<tr>
<td><strong>Operations Technology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often is it necessary that patient care be given in a certain order?</td>
<td>.74</td>
<td></td>
</tr>
<tr>
<td>How often would there be a bad outcome if patient care was not given in the same order?</td>
<td>.49</td>
<td></td>
</tr>
<tr>
<td>How often do you perform patient care procedures that must be completed in a certain order?</td>
<td>.72</td>
<td></td>
</tr>
<tr>
<td>How often do your patients require that you care for them in a certain way?</td>
<td>.57</td>
<td></td>
</tr>
<tr>
<td>How often do patient care procedures have better results if you do them in a certain order?</td>
<td>.63</td>
<td></td>
</tr>
<tr>
<td>How often is it necessary for you to follow patient care procedures step-by-step?</td>
<td>.55</td>
<td></td>
</tr>
<tr>
<td><strong>Knowledge Technology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often do you come across new or different kinds of problems while giving patient care?</td>
<td>.19</td>
<td>.67</td>
</tr>
<tr>
<td>How often does your work change because of a patient’s condition or mood?</td>
<td>.21</td>
<td>.52</td>
</tr>
<tr>
<td>How often do you encounter unfamiliar or unexpected events while caring for patients?</td>
<td>.22</td>
<td>.53</td>
</tr>
<tr>
<td>How often do things happen on your unit that makes it necessary to change the way you give patient care?</td>
<td>.76</td>
<td>.21</td>
</tr>
<tr>
<td>How often is there something “new” happening on your job that affects how you give patient care?</td>
<td>.80</td>
<td>.29</td>
</tr>
<tr>
<td>How often do you have to think about how to solve problems that happen while you are giving patient care?</td>
<td>.39</td>
<td>.39</td>
</tr>
<tr>
<td>How often do your patient care actions require extra thought rather than just being able to rely on standard procedures or guidelines?</td>
<td>.34</td>
<td>.32</td>
</tr>
<tr>
<td>When there is more than one way to perform a patient care procedure (feeding, bathing, dressing, etc) how often can you choose the method or way you think is best for the patient?</td>
<td>.31</td>
<td>.25</td>
</tr>
<tr>
<td>How often does the patient care you give rely on intuition (your “gut feeling”) rather than on set procedures or routines?</td>
<td>.23</td>
<td>.32</td>
</tr>
</tbody>
</table>

Note: Underlined values indicate cross-loading on two factors.
Discrimination of Nursing Subunits

To answer the third research question: “To what extent does the instrument discriminate between nursing subunits within nursing homes”, a one-way analysis of variance (ANOVA) was performed. Three subunits were selected for this analysis because of the more similar number of respondents from each unit and the homogeneity of clients served in these units (Skilled, N= 22; LTC, N=31; Subacute, N=17). However, because the client technology and operations technology subscales failed to meet the assumptions of normality and homogeneity of variance, the Kruskall-Wallis one-way ANOVA of ranks was used to test these subscales. Alpha was preset at ≥ .05. There were no significant differences among the groups for the client technology and operations technology subscales among the three units (Table 12).

Because assumptions of normality and homogeneity of variance were met by the NCCH-NH total scale and knowledge technology subscale, the more powerful parametric one-way ANOVA was used to test the ability of the NCCQ-NH total scale and the knowledge technology subscale to lessen the chance of a Type II error. No significant difference was found among the three units for the total scale (Table 13). However there was a significant difference among the units with regard to the knowledge technology subscale (Table 14). Scheffe post hoc analysis indicated that a significant difference occurred between Long Term Care (mean= 2.56, SD = .49) and Subacute units (mean= 2.93, SD=.48).

To compare the ability of measures of technology to discriminate among nursing home subunits, the two established measures of technology (Work Unit Technology

Scale and the Modified Magnitude of Nursing Care Complexity) were tested. Non-parametric analysis was indicated. Both of the established instruments failed to discriminate among the three nursing subunits (Table 12).
TABLE 12. Discrimination of Nursing Subunits by NCCQ-NH Client Technology and Operations Technology Subscales, Work Unit Technology Scale, and Modified Magnitude of Nursing Care Complexity: (Kruskal-Wallis)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Skilled (N = 22)</th>
<th>LTC (N = 31)</th>
<th>Subacute (N = 17)</th>
<th>$\chi^2$</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>1.73</td>
<td>1.75</td>
<td>2.00</td>
<td>5.56</td>
<td>2</td>
<td>.062</td>
</tr>
<tr>
<td>Range</td>
<td>1.75</td>
<td>2.50</td>
<td>1.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>3.33</td>
<td>3.17</td>
<td>3.00</td>
<td>1.31</td>
<td>2</td>
<td>.520</td>
</tr>
<tr>
<td>Range</td>
<td>2.00</td>
<td>2.50</td>
<td>1.17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Unit Technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>1.70</td>
<td>1.60</td>
<td>1.90</td>
<td>5.63</td>
<td>2</td>
<td>.060</td>
</tr>
<tr>
<td>Range</td>
<td>1.60</td>
<td>2.20</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modified Magnitude</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimate of NCC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>74.50</td>
<td>62.00</td>
<td>70.00</td>
<td>3.86</td>
<td>2</td>
<td>.146</td>
</tr>
<tr>
<td>Range</td>
<td>67.00</td>
<td>93.00</td>
<td>46.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE 13. Summary of ANOVA for NCCQ-NH Total Scale Among Skilled, LTC, and Subacute Nursing Units. (Skilled, N= 22; LTC, N= 31; Subacute, N=17)

<table>
<thead>
<tr>
<th>Unit</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled</td>
<td>2.64</td>
<td>.31</td>
</tr>
<tr>
<td>LTC</td>
<td>2.55</td>
<td>.35</td>
</tr>
<tr>
<td>Subacute</td>
<td>2.78</td>
<td>.28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>.567</td>
<td>2</td>
<td>.284</td>
<td>2.730</td>
<td>.072</td>
</tr>
<tr>
<td>Within Groups</td>
<td>6.959</td>
<td>67</td>
<td>.104</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7.526</td>
<td>69</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 14. Summary of ANOVA for NCCQ-NH Knowledge Technology Subscale Among Skilled, LTC, and Subacute Nursing Units. (Skilled, N= 22; LTC, N= 31; Subacute, N=17)

<table>
<thead>
<tr>
<th>Unit</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled</td>
<td>2.70</td>
<td>.45</td>
</tr>
<tr>
<td>LTC*</td>
<td>2.56</td>
<td>.49</td>
</tr>
<tr>
<td>Subacute*</td>
<td>2.93</td>
<td>.48</td>
</tr>
</tbody>
</table>

* Indicates significant difference between means.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>1.464</td>
<td>2</td>
<td>.732</td>
<td>3.252</td>
<td>.045</td>
</tr>
<tr>
<td>Within Groups</td>
<td>15.084</td>
<td>67</td>
<td>.220</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16.548</td>
<td>69</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Convergent Construct Validity**

Further construct validity was tested by evaluating how the instrument correlated with other instruments purported to measure the same concept. Two instruments were selected to test convergence, the Work Unit Technology Scale and the Modified Magnitude Estimate of Nursing Care Complexity (Appendix F). Psychometric properties for each were described in Chapter 3. The psychometric properties of each using data from this study are reported in this section.

