Efficacy of a behavioral intervention to decrease medication transcription errors among professional nurses

Kathleen Ann Becker
Marquette University

EFFICACY OF A BEHAVIORAL INTERVENTION TO DECREASE MEDICATION TRANSCRIPTION ERRORS AMONG PROFESSIONAL NURSES

by

Kathleen Becker, B.S., M.S.

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ABSTRACT

EFFICACY OF A BEHAVIORAL INTERVENTION TO DECREASE MEDICATION TRANSCRIPTION ERRORS AMONG PROFESSIONAL NURSES

Kathleen Becker, B.S., M.S.
Marquette University

The purpose of this study, guided by Donabedian's structure-process-outcome model, was to evaluate if a cognitive-behavioral education intervention would decrease medication transcription errors among professional nurses when admitting patients 65 years of age or older on 5 or more prescribed medications to a hospital. In 1993 medication errors are estimated to have accounted for about 7,000 deaths (Institute of Medicine, 2000). It has been shown that interventions, pharmacist involvement, and reconciliation tools can help prevent medication errors (Pronovost, et al., 2003; Crotty, Rowett, Spurling, Giles, & Phillips, 2005; Kaboli, McClinton, Hoth & Barnett, 2004). Currently, no peer-reviewed published research exists regarding professional nurses and admission medication list accuracy. In this study, a randomized intervention design was used where professional nurses, n=52, were asked to complete a medication admission list on patients' 65 years of age or older on 5 or more prescribed medications. A medication error score was calculated by advanced practice nurses who were trained on medication reconciliation. A second medication list was obtained from the nurses after an intervention group was provided with a cognitive-behavioral education intervention. The control group completed admission medication lists as usual. Sixty four percent of all patients had one or more medication errors. Further, the medication error score was compared between the intervention and control group. The mean medication error score in the pre-intervention results demonstrated no significant difference between the intervention and control group (means=3.54; $p=1.0$). The mean medication error score for the post-test control group (mean=3.23; $p<.001$) was significantly higher than the mean score for the post-test intervention group (mean=.69; $p<.001$). The findings suggest that providing a cognitive behavioral education component to professional nurses can decrease the number of medication transcription errors on admission medication lists. Also, a small positive relationship was found between number of patient prescribers and medication error score, $r=0.26$, $n=104$, $p<.01$, the more prescribers a patient has the more medication errors occur. This research expands Donabedian's model by demonstrating improvement in the process of medication admission list obtainment by use of a cognitive-behavioral intervention.

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Chapter 1

Introduction

Errors in retrieving accurate and complete medication histories by health professionals often lead to increased injuries and death. The Institute of Medicine (IOM) report *To Err Is Human: Building a Safer Health System* (IOM, 2000) identified medication errors as the most common type of error in health care. In 1993, medication errors are estimated to have accounted for about 7,000 deaths. Medication-related errors occur frequently in hospitals and account for one out of 854 inpatient deaths (IOM, 2000). It is estimated that in 1998, nearly 2.5 million prescriptions were dispensed by U.S. pharmacies. Medication errors have the potential to increase future morbidity and mortality rates due to errors in prescribing, dispensing and unintentional nonadherence on the part of the patient (IOM, 2000). However, deaths and injuries from medication errors can be reduced and avoided if appropriate interventions take place to modify behaviors that lead to medication errors.

Medication error is defined by IOM (2004), as "the failure of a planned action to be completed as intended (i.e., error of execution), or the use of a wrong plan to achieve an aim (i.e., error of planning)" (p30). An error may be an act of commission or an act of omission. "Omissions errors are defined as a deletion of a drug used before admission and commission errors are defined as the addition of a drug not used before admission." (Tam, Knowles, Cornish, Fine, Marchesano and Etchells, 2005, p. 510). An incomplete or inaccurate medication history contributes to the wrong plan to achieve an aim. Hospital medication regimens are established using medication histories.

If they are inaccurate or incomplete, have omissions or commissions, medication errors can occur when ordering admission medications (Cornish et al, 2005).

The American Association for Retired Persons (AARP) reported there were 36.3 million persons 65 years or older in 2004 (AARP, 2005). Five out of six persons 65 years and older are taking at least one medication and almost half are using three or more (Centers for Disease Control and Prevention [CDC], 2004). With many older adults taking three or more medications the possibility for medication errors is increased. Furthermore, medication errors with the elderly often occur upon admission to a hospital, due to many factors including time allowed for the admission interview, the severity of the patient's illness, the patient's cognitive status, language barriers and the patient's familiarity with his or her medication regimen (Cornish, et al, 2005). In addition, Dobrzanski, Hammond, Khan, and Holdsworth (2002) have identified that up to 27% of all hospital prescribing errors can be attributed to incomplete medication histories at the time of admission (Dobrzanski, et al., 2002). Developing nursing interventions at the time of admission that assist older adults in managing their medications can help prevent medication errors and patient death.

There are multiple factors that contribute to medication errors in the elderly, the organization context in which nurses practice, including providing nurses' enough resources (time, staff) to collect medication information, quiet environment for the interview, patient's ability to provide adequate information and the processes in place for medication list obtainment.

Aiken & Patrician (2000) identified how the organization and staffing of hospitals affect patient care. The organizational context in which professional nurses practice is

important in explaining variation in patient outcomes. Aiken & Patrician (2000) developed the Revised Nursing Work Index (NWI-R) to measure characteristics of professional nursing practice environments.

Environmental factors are also important when conducting an admission interview. The hospital room/space where the interview is conducted should be evaluated for noise and distraction. As one ages, hearing tends to diminish due to environmental and genetic factors (Van Eyken et al, 2007; Liu & Yan, 2007). A quiet, calm room where questions can be asked and medications can be clarified is the ideal. Minimal interruptions and allowing enough time for the nurse to conduct a thorough interview is important. Patient safety outcomes are associated with the quality of nurses' work environment (Spence, Laschinger, & Leiter, 2006)

The nurses' responsibility during medication history taking should include asking clear questions and leaving time for the patient to respond. The stress of being admitted to an acute care setting on an elderly patient, along with physical symptoms may impede remembering medications. Family members should be utilized during the admission and history taking process when possible. The ability to make contact with family members or significant others to help provide information on medications used by the patient should be considered (Cornish et al., 2005).

The elderly use the most medications, change medication prescriptions frequently and have the highest potential risk from errors in prescribing (Beers, Munekata, & Storrie, 1990). These multiple factors make it imperative that admission medication histories of the elderly be evaluated for completeness and accuracy.

Medication histories involve obtaining information from the patient, providing professional nurses with the resources to complete the history, and maintaining a supportive environment for nurses to conduct the medication history interview. The patient must be cognitively intact to share information regarding medications. The nurse must have the time and resources to review medications and evaluate discrepancies or inconsistencies. The environment must be favorable to gathering information in a quiet and confidential manner (Van Eyken, Van Camp, & Van Lear, 2007).

Patients' age, gender, education, and cognitive ability may contribute to inaccurate information in an admission history. Thus, it is imperative that other resources are used to substantiate information given to the nurse at the time of admission. Patient's age, the number of medications prescribed and the care provided to the patient by more than one physician were significant predictors of a medication discrepancy (Barnsteiner, 2005). Poor cognition is related to both over adherence and under adherence to a medication regimen (Dorman-Marek & Antle, 2008). Elders may present to the hospital without an accurate medication list or one that is incorrectly followed. In many cases, elders are marginalized by society leaving fewer support systems and human capital resources to either prevent or ameliorate the origins and consequences of poor physical, psychological or social health (Aday, 1994). Without appropriate resources and/or community support the elderly may have difficulty maintaining an accurate medication list.

Complexity of medication regimens may also contribute to misinformation. The number of medications, doses per day, and any recent changes in the prescribed drug regimen can add to the difficultly of remembering and accurately recording information.

Additionally, the number of prescribing providers adds to the complexity of managing medication in the elderly (Dorman- Marek, & Antle, 2008).

Resources in the community should be contacted when taking medication histories. Community resources include pharmacies, multiple prescribers, physician offices, and nursing homes. Other resources that help provide a complete and accurate medication history may also be contacted. The use of medication vials the patient has brought in or home medication lists may be of use (Vira, Colquhoun, & Etchells, 2006). Improved training, accessible community pharmacy databases, and closer teamwork between patients, pharmacists, physicians and nurses could reduce the frequency of medication errors (Tam et al., 2005).

Nursing resources, the patient and environment and processes may contribute to the challenges that confront the nurse when initially meeting with the patient to inquire about medication usage. Current methods for generating and communicating information about medications are inadequate and contribute to the increasing problem of medication errors. Focusing on good techniques to obtain medication information and using appropriate tools may enable nurses to obtain complete and accurate medication lists from the older adult (Beers et al., 1990).

Statement of Purpose of Study

One way to help prevent medication errors is to obtain accurate medication histories via medication reconciliation. Medication reconciliation is a complex process that involves multiple healthcare professionals, including the physician, pharmacist, and professional nurse, and is defined as “a formal process for creating the most complete and

accurate list possible of all pre-admission medications for each patient and comparing the physician's admission, transfer, and/or discharge orders against that list" (Rogers et al., 2006, p.38). Identification of a complete and accurate list of pre-admission medications at the time a patient is admitted to the hospital is one part of the medication reconciliation process that has been ignored and needs to be improved (Beers et al., 1990; Tam et al, 2005; Cornish et al., 2005; Lau, Florax, Porsius, & DeBoers, 2000).

Serious patient harm and even death can occur from incomplete or inaccurate medication histories that are subsequently used in hospitals as the basis for medication regimens. It is estimated that up to 7,000 deaths are caused by medication errors each year (IOM, 2000) and the cost of an adverse drug event (ADE) to a hospital is $2595, per event, double the cost if the event was preventable. These estimates do not include the costs for injuries to patients or malpractice expenses (Bates, Spell, & Cullen, 1997).

Identifying the best practice of obtaining and conducting medication histories for the elderly is essential. Development of a complete list of medications for each patient on admission includes validating the pre-admission list with the patient and/or family and assigning responsibility for collecting the pre-admission list to someone with sufficient expertise. This process needs to proceed within the context of shared accountability (Rogers et al., 2006). Without addressing the problem of incomplete and inaccurate medication lists on admission, the medication reconciliation process cannot be successful. Medication regimens are developed utilizing information from the medication list. Serious errors can occur if the wrong medications, the wrong dosage, or the wrong frequency of medications are prescribed at the time of admission.

This study will identify medication transcription errors upon hospital admission in patients 65 years of age or older and provide a behavioral-cognitive knowledge based education intervention to a specific group of professional nurses to ascertain if a decrease in medication transcription errors occurs after the intervention. Therefore, it is important to understand how nurses learn. Theories of learning focus on and describe the process of learning (Driscoll, 2005). For nurses to change the way they complete admission medication histories, a form of learning must occur. The process of instruction should include an arrangement of events to facilitate a learner's acquisition of some goal (Driscoll, 2005). The goal, in this case would be to instruct the nurse on better obtainment of the admission medication history. The arrangement of events to facilitate the nurses' learning will occur over an hour of instruction and include a review of case studies, a thorough investigation of how nurses' currently think about obtaining the medication history, and exploration of how nurses' think about the process of medication history collection in the future. Further instruction will include the review of a home medication form and techniques for inquiring about home medications. This hour of instruction may enhance and improve the ways nurses currently collect medication information from patients.

Specifically, the purpose of this study is to determine if a behavioral-cognitive knowledge based education intervention will decrease medication transcription errors among professional nurses when admitting patients age 65 years of age or older to a hospital.

The research aims are:

1. Identify if a behavioral-cognitive knowledge based education intervention decreases medication transcription errors among professional nurses when working with patients, 65 years of age or older, on hospital admission.

2. Identify the number and types of medication transcription errors in a population of patients, 65 years of age and older, taking five or more prescribed medications.
3. Identify the association of nurse characteristics, patient characteristics, family characteristics and organizational characteristics on medication transcription errors.

Hypothesis:

Those professional nurses who receive a behavioral-cognitive knowledge based education intervention will have fewer medication errors compared to professional nurses who did not receive the intervention when admitting patients age 65 years of age or older on hospital admission.

The research questions are:

1. How many and what types of medication transcription errors are present in a population of patients, 65 years of age or older, taking five or more prescribed medications?

2. What is the relationship of nurse age, education, years of experience, and hours worked on medication transcription errors?
3. What is the relationship of patient age, gender, number of diagnosis, and complications on medication transcription errors?
4. What is the relationship of family member residing with patient on medication transcription errors?
5. What is the relationship of organizational support for nursing and number of prescribers on medication errors?

Documentation of Need for Study

The impact of medication errors on patients is significant. Up to 60% of patients admitted to the hospital will have at least 1 discrepancy in their admission medication history (Beers et al., 1990; Lau et al., 2000). The present state of the problem includes the lack of interventions to assist older adults and their families in making a smooth admission into the acute hospital system in regards to complete and accurate medication lists. Studies by Kaboli, McClinton, Hoth and Barnett (2004) and Beers et al. (1990) compared hospital medication records to medical histories obtained from patient interviews and found medication discrepancies between the hospital record and the patients' report 83% to 95% of the time.

The Joint Commission is a group formed to continuously improve the safety and quality of care provided to the public through the provision of health care accreditation and related services that support performance improvement in health care organizations. In July 2004, The Joint Commission announced 2005 National Patient Safety Goal #8 to

accurately and completely reconcile medications across the continuum of care (The Joint Commission [TJC], 2008). During 2005, accredited organizations were required to develop and test processes for medication reconciliation and implement then by January 2006 (TJC, 2008). Before this time, little was written in the health care and nursing literature on medication reconciliation (Barnsteiner, 2005). No studies were found that investigated the use of techniques and tools for nurses to gather the appropriate medication history.

Some medication reconciliation studies have been completed in the areas of health care transition involving evaluation of medication reconciliation from the acute hospital setting to long-term care setting, (Crotty, Rowett, Spurling, Giles, & Phillips, 2004), assessment of medication reconciliation in an ambulatory setting (Nassaralla, Nassens, Chaudhry, Hansen, & Scheitel, 2007) and accuracy of medication reconciliation upon discharge from an ICU setting (Pronovost et al., 2003).

Few studies examined the beginning process of acquiring a complete and accurate medication history on admission. Studies that investigated medication errors on admission measured errors by identifying discrepancies between the physicians' admission medication orders and a comprehensive medication history obtained through interview (Cornish et al. 2005), by comparing the interview of the patient to the health medical record (Lau et al, 2000), and evaluating the accuracy of medication histories recorded in hospital medical records compared to a structured history obtained from the patient (Beers et al., 1990). Cornish et al. (2005) recommended medication history interviews be completed by clinical pharmacists and patient populations at high risk for drug-related complications be targeted (e.g. older patients taking multiple medications).

