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Nurses' Decision Making and Pain Management Outcomes

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Nurses' Decision-making Processes and Pain Management Outcomes

John M. Fedo, PhD.

University of Connecticut, 2014

Abstract

The purpose of this study was to identify the cognitive processes used by nurses when making pain management decisions by testing how the structure of a task (well-structured or ill-structured) affects use of analytic cognitive processes. Identifying cognitive processes which nurses use to make clinical decisions in the practice setting may be used to gain understanding of which types of cognitive processes are more effective when managing decisions for planned pain management interventions. Two hypotheses were tested. H1: Nurses reading the well-structured patient vignette will use analytical cognitive processes more than nurses reading the ill-structured vignette, and H2: There is an association between the analytical cognitive processes identified on the continuum and the pain management interventions used.

The theoretical underpinning for the study was cognitive continuum theory. Cognitive continuum proposes cognitive processes occur on a continuum. One end of the continuum is anchored in analysis and the other anchored in intuition with varying degrees of analysis and intuition between.

Two hundred medical surgical nurses participated. Demographic data were collected and the nurses were randomly assigned to read either a well-structured pain vignette or an ill-structured pain vignette. The well-structured vignette was developed and pilot tested to induce analytical cognitive processes and the ill-structured vignette to induce intuitive cognitive processes. Nurses read the vignette and then responded out

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loud describing what they would think and what actions they would take as the nurse caring for the patient. The well-structured vignette described a patient with a leg fracture. The ill-structured vignette included the addition of a family visit to manipulate the task structure characteristics. Protocol analysis was used to gather the verbal data. Protocol analysis elicits the thoughts of a person in a given situation. Content analysis was used to analyze the transcripts for nurses' use of analytic and intuitive cognitive processes, and planned pain management interventions.

Results did not support that the structure of the situation affected the type of cognitive processes used by nurses, that well-structured situations increase use of analytic cognitive processes and ill-structured increased intuitive cognitive processes. Increased use of analytic cognitive processes was positively correlated with planned use of a greater number of pain management interventions, however. The small positive correlation indicates that teaching nurses to use analytical cognitive processes when managing patients pain will increase the number of appropriate pain management actions used by the nurse.

Nurses' Decision-making Processes and Pain Management Outcomes

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CHAPTER 1: INTRODUCTION TO THE STUDY

Background

The purpose of the current study was to identify the cognitive processes that nurses use when making decisions about planned pain management interventions. Decision-making is an intrinsic and essential skill that a nurse uses in clinical practice (Bjork & Hamilton, 2011; Bucknall, 2000; Gillespie, 2010). Nurses make numerous, rapid decisions in a highly complex environment (Gillespie, 2010). Nurses decide what patient data are collected, how to process the data collected, and how to evaluate the outcomes of nursing and medical interventions (Bucknall, 2000). Increased patient acuity, decreased length of patient stay, and advances in technology have been circumstances within which nurses need to think quickly (Simmons, 2010). Nurses' decisions have direct influence on patient care, which in turn, has an effect on outcomes for patients, and may be formative in the healthcare experience of the patient (Bakalis & Watson, 2005; Thompson & Dowding, 2002). Increasingly, nurses are being held accountable for their decisions and the associated outcomes of those decisions (Thompson & Dowding, 2002). Errors in clinical decisions may lead to poor patient care.

Decision making is a complex process, and research has focused on different models and theories, however, no one model or theory fully describes cognitive processes in making clinical decisions for planned pain management interventions. Identifying cognitive processes which nurses use to make clinical decisions in the practice setting may be used to gain understanding of which types of cognitive processes are used to manage decisions for planned pain management interventions. More effective clinical

practice may be possible as effective cognitive practices are identified and errors in decision-making are remedied (Crabtree, 2009; Thompson et al., 2002). Nurses who can articulate the nature and scope of their expertise of cognitive processes and have a better understanding of the cognitive processes could foster awareness of expert decision-making practice to attain optimal decisions (Evans, 2005). If nurses are not clear in their understanding and articulation of the nature and scope of the cognitive processes they use to attain optimal decisions, this could lead to an escalation in difficulty in communicating with other health professional as well as patients (Evans, 2005).

Conceptual Underpinning

Decision-making research in nursing has focused on two distinct models used to describe the cognitive process in decision-making. The two research models have been the systematic-positivist model and the intuitive-humanist model (Bjork & Hamilton, 2011; Thompson, 1999).

The systematic-positivist model was embraced in the nursing profession in the 1970s and the 1980s as a means of giving legitimacy to nursing science (Lee, Chan, & Phillips, 2006). The emphasis on the use of explicit, analytical cognitive processes in decision-making was believed to lead to superior outcomes for patients (de Vries, Witterman, Holland, & Dijksterhurs, 2010). As the systematic positivist model became more widely used, it was argued that the rigid procedures of analytic decision-making was not conducive to decision-making in all situations, such as rapid crisis decision-making, and was prone to produce errors (Lee et al., 2006).

The intuitive-humanist model gained momentum in the late 1980s. The intuitive-humanist model is based on the work of Benner (1984). Benner's research

showed support for intuition as a legitimate decision-making process. Cioffi (1997) stated, however, the legitimacy of intuition was not widely accepted and that intuition was “renounced due to its association with gender; women were thought to be unscientific” (p. 203). Banning (2007) suggested “intuition [had] been viewed with skepticism as the process did not employ scientific reasoning” (p.189). The use of early intuitive decision-making as a cognitive process was questioned for producing errors by the introduction of cognitive biases (Harbison, 2001). Researchers (Buckingham & Adams, 2000; Doherty & Kurz, 1996; Thompson, 1999) suggested that the cognitive processes used in decision-making were neither completely analytical, nor intuitive.

Hammond’s (1996) cognitive continuum theory was developed as an alternative decision making theory. Hammond suggested the cognitive processes used in decision-making were arranged on a continuum with intuition anchored at one end of the continuum and analysis anchored at the opposite end. The area between the two anchors is what Hammond calls quasirationality. Quasirationality is made up of varying degrees of intuition and analysis. The cognitive model is dependent on (a) the structure of the task, (b) the number of information cues, and (c) the time available to make the decision (Hammond, 1996).

In conclusion, the nursing profession has been polarized by which cognitive processes and decision-making result in the most appropriate decisions for best outcomes for patients (Buckingham & Adams, 2000; Doherty & Kurz, 1996; Thompson, 1999). Neither the systematic-positivists model, nor the intuitive-humanist model is used to account for the breadth of cognitive processes used in making

decisions. Hammond's cognitive continuum model is a unified approach to understanding cognitive processes used in decision-making.

Statement of Problem

Research on decision-making in nursing has had a broad topical focus. Research has been conducted on: (a) nursing process (Bucknall, 2000; Evans, 2005), (b) medication management (Manias, Aitken, & Dunning, 2004), (c) heart failure (Dowding, Spilsbury, Thompson, Brownlow, & Pattenden, 2009), (d) critical care (Hicks, Merritt, & Elstein, 2003), and (e) medicine (Norman, 2005). These studies have been focused on either the systematic-positivist model or the humanist-intuitive model as guides in decision-making research.

The systematic-positivist model is based in empirical, rational, and consistent cognitive processes. The model does not take into account contextual variables of a situation, such as social interactions (Bucknall, 2000). While the systematic-positivist model has been shown to be more accurate in reaching decisions, if there are flaws in the initial assessment of the situation, significant errors in decisions can be made (Bucknall, 2000; Standing, 2008).

The humanist-intuitive model is based in intuitive cognitive processes. The model has been shown to be accurate in situations that require time limited decisions or present with large volumes of information (Hall, 2002). The success of the humanist-intuitive model has been correlated with the experience level of the decision maker (Hall, 2002; Lamond & Thompson, 2000; Thompson, 2002). If the decision maker has limited experience with the situation presented or relies on previous experience and

representativeness of the situation, significant errors can be made (Hall, 2002; Lamond & Thompson, 2000; Thompson, 2002).

Hammond's cognitive continuum theory began to be used in decision-making research in the 1980s (Dowie & Elstein, 1987). Studies using his theory include: pharmacology prescribing (Offredy, Kendall, & Goodman, 2008), clinical judgment (Standing, 2008), naval pilot decision-making (Dunwoody, Haarbruer, Mahan, Marino, & Tang, 2000), manufacturing (Mahan, 1994), and leadership (Kutschera & Byrd, 2005).

Offredy et al. (2008) used the cognitive continuum theory to examine nurse practitioners' pharmacological knowledge and decision-making when prescribing medications. The researchers used semi structured interviews and four patient scenarios. Twenty-five nurses participated in the study. The majority of cognitive processes used by the nurses when making decisions on prescribing medications were on the intuitive quasirational spectrum of the continuum. The nurses who used the intuitive quasirational cognitive processes were more likely to fail to identify issues with prescribing, indicating that pharmacological knowledge was a factor in decision-making. The study supported the use of the cognitive continuum theory as a valid model to identify the cognitive processes used in decision-making. The research also suggested the level of experience and knowledge of the individual influenced the cognitive processes used.

Dunwoody et al. (2000) tested the use of the cognitive continuum theory with a group of 104 college students. The students were asked to make judgments about naval command aircraft threats. The researchers designed three scenarios: scenario one was

designed to induce intuitive cognition; scenario two designed to induce quasirational cognition; scenario three designed to induce analytical cognition. The results of the study indicated the students assigned to the intuitive scenario had statistically significant shorter judgment times compared to the analytical group. The students assigned to the analytical group performed judgment tasks better than the other two groups. The researchers also examined the role of correspondence in decision-making. Correspondence refers to the accuracy of the person's cognition system to judge physical properties. Coherence of the judgment is based on the person's knowledge of related concepts and theories. The results of the study supported the number of cues presented, amount of redundancy built into the scenarios, and if the cues were presented in order or simultaneously affected both correspondence and coherence.

Mahan (1994) used the cognitive continuum theory to evaluate how occupational stress in the workplace affected complex decision-making. Twenty-four students participated in the study to understand judgment tasks. The students were given scenarios on production output in manufacturing and were asked to make judgments about the number of operating lines, staffing, machine down time and scheduled maintenance breaks. The findings of the study supported the use of the cognitive continuum theory as a framework to evaluate the effects of occupational stress on complex decision-making. The study further supported that judgments made were affected by the task duration and task uncertainty. The indices that were measured for achievement and consistency became smaller as task duration and task uncertainty increased.

Kutschera and Byrd (2005) applied the cognitive continuum theory to leadership training. The aim of the training was to use cognitive continuum theory with staff to increase their awareness of their own cognitive styles. Using a case discussion method, the participants were asked to rethink how decisions were made. Framing and reframing responses to situations in the context of the type of cognitive processes used to make decisions was the strategy used to increase awareness of the participants. The program proved to be successful, in that cognitive continuum theory can foster the use of different cognitive processes to reach decisions.

The use of cognitive continuum theory has not been used when evaluating the cognitive processes used for pain management decisions. The following studies show the current state of pain assessment and pain management.

Despite the large number of research studies on pain assessment and pain management, there continue to be reports of inadequate pain management. There is variability in the reports. For example, Hutchinson (2007) reported 80% of postoperative patients had severe pain after surgery despite treatment for pain, while Botti, Bucknall, and Manias (2004) reported 34% of postoperative patients reported continued severe pain, despite treatment for pain. Inadequately managed pain may result in delays in recovery time, decrease quality of life, increased health costs, and decreased patient satisfaction (Hutchinson, 2007). The complexity of pain management, which has multiple components, such as physiological, emotional, cognitive, and social dimensions, has led to abundant research literature in pain management. The majority of the literature was focused on barriers to pain management, such as knowledge of pharmacology, perceptions of patient pain, and individual and personal biases (e.g. Bell

& Duffy, 2009; Botti, Bucknall, & Manias, 2004; Hirsh, Jensen, & Robinson, 2010).

Few published research articles were found that were focused on decision-making and pain management (Brockopp et al., 2004; Ferrell, Eberts, McCaffrey, & Grant, 1991). Brockopp et al. (2004) developed a clinical decision-making questionnaire, however the focus of the questionnaire was on the amount of time and energy the nurse would spend on managing patient's pain and not the cognitive processes to arrive at a pain management decision. Ferrell et al.'s (1991) work in decision-making and pain management focused on the behaviors the patient presented with, such as patient cues, barriers and ethical and moral conflicts that affected the nurse's decision-making when choosing pain management interventions. The gap in the literature is the lack of research on what cognitive processes nurses use when choosing pain interventions. Additionally, no literature exists on the use of the cognitive continuum theory in intended pain management interventions.

Significance of the Study

The current study may contribute to the body of literature addressing cognitive processes and decision-making in pain management. The goal of decision-making research is to understand how knowledge is applied in real world situations (Hudson, 2009; Hertz, Chinn, Barnhill & Hertz, 2012). Cognitive processes used to evaluate risk, benefits, and consequences need to be understood so that desired and optimal decision are reached and undesired decisions minimized or avoided (Jonassen, 2012; Knauff & Wolf, 2010; Hudson, 2009).

Nursing and medical knowledge and the amount of information available have increased dramatically; thus, decision-making in healthcare has changed rapidly and

continues to do so. There is also increased complexity of patient presentation. The need for the healthcare provider to reach effective decisions to provide safe, rapid, and effective care is tantamount to achieving positive outcomes (Knauff & Wolf, 2010). Research in cognitive processes and decision-making has shown that many people assume the cognitive processes they use result in a systematic and rational decision. However, people may instead rely on previous perceptions of a situation and use selective memory to make a decision. Currently there is limited research directed at how to apply the understanding of cognitive processes that will lead to effective decision-making. The understanding of the cognitive processes may lead to strategies to teach decision-making. This research may be important to stakeholders in many areas, such as: (a) academic nursing, (b) education, (c) practice arenas, and (d) outcomes research. Nursing educators might benefit from further knowledge of the cognitive processes that students use and have the opportunity to develop teaching strategies to foster beneficial cognitive processes for decision-making among students. The practice arena may benefit from development of research-based learning strategies of cognitive awareness for nurses to use to improve pain management for patients. If nurses employ expert cognitive processes in making decisions regarding pain management interventions and this may improve pain management for the patient.

Purpose

The purpose of the current study was to identify cognitive processes nurses use in making decisions about pain management interventions. Nurses' cognitive processes and the choices made directly affect the pain management of the patient. The following hypotheses were tested.

H1. Nurses reading the well-structured patient vignette will use analytical cognitive processes more than nurses reading the ill-structured vignette.

H2. There is an association between the analytical cognitive processes identified on the continuum and the pain management interventions selected.

Summary

In summary, cognitive processes used by nurses to make decisions take place in complex and rapidly changing situations. Increasingly nurses are being held accountable for the decisions they make. Research on the cognitive processes used to make decisions has focused on the systematic positivist model or the humanist intuitive model. Neither of the models fully explains the breadth of cognitive processes used when reaching a decision. Hammond's (1996) cognitive continuum theory combines elements of the systematic positivist and humanist intuitive models to address the dichotomy. The use of cognitive continuum model will give a better understanding of cognitive processes used in complex and changing environments, leading to the development of strategies to foster beneficial cognitive processes for decision-making among nurses. The purpose of the current study was to identify cognitive processes nurses used in making decisions about pain management interventions under well-structured and ill-structured conditions.