**Work Unit Technology Scale**

Factor analysis using principal axis factoring with varimax rotation demonstrated 2 factors as previously described by Withey and colleagues (1983). Factor loading ranged from .45 to .83. The item “To what extent is there a clearly known way to do the major types of work you normally encounter?” loaded significantly on both factors (.45, .54). The item had also loaded on both factors in the original study (.44 and .79, respectively). Cronbach’s alpha was .86 for the total scale; .86 for the exceptions subscale; and .82 for the analyzability subscale.

**Modified Magnitude Estimate of Nursing Care Complexity**

The mean score for time 1 (N= 160) was 63.48, SD = 24.64 and the mean score for time 2 (N= 31) was 57.39, SD =24.81. Test-retest reliability for the instrument was .50.

Results of correlations to test convergent construct validity are reported in Table 15. It was hypothesized that there would be a positive correlation between the NCCQ-NH total scale and knowledge technology scale with an established measure of knowledge
technology (Work Unit Technology Scale). The NCCQ-NH total scale correlated very modestly, however significantly and positively with the Work Unit Technology ($r = .21$, $p = .008$). The knowledge technology subscale correlated significantly and positively with the Work Unit Technology Scale ($r = .18$, $p = .021$).

<table>
<thead>
<tr>
<th>Scale</th>
<th>Work Unit Technology Scale $r (p)$</th>
<th>Modified Magnitude Estimate of Nursing Care Complexity $r (p)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCCQ-NH Total Scale</td>
<td>.21 (.008)</td>
<td>.31 (&lt;.001)</td>
</tr>
<tr>
<td>Client Technology</td>
<td>.45 (&lt;.001)</td>
<td>.09 (.254)</td>
</tr>
<tr>
<td>Operations Technology</td>
<td>-.11 (.175)</td>
<td>.23 (.003)</td>
</tr>
<tr>
<td>Knowledge Technology</td>
<td>.18 (.021)</td>
<td>.26 (.001)</td>
</tr>
<tr>
<td>Work Unit Technology Scale</td>
<td>-</td>
<td>.21 (.007)</td>
</tr>
</tbody>
</table>

It was also hypothesized that there would be a positive correlation between the NCCQ-NH and subscales with a modified magnitude estimate of nursing care complexity. There was a significant and positive, but modest correlation with the NCCQ-NH total scale modified magnitude estimate of nursing care complexity ($r = .31$, $p > .001$), operations technology subscale ($r = .23$, $p = .003$), and knowledge technology
subscale \((r = .26, p = .001)\). There was no significant correlation between the client technology subscale and the Modified Magnitude of Nursing Care Complexity.

The established instrument (Work Unit Technology Scale and Modified Magnitude Estimate of Nursing Care Complexity) were also compared with each other. There was a significant and positive, but again, very modest correlation between the two instruments \((r = .21, p = .007)\). There was also an unexpected correlation between the Work Unit Technology Scale and the NCCQ-NH client technology subscale \((r = .45, p < .001)\).

Additional Analyses

*Instrument Performance with RN Subsample*

To ascertain whether the instrument performed similarly for the RN subsample, unit discrimination and convergence to evaluate construct validity were reexamined. There was no significant difference among units for the NCCQ-NH total scale or any of the subscales. Convergence with the Work Unit Technology Scale and Modified Magnitude of Nursing Care Complexity was also examined. The correlation coefficients were not significant for this subsample.

The instrument failed to differentiate among nursing subunits and convergence with established technology instruments was not significant however, sample size was very small for this subsample and no clear conclusions can be drawn from this analysis.

*Instrument Performance as a Single Scale*

Further analyses were performed to test whether the instrument functioned better as a single scale. Factor analysis demonstrated that the total scale would not significantly
load onto a single factor when constrained. However, if items in the client technology subscale were deleted, all remaining items loaded significantly onto a single factor (Table 16). Cronbach’s alpha for the newly created scale was .82 and test-retest reliability was .72.

Total explained variance for the single scale was only 25% and there was no significant discrimination among the subacute, skilled and LTC units using the scale. Although not significant, the pattern of scores was what would be expected with regard to nursing care complexity among the units (subacute mean= 2.97, SD=.32; skilled mean= 2.89, SD=.42; LTC mean= 2.74, SD=.48). Convergence with the Modified Magnitude of Nursing Care Complexity was .30 (p= <.001). There was no significant correlation with the Work Unit Technology Scale. Interestingly, the client technology subscale correlated to a greater extent with the Work Unit Technology Scale (r= .45, p= <.001) than did either the operations technology (NS) subscale or the knowledge technology subscale (r= .18, p= .02 ). When individual items from each of the subscales were reviewed, “routiness” seemed to be a common theme (Table 17). Implications of this finding are discussed in chapter 5.
TABLE 16. Factor Loadings for Operations and Knowledge Technology Subscales When Constrained to One Factor: Principal Axis Factoring

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operations Technology</strong></td>
<td></td>
</tr>
<tr>
<td>How often is it necessary that patient care be given in a certain order?</td>
<td>.56</td>
</tr>
<tr>
<td>How often would there be a bad outcome if patient care was not given in the same order?</td>
<td>.49</td>
</tr>
<tr>
<td>How often do you perform patient care procedures that must be completed in a certain order?</td>
<td>.55</td>
</tr>
<tr>
<td>How often do your patients require that you care for them in a certain way?</td>
<td>.50</td>
</tr>
<tr>
<td>How often do patient care procedures have better results if you do them in a certain order?</td>
<td>.47</td>
</tr>
<tr>
<td>How often is it necessary for you to follow patient care procedures step-by-step?</td>
<td>.41</td>
</tr>
<tr>
<td><strong>Knowledge Technology</strong></td>
<td></td>
</tr>
<tr>
<td>How often do you come across new or different kinds of problems while giving patient care?</td>
<td>.56</td>
</tr>
<tr>
<td>How often does your work change because of a patient’s condition or mood?</td>
<td>.44</td>
</tr>
<tr>
<td>How often do you encounter unfamiliar or unexpected events while caring for patients?</td>
<td>.39</td>
</tr>
<tr>
<td>How often do things happen on your unit that makes it necessary to change the way you give patient care?</td>
<td>.57</td>
</tr>
<tr>
<td>How often is there something “new” happening on your job that affects how you give patient care?</td>
<td>.68</td>
</tr>
<tr>
<td>How often do you have to think about how to solve problems that happen while you are giving patient care?</td>
<td>.52</td>
</tr>
<tr>
<td>How often do your patient care actions require extra thought rather than just being able to rely on standard procedures or guidelines?</td>
<td>.49</td>
</tr>
<tr>
<td>When there is more than one way to perform a patient care procedure (feeding, bathing, dressing, etc) how often can you choose the method or way you think is best for the patient?</td>
<td>.38</td>
</tr>
<tr>
<td>How often does the patient care you give rely on intuition (your “gut feeling”) rather than on set procedures or routines?</td>
<td>.33</td>
</tr>
</tbody>
</table>
### TABLE 17. Items from NCCQ-NH Client Technology Subscale and Work Unit Technology Scale: Exceptional Cases Subscale