Lau et al. (2004) concluded that the medication history in the hospital medical record is often incomplete and the pharmacy records from the community pharmacy are easily available and can be used to obtain more complete information on the medication history of patients admitted to the hospital. Beers et al. (1990) suggested that the recording of medication histories from elderly patients by hospital physicians need to be improved, techniques to optimize recall need to be utilized, and data obtained need to be confirmed from other sources.

Barnsteiner (2005) identified that frequently medication errors occur because incorrect or incomplete medication information is obtained. A synthesis of frequency, type, and clinical importance of medication history errors at admission to hospital was completed by Tam et al. (2005). Results revealed that prescription medication history errors at the time of admission were disturbingly common and potentially harmful to patients. Thus, a need for a systematic approach to ensure the acquisition of an accurate medication history at the time of hospital admission was endorsed (Tam et al., 2005).

These studies identified gaps in the current process of medication history obtainment and neglected to review the actual process of interviewing and obtaining a correct and accurate medication history from the patient. Furthermore, none of the above studies involved the professional nurse, a key person in the medical admission history process.

To ensure the safety of patients, it is necessary to have an accurate and complete medication history and to validate this information. Numerous errors can occur between hospital computer lists, clinic record lists, and medication lists generated from patients. Without verification of the patients' actual medication list, medication errors and patient

harm can occur (Cornish et al., 2005; Lau et al., 1999; Tam et al., 2005; Rozich & Resar, 2001; Beers et al., 1990).

An intervention study completed by Crotty, Rowett, Spurling, Giles and Phillips (2004) evaluated if adding a pharmacist to monitor medication errors improved clinical outcomes. One hundred ten older adults were recruited for the study. There was no significant difference between the intervention and control group. This may have been related to small sample size.

Some intervention studies have found improvement in medication reconciliation. Two studies used a medication reconciliation form as an intervention (Rozich & Resar 2001; Pronovost et al., 2003). Rozich and Resar (2001) utilized the Idealized Design of the Medication System Institute for Healthcare Improvement; Premier, Inc., SanDiego, CA) "trigger tool" to identify and track ADEs. The tool allowed for systematic, rapid examination of charts to extract relevant data, and rapidly assess ADEs. The rate of medication errors, decreased from 213 per 100 admissions to 63 per 100 admissions. This study suggests that the development and implementation of a medication safety program decreased clinically harmful drug events. Pronovost et al. (2003) reviewed 10% of the discharges from an adult surgical ICU and found that 31 out of 33 (94%) patients had orders changed. After the implementation of a discharge survey nearly all medication errors in discharge orders were eliminated. The study concluded that the use of the discharge survey in medication reconciliation process results in a dramatic drop in medication errors for patients discharged from an ICU.

While the scientific merit of the these studies varied, numerous studies identified that current medication history processes are incomplete, inaccurate, and potentially

harmful to patients (Cornish et al., 2005; Tam et al., 2005; Lau et al., 2000; Beers et al., 1990). Strengths of the scientific literature included, all studies defined clearly there definition of medication error and all studies found significant number of medication errors in patient records, identifying a significant problem. Strengths also included the identification of errors (percentages) that occurred in omission, commissions, etc., though some studies identified just omission and commission as medication error where more in-depth studies include omission, commission, dose, name, frequency and route. The research limitations consisted of the absence of a consistent definition of medication error across studies. The present state of the problem includes lack of research that test interventions to appropriately address the inconsistent and incomplete medication histories currently obtained on admission by healthcare providers.

Significance of Problem to Nursing

Obtaining medication histories from patients has been the responsibility of the professional nurse in many health care settings. An ideal situation would occur if patients and their families provided a complete and accurate history to the nurse. Frequently, this is not the case. Therefore, for medication safety, it is necessary that providers engage in meaningful communication about the safe and effective use of medications at multiple points in the medication-use process (IOM, 2007). Beers et al. (1990) found that 60% of all patients studied had at least one medication error in their medication history. Barnsteiner (2005) recommended effective strategies of using protocols, implementing medication reconciliation, and having nurses take the lead role

in designing and implementing systems to record medications and changes in them so that a systematic record is available to all providers.

Nursing's Social Policy Statement, a document that professional nurses use as a framework for understanding nursing's relationship with society and its obligation to those who receive nursing care, includes four essential features. One of these features includes integration of objective data with knowledge gained from an understanding of the patient's or group's subjective experience (American Nurses Association [ANA], 1995). Nursing practice includes direct interventions performed through interactions with patients. Interventions are recommended based on the nurse's clinical judgment about the phenomena of concern and theoretical, practical, or scientific knowledge about the relationships between potential interventions and desired outcomes (ANA, 1995).

Chapter Summary

Errors in retrieving accurate and complete medication histories by health care professionals is a significant problem in health care systems today. Factors which affect medication errors include the organization support in which nurses' practice, the hospital environment, patient's ability to provide information, and the process established to collect medication lists. The aims of this study are to identify the association of number of types of medication transcription errors in patients 65 years of age and older, taking five medications or more and to identify nurse characteristics, patient characteristics, family characteristics, and organizational characteristics on medication transcription errors. The hypothesis is; Those professional nurses who receive a behavioral-cognitive knowledge based education intervention will have fewer medication errors compared to

professional nurses who did not receive the intervention when admitting patients age 65 years of age or older on hospital admission. Professional nurses in many health care settings are responsible for obtaining a medication list from patients. This study is significant to nursing because by improving the method in which we gather medication information we can improve patient outcomes.

Chapter 2

Theoretical Framework and review of Literature

This chapter begins with a discussion of Donabedian's Structure-Process-Outcome Health Model. Donabedian's model presents an integrative model of the relations among variables that contribute to health status, quality of care and resource expenditure. The model defines health care quality in terms of outcomes, measured as the expected improvements in the health status attributable to care.

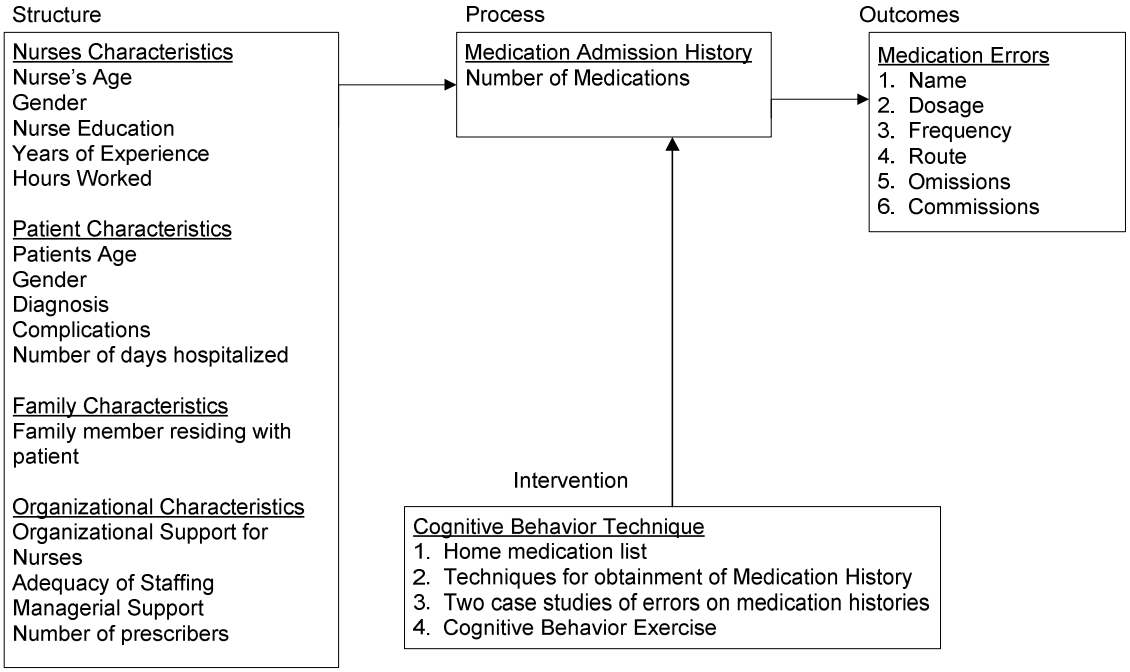
Next, Watson's Behavioral Theory will be discussed with an emphasis on the cognitive behavioral therapy model, this is important because the intervention in this study uses a cognitive behavioral approach. The next section of chapter 2 includes a comprehensive review of the empirical literature of relevance to medication reconciliation including the definitions of medication errors, pharmacist and physician's research, variables affecting medication reconciliation, and finally interventional studies. This chapter concludes with the gaps in the literature and the statement of the research question.

Conceptual Framework

The conceptual framework for this study is derived from Donabedian's structure-process-outcomes health model (Figure 1). The three components of the model are structure, process and outcome. The structural component represents attributes of the setting which may include material resources (the facility, equipment, money), the human resources available (number of personnel and their qualifications), and the organizational structure (medical staff organization, peer review, methods of reimbursement). The

process component focuses on those specific interventions or care practices that health professionals provide. It includes the patients' actions in seeking care and the providers' actions when providing care. Outcomes are the results of the health care process. Objective evidence supports the connection between nursing care (process) and patient outcomes (Duffy & Hoskins, 2002). The inference is that the three part approach to quality assessment is possible only because good structure increases the likelihood of good process, and good process increases the likelihood of good outcomes (Donabedian, 1988). Using Donabedian's framework, improving the process would also affect the outcomes. In this research proposal we are going to identify nurses as a structural component, use a specific cognitive behavioral education intervention to improve the process of obtaining medication histories and hence improve outcomes by decreasing medication errors.

Figure 1. Donabedian's Structure-Process-Outcome Health Model.



Donabedian's Health Model

It is also important to identify the literature that supports the specific characteristics identified in Donabedian's structure-process-outcomes health model when describing the obtainment of admission medication histories. The structural component of Donabedian's model focuses on characteristics of nurses, patients, family, and finally organizational characteristics. The Process components include those specific interventions of care practices that health professionals provide, in this research it would include the medication history obtainment. Outcomes are the endpoints or results of the health care process (Duffy & Hoskins, 2003).

In this study nurse characteristics include nurses' age, gender, education, years of experience, and hours worked (Appendix A) were collected. Patients' characteristics collected included patients' age, gender, diagnosis, complications and number of days hospitalized. Family characteristics were measured by if family members are currently residing with the patient. The organizational characteristics included organizational support for the nurses, adequacy of staff, managerial support and number of prescribers (Appendix B). All characteristics listed above were collected to evaluate if there is a relationship between the variables and the medication error score. Using the Donabedian- conceptual framework allows for variables to be defined and identified as it relates to the structure process outcomes model.

Structure Component-Nurse Characteristics

Specific nurse characteristics, higher education and years of experience improve health care outcomes including mortality and failure to rescue. The literature reviewed

identified research which supported specific nurse characteristics as they related to better health outcomes. The characteristics included nurse education and years of experience. Increase in the proportion of nurses with higher educational degrees decreased the risk of mortality and failure to rescue (Aiken, Clarke, Sloane, & Silber, 2003; Tourangeau, Cranley & Jeffs, 2006). Specifically, Aiken et al. (2003) found each 10% increase in the proportion of nurse with higher degrees decreased the risk of mortality and failure to rescue by 5%, after controlling for patient and hospital characteristics.

Nurses' experience is associated with fewer patient deaths (Tourangeau et al., 2002) and nursing units with more experienced nurses had lower medication error rates and lower fall rates (Blegen, Vaughn & Goode, 2001).

Structure Component-Patient Characteristics

Patient characteristics including age, gender, and severity of illness have been found to be related to medication errors. For example, research identified that older adults, over the age of 70 years had a greater percentage of medication registration errors than younger, with the exception of the group of patients in the 80-89 year bracket. Female patients had more errors in their medication records than males (Lau, Florax, Porius & DeBoers, 2000). The authors stated they found no clear relation between age and distribution of medication errors.

It has been identified that severity of illness is related to poor health outcomes, including pressure ulcers, mortality, quality and cost of health care (Horn et al., 2004; Zimmerman & Kramer, 2008; Parkerson, Broadhead & Chiu-Kit, 1993).

Structure Component-Family Characteristics

A literature review from the years 1948 to 2001, conducted by DiMatteo (2004) including 122 studies found a relationship between social support and patient adherence to medical regimens (DiMatteo, 2004). Older adults present decreased comprehension of medication instructions and adherence (Dorman-Marek & Antle, 2008). Barat, Andreasen and Damsgaard (2001) found the odds ratio of dose-deviations was about two times higher for persons living alone. It is postulated that this is related to the fact that there is no one monitoring or assisting the older adult. Family support in the line of helping with information related to medication lists may be related to decreased medication errors (Barat et al., 2001). Social support enhances medication adherence, it is hypothesized that family support with medication lists on admission could be related to decreased medication errors (DiMatteo, 2004). Living arrangements is important to the elderly adult due to help with managing medications. With no support from the family to remind the patient to take medications, this lack of help with monitoring may lead to medication errors (DiMatteo, 2004; Barat et al., 2001; Dunbar-Jacob, Bohachick, Mortimar, Sereika & Foley, 2003; Fosu, 1995).

Structure Component-Organizational Characteristics

Organizational characteristics including staff/mix workload, resources, organizational culture may directly or indirectly influence outcomes of care (Duffy & Hoskins, 2003). The literature identified that the greater the number of physicians prescribing medications for an elderly patient, the greater the chance of medication discrepancies and medication errors (Tamblyn, McLeod, Abrahamowicz & Laprise,

1996). Tamblyn et al. (1998) followed elderly individuals and concluded from his study, there is a significant increased risk of potentially inappropriate drug combination with the number of physicians involved in the medical management of an elderly patient. The study identified a single primary care physician and a single dispensing pharmacy may be "protective" factors in preventing potentially inappropriate drug combinations (Tamblyn et al., 1996).

The greater the number of providers adds to the complexity and difficulty of patients managing their medications which may lead to medication error (Barat et al., 2001). Barat et al. (2001) found the odds ratio of drug deviations were 2.5 times higher when more than one physician prescribed drugs (Barat et al., 2001). The study involved collecting data from randomly selected individuals 75 years or older to assess their knowledge of medications. The results suggested non-adherence ranged from 20-70%, the participants' knowledge of treatment was poor, and better information on medication and the use of compliance aids may prevent nonadherence. Special attention should be paid to persons receiving three of more drugs, living alone, receiving drugs from other doctors, and to persons with predementia symptoms, as they are at high risk for nonadherence (Barat et al., 2001).

