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Effects Of Shift Work On Insulin Dependent Diabetics

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EFFECTS OF SHIFT WORK ON INSULIN-
DEPENDENT DIABETICS

by

REBECCA D. BLOUNT

A Thesis
Submitted in partial fulfillment of the requirements
for the Degree of Master of Science in Nursing
in the Division of Nursing
Mississippi University for Women.

COLUMBUS, MISSISSIPPI

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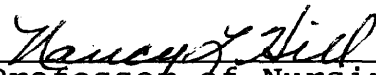
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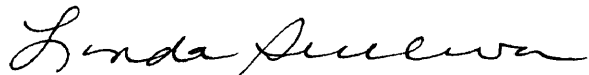
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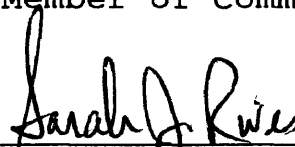
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Abstract

Over 25% of the work force is comprised of insulin-dependent diabetics. The purpose of this descriptive study was to determine the impact of shift work on blood sugar levels in insulin-dependent diabetics. Rogers' Theory of Homeodynamics was the conceptual framework guiding the study. The research question was does rotating shift work have an impact on blood sugar levels in insulin-dependent diabetics. The total sample ($N = 40$) was selected from 100 insulin-dependent diabetics who work at an industrial plant in midwestern Alabama. Thirty insulin-dependent diabetics who were working rotating shifts and 10 insulin-dependent diabetics who worked regular day shift were used for comparison. Blood sugar levels were measured daily during shift rotations, and measurements were taken on the insulin-dependent diabetics who worked regular day shifts. The hypothesis generated was there will be no difference in blood sugar levels in persons who work shift work and those persons who work regular hours. Examination of the data revealed a 2.20% increase in blood sugar level when the insulin-dependent diabetic subjects ($n = 30$) worked the night shift. There was an 11.9% increase in blood sugar level in the diabetic subjects ($n = 30$) when they worked the

evening shift. Analysis of the data using the student t test revealed a significant difference between the blood sugar levels of those who worked shift work and those who worked regular hours ($t = 4.52$; $p < .004$). Implications for nursing and recommendations were presented.

Dedication

1917-1992

With love and appreciation I dedicate this research study to my father-in-law. He taught me the value of a higher education and offered support and encouragement. Although he did not live to see me accomplish my goal, I know he is proud.

D.D. (Dad), this is for you.

Acknowledgements

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Lastly, but most importantly, I wish to extend my deepest love and gratitude to my husband, Pierre, for his constant support, encouragement, and unending patience.

Without this encouragement and support, this research study might never have been completed.

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Chapter I

The Research Problem

Insulin-dependent diabetes mellitus is a condition of relative or absolute lack of insulin, affecting carbohydrate, protein, and fat metabolism (Thompson, McFarland, Hirsh, Tucker, & Bowers, 1989). Diabetes mellitus affects over 12 million people in the United States. By the year 2040, that number may increase to 40 million (Gillis, Highly, Roberts, & Martinson, 1989). This increase in the number of cases diagnosed each year will result in an increasing number of persons with this chronic illness in the work place.

Diabetes mellitus is both a serious health problem and an economically costly condition for the individual and the nation. In terms of jobs and the effect of diabetes mellitus on an individual's work potential, many factors must be understood. Higher paying jobs and/or assembly-line jobs often require that a person work rotating shifts. Persons working shift work sometimes have difficulty adjusting to the change in circadian rhythms brought about by rotation. This normal adaptive process, compounded with diabetes mellitus and the control of blood sugar levels, may negatively impact a worker's health.

Minimal research has been conducted to study the effects of shift work on the blood sugar level of the insulin-dependent diabetic. Therefore, the purpose of this study was to identify the effects that shift work has on insulin-dependent diabetics' blood sugar levels of shift workers at an industrial plant in midwestern Alabama.

Establishment of the Problem

Regardless of the client's age at onset, diabetes mellitus is a life-threatening disease that kills insidiously day by day. Diabetes mellitus shortens the life span, impairs lifestyle, and requires constant daily attention for control. When careful attention becomes part of a management regimen, a client can enjoy a healthy and full life with only modest restrictions. Success at such a lifestyle depends on teamwork among the health care provider, client, and significant others (Gillis et al., 1989).

The goal of diabetes management is to make appropriate modifications in the client's lifestyle to achieve significant levels of diabetic control. Strategies for diabetes management depend in part upon careful planning and on adaptive changes that enable clients to prepare for glycemic control. This process depends on client preparation to recognize patterns and manage appropriate adaptive responses. Only through knowledge and education

can clients develop the motivation required to achieve diabetic control.

For chronically ill people, the burdens of symptoms and regimen management are intertwined with all of life's other work (Strauss, 1985). This is generally true for insulin-dependent diabetics. A rigorous regimen involving exercise, diet, testing blood or urine, manipulation of schedules, treatment judgments and decisions, possible frequent insulin injections, and maintenance of a high level of awareness of physical and mental status imposes difficult demands on a day-to-day basis for an insulin-dependent diabetic.