<table>
<thead>
<tr>
<th>NCCQ-NH: Client Technology Items (N=4)</th>
<th>Work Unit Technology: Exceptional Cases Items (N=5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often is the care you give for one patient the same as you give to most of your other patients?</td>
<td>Think of the tasks you do during the course of your work. How many of these tasks are the same from day-to-day?</td>
</tr>
<tr>
<td>How often can you use established or set procedures or guidelines to care for your patients?</td>
<td>To what extent would you say your work is routine?</td>
</tr>
<tr>
<td>How much of the time is the care you give to patients routine or automatic?</td>
<td>People in this unit do about the same job in the same way most of the time.</td>
</tr>
<tr>
<td>How often is there a standard or usual way to treat your patient’s health problems?</td>
<td>Basically, unit members perform repetitive activities in doing their jobs.</td>
</tr>
<tr>
<td></td>
<td>How repetitious are your duties?</td>
</tr>
</tbody>
</table>

### Chapter Summary

In this chapter, full results of the study were reported. A complete description of the instrument development, description of the study setting and sample, and the results of psychometric testing were included in the report.

Cronbach’s alpha using individual data were acceptable for the NCCQ-NH total scale (0.78), operations technology subscale (0.78), and knowledge technology subscale (0.79). Alpha for the client subscale was low (0.65). Scale stability was examined using test-retest. Retest scores for the total scale and knowledge subscale were acceptable (0.76 and 0.70, respectively). Retest scores for the client and operations subscales were
extremely low (.05 and .31, respectively). However, when LTC and combined skilled and LTC units were deleted, test-retest reliabilities improved to .51 for the client technology subscale and .72 for the operations technology subscale.

Exploratory factor analysis was used to evaluate construct validity. A 3-factor solution with PAF extraction with varimax rotation was used with all items loading greater than .30. Only one item cross-loaded significantly onto more than one factor. The three first-level concepts (client technology, operations technology, and knowledge technology) were demonstrated as conceptualized. One scale, the knowledge technology subscale was found to differentiate between three selected nursing subunits. The NCCH-NH total scale and knowledge technology scale correlated significantly and positively, although modestly, with established measures of knowledge technology and nursing care complexity.

The results will be interpreted and discussed in terms of meaning and relevance to nursing in Chapter 5. Limitations and areas for future research will also be considered.
CHAPTER 5: DISCUSSION AND RECOMMENDATIONS

The purpose of this study was to develop and perform initial psychometric analysis of an instrument to measure the complexity of care delivered in nursing homes. This final chapter contains interpretation of the results reported in Chapter 4. Limitations of the study, areas for further study, and implications for nursing science are discussed.

Interpretation of Psychometric Analysis

The NCCQ-NH is a 19-item questionnaire comprised of three scales: client technology, operations technology, and knowledge technology. The instrument is scaled so that the higher the score, the greater the level of complexity. Development of the scale and methods used to determine initial content validity were described in Chapter 3. This section contains the interpretations the psychometric analysis reported in Chapter 4 organized by hypothesis.

Hypothesis 1: Reliability

Internal consistency

It was hypothesized that the NCCQ-NH would demonstrate internal consistency acceptable for a new scale. Nunnally (1978) suggested .70 as an acceptable lower bound of alpha for early stages of scale development. Cronbach’s alpha for the total scale and two of the three subscales met this criteria (total scale= .78, operations technology= .78, knowledge technology= .79). However, alpha for the 4-item client technology scale was only .65.

The most likely factor underlying the low alpha for the client technology scale is the length of this scale. The primary way to increase alpha is to increase test length
(Nunnally, 1978). However, inter-item correlations for items tested in this scale were low and the addition of any of the items only served to lower alpha. Five items relating to this scale, initially judged by content experts as redundant or needing significant revision, were not included in this pilot study. It may be that these items, once wording is revised, will test better than the items selected for the initial instrument. This subscale also had the greatest number of negatively worded items which might have been confusing to respondents.

**Stability**

Stability was evaluated by performing a 2-week test-retest analysis. It was expected that the scales would demonstrate acceptable test-retest reliability. The total scale test-retest coefficient was .67 and .70 for the knowledge technology subscale. Test-retest coefficients for the client technology and operations technology subscale were very low (.05 and .31, respectively).

While the response rate was lower than desired (20% of the original sample rather than the planned 25%) and, retest questionnaires were returned two to five weeks after the original testing, further examination of the scores for individual units indicated a possible explanation for the low stability estimates. Two units were found to have very low test-retest coefficients (LTC and combined skilled & LTC). A possible explanation for the combined skilled & LTC unit demonstrating low client and operations stability is that individual direct-care providers may have indeed provided care for diversely complex clients. Furthermore, depending on client needs, care requiring varying degrees of adherence to step-by-step processes may have been delivered during this period of
time. However, one might expect that float personnel would encounter similar diversity but scores for this group indicated more stability than combined skilled and LTC units with regard to the two subscales (client technology = .57 and operations technology = .71).

The lowest test-retest coefficients were encountered for the LTC subunit (client technology = -.64; operations technology = -.59). Examination of this subsample revealed that the respondents were equally divided between two nursing homes, each located in a different city, one for-profit and one not-for-profit. All other demographic characteristics were similar to the total sample. While alpha for the client technology subscale is low and the scale itself may be inadequate, alpha for the operations technology subscale was .78 which is “respectable” (DeVellis, 1991).

It appears that the NCCQ-NH functions differently with regard to LTC subunits. While it may be that the difference is a characteristic of the instrument, the difference may be related to the nature of the clients and care delivered within these units. It may be that LTC clients are more variable requiring differing levels of care than is generally assumed.

H1. The NCCQ-NH will demonstrate internal consistency and test-retest reliability acceptable for a new scale, was partially supported. Both the total scale and knowledge technology scale demonstrated alphas greater than .70 and moderate test-retest reliability.

Hypothesis 2: Construct Validity

Construct validity was evaluated by performing exploratory factor analysis using principal axis factoring with varimax rotation. All items loaded significantly (> .30) onto
three factors consistent with theory underpinning this study. All items conceptualized as belonging to a particular subscale could be constrained to one factor lending support that the items functioned as a scale.