CHAPTER 2: REVIEW OF RELATED LITERATURE

Decision-Making Theory

The purpose of this study was to identify the cognitive processes used by nurses when making pain management decisions by testing how the structure of a task (well-structured or ill-structured) affects use of analytic cognitive processes. The literature review includes: (a) descriptive decision making, (b) normative decision making, (c) decision making in nursing, (d) decision making and cognitive continuum theory, (e) a brief overview of research in pain management, (f) an overview of protocol analysis.

Descriptive Decision Making Theory

Descriptive decision making theory describes how decisions are actually made (Hansson, 2005; Wang and Ruhe, 2007). Descriptive decision making has been studied from many different perspectives. The following models and theories describe a variety of frameworks to understand decision making. These include neuroscience, information processing, systems processing, and clinical decision making.

Gold and Shadlen (2007) examined decision-making from the perspective of neuroscience. The theoretical framework is that a simple sensory motor task activity is related to behavior. The researchers used Signal Detection Theory, which allows for the inference of behavior properties from underlying sensory representation. Signal Detection Theory is the first step of the analysis process. An associated theory, Sequential Analysis, is an extension of Signal Detection Theory and is a second step in the analysis process. Sequential Analysis has two phases. The first phase is determining whether a stimulus is present. The second phase consists of determining if it is time to stop the process and make a decision. The framework provides specific

mathematical operations and identifies decisional elements such as deliberation and commitment. The researchers devised experiments that included vibrotactile frequency discrimination, random dot motion direction discrimination, heading discrimination, face/object discrimination, and olfactory discrimination to understand how the brain forms decisions. Gold and Shadlen (2007) concluded that there are two distinct decision-making systems “one intuitive, which controls simple behaviors learned through repeated experience, and the other deliberative, which is designed to achieve goals in a dynamic environment” (p. 562). The use of Signal Detection Theory is limited, as it has not been applied beyond the lab, and was narrowly focused on decisions involving simple sensory motor tasks.

He and Huang (2007) proposed the use of multi-attribute utility theory and the relative maximum absolute value attribute to guide decision-making and risk management related to economics. They suggested risky decision-making can be understood through the cognition of risk attributes. The researchers proposed three theorems that mathematically describe risk attribute and decision-making. He and Huang used the Allais paradox to understand risk attribute and management and the relationship to decision-making in economics. The Allais paradox gives the person a choice of risky prospects in order to win one million dollars. He and Huang also argued other decision-making models only function at the methodological level instead of the theory level, such as expected utility theory. The limitations of this theory are that it has only been tested using one specific decision-making problem, the Allais paradox. To use the theory, multiple complex mathematical models are employed, which does not lend it to situations that require rapid decisions.

Sanfey, Lowenstein, McClure, and Cohen (2006) suggest different disciplines approach decision-making using different techniques and assumptions. They suggested applying the concepts of neuroscience and psychology to understand and predict decision-making better regarding economic choices. The researchers used the expected utility model that compares utility as the product of the value and probability of each potential outcome. Value is based on reward and punishment. Specific areas of the brain generate neurochemical responses to either reward or punishment as part of the execution of decision-making behaviors. The researchers made the distinction that there are two processes used in decision-making: automatic and controlled. Automatic processes are fast and efficient but highly specialized and relatively inflexible. Sanfey et al. (2006) suggested these automatic processes reflect “hardwired mechanisms” (p. 111). Automatic processes allow a task to be done efficiently while engaged in other activities. An example of this is the experienced driver who follows the same route to and from work daily. The task of consciously following the same route has become hardwired. Automatic processes engage the posterior cortical and subcortical systems. Both of these processes operate on a continuum. Controlled processes engage the posterior cortical and subcortical brain structures, and cognitive processes engage the limbic system, which reward processing structures through the ventral tegmental areas. Controlled processes are “relatively slow to engage and can only support a small number of pursuits at a time and are highly flexible”, (Sanfey et al., 2006, p. 112).

Rodgers and Housel (1987) examined cognitive processes, decision-making, and information on the decision-making of banking loan officers. The researchers proposed a two-stage cognitive process model for decision-making. Stage 1 consists of a

preliminary stage in which analysis of the problem is based on perceptual biases. The second stage consists of making summary inferences based on the information from Stage 1. The researchers recruited 59 Master of Business Administration students and 50 loan officers from local banks. Participants were given the Meyers-Brigg Type Indicator and, based on the results, were divided into two groups. One group was the data-driven perceptual type, and the second was the conceptually driven data type. Each participant received 10 randomized cases, five of which were from good-risk companies and five of which were from bad-risk companies. Risk was based on Moody's classification of stocks and bonds, income statements, and balance sheets. Participants were asked to decide the credit worthiness for securing a loan and make a recommendation for the loan approval or not. The results indicated that the conceptually driven data types made significantly more correct loan decisions. The cognitive processes used to reach decisions were significantly different and independent of information available. The model mainly addresses the effect of perception on the decision-making process, not the actual cognitive process associated with decision-making.

Trommershauser, Maloney, and Landy (2008) suggested sensory information from the environment can be framed with Bayesian decision theory, a statistical decision theory. They compared the performance between motor tasks and decision-making under risk for economic decision-making. Trommershauser et al. (2008) used the following example:

Statistical Decision Theory is a remarkably general framework for modeling tasks in cognition, perception and planning of movement. In its simplest forms, it is the mathematical basis for signal detection and common models of optimal visual classification. The models of simple movement tasks considered here are examples of its application. A dinner guest intends to pick-up a salt shaker at the center of the table with his right hand. We follow this movement from initial

planning to eventual social disaster. When possible, the plan of action is schematized as a solid line sketching out the path of the hand that the guest plans to take. An actual movement plan would specify joint movements throughout the reach. His planning should take into account any uncertainty in his estimates of the object location in addition to his accuracy and movement. If his sensory information is poor under candlelight, he might do well to choose a path that gives the wine glass wide berth and proceed slowly, but if he moves too slowly, he will never get through his meal. The potential cost and benefits are measured in units of disgrace, esteem and dry cleaning charges. Statistical Decision Theory enables us to determine the best possible choice of the movement plan, one that maximizes expected gain. In detail, the movement strategy is the mapping from sensory input to a movement plan. There is an expected gain associated with the choice of this strategy....By using the methods described here, visual, motor and economic decision-making tasks can be translated to common mathematical language. We can frame movement in economic terms or translate economic tasks into equivalent, visual motor tasks. Given the societal consequences associated with failures of decision-making in economic, military and legal context, it is worth investigating decision tasks in the domains, which humans seem to do very well. (p. 296)

Statistical decision theory use has been limited, as it has only been used in economic decision-making tasks. The model's main use is to translate decision-making tasks into a mathematical language.

Djulfbegovic, Hozo, Beckstead, Tsalatsanis, and Pauker (2012) suggested human cognition is a dual processing phenomenon, and decision-making can be described as a function of both analytical and intuitive processes. Dual processing is currently the most widely accepted theory of decision-making. In the dual processing theory, it is assumed that human cognition is made up of two systems. System one gives rapid, intuitive, narrative, experiential, and affect-based responses, while system two generates slow, deliberative, and logical responses. The researchers applied the dual-processing model to medical decision-making. Two clinical scenarios were developed to test the treatment of pulmonary embolism and acute leukemia. The researchers developed a mathematical model to understand how systems one and two work in

clinical decision-making. In both clinical scenarios, both systems one and two used risk benefit ratio of treatment. The amount of information available in each scenario drove which system would be used to reach a treatment decision. The researchers suggested that teaching awareness of system one and system two would benefit medical education. In this model, it is suggested that cognitive processes are either analytical or intuitive, which is contradictory to cognitive continuum theory.

Thompson et al. (2007) examined which type of cognitive processes nurses used to identify the occurrence of a critical risk event. The sample consisted of 245 registered nurses from four countries. The nurses were presented 50 scenarios, in which the data on heart rate, systolic blood pressure, urine output, oxygen saturation and support, and level of consciousness were varied. The nurse was asked to provide three judgments on whether the patient, who had had an intraoperative myocardial infarction, was at risk for a critical event within the next four days. Nurses were asked to evaluate blood pressure, pulse rate, urine output, oxygen saturation, oxygen support, and level of consciousness. The nurses were asked to assess (a) whether the patient was low risk (yes or no), (b) the likelihood of a critical event occurring (0-100 scale), and (c) whether the nurse would intervene (yes or no). Nurses with no critical care experience were more likely to judge the patient at high risk, rate the likelihood of a critical event to occur higher, and more likely to intervene. The study's theoretical framework was based on Brunswik's lens model and judgment analysis. The results showed that the nurses relied on intuitive and nonlinear cognitive processes and were prone to representativeness bias when reaching a judgment (Thompson et al., 2007). The study results did not demonstrate that nurses used analytical cognitive processes,

which is a limitation. Further analysis may have shown other variables affected the nurses' use of only intuitive and nonlinear cognitive processes.

DeVries, Witteman, Holland, and Dijksterhurs (2010) examined the role of conscious and unconscious cognitive processes on the quality of classifying complex psychiatric diagnoses among 80 clinical psychology students. The students were assigned to either a conscious or unconscious cognitive processing of diagnostic classifications. The results showed the students assigned to the unconscious processing of diagnostic classifications had statistically more correct classifications than the students assigned to the conscious processing condition. DeVries et al. (2010) drew on psychology in labeling cognitive processes as conscious and unconscious. The researchers compared the similarities between analytical and conscious cognitive processes and intuitive and unconscious cognitive processes. The researchers suggested that, if a large amount of information needs to be processed to reach a decision, unconscious cognitive processes will provide better decisions after a short period of distraction. DeVries et al. (2010) aligned their research with dual processing theory; however, they did not address contextual factors as potential variables affecting the decision, nor were individual biases addressed, especially with the scenarios of complex psychiatric cases.

Bucknall (2000) conducted a qualitative study of 18 critical-care nurses on their decision-making activities. The critical-care nurses were observed in their work environment. The observations showed the nurses most frequently made decisions associated with evaluative decisions, decisions regarding communication, and interactive decisions. Evaluative decisions were defined by Bucknall (2000) as a

deliberate activity that can be “observed, measured, recorded, or reviewed data to make an informed decision” (p. 30). Communication was defined as “required deliberative communication with members of the health team, patient, or visitors” (Bucknall, 2000, p. 30). Interactive decisions were defined as “an act which occurs to prevent or modify a patient situation” (p. 30). Thompson’s (2003) research identified important information on nurses’ decision-making activity by direct observation of their activities. The researcher did not examine the cognitive processes the nurses used to guide the evaluative, communication, and interactive activities used. Further, Thompson (2003) noted that the nurse’s experience, appointment level, type of unit, and shift were variables that affected how the nurses formed decisions. However, other studies (Hall, 2002; Hudson, 2009) did not identify experience, type of unit, and shift as affecting decision-making. Hudson (2009) suggests that that bias and contextual factors of how the patient presents with symptoms affect the cognitive processes of decision-making with greater frequency.

Manias, Aitken, and Dunning (2004) examined the decision-making models graduate nurses used when administering medications. Manias et al. (2004) used qualitative methodology and participant observation in their study, in which 11 graduate nurses participated. The nurses were asked questions about medication administration and then interviewed to get further information. The responses were audio taped, and the following themes of decision-making were identified: hypothetico-deductive reasoning, pattern recognition, and intuition. Hypothetico-deductive reasoning was defined as reviewing vital signs, lab results, clinical condition, or physical assessment. Pattern recognition was defined as matching the

disease process to the clinical presentation of the patient. Intuition was poorly defined, as there were only two instances identified. In those two instances, the nurse “knew” there was something wrong with the patient. The most observed type of decision-making was hypothetico-deductive decisions (25 observations), followed by pattern recognition (10). The least-observed type was intuitive decision-making (two observations). Limitations to this study were the lack of a robust definition of intuition. Additionally, some researchers (Hall, 2002; Tanner, 2006) argued that pattern recognition is a sub-process of intuitive decision-making.

Hoffman, Donoghue, and Duffield (2004) conducted a prospective, correlational survey of nurses’ perceptions of their participation in decision-making. Ninety-six nurses participated in the study. The nurses completed a 46-item questionnaire to measure perceived decision-making and normative decision-making in the areas of activities of daily living, wound dressings, administration of medications, emotional support, and referrals. Nurses’ professional values were shown as the most weighted item that affected the nurses’ decision-making. This study did not show support for education or experience as heavily weighted in the nurses’ decision-making. The study was conducted in Australia, and the researchers did not address the potential of cultural differences that might affect decision-making.

The preceding descriptive theories and models represent the different perspectives on how decisions are made. These theories and models are either middle range theories or practice models (McEwen & Wills, 2011). The theories and models present either a limited number of concepts and have limited application or provide “specific directions for practice.” (McEwen & Wills, 2011, p. 35). Some have limited

concepts (Gold, et al., 2007) Some have been limited to specific disciplines (Bucknall 2000; DeVies et al., 2010; He and Huang., 2007; Rodgers and Housel., 1987; Sanfey et al., 2006; Thompson, et al., 2007) and, therefore not generalizable until tested with other disciplines. The majority of the theories reviewed still suggest that cognitive processes used to make a decision are either analytical or intuitive (Djulgovic, et al., 2012; Gold and Shadlen, 2007; Manias, et al., 2004). Some, such as DeVries et al., (2010) and He and Huang (2007) suggest decision making can be reduced to a mathematical model. Because of the narrow range of application of these theories, the use is limited and still need testing in real life situations.

Cognitive continuum theory is also a middle range theory; however, it has a greater number of conceptual underpinnings to support the theory and has been applied to a greater number of disciplines, such as engineering, medicine, economics, politics, and nursing (Hammond, 1996). Mahan (1994) suggests that cognitive continuum theory is distinguished from other models and theories because Hammond (1984) defines specific methods for testing the theory.

Normative Decision Making Theory

Normative decision theory addresses how a decision should be made in order to be rational (Hansson, 2005; Wang and Ruhe, 2007). Normative decision making has been studied from many different perspectives. The following models and theories describe a variety of frameworks to understand decision making. These include making information more meaningful, process simplification in decision making, and limitations of human cognition in decision making.

Reyna (2008) suggested fuzzy-trace theory is applicable to medical decision-

making and allows a blueprint for practical application to decision-making. Fuzzy-trace theory suggested people rely on the “gist” of representation of information as opposed to verbatim information. The gist of information is interpreted subjectively and is based on education, emotion, culture, experience, and worldview. People extract multiple hierarchies of gist from information. Verbatim information is described as language and includes graphs, numbers, and pictures. Reyna proposed that people use both gist and verbatim information in parallel. Gist provides a context in which information is meaningful to the healthcare provider and patient, allowing for better-informed decision-making, and thereby motivation to make changes in health behaviors. Fuzzy-trace theory also focuses on the effect of judgment in decision-making. Factors such as base-rate neglect, framing effect, and hindsight bias are also addressed in this theory. A limitation of fuzzy-trace theory is that it has not been applied to situations other than medical decision-making. The process of decision-making is framed from the viewpoint of the patient and how diagnoses are explained to the patient in an understandable manner.