There also is accumulating evidence that supports the relationship between nurse staffing and improved patient outcomes (Aiken, Clark, Sloane, Sochalski & Silber, 2002; Needleman, Beurhaus, Mattke, Stewart & Zelevinski, 2002; Needleman & Beurhaus, 2003; Lankshear, Sheldon & Maynard, 2005; Cho, Ketefian, Barkauskas, & Smith, 2003). Aiken et al. (2002) developed a tool to identify the effect of organizational attributes have on patient outcomes (Aiken et al., 2002). It was found that numerous

items support attracting and retaining nurses and those included; flat organizational structure, decentralized decision making by bedside caregivers, inclusion of the chief nurse executive in top management decision making, flexible nursing scheduling, unit self-governance, and investment by management in the continuing education of nurses (Kramer & Schmalenberg, 1988). Nursing involvement in the collective understanding of the interrelationships and subtleties of the organization will allow more reliable system to evolve, will enhance the work of the nurse and promote patient safety (Scott, 2004; Bliss-Holtz, Winter, & Scherer, 2004).

Process Component-Medication Profile

The process component of the Donabedian's model involves interventions or practices that health care providers offer (Duffy & Hoskins, 2003). Admission medication history obtainment and how this process may influence medication errors or outcomes was the focus of this research. The research identified that older age and polypharmacy were the most significant correlates for drug discrepancies (Bedell et al., 2000). Increasing the number of medications also increases the risk of drug-drug interactions and medication errors (Pham & Dickman, 2007). In fact, more than 40 percent of ambulatory adults over 65 use at least five medications per week, and 12 percent use at least 10 medications per week (Kaufman, Kelly, Rosenberg, Anderson & Mitchell, 2002).

Numerous problems can arise from inappropriate use of medications in the elderly. They have risks of falling, confusion, depression, constipation, immobility and hip fractures (Hanlon, Schmader & Kornkowski, 1997; Crotty et al, 2004). Older adults

use the largest amount of medications and with advancing age are at a higher risk for adverse reactions (Marek & Antle, 2008).

A challenge identified in the process of medication admission list obtainment is the amount of time it takes to complete a history. It is estimated that 30 minutes is spent per patient at the time of admission to complete a medication list and pharmacists spent between 45 and 60 minutes for each patient at the time of discharge (Rozich & Roger, 2001). The 30 minute estimate may be a conservative number considering the study was conducted with a general population and not an inpatient population.

Cognitive Behavioral Therapy

Cognitive-behavioral therapy is a concept based upon work by Skinner and Watson. The concept lends support to the intervention portion of the research which in turn supports the process which is defined by the Donabedian model of health. Cognitive-behavioral therapy (CBT) attempts to change individual's behavior through cognitive restructuring (examining assumptions behind the thought patterns) and through the use of behavior therapy techniques. Cognitive behavioral therapy is the combination of classical/operant/social learning and cognitive theory. It is useful in many cases by allowing behaviors to change after thinking about and discussing reasons to change specific ways we may do things (Ledley, Marx & Heimberg, 2005). John B. Watson was considered the “father of behavioralism,” and saw all behavior and all behavioral change as a function of learning via classical conditioning. The three components of classical conditioning including: 1) the unconditioned stimulus and response, 2) the conditioned

stimulus, and 3) the conditioned response. Watson believed that all learning occurred because of these stimulus-response pairings (Watson & Raynor, 1920; Watson, 1924).

B.F. Skinner was also a key figure in the rise of behaviorism; his theories of conditioning were more sophisticated than those of Watson. Skinner's view was that humans are capable of changing through the process of learning new behaviors. By modifying the patterns of reinforcement in a situation, behavior that other theorists would find as permanent and unyielding can be changed and ultimately improved (Skinner, 1975).

Behaviorism, or the stimulus-response associations cannot explain all learned behaviors. Teaching from this perspective would involve eliciting a desired behavior and then positively reinforcing the learned response (Lund, Carruth, Moody & Logan, 2005). The recommended outcome of behaviorism is the transferability of learned behavior to new situations that fall under control of the learner. In addition, the ability to include the way individuals think, or their cognitions about situations, is important, yet different from the behaviorism approach.

The cognitive approach differs greatly from the strictly behavioral approach. The cognitive model is interested in the mind. It is the belief that thoughts serve as the intervening variable between stimuli and responses to them. Aaron T. Beck developed cognitive therapy back in the 1960's. The cognitive treatment approach teaches people how to think in more adaptive ways by changing their cognitions about the world and themselves. The cognitive treatment approach is a treatment approach that incorporates basic principles of learning to change the way people think (Beck, 1991).

The cognitive model begins with central core beliefs. These beliefs about oneself, other people and the world form during childhood and are based on experiences that have occurred. These core beliefs or automatic thoughts influence the way we respond to certain situations. Because beliefs affect the way we respond, different people respond differently to the same situation (Ledley et al., 2005). The cognitive model includes an event (stimulus) plus our interpretation of (or our thoughts about) the event. Stimulus might also consist of thoughts by themselves. In the cognitive model the response or reactions can include emotional, behavioral or/and physiological reactions.

The CBT model posits that thoughts, behaviors, and feelings interact to form a cognitive set. This set changes, or adapts to change. If one component is altered the remaining components will also be altered (Freeman, S. & Freeman, A., 2005). The primary tool of CBT is cognitive restructuring, which involves identifying and reframing maladaptive thoughts. So instead of treating our thoughts as truths, cognitive restructuring involves questioning our thoughts and reframing them as irrational or maladaptive (Ledley et al., 2005). The use of CBT with nurses will include investigating their own beliefs and thoughts about medication history taking and restructuring some of their thoughts about completing the task.

Nursing has long neglected the use of CBT. Cognitive behavioral therapy is a psychological model that has been shown to “fix” negative thought patterns. It is a short term and efficient way to change behavior rather than the whole psyche. CBT has been applied to areas of staff training, consultation, and organizational development. Unfortunately, CBT has only briefly been covered in the nursing literature, even though it

provides advanced practice nursing professionals with a broad range of insights and interventions to use to help change behaviors (Freeman, S. & Freeman, A, 2005).

For a cognitive behavioral approach to obtaining medication history lists, learners must be allowed to discover information and facts about the process. This allows thinking and problem solving to occur and includes a behavioral reinforcement component. Cognitive-behavioral therapy challenges the beliefs nurses hold of themselves, which is they successfully complete medication histories. The cognitive behavioral intervention is aimed at changing behaviors and thoughts by providing information to challenge current beliefs and then introducing new behaviors and ways of collecting data to successfully complete a medication history.

The approach to educating adults versus children is different. Knowles, Holton and Swanson (1998) developed the Adult Learning Theory, this theory supports the idea that adults learn differently than children. The theory has found that adults have accumulated a foundation of life experiences and knowledge, are goal-directed, relevancy-oriented, practical and need to be shown respect (Knowles et al., 1998). Motivation factors for adults include needing education for a particular competency, licensing, promotion, job enrichment, maintaining old skills or learning new ones (Knowles et al., 1998). Malcolm Knowles might well be considered the founding father of adult learning. Knowles' original studies and writings arose from the assumption that there are significant, identifiable differences between adult learners and learners under the age of eighteen. Primarily, the differences, according to Knowles, relate to an adult learner being more self-directing, having a repertoire of experience, and being internally motivated to learn subject matter that can be applied immediately (Knowles et al., 1998).

Incorporating adult learning theory into our intervention approach will provide an appropriate education strategy for adult nurses.

Outcome Component-Medication errors

It has been identified in literature that there are associations between professional nursing care and positive health outcomes (Duffy & Hoskins, 2003). Identifying ways to improve the process of medication history obtainment can improve medication errors. According to the literature, medication errors occur frequently in many different areas of care; admission, transfer and discharge. Measurement of medication errors has occurred using many different processes; some studies focus on the interview (Beers et al, 1990; Rozich & Rogers, 2001) while others focus on the reconciliation tool (Pronovost, et al, 2004; Cornish et al, 2005). A medication reconciliation process involving the nurse, a collaborative culture, a simple tool and a discharge survey can serve to help improve medication safety (Pronovost et al, 2003). In summary, literature supports the idea that medication reconciliation is best completed when there is a tool, a process and accountability for the task all in place.

Review of the Literature

The review of literature section is divided into four subsections including; medication histories, medication errors and how they are defined, pharmacist and physician studies, and lastly interventional studies related to medication reconciliation.

Medication Histories

What constitutes a good medication history? Research suggests there is an absence of a gold standard (Cornish et al., 2005; Tam et al., 2005). Most research completed up until now has not included a definition for a good medication history. Gleason et al. (2004) state that health care professionals should educate patients about the importance of maintaining an updated medication history and reconcile this information at every health care visit. Lau et al. (2000) demonstrated utilizing pharmacy records from community pharmacists provides more complete information on medication histories of patients admitted to the hospital. Tam et al. (2005) identified a need for a systematic approach to ensure the acquisition of accurate medication histories at the time of hospital admissions. A summary of safe practice recommendations for reconciling medications at admission was published in *The Journal on Quality and Patient Safety*, January, 2006. The suggestions included collecting a complete list of current medications for each patient on admission. The goal is to develop the most complete and accurate medication list possible, given available information, even though producing a perfect list for each patient may not be possible. The second recommendation is to validate the pre-admission medication list with the patient and lastly to assign primary responsibility for collecting the pre-admission list to someone with sufficient expertise, within a context of shared accountability (Rogers et al., 2006). With these broad and varied recommendations it is easy to see that more specific interventions to obtain an accurate medication list are needed.

The medication reconciliation begins with a patient medication history, when a rigorous review of medications should occur (Rozich & Resar, 2001). Currently the way

nurses collect medication histories is not sufficient and will have to be improved. It is difficult to obtain accurate medication histories if insufficient time or proper review is not completed. The process nurses use will have to include more specific and directed questions for patients and family members, and utilize more resources, including pharmacies, physicians, and medication vials to collect information.

For a behavior change to last, the behavior or results need to be reinforced. By sharing the improved outcomes of decreased medication errors with nurses the behaviors taught in the intervention were reinforced. Results of the research were distributed to all nurses participating in the research at the conclusion of the study. Feedback not only reinforces a response, it also provides information to the learner as to how performance can be improved. Outcomes from the research can be shared with the learners, reinforcing the behavior (Driscoll, 2005). The learning outcomes were evaluated by evidence of improvement in admission medication completion and accuracy.

Medication Errors-Definitions

Critical examination of current research in the area of medication lists/reconciliation is important to consider when contemplating new research to be conducted. Most of the work in this area has been completed by pharmacists and physicians. The results have been reported in numerous ways. Unfortunately, there are also many definitions for medications errors and it makes it difficult to synthesis the research. For example, Cornish et al. (2005) measured if medications patients were taking differed from what was ordered and considered these medication errors. Pronovost et al. (2003) defined medication errors as a change in the medical record after

a review was completed. Crotty et al. (2004) used the Medication Appropriateness Index (MAI), an index that is used to quantify appropriate and inappropriate prescribing and changes in prescribing quality in intervention studies. Beers et al. (1990) compared the admission history documented in the medical records to the interviewed subjects' lists communicated to the research assistant. He defined error in two ways. The first type of error was failure of the physician to record a medication which was listed by the patient, and the second type of error was the physician recording a medication that the patient denied using. Different methods of measuring medication history errors have led to information that is not easily synthesized or explained (Beers et al., 1990). Many definitions of medication errors lead to confusion in the area and a lack of consistency in measuring errors.

Some more confusion is presented when medication errors are added up differently. Some researchers measured just omissions and commissions (Kaboli et al., 2004; Beers et al., 1990; Lau et al., 2000), while other studies measured omissions, commissions, name, dosage, frequency, and route of medication (Nasarralla et al., 2007; Cornish et al., 2005; Vira et al., 2006; Gleason et al., 2004). A study completed by Kaboli et al. (2004) found that after comparing computer records to interviews conducted by pharmacists, only 1 in 20 patients had perfect agreement. Studies have demonstrated that numerous medication omissions occurred in the medical history, up to 61% (Lau et al., 2000; Vira et al., 2006).

Beers et al. (1990) found 83% of individuals had at least one medication error and 46% had three or more errors. Beers studied individuals over the age of 65, he compared

house staff and attending physician medication notes and compared to research assistants interviews.

Medication errors are dangerous to the patient and are costly to organizations. Bates, Spell and Cullen (1997) completed a study on the costs of adverse drug events in hospitalized patients. The goal of the study was to assess the additional resource utilization associated with an adverse drug event. The researchers randomly selected patients with adverse drug events and the controls were patients on the same unit with the most similar pre-event length of stay. During the study there were 247 adverse drug events, of which 70 (28%) were preventable. When evaluating all the adverse drug events, 57% were judged significant, 30% serious, 12% life-threatening, and 1% fatal. The study identified that an adverse drug event was associated with $2595 of additional costs to the hospital. For preventable adverse drug events this figure was almost twice as high (Bates et al., 1997).

Pharmacist and Physician Literature

A significant amount of research in medication list completion and reconciliation has been completed by pharmacists and physicians. Most research identified pharmacists and physicians' involvement in medication reconciliation, yet it is the nurse who collects most medication lists at the time of hospital admission. A systematic review of literature completed by Tam et al. (2005) identified that over a quarter of hospital prescribing errors occur because of incomplete medication histories obtained at the time of admission.

Utilizing pharmacists exclusively for every admission list would be a costly and an impossible endeavor for hospitals trying to contain costs and nurses have the skills and knowledge base to complete medication histories. After completing and evaluating a literature review in medication reconciliation, it was identified that research is needed in the area of the process of medication reconciliation and to help identify some of the barriers that impede the nurses' completion of a complete and accurate medication list.

Most research reviewed in the area of medication reconciliation lacked a theoretical or conceptual model (Beers et al., 1990; Kaboli et al., 2004; Rozich & Resar, 2004; Lau et al., 2000), or it was implicit in the research without being formally acknowledged or described. When researchers fail to clarify key concepts or conceptual underpinnings, it becomes difficult to integrate the research findings. Polit & Beck (2008) found quantitative researchers guiltier of failing to identify their framework more so than qualitative researchers. This was also evident in the research reviewed by this writer. The purpose of theoretical and conceptual frameworks is to make research findings meaningful and generalizable (Polit & Beck, 2008).

The research completed and documented by physicians and pharmacists used descriptive data, and lacked randomization and scientific methods (Vira et al., 2006; Kaboli et al., 2004). Polit & Beck (2008) described the traditional, positivist scientific method as a general set of orderly, disciplined procedures used to acquire information. Most studies compared one list of medications (patient admission lists) to other lists (physician's order, computer lists of medication). This provided a limited look at medication reconciliation. No control group was created, nor did randomization occur. Additionally, most studies ignored the first step of medication reconciliation: the

"admission medication list." Without identifying the errors in the admission medication list, the error can continue throughout the hospitalization and even through discharge.

Medication reconciliation is a complex and multi-faceted process. There are multiple factors that contribute to developing an accurate admission medication list. Identifying professional nurse characteristics, including educational level, years of experience may play an important role in accuracy of medication history.

