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The Effects of Twelve-Hour Shifts on Critical Care Registered Nurses' Decision-Making Abilities and Eye-Hand Coordination

A Thesis

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Degree

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Lynn Marie Isakson Beeler

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ABSTRACT

The nursing shortage has brought about many changes in hospital staffing patterns. Nurses are demanding new and more flexible scheduling patterns. Twelve hour shifts have been seen as one option to provide nurses with a shorter work week. The purpose of this descriptive study was to examine the effects of twelve hour shifts on critical care registered nurses' decision making ability and eye-hand coordination. The Neuman Systems Model was used as a framework for this study. The setting was a 500 bed community, not-for-profit hospital in the southeast.

This study identified changes in decision making ability and eye-hand coordination over time. Nurses were assessed at the beginning of their first twelve hour shift, at the end of this shift, and the end of their third consecutive twelve hour shift. The day shift showed improvement in performance over time in both areas. The night shift demonstrated an improvement in performance at the end of the first twelve hour shift but then demonstrated a significant

decrease in performance by the end of the third twelve hour shift. Implications for the nursing administrator based on the results of this study are discussed. Recommendations for further research are specified.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

FIGURES PAGE

CHAPTER I

INTRODUCTION

Hospitalized patients need care twenty-four hours a day, seven days a week regardless of whether it is a weekend, a holiday, or someone's summer vacation. In today's job market hospitals are competing vigorously with each other for the limited number of available registered nurses (RN). The critical nursing shortage has dictated that managers look for creative and innovative ways to supply the needed numbers of nurses to care for the growing numbers of critically ill, hospitalized patients. New and more flexible scheduling patterns are being demanded by the nurses to allow them full time employment while working fewer number of days. Such schedules allow them more time off to pursue personal endeavors involving family, school, and recreational activities.

In the late 1970's healthcare providers looked to the industrial setting for ways to increase the productivity of workers, use available

human resources more efficiently, and improve recruitment and retention of employees. Twelve-hour shifts, and the three day work week were adopted in many hospital settings in the late 1970's and even today hospitals are moving more and more to this shift option (Ugrovics, & Wright, 1990).

Twelve-hour shifts have been seen as the solution to many hospitals' staffing problem. This option has increased retention and aided the recruitment of new R.N.'s, including recruitment of part-time employees to full time status with the shorter work week (Ugrovics, & Wright, 1990). However, a large percentage of nurses working the twelve-hour option complain about feelings of fatigue (Fields & Loveridge, 1988). The concept of fatigue in nurses, especially in nurses working in critical care units, demands further investigation. What are the effects of these extended workhours on patient care? What are the effects on the nurse-physically, mentally, and emotionally? These are questions that must be examined thoroughly by nurse managers to ensure continuation of quality

patient care and to decrease burn-out of nurses working in critical care.

Statement of Purpose

The purpose of this study was to examine the effects of twelve-hour shifts on the decision-making abilities and on eye-hand coordination of critical care RN's.

Background and Significance

The trend today is toward a shortened work week for R.N.'s. The ultimate goals of the shortened work week are to increase the nurse's level of job satisfaction by allowing for more time off and more flexible scheduling patterns and to improve patient care (Vik & MacKay, 1982). Therefore to achieve these goals, many hospitals have initiated twelve-hour shifts.

There are many advantages for the nurse manager and the staff nurse in utilizing twelve-hour shifts. One important advantage, especially in today's cost conscious healthcare environment, is that twelve-hour staffing patterns are the most cost effective. Twelve hour shift staffing

requires fewer full time equivalent employees to care for the same number of patients as eight hour shifts. There are also other cost effective advantages which include the nurses spending less time in report since there are only two times to give/take report instead of three times required with eight hour shifts, and the improved continuity of care that can be provided with twelve hour shifts. Another aspect of cost-containment is that of recruitment and retention of nurses. In 1987, twenty seven percent of RN's were working part-time. With implementation of twelve-hour shifts many of these nurses are taking advantage of the extended workhours and shortened work weeks and opting for full time employment (Ugrovics & Wright, 1990). Thus, many part-time R.N.'s were funneled back into the system as full time employees. Other benefits noted were increased levels of experienced staff, less use of accrued sick time, increased time off for the employee, and increased job satisfaction (Ugrovics & Wright, 1990). Also, high employee satisfaction contributes indirectly to long term productivity by reducing turnover and absenteeism (Crump & Newson, 1975).

Disadvantages of twelve-hour shifts include the complexities of balancing eight and twelve hour staff, more difficulty maintaining communication among staff, decrease in the quality of patient care, and lower productivity due to fatigue from the extended workhours. The research that has been done to investigate the effects of twelve hour shifts on fatigue and decision making has produced inconclusive findings. It is essential that the possible effects of these extended workhours for the nurse and the patient be examined more closely.

The significance of the change from the traditional eight-hour scheduling of R.N.'s to the twelve-hour option is potentially great. Increasing the length of a shift by four hours may be associated with increased levels of fatigue especially when working consecutive twelve-hour days (Niemeier & Healy, 1984). Increased levels of fatigue can directly and indirectly affect patient care in areas such as critical care, where decision making and eye-hand coordination are extremely important throughout the entire shift. The patient's status can change rapidly, and the nurse

must be able to make quick, precise decisions to preserve life and prevent further complications.

With the technology present in today's critical care units, it is equally important that the nurse maintain good hand-eye coordination throughout the shift to deal with the multitudes of lines, including arterial catheters, Swan Ganz catheters, intravenous accesses, nasogastric tubes, foley catheters, and machines such as ventilators, cardiac and invasive line monitors, and intravenous pumps. Nurses must be able to carefully and skillfully manipulate lines such as the Swan Ganz catheter and machines such as the monitoring systems to obtain sensitive readings of the pressures within the body which in turn will determine the best course of treatment. Another important consideration regarding eye-hand coordination is that the nurse is frequently dealing with contaminated syringes, and in this day he/she must use caution to prevent accidental needle sticks.

The nurse manager and the staff nurse must be concerned with the possible negatives as well as

the positives when initiating twelve-hour scheduling. When working extended hours, the effects of fatigue on decision-making abilities and eye-hand coordination can have significant consequences for patients and nurses.

Conceptual Framework

Betty Neuman's Health-Care Systems Model of Nursing was used as the conceptual framework for this study. The primary concepts in this model are an individual's or group's interaction with the environment and the response of individuals and groups to the stressors that may arise from their environment. The Neuman Systems Model has been applied and adapted to various specialties and subspecialties of nursing practice with success (Hermiz & Meininger, 1986). This model can can be easily adapted to individuals, groups, and even communities.

Neuman uses a total person approach incorporating a holistic and open system view (Hermiz & Meininger, 1986). Neuman views the individual as a system comprised of psychological, physiological, sociological, spiritual, and

developmental variables. The individual is seen as having a central structure that is unique to that person but which shares common characteristics with the central structure of other people.

The inner core of this model represents the basic survival type resources common to most people. This inner core is surrounded by lines of resistance that protect the individual from stressors. These lines of resistance represent the internal factors that assist the individual to defend against stressors, and are then surrounded by the normal line of defense which can be viewed as an individual's general state of wellness or adaptation and consists of a range of normal responses. A flexible line of defense surrounds the normal line of defense. This flexible line is dynamic and can be rapidly altered over a short period of time. It is a protective buffer to prevent stressors from breaking through the normal line of defense. This flexible line of defense can vary situationally in the resistance to stressors it provides (Neuman, 1982).