Schwenk (1984) stated that cognitive simplification processes can be used to aid strategic decision-making. The author argued that current strategic decision-making processes that have been developed involve multiple steps and can be simplified. Schwenk outlined and described a process for simplification of decision-making. Strategic decision-making is simplified to a three-stage decision-making process. Stage 1 is goal formulation and problem identification. Stage 1 is further divided into two activities, recognition of the problem and diagnosis, where further information is collected to define the problem and causes. Four areas have been identified that may affect problem identification: (a) prior hypothesis bias, (b) adjustment and anchoring, (c)

escalating commitment, and (d) assessment by analogy. Stage 2 is strategic alternative generation. Alternative generation is the generation of strategic alternatives based on memory of previous problems or development of a solution. Stage 3 is evaluation and selection of a course of action. The author conceded that this type of decision-making process may not operate in all strategic decisions and suggested further research for specific decision-making processes that could be identified in each stage. Schwenk acknowledged support for the theory is variable, as only one laboratory experiment and single business strategy case was used to support the process.

Klein (2008) suggested a naturalistic decision-making model as an alternative to statistical decision-making theories. Klein argued that most people do not adhere to algorithmic strategies but, instead, rely on recognition-primed decision-making. Furthermore, training methods in decision support strategies did not improve decision-making and people found the “tools and methods developed were cumbersome and irrelevant to the work they needed to do” (Klein, 2008, p. 456). Klein stated that recognition-primed decision-making is what most people use to make decisions. People identify patterns in situations and match the pattern they have learned to the situation at hand. Recognition-primed decision-making is a blend of intuition and analysis. Klein stated that pattern matching is intuition, while mental simulations of the situation are the analytical portion. Klein applied naturalistic decision-making to improve military planning. A limitation of the naturalistic decision-making model is the model has only been used for military planning and engineering.

Campitelli and Gobet (2010) proposed the work of Herbert Simon should be integrated into current approaches to decision-making, which would make decision-

making paradigms more generalizable. They suggested that people do not make decisions in a rational way that maximizes utility. Instead, they subscribed to Simon's view of bounded rationality. Simply described, due to the complexity of the environment in which decisions are made and the limitations of human cognition systems, people will "satisfice" to make a decision. Satisficing means that people will chose the first option that is satisfactory without evaluating all options available. People will chose a good option, but not necessarily the best option. Campitelli and Gobet did not suggest the use of bounded rationality as a theory, but as an adjunct to further expand and enrich other decision-making theories.

Research literature has been focused on a variety of methods to assess and classify types of decision-making. The majority of studies were attempts to categorize decision-making into either the systematic positivist model or the intuitive humanist model. Although each has been shown useful, the extent of the application of each model to all situations is limited, which could be used to suggest that a model in which the concepts of both existing models are combined would be more useful in gaining an understanding of the decision-making process. Given that the health-care environment has become increasingly complex and ever-changing, and health-care providers must be fluid in their decision-making, the use of a model that addresses these issues is relevant.

Decision-Making Theory in Relation to Nursing

In reviewing the decision-making literature in relation to the discipline of nursing, multiple terms have been used to describe the same phenomena of decision making (Tanner, 2006; Thompson, 1999; Thompson & Dowding, 2002). Terminology used to describe decision-making in nursing research has included: (a) clinical

judgment, (b) problem solving, (c) critical thinking, (d) clinical inference, (e) clinical reasoning, and (f) diagnostic reasoning. Harbison (2001) argued that the terms were not interchangeable. She suggested that clinical reasoning and clinical judgment were different from other terms and were indicators that a clinical problem existed, but that these were not the actual cognitive processes used to make decisions. No current consensus exists in the literature about terminology for describing the cognitive processes nurses use to make decisions. The terminology addresses only definitions of decision-making, not the processes used to arrive at a decision.

The systematic-positivist model encompassed several models: (a) information processing model, (b) hypothetico-deductive reasoning, (c) subjective expected utility theory, and (d) Bayesian logic (Banning, 2007; Simmons, 2010; Thompson, 1999). The information processing model has four stages: (a) cue acquisition, (b) hypothesis generation, (c) cue interpretation, and (d) hypothesis evaluation (Thompson & Dowding, 2002). Hypothetico-deductive reasoning is similar to the information-processing model and has four stages: (a) hypothesis generation, (b) hypothesis evaluation, (c) hypothesis refinement, and (d) hypothesis verification (Banning, 2007). Bayesian logic is the sequential processing of information to arrive at a probability based on the confidence the individual has in the representation of the available information. The probabilities must follow the axioms of mathematical theory (Round, 2001). Subjective expected utility theory is based on Bayesian logic and on the premise that people make decisions under uncertain conditions, while accounting for the usefulness of the expected outcome (Round, 2001). The systematic-positivist models all show that cognitive processes used to make decisions occur in a slow, conscious,

logical process according to a rationalist perspective. Situations in which rapid decision-making is required, such as crisis situations or situations with ambiguous data or cues, are not addressed with these models (Round, 2001). Proponents of systematic-positivist models reject the use of intuition as a valid cognitive process to arrive at a decision (Lee et al., 2006).

The intuitive-humanist model gained use in the late 1980s. This model, in contrast to the systematic-positivist model's rationalistic perspective, was rooted in a phenomenological perspective. The intuitive-humanist model is based on Benner's (1984) work. Using Dreyfus and Dreyfus's model of intuitive judgment, Benner's research showed support for intuition as a legitimate decision-making process. Benner contended that intuitive decision-making was related to the nurse's level of experience; however, other researchers have suggested intuition was related to risk-taking, self-awareness, and creativity (Banning, 2007; Lee et al., 2006).

The intuitive-humanist model has six stages: (a) pattern recognition, (b) similarity recognition, (c) common sense understandings, (d) skilled know-how, (e) sense of salience, and (f) deliberative rationality (Lee et al., 2006). Intuition has several definitions in the literature. Hall (2002) described intuition as a "cognitive short circuitry, where a decision is reached even though the reasons for the decision cannot be easily described" (p. 216). Rew (2000) defined intuition as "the deliberate application of knowledge, or understanding that is gained immediately as a whole that is independently distinct from the usual, linear and analytical reasoning process" (p. 95). Schrader and Fischer (1987) defined intuition as "immediate knowing of something without conscious use of reason" (p. 45). The differences in the preceding definitions

show the difficulty in reaching consensus on a standard definition of intuitive cognitive processes.

The initial legitimacy of intuition was not widely accepted. Cioffi (1997) observed that intuition was “renounced due to its association with gender; women were thought to be unscientific” (p. 203). According to Banning (2007), intuition has been viewed with skepticism because the process did not employ scientific reasoning. Buckingham (2000) suggested intuition is little more than pattern recognition or heuristic rules of thought.

Debate has continued regarding the use of which cognitive process, analytical or intuitive, results in the best patient outcomes. Intuitive decision-making as a cognitive process could result in errors by the introduction of cognitive biases (Harbison, 2001). Analytical decision-making could result in errors due to a lack of available information or time constraints (Harbison, 2001). Researchers (Bucknall, 2000; Lee et al., 2006) who have used each model suggested that the cognitive processes used in decision-making were neither completely analytical nor completely intuitive.

The systematic-positivist model was thought to be the best way to add legitimacy to nursing science with the incorporation of logical and rational cognitive processes (Lee et al., 2006). The systematic positivist model has limited application in emergent or crisis situations. In emergent or crisis situations, cognitive processes are time-limited, and if the decision-maker perceived there were limitations to resources available, or if there were multiple competing tasks the decision-maker must prioritize, the systematic-positivist model is of little benefit (Hammond, 1996). The intuitive humanist model has gained more acceptance as a cognitive process in decision-making;

however, it has limitations, such as errors that may result in the decision-making process from the cognitive biases of the individual. As nurses work in ever-changing environments, neither model alone is adequate to describe the dynamic cognitive processes nurses use to arrive at decisions.

Decision-Making and Cognitive Continuum Theory

Hammond (1996) recognized the limitations of the systematic-positivist model and intuitive humanist model. Hammond (1996) recognized that cognition was not a function solely of analysis or of intuition, in that “the rivalry, the competition between them, can be ended by recognizing the properties and merits of each in the various contexts in which they are applied” (p. 89). In recognizing this, Hammond developed the cognitive continuum theory in which he postulated that cognitive processes operated on a continuum that was anchored with analysis at one pole and intuition at the opposite pole. The area between the poles is what he called quasirational decision-making, a combination of analytical and intuitive processes.

The use of Hammond’s (1996) theory has been a way to unify the differing models of decision-making. Hammond’s cognitive continuum theory was derived from various sources, including social judgment theory, Brunswick’s concept of quasirationality, Church’s concept of modes of inquiry, and Edwards’s coherence theory (Doherty & Kurz, 1996; Standing, 2008; Thompson et al., 2007). Hammond proposed that only one dimension to decision-making exists. The cognitive dimension is the way a person thinks about a task. The cognitive process in this dimension moves from highly intuitive to highly analytical. Decisions are made along this dimension. The analytical process is a slow, conscious processing of data using complex principles

of averaging cues presented to the decision maker. An analytical approach is characterized by a high degree of consistency and accuracy, but also by a greater potential for major errors. Intuition involves the rapid, unconscious processing of data that combines an averaging principle with low consistency, moderate accuracy, and a limited potential for errors (Dowie, 1999). Hammond's (1996) theory has four components:

1. The cognitive continuum of decision-making, with analytical cognition at one end of the continuum and intuitive cognition at the other end;
2. Common sense, a quasirational mode of the continuum, which is between the ends of the continuum, which combines varying degrees of analytic and intuitive decision-making;
3. The theory of task structures, which is the capacity of the task structure to induce analytical, intuitive, or quasirational cognition;
4. Dynamic cognition, which is movement along the continuum at different rates and in different forms. (p. 147)

Definition of Key Terms

The following definitions of key terms of Hammond's theory were used in the current study:

Analysis. Analysis is a slow, conscious, consistent, and detailed process that has (a) high cognitive control, (b) slow data processing, (c) high conscious awareness, (d) task-specific organized principle, and (e) high confidence in the method (Cader, Campbell, and Watson, 2005, p. 5).

Coherence. Coherence is the judgment made by the person based on his or her relative knowledge of scientific concepts and theories. A judgment may be coherent but inaccurate, or a judgment may be incoherent and accurate (Hammond, 1996, p. 220).

Correspondence. Correspondence is the accuracy of the person's cognitive system to perceive, judge, and appraise the observable physical properties of the world (Hammond, 1996, p. 219).

Functional relations. Functional relations are inferences made from observations of statistical data (Cader, Campbell, and Watson, 2005, p. 5).

Intuition. Intuition involves rapid and unconscious data processing. Properties of intuition include (a) low cognitive control, (b) rapid data processing, (c) low conscious awareness, (d) averaging organizing principle, and (e) low confidence in method (Cader, Campbell, and Watson, 2005, p. 5).

Modes of inquiry. There are six modes of inquiry. Mode 1 is pure analytical cognition. Mode 2 is based on statistical inference and is less analytical than Mode 1. Mode 3 is the weakest of the three analytical modes and is thus labeled a quasianalytical mode among the three. Mode 4 is labeled computer modeling. Mode 5 is referred to as data-based expert judgment in which decisions are based on expert judgment. Mode 6 is unrestricted judgment and is purely intuitive thought (Cader, Campbell, and Watson, 2005, p. 5).

Oscillation. Oscillation is the process by which modes of cognition can change from analysis to intuition and vice versa (Cader, Campbell, and Watson, 2005, p. 5).

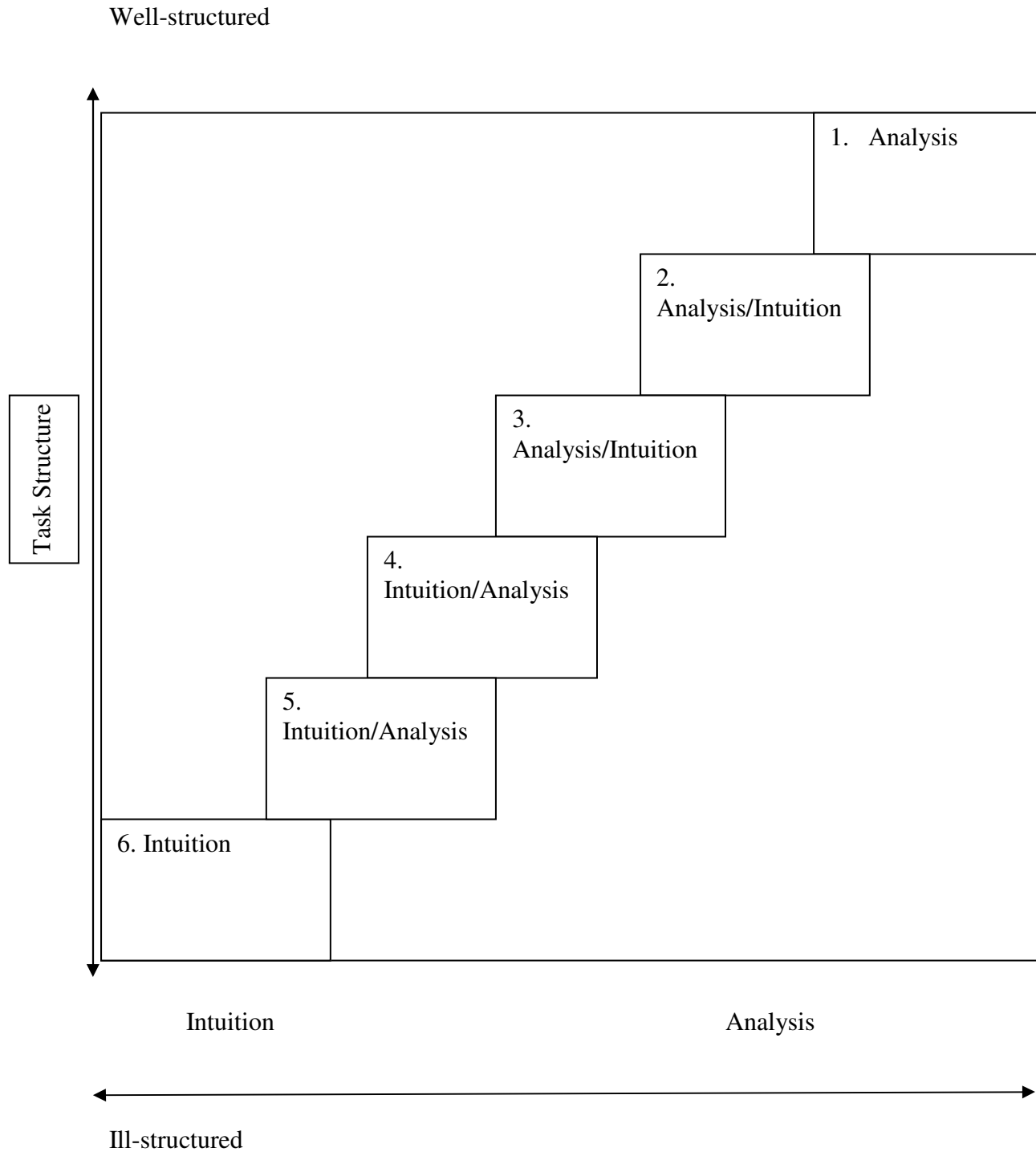
Pattern recognition. Pattern recognition is an inference to patterns of information recognized from experience (Cader, Campbell, and Watson, 2005, p. 5).