Two third-level concepts were delineated for each of the second-level concepts (client technology- understandability and standardization; operation technology- automation and sequence rigidity; knowledge technology- exceptional cases and analyzability). Both client technology and operation technology subscales were unidimensional when each scale was not constrained to one factor. After examining the remaining items, it was noted that all items retained for the client technology subscale had been conceptualized as measuring standardization, and all items for the operations technology subscale were conceptualized as measuring sequence rigidity. The knowledge subscale split into two factors when not constrained, however, four items failed to load significantly or cleanly on either factor. Items conceptualized as exceptional cases and analyzability were both included in the subscale although, there were a number of cross-loadings.

Total explained variance for the three factors was low (36.19%). Although, common factor analysis results in lower explained variance than principal component analysis, the instrument does not approach the explained variance of the Overton, et al. (1977) scale at 61% or the Leatt and Schneck (1981) adaptation which explained 66.5% of total variance. However, the three factors that emerged were consistent with the theory used to underpin the study and congruent with theory used in studies of other types of organizations therefore facilitating cross-study comparisons.
H2: Three second-level concepts (client technology, knowledge technology, and operations technology) will be demonstrated by exploratory factor analysis was supported.

**Hypothesis 3: Nursing Subunit Discrimination**

The ability to discriminate among nursing home subunits was used to further examine construct validity of the instrument. Three units (LTC, Skilled, and Subacute) were selected for this analysis based on more similar sample size among the units and the homogeneity of clients served within each unit.

Only the knowledge technology subscale demonstrated the ability to discriminate among the subunits. It is expected that more exceptional cases requiring increased levels of analysis would occur in both subacute and skilled units compared to LTC units. While the only significant difference occurred between the subacute and LTC units, the pattern of the findings was consistent with this expectation (subacute mean= 2.93, SD= .48; skilled mean= 2.70, SD=.45; LTC mean= 2.56, SD= .49).

There was no significant difference among the units with regard to the client technology. Although the subacute unit had the highest score (median= 2.0) as expected, LTC scores were very similar to the skilled unit (median =1.75 and 1.73, respectively). While it may be that client complexity in both skilled and LTC units is similar, the low alpha for the client technology scale makes it necessary to view this finding with caution.

The operations technology scale however, had an acceptable alpha and was expected to discriminate among subunits. While not statistically significant, the Skilled unit had a slightly higher median score than LTC (3.33 compared to 3.17), however the
Subacute score (median= 3.00) was lower than either Skilled or LTC. While it would be expected that there are more procedures or treatments requiring higher levels of sequence rigidity within the Skilled Units compared to LTC, it would also be expected that subacute units would also have more procedures requiring adherence to specific steps compared to LTC units. Although, it may be that nursing personnel in the subacute unit perform procedures more frequently and rely less on step-by-step guidelines.

H3: The NCCQ-NH total scale and/or subscales will differentiate between nursing subunits within nursing homes was partially supported. Only the knowledge technology subscale significantly discriminated among nursing subunits.

Hypothesis 4: Convergent Construct Validity

Construct validity was further evaluated by measuring how the instrument correlated with two established instrument purported to measure the same concept. The Work Unit Technology Scale was derived from six instruments developed to measure technology in a variety of organizations (e.g., welfare agencies, academic libraries, employee and security workers) and was tested among government workers in Canada. While Perrow (1967) viewed the concepts as sufficiently broad to be applicable across settings, it is not expected that an instrument developed specifically for use in nursing homes would correlate highly with instruments developed for other settings. There was a significant and positive, although quite modest, correlation of the NCCQ total scale and knowledge technology subscale with the Work Unit Technology Scale as hypothesized.
There was also a significant and positive, but modest, correlation between the NCCQ-NH total scale and the Modified Magnitude Estimate of Nursing Care Complexity. However, the range for the Modified Magnitude Estimate is 0 to 100 and the wide variation in scores (SD= 22.88) may partially explain the modest correlation.

H4: There will be a positive correlation between the NCCQ-NH total scale and knowledge subscale with the Work Unit Technology Scale was supported.

H5: There will be a positive correlation between the NCCQ-NH total scale and the Modified Magnitude Estimate of Nursing Care was supported.

Conclusions from Additional Analyses

The instrument was purposely tested among professional, skilled, and semi-skilled nursing personnel because care in nursing homes is largely delivered by a non-professional staff. However, to ascertain whether the instrument performed differently among the professional RN staff, the ability of the instrument to discriminate among nursing subunits and convergence with established instruments was tested for this subsample (N=21). There was no significant difference for the NCCQ-NH total scale or subscales among the units. However, RNs in many nursing homes perform treatments and procedures for residents throughout the facility thus blurring unit boundaries.

There were no significant correlations for the NCCQ-NH total scale and knowledge technology subscale with either of the two established instruments. However, the sample size of RNs is too small to draw any clear conclusions and further study is needed to ensure the instrument functions similarly among professional and non-professional personnel.
Study Limitations

Limitations Related to Methodology

This section will discuss limitations of the study in terms of methodological limitations and those related to study findings. The first methodological limitation is the sample size. It is generally recommended that the sample size consist of 5-10 subjects for each item being tested. The original instrument consisted of 45 items therefore a sample size of at least 225 individuals was desired. The sample size for this pilot study was N=168 which might have affected study findings.

The second methodological limitation was related to testing stability reliability. Only 20% compared to the desired 25% of retest questionnaires were returned. In addition, the mail-in process used to perform this test resulted in retest questionnaires being returned over a 2 to 5 week period after the initial testing. In addition, the small sample size may have affected the test-retest correlations.

Limitations Related to Findings

The first limitation related to findings is the low alpha for the client technology scale. While the size of the scale is most likely the primary factor, the small sample size may have also contributed to this finding.

The second limitation related to findings is the stability of the client and operations technology subscales. Although, test-retest reliability was very low for the client and operations technology scale, when units caring for LTC clients were eliminated, the test-retest reliability for the operations scale was acceptable and much improved for the client technology scale.
The third limitation is the low explained variance by the instrument. Although a strength of this instrument is its congruency with theory, almost two-thirds of nursing care complexity remain unexplained by the NCCQ-NH. It may be that adding questions that explore the third-level concepts of client understandability and operation automation would increase total explained variance.

Implications for Further Research

The limitations of the study suggest immediate areas for further study. Two of the NCCQ-NH subscales (client technology and operations technology) perform differently with regard to stability when tested among individuals who deliver care in LTC or combined skilled and LTC units. These scales need further study as to why the instrument performs differently in these units.

The Work Unit Technology Scale purports to measure two dimensions of knowledge technology (exceptional cases and analyzability) and was selected to test convergent construct validity. However, it was noted that there was an unexpected and moderately high correlation between the NCCQ-NH client technology subscale and the Work Unit Technology Scale. Further examination of the items revealed that the Work Unit Technology questions related to exceptional cases and the client technology scale appeared to have tapped an additional concept, that of “routiness”. Therefore, more research is needed to more clearly define and operationalized the terms standardization, routiness, and exceptional cases.

