

THE EFFECT OF SHIFTWORK ON DIETARY INTAKE AND PERSONAL  
HEALTH PERSPECTIVE OF NURSES

by

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## (ABSTRACT)

The purpose of this study was to determine if there are differences in dietary intakes and meal patterns, schedule satisfaction, and health satisfaction between nurses who work a permanent day shift (controls), and nurses who work alternate schedules. Subjects were selected from four hospitals: a large urban military hospital, a small military hospital located on a southern army base, a large southern community hospital, and a large southern university teaching hospital. One hundred and eighty full-time nurses were assigned to four schedule groups: Day, Evening, Night, and Rotating. Subjects completed a detailed survey regarding their work history, schedule and health satisfaction, meal patterns, and background, as well as a 24-hour dietary recall.

Nurses who worked permanent days were the most satisfied with their schedules, followed, in order of priority, by the Night, Evening, and Rotating shift groups. Day shift nurses were also the most satisfied with the way their schedule affected their health, followed by nurses in the Evening, Night, and Rotating shift groups.

There were no significant differences among the groups in nutrient intake although there were some differences in eating patterns. Nurses working the day shift ate more meals each day and more meals with their families. Rotating shift group nurses were more likely to skip meals. Nurses working the night shift ate more snacks per day and more snacks while at work. Nutrient analysis revealed that all four groups had intakes deficient in Vitamin D according to the RDA. Intakes were below the RDA for calcium, but only the Evening shift group was deficient.

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## INTRODUCTION

At least 10 million Americans do not work during the traditional daytime hours. Some industries use multiple shifts to meet production quotas, while others require extended hours to provide needed services. In the nursing profession, shiftwork is required to ensure constant patient care in hospitals.

The purpose of this study was to determine if the diets of nurses who are shiftworkers are different from the diets of nurses who are not shiftworkers. A questionnaire and 24-hour diet recall was used to collect demographic information and to evaluate the nutrient content as well as the regularity of meals of hospital nurses.

### The Importance of the Study

Many studies have been done on the effects of shift work on workers' health, family life, and work performance, but only a few have been done on the effects of shift work on the diets of these workers. Even fewer studies have been done on the effects of shiftwork on shiftworking women. Indeed, in several studies women are mentioned only in discussions of the effects of shiftwork on the wives of shiftworkers!

Like most professions that depend on shiftwork, the nursing field requires that most entry-level nurses start out rotating shifts or working the less desirable shifts, usually evening or night. As they gain seniority, nurses are able to transfer to fixed-shift schedules or to schedules that require rotating between more desirable shifts, such as day and evening. Many rural, military, government, and public hospitals depend on oscillating rotating shifts due to chronic staffing shortages.

The nursing profession is one of the few (some others are law enforcement and emergency medical care) that requires trained personnel or professionals with degrees to rotate shifts. The most common fields requiring shift work are "blue collar" and involve assembly line or factory work. The decision to require 24-hour shifts is an economic

one, usually to increase production by running the factory around the clock or to avoid the high start-up costs of machinery.

Nursing is a physically, emotionally, and intellectually demanding profession. Decisions made are often life-and-death, and the hours worked routinely exceed those scheduled. There are rarely scheduled meal times or breaks, and cafeterias and snack bars often close during the evening and night shifts.

Rotating shifts requires a worker to work when the rest of the world is sleeping, sleep when everyone else is awake, and eat meals at times that are at odds with one's digestive system. Many workers report that it is difficult to eat when one is working the night shift, or that they subsist on snacks and coffee.

Whereas most "day" workers eat breakfast before work or some kind of morning snack once at work, have a scheduled lunch break in the middle of the day and enjoy a dinner hour shared with family or friends, the shiftworker may eat only one or two meals a day. Due to the irregular hours, meals not eaten at work are often eaten alone.

Fatigue is a common complaint of workers who rotate shifts. It is difficult to sleep during the day due to environmental factors, such as street noises and daylight, and also due to the body's circadian rhythms which dictate that one sleeps at night and works and eats during the day. Also, even workers who work "permanent" nights must revert to a "day" schedule on days off which precludes the body permanently adjusting to a "night" schedule. For workers who rotate shifts the situation is more complicated because their bodies begin to adjust to one schedule just as it is time to take a few days off or switch to a new schedule.

The combination of fatigue, irregular hours, and a stressful work situation can make selecting and eating a balanced diet difficult. Therefore it is possible that the nurses who rotate shifts may be eating a diet less adequate than their co-workers who work a fixed shift. The purpose of this research was to determine if this is true.