Quasirationality. Quasirationality occupies the central region on the cognitive continuum and relates to modes of cognition that include elements of both intuition and analysis (Cader, Campbell, and Watson, 2005, p. 5).

Task properties. Task properties include task complexity, such as the number of information cues, the redundancy of cues and principles for combining information, the level of ambiguity, and the content and presentation. Two dimensions for task properties have been identified: ill-structured and well-structured. Well-structured tasks have properties that induce analysis. These tasks have a high level of decomposition, a high degree of certainty, and require time to resolve. Ill-structured tasks have task properties that induce intuition. These tasks have a low level of decomposition, a low degree of certainty, and are tasks that need to be resolved quickly (Cader, Campbell, and Watson, 2005, p. 5).

Figure 1 shows a schematic representation of Hammond's theory. On the left vertical axis are task structures. One end of the axis represents ill-structured tasks, and the opposite end of the axis represents well-structured tasks. On the horizontal axis are intuition at one end and analysis at the other. Each box is labeled one through six, with box one representing pure intuitive decision-making and box six pure analytical decision-making. Boxes two through five represent varying combinations of intuitive and analytical decision-making. This is what Hammond calls quasirational decision-making, and it is in these areas that most decisions are made. The more ill-structured the task, more intuitive decision-making will be employed. The more well-structured the task, the more analytical decision-making will be employed.

Figure 1. Hammond's Cognitive Continuum.



The following are studies that have used Hammond's theory.

Dunwoody, Haarbruer, Mahan, Marino, and Tang (2000) developed scenarios of aircraft threat using task properties to induce intuitive, quasirational, or analytical decision making. The results of the study supported the use of task properties can induce different types of cognitive processes according to the task characteristics presented.

Hammond, Hamm, Grassia, and Pearson (1984) tested the cognitive continuum premise that complexity of task structure, ambiguity of task content, and form of task presentation will induce specific types of cognitive process. Highway design experts were recruited to evaluate highway aesthetics (intuitive cognitive processes), safety (quasirational cognitive processes), and capacity (analytical cognitive processes). The results supported task characteristics will induce specific types of cognitive processes.

Bjork and Hamilton (2011) developed a Nursing Decision-making instrument based on Hammond's cognitive continuum theory. A total of 2,095 nurses in Norway participated in the study. The 24-item instrument was used to measure intuitive, analytical, and combined analytical-intuitive or intuitive-analytical decision-making. The results of the study showed that nurses most frequently used intuitive and intuitive-analytical decision-making. The frequency associated with this type of decision-making was related to experience in the type of unit in which the nurses worked, followed by education, gender, and age.

Offredy et al. (2008) used Hammond's cognitive continuum theory to guide a qualitative study on nurse prescribers' pharmacology knowledge and decision-making using patient scenarios. A purposive sample was made up of 25 nurses. The results of

the study showed that the majority of participants lacked pharmacology knowledge and were unable to identify patient issues in the scenarios to advise patients on medications. Of the participants who did identify patient issues, intuitive decision-making was used most frequently. The results were used to suggest that the lack of pharmacological knowledge and use of intuition could be problematic.

Dowding, Spilsbury, Thompson, Brownlow, and Pattenden (2009) examined the decision-making of heart failure specialist nurses and titration of medication. The researchers used both observation and interviews with a purposive sample of 12 nurses. Using Hammond's cognitive continuum theory to guide the study, the researchers reported the nurses used more analytical decision-making rather than intuitive when making choices about titrating medications. Despite using analytical decision-making more frequently, the complexity of the patient condition made it difficult to reach optimum medication titration. The researchers suggested that the use of protocols for medication titration would be of benefit to the nurses' decision-making process.

Mahan (1994) used the cognitive continuum framework to get a better understanding of the work environment. In his study, Mahan looked at the relationship between the stress of continuous work and the performance of complex jobs. In his study, Hammond's framework was used to describe the importance of intuitive cognition and its analytical counterpart in determining what role framework models play in the evaluation of work.

Dowie and Elstein (1987) used the cognitive continuum theory with medical students' decision-making. The study showed that the type of task presented to the student was important in determining where on the continuum the student made

decisions. A match between the task characteristics and the cognitive process used influenced the accuracy of the decision. The previous experience that the medical student brought into the situation also influenced the type of decision-making he or she used.

Lauri, Salanterä, Chalmers, Ekman, Kim, Kappeli & MacLeod (2001) examined the decision-making of 459 nurses who worked in medical surgical units or geriatrics units in five countries. The survey instrument used a combination of theories, including Hammond's cognitive continuum theory. The instrument was used to measure decision-making stages and analytical and intuitive cognitive processes. The results indicated that nurses used both analytical and intuitive decision-making and the type of decision-making was dependent on the situation. Findings indicated partial support for Hammond's theory in that decision-making ranged along the continuum; however, this study was not used to address Hammond's notion of quasirationality as a mode of decision-making. Limitations of this study were the use of a convenience sample, which limited generalizability, and a questionnaire to measure the qualitative aspects of decision-making that was translated into five different languages, which meant that the researchers could not ensure that the words had the same meanings in different languages.

Hammond's (1996) cognitive continuum theory has been used by a number of disciplines to describe how decisions are made. The research reviewed using cognitive continuum theory has shown mixed results. Some studies suggested that nurses used intuitive cognitive processes more frequently than analytical cognitive processes to reach decisions (Offredy, et al., 2008; Thompson, et al. 2003), while other research

studies suggest analytical cognitive processes are used more frequently (Dowding et al., 2009; Manias, et al., 2004). However, the studies previously mentioned did not implicitly or explicitly indicate the task structure used to access the cognitive processes used. Hammond (1996) postulates whether the task at hand is ill-structured or well-structured will induce intuitive cognitive processes or analytical cognitive processes. Other studies support cognitive processes used are a combination of analytical and cognitive (DeVries, et al., 2010; Djulbegovic, et. al., 2012; Klein, 2008). Cognitive continuum theory has not been used to examine decision-making and how pain is managed when the participant is presented with a well-structured or ill-structured pain vignette.

Decision-Making and Pain Management

Numerous research studies have been used to address pain management. A number of these studies were focused on the knowledge, attitude, and biases of the caregivers (Brockopp et al., 2003, Burns et al., 2010; Elander, Marczewska, Amos, Thomas, & Tangayi, 2006; Ferrell, Eberts, McCaffery, & Grant, 1991; Hirsh, Jensen, & Robinson, 2010; Layman-Young, Horton, & Dvidhizar, 2006; Manias, Bucknall, & Botti, 2002). However, there is limited research on decision-making and pain management, and no studies were found in which the cognitive continuum theory was used to examine cognitive process and pain management.

Research on pain management suggests while nurses have been educated on the use of pain assessment tools, many use subjective observation (movement, verbal cues, emotional cues, positioning, guarding) as a more accurate indicators of pain (Ferrell et al., 1991; Layman-Young, et al. 2006). Other studies have suggested bias as a factor in

decisions when managing pain. Negative patient behaviors, such as perceived addictive behaviors (Elander, et al. 2006), racial and ethnic minorities and the elderly receive sub optimal pain treatment (Hirsh, et al. 2010). Some studies suggest that the number of years of experience of the nurse, educational level, and pharmacological knowledge impact the decision-making for pain management. Lewthwaite, Jabusch, Wheeler, Schnell-Hoehn, Mills, Estrella-Holder, & Fedorowicz, (2011) completed a study suggesting the greater number of years of experience of the nurse, higher education level, and pharmacological knowledge impacted the nurse's decision-making of pain management; however, Hirsh, et al.'s (2010) conducted a study that found the number of years of experience of the nurse, educational level, did not affect the nurse's decision-making of pain management; this study did not address pharmacological knowledge as a factor, however. This suggests that the cognitive processes used in planning pain management interventions may be influenced by other factors.

Protocol Analysis

Protocol analysis is a research methodology used to infer a person's cognitive processes in a given situation. Verbal data are used in protocol analysis to examine how information is accessed and verbalized and how participants respond to stimuli (Anders-Ericsson & Simon, 1993). The type of cognitive processes used can be inferred from analyzing the transcribed verbalizations.

In protocol analysis, the think out loud process is used, in which the participant "explains their thoughts, ideas, and hypothesis in a given situation" (Anders-Ericsson & Simon, 1993, p. 79). The resulting verbalizations are recorded and coded for analysis.

Think out loud protocols have been used to assess cognitive processes and qualitative and quantitative research studies.

Lundgren-Laine and Salantera (2010) assessed the usefulness of protocol analysis as a methodology in understanding decision-making processes in nurses. The researchers noted that the think out loud methodology was challenging from the perspective of analysis, which was labor-intensive and time-consuming.

Flaherty (2001) used protocol analysis to devise a coding system to analyze the thought processes of 100 high school students as they attempted to solve algebraic word problems. Based on the study results, Flaherty asserted that the think out loud protocol was an effective technique to analyze problem-solving.

Best (1987) employed protocol analysis to examine the cognitive processes of undergraduates as they attempted to solve problems of logical deduction. From the results, Best suggested that, in using the think out loud protocol, the structure of the problem affected the decision makers' strategy for solving the problems.

Simmons (2010) conducted a qualitative study with protocol analysis to understand the clinical reasoning used by experienced nurses. Fifteen nurses verbally expressed the ways they would assess patients. The findings of Simmons' study were used to suggest that nurses used conceptual language and cognitive shortcuts to reason more quickly and effectively.

Offredy and Meerabeau (2005) compared clinical decision-making used by nurse practitioners and general physician practitioners in six medical scenarios with the think out loud protocol. Offredy and Meerabeau suggested that think out loud

approaches were suitable for identifying errors in decision-making and could be used as teaching tools.

Kuhberger and Huber (1998) used protocol analysis to get a better understanding of how missing information could be applied to individuals who had to make a decision to hire or not hire someone. The researchers recruited 24 participants from different professions and levels of education. The participants were presented with a pair of candidates who were applying for an editor's job at a newspaper. The participants were asked to make the choice of hiring or not hiring one or the other for the job. Each of the pair of applicants was described using six attributes. The participants were presented with the information available on the attributes of each candidate; however, one of the candidates had an attribute missing from the information. The researchers found that using protocol analysis showed that the missing information of the applicant played a part in the decision on whether to hire or not hire a candidate. This suggests that lack of information and knowledge of a given situation may impact the type of cognitive processes the nurse uses.

Hughes and Parks (2003) reviewed research articles on the use of verbal protocol analysis within software engineering over the past two decades. The reports included levels of expertise, teamwork, novice versus expert, comprehension strategies, problem-solving strategies, domain knowledge, debugging strategies, use of diagrams, and reuse strategies. The researchers found that the use of protocol analysis contributed toward a demonstrable theoretical underpinning for software engineering in order to advance the maturity of software engineering as a discipline. The researchers suggested that protocol analysis can be used effectively as a technique to

obtain accurate insight into a person's thinking while performing a problem-solving task. They found that the technique contributed toward the development and testing of models of the information processing that takes place during software engineering processes, particularly those related to software design and comprehension.

Goransson, Ehnfors, Fonteyn, and Ehrenberg (2007) conducted a research study on the thinking strategies of registered nurses during emergency triage using the protocol analysis. In the study, they described and compared thinking strategies and cognitive processing in emergency department triage processes by RNs who had high and low triage accuracy. The study was a descriptive comparative study and was a secondary analysis from a previous study. A total of 16 RNs participated in the study. Five patient scenarios were developed for this study. The nurses were brought in and asked to read the scenarios and then think out loud while they decided how they were going to manage the triage scenarios. The analysis of the data revealed nurses followed a cognitive pattern of recognizing a pattern in the patient, setting priorities, searching for more information, generating hypotheses, making predictions, forming relationships, adhering to practice rules, judging the value, drawing conclusions, providing explanations, and then making generalizations. The study showed the RNs used a large variety of thinking strategies while reasoning during triage. The study revealed differences between the nurses with low triage abilities and those with high triage abilities.

McAllister, Billett, Moyle, and Zimmer-Gembeck (2009) used protocol analysis to gain a better understanding of the relationship between clinical reasoning and self-harm as a risk factor for suicide. A total of 28 emergency-room nurses participated in

the study. The researchers developed an education intervention, which was a two-hour lecture and discussion, to get a better understanding of the participant's attitudes, learning issues, and current practice demands in relation to self-injury. The researchers used a variety of educational methods about how to use communication strategies, engagement, and educational processes available for use with patients. A pretest and post-test to measure changes in professional identity and the perceived relevance a solution focused care of the patient who self-harms. The results revealed that there was a statistically significant change in the pretest and post-test scores after the education was given to the nurses.

Hoffman, Aitken, and Duffield (2009) conducted a survey using protocol analysis to identify differences between novice and expert nurses' cue collection during clinical decision-making. The study compared cue usage in the decision-making of novice and expert nurses while caring for abdominal aortic aneurysm repair patients. A total of four novice nurses and four expert nurses were recruited to participate in the study. The results of the study showed that the expert nurses collected a wider range of cues than the novice nurses—almost 50% more different cues. The expert nurses also clustered more cues together to identify patient status when making decisions. Expert nurses were more proactive in collecting relevant cues and anticipating issues that may help identify patient problems.

Protocol analysis has been widely used across multiple disciplines to infer cognitive processes used to make decisions. The majority of literature reviewed indicates protocol analysis is an effective method to infer a person's cognitive processes in a given situation.

Summary

The review of decision-making literature has shown that gaining an understanding of decision-making has been approached from a variety of perspectives as well as a variety of proposed models to explain decision-making phenomena. These models have been used to describe decision-making processes in different situations. The commonality of these models is that all acknowledge decision-making processes involve either analytical or intuitive processes. However, none of the models reviewed suggested decision processes are on a continuum, as Hammond's (1996) theory did. Hammond's (1996) theory provided a more complete explanation of decision-making processes.

The review of the nursing literature showed the difficulty in defining the phenomena of decision-making. Multiple terms are used that may describe the same cognitive processes. The variability in definitions has made it difficult to ascertain that the same cognitive process has been examined (Tanner, 2006; Thompson, 1999; Thompson & Dowding, 2002).

Research on decision-making has mainly focused on the systematic positivist model as an umbrella to describe the cognitive processes used. The systematic positivist model has several middle-range models. The nursing profession embraced these models in the 1970s and 1980s as a way to legitimize decision-making, supporting nursing as a science (Lee et al., 2006). However, the systematic positivist model was not without limitations. Situations that required rapid decisions, which happen frequently in nursing, do not support cognitive processes that are logical and slow to reach a decision.