One of the biggest gaps of current literature rests in the fact that no one has yet researched the role of the professional nurse, who in most institutions obtains the admission medication history. Some interventional studies (Rozich et al., 2004; Pronovost et al., 2003) evaluated the reconciliation process, but did not begin with the admission list, allowing for errors to transcend the entire hospitalization if the admission medication list was incorrect at admission. Other studies focused on improving interviewing techniques (Cornish et al., 2005; Beers et al., 1990) completed by pharmacists and research assistants, suggesting additional pharmacist staffing would be needed to support this service.

Many methods have been used to improve the process of medication reconciliation, including using medication reconciliation forms or pharmacist interventions, but no studies were conducted that use a behavioral knowledge approach to improve or increase accuracy of medication lists collected by the nurse. Also many of the studies evaluated the role of the physician or pharmacist in medication reconciliation. This proposed research will provide behavioral knowledge-based education to nurses to evaluate if nurses can decrease medication transcription errors in hospitalized elderly at the time of admission.

Intervention Studies

Intervention studies were reviewed to help develop an intervention that would best suit the needs of nurses completing admission medication lists. Numerous interventional studies utilized pharmacists to complete medication history lists in inpatient settings. The problem with this approach is hospitals currently use professional nurses to complete admission medication histories not pharmacists. Only 3% of institutions employ pharmacists in the role of conducting medication histories (Bond, Raehl, & Franke, 1999). Numerous studies identified medication discrepancies up to 50% on admission medication interviews with the patients (Gleason et al., 2004; Cornish et al., 2005; Crotty et al., 2004).

Gleason et al. (2004) provided an educational intervention to pharmacists. The pharmacist received intensive education on the project's purpose and study methodology and training in data collection and the reconciliation process (Gleason et al., 2004). The purpose of the study was to identify type, frequency, and severity of medication discrepancies in admission orders and assess whether pharmacist-obtained and reconciled admission medication histories reduced the number of medication errors and the potential for patient harm (Gleason et al., 3004). The results found that more than half of the patients evaluated had discrepancies in their medication histories.

Crotty et al. (2004) completed a randomized, single-blind, controlled trial enrolling hospitalized older adults to assess the impact of adding a pharmacist transition coordinator on evidenced based medication management and health outcomes in older adults undergoing first-time transfer to a long-term care facility. The intervention included patients either receiving the services of the pharmacist transition coordinator

(intervention group) or received the usual hospital discharge process (control group). The results included no significant difference at baseline with medication appropriate index, but at the 8 week follow-up the medication appropriate was significantly lower in the intervention group compared to the control group, suggesting this difference was the result of medication becoming more inappropriate in the control group while medication appropriateness was maintained in the intervention group.

Nassaralla et al. (2007) completed a study in an academic, ambulatory primary care clinic. The intervention involved teaching all healthcare members in the clinic what constituted a complete and accurate medication list. The objective of the study was to evaluate the causes of medication list inaccuracy, implement interventions to enhance overall accuracy of medication lists and measure the sustainability of the intervention. The results showed medication lists were incorrect 81.5% of the time at the sustainability phase. The research showed significant improvement in the completeness of the documentation of individual medication and lists in an outpatient primary care practice can be achieved in a short time if all members of the team are trained and involved (Nassaralla et al., 2007).

Nassaralla et al. (2009) also completed a prospective study conducted in four academic, ambulatory care internal medicine clinics. The objective was to improve the overall accuracy of medication lists by providing performance feedback to the healthcare providers and also by encouraging patient participation in the medication reconciliation process. The results demonstrated completeness of medication improving from 20.4% to 50.4% ($p<0.001$). Correctness of the medication lists improved from 23.1% to 37.7%. ($p=0.087$). This study demonstrated it was beneficial to enlist the active participation of

all health care providers and patients in the reconciliation of medication lists in an ambulatory setting (Nassaralla, et al., 2009).

Pronovost et al. (2003) completed an intervention study where the specific goal was to reduce medication errors in discharge orders by implementing a medication reconciliation process for all patients discharged from the surgical ICU. The intervention included members of the working team creating a data collection tool called the discharge survey to evaluate the extent to which medication errors were present in the discharge orders for patients leaving the surgical ICU. The nurse reviewed all of the patients' discharge medication orders to identify discrepancies between what the patients are currently receiving and what was prescribed in the discharge orders. The study found that it was difficult to obtain an accurate list of pre-hospital medications. The results found that during the first two weeks 94% of the patients had their orders changed. As a result of the study, the collection tool became part of the routine ICU discharge process and the nurse's use of medication reconciliation was associated with a dramatic reduction in medication errors in patients transferring from a hospital surgical ICU unit to another unit (Pronovost et al., 2003).

Chapter Summary

Medication errors can cause harm and even death to patients. There is evidence to suggest that with education and utilization of specific tools (reconciliation forms) medication errors can be reduced. Research has identified the need for a complete and accurate medication history on admission. Donabedian's structure-process–outcome health model provided the theoretical framework for the study. The researcher examined

the relationship between improving the (process) of obtaining medication lists to the decrease of medication errors (outcomes). The study was designed to contribute information to the existing theory related to structure-process-outcomes. The results of the research contributed to the body of evidence-based research that currently exists in medication reconciliation.

Chapter 3

Research Design and Methods

This chapter presents the study design and methods. The overall purpose is to determine if a behavioral-cognitive knowledge based education intervention decreases medication transcription errors among professional nurses when working with patients, 65 years of age or older, on hospital admission. The findings will be used in developing a recommended set of best medication safety practices for adoption by nurses practicing in an acute hospital setting. Specific aims of this work are to 1) Identify if a behavioral-cognitive knowledge based education intervention decreases medication transcription errors among professional nurses when working with patients, 65 years of age or older, on hospital admission. 2) Identify the number and types of medication transcription errors in a population of patients, 65 years of age and older, taking five or more prescribed medications. 3) Identify the association of nurse characteristics, patient characteristics, family characteristics, and organizational characteristics on medication transcription errors.

Research Design

A pre-test, post-test interventional design was utilized to determine if a behavioral-cognitive based education provided to professional nurses reduced medication errors on admission medication lists. The independent variable was the intervention provided to professional registered nurses. The dependent variable was medication error score. In addition, medication errors and the relationship of subject variables including

nurse characteristics, patient characteristics, family support and organizational characteristics was described.

The Pretest-Posttest Control Group Design

R	O	X	O	(experimental group)
R	O		O	(control group)

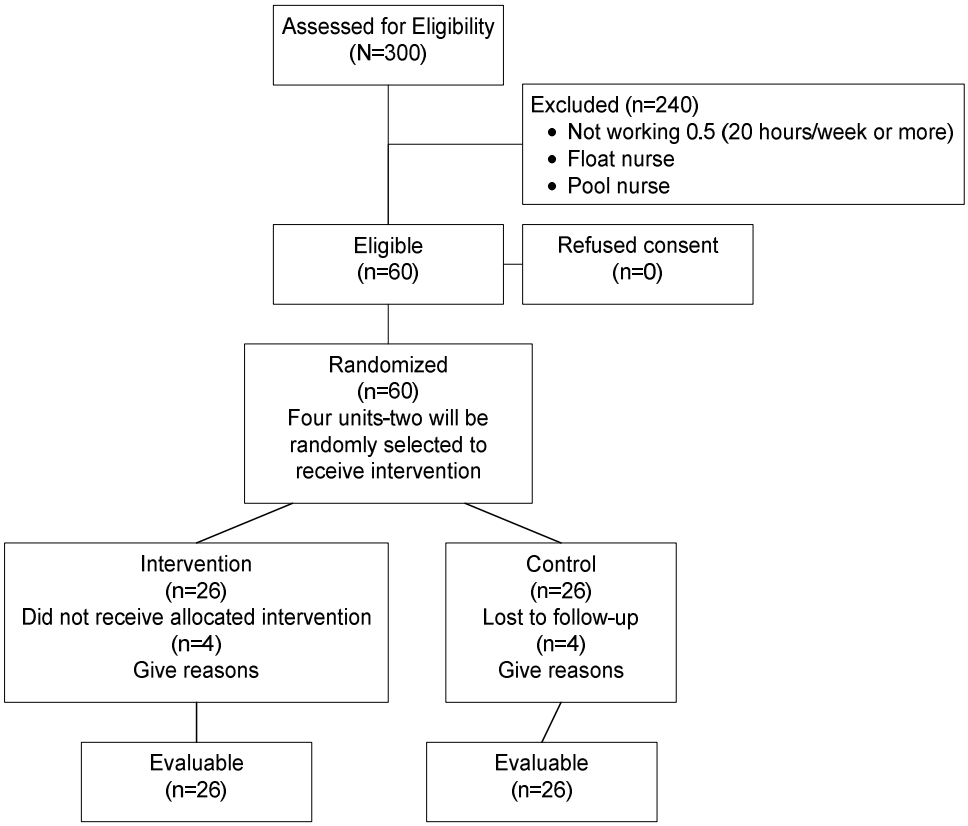
Medication errors are identified pre-test and post–test (after the intervention). Medication errors are identified if the medication has an incorrect name, dose, frequency, or route and assigning one point for each of the errors. Also, any additional medications added on the medication list (commissions) or medications missing from the list (omissions), are assigned two points. The total points assigned were the medication error score.

Sample

A convenience sample of eligible professional nurses-Registered Nurses (R.N.) participants were recruited from a Midwestern community hospital. Participants' inclusion criteria include: current employment at a 0.5 FTE (20 hours/week) to account for consistency and regularity as a staff member. Exclusion criteria include any registered nurse working less than 0.5 FTE (20 hours/week) and pool staff (any staff not regularly working on the specified unit) or any staff floated to the unit (Figure 2). No financial compensation for participating in the study was provided and the registered nurses received their usual regular hourly salary. The procedure included contacting nurse managers of the hospital units by the P.I. to explain the study and also request permission to attend unit staff meetings. Registered nurses were recruited by P.I. at staff

meetings to sign up to be a part of the study. Only registered nurses working more than 20 hours a week and working as a regular staff (not pool or float) member on the unit were allowed to enter the study.

Figure 2. Flow of registered nurse participant through the study.



Sample Size with Rationale

Effect size is the ability to detect an association between two variables and this depends on the actual magnitude of that association in the target population. Unfortunately, the investigator did not know how large or small the association is prior to their research (Hully et al., 2001). Of the literature reviewed none of the studies listed

effect size. A power analysis was completed using G Power Software (Buchner, Erfelder, Franz & Lang, 2006). Small, medium and large effect sizes were reviewed, with power 0.8 and alpha 0.05. The small effect size would require 394 participants per group, the medium effect size would require 64 participants per group and the large effect size would require 26 participants per group. The large effect was determined most appropriate for this study due to the significant effect recorded in Pronovost et al (2003) study. Results of the study found a 94% change in patients' orders due to a reconciliation process (intervention). The sample size of 26 for large effect was consistent with Cohen's recommended sample size of 26 participants per group (Cohen, 1992).

The calculated sample size was increased by approximately 15% to allow for missing data. Thus, the final sample size for the proposed dissertation was 60 participants- (registered professional nurses). The population selected to collect the medication histories was 104 patients (2 histories per nurse, a pre-test medication history and a post-test medication history) 65 years of age or older, active prescriptions for 5 or more regularly scheduled medications, cognitively intact (alert and oriented, no activated power of attorney, no guardianship for patient and no fall risk initiated) and English speaking admitted to hospital. No patients admitted from a nursing home were used for the study. No financial compensation was offered to patients.

Setting

Potential candidates were recruited from a Midwestern community hospital. The hospital is a tertiary care hospital with 300 beds located in a suburban community. The nursing units initially selected to participate in this study included; 5 medical, 4SW, 2SW

and HCU (Heart Care Unit). Five medical is a 53 bed unit which includes patients with diagnoses of pneumonia, renal failure, detoxification, diabetes, etc. The HCU has 38 beds and treats patients with congestive heart failure, myocardial infarction, etc. Four SW is a surgical unit has 42 beds, and is a general surgical unit that treats abdominal surgeries, including colon resections, appendectomies, cholecystectomy, etc. Due to the nature of 4SW, surgical, the admission medication lists were completed pre-admission by a telephone assessment nurse. This made obtaining medication lists patients on admission not possible. 4SW was not used as a participating unit. The fourth unit is 2SW, a medical digestive unit with 23 beds.

Measurement of Variables

The dependent variable is medication error score. The subject variables are nurse characteristics, patient characteristics, family characteristics and organizational characteristics. The independent variable in this study is cognitive behavioral education component provided to professional nurses.

Dependent Variable

The dependent variable is medication error score. Medication errors were identified when two medication histories are compared and the differences in medications counted. The two histories included the original medication history the staff nurse completes on a patient at the time of admission and the second history completed by an Advanced Nurse Practitioner within 24 -48 hours after an admission, using a standardized form. Inter-rater reliability was established by having a third medication history

completed by a different APN. The two histories completed by the APNs' were compared. Five percent of the sample size (Beers, 1990) was used to verify inter-rater reliability. A discrepancy between the second and third admission history would demonstrate poor inter-rater reliability.

The dependent variable is the medication error score identified when comparing two medication histories. Errors were counted by comparing the staff nurse's completed medication list to a medication list compiled by the advanced practice nurse (APN). The advanced practice nurses (research team) are currently employed in a senior health center that works specifically with patients 65 years and older. Their role consists of obtaining history and physicals, including a medication history, evaluation of labs, nutrition, fall risk and formulating a diagnosis and treatment plan. For the medication errors to be scored in this study, one point was assigned to incorrect name, dose, frequency and route, and two points was assigned to commission and omissions. This established a scoring system for each patient. Omissions and commissions were scored with 2 points because an added medication or missing medications is significant enough to have a higher allocation of weight. In fact, some studies only counted commissions and omissions (Kaboli et al., 2004; Lau et al., 2005). Complete medication lists were identified by (Cornish et al., 2005; Nassaralla et al., 2007) as including omissions, commissions, and correct name, dosage, frequency and route. Errors in this study were scored and a medication error score was established for every medication history list.

No gold standard for the identification of home medication use has been established. The best available measure of patient's actual home medication usage is the information provided from patient medication vials, pharmacy contacts, primary care

physician contacts and family members and/or significant others. The source of medications reported e.g. patient, prescription bottle, family report, etc was counted by assigning a number to each source and combination of sources.

Subject Variables

The variables looked at to identify relationships with dependent variable included; 1) nurse characteristics, 2) patient characteristics, 3) family characteristics and 4) organizational characteristics.

Nurse characteristics, were measured by identifying nurses' age, gender, years of education, years of experience, and hours worked. The demographic sheet is a self-report questionnaire was filled out by the registered nurse. It identified the nurse's name, the department/unit, age, gender, years of experience as a nurse, educational level of nurse and the amount of hours the nurse works. The form also listed patient criteria for the nurse to use when identifying potential research candidates.