## Hypotheses

The first hypothesis of this study was that the diets of nurses who rotate shifts would be different in nutrient content from those of nurses who did not rotate shifts. A second hypothesis was that the diets of nurses who rotate shifts would be less adequate than the diets of nurses who work a fixed shift. A third hypothesis investigated was that the job and health satisfaction levels of nurses who rotate shifts would be less than that of nurses who work a fixed shift. The study was limited to registered and licensed practical nurses employed full-time at hospitals.

## Definition of Terms

**SHIFT** shall refer to a length of time during which a person works. The Bureau of Labor Statistics (BLS) definitions of shift work were used (Akerstedt & Gillberg, 1981).

Shift systems can be continuous or semi-continuous. A hospital operates under a **Continuous System** which allows services 24 hours a day, seven days a week. This is generally achieved by scheduling three eight-hour shifts per day, with periodic changes in the specific days worked to provide weekend coverage.

**Day Shift** indicates the shift in which at least half of the hours worked fall between 8 A.M. and 4 P.M.

**Evening Shift** indicates the shift in which at least half of the hours worked fall between 4 P.M. and midnight.

**Night Shift** indicates the shift in which at least half of the hours worked fall between midnight and 8 A.M.

**Rotating Shifts** are those in which the workers are rotated periodically among the day, evening, and night shifts.

On **Oscillating Shifts**, workers usually alternate weekly between the day and evening shift or between the evening and night shift, while under a **Fixed Shift** system, a worker is on the same shift indefinitely.

**Diet** shall refer to a participants' entire intake of food and beverages for one work day.

## REVIEW OF LITERATURE

Over ten million people, or one in six, in the United States work other than traditional daytime hours (Hedges & Sekscenski, 1979). Other sources place the figure as high as 26% of men and 18% of women in the United States labor force (Gordon, Cleary, Parker, & Czeisler, 1986). The AFL-CIO estimates that in the last twenty years the number of shiftworkers around the world has doubled (Margolick, 1980). An undetermined number of workers rotate shifts. Although shift work has been fairly common in the United States for years, relatively little is known about the long-term effects on the health of workers, and even less is known about its effects on the diets of shiftworkers. Since diets have a direct and long-term effect on health, it is important to study the impact of shift work on the quantity and quality food intake.

Workers often speak of shift and night work as being unnatural. Workers complain of fatigue, loss of appetite, indigestion, and difficulties in sleeping (Cook, 1954). Folkard and coworkers (Folkard, Minors, & Waterhouse, 1985) place the problems caused by shift work into three interrelated domains: biological, medical, and social.

The biological problems relate to disturbances of the circadian rhythms present in most physiological functions, including the sleep/wake cycle. The medical problems include impairment of both subjective and objective health measures, such as appetite and digestive problems. Tasto and coworkers (Tasto, Colligan, Skjei, & Polly, 1978) have related the major medical problems associated with shiftwork to sleep, eating, and digestion. Social problems result from a conflict between the times available to a shiftworker for social (including family) activities, and the limited times during which these activities can be pursued.

For the individual shiftworker, these symptoms are often reflected in general feelings of malaise and may result in various consequences for both the individual and his employer (Folkard, Minors, & Waterhouse, 1985).

## Disruption of Circadian Rhythms

Humans are either genetically or by adaptation diurnal, that is day-oriented. We do not function at a constant rate over a 24-hour day, but rather exhibit regular and predictable changes in an oscillating fashion. Our biological clock dictates that we are active during the day and rest at night. This phenomenon parallels the regular 24-hour rhythm between day and night as the earth spins on its axis. Body functions are in a wave-like rhythm and are at optimal levels when the body is awake. The rhythm rises in the morning, peaks between noon and late afternoon or early evening, then begins to fall, reaching a low point between 2:00 and 5:00 A.M. before it begins to rise again. This pattern applies to body temperature, hormonal secretions, and even urine constituents. Most of us sleep when many of our body rhythms are at the lowest point in the cycle. The circadian rhythm of night workers is the reverse of day workers, featuring a 12-hour phase shift. (Glazner, 1991; Felton & Patterson, 1971).

Circadian variations resulting from shift work can be demonstrated by a number of bodily processes including temperature, pulse, blood pressure, urine flow, some blood constituents, and certain endocrine functions (Tasto, Colligan, Skjei, & Polly, 1978). Other researchers have noted that disruption of circadian rhythms can result in restlessness, nervousness, being awake or sleepy at inappropriate times, headaches, gastrointestinal irregularities, anorexia, fatigue, slower reaction time, error proneness, and lowered resistance to disease (Felton & Patterson, 1971). Adjusting to a disruption of circadian cycles may take anywhere from a few days to three weeks, or it may never occur.