The intuitive humanist model came into use in the 1980s as another model, which addressed intuitive cognitive process used to make decisions. Intuitive decision-making,

as previously described, was not widely accepted, as intuitive processes were difficult for nurses to articulate and researchers to quantify. The work of Benner (1984) gave credence to intuition as a cognitive process for decision-making. The dichotomy in the two approaches has become more apparent in that each model could not fully explain the breadth of decision-making required in different situations and highlighted the need for a more inclusive model.

Hammond (1996) recognized this dichotomy and the limitations of each model. He suggested another model, the cognitive continuum theory, which blended the attributes of the systematic positivist and intuitive humanist models. In developing the cognitive continuum theory, Hammond (1996) drew from a variety of theories to develop a general theory of decision-making. Hammond gave detailed applications of his theory to law, medicine, engineering, literature, and economics.

The current study was developed to examine the use of cognitive continuum theory to understand cognitive processes used to reach decisions. The study will give a better understanding of how ill-structured tasks and well-structured tasks induce either intuitive or analytical cognitive processes, and which cognitive processes are associated with optimal decision-making. Additionally, pain management continues to remain suboptimal, and if cognitive processes that lead to optimal decision-making when choosing pain interventions are identified, strategies to teach awareness of cognitive processes leading to optimal pain interventions may be developed.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

Introduction

The purpose of this current study was to identify the cognitive processes nurses use in making decisions when planning pain management interventions. Clinical decision-making has a direct influence on patient care, patient outcomes, and the healthcare experience for the patient. Identifying which types of cognitive processes nurses use was sought to provide a better understanding of how clinical decisions are made. More effective clinical practice is possible if the nurse has awareness regarding those cognitive processes that could be used to reach the most appropriate clinical decisions. Institutional review board approval was secured prior to commencing the research.

Research Hypotheses

The following hypotheses were analyzed in the current study.

H1. Nurses reading the well-structured vignette will use analytical cognitive processes more than nurses reading the ill-structured vignette.

H2. An association exists between the types of analytical cognitive processes used and the pain management interventions selected.

Methods

Design

A posttest only experimental design was used. Two hundred medical surgical nurses were randomly assigned to read a well-structured condition or ill-structured pain management vignette.

Sample and Setting

A convenience sample consisted of registered nurses employed on medical surgical units in two academic teaching hospitals and of registered nurses enrolled in a graduate nursing program. All three sites were located in the northeastern United States. Registered nurses were eligible to participate if they provided direct patient care, worked more than 16 hours per week, and cared for patients in acute pain. Registered nurses who did not provide direct care, contract travel registered nurses, and registered nurses who had participated in the pilot study were ineligible to participate. G*Power 3.1.2 Software (Faul, Erdfelder, Buchannan, & Lang, 2009) was used to determine sample size. Based on the power analysis software calculations for a One-way Analysis of Variance (ANOVA), with a small effect size of 0.20, significance level of 0.05, and power of 0.80, a sample of 200 was needed. A total of 200 registered nurses participated in the research.

Instrumentation

Demographic Questionnaire.

A demographic data collection questionnaire (Appendix A) was developed from the questionnaire used in the pilot study. Data were collected on (a) age, (b) gender, (c) highest level of education, (d) number of years in nursing, (e) work status, (f) national nursing certification obtained, (g) availability and use of pain services in the workplace, and (h) pain education within the past year.

Pain Vignettes.

Two pain vignettes were developed that differed only in well versus ill-structured information. One vignette intentionally was ill-structured to induce intuitive cognitive processes. The second vignette was well-structured to induce analytical cognitive

processes. The development of the pain vignettes was guided by Hammond's cognitive (1996) continuum theory. The pain vignettes were initially developed for the pilot study. Two nurses with PhD's, one with expertise in pain management and one with expertise in the design and use of vignettes, reviewed the pain vignettes for the current study. Recommendations from the reviewers were incorporated into the vignettes.

Well-structured Condition.

David Smith is a 36-year-old white male who sustained a right femur fracture as a result of a skiing accident. He sustained no other injuries. He is newly admitted to your unit. His right leg is immobilized and he will be going to the operating room in the morning for surgical repair. You receive the following information from the ED: no known allergies, no prescribed or over-the-counter medications, non-smoker, rare alcohol use, no illicit drug use. Your assessment reveals the following: P-98; R-26; T-99; BP-145/80. Weight 160 pounds. The circulation, sensation, and motion of his right foot are intact. Pedal pulses are 2+ bilaterally, and both feet are equally warm to the touch. There is no visible swelling. When asked, Mr. Smith describes his pain as a throbbing, dull ache in the area over his fracture and gives it a rating of 8 on a 0 – 10 scale. He states that as a result of the pain he cannot relax enough to get any rest. He has a range order of morphine sulfate for 2, 4, 6, and 8 mgs IV, which can be given every 3 to 4 hours as needed for pain. He has received 2 doses of 4 mg IV at 3-hour intervals, but the medication lowers his pain to a 6 intensity rating for only a few hours. The second morphine dose was given 3 hours ago.

Ill-structured Condition.

David Smith is a 36-year-old white male who sustained a right femur fracture as a result of a skiing accident. He sustained no other injuries. He is newly admitted to your unit. His right leg is immobilized and he will be going to the operating room in the morning for surgical repair. You receive the following information from the ED: no known allergies, no prescribed or over-the-counter medications, non-smoker, rare alcohol use, no illicit drug use. *He is talking with his wife and two young children as you enter the room. The wife is sitting with the youngest child on her lap. The children are well behaved and appear happy to be with their father. The wife states it is time for them to leave and kisses her husband good bye telling him she will be back later that day. He reminds her to call their family and friends to let them know that he is feeling good and doing all right after the accident.* Your assessment reveals the following: P-98; R-26; T-99; BP-145/80. Weight 160 pounds. The circulation, sensation, and motion of his right foot are intact. Pedal pulses are 2+ bilaterally, and both feet are equally warm to the touch. There is no visible swelling. When asked, Mr. Smith describes his pain as a throbbing, dull ache in the area over his fracture and gives it a rating of 8 on a 0 to 10 scale. He states that as a result of the pain he cannot relax enough to get any rest. He has a range order of morphine sulfate for 2, 4, 6, and 8 mgs IV, which can be given every 3 to 4 hours as needed for pain. He has received 2 doses of 4 mg IV at 3-hour intervals, but the medication lowers his pain to a 6 intensity rating for only a few hours. The second morphine dose was given 3 hours ago.

Procedure

Institutional review board approval from both hospitals and the university was obtained. Participants were recruited by placing flyers in the common break areas in the hospitals' medical surgical units and at the university by placing a flyer on the MS/Ph.D. list serve. Nurses that met inclusion criteria were invited to participate. Informed consent was obtained and the nurse was taken away from the work area to a private area. The steps of protocol analysis were explained to the nurse. Demographic data were collected from each participating nurse. The nurse completed the demographic form independently. Nurse participants were randomly assigned to the well-structured or ill-structured condition via a web based number generator.

Protocol Analysis

Protocol analysis was used as the research methodology. Verbal data are used in protocol analysis to examine how information is accessed and verbalized and how participants respond to stimuli (Anders-Ericsson & Simon, 1993).

In protocol analysis, the think out loud process is used, in which the participant "explains their thoughts, ideas, and hypothesis in a given situation" (Anders-Ericsson & Simon, 1993, p. 79). The resulting verbalizations are recorded and coded for analysis.

The results of the pilot suggested that the warm up exercises suggested by Anders-Ericsson and Simon (1993) primed a greater number of analytical responses to both the ill-structured and well-structured vignette. The warm up exercises used in the pilot study consisted of multiplication, counting the number of windows in the participant's parent's house, and naming 20 animals. To avoid priming the participant for analytical cognitive processes, the warm up exercises were omitted.

Nurses were instructed to read either the well-structured or the ill-structured vignette and think out loud on how she or he would manage the patient's pain.

The principal investigator (PI) used the following script prior to having the nurse read the vignette: “We are interested in getting a better understanding of how nurses manage patient's pain. After reading the vignette silently, tell me everything that passes through your head while managing the patient's pain, no matter how irrelevant it may seem”. The PI was positioned, when possible, out of the nurse's sight, to avoid inducing bias by the PI's facial expression or body language. If the nurse was silent longer than 30 seconds the researcher prompted the nurses to “continue to talk outloud” or be asked “What are you thinking now?” The average amount of time taken to collect data was 5 minutes. The responses were audio taped for later transcription. Participants were debriefed on their perceptions of the purpose of the study and a brief explanation of the study was provided. The researcher asked each participant not to share information about the vignette with colleagues to avoid hypothesis guessing by future participants.

Content Analysis

Content analysis was the method used to analyze the transcripts. Krippendorff (2004) defines content analysis as “a research technique for making replicable and valid inferences for texts (or other meaningful matter) to the contexts of their use” (p.18). Krippendorff's components for content analysis were used to conduct the review of the nurses' pain management decision-making. Content analysis components included (a) unitizing, (b) sampling, (c) coding, (d) reducing, and (e) inferring. Each component is described in the following paragraphs.

Unitizing

Unitizing provided a method to systematically identify segments of text. The unit of analysis for content analysis was any word or phrase that described a priori criteria. Cognitive processes were identified and analyzed as analytical, intuitive, or quasirational. Pain management strategies were identified and analyzed separately from cognitive processes. The criteria for analytical, intuitive, quasirational and pain management strategies is provided below under coding.

Sampling

Transcripts of the nurses' responses constituted the sample for content analysis of their pain management decision-making. The transcripts were read at the level of words and phrases to identify important content for decision-making as described in Hammond's (1996) theory. The sampling process was used to aid identification of nurses' plans for pain management actions based on the American Pain Society's (2008) recommendations.

Coding

The descriptions of analytical, intuitive, and quasi-rational decision-making processes were based on Hammond's (1996) theory. Analytical decision-making is a slow, conscious, rational process used by the individual. Participants' responses that reflected this type of decision-making included: (a) verbalizations of intent to examine technical data, (b) seeking new information, (c) intent to seek alternatives, and (d) review of symptoms.

Intuitive decision-making is the unconscious or automated process indicative of rapid thought. Responses from participants that reflected this thinking included (a)

verbalized hunches, (b) emotions, (c) feelings, (d) beliefs, and (e) impressions. Quasi-rational decision-making is a combination of analytical and intuitive decision-making processes.

The a priori criteria for pain management were based on the American Pain Society's Principles of Analgesic use in the Treatment of Acute Pain and Cancer Pain (2008) and previous research (McDonald, LaPorta, & Meadows, 2007). Criteria included the following:

- conducting a timely more complete pain assessment,
- choosing pain medication dosing,
- incorporating adjuvant pain measures,
- reassessing the pain following interventions, and/or

making recommendations for potential changes to a pain treatment regimen

Reducing

The data were coded for analytical, intuitive, and quasi-rational cognitive processes in pain management. The data were entered into SPSS and descriptive statistics for frequencies and distributions were calculated to categorize the data.

Inferring

The theory-based criteria were based on Hammond's (1996) cognitive continuum theory and research-based criteria on the American Pain Society's Principles of Analgesic use of Treatment of Acute Pain and Cancer Pain (2008), which provided criteria for the coding data. A code book was developed and a pilot study was used to

guide content analysis (Appendix B.) The primary investigator and a second trained rater independently conducted the content analysis on the transcribed data. The raters compared coded data for agreement, encoding the data in the same way, and documenting instances of coding disagreements.

Coding Reliability

The transcripts were independently coded by this researcher and faculty advisor using the code book (Appendix B) for types of decisions identified on the cognitive continuum and pain management interventions chosen. The code book was developed from the previous pilot study. The number of coding agreements and disagreements was recorded, and disagreements resolved after comparison and discussion between the coders. Krippendorff's alpha and interater reliability were calculated for both the types of decisions and pain management interventions. Krippendorff's alpha and interater reliability for type of decisions were $\alpha = 0.44$ and 77%, respectively. The Krippendorff's alpha and interater reliability for high quality intuitive decisions and low quality intuitive decisions were $\alpha = 0.59$ and 79% respectively. Krippendorff's alpha and interater reliability for pain management interventions were $\alpha = 0.81$ and 90%, respectively.

Statistical Analysis

Data were entered into SPSS databases and checked for input errors. Descriptive statistics were used to summarize and report means and standard deviations for continuous variables and frequency and percentages used to report on categorical variables obtained from the demographic data. Nurses' responses, the dependent variable, were analyzed for frequency of analytical, intuitive, and quasi-rational verbalizations and

responses to each of the two vignettes. Krippendorff's alpha and interater reliability were calculated for types of decisions and pain management interventions. Frequencies were calculated for each of the a priori pain management actions. The data for the cognitive verbalizations and pain management actions were analyzed using mean and standard deviation. Normality and homogeneity of variance were assessed by examining skewness and kurtosis for the dependent variables.

The assumption of normal distribution of the variables to perform the ANCOVA were violated and transformations were unsuccessful, therefore, nonparametric testing was conducted. Cross tab with chi square statistics were conducted to examine H1: Nurses reading the well-structured vignette will use analytical cognitive processes more than nurses reading the ill-structured vignette. Levene's test for homogeneity of variance was used to check the assumption that the variances of the well and ill-structured groups were equal for analytical, intuitive, and quasirational dependent variables. Spearman rho correlation was conducted to examine H2: An association exists between the types of cognitive processes used and the pain management interventions selected. The correlation was used to assess the relationship and strength of nominal variables of types of cognitive processes and number of pain responses.

Rigor

The primary investigator made efforts to assure an environment without distractions during the sessions by taking the nurses away from the work area to a quiet area. This was not possible for all participants, however. Both the researcher and the second rater were trained in content analysis and used the coding manual as a guide. The researcher and second trained rater were blinded to participants' conditions. The raters

independently coded the data then compare their coding and noted agreement and disagreements and resolution of disagreements.

Confidentiality

All nurses who met the inclusion criteria were included. The primary investigator disclosed the nature of the study, risks, and benefits in the consent form. Participants were allowed to ask questions and withdraw from the study without penalty at any time. Confidentiality was maintained by not using participant names and assigning each participant a unique identification number. Only the primary investigator, coders, and the primary investigator's faculty adviser had access to the data. All data were stored in a locked cabinet that only the primary investigator could access. Data also were stored on a password-protected computer.

Summary

Chapter three provided the research methodology for the study. A posttest only experimental design was used. A sample of 200 nurses was randomly assigned to read either a well-designed or ill designed vignette, which were developed to induce either analytical, intuitive, or quasirational cognitive processes. Demographic data were collected. Protocol analysis was used to gather verbal think out loud data from the nurses as they related the decisions that they would make. Content analysis was used to make inferences of cognitive processes from transcripts. Coding reliability and examples of analytical and intuitive statement given. Descriptive statistics were used to summarize and report means, standard deviation, frequencies, or percentages based on the type of variable. Cross tab with chi square statistics were conducted to examine H1 and

Spearman rho correlation to examine H2. The methods used to maintain rigor and confidentiality were described.

CHAPTER 4: RESULTS

The purpose of this study was to gain a better understanding of the cognitive processes used by nurses when planning pain management interventions. This chapter provides the results of the study. The minimum level of significance was set at .05 for all analyses.