Many variables will determine an individual's response to stressors. Variations in the

individual's central core and past experiences in coping with stressors will influence the strength of the various lines of defense. The nature, intensity, and perception of the stressor will impact the individual's resistance (Neuman, 1982).

Environment is crucial to Neuman's model. An individual must deal with both internal and external environment. Environment is conceptually defined by Neuman (1982) as "all factors affecting and effected by the system". Stressors are viewed as part of the environment and she considers them as intrapersonal, within the person themselves, interpersonal, between people, and extrapersonal, dealing with situations or surroundings.

Neuman (1982) states that health is the condition in which the parts and subparts of the whole man are in harmony. Health is a state of well-being or illness determined by the arrangement of the variables; psychological, physiological, sociological, spiritual, and developmental. Health is relative and in a dynamic state of being (Lancaster & Whall, 1989). Using Neuman's model health can be viewed as a state in which the lines

of defense prevent the intrusion of stressors into the inner core. Within this model nursing is concerned with the holistic view of the person and in the maintenance of the stability of the individual system.

Neuman (1982) supports the beginning of interventions when the stressor is either suspected or identified. Interventions can occur before or after the lines of defense are penetrated.

Prevention of problems involves three levels of intervention; primary, secondary, and tertiary. Primary prevention is aimed at eliminating contact with the potential stressor and at strengthening the lines of defense. Secondary prevention involves interventions after symptoms have occurred and is aimed at early recognition of problems and dealing with them to allow the individual's internal and external resources to stabilize the situation. Tertiary prevention focuses on readaptation and its' goals are to maintain stability and educate the individual to prevent future problems (Neuman, 1982).

Neuman's model provides a framework for examining the inner core of an individual, the

lines of defense, and the effects of stressors. The model provides a basis for examining a group of individuals with common stressors. This model provided a basis for data collection for this study. The factors that could be potential stressors (12 hour shifts) for the individual and the group as well as their responses to these stressors (changes in the RN's decision-making abilities and eye-hand coordination) were examined.

Prevention of problems for the staff nurse and the nurse manager can occur on all three levels of Neuman's model. Primary prevention can be utilized if potential stressors are identified to reduce the chance of the stressor breaking through the flexible line of defense. Secondary prevention can be initiated when stressors are identified and interventions can be made to eliminate or reduce the stressor. If stressors can be identified early then effective interventions can be put into place. Finally, tertiary prevention can be utilized by setting up educational programs that can be structured to assist the individual and/or group to identify stressors and find positive ways in which to readapt and maintain stability.

Research Questions

What are the effects of twelve-hour shifts on the decision making abilities and the eye-hand coordination of critical care registered nurses?

What are the effects of working three consecutive days of twelve-hour shifts on decision-making?

What are the effects of working three consecutive days of twelve hours shifts on eye-hand coordination?

Definition Of Terms

The following terms are defined to clarify their meaning in the text of this particular study:

1. Extended Workhours- hours worked beyond the traditional eight-hour shift, twelve-hour shifts in particular.
2. Decision-making Ability- the ability to consider evidence and reach some conclusion without undue delay (Jacobs, 1985). It is an objective criterion of thought processes as operationalized by the score on the Three Minute Grammatical Reasoning Test (Baddeley, 1968).

3. Eye-Hand Coordination- the ability to use the eyes and hands together to perform a task (Jacobs, 1985). This variable was operationalized for the study by scores on the Purdue Pegboard Test.
4. Fatigue- a decrease in physical performance. Subjective sense of weariness or tiredness resulting from exertion or stress or as a condition of impaired efficiency resulting from prolonged mental and/or physical activity (Varricchio, 1985).

Assumptions

1. It is assumed by the investigator that twelve hour shifts are a stressor.
2. It is assumed by the investigator that fatigue is a probable outcome of the stressor of twelve hour shift work, and that this fatigue could have an impact on physical and mental abilities of critical care nurses.
3. It is assumed that the nurses will perform the tasks requested by the investigator to the best of their ability.

CHAPTER II

REVIEW OF LITERATURE

This chapter presents a limited review of the literature concerning the effects of twelve hour shifts in relation to fatigue, decision making, eye-hand coordination, and quality of patient care. A notable aspect of the literature review was the paucity of research on nurses.

Fatigue

Everyone has felt fatigued at one point or another in his or her life. Fatigue is a multifaceted, diverse concept that is difficult to define. Psychologists consider fatigue as a condition affecting the whole organism, including factors such as subjective feelings of physical and emotional fatigue, motivation, and resulting deterioration of mental and physical activity (Grandjean, 1968). In a study of sixty-five industrial workers, Bartley (1976) examined objective and subjective symptoms of fatigue. He

used the Subjective Symptoms of Fatigue Test and a number of objective measurements looking at performance and efficiency. He found that fatigue involves a decrease or impairment in enthusiasm for work and/or a lowering of efficiency. He described objective and subjective signs and symptoms for fatigue and they included: a decreased attention span, slowed or impaired perceptions, impaired thinking, decreased motivation, and decreased performance in physical and mental activities.

Fatigue is one of the most common complaints of industrial workers. It is important to prevent fatigue because it has an adverse effect on productivity. Excessive fatigue may lead to a reduction in both the quality and quantity of industrial output. In a study by Linden (1968), 102 industrial workers were surveyed for subjective fatigue using the Subjective Symptoms of Fatigue Test and this subjective data was correlated with the number of accidents that resulted in personal injury and/ or damage to equipment. He found that subjective complaints of fatigue were reported 48% of the time by the sixth hour of work. He documented that increasing levels of fatigue

measured by subjective reporting were associated with increased risk of personal injury and increased rate of damage to equipment. Also a review of these same workers personnel records revealed an increasing loss of productive time, increased absenteeism, and an increasing turnover rate during periods of reported high levels of fatigue.

Snook and Irvine (1969) demonstrated a strong relationship between subjective measure of fatigue and measure of work performance. They performed a laboratory experiment designed to define the relationship between one physiological measure of fatigue and performance. The subjects for the laboratory study were nine male industrial workers who were asked to do repeated lifting of various size boxes over a four hour period. The researchers found that fatigue, either physical or psychological would adversely affect task performance. Then a field study was used to validate the data. The subjects for the field study were twelve shoe factory workers who were observed as they performed their daily work

activities. The field study validated the results of the laboratory experiments and indicated that excessive fatigue would adversely affect task performance.

Bartlett (1943) in the Cambridge Cockpit studies documented the analysis of task fatigue. He studied 60 pilots as they performed simulated flight tasks. He observed the pilots and questioned them on the level of alertness and measured their level of task performance. He noted that over time pilots' skills began to deteriorate. As alertness declined there were progressive increases in the deviation from instrument readings and there appeared to be lapses in attention with the pilots becoming more and more easily distracted. The pilots' responses became more variable and there was a significant decrease in their accuracy. One other interesting point he noted was that as subjects became more fatigued they chose to exert less effort.