Diabetes mellitus affects all body systems. The emotional response to a diagnosis of diabetes mellitus is often severe and is not easily dealt with initially. Perhaps an even greater cause of emotional reaction is that diabetes mellitus affects the person's entire life pattern. Although diabetes mellitus cannot be cured, it can be controlled to a large extent by regulating the diet, taking medications, and adjusting to changes in lifestyles. The ramifications of the effects of changes in circadian rhythms on a person's health are multiple (Phillips, 1991).

Laboratory studies have consistently demonstrated circadian variations in performance efficiency (Broughton, 1975). Dirken (1976) found that performance on tasks involving signal detection, reaction time, and simple arithmetic calculation correlated highly with circadian

variations in body temperature. It has been recognized that insulin-dependent diabetics working shift work frequently present at medical clinics and emergency rooms with elevated blood sugar levels.

Bryden and Holdstock (1985) suggested that 20% to 30% of the working population is unable to adapt to shift work because of nervous diseases and digestive complaints related to sleepiness. Corroborative evidence indicates a relationship between shift work and an increase in accidents (Gold et al., 1992). As the National Survey of Personal Health Practices and Consequences (1987) noted, the existence of circadian and possible other period susceptible rhythms appear to be the rule rather than the exception in characterizing human responses to physical, chemical, and biological challenges.

Significance to Nursing

Exploration of the influence that shift work has on insulin-dependent diabetics' blood sugar levels has implications for the nurse researcher, nurse educator, and nurse practitioner. The nurse researcher interested in the impact of shift work on insulin-dependent diabetics' blood sugar levels can replicate this study in a population of persons working shift work in another part of the United States to determine the generalization of these results to other persons working shift work. This study will contribute to the body of nursing knowledge, as valuable

information will be obtained about circadian rhythms and the effects on insulin-dependent diabetics' blood sugar levels.

The nurse educator can present the information obtained from this study to entry-level nursing students as part of diabetic teaching strategy. Perceived control problems of insulin-dependent diabetics can be related to shift work, and interventions can be initiated. The student can then utilize this information in practice to facilitate better control of blood sugar levels in insulin-dependent diabetics who work rotating shifts. The nurse practitioner can use the results of this study in practice to help insulin-dependent diabetics meet their perceived health needs. A general knowledge of shift work and potential changes in circadian rhythms for the insulin-dependent diabetic can be used by the nurse practitioner as the basis for open communication and for the formation of a trusting, understanding, and professional relationship. The nurse practitioner can then better serve as the insulin-dependent diabetic's advocate, counselor, and promoter of improved health status.

Theoretical Framework

The theoretical basis for this study evaluating the effects of shift work on insulin-dependent diabetics' blood sugar levels is Rogers' Theory of Homeodynamics. Rogers' (1983) view of man is as a unified whole and open system who is in a constant state of exchange with the environment.

The foundation for Rogers' model includes five basic assumptions (Marriner-Tomey, 1989):

1. Man is a unified whole possessing an individual integrity and exhibiting characteristics that are more than, and different from, the sum of his parts.

2. The individual and environment are continuously exchanging matter and energy with each other.

3. The life progression of an individual evolves along a space and time continuum.

4. Pattern and organization identify an individual and reflects his innovative wholeness.

5. Man is characterized by the capacity for abstraction, imagery, language, thought, sensation, and emotion (Rogers, 1989). The life process in Rogers' view is one of wholeness, continuity, dynamic, and creative change.

Rogers' (1983) theory is built upon the principles of homeodynamics which constitute three separate principles and in essence describe the life process (Marriner-Tomey, 1989). Integrality, the first of these principles, describes the continuous, mutual, and simultaneous interaction between man and environment. The second, Helicy, states that life proceeds in one direction of sequential and increasingly complex stages in the life continuum. The third, Resonancy, deals with the continuous changes in the wave patterns between man and the environment (Rogers, 1983).

Rogers states that nursing practice should be one in which the practitioner strives to promote a balance between man and his environment by strengthening the bond and the integrity of the human field while helping to correct those deficits in the man/environment relationship. Rogers believes that maintenance and promotion of health are the two foremost responsibilities of nursing (Rogers, 1983). Nursing promotes and maintains health by evaluation, therapeutic measures, and/or rehabilitative means (Thibodeau, 1983).

The principles of homeodynamics hypothesize the way the life process proceeds and can be used to predict its evolution. Integrality, Helicy, and Resonancy can be used to explain and predict those phenomena related to the life process of man (Marriner-Tomey, 1989). These principles rely heavily on observations pertaining to the mutual interactions of the human and environmental fields.

Assumptions

The assumptions for this study were

1. Diabetic control is dependent upon establishing specific patterns for activities of daily living.
2. Circadian rhythms interfere with normal patterns of functioning.

Purpose of the Study

The purpose of this study was to ascertain the effects of shift work on insulin-dependent diabetics' blood sugar levels.

Statement of the Problem

Over 25% of the work force is comprised of insulin-dependent diabetics (Whitley, 1989). Some of these have jobs that require shift work. It has been demonstrated that shift work alters one's circadian rhythms. This alteration may interfere with the diabetic's ability to adequately control his/her diabetes. Therefore, this study addressed the question, what is the impact of shift work on blood sugar levels of insulin-dependent diabetics?