Sample Descriptives

The sample consisted of 200 mostly female baccalaureate prepared nurses working full time. Most did not have a specialty certification. One hundred ninety eight of the nurses were from the academic medical centers, and two were from the graduate school of nursing. The mean for age was 35.8 (SD = 10.31) and mean years in nursing for the total sample was 8.3 (SD = 8.63). The total sample's complete demographic characteristics of the study participants' gender, education, work status, and certification, and nurses assigned to the well-structured or ill-structured vignette are displayed in Table 1. The use of well-structured and ill-structured vignettes was to induce analytical cognitive processes or intuitive cognitive processes.

Most nurses had some type of pain education within the past year and worked in institutions with pain services. The nurses referred to the pain service most frequently on a monthly basis. Descriptive characteristics of the participants for pain related information are displayed in Table 2.

Initial Analyses

Independent sample t-tests were conducted to compare age and years in nursing between the participants in the well-structured group and the ill-structured group in order to assess that random assignment to each group was effective in equally

distributing the characteristics for the sample. The results revealed there was not a significant statistical difference between the well-structured and ill-structured groups in either age, $M = 35.8$ ($SD = 10.50$) and $M = 35.7$ ($SD = 10.20$), respectively, $t(198) = 0.04$, $p = 0.97$, or years of nursing, $M = 8.5$ ($SD = 9.20$) and $M = 8.1$ ($SD = 8.20$), respectively, $t(198) = 0.33$, $p = 0.74$. Therefore, the groups assigned to the well-structured group and ill-structured group were equivalent. Cross tabs analyses with chi square statistic were done to compare gender, education, work status (full or part time), certification, pain education within the past year, and pain management services available at work. There were no significant differences: gender $\chi^2(1) = .53$, $p = .47$, education $\chi^2(2) = 1.11$, $p = .57$, work status $\chi^2(1) = 2.22$, $p = .14$, certification $\chi^2(1) = .32$, $p = .32$, pain education $\chi^2(1) = 1.48$, $p = .22$, and pain management services $\chi^2(1) = .00$, $p = .99$. Therefore, the groups assigned to the well-structured group and ill-structured group were equivalent. Table 1 contains the number and frequency of nurses for the well-structured and ill-structured groups for each comparison.

An independent sample t-test was conducted to compare the number of words spoken out loud by each nurse in the well-structured group and ill-structured group. The results from the pilot study suggested a relationship between the numbers of words spoken by nurses in each group. The pilot study suggested nurses in the analytical group may have a greater number of verbal responses. The results did not show a significant difference between the two groups, $t(197) = 0.08$, $p = 0.94$. The mean number of words spoken out loud by nurses reading the well-structured and ill-structured vignette was 182.1 ($SD = 101.15$) and 183.2 ($SD = 102.76$), respectively. A Spearman's rho correlation was done to further test for a possible relationship between number of words

spoken out loud and use of analytic decision making. The correlation was not significant, $r(200) = .02$, $p = .84$, therefore no relationship existed between analytical cognitive processes and the number of words spoken outloud by each nurse.

Hypothesis Testing

The first directional hypothesis analyzed was: Nurses reading the well-structured patient vignette will use analytical cognitive processes more than nurses reading the ill-structured vignette. The assumption of normal distribution of the variables to perform the ANCOVA were violated and transformations unsuccessful, and therefore, nonparametric testing was conducted. The number of distinct analytic cognitive processes was re-coded to 1 = use of an analytic statement and 0 = did not use an analytic statement. Crosstabs with chi square statistic was done to investigate if there was a difference between use and nonuse of analytic cognitive processes for the nurses in the well-structured group and the ill-structured group. The result did not show a statistically significant difference $\chi^2(1) = .27$, $p = .61$. Table 3 contains the number of nurses and frequencies for the full sample, and analytic versus no use of analytic cognitive processes between the well-structured and ill-structured group.

Crosstabs with chi square statistic was done to investigate if there was a difference between years of experience and analytical responses and optimal intuitive responses. The results did not show a statistically significant difference $\chi^2(1) = .40$, $p = .53$ and $\chi^2(1) = .18$, $p = .67$, respectively. Crosstabs with chi square statistic was done to investigate if there was a difference between years of work status and analytical responses and optimal intuitive responses. The results did not show a statistically significant difference $\chi^2(1) = 3.02$, $p = .08$ and $\chi^2(1) = .36$, $p = .55$, respectively. A

Fischer's Exact Test was done to compare education level and analytical responses and optimal intuitive responses. The results did not show a statistically significant difference $\chi^2(1) = 1.0, p = .61$ and $\chi^2(1) = 1.51, p = .22$, respectively.

The second hypothesis analyzed was: An association exists between analytical cognitive processes and planned pain management interventions. Spearman's rho correlation was conducted because of the lack of normality for analytic cognitive processes. There was a small positive correlation between use or nonuse of analytic cognitive processes and the number of planned pain management interventions, $r(200) = .26, p = .001$. Nurses who used analytical cognitive processes chose a greater number of pain management interventions, supporting Hypothesis 2. Table 4 contains the five planned pain management actions and the corresponding number of nurses who planned to use each action in the full sample, the well-structured vignette group and the ill-structured vignette group. Planned pain management actions included conducting a timely and more complete pain assessment, administering an increased analgesic dose, incorporating adjuvant pain measures such as heat or cold, reassessing the pain following the pain intervention, and making recommendations to the physician for potential changes to the treatment regime. Pain management interventions planned by the nurses were similar between the well-structured and ill-structured group. The most frequently chosen planned pain management intervention was increasing the analgesic dose, 39% for the well-structured group and 43% for the ill-structured group; recommending to the physician potential changes to the treatment regime, 28% for the well-structured group and 24% for the ill-structured group; using adjuvant measures, 19% for the well-structured group and 21% for the ill-structured group; reassessment of the pain after the

intervention, 8% for the well-structured group and 10% for the ill-structured group; and lastly, doing a more complete pain assessment, 6% for the well-structured group and 8% for the ill-structured group.

Examples of Cognitive Processes

Analytical Cognitive Processes

Shown below are examples from the coded transcripts that illustrate an analytical cognitive process used by the nurse when choosing pain management interventions. Analysis is the slow processing of data, greater awareness of the cognitive process, step by step processing (Cader, Campbell, and Watson, 2005). The following examples show the nurses' step by step process of analyzing the situation, indicating the use of analytical cognitive processes.

“I would assess the patient, and once I assessed him I would give him the next higher dose.” (Nurse # 2).

“First of all the patient has an 8/10 of pain scale so he's getting morphine 2 mg, 4 mg, 6 mg every 4 hours. His first dose is 4 mg and it just relieved his pain to a 6.” (Nurse # 66).

“I was looking at his vital signs just like indicating that you know, his respirations are a little bit elevated, his pulse is 98, which is high/normal, and his blood pressure is a little bit high for a young guy. So it could be all this indicating that he is experiencing pain so we can get it under control.” (Nurse # 128).

Optimal Intuitive Cognitive Processes

Intuition reflects the opposite properties of analysis with rapid processing of data, low awareness of the cognitive process, and averaging principles (Cader, Campbell, and Watson, 2005). Shown below are examples from the coded transcripts that illustrate an optimal intuitive cognitive process used by the nurse when choosing pain management interventions. Optimal intuition reflects the nurse's insight of the meanings and relationships that leads to expert decision making in planning pain management (Bjork and Hamilton, 2011). Optimal intuition is usually associated with expert nurses, as they are able to identify patterns in patient situations, and apply their expertise effectively to arrive at a decision (Benner, 1984). The following are examples of averaging principles with the nurse using perceptual cues to rapidly arrive at a decision when planning pain interventions.

“He’s not drug-seeking so I wouldn’t think he’s looking for that.” (Nurse # 49).

“I mean I did see that it’s like rare alcohol use, like I’m always looking at that kind of thing, like if he is naïve possibly to the narcotic.” (Nurse # 61).

“...and looking at the vital signs he is stable so I’m not worried about his blood pressure, his pulse. He’s not a drug user or whatever. Anyway that will not affect my opinion because I’m only concerned about managing the patient’s pain.” (Nurse # 71).

Suboptimal Intuitive Cognitive Process

Shown below are examples from the coded transcripts that illustrate suboptimal intuitive cognitive process used by the nurse when choosing pain management interventions. Suboptimal intuitive cognitive process show, that despite the nurses

intuiting the patient's pain, biases affect the cognitive processes in planning pain management.

“The only thing is that kind of bugs me is that he's not saying that he's in a lot of pain but there is no like body language indicating a lot of pain, but again, it depends on, it's a male. He can be more stoic in expressing himself so I can only treat what the patient tells me so just how I think about it, that's it.” (Nurse # 27).

“I don't know, it's kind of weird though, that he seemed kind of relaxed when he was with his family, but...” (Nurse # 29).

“No, I mean I'm putting it into perspective of like the night shift and I'm like oh maybe he needs something to help him relax, like something other than pain medication might help him too, you know. As far as something to help him sleep or relax....” (Nurse # 78).

Despite the patients' self-report of pain, the nurse seems to be intuiting the pain rating may be inaccurate due to the presentation of the patient. This led to suboptimal intuitive process which affected the planned pain management interventions. In the final example, the nurse is intuitively assuming the patient is anxious and treatment should focus on anxiety rather than pain; the resolution of the primary problem of pain would allow the patient to relax and sleep.

One hundred six nurses exclusively articulated analytical decision making, 10 nurses exclusively articulated intuitive decision making, One nurse did not articulate either analytic or intuitive decision making, and the remaining 83 nurses articulated both analytic and intuitive decision making, and quasirational cognitive processes. This

indicates the majority of nurses use analytical or analytical/intuitive processes, despite an approximate mean of eight years of experience. The expectation is that a nurse with eight years of experience would be labeled as proficient or expert (Benner, 1984) and therefore would have used a greater number of intuitive cognitive processes.

Pain Management Decisions

Listed below are examples of the pain management decisions chosen by the nurses. The pain management interventions were based on recommendations from the American Pain Society (2008).

The recommended practice is (American Pain Society, 2008) administration of increased pain medication dose until the patient experiences unacceptable side effects, and then titrating the dose according to pain relief and severity of side effects.

Increasing the dose was the most frequently chosen intervention.

Administering an increased analgesic dose

“It’s been 4 hours, I would definitely bump it up to the 6 mg and see how it works.” (Nurse # 21).

“So maybe giving him another dose, but a little bit higher going to six.” (Nurse # 5).

Collaboration between the nurse and physician include increasing the analgesic dose, changing the drug, changing the time interval for administration, or suggesting the use of a PCA. Collaboration reflects knowledge sharing and joint responsibility for the patient’s pain.

Making recommendations to physicians for potential changes to treatment regimen

“If it didn’t go below a three I would call the physician to have something ordered.” (Nurse # 120).

“I would give him a 6 mg dose and then reassess his pain. If his pain was not below a 4 I would go up to the 8 mg and reassess. If that did not help, I would contact the MD. I might also recommend a change to another med.” (Nurse # 162).

The use of adjuvant pain measures includes the use of heat, cold, position, distraction, relaxation, guided imagery, or massage. Adjuvant measures may contribute to more effective analgesia.

Incorporating adjuvant pain measures

“You know, elevate, teach him some breathing techniques and make sure he’s calm, you know, ice for relief.” (Nurse # 72).

“See if we can do any ice. Maybe dim the lights, try to make the atmosphere a little quieter.” (Nurse # 7).

A more complete pain assessment includes source of pain, pain location, pain relief goal, functional interference from pain, and factors that increase and decrease pain. A more complete pain assessment provides the patient with optimal pain management.

Conducting a more timely complete pain assessment

“I would go in and assess him on my own. And see how he’s doing. Ask him how he felt after the four, if he had any nausea, if it – kind of describe the pain you had when it was a six. How it felt. And if he could relax at all with that.....

I'd ask him if there was anything that's worked in the past, anything he knows of that have worked in the past or any pharm interventions." (Nurse #9).

"I would probably ask him if like anything helps the pain, like any different positions that he's in. To ask him what makes it worse or what makes it better. Probably try and do like a couple of non-pharmacological, like ask him."

(Nurse #38).

The reassessment of pain is a patient care standard mandated by The Joint Commission (2011); while The Joint Commission does not mandate the time frame for reassessment after pain medication administration, however the peak time for intravenous opioids is 30 minutes (American Pain Society, 2008). Reassessment of pain is a quality indicator and a measure of patient satisfaction.

Reassessing pain following the pain intervention within 30 minutes

"So basically, what I would do, maybe to try a dose as it's due now because it's been 4 hours and the second was given 4 hours ago, so maybe with this dose now I could try the 6 and then, you know, check in half an hour for IV pain medication, check in half an hour to see how his pain is managed." (Nurse # 69).

"I would reassess his pain, I would say within 20 minutes after I gave the morphine." (Nurse # 158).

Summary

Reading an ill-structured patient vignette did not result in the nurse using significantly less analytical cognitive processes than nurses reading the well-structured vignette when planning pain management interventions for the patient, however, use of

analytical cognitive processes was associated with a greater number of planned pain management interventions.

The most frequently chosen planned pain management intervention was increasing the analgesic dose, followed by recommending to the physician potential changes to the treatment regime, using adjuvant measures, reassessment of the pain after the intervention, and lastly, doing a more complete pain assessment.

The majority of nurses used analytical cognitive processes, followed closely by a combination of analytical and intuitive cognitive process. A small number of nurses used only intuitive cognitive processes.

Finally, examples of analytical cognitive processes, optimal intuitive cognitive processes, suboptimal intuitive cognitive processes, and pain management interventions were presented to illustrate the different types of cognitive processes the nurses used in responding after reading the vignette. The findings and implications for implications for practice, education, and further research are discussed in Chapter 5.