Data, for this study, were collected and analyzed at the individual level. However, nursing care complexity is conceptualized as a unit level phenomenon.
Therefore, the appropriateness of aggregating individual level data to unit level needs to be tested. Limitations with regard to this issue were primarily related to the size of the sample from individual units. It is recommended that responses from at least 50% of group members from a unit be analyzed for within group agreement before testing the appropriateness of aggregating the data (Verran, Gerber, & Milton, 1995).

Recommendations for Immediate Use of the NCCQ-NH

As it stands, it is recommended that the operations technology and knowledge technology subscales be combined to form a single 15-item scale of Nursing Care Complexity. Reliabilities are acceptable for all nursing home units. While the instrument failed to significantly discriminate among nursing subunits, expected patterns of nursing care complexity (subacute>skilled>LTC) were demonstrated. A larger sample size may demonstrate discrimination. The single scale only explains the 25% of the total variance, indicating that more work is needed to improve the reliabilities of the subscales.

Implications for Nursing Science

There is theoretical and empirical evidence that nursing care complexity can be used to guide the development of organizational structure to improve outcomes. However, studies performed in nursing settings have had somewhat different results related to technology/structure match than those found in other types of organizations. It may be that the instruments most often used for the nursing studies are not conceptually congruent with the instruments used in other settings. The NCCQ-NH provides an alternative instrument for use in nursing homes. It is recommended that the operations
and knowledge technology subscales be used as a single scale until more work is done to improve reliabilities for the client technology subscale.

Summary

Nursing has the responsibility for determining how best to structure the delivery of care in nursing homes. Currently, the structure in nursing homes is based on the traditional hierarchical model found in acute care. In addition, structure is more likely to be influenced by management preferences and organizational culture rather than scientific evidence. Measuring nursing care complexity may provide information needed to guide the development of structures that fit better with the level of complexity within the organization.

This study describes the initial reliability and validity of a questionnaire designed to measure the complexity of care in nursing homes. All of the study hypotheses were fully or partially supported. Although, alpha for the client technology was low and it is recommended that further work be done with regard to this scale. Total explained variance of the instrument was also low indicating further study is needed to better define and measure the concept of nursing care complexity. However, initial reliability and construct validity of two subscales (operations technology and knowledge technology) has been established to the extent that the instrument, as a single scale, can provide a measure of nursing care complexity in nursing homes.
APPENDIX A

LETTERS OF PERMISSION
Permission to Reprint is granted to: Donna Velasquez, 7331 E. Roosevelt, Scottsdale, AZ 85257

- Beverly P. Lynch, “An Empirical Assessment of Perrow’s Technology Construct” Volume 19, Number 3 (September 1974)
- Peggy Less, Rodney Schneck, “Nursing Subunit Technology: A Replication” Volume 26, Number 2 (June 1981)

The following phrase should appear, giving full identification of author, title, volume, and issue numbers. "Reprinted from (title of article) by (author) published in Administrative Science Quarterly (volume and issue number) by permission of Administrative Science Quarterly.” The identical copyright notice appearing in our publication should follow this phrase. ©

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Date of approval December 20, 2004.

Approved: Administrative Science Quarterly

Sally A. Iacovelli, Business Manager
APPENDIX B

HUMAN SUBJECTS – EXEMPT STATUS
5 July 2005

Donna Velasquez, Ph.D., candidate
Advisor: Joyce Verran, Ph.D.; RN
College of Nursing
P.O. Box 210203

RE: MEASURING NURSING CARE COMPLEXITY IN NURSING HOMES

Dear Ms. Velasquez:

We received documents concerning your research proposal as cited above. This project involves the development and testing of a questionnaire that measures the perceived complexity of work performed in nursing homes by the nursing staff. The procedures to be followed in this study pose no risk to subjects providing the data. Regulations issued by the U.S. Department of Health and Human Service [45 CFR Part 46.110(b)(2)] exempt this type of research from review by our Institutional Review Board.

Exempt status is granted with the understanding that no further changes or additions will be made either to the procedures followed or to the consenting instrument used (copies of which we have on file) without the review and approval of the Human Subjects Committee and your College or Departmental Review Committee. Any research related physical or psychological harm to any subject must also be reported to each committee.

Thank you for informing us of your work. If you have any questions concerning the above, please contact this office.

Sincerely yours,

[Signature]
Rebecca W. Dahl, RN, Ph.D.
Director
Human Subjects Protection Program

RWD:pm

cc: Departmental/College Review Committee
APPENDIX C

CONTENT VALIDITY: EXPERT OPINION INSTRUMENT
Instructions: The following questions are being asked to measure the complexity of the work done by direct patient-care providers in nursing homes (including RNs, LPNs, and CNAs). The questions are based on Perrow’s Model of Technology and definitions of construct dimensions are provided. Please check the box which most accurately describes how relevant you think each question is as it relates to the definition. Readability has been purposefully kept below an eighth grade level. If you feel the question is relevant but needs minor alteration, please feel free to add your suggestions.

Thank you,
Donna Velasquez
Doctoral Candidate
Client Technology- Two dimensions are conceptualized.

*Understandability*- the extent to which the client and their problems are known by the direct care provider and the extent to which client responses are perceived to be known and predictable.

*Standardization*- the extent to which client problems can be addressed by set protocols or procedures or whether continuous adjustment of treatment is necessary.

<table>
<thead>
<tr>
<th>Understandability</th>
<th>Not relevant</th>
<th>Unable to assess relevance without item revision</th>
<th>Relevant but needs minor alteration</th>
<th>Very relevant &amp; succinct</th>
<th>Comments: Suggestions for alteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>To what extent the patients you care for have multiple problems?</td>
<td></td>
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<tr>
<td>To what extent do the patients you care for have complex problems or problems that are difficult to understand?</td>
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<tr>
<td>How often do you care for the same patients day-to-day?</td>
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<tr>
<td>To what extent do you know your patients so that you can tell when they have a change in their health?</td>
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<tr>
<td>To what extent do you understand your patient’s health problems?</td>
<td></td>
<td></td>
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<tr>
<td>To what extent do your patients respond the same to treatments or medications from day-to-day?</td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
How often do most of your patients have simple, well understood problems?

How often do the patients you care for change so frequently that you don’t know them well enough to tell if there is a change in their condition?

<table>
<thead>
<tr>
<th><strong>Standardized Treatment</strong></th>
<th>Not relevant</th>
<th>Unable to assess relevance without item revision</th>
<th>Relevant but needs minor alteration</th>
<th>Very relevant &amp; succinct</th>
<th>Comments: Suggestions for alteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>To what extent are there set protocols or procedures for caring for your patients?</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>To what extent is the care you give to each patient individualized for that patient?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To what extent can the patients you care for be treated in the same way?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To do your work, to what extent can you actually rely on established procedures and practices?</td>
<td></td>
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<tr>
<td>To what extent is the care you give to patients routine and automatic?</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>To what extent is there a standard or usual way to treat most of your patient’s health problems?</td>
<td></td>
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</tr>
</tbody>
</table>
To what extent do you give patient care guided by written procedure manuals?