Decision Making

The decision-making process may be viewed simply as making a choice, or more comprehensively,

as a systematic process that begins with a need or problem. Viewed comprehensively, the decision-making process also involves making a choice, but only as part of a more extensive process. An adequate decision cannot be made unless complete, factual, relevant, and objective data are available to the decision maker. The decision maker must gather and use all available data. Behavioral characteristics of the decision maker affect the way he/she will deal with the data and use the decision making process. The decision maker's perception of the problem will determine what data are collected and how that data will be processed.

The first step in the decision making process is to identify the problem, actual or potential. This step can be the most difficult because many factors influence the ability to identify the specific problem; these include obtaining a complete data base, ability to concentrate and focus attention, attitudes, situatuional characteristics, and past experiences.
The best decision cannot be made unless the right problem is selected. The second step is the generation of alternatives for the decision. This

step involves the anlysis of possible solutions and the risks associated with each. The last step is the selection of the best alternative or solution to the problem. A clear best decision does not always appear. The difficulties depend on the number and quality of the alternatives generated and the ability of the decision maker to weigh the risks and benefits appropriately (Bernhard & Walsh, 1990).

Aspinall and Tanner (1981) refer to the intellectual strategies used in clinical decision making. In general, the process consists of generating multiple alternatives and systematically testing those against additional information obtained from the patient and other sources. When sufficient data are obtained that strongly support one decision, eliminating other possibilities, then a decision is reached.

The complex legal and professional problems confronting nursing today emphasize the need for effective decision making skills at all levels of practice (Jenkins, 1985). Decision making ability for the nurse working in the rapidly changing critical care environment is vital for successful

patient outcomes. Clinical decisions are the result of a unique process which begins with a problem or a state of discrepancy requiring a decision or intervention. Each decision is heavily influenced by certain assumptions and the environment in which the decision is made (Jenkins, 1985). The nurse must be able to assimilate the necessary information and determine the possible courses of action. The nurse must also consider the probable results of the course of action which might be taken in relation to the risks and benefits to be gained. There are many possible explanations of the failure to make an acceptable or effective decision. These include failure to recognize or to sense cues or clues, inability to synthesize the clues into a diagnosis, ignorance of the options for action, failure to recognize the context in which the clues were given, or simple disinterest in the problem (del Bueno, 1983). As fatigue (actual or perceived) increases any of the above-mentioned failures are more likely to occur due to the decrease in mental activity which also was noted in the research by

Snook and Irvine (1969).

The process of decision making is a complex one and changes in the decision maker's ability to collect and analyze all available data will influence the decision that is reached. Changes in the decision maker when fatigue is present, as documented in the study by Bartley (1976), may affect the ability to process information appropriately.

The problem of fatigue is central to the analysis of the effects of twelve hour shifts on the nurse and the patient. Poulton, Hunt, Carpenter, and Edwards (1978) documented a significant fall in efficiency related to working eight hours or longer. They studied thirty junior doctors over a one month period and examined their decision making ability using the Three Minute Grammatical Reasoning Test and a Laboratory Forms Test. The doctors were tested at three and eight hour increments over the course of a twenty four hour duty. The doctors' efficiency began to significantly decline after eight hours.

Mills, Arnold, and Wood (1983) studied the effects of extended workhours on nurse levels of

fatigue and decision making. The sample consisted of thirty critical care RN's who were placed on twelve hour shifts and tested after three months on the extended hours during the first hour, the sixth hour, and the twelfth hour of work. They were tested using the Subjective Symptoms of Fatigue Test, The Three Minute Grammatical Reasoning Test and a Paper and Pencil Performance Test. Using a t-test they evaluated the differences between the first and twelfth hours. Significantly increased levels of drowsiness ($t=2.71$, $p<.05$) and increased levels of physical impairment ($t=2.92$, $p<.01$) were found. They also noted a significant increase in the number of errors as measured by a paper-and-pencil performance test with the highest error scores occurring between the sixth and the twelfth hours. The Three Minute Grammatical Reasoning test indicated a nonsignificant change over the twelve hours but the performance test indicated a decreasing accuracy rate, especially after the sixth hour.

Fields and Loveridge (1988) investigated the relationship between critical thinking and fatigue in nurses working eight and twelve hour shifts.

The subjects were 102 critical care RN's who were tested for critical thinking ability using the Three Minute Grammatical Reasoning Test and subjective fatigue using the Subjective Symptoms of Fatigue Test. They were tested during the first and last hours of their shift. They concluded that total fatigue scores were significantly higher at the end of the shift than at the beginning of the shift ($p = .008$), although the increase in subjective feelings of fatigue during the work day was no greater for nurses working twelve hours than those working eight hours. No significant differences were found between nurses working 12-hour or 8-hour shifts in relation to nurses' levels of fatigue or performance on a critical thinking test. The results were interesting in that the reported levels of fatigue were greater at the end of the shifts and yet the nurses scored higher on the critical thinking test at the end of the shift than at the beginning.

Hutto and Davis (1989) in a study of twenty-three critical care nurses documented that nineteen of the twenty-three nurses surveyed felt emotionally drained following a twelve-hour shift.

Ten nurses worried that the length of their shift was detrimental to their health due to feelings of extreme fatigue. Seven nurses feared that their reaction times, judgments and decision making abilities were less accurate at the end of their shift. The sample size was very small, therefore, results were generalizable only to this population. However, the study gives direction for further investigation of the potential impact of emotional and physical fatigue on nurses' well-being and on patient care.

In a study by Wilkinson, Tyler, and Varey (1975) 2,452 young doctors were questioned regarding the amount of sleep they had and their feeling regarding their abilities to perform their duties accurately and efficiently. Approximately thirty-seven percent replied they felt often or always that their duty hours impaired their ability to work accurately and efficiently. Forty-seven percent stated they felt occasionally that their duty hours impaired their ability to work accurately and efficiently. Friedman, Biggers, and Kornfield (1971) studied fourteen interns and their ability to determine cardiac arrhythmias and

related subjective fatigue to the ability to detect the arrhythmias appropriately. They documented a significant impairment when they were asked to detect signs of arrhythmias in a prepared twenty-minute electrocardiogram strip after having slept only two hours. They also concluded that subjective feelings of fatigue were associated with impairment of the interns' decision-making abilities. This study is not generalizable to other groups due to its small sample size.

Eye-Hand Coordination

Coordination is the process that results in the combination of activities of a number of muscles into the smooth patterns of cocontraction and the sequences of contraction and relaxation. Motor coordination is the ability to coordinate eyes and hands rapidly and accurately in making precise movements. It is also the capacity to make a movement response accurately and swiftly. Coordination requires the integrating activity of the basal cerebral ganglia and the brain stem ganglia acting on the excitatory and inhibitory centers (Kottke, Stillwell, & Lehmann, 1982).

Eye-hand coordination can be affected by changes, or disturbances, in the central nervous system. Central fatigue, also known as psychological fatigue, occurs when the central nervous system no longer adequately activates the motor neurons supplying the working muscles. Central fatigue can bring about reduced physical performance in association with tiredness, lack of adequate sleep (Sherwood, 1989).