Patient characteristics of age, gender, diagnosis, complications and number of days hospitalized were identified by using the medical record. Medical diagnosis were extrapolated from the discharge summary and complications were identified by reviewing the medical record for; infections, septicemia, thrombosis, and/or death that complicate the existing diagnosis and number of medications.

The characteristic of family was identified by assessing if the patient was currently residing with a family member. A yes or no answer was used in SPSS to rate this question.

Lastly, the organizational characteristics were measured by identifying number of prescribers, resource adequacy, nurse autonomy, nurse control and nurse-physician relationship and influence on medication error score. The Nursing Work Index-Revised, organizational support subscale, was used to collect this information. The original Nursing Work Index tool was examined conceptually and 10 items were selected to measure organizational support for nurse caregivers. The subscale included nurses' autonomy, control over practice setting and nurse-physician relationship. The NWI-R was used in a study of Medicare mortality rates for 39 magnet hospitals and 195 matched hospitals. The magnet hospitals were found to have significantly lower mortality and significantly higher NWI-R scale scores on nurse autonomy, control over practice, and relationship with physicians (Aiken & Patrician, 2000). The tool asks the nurse respond to ten questions. To calculate an overall NWI-R score, all questions were added and a total score for the tool will be used to enter into SPSS. The NWI-R is a self report inventory of nurses' perception of organizational support. The organizational support for nursing care subscale consists of ten items reflecting nurses' perception of the adequacy of staffing and managerial support for nurses' decisions about care. Overall Cronbach's alpha for the NWI-R was 0.96. Reliability for the organizational support subscale was 0.84. Validity was demonstrated by significant results when magnet hospital attributes of nurse autonomy nurse control and nurse physician relationship were compared to non-magnet hospitals. Nurse autonomy, nurse control and nurse-physician relationship were all significant at $p<0.001$. The content validity of the original instrument was established using magnet hospital characteristics (Aiken & Patrician, 2000). The 10 questions are scored on a 1-4 scale. The least possible score tallied could be 10 with the largest

possible score tallied a 40. The larger the score on the scale the more organizational support the nurse perceives available to them. Permission for instrument use: NWI-Revised see (Appendix I). The Cronbach's alpha for the NWI-R for this research was 0.902. With 100% of 52 cases valid, none excluded.

Intervention

The independent variable in this study is the intervention or education in obtainment of admission medication list. The intervention was administered to registered nurses on a randomly selected unit. The units were randomized by placing names of the units on slips of paper, placing them in a container and selecting one of the units. The registered nurses who worked on the unit randomly selected received the intervention. The intervention was provided to the professional nurses by the principal investigator. The intervention outline (Table 1) helps identify key objectives in the intervention.

The Home Medication list was used to collect information regarding medications including name, dose, route and frequency of medications from the patient. All medications used by the patient were listed enabling the APN's to identify errors in name, dosage, frequency and route along with omissions and commissions. Physicians and pharmacies were listed along with who the information was collected from including patient and family. Medication reconciliation forms (Pronovost et al, 2003; Rozich et al, 2001) were identified in many studies as the best tool to use in obtaining medication information.

Table 1

Brief Outline of the Cognitive Behavioral Content

Part 1:	Review of case studies (Appendix H).
	Case 1: Review of the case of the woman with heart disease.
	Case 2: Review of the case of the man on Depakote.
Part 2:	Nurse will be involved in a cognitive behavioral exercise. The task will be to identify old rules or assumption about obtaining admission medication histories. The P.I. will work with the nurses to identify more adaptive methods obtaining medication histories (Appendix E).
Part 3:	Review of the Home Medication List (Appendix C).
Part 4:	Review of techniques for Medication History obtainment (Appendix D).

The intervention consisted of an hour of cognitive behavioral education; the first 15 minutes was spent on reviewing two cases which involved errors on the admission medication history which caused significant negative outcomes. The next 15 minutes included identifying old rules or assumptions in which nurses obtained admission medication and also to identify more adaptive methods for the nurse to incorporate into practice. The nurses investigated their own beliefs and thoughts about medication history taking and restructure some of their thoughts about completing the task. Some old assumptions that nurse had include: I do not have enough time to complete medication admission history list, if I do an O.K. job the doctor of pharmacist will double check it for me, I am not the only one responsible for this history, the patient should be bringing an accurate list of what medications they are taking, etc. It is the examination of these

assumptions that lead the nurse be open to collecting a more complete and accurate list of medications. Permission for instrument use: Changing Old Rules/Assumptions into New Rules/Assumptions (Appendix J).

The next 15 minutes involved reviewing and explaining the home medication list and requesting that all questions are answered and the tool is completely filled out. The last portion of the hour was spent discussing techniques that may help the nurse to critically think about medication history obtainment including asking the patient about a typical day and what medication he or she takes in the morning, afternoon, evening and at bedtime. Have the nurse ask the patient what they do if they forget to take a dose of medication. Have the nurse link medications to medical conditions. These techniques for medication history obtainment helped to provide a consistent approach to medication admission history obtainment using a standardized home medication list.

Data Collection Procedures

The research team included the Principal Investigator (P.I.) and two nurse practitioners. The research team contacted nurses from the Midwestern hospital to inquire if they would be interested in participating in the study. The nurses agreeing to participate in the study were introduced to the study. Nurses interested in participating in the research were asked to sign a permission agreement to participate in the study (Appendix F). The expectations of nurses included a minimum of two reviews of their completed medication histories, completion of a demographic questionnaire, a Nurse Work Index-Revised and the possibility of being selected for the intervention. The total intervention consisted of one hour of instruction. All nurses received their normal hourly

wage for the time spent on the research project. The P.I. provided a self-report/demographic questionnaire to the nurses with instruction (Appendix A). The demographic questionnaire is a self-report sheet developed by the investigator.

The nurses were instructed on how to contact the research P.I. after a medication history is complete. The patients were contacted by the research team to request permission to use their medication history information and conduct another medication history for research purposes (Appendix G). The minimum requirement from the patient included completing a second medication history with an advanced nurse practitioner, possibly a third if selected for the consistency/reliability portion of the study. The first medication history would be the history completed by the nurse on admission (usual practice). The second medication history collected by the NP was used to compare to the medication history collected by the staff nurse. Five percent of the total 104 patients were asked to complete three medication histories, one original history on admission, then a second for study purposes, the third history was for purposes of validating the consistency/reliability of nurse practitioners (researcher team) gathering medication histories, or 5% of the sample size (Beers et al., 1990). Inter-rater reliability of the home medication tool was completed. The medication history collected by this investigator was compared to the medication history collected by the nurse practitioner. Accuracy was 100%. The second medication history was completed by the research team using the Home Medication List (Appendix C). If the patient did not sign written consent, no information from the patients was used.

Accuracy of the data were reviewed by rechecking each data point to ensure the correct number was entered. The frequencies were also performed to check the minimum

and maximum value for each variable. This was to assure that all values for each variable were "valid." The data were checked for any missing numbers, errors were minimal and corrected. There was no missing data. The SPSS Descriptive Statistics, Explore, was utilized to evaluate the assumption of normality. All variables were found to exhibit normality with skew and kurtosis between -1 to +1.

Errors were measured comparing information from the staff nurse's medication history to the one completed by the researcher team. The researcher team identified if there were discrepancies in the name of medication, dosage and frequency of medication and route of medication. Other errors included omissions, which were defined as medications that were not on the medication history completed by the nurse, but that currently were taken by the patient and commissions defined as medications that were on the medication history, but that were not currently taken by the patient.

Randomization of the hospital units' occurred, the participants were unaware if their unit was chosen as the intervention unit or not. The APN (research assistants) were also blinded to the study. The study began by collecting admission history lists from the 52 nurses agreeing to participate. The APN then collected a second medication history from the same patient and compared results. Discrepancies in omissions, commissions, and correct name, dosage, frequency and route were tallied.

The group of nurses receiving the intervention (intervention group) received a cognitive behavioral intervention along with an education component. The cognitive intervention provided by the P.I. included: 1) two case study reviews which included medication errors on admission medication lists and the consequences to the patient, 2) a cognitive behavioral worksheet, reviewing the nurses' rules and assumptions about

admission medication history obtainment (Appendix E), how to build new rules and assumptions regarding medication history obtainment. 3) An education component to discuss techniques for medication history obtainment (Appendix D), and 4) instruction on the Home Medication List (Appendix C) to the nurses in the intervention group.

The intervention group of nurses (nurses receiving the education and cognitive therapy) and control group completed medication histories on patients as usual. The research team completed the second medication history on patients documenting all medication errors. The intervention group error rate was compared to the control group's error rate to establish if there was a significant change from the intervention group to the control group.

Plan for Data Analysis.

Data were entered by the P.I. using, the statistical Package for Social Sciences SPSS 13.0 (2004). All data entered was checked for errors. If 15% or more of data collected by the participant was missing, those data were not entered into the database (George & Mallery, 2001).

Descriptive Statistics

Descriptive statistics, including percents, means, and standard deviations were used to describe the demographic and data. The data were analyzed by pre-test control and intervention group and by post-test control and intervention group. Descriptive statistics were provided for nurses' characteristics including; age, gender, number of years of education, years of experience, and hours worked. Patient's characteristics were

described with mean age, gender, diagnosis, complications, and number of days hospitalized. Families residing with patients were converted to a percentage number. Organizational characteristics included average number of prescribers per patient and NWI-R scores.

Hypothesis

The hypothesis states those professional nurses who receive a behavioral-cognitive knowledge based education intervention will have fewer medication errors compared to professional nurse who did not receive the intervention when admitting patients age 65 years of age or older on hospital admission.

The hypothesis was tested using an independent-measures *t* statistic, to determine if there is a significant difference between the intervention and control groups. A significant difference in the dependent variable (medication errors) between the intervention group (receives cognitive behavioral education) and the control group (no intervention) would indicate the intervention was successful in reducing the number of medication errors. A result is said to be statistically significant if it is very unlikely to occur when the null hypothesis is true. A *p* value ($p \leq .05$) is the probability that the result would occur simply by chance (without any intervention), which is also the probability of Type I error.

Research Questions

Descriptive statistics answered the research question 1) How many and what types of medication errors are present in a population of patients, 65 years of age or older

on 5 or more prescribed medications? Percentages were calculated to represent the number and type of medication errors.

Correlation is a statistical technique that is used to measure and describe a relationship between two variables (Gravetter & Wallnau, 2005). The correlation coefficients can range from +1.00 (direct relationship) to a -1.00 (inverse relationship), 0.0 indicating no relationship between variables. The Pearson *r* was used when the relationship between the two variables was scale (interval, ratio) level and the distribution scores were approximately symmetrical (not highly skewed) and the Spearman's *rho* was utilized when one or both of the variables were categorical level (nominal, ordinal). The correlation coefficients were calculated to indicate strength and direction of relationships between the 2) nurse variables of age, gender, years of education, years of experience, and worked hours on medication errors. A Pearson correlation was calculated among the variables of nurse age, nurse years of experience and worked hours. A Spearman's correlation was calculated for nurse education. 3) What is the relationship of patient characteristics of age, gender, number of diagnosis and complications on medication errors? A Pearson correlation was calculated among the patient's age and diagnosis. A Spearman's *rho* was used to calculate patient's gender and complications. 4) What is the relationship of family characteristic or family member residing with patient on medication errors? A spearman's *rho* was used to calculate family residing with patient. 5) What is the relationship of organizational characteristics, which includes number of prescribers, and organizational support defined as, resource adequacy, nurse autonomy, nurse control and nurse-physician relationship, nurse-patient ratios and unit acuity on medication errors? A Pearson correlation statistic was used to identify if a relationship

was evident among number of prescribers and organizational support and medication error number. The Bonferroni was not utilized since each t-test was performed independently and there is no need to adjust for multiple comparisons.

Human Subjects Protection

The study was conducted in accordance with the Healthcare Information Portability and Accountability Act (HIPPA) regulations. The subject's privacy and confidentiality were maintained. Informed consent was obtained by the P.I., who has completed the NIH Protection of Human Subjects Training. The informed consent contained all relevant material including purpose, background, procedures, benefits, risks, and the right to refuse or withdraw reimbursement, confidentiality, and the contact information. Data collected was coded with numbers 1 to 52 for nurses and entered without any verifying information into a computerized data base available only to the P.I. and assisting faculty. All consent forms are kept in a locked file. The benefit-risk ratio was minimal if no risk and important benefits. The protocol was submitted to and approved by the Institutional Review Board (IRB) from Marquette University and Waukesha Memorial Hospital.

Limitations

A limitation in this study is the lack of a gold standard for the identification of home medication use in hospitalized patients. This study used information from patients or significant others to collect a medication list, the P.I. and research assistants also used information from medication vials, collateral information from pharmacies and primary

care doctors. A second limitation is the home medication list tool developed for this study has not been validated. A third limitation of the study is the home medication list developed for this research is a paper medication tool where both hospitals currently utilize an electronic medical record when acquiring medication history lists. Another limitation of the study is the randomization of nursing units not of individual nurses, it was decided to follow this procedure to help decrease the diffusion potential of nurses sharing information with other nurses.

Chapter Summary

The purpose of this study was to test an intervention, if a cognitive-behavioral education intervention to a group of professional nurses would decrease medication transcription errors in hospital patients 65 years or older on an admission medication history. This chapter included a comprehensive review of the research design and methods. A discussion of the study sample, setting, data collection procedures, measurement of variables, and data analysis was provided. This chapter concluded with information on human subject's protection and the limitations of the study.

Chapter 4

Results

This chapter will present the analysis of the data to test the hypothesis and to answer the research questions. The demographic characteristics of the nurse and patient participants are described followed by the correlations and an independent t-test. The statistical measures used in this intervention study included descriptive statistics, bivariate correlations, and an independent t-test. A summary of the results concludes the chapter.

Demographic Characteristics of the Control versus the Intervention Group

Nurse Participants

The nurse sample consisted of 60 nurses who had met the inclusion criteria if they worked 20 hours or more a week and were not considered pool staff. The convenience sample of 60 nurses included a 15% over sampling for attrition purposes. Eight nurses did not complete the study because 3 moved from the area and 5 were unable to arrange a time meet for the intervention. The final sample of 52 nurses included: Control Group (25 women and 1 man) and the Intervention Group (23 women and 3 men). Ages ranged from Control Group 22-58 years and the Intervention Group 22-65 years. There were no significant differences between the control group and the intervention group when comparing for nurse age ($t=.24$, $df=50$, $p=.81$, two-tailed), experience ($t=.66$, $df=50$, $p=.51$, two-tailed) or hours worked ($t=-.98$, $df=50$, $p=.33$,two-tailed). The Nursing Work

Index-Revised tool demonstrated a significant difference between the control group and the intervention group (t=-2.19, df=50, p=.03, two-tailed). The magnitude of the difference in the means (mean difference = 3.3, 95%CI: -6.20 to -.265) had a small effect (eta squared = .047). The mean score was 32 with 40 being the highest possible number. The higher the number the more organizational support perceived by the nurses. The implications suggest the intervention group had more resources and felt they had more organizational support. The ages, experience, and hours worked were grouped for reporting purposes. Tables 2 and 3 include a partial summary of the nursing characteristics for the intervention and control groups.