To what extent do the patients you care for require different treatments or types of care from day-to-day?

To what extent is no routine or standardized way to care for your patients?

To what extent is the care you give considered as regular nursing care given to a patient with the same type of health problem?

<table>
<thead>
<tr>
<th>Operations Technology</th>
<th>Consists of two dimensions that describe the extent to which work activities are automated and/or highly sequenced or linked in a series of predetermined steps.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equipment automation</strong></td>
<td>- Includes quantity of automated equipment and level of sophistication of equipment as measure by such characteristics as frequency of calibration, amount of additional training required to operate equipment, invasiveness of equipment, and amount of “troubleshooting” required.</td>
</tr>
<tr>
<td><strong>Sequence rigidity</strong></td>
<td>- The extent to which procedures must be completed in a predetermined step by step manner and the extent to which there are adverse consequences to not completing procedures in the prescribed manner.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment automation</th>
<th>Not relevant</th>
<th>Unable to assess relevance without item revision</th>
<th>Relevant but needs minor alteration</th>
<th>Very relevant &amp; succinct</th>
<th>Comments: Suggestions for alteration</th>
</tr>
</thead>
</table>

How often do you use equipment such as (suction machines, monitors, IV pumps, automatic blood pressure machines) day-to-day?
<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>To what extent did you have special training to use the equipment you</td>
<td></td>
</tr>
<tr>
<td>use to care for your patients?</td>
<td></td>
</tr>
<tr>
<td>How often do you need to adjust or troubleshoot the equipment you use</td>
<td></td>
</tr>
<tr>
<td>to care for your patients?</td>
<td></td>
</tr>
<tr>
<td>How much of your work involves doing technical procedures or special</td>
<td></td>
</tr>
<tr>
<td>tests?</td>
<td></td>
</tr>
<tr>
<td>To what extent does the equipment you use day-to-day become outdated?</td>
<td></td>
</tr>
<tr>
<td>How often do you have to calibrate the equipment you use to care for</td>
<td></td>
</tr>
<tr>
<td>patients?</td>
<td></td>
</tr>
<tr>
<td>How often do you have special training or classes to learn to use new</td>
<td></td>
</tr>
<tr>
<td>equipment?</td>
<td></td>
</tr>
<tr>
<td>To what extent is the type of equipment you use the same for all of your</td>
<td></td>
</tr>
<tr>
<td>patients?</td>
<td></td>
</tr>
<tr>
<td>To what extent is the type of equipment you use for patient care simple</td>
<td></td>
</tr>
<tr>
<td>to operate?</td>
<td></td>
</tr>
<tr>
<td><strong>Sequence rigidity</strong></td>
<td>Not relevant</td>
</tr>
<tr>
<td>------------------------</td>
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</tr>
<tr>
<td>To what extent is it necessary that your work be done in a certain order?</td>
<td></td>
</tr>
<tr>
<td>To what extent would there be a bad outcome if your work were not done in a certain order?</td>
<td></td>
</tr>
<tr>
<td>To what extent can you change the order of the tasks you do to care for your patients day-to-day?</td>
<td></td>
</tr>
<tr>
<td>To what extent do you do procedures that require you to do them in a certain order?</td>
<td></td>
</tr>
<tr>
<td>To what extent do your patients require that you care for them in a certain order?</td>
<td></td>
</tr>
<tr>
<td>To what extent are you able to decide the order in which you do your work?</td>
<td></td>
</tr>
<tr>
<td>To what extent do procedures have better results if you do them in a certain order?</td>
<td></td>
</tr>
</tbody>
</table>
To what extent does your work turn out the same no matter which order you do it?

How often is it necessary for you to follow procedures step by step?

---

Knowledge Technology - the knowledge necessary to deliver nursing care as perceived by the direct care provider

*Exceptional Cases* - how familiar/predictable or unfamiliar/unpredictable events are that occur throughout the course of the day while caring for clients; how routine the work is throughout the work day

*Analyzability* - the extent to which analytical thought or search processes are necessary to deliver nursing care.

<table>
<thead>
<tr>
<th>Exceptional Cases</th>
<th>Not relevant</th>
<th>Unable to assess relevance without item revision</th>
<th>Relevant but needs minor alteration</th>
<th>Very relevant &amp; succinct</th>
<th>Comments: Suggestions for alteration</th>
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</thead>
<tbody>
<tr>
<td>Think of all the kinds of jobs that you do during your work day. How many of these tasks are the same from day to day?</td>
<td></td>
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<tr>
<td>How often do you know how the jobs or tasks you do during the day will turn out?</td>
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<tr>
<td>How often do you come across new or different kinds of problems in your work?</td>
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<tr>
<td>Question</td>
<td>Response</td>
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<tr>
<td>To what extent do most of your patients require the different or unknown types of care from day to day?</td>
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<tr>
<td>How repetitious are your duties?</td>
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<tr>
<td>To what extent do you feel work is the same from day-to-day?</td>
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<tr>
<td>To what extent would you say your work is routine?</td>
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<tr>
<td>To what extent do you do the same job in the same way most of the time?</td>
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<tr>
<td>How often does your work change because of a patient’s condition or mood?</td>
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<tr>
<td>How often in your job is there something new happening every day?</td>
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<tr>
<td>How often do you encounter unfamiliar or unexpected events at work?</td>
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<tr>
<td>How often do “emergencies” happen during the day?</td>
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<tr>
<td>How often do events occur on your unit that makes it necessary to change the way you do your work?</td>
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</tbody>
</table>
How often do the patients you care for require a change in treatment because their health problem has changed?

<table>
<thead>
<tr>
<th>Analyzability</th>
<th>Not relevant</th>
<th>Unable to assess relevance without item revision</th>
<th>Relevant but needs minor alteration</th>
<th>Very relevant &amp; succinct</th>
<th>Comments: Suggestions for alteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you have to think about how to solve problems that happen throughout the day?</td>
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<tr>
<td>To what extent are the work decisions you make the same from day to day?</td>
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<tr>
<td>To what extent are the jobs and tasks that make up your work easy to handle?</td>
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<tr>
<td>To what extent do you have to spend time thinking and planning care for your patients?</td>
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<tr>
<td>To what extent do your nursing actions for each patient require careful thinking about rather than relying on a standard or set procedure?</td>
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<tr>
<td>Question</td>
<td>Answer</td>
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<td>------------------------------------------------------------------------</td>
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<tr>
<td>To what extent is there a clearly known way to do most of the work you do from day-to-day?</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>When there is more than one way to perform a care procedure (feeding, bathing, dressing, etc.) for a patient, how free are you to choose the method you think is best?</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>How often does the care you give rely on intuition rather than on set procedures or routines?</td>
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<tr>
<td>To what extent does it take a lot of thought and planning to care for your patients?</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>How often are the decisions you make during the work day automatic rather than needing a lot of extra thought?</td>
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</tbody>
</table>
APPENDIX D