It is important to recognize the significance of eye-hand coordination of all practicing nurses but especially those working in the critical care units. Bartley (1976) documented, in an industrial setting, a decrease in physical, motor skills associated with objective and subjective signs and symptoms of fatigue. There is little documentation of the necessity for adequate eye-hand coordination in the critical care RN's, but the need for fine motor skills is easily seen in observing the RN in his/her workplace. The handling and manipulation of such objects as Swan Ganz Catheters or cardiac pacemakers located in the heart, or the insertion of needles into a patient's vein require the nurse to maintain fine motor skills. With a loss or

decrease in this eye-hand coordination there may be an increase in risk for harm to the patient due to dislodging of life-saving equipment or harm to the nurse through exposure to the body fluids of the patient from accidental needle sticks or splashing of body fluids such as blood or urine.

Quality Patient Care

Vik and MacKay (1982) studied the effects of nurses who work twelve-hour shifts on the quality of patient care. The sample was comprised of sixty medical-surgical nurses on six different units, three units on twelve hour shifts and three units on eight hour shifts. They used the Quality Patient Care Scale to measure the care given to patients. Ten patients from each of the six units were randomly selected, and the nursing care they received for a two hour period was observed. The two investigators did the observation and rated the quality of care. The standard of measurement for this scale is, "care expected of a first level staff nurse". The primary elements of the rating process are 1) the care factor of the observed nurse-patient interaction, and 2) the care expected

of a nurse charged with the responsibilities for first level staff nursing: adequate, safe, therapeutic, and supportive care. Data were analyzed using the Wilcoxon matched-pairs signed rank test. Analysis showed that the quality of care received by the patients was significantly higher on eight hour shift units than twelve hour shift units. The total mean score for eight hour shifts was 3.0 out of a possible 5.0. Reference to the Quality Patient Care Scale indicates that a rating of 3.0 is average quality of expected care. The total mean score for twelve hour shifts was 1.7, which indicates that in general, care did not meet the standard expected. The results of this study suggest that staffing patterns do affect patient care.

Summary

The research literature is somewhat inconsistent in respect to its view of the effects of twelve hour shifts on nurses and patients. As noted in early research in industrial settings, the effects of extended workhours included decreasing physical accuracy and efficiency.

Nursing has relatively recently (1970's) adopted the twelve-hour shift option, and there is not much conclusive data available on the effects of the twelve hour shifts on nurses and/or patients. The research that is available does document increasing levels of subjective fatigue with the twelve hour shift, but as in the study by Fields and Loveridge (1988) critical thinking ability seems to increase. These results do not seem to follow with earlier industrial research that documents decreasing levels of performance both mentally and physically with extended workhours. One other consideration when examining the present research is that most of the sample sizes are relatively small and therefore generalization is limited. No studies were found examining the impact of consecutive twelve hour days, although Niemeir and Healy (1984) speculated from their research that increasing shift lengths may be associated with increasing levels of fatigue, especially when working consecutive days. The research does support further investigation into the effects of twelve hour shifts on many fronts including decision making and eye-hand coordination.

This study was undertaken to investigate the effects of twelve hour shift on critical care RN's decision making abilities and the eye-hand coordination. The literature is inconclusive regarding the effects of twelve hour shifts on fatigue and performance. No data is available on the effects of twelve hour shifts on R.N.'s eye-hand coordination. Industrial data available indicates a decreasing level of physical performance with extended workhours. Federal agencies such as the Department of Transportation have recognized this decreasing mental and physical performance with extended workhours. One example is truck drivers who are limited to a specific numbers of hours they can drive per day due to the decreasing eye-hand coordination and decision making ability associated with excessive fatigue.

In order to adequately evaluate the impact of twelve hour shifts on critical care RN's decision-making abilities and eye-hand coordination, more objective data are needed.

CHAPTER III

METHODS

A description of the design and methodology utilized in this study is presented in the following sections of this chapter: research design, instrumentation, sample, procedures, and data analysis.

Research Design

A descriptive study was used to examine the effects of twelve-hour shifts on critical care nurses' decision-making abilities and eye-hand coordination. The subjects of this study were thirty registered nurses who work in the critical care units of a metropolitan general hospital in the southeast. Subjects were already working twelve-hour shifts. A convenience sample was used. There was no control group. The independent variable was extended workhours, specifically 12-hour shifts. The dependent variables were decision-making

ability and eye-hand coordination. Demographic data such as as age, marital status, educational level, length of time on twelve-hour shift, what shift (day or night), and desire to be on twelve-hour shifts were collected.

Instrumentation

Three different instruments were utilized for data collection in this study. They included a) Three Minute Grammatical Reasoning Test, b) Purdue Pegboard Test, and c) Demographic characteristic questionnaire.

The Three Minute Grammatical Reasoning Test

This instrument was used to test the decision making performance of the subjects. The Medical Research Council, Applied Psychology Research Unit in Cambridge, England, developed this test to provide a simple, quick test suitable for evaluating higher mental processes. The instrument consists of 64 index cards each of which contains a short phrase followed by a pair of letters. The subject was asked to evaluate the phrase and the two letters to determine if the two items describe

the same condition. If both items state the same condition then the item is true. An example of a true card was A follows B, BA. If either of the two do not describe the same condition then the item is false. An example of a false card was A precedes B, BA. The subjects were directed to place each card into the appropriate true or false pile. The total items answered correctly in three minutes provides the most sensitive score. (Baddeley, 1968).

Aside from the instrument's considerable face validity, the assumption that the tasks involve higher mental processing is supported by the positive relationship with intelligence test scores. A study involving twenty-nine enlisted men found a positive correlation of .59 with performance on the Army verbal intelligence test ($p < .001$) (Baddeley, 1968).

Test-retest reliability was demonstrated by testing 18 subjects, male college students, twice on successive days; there was a mean correlation of +.80 between the scores obtained (Baddeley, 1968).

The extent of the practice effect is reasonably small after the initial trial. Forty-

nine enlisted men performed the Three Minute Grammatical Reasoning Test five times in one hour. A mean score of 32.9 was noted on initial testing and a mean score of 40.9 was noted on the fifth, testing (Baddeley, 1968).

The 64 items comprising the Three Minute Grammatical Reasoning Test appear in Appendix C.

The Purdue Pegboard Test

The Purdue Pegboard Test (PPT) instrument was used to test the eye-hand coordination of the subjects. This instrument, which measures individual fine eye-hand coordination, consists of a board with twenty five pairs of holes and pegs. The subjects were instructed to place a peg in each hole, and to place as many as they could in thirty seconds. The test was repeated three times, once with the subjects using only their right hand, then using only their left hand, and finally using both hands. Each test was scored by adding the total number of pegs inserted during the three thirty second periods.

The PPT has face validity. In a study of 760 airmen, a positive correlation of .56 ($p < .05$) was

found with a test of ability to make rapid, skillful, controlled manipulative movements of small objects, where the fingers are primarily involved (Tiffin & Asher, 1948).

Test-retest reliabilities for single-trial scores recorded with the first Purdue Pegboard ranged from .60 to .76. According to the Spearman-Brown formula, reliabilities for the three trial scores range from .82 to .91. In 1965 test-retest correlations were determined for twenty-eight professional personnel as .89 (Tiffin & Asher, 1948).

Demographic Questionnaire

This instrument was used to collect personal data related to each subject. Included in the questionnaire were age, sex, marital status, number of children, years of experience as an RN and in critical care. Information directly related to the twelve hour shifts was also included such as the amount of time the subject had worked 12-hour shifts, number of twelve hour shifts in a row, preference for 12-hour shifts, and likes and dislikes regarding 12- hour shifts.