Hypothesis

The hypothesis generated for this study was there will be no difference between the blood sugar levels of persons who work shifts and those persons who work regular hours.

Research Question

The research question for this study was, does shift work have an impact on blood sugar levels in insulin-dependent diabetics?

Definition of Terms

For the purposes of this study, terms were defined as follows:

1. Rotating work shifts: Working hours that change at specific intervals. In this particular case, the time and intervals are 6:00 a.m. to 2:00 p.m., the day shift for 7 days; 2:00 p.m. to 10:00 p.m., the evening shift for 7 days; and 10:00 p.m. to 6:00 a.m., the night shift for 7 days.

2. Insulin-dependent diabetics: Those individuals requiring an injection of insulin to maintain blood sugar levels within normal limits.

3. Blood sugar levels: The amount of circulating glucose in an individual's blood at any given time which can be measured with a glucose monitoring machine (Accu-Check). The technique involves using reagent strips with a reflective meter. The reagent strip develops a color reaction to the glucose level in an individual's blood. After the reagent has developed in color, it can be read by a reflective meter that will electronically display a numerical value for blood glucose concentration (Lewis, Cox, & Collier, 1992).

Chapter II

Review of the Literature

Despite the great amount of research carried out on various aspects of the sleep behavior of humans, little attention has been paid to the effects of shift work on insulin-dependents' blood sugar levels. Research into the health effects of shift work has involved a variety of strategies. Sleepiness (Bryden & Holdstock, 1985), self-report health inventories (Dirken, 1976), physician examination and physiological monitoring (National Survey of Personal Health Practices and Consequences, 1987), and accidents due to shift schedules (Gold et al., 1992) have all been used in shift work investigations. This review of the literature will focus on the sleepiness, self-report health inventories, physical examination, and physiological monitoring, and accidents due to shift schedules.

Recent literature suggests that the health concerns of people working shift work are unique and vary considerably. Dirken (1976) conducted a research study for the purpose of determining a possible decrease of well-being and to identify specific complaints caused by shift work. The sample for the study consisted of 2,500 workers. The instrument used was a 58-item questionnaire prepared by the

researcher. The instrument included yes/no type questions: 48 items were used for the so-called complaints score; 10 items served to stimulate concentration during the filling out of the form and to prevent the effects of irrelevant response sets. Face validity of the instrument was determined by pilot testing. The reliability was 0.91 and the standard error of measurement was 0.78, with the mean score being 9.2 and the standard deviation 8.1. The results of the study (Dirken, 1976) showed a small but very significant difference between the shift workers and the non-shift workers. Thus, the hypothesis that shift workers have a lower general well-being than non-shift workers was confirmed.

Dirken (1976) suggested that the negative effects of shift work might be partly veiled due to the selection of workers that resulted in a group of shift workers who were stronger and healthier than non-shift workers. The main conclusion of the study was that shift work did not affect subjective well-being in either the somatic or psychological aspects.

Bryden and Holdstock (1985) conducted a study to determine the effects of night duty on sleep patterns of nurses. The sample consisted of 12 female nursing students employed in a large hospital. The subjects volunteered for the study. The ages ranged from 17 to 25 years (mean age 18.9).

The instrument used for this study was a Beckman Type R Dynograph to record the electroencephalogram (EEG), electrooculogram (EOG), and muscle potential (EGM) of each subject. The subjects were assigned to two groups, each consisting of 6 subjects. A questionnaire was completed to obtain information concerning the usual hours slept by each subject, including data on commencement and duration of sleep. These data were used as the basis for commencing and ending sleep periods during the night and day. Questions were also asked concerning the quality of the subject's sleep as well as the number and duration of naps taken outside the sleep periods being studied.

The results of this study (Bryden & Holdstock, 1985) revealed that changes occurred in both the pattern and duration of the daytime sleep of nurses working night duty. Although no differences were evident with respect to the overall percent rapid eye movement (REM), differences in the distribution of REM sleep did occur. REM sleep occurred sooner during diurnal than nocturnal sleep, and there seemed to be more REM sleep during the first part of diurnal sleep. Coupled with the earlier onset of diurnal sleep, the data suggested that night duty enhanced the onset of sleep and the occurrence of REM. Thus, alterations in the pattern and not in the absolute amount of sleep seemed to be the major effect of working night duty. Additional support for this assumption was derived from the fact that although the

duration of the major sleep period was on the average 20 minutes less on the day shift than the night shift, the nurses actually experienced a greater overall amount of sleep while on night duty due to the additional naps.

The study of Bryden and Holdstock (1985) was similar to the current study in that both studies tested the effects of shift work on individuals' health. However, the current study obtained health effects of insulin-dependent diabetic's blood sugar levels while the Bryden and Holdstock study focused on diurnal versus nocturnal sleep patterns.

Gold et al. (1992) conducted a study that examined the impact of the work schedule on the sleep schedule, sleepiness, and accident rates of female nurses in a Massachusetts hospital. The sample for this study consisted of 593 female registered nurses and 42 licensed nurses. A self-administered questionnaire was distributed, and data were collected through June-September 1986.