STUDY INSTRUMENTS
Measuring Nursing Care Complexity in Nursing Homes
Demographic Form

Code #: __________________

1. What is the name of the facility where you work?

2. What unit do you work on?

3. How long have you worked on this unit? (Please circle)
   - 6 weeks to 3 months
   - 4 months to 1 year
   - More than 1 year but less than 5 years
   - More than 5 years

4. What is your job title? (Please circle)
   - Nursing assistant
   - Healthcare aide
   - Licensed practical nurse
   - Registered nurse
   - Other (please write in job title) _________________________

5. What is the grade in school you have completed? (Please circle)
   - 8th grade
   - Some high school
   - GED
   - High School graduate
   - Some college
   - Associate degree
   - Bachelor’s degree
   - Master’s degree
   - Other (please write in) _________________________

6. What age group are you in? (Please circle)
   - 18-25 years
   - 26-35 years
   - 36-45 years
   - 46-55 years
   - 56-65 years
   - 66 years or older

7. What is your work status? (Please circle)   Full-time         Part-time

8. What shift do you work? (Please circle)
   - Day shift
   - Evening shift
   - Night shift
   - Rotating shifts
Nursing Care Complexity Questionnaire - Nursing Home (NCCQ-NH)

Directions: Think about the nursing unit you have worked on most frequently for the past 6 weeks. Please circle the number (1, 2, 3, or 4) which most closely describes how you feel about the work you do while giving patient care. It is important to try and answer all questions.

1. How often do your patients have many different health problems?
   1. Never 2. 3. 4. Frequently

2. How often do your patients have complicated problems (problems that are hard to understand)?
   1. Never 2. 3. 4. Frequently

3. How often do you care for the same patients day-to-day?
   1. Never 2. 3. 4. Frequently

4. How often do you know your patients well enough so that it is easy to tell when there is a change in their health?
   1. Not Very Well 2. 3. 4. Very Well

5. How well do you understand your patient’s health problems?
   1. Not Very Well 2. 3. 4. Very Well

6. How often do your patients have simple, easy to understand problems?
   1. Never 2. 3. 4. Frequently
7. How often do you feel that you don’t know your patients well enough to tell if their condition changes?

1 2 3 4
Never Frequently

8. How often is the care you give individualized or specific for that patient?

1 2 3 4
Never Frequently

9. How often is the care you give for one patient the same as you give to most of your other patients?

1 2 3 4
Never Frequently

10. How often can you use established or set procedures or guidelines to care for your patients?

1 2 3 4
Never Frequently

11. How much of the time is the care you give to patients routine or automatic?

1 2 3 4
Never Frequently

12. How often is there a standard or usual way to treat your patient’s health problems?

1 2 3 4
Never Frequently

13. How often do your patients require different or new types of treatments or care?

1 2 3 4
Never Frequently

14. How often do you use equipment, such as suction machines, monitors, IV pumps, or automatic blood pressure machines to give patient care?

1 2 3 4
Never Frequently
15. How often do you get special training for the equipment you use for patient care?

1. Never  
2.  
3.  
4. Frequently

16. How often do you need to adjust or troubleshoot the equipment you use while giving patient care?

1. Never  
2.  
3.  
4. Frequently

17. To give patient care, how much of your work involves doing technical procedures or special tests?

1. None  
2.  
3.  
4. All

18. How often is the type of equipment you use for patient care simple to operate?

1. Never  
2.  
3.  
4. Frequently

19. How often is it necessary that patient care be given in a certain order?

1. Never  
2.  
3.  
4. Frequently

20. How often would there be a bad outcome if patient care was not given in a certain order?

1. Never  
2.  
3.  
4. Frequently

21. How often can you change the order of the tasks you do while giving patient care?

1. Never  
2.  
3.  
4. Frequently

22. How often do you perform patient care procedures that must be completed in a certain order?

1. Never  
2.  
3.  
4. Frequently
23. How often do your patients require that you care for them in a certain way?

1. Never
2.            3                            4
   Frequently

24. How often are you able to decide the order in which you give patient care?

1. Never
2.            3                            4
   Frequently

25. How often do patient care procedures have better results if you do them in a certain order?

1. Never
2.            3                            4
   Frequently

26. When giving patient care, how often does your work turn out the same no matter in which order it is done?

1. Never
2.            3                            4
   Frequently

27. How often is it necessary for you to follow patient care procedures step-by-step?

1. Never
2.            3                            4
   Frequently

28. When giving patient care, how often do you know how the jobs or tasks you do will turn out?

1. Never
2.            3                            4
   Frequently

29. How often do you come across new or different kinds of problems while giving patient care?

1. Never
2.            3                            4
   Frequently

30. How often do your patients need different or unknown types of care?

1. Never
2.            3                            4
   Frequently
31. How often do you feel the work you do while giving patient care is the same from day-to-day?

1  2  3  4
Never  Frequently

32. How often do you do the same patient care tasks in the same way day-to-day?

1  2  3  4
Never  Frequently

33. How often does your work change because of a patient’s condition or mood?

1  2  3  4
Never  Frequently

34. How often do you encounter unfamiliar or unexpected events while caring for patients?

1  2  3  4
Never  Frequently

35. How often do “emergencies” happen during the day?

1  2  3  4
Never  Frequently

36. How often do things happen on your unit that makes it necessary to change the way you give patient care?

1  2  3  4
Never  Frequently

37. How often is there something “new” happening on your job that affects how you give patient care?

1  2  3  4
Never  Frequently

38. How often do you have to think about how to solve problems that happen while you are giving patient care?

1  2  3  4
Never  Frequently
39. When giving patient care, how often are the decisions you make the same from day-to-day?

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40. How often do you find patient care problems easy to solve?

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41. How often do you have to spend extra time thinking and planning about the kind of care your patients need?

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42. How often do your patient care actions require extra thought rather than just being able to rely on standard procedures or guidelines?

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43. When there is more than one way to perform a patient care procedure (feeding, bathing, dressing, etc) how often can you choose the method or way you think is best for the patient?

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44. How often does the patient care you give rely on intuition (your “gut feeling”) rather than on set procedures or routines?

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45. How often are the decisions you make while giving patient care automatic?

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APPENDIX E

19-ITEM TOTAL SCALE
Nursing Care Complexity Questionnaire-Nursing Home (NCCQ-NH)
19-Item Total Scale

Directions: Think about the nursing unit you have worked on most frequently for the past 6 weeks. Please circle the number (1, 2, 3, or 4) which most closely describes how you feel about the work you do while giving patient care. It is important to try and answer all questions.