Table 2

Descriptive Statistics for Nursing Characteristics, Control and Intervention Groups

	n	Percent		n	Percent
Control Group	26		Intervention Group	26	
Age			*Age*		
22 – 30	10	39	22 – 30	10	38
31 – 40	3	12	31 – 40	5	20
41 – 50	9	34	41 – 50	7	27
51 +	4	15	51 +	4	15
Gender			*Gender*		
Female	25	96	Female	23	88
Male	1	4	Male	3	12
Education			*Education*		
Associate Degree	15	58	Associate Degree	16	61
Bachelor Degree	11	42	Bachelor Degree	10	39
Experience (Years)			*Experience (Years)*		
1 - 5	13	50	1 - 5	13	50
6 – 15	8	31	6 – 15	10	39
16+	5	19	16+	3	11
Hours Worked			*Hours Worked*		
24 - 35 hrs or less	11	42	24 – 35 hrs or less	10	38
36 - 40 hrs or less	15	58	36 – 40 hrs or less	16	62

Table 3

Mean and Standard Deviation for Nursing Characteristics, Control and Intervention Groups

	Mean	SD		Mean	SD	T-Test	P
Control Group			Intervention Group				
Age	38	11.1	*Age*	37	13.1	.24	.81
Experience (Years)	9.0	8.2	*Experience (Years)*	7	9.0	.66	.51
Hours Worked	33	5.7	*Hours Worked*	35	5.6	-.98	.33
NWI-R score	30.2	6.5		33.5	3.8	-2.19	.03

Patient Participant

The patient sample met inclusion criteria if they were 65 years of age or older, had active prescriptions for 5 or more regularly scheduled medications, were cognitively intact (alert and oriented, no activated power of health care, no guardianship, and not at risk for falls) and spoke English. The final sample consisted of 104 patient participants. The hospital units were randomly assigned into control and intervention groups. The Heart care unit, 4South West and 2SouthWest, were assigned as the control group and 5 medical was assigned the intervention. The groups were divided into pre-test control, pre-test intervention (52 patient participants) and post-test control and post test intervention (52 patient participants). An independent sample t-test was conducted to compare the means for pre-test control and pre-test intervention group characteristics. There were no significant differences between the pre-test control group and the pre-test intervention group when comparing for patient age (t=-1.5, df=50, p=.13, two-tailed), or

patient hospitalized days (t=-.52, df=50, p=.61, two-tailed). There was a statically significant difference in number of diagnosis in the pre-test control group (M=5, SD=2.8) to the pre-test intervention group (M=11, SD=6.5), t=-4.4, df=50, p<.01 (two-tailed). The mean change in diagnosis scores was 6 with a 95% confidence interval ranging from -8.88 to -3.34. The eta squared statistic (.28) indicated a large effect size. The number of diagnosis was determined to cause an increase in the number of patient's medications but did not have an effect on number of medication errors. Table 4 includes a summary of the selected patient pre-test demographic characteristics, and table 5 describes the mean and standard deviations for the pre-test groups.

Table 4

Descriptive Statistics Pre-Test for Patient Characteristics and Family Characteristics, Control and Intervention Groups

	n	Percent		n	Percent
Pre Test - Control Group	26		Pre Test – Intervention	26	
Age			*Age*		
65 – 70	8	32	65 - 70	4	16
71 – 75	5	19	71 - 75	3	11
76 – 80	5	19	76 - 80	4	16
81 – 85	4	16	81 - 85	7	34
86 +	4	16	86 +	6	23
Gender			*Gender*		
Female	15	58	Female	12	46

Male	11	42	Male	14	54
Diagnosis			*Diagnosis*		
1 – 5	12	46	1 - 5	8	31
6 – 10	13	50	6 - 10	4	15
11 – 15	1	4	11 - 15	7	27
16 +	0	0	16 +	7	27
Complications			*Complications*		
Yes	3	12	Yes	0	0
No	23	88	No	26	100
Number of Days Hospitalized			*Number of Days Hospitalized*		
1 – 5	21	81	1 - 5	18	69
6 – 10	3	11	6 - 10	26	23
11 +	2	8	11 +	2	8
Source of Medication Information			*Source of Medication Information*		
Family / Patient	3	11	Family / Patient	1	4
Pharmacist	4	16	Pharmacist	5	19
Primary Prescriber	4	16	Primary Prescriber	11	42
Combination	15	57	Combination	9	35
Family Characteristics			*Family Characteristics*		
Family / Patient Member Residing Together			Family / Patient Member Residing Together		

Yes	16	61	Yes	11	42
No	10	39	No	15	58

Table 5

Mean and Standard Deviation Pre-Test for Patient Characteristics and Family Characteristics, Control and Intervention Groups

	Mean	SD		Mean	SD	T-Test	P
Pre Test – Control Group			Pre Test – Intervention				
Age	77	7.3	*Age*	80	7.1	-1.54	.13
Diagnosis	5	2.8	*Diagnosis*	11	6.5	-4.43	.00
Number of Days Hospitalized	4	3.5	*Number of Days Hospitalized*	5	2.9	-.52	.61

Table 6 includes a summary of descriptive post-test patient characteristics and family characteristics. Independent sample t-tests were conducted to compare the means of patient and family characteristics for the post-test control and post-test intervention groups (see table 7). There was a significant difference in pre-test control and pre-test intervention group when comparing patient diagnosis (t=-4.43, df= 50, p=.00, two-tailed). No significant differences between pre-test patient age (t=-1.54, df=50, p=.13, two-tailed) and patient hospital days (t=-.52, df=50, p=.61, two-tailed). There were no significant differences between the post-test control group and the post-test intervention group when comparing for patient age (t=-.84, df=50, p=.40, two-tailed), patient diagnosis (t=-1.50, df=50, p=.14, two-tailed) and patient hospitalized days (t=-.81, df=50, p=.43, two-tailed).

Complications were identified in the pre-test control group (3) 12%, none were identified in the pre-test intervention group. Also complications were identified in the post-test control group (2) 8%, none were identified in the post-test intervention group. The complications were due to hospital acquired infections, none were related to medication errors. In the number of days patients were hospitalized, in all groups, the largest percentile was in the 1-5 hospital days, with 6-8 days the second largest group. The largest source of medication information in all groups but one was the use of the primary prescriber. Identifying the effect of obtaining medication information from different sources, including family report, physician report, pharmacy, etc. is hard to quantify with direct relationship with medication errors. Further research may help identify where specific error may occur when working with medication obtainment and family's involvement in medication list accuracy. Lastly, answering yes to the question of family member residing with patient, the pre-test control group had (16) 61% and the pre-test intervention group had (11) 42% of family member residing with patient. The post-test control group had (14) 54%, and the post-test intervention group had (12) 46% of family member residing with them. Tables 5 and 6 include the selected patient post-intervention demographic characteristics.

Table 6

Descriptive Statistics Post-Test for Patient Characteristics and Family Characteristics, Control and Intervention Groups

	n	Percent		n	Percent
Post Test – Control Group	26		Post Test – Intervention	26	

Age			*Age*		
65 – 70	7	27	65 - 70	5	19
71 – 75	3	11	71 - 75	2	8
76 – 80	5	20	76 - 80	5	19
81 – 85	3	11	81 - 85	3	11
86 +	8	31	86 +	11	43
Gender			*Gender*		
Female	12	46	Female	13	50
Male	14	54	Male	13	50
Diagnosis			*Diagnosis*		
1 – 5	7	27	1 - 5	6	23
6 – 10	11	42	6 - 10	9	34
11 – 15	6	23	11 - 15	8	32
16 +	2	8	16 +	3	11
Complications			*Complications*		
Yes	2	8	Yes	0	0
No	24	92	No	26	100
Number of Days Hospitalized			*Number of Days Hospitalized*		
1 – 5	18	69	1 - 5	17	65
6 – 10	5	19	6 - 10	8	31
11 +	3	12	11 +	1	4
Source of Medication			*Source of Medication*		

Information			*Information*		
Family / Patient	0	0	Family / Patient	1	4
Pharmacist	3	12	Pharmacist	6	23
Primary Prescriber	14	54	Primary Prescriber	11	42
Combination	9	34	Combination	8	31
Family Characteristics			*Family Characteristics*		
Family / Patient Member Residing Together			Family / Patient Member Residing Together		
Yes	20	77	Yes	12	46
No	6	23	No	14	54

Table 7

Mean and Standard Deviation Post-Test for Patient Characteristics and Family Characteristics, Control and Intervention Groups

	Mean	SD		Mean	SD	T-Test	P
Post Test – Control Group			Post Test – Intervention				
Age	78	9.3	*Age*	81	8.8	-.84	.40
Diagnosis	8	4.9	*Diagnosis*	10.5	5.1	-1.50	.14
Number of Days Hospitalized	5	6.0	*Number of Days Hospitalized*	4	2.6	.81	.43

* Correlation is significant at the 0.05 level (2-tailed)

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

Hypothesis

The hypothesis states those professional nurses who receive a behavioral-cognitive knowledge based education intervention will have fewer medication errors compared to professional nurse who did not receive the intervention when admitting patients age 65 years of age or older on hospital admission.

The hypothesis was tested using an independent-samples t-test to compare the medication error score for pre-test control and pre-test intervention groups and post-test control and the post-test intervention group. There was no significant difference in medication error score for the pre-test control (M=3.54, SD=3.51) and pre-test intervention groups, (M=3.54, SD=2.89), t=.00, df= 50, p = 1.00, (two-tailed). There was a statistically significant decrease in medication error score from the post-test control group (M=3.23, SD 3.34) to the post-test intervention group, (M=.69, SD=1.49), t=3.54, df=50, p=.001 (two-tailed). The mean decrease in medication error scores was 2.54 with a 95% confidence interval ranging from 1.10 to 3.98. The eta squared statistic (.113) indicated a large effect size.

Research Question One

Descriptive statistics were utilized to answer the research question 1) How many and what types of medication errors are present in a population of patients, 65 years of age or older on 5 or more prescribed medications? The number and type of medication errors for all patients n=104, pre-test control and intervention and post-test control and intervention are presented in table 8. The largest percentage of error occurred by omissions (40%) followed by commissions (30%) and dose errors (26%). There were no

errors found in route (0%). The smallest errors found in frequency (3%) and name (1%). The mean medication errors per patient was (mean=1.62). From the total sample of patients n=104, it was identified that 67 patients (64%) had medications errors on their admission medication lists and 37 patients (36%) had no medication errors on their admission medication lists. Tables 9 and 10 identify specific medication errors in Pre-Test control and intervention groups and Post-Test control and interventions groups.

Table 8

Number and Type of Medication Errors

Type	Number of Errors	Percent
Name	2	1
Dose	43	26
Frequency	5	3
Route	0	0
Commission	50	30
Omission	68	40
	168	100
Number of Patients	n	Percent
No error	37	36
Error	67	64
	104	100

Table 9

Medication errors Pre-Test Control and Pre-Test Intervention Groups (n=52)

Pre-Test Control						Pre-Test Intervention					
Errors:	None	1	2	3	4	Errors	None	1	2	3	4
Name:	26	0	0	0	0	Name:	18	6	1	0	1
Dose:	15	8	3	0	0	Dose:	26	0	0	0	0
Frequency:	24	2	0	0	0	Frequency:	26	0	0	0	0
Route:	26	0	0	0	0	Route:	26	0	0	0	0
Commissions:	19	3	3	1	0	Commissions:	13	11	1	1	0
Omissions:	12	7	3	3	1	Omissions	11	10	2	2	1

Table 10

Medication errors Post-Test Control and Post-Test Intervention Groups (n=52)

Post-Test Control						Post-Test Intervention					
Errors:	None	1	2	3	4	Errors	None	1	2	3	4
Name:	26	0	0	0	0	Name:	25	0	1	0	0
Dose:	15	7	3	1	0	Dose:	26	0	0	0	0
Frequency:	23	3	0	0	0	Frequency:	26	0	0	0	0
Route:	26	0	0	0	0	Route:	26	0	0	0	0
Commissions:	19	3	0	3	1	Commissions:	22	3	0	1	0
Omissions:	16	6	3	0	1	Omissions:	24	2	0	0	0

Research Questions Two, Three, Four and Five

Correlation of Variables

Research question two, what is the relationship of nurse age, education, years of experience, and hours worked on medication transcription errors? The relationship between nurse's age, experience, and nurse's hours worked and medication transcription error score (as measured by information compared from the staff nurse's medication history to the one completed by the research team) was investigated using Pearson correlation coefficient. The Assumptions of Pearson Correlation Coefficient were met. There was a strong positive correlation between nurse experience and nurse age r=. 71, n= 52, p<.01. As nurse experience increased nurse age increased. This statistic would be expected. The more experience you acquire the more you age. There was a medium negative correlation between nurse's age and hours nurses worked per week, r=-.34, n= 52, p=<.05. As nurses' age increases hours worked decreases. The correlation suggests the older a nurse becomes the less hours she is working. No relationships were identified between nurse characteristics and medication error score. Refer to Table 11 and Table 12.

Table 11

Pearson Correlations between nurse variables and medication score (n-52)

Nurse Variables	1	2	3	4
1. Nurse Age	1	.709**	-.155	.175
2. Experience		1	-.342*	.043
3. Hours Worked			1	-.065
4. Medication Score All				1

* Correlation is significant at the 0.05 level (2-tailed)

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

Table 12

Spearman Correlation between nurse variable and medication error score (n-52)

Nurse Variables	1	2
1. Nurse Education	1	-.004
2. Medication Score All		1

* Correlation is significant at the 0.05 level (2-tailed)

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

Research question three, what is the relationship of patient age, gender, number of diagnosis, and complications on medication transcription errors? The relationship between medication transcription error score and patient variables was investigated using Pearson correlation coefficient. There was a small positive relationship between number of patient prescribers and medication error score, $r=.26$, $n=104$, $p<.01$, and patient diagnosis and patient's age, $r=.23$, $n=104$, $p<.05$. As patient prescribers increase medication error score increases. There were no other relationships found between patient variables and medication transcription error score. Refer to Table 13.

Research question four, what is the relationship of family member residing with patient on medication transcription errors? No relationship was identified between family members residing with patient on medication error score. However, a relationship between the gender of the patient and family member residing with patient was identified. Using the Spearman's correlation, there was a small positive relationship, r=.29, n=104, p=<.01, with patient gender and having a family member residing with patient. The data results describe men have family member residing with them 71% of the time and females have family members residing with them 42% of the time. Refer to table 14.