The hypotheses generated by Gold et al. (1992) were based on physiological and epidemiological data regarding shift work and circadian disruption. The method of analysis was univariate analysis. Analysis indicated the odds of having an accident or error were twice as high for nurses who rotated schedules than straight day/evening nurses. Nurses who rotated had 2.5 times the odds of reporting near-miss accidents.

The results of this study indicated that sleep deprivation and off-setting of circadian rhythms as experienced during rotating shift work were associated with frequent lapses of attention and increased reaction time. This in turn led to increased error rate on performance tasks. These data also suggested that bias and selection bias may have influenced the findings in this cross-sectional study.

Gold et al. (1992) suggested that female shift workers had frequent lapses of attention and increased reaction time, leading to increased error rates of performance tasks. The current study made no comparison between sleepiness and accidents and included both female and male subjects.

The National Survey of Personal Health Practices and Consequences (1987) was a two-wave panel study of a three-stage stratified cluster sample of the non-institutionalized adult population aged 20 to 64 years in the United States. The sample consisted of 3,025 respondents in the spring of 1980. Telephone interviews were conducted which contained questions about sociodemographic characteristics, perceived health status and health practices, as well as a question regarding variability of work schedules. Longitudinal data and percentiles were used to report the findings. Data from this indicated that 32.6% of men and 18% of women in the United States labor force reported working a variable shift in the spring of 1987. As compared to men working

non-variable work schedules, those working variable shifts exhibited higher rates of heavy drinking, job stress, and emotional problems. Female variable shift workers reported higher rates of sleeping pills, tranquilizers, and alcohol use, as well as lower social scores, more job stress, and more emotional problems.

The National Survey of Personal Health Practices and Consequences (1987) was dissimilar to the current study since the study queried the heavy drinking, job stress, emotional problems, and use of sleeping pills and tranquilizers. The current study was concerned with only the effects of shift work on insulin-dependent diabetics' blood sugar levels. Another difference was that the National Survey of Personal Health Practices and Consequences utilized telephone interviews, whereas the current study utilized a questionnaire.

A review of the literature revealed that with round-the-clock operations here to stay, it is important for public health researchers to examine more carefully the impact of shift work on the health, behavior, and quality of life of shift workers and their families. The growing interest in the workplace as an arena for health intervention provides an opportunity for occupational health, health promotions, and organization of development specialists to cooperate in the exploration of how the structure of work influences lifestyles and health.

Research suggests that restructuring the way work is done, i.e., redesigning shift schedules to be more compatible with the body's circadian rhythms, can lead to improved health, reduced stress, and increased job satisfaction and productivity. Further research in and application of the principles of sleep research and ergonomics, the study of how to improve the interaction of people with their physical environment, may well broaden the scope and potential effectiveness of work site health promotion activities (Bryden & Holdstock, 1985; Dirken, 1976; Gold et al., 1992; National Survey of Personal Health Practices and Consequences, 1987).

Chapter III

The Method

The purpose of this research study was to determine the impact of work shift changes on insulin-dependent diabetics. In this chapter, the research design, population, and sample are discussed. Procedures for data collection, techniques for data analysis, and measures taken for the protection of human subjects are also explained.

Design of the Study

A longitudinal panel study design was utilized to achieve the purpose of the study. According to Polit and Hungler (1991), the goal of longitudinal research is to collect data at more than one point in time. The goal of panel studies is to collect data on the same subjects at two or more points in time. The researcher was able to utilize longitudinal panel studies as data were collected from the same subjects at different points in time. Using panel studies, the researcher can usually discover patterns of change and possible reasons for changes. The researcher can identify the subjects who did or did not change and isolate the characteristics of the subgroups.

Research Question

The research question guiding this study was does rotating shift work have an impact on blood sugar levels in insulin-dependent diabetics?

Hypothesis

The hypothesis generated for this study was there will be no difference in blood sugar levels in persons who work shifts and those persons who work regular hours.

Setting, Population, and Sample

The setting for this study was an industrial plant in midwestern Alabama. This particular plant has been in operation 38 years and maintains a 24-hour production schedule. The production schedule necessitates shift work by the employees. The plant makes and distributes paper products. There are approximately 2,000 employees at the plant.

A review of the medical records revealed that approximately 100 employees were insulin-dependent diabetics. From the accessible population ($N = 100$) selection of the employees was undertaken until 30 insulin-dependent diabetics starting the day shift rotation (6:00 a.m. to 2:00 p.m.) were selected. Also, 10 insulin-dependent diabetics who work only the day shift were selected for comparison.

Methods of Data Collection

Instrumentation: The instrument utilized for this study was a questionnaire developed by the researcher and will be referred to as the Blount Diabetic Experience Tool (see Appendix A). A log of approximate clinical data was completed on each subject during data collection (see Appendix B).

The Blount Diabetic Experience Tool consisted of four major topics which included (a) demographics, (b) job specifications, (c) diabetic experience, and (d) general health status. The participant was asked to complete the Blount Diabetic Tool prior to the initial blood sugar testing. Certain demographic data were collected, such as age, sex, ethnicity, length of present work experience, as well as selected related factors known to influence blood sugar levels.

Procedure. Permission to conduct this study was obtained from Mississippi University for Women's Committee on Use of Human Subjects in Experimentation (see Appendix C). Following that, permission was obtained from management of the corporation to conduct the study (see Appendix D). Finally, permission was obtained from the 40 randomly-selected insulin-dependent diabetics (see Appendix E).