Table 1

Descriptive Statistics Demographic Data N = 200

	<u>Total Sample</u>		<u>Well-structured</u>		<u>Ill-structured</u>	
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>
Gender						
Male	11	4%	4	4%	7	7%
Female	189	96%	90	96%	99	93%
Education						
AD	54	26%	27	29%	27	25%
BS/N	145	73%	67	71%	78	74%
MS/N	1	0%	0	0%	1	1%
Work Status						
FT	138	69%	60	64%	78	74%
PT	62	31%	34	36%	28	26%
Certified						
Yes	40	20%	16	17%	24	23%
No	160	80%	78	83%	82	77%

Table 2

Descriptive Statistics Pain Information Data N = 200

	<u>Total Sample</u>		<u>Well-structured</u>		<u>Ill-structured</u>	
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>
Pain Service						
Yes	151	76%	71	75%	80	76%
No	49	24%	23	25%	26	24%
Pain Referral						
Never	53	27%	23	25%	30	28%
Weekly	33	16%	17	18%	16	16%
Monthly	55	27%	24	26%	31	29%
2-6 per month	50	25%	25	26%	25	23%
7-12 per month	9	5%	5	5%	4	4%
Pain Education						
Yes	130	65%	57	61%	73	69%
No	70	35%	37	39%	33	31%

Table 3

Frequency Distribution of Analytical and Intuitive Responses for Well-structured and Ill-structured Groups {n(%)} N = 200

<u>Cognitive Process</u>	<u>Total Sample</u>	<u>Well-structured</u>	<u>Ill-structured</u>
	n(%)	n(%)	n(%)
Analytical			
Yes	189(95%)	88(94%)	101(95%)
No	11(5%)	6(6%)	5(5%)
Intuitive			
Yes	93(47%)	38(40%)	55(52%)
No	106(53%)	55(60%)	51(48%)

Table 4

Frequency Distribution of Each Planned Pain Management Actions {n(%)} N = 200

<u>Code</u>	<u>Total Sample</u>	<u>Well-structured</u>	<u>Ill-structured</u>
	n(%)	n(%)	n(%)
More complete pain assessment			
Yes	27(14%)	11(6%)	16(8%)
No	173(87%)	83(42%)	90(45%)
Increase dose			
Yes	163(82%)	77(39%)	86(43%)
No	37(19%)	17(9%)	20(10%)
Adjuvant Measures			
Yes	80(40%)	38(19%)	42(21%)
No	120(60%)	56(28%)	64(32%)
Reassess after intervention			
Yes	36(18%)	16(8%)	20(10%)
No	164(82%)	78(39%)	86(43%)
Recommendations to MD			
Yes	103(52%)	55(28%)	48(24%)
No	97(49%)	39(20%)	58(29%)

CHAPTER 5: DISCUSSION

Overview

The current study was conducted to test the premise of cognitive continuum theory (Hammond, 1996) that well defined task structure characteristics will induce analytical cognitive processes. The second segment of the study was conducted to determine if an association exists between analytical cognitive processes and selected pain management interventions. In the study, 200 medical surgical nurses were randomly assigned to read and respond to either a well-structured or an ill-structured pain vignette. Protocol analysis was used as the research method. Verbal data are used in protocol analysis to examine how information is accessed and verbalized and how participants respond to stimuli (Anders-Ericsson & Simon, 1993). In protocol analysis, the think out loud process is used, in which the participant “explains their thoughts, ideas, and hypothesis in a given situation” (Anders-Ericsson & Simon, 1993, p. 79). The resulting verbalizations are recorded and coded for analysis. Content analysis was the method used to analyze the transcripts.

Discussion

The results of the analysis of hypothesis one, nurses reading the well-structured pain vignette will use analytical cognitive processes more than nurses reading the ill-structured vignette was not supported. Nurses reading the ill-structured patient vignette verbalized a similar number of analytic cognitive processes as nurses reading the well-structured patient vignette. The findings of the current study were in conflict with previous research, which supported the theory that task characteristics of the situation will induce analytical cognitive processes or intuitive cognitive processes (Dunwoody et

al., 2000; Hammond et al., 1984; Lauri et al., 2001). Potential factors contributing to hypothesis one not being supported may have been related to: (a) task structure of the well-structured and ill-structured pain vignettes, (b) environmental factors, and (c) intrinsic factors of the nurses, each of which is discussed in the following section.

Task Structure Characteristics

The development of the well-structured and ill-structured pain vignettes was based on the theory of task structure characteristics. Table 5 provides the theoretical basis for task structure characteristics (Custers, 2013; Dunwoody et al., 2000; Hammond et al., 1984; Lauri et al., 2001; Mahan, 1994). The theoretical basis for task structure characteristics has been used in only two previous studies to induce different cognitive processes (Dunwoody et al., 2000; Hammond et al., 1984).

Hammond et al. (1984) developed three scenarios based on task structure characteristics. The scenarios involved highway esthetics, highway safety, and highway capacity to induce intuitive, quasirational, and analytical cognitive processes, respectively, when read by highway engineers. The results provided empirical support for cognitive continuum theory. Dunwoody et al., examined cognitive continuum theory and task structure in more depth. Dunwoody et al., hypothesized that it was possible to calculate a task continuum index to predict which types of tasks will induce a particular types of cognitive processes. The study suggested cognitive continuum theory is a consistent and useful measure of cognitive modes. The remainder of literature reviewed provided the theoretical basis for task structure characteristics, however no empirical support. There has been no published literature that tested task structure characteristics for the effect on nurses' cognitive processes.

Table 5

Comparison of Task Structure Characteristics Inducing Intuition or Analysis

<u>Characteristics Inducing Intuition</u>	<u>Characteristics Inducing Analysis</u>
Complexity of Task Structure	Complexity of Task Structure
Cues displayed simultaneously	Cues displayed successively
Greater than 5 cues displayed	Less than 5 cues displayed
High redundancy among cues	Low redundancy among cues
Ambiguity of Task Content	Ambiguity of Task Content
Task outcome not available	Task outcome available
Unfamiliar with task	Familiar with task
High accuracy not likely	High accuracy likely
Form of Task Presentation	Form of Task Presentation
Continuous cue data	Discrete cue data
Cues measured perceptually	Cues measured objectively

Table 6 shows the comparison of task cues of the well-structured and ill-structured vignettes. The well-structured vignette grouped task cues according to information provided to the nurse in separate categories. The task cues are less than 5 for each category, have low redundancy, and are displayed successively. The task of assessing and choosing pain interventions are highly familiar to the nurse, as well as the

task outcome. The task is the alleviation of pain, and the accuracy of the task, the use of opioids to alleviate pain. The cues are presented objectively. The ill-structured vignette incorporated all of the task cues of the well-structured vignette, with the addition of a family visit. The family presence introduced greater than five cues; cues were measured perceptually, and increased the ambiguity of the task content. While the task structure characteristic cues introduced in the ill-structured vignette met the criteria for inducing intuition, the addition of the family visit may have been too subtle to induce intuitive cognitive processes in the nurse. The nurse's mental representation of the vignette may have been mismatched to the task structure characteristics. The family may have served as more a distraction than as a method to induce intuitive cognitive processes.

The vignettes were developed based on the results from the pilot study. The pilot study used the warm up exercise suggested by Anders-Ericsson & Simon, (1993) in which participants were asked to think outloud when asked a series of questions, such as simple mathematical computations and counting items. The results of the pilot study showed a greater number of analytical responses from the participants, suggesting the warm up exercise primed the participant to use analytical cognitive processes, and therefore the warm up exercise was omitted from the current study. As a result of omitting the warm up exercise a greater number of participants used intuitive cognitive processes. While the nurses used more intuitive cognitive processes in the current study than in the pilot study, the majority of cognitive processes used were analytical for both the well-structured and ill-structured vignette, hence the cues may have been too subtle to induce a greater number of intuitive cognitive processes.

Table 6

Comparison of Task Cues for the Well-Structured and Ill-structured Vignettes

	<u>Well -Structured Vignette</u>	<u>Ill-Structured Vignette</u>
Task Cues	Report	Report/Family Visit
	No known allergies	No known allergies
	No medication	No medication
	Non smoker	Non smoker
	Rare alcohol use	Rare alcohol use
	No recreational drug use	No recreational drug use
	Physical Assessment	Physical Assessment
	Vital signs	Vital signs
	Weight	Weight
	Circulation, sensation, motion	Circulation, sensation motion
	Positive pulses	Positive pulses
	No swelling	No swelling
	Pain Assessment	Pain Assessment
	Throbbing dull ache	Throbbing dull ache
	Pain 8	Pain 8
		Family Visit

Talking with wife

Two children in room

Youngest child sitting with wife

Children well behaved

Children appear happy

Kisses husband good by

States she will be back

Wife will call family & friends

Reminds wife to let family

and friends know he is

feeling good and doing

all right after the accident

Environmental Factors

Environmental factors may have influenced the responses of nurses to the well-structured vignette. The presence of stress while responding to the vignette was not taken into account when the nurses were reading the vignettes. Stress could be related to workload, such as the number of patients assigned to the nurse, acuity of patient load, noise level on the unit, or information overload, and have been identified as contributing factors to stress (Milliken, Clements, & Tillman, 2007) and may not have been readily recognized. The implications of stress on cognitive processes have been studied. Stress may cause changes in perceptions, thoughts, comprehension, and judgment. Decreased

reading comprehension, decreased confidence in decisions made, and loss of auditory attention have been documented. Furthermore, inability to attend to simultaneous and sequential tasks and impaired communication become more evident (Shirey, Ebright, & McDaniel, 2013). Participating nurses may have experienced time pressure because of multiple priorities in patient care and workload, which may have caused nurses to use cognitive short cuts. Stress and time pressure may have contributed to distraction of the nurse.

Another factor may have been the location where the nurses who worked in the academic medical centers were able to read the vignette. Prior to the nurse reading the vignette, attempts were made to find a mutually agreeable time away from the unit to participate in the study; however, the goal of being away from the unit was not always accomplished. Since there was variability in where the nurses were able to read the vignette, this may have been a potential limitation.

Intrinsic Factors

Intrinsic factors of individual nurses may have affected responses to the vignettes. The previously mentioned factors of stress and fatigue may have affected how the nurse responded after reading the vignette. The nurse may have used cognitive short cuts when responding to the vignettes. For example, Hammond (1996) described the phenomena of satisfying, which is defined as “an attempt to satisfy common sense....people do not have the resources in time, skills, or tools to process and fully explore the entire problem, so they satisfy” (p. 155). For example, interviews #152 and # 136, the transcripts were less than 5 lines, which perhaps from the individual nurse’s perspective, was a common sense

way to deal with a straight forward situation, and indicate the cause of patient's pain did not need to be further explored.

Another factor may have been the shift the nurse worked and the nurse's fatigue. Approximately 30%-40% of the nurses who participated worked evening or night shifts, either 7 pm to 7 am or 11 pm to 7 am. The effects of fatigue related to lack of sleep include cognitive problems, mood alterations, reduced job performance, increased safety risks, and physiological changes (Roger, 2008). Additionally, the number of extended hours the nurse may have worked, or the number of consecutive shifts the nurse may have worked was neither measured nor controlled and thus fatigue may have been a limitation when the nurses responded to the vignette (Roger, 2008). Random assignment to group controlled for the above intrinsic factors, but the intrinsic factors might have produced a ceiling effect, limiting use of cognitive processes across groups. Lastly, the nurse's response may indicate the static nature of a written vignette will not induce cognitive processes. The vignettes lack the visual images that can provide nonverbal cues and opportunity for interactions. Furthermore, the nurse may have perceived that the vignette was an oversimplification of the situation or the vignettes lack of realism. A more robust response from the nurse might occur in an actual clinical situation where the nurse is interacting with a patient.

Hypothesis Two

Hypothesis two supported a positive correlation between the analytical cognitive processes identified on the continuum and the number of planned pain actions. The significance indicates that nurses who use analytical cognitive processes plan an increased number of pain management actions when presented with a pain vignette. This

suggests that nurses who used analytical cognitive processes were able to identify the problem, using a slower, step by step, conscious cognitive process. The current study is the first to specifically examine the type of cognitive processes used and planned pain management interventions, and to show an association between analytical cognitive processes and planned pain management interventions. Other studies have examined the association of analytical cognitive processes and the selection of interventions and the results show nurses that have used analytical cognitive processes when planning interventions did not lead to a more appropriate selection of interventions (Dowding et al., 2009; Offredy et al., 2007).

Dowding et al., (2009) study examined the decision making of heart failure nurse specialists when making treatment decisions for patients with heart failure. The focus of the study was medication titration and palliative care. The study was an exploratory and qualitative and used non-participant observation and semi structured interviews. The current study was a posttest only experimental design, and used protocol analysis and content analysis. In Dowding et al., (2007) the semi structured interviews of the nurses grouped questions into five areas: (a) types of decisions, (b) sources of information and their use (medical records, guidelines, and protocol), (c) sources information (clinical and patient cues), (d) difficulty and confidence related to making decisions, and (e) risk and benefit of treatment. The semi structured interviews may have primed the nurse to use one type of cognitive processes over another. For example, the question “Can you take me through the process of how you decide what to do?” (p.1317), may have primed the nurse to use more analytical cognitive processes. The current study avoided the suggested warm up exercise used in protocol analysis. The use of the warm up exercise was

identified as a confounding factor from the pilot study, potentially priming the nurse to use more analytical cognitive processes. The current study only prompted the nurse to continue to “think out loud”, in order to capture the cognitive processes used. In the Dowding et al., (2009) study, the task characteristics for both medication titration and palliative care were identified by the thematic analysis. The task characteristics were defined as: the amount of information collected how information was measured, was the information inter-related, was there a way of organizing the information, could the decision be decomposed, and what time was available to reach a decision. The response of the nurse was matched to the task characteristic and then coded for the type of cognitive process used. The task structures were not incorporated into the scenarios. The criterion to identify what constituted analytical, intuitive, or quasirational cognitive processes was absent. In contrast, the current study used task structure criteria to develop the vignettes and developed a code book for the pilot study which was used to guide the coding process for the current study.

Offredy et al., (2007) used scenarios and semi structured interviews to examine pharmacological knowledge of medication related issues with cognitive continuum theory used to guide the study. Similar to the current study, scenarios were used, as was content analysis. The difference between the studies was the scenarios used in Offredy et al., (2007) were from another study and the use of task structure characteristics in the development of the scenarios was not discussed. Examples of the scenarios provided seem to indicate task structure characteristics were not incorporated. Scenario 4 was as follows: “A 65 year old man asks you if he can take some aspirin for his severe pain due to gout. How would you proceed?” (p. 860). The scenarios were validated, however, the

researcher stated the purpose of the scenarios was to assess the participant's knowledge of medication issues. Knowledge of medication issues were coded by the number of correctly identified issues and correct solution provided by the nurse. Content analysis was used; however, the transcripts were analyzed for how confident the nurse was with medication issues. How the researcher determined the coding for analytical, quasirational, and intuitive was not described. The current study developed a code book for task characteristics based on cognitive continuum theory and pain management standards of care to analyze transcripts. The current study developed the pain vignettes on task structure characteristics. Furthermore, it is not clearly described how Offredy et al., (2007), linked the type of cognitive processes identified to medication issues and to the correct solution. The findings of the two studies conflict with the findings of the current study. The conflicting results of Dowding et al., (2009) and Offredy et al., (2007) studies may be related to the methods used. It is not clear from the studies how task structure characteristics were used to develop well-structured or ill-structured scenarios. Additionally, the use of the semi structured interviews may have primed the nurse to favor one type of cognitive process over another.

Limitations

Limitations that were identified in the study included subtlety of task cues in the ill-structured vignette, bias, use of written vignettes, and theoretical framework. The family visit was added to introduce ill-structured task cues. While the task cues added to the vignette fulfilled the criteria for ill structured characteristics, the family visit may have been too subtle. If the family visit cues were too subtle, and depending on the nurse's knowledge base of pain management, the nurse may have different interpretations

of the portrayal of the family visit. For example the nurse may have interpreted the family visit as a distracter or interpreted the visit as family support. For example, Ferrell and McCaffery (2012) developed the Knowledge and Attitudes Survey Regarding Pain, in which two scenarios are presented. One scenario portrays a patient as laughing with a visitor and one scenario portrays the same patient grimacing in pain. The Ferrell and McCaffery (2012) scenario portrays a less ambiguous cue than the scenario in the current study. This suggests less subtlety may be indicated when using task cues in vignette development to ensure the inducement of different cognitive processes.