Table 13

Pearson Correlations between patient variables and medication score

Patient Variables	1	2	3	4
1. Patient Age	1	.229*	-.139	-.068
2. Diagnosis		1	-.121	-.132
3. Prescribers			1	.259**
4. Medication Score All				1

* Correlation is significant at the 0.05 level (2-tailed)

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

Table 14

Spearman's rho Correlations between patient variables and medication score

Patient Variables	1	2	3	4
1. Gender	1	-.045	.291**	-.040
2. Complications		1	.015	-.104
3. Family Residing			1	-.075
4. Medication Score All				1

* Correlation is significant at the 0.05 level (2-tailed)

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

Research question five, what is the relationship of organizational support for nursing and number of prescribers on medication errors? No significant relationship was identified between the nurse organization support (as measured using the Nurse Work Index-Revised scale) and medication transcription error score (as measured by information compared from the staff nurse's medication history to the one completed by the research team) using the Pearson correlation coefficient. Refer to table 15.

Table 15

Pearson Correlations between nurse organization support and medication score

Nurse Variables	1	2
1. Nurse Organization Support	1	.046
N	52	
2. Medication Score All		1
N	104	

* Correlation is significant at the 0.05 level (2-tailed)

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

Chapter Summary

This study examined the significance of a cognitive behavioral education based intervention on medication transcription error score. The results indicated that the intervention was effective. The behavioral knowledge based education intervention decreased medication transcription error score among professional nurses when working with patients 65 years of age or older and taking five or more prescribed medications on hospital admission histories.

The number and type of medication error for patients 65 years of age were described. Sixty-four percent of all patients admitted to the hospital had medication errors on their admission histories. Thirty-six percent had no errors. No relationship was found between the nurse characteristics, patient characteristics, and family member living with the patient on the medication error score. A small positive relationship between number of patient prescribers and medication error score was identified.

Chapter 5

Discussion

This researcher examined if a cognitive behavioral based education intervention would decrease medication transcription errors when working with patients 65 years of age or older taking five prescribed medications or more on admission medication histories. Additionally, the number of medication errors and types of errors were examined. Finally, the relationships between nurse, patient, family member residing with patient and organizational support for nursing and number of prescribers on medication errors was examined. This chapter will include: (1) interpretations of the findings, (2) limitations of the study, (3) implications for nursing practice, and (4) suggestions for further research.

Interpretations of the Findings

The data gathered for this study demonstrated that the behavioral-cognitive intervention for professional nurses resulted in significantly lower medication error rate on admission history and assessment than a control group of nurses that provided standard care. These findings are similar to other studies such as (Pronovost et al, 2003; Crotty et al, 2004) who identified that using a standardized reconciliation process decreased medication errors. Research completed by Gleason,et al., 2004, suggested that providing intensive education in the reconciliation process and using a standardized data collection form decreased the opportunities for medication errors. Also, Nassaralla (2007) found that when physicians and nurses truly worked together there were lower rates of incomplete medication lists.

The results of this study demonstrated that the cognitive behavioral education intervention provided to professional nurses improved the medication error score. These findings fit nicely with the conceptual framework developed to guide this research. Improving quality is possible when solid structure and processes are in place. When reviewing the process of medication list obtainment, it was determined a new approach would be attempted. A behavioral cognitive education intervention was developed to help nurses identify the ways in which obtaining medication histories have been challenging. Previously, behavioral cognitive approaches have mainly been used in the behavioral health arena assisting patients to re-structure the way they think and behave regarding certain issues. Providing a cognitive behavioral education intervention to nurses allowed them to contemplate the way in which they collect medication information and discuss different options available thereby, providing insight and alternatives. The study findings were significant and demonstrated that providing a cognitive behavioral based education intervention to professional nurses improved medication error scores.

This research also found that 67% of patients had medication errors on their admission history lists. Thirty-six percent of patients had no error. Other studies have found similar results. Beers, et al. (1990) found that 83% of patients had at least one medication error and Cornish, et al. (2005), found that 54% had at least one medication discrepancy. The most frequently occurring errors included omissions of medications (40%), commissions (30%), and dose (26%). Errors of omission and commission are serious and were weighted with a higher score in this research. It was demonstrated that

the more serious medication errors, omissions and commissions occurred most frequently.

The results from this research found that omissions occurred most frequently (40%) than other errors in patients admission lists. Researchers Lau, Florax, Porsius and DeBoer (2000) and Beers, Munekata and Storrie (1990) identified similar findings. The study conducted by Lau, et al., (2000) found 61% of all patients had one or more omission errors. Beers, et al. (1990) found 78% of all subjects had at least one error of omission.

Other medication errors included frequency (3%), name (1%) and route (0%). The low error in name may be due to the computer system currently in place. All medications in the computer system had pre-spelled the medication names listed before the nurse could select a medication. There was no free typing in the medication field. Frequency was a small error finding and route had no errors. The no error in route of medication may be accounted for by the fact most medications used at home are oral, and only a few medications are delivered sub-cutaneous, e.g., insulin.

The convenience sample consisted of 52 nurses, 26 nurses in the control group and 26 nurses in the intervention group. The ages of the nurse, experience, education and hours worked were similar in the control group and the intervention group. In the control group, the nurses' ages were between 22-30 (39%) and 41-50 (34%). In the intervention group, the nurses' ages were between the ages of 22-30 (38%) and 41-50 (27%). Work experience in both groups was similar; control group 1-5 (50%) years of experience and 6-15 (31%) years of experience, the intervention group years of experience 1-5 (50%) and years of experience 6-15 (39%). The education in both groups was comparable with

control group associate degree (58%) and bachelor degree (42%). In the intervention group associate degree (61%) and the bachelor degree (39%). Hours worked control group 24-35 (42%) and 36-40 (58%) and in the intervention group hours worked 24-35(38%) and 36-40 (62%).

In reviewing the relationships between nurse characteristics and medication error score, no relationship was found between nurses' education and medication error score. This disagrees with the literature conducted by Aiken, et al, (2003) which stated bachelor's trained nurses were associated with a 5% decrease in both patients dying within 30 days of admission and the odds of failure to rescue. Understanding the relationship between nurse education and medication error would need more research investigation. Not finding a relationship between nurse's education and medication error might suggest the process has more of an influence on this outcome than nursing education.

In addition, there was no relationship found between years of nurse experience and medication error score. Even though, Tourangeau, (2002), and Blegen, Vaughn & Goode, (2001) found association between years of experience and fewer patients deaths, medication error rates and lower fall rates. Again, this might suggest the process of obtaining the medication list is more of a predictor of outcomes than nurse experience.

Additionally, table 4 and 5 describes the patient and family characteristics. The sample included a total of 104 participants, 26 in each of the pre-test control and intervention groups, and 26 participants in each of the post-test control and intervention groups. Patients' mean age in all groups was between 77-81 years of age. Fifty two percent of the pre-test control and pre-test intervention group were female and forty eight

percent of the post-test control and post-test intervention group were female. The average number of diagnosis if the pre-test control, intervention group was 8 and the post-test control intervention group was 9. The number of days hospitalized was similar for both groups with a mean of 4.5 days.

The literature has found that patients 70 years old or older had a greater percentage of medication registration errors than younger patients (Lau, et al., 2000). My research demonstrated no relationship between patients age and medication error. Also, no relationship was found between gender of patient and medication error score. This additionally differs from the literature where Lau, et al (2000) found that female patients had more errors in their medication records than male patients. The number of diagnosis and complications did not demonstrate an association with medication error score. Even though the literature identified that severity of illness is related to poor outcomes, including pressure ulcers, mortality, quality and cost of health care (Horn, et al, 2004; Zimmerman & Kramer, 2008; Parkerson, Broadheal &Chiu-Kit, 1993). In other studies a severity of illness scale was utilized, I was unable to incorporate a specific severity of illness scale into my study, prohibited due to cost and training.

In the pre-test control and pre-test intervention group the number of patients that had family residing with them was 51.5% compared with the post-test control and post-test intervention group, with an average of 61.5% having family members residing with patients. As noted there was a larger amount of patients having family reside with them in the post-test control and intervention group, yet no relationship was noted when a bivariate correlation was conducted to compare residing with medication error score. Research conducted by DiMatteo (2004) suggests that social support enhance medication

adherence and with family support medication lists on admission could be related to decreased medication errors. Living arrangements is important to the elderly adult due to help with managing medications. With no support from the family to remind the patient to take medications, this lack of help with monitoring may lead to medication errors (DiMatteo, 2004; Barat et al., 2001; Dunbar-Jacob, Bohachick, Mortimar, Sereika & Foley, 2003; Fosu, 1995). The results reported disagree from the literature, suggesting that more comprehensive interviewing questions for the family might be beneficial when conducting research. The questions might include who resides with patients and more about their social support related to medication history lists. In summary, this research found no relationships between organizational structure, except the number of prescribers and medication error score or outcomes. This may be reflective of using tools that were not comprehensive enough, not asking the right questions, or maybe not measuring enough variables. In future research, it would be interesting to comprehensively measure organizational structure and continue to find outcomes that are affected by these components of health care.

The results of this study demonstrated a positive relationship between increase in the number of prescribers and increase in the medication error score. The literature identified that the greater the number of physicians prescribing medications for an elderly patient, the greater the chance of medication discrepancies and medication errors (Tamblyn, McLeod, Abrahamowicz & Laprise, 1996). Tamblyn et al. (1998) followed elderly individuals and concluded from his study, there is a significant increased risk of potentially inappropriate drug combination with the number of physicians involved in the medical management of an elderly patient. The study identified a single primary care

physician and a single dispensing pharmacy may be “protective” factors in preventing potentially inappropriate drug combinations (Tamblyn et al., 1996). The risk for medication error increases when you have multiple prescribers changing the medication regimen and no process or system to communicate these changes.

No significant relationship was found between the organizational structure as measured by the NWI-Revised tool and medication error score. Duffy & Hoskin’s (2003) research identified organizational characteristics including staff/mix workload, resources, organizational culture may directly or indirectly influence outcomes of care. Aiken et al. (2002) developed a tool to identify the effect of organizational attributes have on patient outcomes (Aiken et al., 2002). Numerous items support attracting and retaining nurses and those included; flat organizational structure, decentralized decision making by bedside caregivers, inclusion of the chief nurse executive in top management decision making, flexible nursing scheduling, unit self-governance, and investment by management in the continuing education of nurses (Kramer & Schmalenberg, 1988). Nursing involvement in the collective understanding of the interrelationships and subtleties of the organization will allow more reliable system to evolve, will enhance the work of the nurse and promote patient safety (Scott, 2004; Bliss-Holtz, Winter, & Scherer, 2004). The NWI-R scores were significantly higher in the intervention group than the control group, this fact may help contribute to the significant decrease in medication errors identified in the intervention group. The improved outcomes maybe associated with having enough resources, measured by the NWI-R, to complete the medication list more completely with less errors. This would support Donabedian’s Health model suggesting that structure and processes have impact on outcomes. Some

confounding variables not measured that could influence medication error score is staffing levels and acuity, this was challenging to measure. The NWI-R is an overall measure of nurse satisfaction, utilizing a more time-sensitive instrument might have captured the immediate work load of the nurse and provided valuable information.

Donabedian Model and Results.

Donabedian's structure-process-outcome health model was utilized as a framework to demonstrate, with stable organizational structures the processes can be improved and result in better outcomes as measured by medication error score. The structure of the model included nurses' characteristics, patients' characteristics, family characteristics and organizational characteristics. The process improved was medication list obtainment on admission. A cognitive behavioral education intervention was provided to a group of professional registered nurses. The organizational data demonstrated no relationships in the nurses' characteristics, patient characteristics or family residing with patients on patient outcomes. This suggests that the structure did not have a direct relationship with the medication error score. The organizational characteristic of organizational support for nurses also did not have a relationship with the medication error score. The overall mean score for the NWI-Revised was (mean=32), 40 being the highest possible score. This might suggest the nurses' felt supported by the organization (structure component) and had enough resources not effecting the medication transcription score (outcomes) when conceptualizing using the Donabedian health model, or that the measure was not specific enough.

The organizational characteristic of number of prescribers' patients had demonstrated a positive relationship with medication error score. The more prescribers that are attached to a patient increased the risk for medication error score. This may be due to multiple prescribers changing medication regimens and no comprehensive system to track changes, leaving the patient responsible. With, five out of six persons 65 years and older taking at least one medication and almost half are using three or more (Centers for Disease Control and Prevention [CDC], 2004) it is understandable medication errors can occur. Further research including sustainability of the process would be beneficial to evaluate if improved outcomes would be sustained if reinforcement of the intervention is not provided.

Limitations of the Study

A limitation of the study is the lack of a gold standard for the identification of home medication use, or a computer system to support the process of medication regimen tracking including inpatient and outpatient. Nurses participating in the study were mainly on first shift allowing more available resources to them including primary prescribers and pharmacies than nurses on other shifts. This study was time sensitive. In the next 5 to 10 years hospital computer systems and networks will look different than today, more sophisticated. Hopefully, all hospitals and outpatient clinics will have a transparent medical record increasing the communication between outpatient and inpatient providers, with the ability for the health care provider to update the record as necessary. Measuring other variables including the patient's characteristics in this study was challenging. The cost and preparation time prohibited the use of the severity of illness tool, and no tool

was found to quantify patient complications. Also, variables including staffing levels and patient acuity were not measured in this study. Finally, the sample for this study was of homogeneous nurses and patients from one Midwestern hospital limiting the generalizability of the research results.

Implications for Nursing Practice

Admission medication list errors affect the health of individuals. Lists that are inaccurate can lead to injury and possible death. Professional nurses in many hospital systems are responsible for obtaining admission medication lists. This has serious implications for nursing practice. This study identified a process for improved admission medication list obtainment to reduce medication error and improve patient care. The intervention was easy to administer and was completed in an hour. This research suggests that interventions can be developed and implemented to decrease medications transcription error.

This research also demonstrated that utilizing a primary prescriber, pharmacy, family/patient list, medication vials, etc. for obtaining medication information helped with accurate medication lists. Nurses spend more time with patients than any other discipline, they have the ability to provide the structure for disciplines to work together. It is evident that when multiple disciplines work together to provide care that patient outcomes are improved.

Other suggestions having implications for nursing practice include facilitating seamless computer systems for all health systems to capture all medications currently used by patients, for both inpatient and outpatient care, where all disciplines have access

and ability to update and input important medication and health information. Until that occurs, nurses' have the increased responsibility to obtain an accurate medication list. This research demonstrates that with a diligent approach to the way nurses' obtain medication lists, improvement in outcomes by reducing medication errors may be delivered. Utilizing a cognitive behavioral approach demonstrated that behaviors and thoughts can be changed to produce a complete and accurate admission medication history.