The researcher met with the Director of Human Resources Department at the corporation in midwestern Alabama to discuss the study and its implications for improved health

care for control of blood sugar levels in insulin-dependent diabetics working shift work. At this time, the letter of consent was signed granting permission to conduct the study (see Appendix D).

The researcher then mailed copies of the Blount Diabetic Tool to the selected subjects for completion, to be returned to the researcher at the initial blood sugar testing. Each participant had already signed a letter of consent (see Appendix E). The participants were assured that no names would be placed on the Blount Diabetic Experience Tool to assure confidentiality, and their employment would not be jeopardized in any way by participation in the study.

On the first day of the day shift, the initial blood sugar levels of each participant were checked by the researcher. The researcher visited the employees at the job site to obtain the blood sample and perform the test. The entire procedure took approximately 10 minutes per employee to complete for a total of approximately 6 hours. The employee was followed for one month during a complete shift rotation. The clinical data collected were recorded on a Clinical Data Log.

Methods of Data Analysis

The data were analyzed using descriptive statistics. According to Polit and Hungler (1991), descriptive statistics are used to describe the synthesized data

obtained from empirical observations and measurements. Examples of descriptive statistics are measures of central tendency, or the mean, median, and mode. These measures, along with percentages, were used to describe the importance of variations in blood sugar levels and shift work.

The student t test was used to compare the groups. According to Polit and Hungler (1991), the t test is used for testing the statistical significance of differences between means. According to Polit and Hungler (1991), a distinction must be made between the cases when the two groups are independent (insulin-dependent diabetics who work shift work and those who work a regular day shift). Therefore, the student t test was appropriate for the current study.

Limitations

The following limitations of this research are identified:

1. The longitudinal panel design utilized for this study had limited internal and external validity.
2. There was lack of control over the subjects, including dating patterns, work environments, or stress levels.
3. Small sampling limits generalization.

Chapter IV

The Findings

The purpose of this descriptive study was to explore the effects of shift work on insulin-dependent diabetics' blood sugar levels. In this chapter, the sample used for the study is described, and the results of the data analysis are presented. Additional findings are also presented.

Description of Sample

Sample profile. The sample ($N = 40$) was selected from 100 diagnosed insulin-dependent diabetics ($n = 30$) working rotating shifts and from those insulin-dependent diabetics employed at regular hours ($n = 10$) at an industrial plant in midwestern Alabama.

The shift work employees consisted of 17 males and 13 females. Twenty-six of the subjects were African-American, and 4 were Caucasian. Nine of those working regular hours were male, and 1 was female. There were 5 African-Americans and 5 Caucasians. The age range of those participants working shift work was 19 to 62 years, with the average being 34.2 years of age. The age range of those participants working regular day shift was 22 to 42 years, with the average being 25 years of age.

Thirty of the subjects were required to work 7 days per rotation cycle with off days at the end of the 7 days for a month rotation. Ten of the subjects worked strictly day shift, Monday through Friday, with weekends off. The length of time of working rotating shifts was from 2 years to 15 years, with the average number of years worked being 5 years. Job specifications ranged from subjects working in the utilities department ($\underline{n} = 10$) to subjects working in the pulp mill ($\underline{n} = 3$). The majority of workers worked in converting ($\underline{n} = 17$). Those subjects who worked strictly day shift worked in the utilities department ($\underline{n} = 10$).

Subjects were requested to rate their health status. The majority (76%) of the subjects working rotating shifts considered themselves to be in average or good health ($\underline{n} = 23$). Eight (25%) of this group of insulin-dependent diabetics reported having a cardiovascular problem, while 5 (15%) reported having problems with eyes. Sixteen (51%) reported a noticeable change in blood sugar levels while rotating through the different shifts, with changes being noticed more on the night shift. Eight (25%) persons reported making more visits to the physician while working the evening shift, but they did not know whether this increased number of visits was related to the diabetic diagnosis. Some of the physician visits were for somatic complaints other than diabetes.

Conversely, the persons who worked regular hours reported a lesser number of health conditions. Interestingly, the persons working regular hours reported a high incidence of cardiovascular problems and reported lack of exercise (see Table 1).

When queried as to medications other than insulin, the shift workers ($n = 16$) reported medications such as Dynacirc, Nitroglycerine, Pepcid, Axid, Tylenol, Aspirin, and Mylanta. Those who worked regular hours ($n = 4$) reported taking Zantac, Tenormin, nitroglycerine patches, Mylanta, Maalox, Tylenol, and Aspirin. Eighteen of the shift workers smoked, and 2 of the regular hour workers smoked.

The subjects who worked shift work had been diagnosed as insulin-dependent diabetics for an average of 12 years. The length of time being a diabetic ranged from 9 months to 18 years. Eighteen (60%) of the subjects had been taking insulin for more than 15 years and reported checking blood sugar levels at least two times a week. Eleven (35%) of the subjects reported that in addition to the usual dosage of NPH insulin, regular insulin had to be taken because of increase in blood sugar levels occasionally while working night shift. Only 6 (20%) reported more visits to the physician during any particular shift related to the diabetic diagnosis, while 15 (50%) reported lost days of work related to changes in blood sugar levels.