The complete Demographic Questionnaire can be found in Appendix B.

Sample

A convenience sample of thirty registered nurses employed full-time in a critical care area (ICU/CCU) at a metropolitan hospital in the southeast was used. Subjects were asked to participate in a project related to twelve-hour shifts. Participation of subjects was entirely voluntary and an informed consent was obtained. Data were collected at the subject's place of employment during normal work hours. Participants were informed that all data would be treated as confidential and kept in a locked filing cabinet in the researcher's home.

Procedures

Human subject approval was sought and granted from the College of Nursing, the University of Tennessee Institutional Review Board, and the hospital review committees. Once human subject approval was granted, data collection began. Subjects were informed that the researcher was

collecting information about nurses working twelve-hour shifts and that it would take approximately twenty minutes for the initial testing and approximately fifteen minutes on two other occasions to complete the testing. Testing was done after arrangements had been made with the subject and his/her supervisor during the regular work shift. Times selected were within the first hour of their first twelve-hour workday, at the end of that workday, and at the end of their third consecutive twelve hour workday. The subjects were asked to complete the testing at these specific times during their normal workhours.

Each subject was asked to sign an informed consent form (Appendix A), which included the purpose and significance of the study. They were assigned a two digit code for use on each instrument. Each subject's instruments therefore had the same two digit number appearing on all instruments in order to identify all responses by the same individual. Individual scores on the instruments are not reported.

The demographic questionnaire and the tests were completed by the subjects in a classroom near

their assigned work areas. The researcher alone conducted the testing. All data were held as confidential and kept in a locked filing cabinet in the researcher's home.

Data Analysis

The tests used in this study were scored using the scoring systems developed by the respective developers. All demographic data were reported by frequency of responses and percentage of sample responding in each category.

Interval/ratio data was generated from the two instruments used in this study. Two-way repeated measure multiple analysis of variance (MANOVA) was the parametric procedure used to test for the significance of the differences between mean scores. MANOVA allows for the analysis of the main effects and of any possible interaction between the main effects. The F-ratio statistic was computed. Level of significance for this study is .05. Results of the analysis are described and discussed in Chapter IV.

CHAPTER IV

RESULTS

Chapter IV presents the finding of this study. Each question is stated and followed by the analysis utilized to obtain the results. Tables and Figures are included that illustrate the findings.

Demographic Characteristics of the Sample

Thirty RN's were asked to participate in the study and all thirty did agree to participate. The typical staff nurse in the sample was female and married. Slightly more (fifty-seven percent) of the sample worked day shift, 7am- 7pm, than worked night shift, 7pm - 7 am. Educational level was relatively evenly distributed with the highest percentage(37%) being diploma graduates.

The majority of the sample preferred working twelve hour shift to other shift options (83%). Seventeen percent would not choose twelve hour shifts as their first choice of shift option. Of

that 17%, 80% would prefer ten hour shifts and 20% would prefer eight hour shifts. A majority (93%) stated they were satisfied or very satisfied with twelve hour shifts. Sixty percent of the sample listed the feeling of being tired, physically and emotionally, as the thing they liked least about twelve hour shifts. Other dislikes were the long hours (cited by 24%) and the lack of time for anything else but work (cited by 16%). All of the sample listed "more days off" as what they liked best about twelve hour shifts. Frequency distributions for categorical variables are presented in Table 1.

The average age of the sample was 30.8 years The average number of years of experience as an RN was 5.99 years (71.88 months). Average years of experience in Critical Care was 5.24 years (62.88 months). The average length of time working twelve hour shifts was 22.32 months (1.86 years). The average number of consecutive days of twelve hour shifts worked was 3.63 days.

Table 1

Frequency Distributions of Selected Demographic Variables for the Total Nurse Sample

Variable	Number	Percent
Sex		
Female	23	77
Male	7	23
Marital Status		
Single	7	23
Married	21	70
Divorced	2	7
Work Shift		
Day 7am- 7pm	17	57
Night 7pm- 7am	13	43
Educational Level		
ADN	9	30
Diploma	11	37
BSN	10	33
Shift Preference		
12-hour	25	83
10-hour	4	13
8-Hour	1	4
Satisfaction with 12-hours		
Very	18	60
Adequate	10	33
Not	2	7
Likes		
More Time Off	30	100
Dislikes		
Feeling Tired	18	60
Long Hours	7	24
No Time For Other Things	5	16

Table 2 presents descriptive data of the sample, including the mean, standard deviation, and range of age, years of work experience, years of work experience in critical care, length of time working twelve hour shifts, and number of consecutive days of twelve hour shifts worked.

Table 2

Mean, Standard Deviation, and Range of Age, Years of Experience, Length of Time on 12-Hour Shifts, and Number of Consecutive Days of 12-Hour shifts for 30 Critical Care Nurses

	Mean	S.D.	Range
Age (years)	30.8	5.33	23-45
Experience as RN (Months)	71.88	48.06	6-180
Experience in CC (Months)	62.88	45.02	6-120
Time on 12-hour (Months)	22.32	14.30	6-72
Number of Consecutive Days	3.63	0.85	3-7

Research Questions

The research questions asked: "What are the effects of twelve hour shifts on the decision making abilities and the eye-hand coordination of critical care registered nurses?", "What are the effects of working three consecutive days of twelve hour shifts on decision making ability?", and

"What are the effects of working three consecutive twelve hour shifts on eye-hand coordination?". The scores on both the Three Minute Grammatical Reasoning Test and the Purdue Pegboard were normally distributed.

In analyzing the data related to decision-making abilities, it is first important to examine the main effects, shift and time independently. Table 3 illustrates the main effects and the interaction present related to the decision making data. Examining shift mean scores, irrespective of time demonstrated no significant difference, $p = .814$. Next examining time only as a factor, irrespective of the different shifts there is a significant increase in performance of the total sample over time, $p = .0085$. The difference in the means of the total sample over time is noted in Table 4.

Table 3

Multiple Analysis of Variance with repeated measures on decision making scores

Source	SS	MS	DF	F	P	
Shift	18.16	18.16	1	0.06	.814	
Time	97.36	48.68	2	5.20	.0085	*
Shift X Time	187.24	93.62	2	10.00	.0002	**
Error	524.07	9.36	56	---	---	

Table 4

Effects of Time on Decision Making Mean Scores

Time	Mean Score	S.D.
Beginning of 1st 12-hour shift	36.733	11.17
End of 1st 12-hour shift	38.233	10.20
End of 3rd 12-hour shift	39.267	10.40

When dealing with two main effects, shift and time, it is important to determine if there is interaction between these factors. Interaction between two factors represents the extent to which

the effect of one factor depends on the level of the other factor. When examining the main effects in relation to each other, a significant interaction ($p = .0002$) was found (Table 3). This interaction can be visualized in Figure 1.