Suggestions for Further Research

The results did not demonstrate a relationship between organizational characteristics of nurses and medication error outcome. However, results from previous studies have suggested that nurse characteristics can play an important role in patient outcomes (Aiken, et al, 2003; Aiken et al, 1997). Further research including nurse resources, education, skill level, and experience should be investigated to ensure improved patient outcomes.

Further research should investigate the relationship of number of prescribers for patients and medication errors. It is evident that increased prescribers increase risk for medication error, identifying systems and processes that would reduce error would be an appropriate area of research.

Also, it would be important to do research to include a sample of participants from multiple hospitals and from different health systems to increase the generalizibility of the research. Further research could investigate the computerized medication history, accuracy of information entered, accessibility of computer systems, etc for improvement

not only with medication admission lists but also reconciliation of medication lists at all levels of care.

Conclusion

Admission medication list accuracy is important to the health of our patients. The complexity of medication regimens with extended life expectancy of individuals will continue to make this a challenging process. Until we have comprehensive computer systems and the human resources to enter data appropriately we will be faced with this dilemma of inaccurate medication records. The findings in this research contributed to the existing knowledge of medication errors in inpatient settings. Future research needs to address the continued need for interventions to improve the quality of medication admission lists and reduce medication errors. The work with medication reconciliation is just beginning, the challenges and complexities inherent when conducting research with a multi-disciplinary, multi-phase process, including in-patient and outpatient settings will be arduous but necessary work for the future.

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Appendix A

Demographic Sheet

Name: _____

Department:_____

Hospital_____

Years of experience as a registered nurse_____

Current age _____

Education level, e.g. BSN, ADN, etc _____

Patient Criteria

- **65 years of age or older/ Not residing in a nursing home**
- **Active prescriptions for 5 or more regularly scheduled medications**
- **Cognitively intact**
- **English speaking**
- **Pt's name _____**
- **Male or Female (Please Circle)**

1) Amount of time it took to complete medication history_____
2) Is a family member or significant other residing with the patient? YES or NO (Please circle one)
3) Patient staff ratio_____
4) RN hours worked per week_____

When history is completed please call Kathy Becker at 414-614-8868

Appendix B
Nursing Work Index-Revised
Organizational support subscale

For each item in this section, please indicate the extent to which you agree that the following items are present in your current job. Indicate your degree of agreement by circling the appropriate number.

Present in Current Job	**Strongly Agree**	**Somewhat Agree**	**Somewhat Disagree**	**Strongly Disagree**
1. Adequate support services allow me to spend time with my patients.	1	2	3	4
2. Physicians and nurses have good working relationships.	1	2	3	4
3. Nursing controls its own practice.	1	2	3	4
4. Enough time and opportunity to discuss patient care problems with other nurses.	1	2	3	4
5. Enough registered nurses on staff to provide quality patient care.	1	2	3	4
6. A nurse manager who is a good manager and leader.	1	2	3	4
7. Freedom to make important patient care and work decisions.	1	2	3	4
8. Not being placed in a position of having to do things that are against my nursing judgment.	1	2	3	4
9. Much teamwork between nurses and doctors.	1	2	3	4
10. Patient assignments foster continuity of care (i.e. the same nurse cares for the patient from one day to the next).	1	2	3	4

The NWI-R is in public domain and no permission is needed.

This form is intended for use in Home Medication List **Appendix C**

Home Medication List

Please include all prescription drugs, herbal product, dietary supplement (vitamins) and over-the-counter medication use.

Weight _____ lb. How is this taken?
_____ scale / verbal

Prescriptions from more than one physician list: _____
_____
_____
_____
_____

Patient name _____
Patient DOB (Date of birth) _____
Date _____ Time _____
Pharmacy: Name _____
Location _____
Phone _____

Source of Information (see code)	Drug (generic name preferred) (Any Suffices)	Dose	Route	Frequency (Must include reason)	Why?	Dose within acceptable range	If dose was questionable, how was it verified? Called pharmacy, examined bottle, etc.
Example: B	Drug A	20 mg	PO	BID	How long taking?	☐	
						☐	
						☐	
						☐	
						☐	
						☐	
						☐	
						☐	
						☐	
						☐	
						☐	
						☐	
						☐	

Comments:

RN Signature _____ Credentials _____ Time _____

Source code: A = patient report (list) B = prescription bottle/receipt C = family report D = pharmacist E = primary prescriber

Appendix D

Techniques for Medication History Obtainment

1) Ask Patient to bring in vials/bottles for medication identification

2) Ask Patient about a typical day and what medications he or she takes in the morning, after noon, evening and at bedtime

3) Link medications to medical conditions

4) Review and clarify medication dosage forms including medications with **suffixes**

5) Inquire about complete allergy information including a description of adverse reactions and food allergies

6) Request information about **over-the-counter** medications, **herbals, vitamins**, and **supplements** and assess the Patient's understanding of why they are taking those

7) Ask the Patient what they do if they forget to take a dose

8) Solicit the name, location, and phone number of the pharmacy that the Patient uses. The pharmacy can be contacted to help reconcile

9) Inquire if the Patient has prescriptions from more than one physician

10) Question dietary habits related to know drug interactions such as green vegetables and Warfarin

11) Encourage and assist Patients' to create a list of medications, especially on discharge and to bring this list to all appointments, and to update it consistently.

Appendix E

Changing old Rules/ assumptions into new Rules and assumptions

In the left-hand column write down examples of your rules, "Should" statements, and assumptions. In the right-hand column, write down more adaptive, practical rules, "Shoulds," and assumptions.

Old Rule or assumptions about admission medication history obtainment	More Adaptive Rule or assumptions about medication history obtainment

Appendix F
Human Subject Consent Form
(Nurse)

Title: Does Behavioral Knowledge Based Nurse Education Decrease Medication Transcription Errors in Hospitalized Elderly at Admission?

Department: Nursing

Principal Investigator: Kathy Becker

Phone: 414-614-8868

INTRODUCTION: I, _____, hereby agree to participate in the research investigation entitled, **Does Behavioral Knowledge Based Nurse Education Decrease Medication Transcription Errors in Hospitalized Elderly at Admission?**
I understand that the research study will be under the supervision of Kathy Becker. I understand that I will be one of 140 participants in this research study.

PURPOSE: The purpose of the study is to identify if education of nurses can help improve the accuracy and completeness of medication histories in hospitalized elderly at the time of admission.

PROCEDURES: After my verbal permission, Kathy Becker, or an advanced practice nurse will introduce me to the study and answer any questions I may have. The study will involve me filling out a demographic sheet and having two medication history lists reviewed by an advanced nurse practitioner. Two of four nursing units at the hospitals will be selected randomly for the intervention. If I practice on the unit selected I will be asked to participate in an hour long behavioral knowledge based education session (your time will be reimbursed at your hourly wage).

RISKS: I have been informed of the risks that I may reasonably expect as part of the study. I understand that interviewing will be stopped immediately if I wish.

BENEFITS: The results of the study may help explain the importance of complete and accurate medication history at the time of admission for the elderly.

FINANCIAL RISKS: I understand that no cost will be incurred to me.

ALTERNATIVE PROCEDURES: Another option is not to participate in the study.

ANSWER INQUIRIES: Kathy Becker has explained the above procedure and consent to me and I understand the explanation. She has offered to answer my questions concerning the procedures involved in the study.

CONFIDENTIALITY: I have been informed that any information obtained from this study that can be identified with me will remain confidential. I understand that the data will be destroyed by shredding paper documents and deleting electronic files after the completion of the study.

NO PREJUDICE: I have been informed that my decision to participate in the study is completely voluntary. I can stop being part of this study at any time. My employment at the hospital will not be affected by my decision to stop being part of this study.

COMPENSATION: I understand that there is no compensation for participation in the study.

FURTHER INFORMATION: If I have further questions concerning this project at any time, I understand that I am free to ask them of Kathy Becker, who will be available to answer them at 414-614-8868 or 262-781-2159. Additional information about my rights as a research participant can be obtained from Marquette University's Office of Research Compliance at 414-288-1479.

_____ _____

Signature of Subject Date

_____ _____

Signature of Witness Date

I have defined and fully explained the study as described to the participant.

Appendix G
Human Subject Consent Form
(Patient)

Title: Does Behavioral Knowledge Based Nurse Education Decrease Medication Transcription Errors in Hospitalized Elderly at Admission?

Department: Nursing

Principal Investigator: Kathy Becker

Phone: 414-614-8868

INTRODUCTION: I, _____, hereby agree to participate in the research investigation entitled, **Does Behavioral Knowledge Based Nurse Education Decrease Medication Transcription Errors in Hospitalized Elderly at Admission?**
I understand that the research study will be under the supervision of Kathy Becker. I understand that I will be one of 280 participants in this research study.

PURPOSE: The purpose of the study is to identify if education of nurses can help improve the accuracy and completeness of medication histories in hospitalized elderly at the time of admission.

PROCEDURES: After my verbal permission, Kathy Becker, or an advanced practice nurse will introduce me to the study and answer any questions I may have. The study will involve an interview to review all the current medications I am taking, my pharmacy or physician's office may be called to review medications, or medication vials may be asked to be brought in by family or friends. You may be asked to do this two times; most participants will be interviewed only once. (Two participants out of 64 will need to be interviewed twice).

RISKS: I have been informed of the risks that I may reasonably expect as part of the study. I understand that interviewing will be stopped immediately if I wish.

BENEFITS: The results of the study may help explain the importance of complete and accurate medication history at the time of admission for the elderly.

FINANCIAL RISKS: I understand that no cost will be incurred to me.

ALTERNATIVE PROCEDURES: Another option is not to participate in the study.

ANSWER INQUIRIES: Kathy Becker has explained the above procedure and consent to me and I understand the explanation. She has offered to answer my questions concerning the procedures involved in the study.

CONFIDENTIALITY: I have been informed that any information obtained from this study that can be identified with me will remain confidential. I understand that the data will be destroyed by shredding paper documents and deleting electronic files after the completion of the study.

NO PREJUDICE: I have been informed that my decision to participate in the study is completely voluntary. I can stop being part of this study at any time during the hour when completing the medication history. My care at the hospital will not be affected by my decision to stop being part of this study.

COMPENSATION: I understand that there is no compensation for participation in the study.

FURTHER INFORMATION: If I have further questions concerning this project at any time, I understand that I am free to ask them of Kathy Becker , who will be available to answer them at 414-614-8868 or 262-781-2159. Additional information about my rights as a research participant can be obtained from Marquette University's Office of Research Compliance at 414-288-1479.

_____ _____

Signature of Subject Date

_____ _____

Signature of Witness Date

I have defined and fully explained the study as described to the participant.

Appendix H

Case Studies-Medication errors

Ms. Brown is a 72 year old female who presented to the Emergency Department with psychiatric complaints. The Emergency Department nurse reviewed with Ms. Brown the medications she was taking at home. The nurse then transcribed them onto a medication history form. However, the nurse did not correctly transcribe the dose of one of Ms. Brown's heart medications. Ms. Brown was transferred from the Emergency Department to a psychiatric hospital for further care. During the physician to physician referral, the Emergency Department physician relayed the medication dose written on the medication history form. Three days later Ms. Brown was readmitted from the psychiatric hospital with heart problems, because she had received the wrong dose of heart medication at the psychiatric hospital.

What could the nurse do to prevent medication transcription errors from occurring in this population?

Mr. Smith is a 33 year old male who was playing football with his son. He fell and sustained a broken arm. He went to the Emergency Department, where the nurse obtained a medication history. In the interview, Mr. Smith told him he was taking Depoke extended release for seizures. Although the nurse wrote on the history form that Mr. Smith was taking Depokote, she did not indicate it was extended release. Mr. Smith was admitted for surgery and hospitalized for 2 days. The second day of the hospitalization, Mr. Smith had a seizure. When the physician reviewed his anti-seizure medication, she realized that Mr. Smith had a seizure because he had not been receiving the extended release form the medication.

How could the nurse approach this patient to insure that the appropriate medication form is written on the medication history?

Appendix I

From: Aiken, Linda [laiken@nursing.upenn.edu]
Sent: Saturday, September 27, 2008 9:16 AM
To: Becker, Kathleen
Subject: RE: nursing dissertation

The NWI-R is in the public domain and no permission is required. Best wishes, Linda Aiken

Linda H. Aiken, Ph.D.
The Claire M. Fagin Leadership Professor of Nursing Professor of Sociology Director, Center for Health Outcomes and Policy Research University of Pennsylvania
418 Curie Blvd.
Claire M. Fagin Hall, 387R
Philadelphia, PA 19104-4217
Phone: 215-898-9759
Fax: 215-573-2062

-----Original Message-----
From: Becker, Kathleen [mailto:kathleen.becker@marquette.edu]
Sent: Saturday, September 27, 2008 9:27 AM
To: Aiken, Linda
Subject: nursing dissertation

Hi Dr. Aiken, I am wondeering if I could have permission to use your Nursing Work Index-Revised tool? I am currently working on my dissertation at Marquette University and my focus is in medication reconciliation. I am interested in how organizaitonal support may effect medication errors? Please let me know if you need any additional information, thank-you, Kathy Becker (414)-614-8868.

Appendix J

From: Leahy [Leahy@CognitiveTherapyNyc.com]
Sent: Tuesday, September 09, 2008 12:11 PM
To: Becker, Kathleen
Subject: RE: cognitive therapy tool

Hi Kathy--- sounds interesting. Let me know what you find. Good luck with your dissertation.

Best wishes,
Bob
Robert L. Leahy, Ph.D.
Director, American Institute for Cognitive Therapy President, International Association for Cognitive Psychotherapy President, Academy of Cognitive Therapy President-Elect, Association for Behavioral and Cognitive Therapies Associate Editor, International Journal of Cognitive Therapy Clinical Professor, Department of Psychiatry, Weill-Cornell University Medical College, New York Presbyterian Hospital
136 East 57th Street, Suite 1101
New York, NY 10022
Tel: 212 308 2440
Fax: 212 308 3099
See: The Worry Cure: Seven Steps to Stop Worry from Stopping You

-----Original Message-----
From: Becker, Kathleen [mailto:kathleen.becker@marquette.edu]
Sent: Tuesday, September 09, 2008 10:59 AM
To: Leahy@cognitivetherapynyc.com
Subject: cognitive therapy tool

Hi Dr Leahy, my name is Kathy Becker and I am currently working on my dissertation at Marquette University. My degree when completed will be a PhD in nursing. My research is centering around medication reconciliation. I would like to use a tool you developed in the book, Cognitive Therapy Techniques - a pratitioner's guide (2003), labeled Changing Old
Rules/Assumptions into New Rules/Assumptions (p99). I am hoping to have registered nurses identify some of the rules they use when practicing admission medication taking. If you need more information please let me know. Kathy Becker (262-928-7887).