Table 1

Distribution of Reported Health Problems of Shift and Regular Hour Workers

Health Problem	No. of Subjects		%	
	Shift ^a	Regular ^b	Shift	Regular
Cardiovascular problems (HTN, peripheral edema, post-MI)	4	6	13	60
Gastrointestinal (Ulcer, diarrhea, constipation)	13	9	43	90
Menstrual disorders	9	-	30	0
Musculoskeletal disorders (arthritis, low-back pain, knee injuries)	9	6	30	60
Eye problems	11	4	35	40
Foot problems (calluses, corns, bunions, ulcers)	17	7	56	70
Decrease in amount of quality sleep	15	0	50	0
Lack of exercise (formal and informal)	24	10	80	100

^an = 30. ^b = 10.

Nine (30%) reported being on no particular diet, but watched what was eaten.

The subjects who worked regular hours had been diagnosed as an insulin-dependent diabetic for an average of 15 years. The length of time ranged from 3 years to 20 years. Eight subjects (75%) reported taking insulin for more than 10 years. Five subjects (50%) reported checking blood sugar levels weekly. Eight subjects (75%) reported

taking regular insulin in addition to the usual dosage of NPH insulin due to elevated blood sugar levels; however, this usually was reported during holidays. Three subjects (30%) reported lost days of work related to the diabetic diagnosis. All of the regular hour workers reported being on an 1800-calorie American Dietary Association (ADA) diet.

Results of Data Analysis

The research question guiding this study was does shift work have an impact on blood sugar levels in insulin-dependent diabetics? The findings of this study indicated that 20 (65%) of the subjects had a change in blood sugar levels while working the night shift. Fourteen (45%) of the subjects had an increase in blood sugar levels while working the evening shift, and 3 (10%) of the subjects showed an increase while working the day shift. The blood sugar levels of the 10 diabetics working strictly days remained within the normal range (60-115).

Results of Hypothesis Testing

One hypothesis was generated for this study: There will be no difference in blood sugar levels in persons working shift work and persons working regular day shift.

Examination of the data revealed a 2.20% increase in blood sugar levels when the insulin-dependent diabetic ($n = 30$) subjects worked the night shift (10:00 p.m. to 6:00 p.m.). There was an 11.9% increase in blood sugar levels in

the subjects when they worked the evening shift (2:00 p.m. to 10:00 p.m.).

Analysis of the data using the student t test revealed a significant difference in blood sugar levels between those who worked shift work and those who worked regular hours ($t = 4.52, p = .0004$) (see Table 2).

Table 2

Comparison of Blood Sugar Levels in Shift Work and Regular Hours Using the t Test

Worker	<u>n</u>	<u>M</u>	<u>SD</u>	<u>t</u>	<u>p</u>
Shift	30	96.967	5.163	4.529	< .0004
Regular	10	88.500	5.104		
Difference		8.467			

Note. $p \leq .05$.

Additional Findings

As well as identifying the effects of shift work on insulin-dependent diabetics' blood sugar levels, this study also identified other health issues of this population, which were considered important to health care providers. These issues included illnesses concurrent with diabetes, medications subjects presently take, smoking history, diet history, heat and job stress, as well as health status rating.

Chapter V

The Outcomes

In this study examining the effects of shift work on insulin-dependent diabetics' blood sugar levels, 30 insulin-dependent diabetics were followed for a complete rotation (one month), to determine the effects of shift work on blood sugar levels, and 10 insulin-dependent diabetics who worked the day shift were followed as a comparison group. This chapter will include a summary of the findings, discussions, conclusions, implications, and recommendations.

Summary of Findings

The total sample for this study consisted of 40 persons. Thirty insulin-dependent diabetics worked rotating shifts, and 10 insulin-dependent diabetics worked strictly day shift. The workers who worked shift work began the week rotation on Wednesday with days off after 7 days of work, while the non-shift workers had weekends off. There was a 2.20% increase in blood sugar levels while the insulin-dependent diabetic worked the night shift. There was an 11.9% increase in blood sugar levels in the subjects while working the evening shift. The blood sugar levels remained within the normal range (60-115) of the subjects who worked strictly day shift. The t test was used to determine if the

increase in blood sugar levels was significant. The results of the t test revealed a t value of 4.529 at p .0004. Thus, the null hypothesis was rejected.

The participants also indicated other health problems, for example, cardiovascular disease, eye problems, and stomach problems. Heat stress and job stress were major concerns of the workers.

Discussion

The findings from this study were similar to the findings from the study by Gold et al. (1992). Both studies revealed that shift workers had a unique set of sleep alterations. The results of the Gold et al. (1992) study indicated that sleep deprivation and alterations of circadian rhythms as experienced during rotating shift work were associated with frequent lapses of attention and increased reaction time, leading to increased error rate on performance tasks. The current study indicated that the amount of quality sleep was decreased during shift change as opposed to non-shift workers who did not report sleep variations.