The current study did not address potential or actual bias on the part of the nurse. Two biases specific to the study were identified: age and gender. Age bias is based on the nurse's perception of how age groups react in specific situations. For example, people in the age range of 70 to 80 may be viewed as stoic (Arslanian-Engoren, 2000; Wandner, et al., 2013). Provided are examples of the nurses responses as they relate to the age of the patient in the vignette.

“He’s young enough to handle it.” (Nurse #86).

“He’s 36, so he can handle an even higher dose.” (Nurse #64).

“He’s 36, so that has a lot to do with it.” (Nurse #23).

The nurses were planning pain management interventions based the patient's age. There is the assumption that younger patients are able to tolerate higher doses of opioids. The nurses' responses indicate the patients age affected the planned pain management interventions however it is not clear if the cognitive processes used were also affected.

Gender bias is based on the nurse's perception of presentation of symptoms of males and females. Provided below are examples that reflect gender bias.

“He’s a male, sorry, but they are, they have more pain than women I think. They don’t have the pain tolerance that women would have, to me.” (Nurse 23).

“Maybe he’s trying to be tough.” (Nurse 175).

“He’s a male; he can be more stoic in expressing himself.” (Nurse 23).

There are studies that show gender stereotypes affect pain management. Some studies indicate men are perceived as “tough” and do not need higher doses of pain medication (Wandner et al., 2013). Other studies show men have a lower pain tolerance than women, and others studies indicate gender bias is not an issue (Wellington & Chia, 2009). Both age and gender bias were identified, however the potential effect on the cognitive processes used by the nurse was not examined.

Because the research in cognitive continuum theory has been limited to the use of written vignettes or scenarios, it may not capture cognitive processes used given the complexity and fluidity of real life decisions that are made by nurses. The static presentation of a written vignette may have limited the responses of the nurses because the contextual factors, including facial expressions, body movements, and other subtle cues could have enhanced the types of cognitive processes used by the nurse. The use of simulation provides a more realistic environment and could have enhanced the contextual factors, including facial expressions or body language, presented to the nurse. Simulation can be more effective in providing more effective training to achieve proficiency in clinical skills than traditional experiential methods. Simulation can provide the ability to use a range of task structure characteristics, capture clinical variation and task cues, and provide control of the environment (Grant & Marriage, 2011). The focus of simulation is to provide a controlled safe environment where learners can practice clinical skills

without harming patients, and focus on the development of clinical skills. However, no literature was identified that examined the use of simulation, cognitive processes, and pain management.

The theoretical framework of cognitive continuum theory may not capture cognitive processes in all nurses. Cognitive continuum theory provides a general framework; it describes the different types of cognitive processes and how they are correlated to task features (Hamm, 1987). It does not describe how a person should think analytically or intuitively. Additionally, there are situations in which a person may not use either analytical or intuitive cognitive processes. Hammond (1996) describes satisfying, as one of the elements of cognitive continuum theory, in which the person does not have the skills, or tools to process the problem fully.

Cognitive continuum theory does not address cultural or social aspects or perspectives of the individual or the association with cognitive processes. For example, the cultural aspects nurses bring with them to the situation could include what their own cultural views are of pain. For example, a Mexican American nurse may have a strong Roman Catholic belief and values, may ascribe those values and beliefs, consciously or unconsciously, when planning pain management interventions. The nurse may believe that pain is an inevitable part of life; pain is necessary, natural, and beneficial (Brennan, Carr, & Cousins, 2007). The societal aspects affecting cognitive processes used by nurses may include opioid side effects, risk of addiction, and misuse (Coker, Papaioannou, Kaasalainen, Dolovich, Turpie & Taniguchi, 2010). Additionally, segments of society may expect that “good patients” do not complain (Coker, et al., 2010). Lastly, treatment modalities are based in biomedical models, which emphasize the saving of life rather than

the quality of life (Brennan, et al., 2007). Understanding the cognitive processes used by nurses is one part of pain management, which may be affected by the cultural, societal, and personal biases the nurse brings to the situation. Since pain management is a multifaceted problem, the cognitive continuum theory addresses only one specific aspect and may not decrease barriers to pain management.

Implications

Education Implications

The results of hypothesis two showed an association between analytic cognitive processes and planned pain management interventions. Educational strategies could be developed to teach the nurse to identify the task structure characteristics of situations. Teaching the nurse task structures characteristics would then lead to the teaching of the types of cognitive processes that are used by the nurse. The education strategy could entail that each process of pain management could be deconstructed (assessment, pharmacological knowledge, non-pharmacological knowledge, reassessment) and an educational scenario or simulation be developed for each that incorporates ill-structured and well-structured task characteristics for each of the deconstructed process. The nurse could be debriefed after the education to identify the task structure and cognitive processes used in relation to the pain management interventions chosen. Once the nurse could identify task structure characteristics and cognitive processes used, further education on fostering analytical cognitive process could be developed. For example, knowledge, skills, and attitudes for pain management could serve as a template to guide the nurse through analytical processes to manage pain.

In addition to addressing education of cognitive processes, the study identified knowledge deficits in recommended pain management practices. Lack of knowledge and inadequate assessment skills have been identified as barriers to effective pain management (Vallerand, Hasenau, and Templin, 2004; Wright and Bell, 2001). Despite the fact that 65% of the nurses received pain education within the past year, optimal planned pain management choices were not selected, suggesting nurses may need more frequent education on pain management strategies. Nurses selected administering an increased analgesic dose in 81% of instances. Surprisingly, the researcher anticipated that the most frequently chosen intervention of increasing the analgesic dose would have been at 100%. However, some of the nurses opted to repeat the same dose the patient had last received. The nurses indicated this was chosen because of concerns of respiratory depression.

If the nurse does not have an adequate knowledge of assessment or basic assessment skills, pharmacological knowledge, knowledge of adjuvant measures, and reassessment, educational strategies to identify task structure characteristics and associated cognitive processes will not be effective. In this case the nurse may resort to satisfying, as previously described by Hammond (1996), in which the person does not have the knowledge, skills, or tools to process the problem fully, to choose pain management interventions. Other potential knowledge deficits were doing a more complete pain assessment. This was the least chosen pain management intervention, with only 14% of the nurses indicating they would do a more complete assessment. A more complete assessment would have been verifying the location of the pain, were there aggravating factors, such as movement, alleviating factors, such as position, duration of

the pain, and any other symptoms associated with the pain. Another deficit was the nurse making a recommendation to the physician for potential changes to the treatment regime; for example, the nurse must have a broad baseline knowledge of pain medications to collaborate with the physician and advocate for a change in the treatment regime. Other potential knowledge deficits include the use of adjuvant pain measures; for example the nurse must have a baseline knowledge of the indications for use of heat, cold, and positioning for the treatment of pain. The pain knowledge deficits described indicate the nurse may rely on satisfying, rather than engaging in analytical or intuitive cognitive processes..

Practice Implications

How nurses reach a decision is a key component of nursing practice. The understanding of the types of cognitive processes used by nurses remains limited. Cognitive continuum theory provides a general framework for describing cognitive processes and the correlation with task features. Understanding the correlations can lead to better clinical practice, and in turn lead to better pain management. The Institute of Medicine (IOM) (2011) in their report on pain outline the challenges that need to be addressed to treat pain. These included pain as public health challenge, educational challenge, and research challenge. Under treatment of pain causes needless suffering, has social and monetary consequences and the IOM (2011) recommended the adequate treatment of pain become a national priority. Since nurses are involved in most aspects of patient care across the continuum, the opportunity exists to address the issues presented. The implications for nursing practice are the opportunity to contribute to the body of literature that addresses the cognitive processes used by nurses when planning pain

management interventions. An increased awareness of the cognitive processes the nurse uses could enhance competence in pain management in clinical practice.

Other practice implications include the association of cognitive processes to nursing process. The nursing process, assessment, diagnosis, planning/outcome, implementation, and evaluation (ANA, 2013) is the accepted core of nursing practice. Cognitive processes used by the nurse are an integral part of the assessment phase of the nursing process, in which the nurse gathers and analyzes data. Gaining an understanding of the cognitive processes used by the nurse in this phase would support the nursing process, and potentially aid in the diagnosis, planning/outcome, implementation and evaluation phases of the process. If the nurse has an awareness of the cognitive processes used, the nurse could better assess either the under treatment of pain or the overtreatment of pain, both of which consequences for the patient (Pasero, Manworren, & McCaffery, 2007). Implications for education could focus in the assessment of under treatment of pain, as under treatment can be detrimental to the patient. For example, unrelieved pain can lead to decreased mobility, leading to pulmonary embolus or pneumonia. At the opposite end of the spectrum, overtreatment can lead to respiratory depression, however if the nurse has a better knowledge of pain interventions, the nurse would know respiratory depression is relatively rare (Pasero, Manworren, & McCaffery, 2007; The Joint Commission, 2012).

In addition to the nursing process being an accepted core of nursing practice, critical thinking has been espoused by the nursing profession for approximately the last 20 years as another core nursing practice (Riddell, 2007). Critical thinking has multiple definitions. Riddell (2007) identified key commonalties in the multiple definitions of

critical thinking: reflection, identification and appraisal of assumptions, inquiry, interpretation, analysis, reasoning, judgment, and context (p.122). Critical thinking has achieved such a degree of importance in the nursing profession, the National League for Nursing Accrediting Commission and the Commission on Collegiate Nursing Education mandate nursing schools includes the development of critical thinking skills in curricula (Cody, 2002). The majority of research literature has focused on the development of critical thinking skills in nursing students (Newton & Moore, 2013; Redding, 2001), while research on fostering critical thinking skills for the practicing nurse is not as common in the research literature. Measuring critical thinking skills remains elusive. Riddell (2007) suggests the current tools developed and used to measure critical thinking skills may not be appropriate to nursing. Cody (2002) argues nursing education has used critical thinking as a buzz word and has provided “virtually no substantive content on critical thinking (p. 185). Further, no research was identified that examined if there is an association of cognitive processes and critical thinking skills.

The understanding of the cognitive processes used by nurse when planning pain interventions would aid in pain management education and research. Factors cited previously, such as bias, can affect the cognitive processes. Nurses are not accustomed to examining biases or the cognitive processes they use when planning pain management interventions, and would require using evidence based examples of pain management. Interactive group discussion would facilitate increasing knowledge and awareness of cognitive processes used.

Future Research

The current state of decision making research focuses on descriptive and normative decision making (Hansson, 2005; Wang & Ruhe, 2007). The focus of cognitive continuum theory (Hammond, 1996) is how task structures characteristics are correlated to the type of analytical process used (Hamm, 1987). The focus of research on pain is the knowledge of pain management, attitude, and biases of the caregiver (Brockopp et al., 2003, Burns et al., 2010; Elander, Marczewska, Amos, Thomas, & Tangayi, 2006; Ferrell, Eberts, McCaffery, & Grant, 1991; Hirsh, Jensen, & Robinson, 2010; Layman-Young, Horton, & Dvidhizar, 2006; Manias, Bucknall, & Botti, 2002). There has been no literature identified that address the association of cognitive processes and planned pain management interventions. There is an opportunity for continued research in this area.

The aim of future research could be continued examination of well-structured and ill-structured task characteristics to induce different cognitive processes. Perhaps the addition of the use of Dunwoody et al., (2000) task continuum index would provide additional guidance in the development of vignettes or simulation. Additionally, a pre-test, post-test experimental design that measured nurse's pain management knowledge before reading the vignette would provide an additional control. Another aim of future research should be directed at the task structure characteristics and the inducement of different types of cognitive processes when planning pain management interventions. The research could include the examination of task structures and psychological factors associated with cognitive processes and pain management. For example, would a scenario or simulation that incorporated well-structured task characteristics and ill-

structured characteristics of a patient with depression and pain affect the cognitive processes used by the nurse? Research on cultural factors and ethical issues using task structures on patients from different cultural backgrounds, or task structure characteristics with well-structured and ill-structured ethical issues in pain could be examined.

Age and gender bias were identified in this study. Specifically, age bias related to younger patients and gender bias related to male patients was identified. However, it could not be determined from this study if there was an association between bias and cognitive processes used. Further research could explore if there is an association between cognitive processes, age, gender, and pain management.

Another aim of future research could focus on the how cognitive processes and critical thinking skills are associated. What is the role of cognitive processes in developing or teaching critical thinking skills? Would fostering the use of different types of cognitive processes enhance critical thinking skills?

Conclusions

The current study examined the use of cognitive continuum theory and task structure characteristic to induce analytical and intuitive cognitive processes and the association of cognitive processes in the planning of pain management interventions. The study did not support well-structured task characteristics induced any greater number of analytical cognitive processes. The potential factors and limitations were discussed.

A small significant association between the use of analytical cognitive processes and planned pain management interventions was shown. The significance indicates that analytical cognitive process may be better than intuitive cognitive processes in choosing recommended pain management interventions.. The use of cognitive continuum theory

should continue to be tested to increase the understanding of decision making by nurses and further add to the body of knowledge of decision making. Cognitive continuum theory provides a way to unify these different theories and models. Cognitive continuum theory may increase nursing knowledge about cognitive processes used to make pain management decisions and decisions about other common areas of nursing practice. The role of analytical cognitive processes and nursing process along with critical thinking skills needs to be explored and operationalized. The increasing complexity of the health care environment poses challenges to nurses when making decisions. As decision making remains a multifaceted phenomenon, the continued use of nursing process and critical thinking skills has not led to nurses arriving at better pain management decisions, suggesting teaching the use of analytical cognitive processes may play a more important role in the use of nursing process and critical thinking when making decisions about pain management.

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Pain education in past year? Yes _____ (1)

No _____ (2)

Thank you for your participation!!

Appendix B

Code Book

Decision-making

Code 1. Analytical. Analytical decision-making is defined as the slow, conscious, rational process used by the individual. Key words used by the participant to reflect this type of decision-making include verbalizations of intent to examine technical data, seeking new information, intent of seeking alternatives, and review of symptoms.

Code 2. Intuitive. Intuitive decision-making is defined as a rapid, unconscious, or automated process. Key words that reflect this type of thinking are verbalizations of hunches, emotions, feelings, beliefs, and impressions.

Code 3. Quasirational. Quasirational decision-making is the combination of analytical and intuitive decision making. Participants' verbalizations include previously described words, but may also include key words indicating options, consensus, risk, or alleviating factors.

Coding is done in the right hand margin of the manuscript.

Code groupings of similar comments together (e.g., vital signs).

Do not double code.

Pain Management

Code A. Conducting a timely, more complete pain assessment. This includes source of pain, type of pain, use of numerical scale, pain relief goal, distress measures (potential external issues, such as financial worries), and non-verbal cues.

Code B. Administering an increased analgesic dose.

Code C. Incorporating adjuvant pain measures, such as heat, cold, position, distraction, relaxation, or guided imagery.

Code D. Reassessing pain following the pain intervention. Usual time frame for IV medication is within 30 minutes.

Code E. Collaborating with the physician for potential changes to treatment regime. Increasing dose, changing drug, changing time interval for administration, or suggesting PCA. Pain management strategies will be coded in the left margin of the transcript.