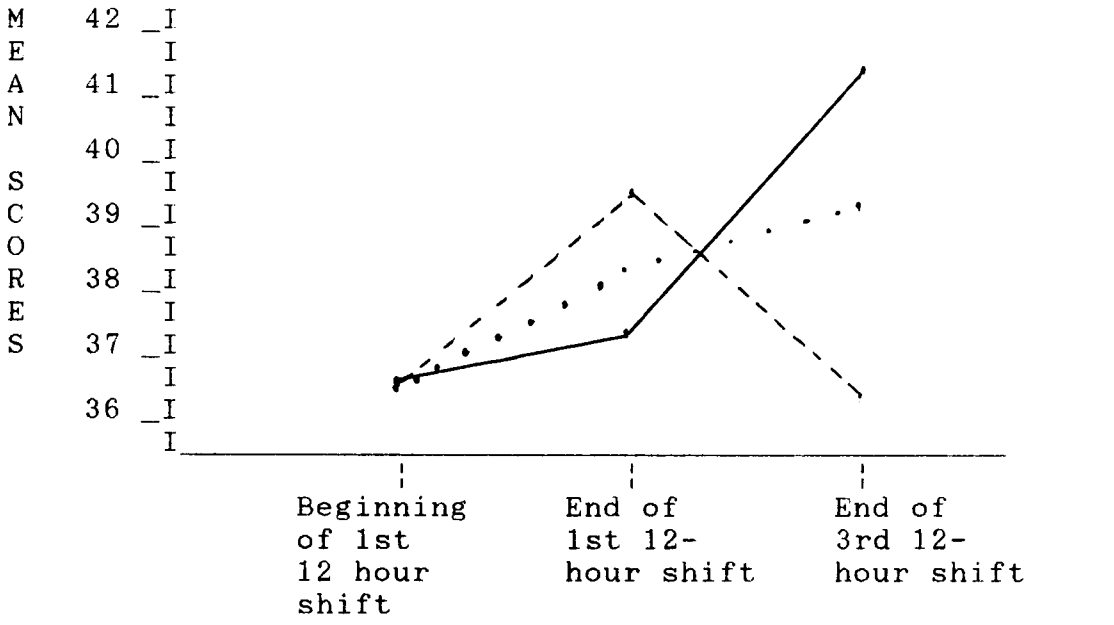

Figure 1

Comparison of Shifts Over Time on Decision Making

It is important to note that when there is interaction present main effects are uninterpretable, or at least do not reveal much about what is really going on. If the main effects

were interpreted without noting the interaction from the data presented, it could be concluded that the sample significantly improved over time in their performance on decision making ability. However, when examining the interaction it is noted that the day shift significantly improved their performance while the night shift had a slight decrease in performance, as seen in Table 5.

Table 5

Effects of Time and Shift on Decision Making Mean Scores

Time	Day Shift Mean Scores	Night Shift Mean Scores
Beginning of 1st 12-hour Shift	36.76	36.69
End of 1st 12-hour Shift	37.29	39.46
End of 3rd 12-hour Shift	41.35	36.54

In analyzing the data related to eye-hand coordination, it is important to first examine the main effects, shift and time independent of each

other. Table 6 illustrates the main effects and the interaction related to eye-hand coordination. Examining shift mean scores irrespective of time demonstrated no significant difference , p = .722. In examining time only as a factor there is again no significant difference in the mean scores, p = .146. The mean scores for the total sample over time are illustrated in Table 7.

Table 6

Multiple Analysis of Variance with Repeated Measures on Eye-Hand Coordination

Source	SS	MS	DF	F	P
Shift	34.80	34.80	1	0.13	.722
Time	23.82	11.91	2	1.99	.146
Shift X Time	54.78	27.39	2	4.57	.015 *
Error	335.39	5.99	56	--	--

Table 7

Effects of Time on Eye-Hand Coordination
Mean Scores

Time	Mean Score	S.D.
Beginning of 1st 12-hour shift	47.60	8.97
End of 1st 12-hour shift	47.87	9.24
End of 3rd 12-hour shift	46.67	10.40

When dealing with the two main effects shift and time it is important to note whether there is an interaction present. When examining the main effects of the data related to eye-hand coordination in relation to one another, a significant interaction ($p = .015$) was found (Table 6). This interaction can be visualized in Figure 2. The significance of the interaction is that it make the main effects uninterpretable. If the main effects were interpreted without noting the interaction from the data presented it could be concluded the the sample demonstrated no significant change in performance in eye-hand coordination. In fact, when examining the

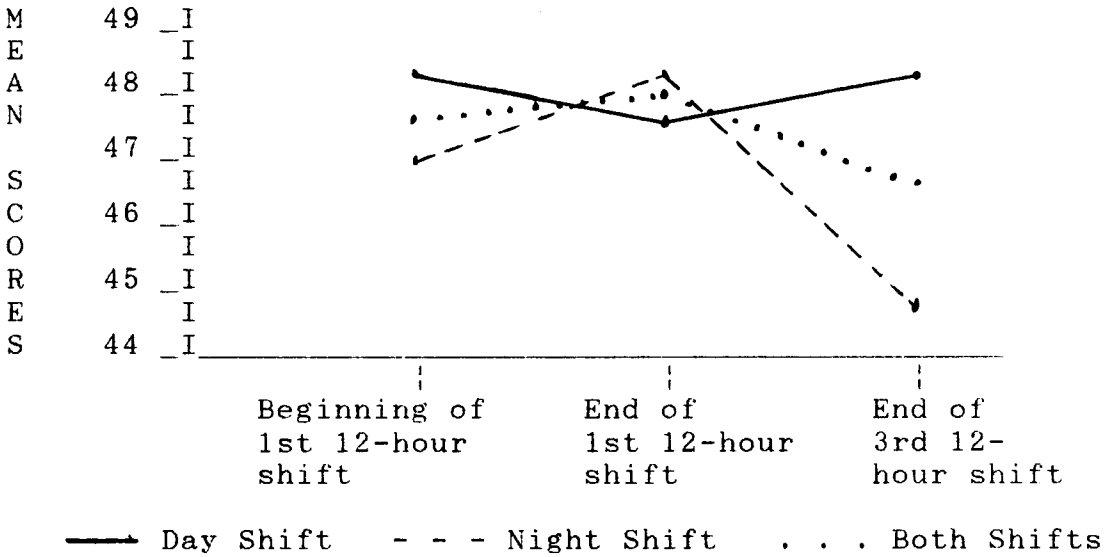

Figure 2

Comparison of Shifts over Time on Eye-Hand Coordination

interaction, it is noted that the day shift demonstrated only a slight decrease in performance, while the night shift demonstrated a significant decrease in performance over time, as seen in the mean scores in Table 8.

Summary

Analysis of the data indicates that for the total sample a nurse's decision making ability significantly increases from the beginning of the first twelve hour shift to the end of the third consecutive twelve hour shift. These results are

Table 8

Effects of Time and Shift on Eye-Hand Coordination Mean Scores

Time	Day Shift Means Scores	Night Shift Mean Scores
Beginning of 1st 12-hour shift	48.12	46.92
End of 1st 12-hour Shift	47.59	48.23
End of 3rd 12-hour Shift	48.06	44.85

similar to those of Mills et al (1983). They reported that the nurses tested improved their scores in critical thinking, although in their study the improvement was not statistically significant. The most significant finding was the presence of an interaction between the main effects, shift and time. In light of the interaction, it is inappropriate to interpret the data solely using the main effects. Rather it is important to examine the interaction that is present. For decision making ability, it is important to note that the day shift demonstrated

significant improvement in performance over time, while the night shift demonstrated a slight decrease in performance, as seen in Figure 1 and Table 3. If the main effects are examined alone without noting the interaction a false conclusion may be assumed and the significance of the data missed.