According to a study done by Dirken (1976), shift workers in general had a lower feeling of well-being than non-shift workers. Dirken (1976) also indicated that shift workers have a unique set of health problems. The current study revealed that shift workers had a wide range of health complaints. Health problems ranged from heart to stomach

problems. The health concerns identified by insulin-dependent diabetics working shift work should be addressed by the nurse practitioner who is a member of the health team.

The current study was similar to both the study done by Gold et al. (1992) and Bryden and Holdstock (1985) in that the subjects indicated that quality of sleep was decreased. In the study conducted by Bryden and Holdstock (1985), the participants experienced a greater overall amount of sleep while on the night shift due to the extra naps taken.

The two-wave panel study by the National Survey of Personal Health Practice and Consequences (1987) found that over 50% of the population in the United States' labor force reported working a variable shift. The National Survey of Personal Health Practice and Consequences study also indicated that males working variable shifts exhibited higher rates of heavy drinking, job stress, and emotional problems. Females working on variable shifts reported higher rates of sleeping pills, tranquilizer, and alcohol use, as well as lower social scores and more job stress and emotional problems. The findings of the current study indicated that job stress, as well as heat stress, were of primary concern to the participants.

The questionnaire used in the present study did not address alcohol consumption, emotional problems, and social interaction as did the National Survey of Personal Health

Practice and Consequences (1987), but did include data on prescription medication ($n = 10, 40\%$), over-the-counter medication ($n = 18, 45\%$), and smoking history ($n = 20, 50\%$), as part of the general health status. In this study, shift workers utilized more medications, both prescription and over-the-counter, than did the regular hour workers. Shift workers also had a higher frequency of tobacco use. The National Survey of Personal Health Practice and Consequences study had a sample size of 3,025, while the present study had a sample size of 40. Also the National Survey of Personal Health Practice and Consequences study was conducted over a period of 3 months, while the current study was conducted over a one-month period.

Conclusion

As indicated by the present study, shift work does have an influence on insulin-dependent diabetics' blood sugar levels. It is, therefore, important that health care providers address the health problems of insulin-dependent diabetics' required to work rotating shifts. For the majority of workers, shift work may be perceived as nothing more than an inconvenience or an obligation that must be fulfilled in order to meet the requirements of the job. For the health care provider, however, shift work represents a source of potential problems which may significantly affect the workers' ability to function effectively.

One of the most important ways in which the health care provider can begin to improve the adjustment to shift work is to assess the work place's shift work schedules and determine how often shift assignments change and in what sequence this occurs.

Health care providers need to become familiar with the common health problems associated with shift work so assessments can be focused in these areas. Potential problems to be assessed include gastrointestinal disorders, cardiovascular diseases, and hypertension.

Implications for Nursing

This study has implications for the nurse educator, the nurse practitioner in primary care, nursing theory, and research. The nurse educator will find the results of this study can enhance the provision of appropriate diabetic health care to students. Both graduate and undergraduate students can utilize the information gained from this study to facilitate communication with insulin-dependent diabetic clients.

Nurse practitioners in primary care can utilize the results of this study to refocus attention to the health needs of insulin-dependent diabetics required to work rotating shifts. Administration of a simple, easy-to-review health history questionnaire could be incorporated into the data collection process for each insulin-dependent diabetic who is to receive care. The information obtained

could then be included in the interview with the insulin-dependent diabetic, thus encouraging open communication regarding health concerns and issues.

The results of this study could be utilized to emphasize to health care providers that the health care needs of insulin-dependent diabetics required to work rotating shifts may vary considerably from those of insulin-dependent diabetics who work strictly day shift. Thus, the results could be utilized by employers of potential employees diagnosed as insulin-dependent diabetics to enhance working conditions and influence performance.

The findings from this study supported the theoretical framework of Martha E. Rogers (1983). One of the major concepts of this theory is that maintenance and promotion of health are the two foremost responsibilities of nursing (Rogers, 1989). Principles expressed by Rogers (1989) rely on observations of the interactions of the human and environment fields. Rogers' (1989) principle of Helicy, or the relationship of man and environment, was a major concern of this study. Belief that the nurse is to strengthen the bond between man and his environment is reinforced by the implications of this study. For example, as the nurse practitioner becomes aware of the effect that the environment has on a person's health, changes can be made in the environment (in this specific case, shift work) to enhance the health of a normal person, as well as those with

health problems. Being aware of the effect that shift work has on insulin-dependent diabetics' blood sugar levels will enhance the nurse practitioner's understanding of insulin-dependent diabetics' health needs. As the nurse practitioner develops a comprehension of the needs of the insulin-dependent diabetic required to work shift work, intervention can occur.

Implications for research included the importance of examining the influence of circadian rhythms and a disease process. Therefore, nursing research could explore the relationship between circadian rhythms and other diseases, such as hypertension or gastrointestinal problems.

Recommendations for Further Study

As a result of this study, the following recommendations are made:

1. Replication of this study with a larger sample in another geographic location.
2. Replication of this study examining the difference between insulin-dependent diabetics and noninsulin-dependent diabetics required to work rotating shifts.