1. How often is the care you give for one patient the same as you give to most of your other patients?

   1
   Never
   2
   3
   4
   Frequently

2. How often can you use established or set procedures or guidelines to care for your patients?

   1
   Never
   2
   3
   4
   Frequently

3. How much of the time is the care you give to patients routine or automatic?

   1
   Never
   2
   3
   4
   Frequently

4. How often is there a standard or usual way to treat your patient’s health problems?

   1
   Never
   2
   3
   4
   Frequently

5. How often is it necessary that patient care be given in a certain order?

   1
   Never
   2
   3
   4
   Frequently

6. How often would there be a bad outcome if patient care was not given in a certain order?

   1
   Never
   2
   3
   4
   Frequently
7. How often do you perform patient care procedures that must be completed in a certain order?

1  2  3  4
Never  Frequently

8. How often do your patients require that you care for them in a certain way?

1  2  3  4
Never  Frequently

9. How often do patient care procedures have better results if you do them in a certain order?

1  2  3  4
Never  Frequently

10. How often is it necessary for you to follow patient care procedures step-by-step?

1  2  3  4
Never  Frequently

11. How often do you come across new or different kinds of problems while giving patient care?

1  2  3  4
Never  Frequently

12. How often does your work change because of a patient’s condition or mood?

1  2  3  4
Never  Frequently

13. How often do you encounter unfamiliar or unexpected events while caring for patients?

1  2  3  4
Never  Frequently

14. How often do things happen on your unit that makes it necessary to change the way you give patient care?

1  2  3  4
Never  Frequently
15. How often is there something “new” happening on your job that affects how you give patient care?

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16. How often do you have to think about how to solve problems that happen while you are giving patient care?

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17. How often do your patient care actions require extra thought rather than just being able to rely on standard procedures or guidelines?

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18. When there is more than one way to perform a patient care procedure (feeding, bathing, dressing, etc) how often can you choose the method or way you think is best for the patient?

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19. How often does the patient care you give rely on intuition (your “gut feeling”) rather than on set procedures or routines?

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APPENDIX F

INSTRUMENTS TO TEST CONVERGENT VALIDITY
Work Unit Technology Scale

Directions: For the following 10 questions, think about all the work you do in a day. Please circle the number (1, 2, 3, or 4) that most closely describes the work you do from day-to-day.

1. Think of the tasks you do during the course of your work. How many of these tasks are the same from day to day?
   1. Very few
   2. Most of them

2. To what extent would you say your work is routine?
   1. To a small extent
   2. To a great extent

3. People in this unit do about the same job in the same way most of the time.
   1. To a small extent
   2. To a great extent

4. Basically, unit members perform repetitive activities in doing their jobs.
   1. To a small extent
   2. To a great extent

5. How repetitious are your duties?
   1. Very little
   2. Very much

6. To what extent is there a clearly known way to do the major types of work you normally encounter?
   1. To a small extent
   2. To a great extent

7. To what extent is there a clearly defined body of knowledge of subject matter which can guide you in doing your work?
   1. To a small extent
   2. To a great extent

8. To what extent is there an understandable sequence of steps that can be followed in doing your work?
   1. To a small extent
   2. To a great extent

9. To do your work, to what extent can you actually rely on established procedures and practices?
   1. To a small extent
   2. To a great extent

10. To what extent is there an understandable sequence of steps that can be followed in carrying out your work?
    1. To a small extent
    2. To a great extent
Modified Magnitude of Nursing Care Complexity

Directions: Read the following definition of “Nursing Care Complexity. Then draw a slash through the line under the question asking you to rate how complicated you think the nursing care complexity is that you give.

Examples Only:
If the patient care is very routine and you do not have to spend a lot of time thinking about it, then you would rate “nursing care complexity” closer to zero “0” or “very simple”.

/------------------------------------------------------------------------/

0                                                                 100
Very simple                                                        Very complex

If your patients are very complicated and it takes a lot of knowledge to care for them, then you would rate “nursing care complexity” closer to “100” or “very complex”.

/------------------------------------------------------------------------/

0                                                                 100
Very simple                                                        Very Complex

Please Read

Nursing care complexity is defined as how complicated it is to care for your patients. It includes how many problems your patients have and how much knowledge you need to care for them, how much equipment is used, and how important it is that the care is done in a certain order. It does not matter how long it takes to give patient care. Something may take a long time to finish but you still may think that it is a simple task.

How would you rate the overall level of nursing care complexity that you provide on your unit?

0                                                                 100
Very Simple                                                        Very Complex
APPENDIX G

SINGLE SCALE RECOMMENDED FOR IMMEDIATE USE
Nursing Care Complexity Questionnaire-Nursing Home (NCCQ-NH)
(15-Item Single Scale for Immediate Use)

Directions: Think about the nursing unit you have worked on most frequently for the past 6 weeks. Please circle the number (1, 2, 3, or 4) which most closely describes how you feel about the work you do while giving patient care. It is important to try and answer all questions.

1. How often is it necessary that patient care be given in a certain order?

   
   
   
   \[
   \begin{array}{cccc}
   1 & 2 & 3 & 4 \\
   \text{Never} & \text{Frequently}
   \end{array}
   \]

2. How often would there be a bad outcome if patient care was not given in a certain order?

   
   
   
   \[
   \begin{array}{cccc}
   1 & 2 & 3 & 4 \\
   \text{Never} & \text{Frequently}
   \end{array}
   \]

3. How often do you perform patient care procedures that must be completed in a certain order?

   
   
   
   \[
   \begin{array}{cccc}
   1 & 2 & 3 & 4 \\
   \text{Never} & \text{Frequently}
   \end{array}
   \]

4. How often do your patients require that you care for them in a certain way?

   
   
   
   \[
   \begin{array}{cccc}
   1 & 2 & 3 & 4 \\
   \text{Never} & \text{Frequently}
   \end{array}
   \]

5. How often do patient care procedures have better results if you do them in a certain order?

   
   
   
   \[
   \begin{array}{cccc}
   1 & 2 & 3 & 4 \\
   \text{Never} & \text{Frequently}
   \end{array}
   \]

6. How often is it necessary for you to follow patient care procedures step-by-step?

   
   
   
   \[
   \begin{array}{cccc}
   1 & 2 & 3 & 4 \\
   \text{Never} & \text{Frequently}
   \end{array}
   \]

7. How often do you come across new or different kinds of problems while giving patient care?

   
   
   
   \[
   \begin{array}{cccc}
   1 & 2 & 3 & 4 \\
   \text{Never} & \text{Frequently}
   \end{array}
   \]

8. How often does your work change because of a patient’s condition or mood?

   
   
   
   \[
   \begin{array}{cccc}
   1 & 2 & 3 & 4 \\
   \text{Never} & \text{Frequently}
   \end{array}
   \]
9. How often do you encounter unfamiliar or unexpected events while caring for patients?

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10. How often do things happen on your unit that makes it necessary to change the way you give patient care?

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REFERENCES


Castle, N.G. (2000). Differences in nursing homes with increasing and decreasing use of physical restraints. *Medical Care, 38*(12), 1154-1163.