Analysis of the data related to eye-hand coordination indicates that for the total sample there is no significant difference in performance from the beginning of the first twelve hour shift to the end of the third consecutive twelve hour shift. The significance of the data analysis is the presence of an interaction when examining the main effects in relation to one another. As seen in Table 6 and Figure 2, the day shift mean scores are essentially the same over time while the night shift mean scores increase slightly at the end of the first twelve hour shift but then significantly decrease at the end of the third consecutive twelve hour shift. If the data are interpreted in terms of the main effects alone the significance of the study may be missed. The presence of an interaction between the two shifts

over time is important to examine.

According to Baddeley (1968), there is a minimal learning effect after the first trial for the Three Minute Grammatical Reasoning Test. One factor not tested in this study was the effect of the testing time on the nurses' ability to concentrate. At the beginning of the shift, the nurses were tested after they had received their patient assignment and report, but before they saw their patients. It is possible that the sample subjects, especially the day shift because of the normally busy activities early on the shift went through the decision making test at the beginning of the shift without concentrating since they were eager to start their day's work. At the end of their shift, the nurses had reported off to the next shift and their work was completed at the time of testing.

It may be important to look to other tools to document decision making ability. The Three Minute Grammatical Reasoning Test has been widely used to test higher mental functioning but in the nursing setting the use of more specific tools may reveal a more significant picture of performance levels.

Tools such as those used by Mills, Arnold, and Wood (1983), the Paper and Pencil Performance Test, or the Laboratory Forms Test used by Poulton, Hunt, Carpenter, and Edwards (1978) may give more precise information regarding decision making in nurses specifically.

CHAPTER V

DISCUSSION

This chapter includes a discussion of the results, the limitations, recommendations for further research, and implications for nursing administration from this study.

Discussion

The research questions in this study addressed two variables, nurses' decision making ability, and eye-hand coordination, in relation to what effect twelve hour shifts, and consecutive twelve hour days would have on them. Results from the Three Minute Grammatical Reasoning Test indicate that nurses on the day shift increase in performance over time with only a slight increase at the end of the first twelve hour shift but a significant increase at the end of the third twelve hour shift. These results are similar to those of Mills et al (1983) and may indicate a more significant learning or practice effect than has

been documented. The results from nurses working the 7pm - 7am shift indicate an increase at the end of the first twelve hour shift, similar to the result of Mills et al (1983), but at end of their twelve hour shift the performance is slightly lower than that at the beginning of the first twelve hour shift. The results indicated that the day and night shift do not suffer from a decrease in decision making ability. From this it could be concluded that the quality of decisions may improve for the day shift nurses and are essentially unchanged in the night shift nurses over the three days of twelve hour shifts. Therefore, patient care would not suffer.

The results from the Purdue Pegboard Test indicate essentially no change in performance over time for nurses working on the day shift. For those on the night shift, the mean scores increase at the end of the first twelve hour shift then significantly decrease at the end of the third twelve hour shift. The fact that the nurses working the night shift perform at significantly decreased levels for eye-hand coordination may have impact on the patient care and on the nurse.

This may cause the nurse to make more mistakes or errors such as increased incidence of accidental needle sticks, or improper manipulation of vital catheters. One other consideration is that of the nurse's safety. For example, since the performance of eye-hand coordination is significantly decreased at the end of the shift the question can be raised, "Is this nurse safe to drive home?".

In examining the data analysis in terms of the conceptual framework, there is some question as to the stability (the ability to maintain adequate levels of functioning in regard to eye-hand coordination) of the night shift staff at the end of three consecutive days of working twelve hour shifts. Secondary prevention may be needed to maintain stability of the individual and the group. This secondary prevention may need to include (a) education for the nurses related to the potential hazards, (b) exercise programs during the extended workhours to break up the long shifts, or (c) exercise programs at the end of the shift. Another possibility is limiting the number of consecutive days worked. Part of primary prevention could include education on the potential stressors and

effects of the stressor, twelve hour shifts, on the nurse and the care that is delivered. Also, reevaluation may be needed if work load and acuity were to increase.

In discussion of the findings it is important to note that as nurses become acclimated to the twelve hour shift the performance levels on decision making and eye-hand coordination may improve. This requires further investigation. In this study the average length of time on twelve hour shifts was 22.32 months. Nurses who are adversely effected by the twelve hour shifts may choose not to work the extended hours. The nurses in this study worked in an institution where they had the option of eight hour shifts so by self-selection those who had significant adverse effects from the twelve hour shifts may have removed themselves from that staffing option.

The majority (60%) of the nurses used in this study were also very satisfied with the twelve hour shifts. As stated above, this may have influenced the results. Different results may be found in groups who are dissatisfied with twelve hour shifts due to the fact that they may be

suffering more adverse effects of the shift option. These factors may play a role in the levels of performance.

Limitation

The conclusions and interpretations of the study should be considered with caution due to several limitations. The sample was a non-randomized convenience sample limited to one hospital. The problem with a convenience sample is that the available subjects might be atypical of the population with regard to the critical variables being measured (Polit & Hungler, 1985). Risk for bias is high for this type of sampling method. A sample size of thirty nurses was used. Sample size was small and therefore is also a limitation. Results of a small sample are representative of the participants but are not generalizable to nurses in general.

Patient census and acuity levels of the patients during the time of data collection may have influenced the results of this study. Also, the amount of activity in the unit at the beginning of day shift versus the beginning of night shift

may have influenced the study. When acuity and census were high, nurses deferred participation in the study to another day. This deferral of participation also may have influenced the study.

Intervening variables that might affect eye-hand coordination and decision making ability were not controlled. For example, the study did not control for the amount of sleep, hours and type of physical activity, consumption of medications, alcoholic beverages, caffeine, or tobacco prior to working. It was beyond the scope of this study to control for individual factors such as the subject's stress and energy levels and circadian rhythm.

In terms of the conceptual framework for this study, the cost of intrasystem stability was only evaluated in respect to decision making ability and eye-hand coordination. Other factors were not examined such as patient satisfaction, nurse job satisfaction, and staff's level of clinical performance. The extrasystem and intersystem stability was not evaluated in terms of the economic impact of twelve hour shifts.

Many of the nurses questioned to whom the

results of this study would be reported. They exhibited some anxiety about the possibility that the results might be used to eliminate the option of twelve hour shifts. Over the past several months there had been many changes in the critical care units with the future of flexible scheduling being questioned. It is possible that this may have biased the results.

Another possible bias was the familiarity of the subjects with the investigator. The investigator had been working in the institution for seven years and all subjects knew the investigator. This may have encouraged them to perform at a higher level, although over time this level would not have changed.

Recommendations For Further Research

Based on the results and the limitation presented, the following recommendation are made.

1. Since the present study was limited to a sample of nurses at one hospital, it would be helpful to replicate the study in other hospitals in the region and in other regions of country. Another possibility would be to study nurses who care

for patients in departments other than critical care. This would aid in validating these findings and increasing generalizability.

2. The significant decrease in the night shift decision making ability and eye-hand coordination needs to be investigated further. It would be helpful to replicate the study in the critical care units and in addition to testing three times, as in this study, test also at the end of several consecutive twelve hour shifts. This may be especially significant for the night shift staffs.