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APPENDIX A
BLOUNT DIABETIC EXPERIENCE TOOL

I.D. # _____
Date: _____

Blount Diabetic Experience Tool

I. Demographics

1. Age: _____
2. Sex: a) Male _____ b) Female _____
3. Ethnicity: a) W _____ b) B _____
c) Native American _____ d) Other _____
4. Length of present work experience: _____
5. Job Specification: _____

II. Diabetic Experience

6. How long have you been a diabetic? _____
7. How long have you taken insulin? _____
8. How often do you check your blood sugar? _____
9. What is your normal blood sugar? _____
10. How does your blood sugar level change when you change shifts? Increase _____ Decrease _____ No Change _____
11. Do you notice any effects on your blood sugar level when you change shifts? Yes _____ No _____
12. Do you have to see your doctor more often during any particular shift for diabetic related problems? Yes _____ No _____
13. Do you have to lose days of work due to the effect that shift changes have on your blood sugar? Yes _____ No _____
If yes, how many days per month? _____
14. Describe your current diet: _____
15. Do you think shift work has an influence on your eating habits? Yes _____ No _____ If yes, describe how: _____

III. General Health Status

16. List other illnesses: _____
17. What medications are you taking now?
Prescription: _____
Over-the-counter: _____
18. Body Characteristics: Height: _____ Weight: _____
19. I rate my health status as:
Excellent _____ Good _____ Fair _____ Bad _____
20. I smoke: Yes _____ No _____ Less than 1 pk/day _____
1-2 pk/day _____ Over 2 pk/day _____

APPENDIX B
CLINICAL DATA

I.D. # _____

CLINICAL DATA

	Date	Time	Blood Sugar	Diet	# Hours	(Activity) Exercise	Type and Amount of Insulin	General Well-Being	Work Environment: Type Machine Heat Stress: Type of Work
DATE (DAYS)									
DATE (PMS)									
DATE (NIGHTS)									
DATE (DAYS)									

APPENDIX C

APPROVAL OF MISSISSIPPI UNIVERSITY FOR
WOMEN COMMITTEE ON USE OF HUMAN
SUBJECTS IN EXPERIMENTATION



MISSISSIPPI
UNIVERSITY
FOR WOMEN

Columbus, MS 39701

Office of the Vice President for Academic Affairs
Endora Welty Hall
P.O. Box W-1603
(601) 329-7142

April 20, 1993

Ms. Rebecca Blount
c/o Graduate Nursing Program
Campus

Dear Ms. Blount:

I am pleased to inform you that the members of the Committee on Human Subjects in Experimentation have approved your proposed research concerning "the impact of changing work shifts on insulin-dependent diabetics."

I wish you much success in your research.

Sincerely,

A handwritten signature in cursive script, appearing to read "T. Richardson".

Thomas C. Richardson
Vice President
for Academic Affairs

TR:wr

cc: Mr. Jim Davidson
Ms. Jeri England
Dr. Nancy Hill
Dr. Rent

APPENDIX D
AGENCY CONSENT

February 23, 1993

(Inside Address)

Dear _____:

My name is Rebecca Blount. I am a native of Choctaw County and live in Butler, Alabama. I am a graduate student in nursing at the Mississippi University for Women in Columbus, Mississippi, preparing to be a Family Nurse Practitioner.

A research project is a requirement for graduation. From my nursing experience in Choctaw County, I have rendered care to many employees working at _____. For my project I am interested in learning more about the impact of changing shifts and the problems that insulin-dependent diabetics experience in controlling their blood sugar levels.

This letter is a formal request to approach 40 insulin-dependent diabetics who are employees of your plant to participate in this research project. The project will require the completion of the Blount Diabetic Experience Tool and the determination of blood sugar levels (at no cost to _____) for a period of 4 weeks. I have enclosed a copy of the questionnaire and the permission form to be completed by the participant. If acceptable to _____, the actual data collection for the research project should begin in April 1993 and last approximately 4 weeks. Protection of _____ proprietary information and other aspects of confidentiality will be maintained.

If you would need for me to personally meet with you and discuss my project, I can be reached at (205) 459-3644. I have enclosed two copies of this letter. Please sign one copy and return to me indicating your support and approval

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February 23, 1993

of my study. Please keep one copy for your records. I look forward to working with you on this endeavor.

Sincerely,

Rebecca Blount

I have read this letter and the supporting documents and grant permission of this study.

Name

Title

Date

APPENDIX E
PARTICIPANT'S CONSENT

Dear Participant:

My name is Rebecca Blount. I am a graduate student in nursing at Mississippi University for Women, Columbus, Mississippi. I am interested in researching the impact of changing work shifts on insulin-dependent diabetics. To do this study, I need to follow and check blood sugar levels on insulin-dependent diabetics whose employment necessitates changing shifts compared with insulin-dependent diabetics who work strictly days.

As part of this study, blood sugar levels will be determined by a finger stick with a lancet everyday of each shift until a complete rotation has occurred. This will be done on site at your work area at no cost to you. Confidentiality and anonymity will be maintained at all times. The information collected will be reported as group data.

This signed form will serve as documentation indicating that you have had the opportunity to talk with me, Mrs. Blount, about the study. You may reach me at (205) 459-3644 if you have any questions. Please keep a copy of this letter for your record. You have the right to refuse to participate or to withdraw at any time up to data analysis without any jeopardy to your employment. Please sign below and date.

Participant's Signature: _____ Date: _____

Researcher's Signature: _____ Date: _____