3. Due to possible learning or practice effects, it is recommended that the sample be divided into two groups, with one group being tested in the same fashion as in this study, and the other group being tested in reverse order. In other words, the second group would be tested first at the end of a third consecutive twelve hour shift, then at the end of their first twelve hour shift, and lastly at the beginning of their first twelve hour shift. This would assist in determination if the scores were the result of a learning effect.

4. It is recommended that this study be

replicated in a hospital with stability in regard to their use of twelve hour shifts. This stability should mean no previous record or future plans for decreasing the number of twelve hour shifts. This replication would help to determine if the anxiety in the present sample regarding possible elimination of this option helped to bias the results.

5. The intervening variables of sleep, physical activity, and consumption of medications, alcohol, caffeine, and tobacco need to be investigated further for their effect on decision making ability and eye-hand coordination. There is evidence that these factors can effect decision-making ability and eye-hand coordination.

Implications for Nursing Administration

The utilization of twelve hour shift is a current issue in nursing. Some hospitals are considering its adoption while others are re-evaluating its usefulness. The decision to implement or delete twelve hour shifts is a complex one. It needs to be evaluated on many domains, of which decision making ability and eye-hand

coordination are only two. Along with the effects of extended workhours, the needs of the staff and the patients must also be evaluated in the decision making process.

Most of the staff nurses in the present study preferred to work the twelve hour shift, although management was considering decreasing the number of twelve hour positions because of some complex benefits issues. This discrepancy between what most nurses prefer and what managers want could have severe recruitment and retention implications, and possibly implications for the quality of patient care. Nurses are in a position presently, with the current supply and demand situation, to demand the shifts and hours they want to work and managers must take this into consideration.

Due to the decrease in performance of the night shift at the end of the third consecutive twelve hour shift, especially on the eye-hand coordination test, it may be advisable to limit the number of consecutive twelve hour shifts being worked. This decrease may have implications for both the staff and the patients.

All staffing decisions should be made

based on the available research on the subject, the unique needs of a particular staff, the maintenance of quality patient care, and the resources available within the nursing department.

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APPENDICES

APPENDIX A

Informed Consent Form

Informed Consent Statement

Dear Participant:

I am doing a study for a Master's Thesis at the University of Tennessee, College of Nursing. The study is designed to develop greater understanding regarding the effects of extended workhours (twelve-hour shifts) on decision-making abilities and eye-hand coordination in critical care nurses and you are invited to participate. Your participation will involve the completion of a questionnaire, a test to look at decision-making abilities, and a test to look at eye-hand coordination. This will require approximately 30 minutes of your time on the initial testing and approximately 20 minutes on 4 other occasions.

No negative effects will result from your participation in this study. Your participation may provide information that will benefit nurses and patients. All data will be kept confidential.

Participation in this study is strictly voluntary and your consent for participation can be withdrawn at any time prior to completion of data analysis by giving written notice of your wish to withdraw to the researcher listed below. If you do withdraw, or choose not to participate you will not incur any penalties.

If you have any questions about your participation in the study please contact the researcher listed below.

Lynn Beeler
7320 Winchester Drive
Knoxville, Tennessee 37919
(615) 694-4061

I have read and understand the statement above. I freely consent to participate in the above mentioned study under the circumstances addressed above.

Signature_____

Date_____

Code # __ - __

APPENDIX B

Demographic Data Sheet

CODE # __ - __

DEMOGRAPHIC DATA SHEET

1. Age_____

2. Sex: Female_____ Male_____

3. Marital Status: Single____ Married____ Divorced____

4. Number of children_____ Their Ages_____

5. Years of experience as an R.N._____

6. Years of experience in critical care_____

7. Amount of time you have worked twelve-hour shifts: Years_____ Months_____

8. How many consecutive twelve-hour shifts do you normally work? _____

9. What shift do you work: Days_____ Nights_____

10. Are 12-hour shifts your shift option of choice? Yes____ No____

11. If 12-hour shifts are not your preferred option, what would be?_____

Why?_____

12. How satisfied are you working 12-hour shifts?

_____

13. What do you like best/ least about 12 hour shifts? _____

14. What is the highest nursing degree that you hold?_____

APPENDIX C

3-Minute Grammatical Reasoning Test

Three Minute Grammatical Reasoning Test

This test consists of 64 items. The following are sixty-four phrases and the corresponding pair of letters:

1. B does not precede A --AB
2. B follows A -- BA
3. A has preceded B -- AB
4. A is followed by B-- BA
5. B has not preceded by A -- AB
6. B is followed by A -- BA
7. A has followed B -- AB
8. A followed B --AB
9. A is not preceded by B --AB
10. B has not followed A -- AB
11. B preceded A --BA
12. A follows B --AB
13. B is preceded by A --AB
14. A precede B --BA
15. B preceded A -- AB
16. B follows A --AB
17. A does follow B -- BA
18. A has not preceded B --AB
19. A does not follow B --BA
20. B has followed A --BA
21. A is preceded by B -- BA

22. B has followed A -- AB

23. A does not follow B --AB

24. A has preceded B --BA

25. B has preceded A -- AB

26. B has not preceded A -- BA

27. A does precede B --BA

28. A is preceded by B -- AB

29. A preceded B -- AB

30. B is not preceded by A --BA

31. B followed A -- AB

32. A has followed B -- BA

33. B is followed by A -- AB

34. B is preceded by A -- BA

35. B does follow A --AB

36. A is not followed by B -- BA

37. A does not precede B -- AB

38. A does precede B -- AB

39. A does not precede B -- BA

40. B does precede A -- BA

41. B does not follow A -- AB

42. B is not followed by A -- BA

43. B precedes A -- BA

44. B has preceded A --BA

45. A precedes B -- AB

46. B is not followed by A -- AB

47. A does follow B -- AB

48. A is followed by B --AB

49. B does follow A -- BA

50. B does precede A --AB

51. A has not followed B --AB

52. A follows B -- BA

53. B does follow A -- BA

54. B followed A -- BA

55. B precedes A -- AB

56. B is not preceded by A -- AB

57. B has not followed A -- BA

58. A is not followed by B -- AB

59. B does not precede A -- BA

60. A is not preceded by B -- BA

61. A has not followed B -- BA

62. A precedes B -- BA

63. A followed B -- BA

64. A has not preceded B -- BA

VITA

Lynn Marie Isakson Beeler was born in Chicago, Illinois. She received her secondary education in public schools in Knoxville, Tennessee. She received an Associate Degree in Nursing from East Tennessee State University, Johnson City, Tennessee in 1982. After graduation, she worked as a staff nurse in the Critical Care Units at Parkwest Hospital and Fort Sanders Regional Medical Center both in Knoxville, Tennessee. She received the Bachelor of Science in Nursing Degree from East Tennessee State University in 1988. She accepted a position as Assistant Nurse Manager for Critical Care at Fort Sanders Regional Medical Center in 1988. She Accepted a position as Nurse Manager for the Emergency Department at Fort Sanders in 1991.

She entered the University of Tennessee in August, 1989 and received the master of Science in Nursing degree in May 1991. Mrs. Beeler is a member of the American Association of Critical Care Nurses and the Emergency Nurses Association.