### Shiftworkers Sleep Less

The loneliness of shiftwork is especially apparent when the worker must try to sleep during the day. Researchers have found that not only do shiftworkers sleep less, but they feel less rested upon rising.

Lee (1992) found that female nurses working night and rotating shifts had higher incidences of sleep disturbances and excessive sleepiness than nurses working day and evening shifts. Although permanent night nurses reported receiving too little sleep, when their hours of sleep for both work days and days off were calculated, they actually slept more hours than nurses in the day, evening, and rotating shift groups. However, there was an exception within this group. Younger nurses working permanent nights and rotating shifts slept significantly less than older women on permanent day or evening shifts. Day and evening shift nurses found it easier to fall asleep and maintain that sleep than night and rotating shift nurses. Nurses working nights and rotating shifts reported more difficulty maintaining wakefulness than nurses working day and evening shifts, and younger nurses had more trouble than older women. Matsumoto (1978) found that both time spent in bed and total sleeping time were significantly shorter for hospital nurses sleeping in the daytime than for those sleeping at night.

In a review article, Akerstedt (1988) noted that a fundamental observation from studies on shiftworkers has been that shiftworkers report more fatigue than day workers. Usually the fatigue is widespread on the night shift, rare on the evening shift, and intermediate on the day shift. It can also be demonstrated that fatigue increases upon starting shiftwork and decreases on leaving it.

Most workers are unable to sleep more than a few hours before the first night shift in a sequence, thus almost 24 hours may be spent awake before the first day sleep is taken. Consequently, the first night shift is often more affected by sleepiness than the subsequent night shifts. Further, sleep at home after the night shift is at least one-third shorter than normal night sleep. Although the shorter day sleep is usually attributed to higher noise levels during the day, even when this sleep is taken under optimal laboratory conditions it is shortened. It is the circadian rhythm that exerts the strongest influence (Akerstedt, 1988).

Akerstedt and Gillberg (1981) surveyed 2000 steel workers, policemen, train drivers, and meteorologists on conventional 3-shifts or irregular work hours about sleep

disturbances in connection with different shifts. Night shifts always caused more disturbances than day shifts, and night shifts were associated with difficulties maintaining sleep and feelings of not having been sufficiently restored. These survey results were corroborated by an EEG-study which found that the increased tendency to wake up around morning and noon is part of a general arousal rhythm. In other words, environmental disturbances do not seem to play the major role in day sleep difficulties.

While environmental factors may not be the most important factor in sleep disturbances, they clearly play a role for some. Margolick (1980) points out that some workers may lack the self-discipline necessary to resist daytime pastimes, and that rotating and night shifts are generally populated with younger workers who are more likely than their elders to sleep less, and consume more alcohol, caffeine, and tobacco. This results in all of the classic symptoms of chronic sleep deprivation, including fatigue and inefficiency. It has also been noted that sleep disturbances increase with age and shiftwork experience. EEG studies show middle-aged workers experienced more superficial sleep than day workers (Akerstedt, 1988; Lee, 1992).

Researchers have examined total sleep deprivation, performance, adjustment, and effects on the circadian rhythm. When subjects were deprived of sleep their body temperatures dropped and the individuals' circadian rhythm flattened (Glazner, 1991). Orton and Gruzelier (1989) found that after night duty resident physicians demonstrated a significant slowing in cognitive processing and a decline in reaction time.

It has been suggested that shift rotation should occur no more frequently than once a month. Consistently working nights and sleeping days can enable a worker to develop a new sleep-wakefulness rhythm and thus find it progressively easier to get restful sleep (Patterson & Felton, 1971).

Folkard and coworkers (Folkard, Condon, & Herbert, 1984) reported that 12% of night nurses surveyed claimed to have experienced "night nurse paralysis," a totally incapacitating paralysis that may be related to sleep paralysis. This paralysis normally occurs when the nurse is performing a sedentary task in the early morning hours. When

the nurse is suddenly required to make a gross motor movement, such as when responding to a patient, she finds that she is unable to move at all. This paralysis can last from a few seconds to thirty minutes, although 84% of the nurses reported it to be more than 2 minutes. More than half of the nurses who had experienced this said that they remembered feeling sleepier than normal prior to the paralysis. This syndrome was age-related, occurring primarily in nurses under age thirty, and increased over consecutive night shifts.

Although there are workers who adjust rapidly to new shifts, or who work a "permanent" evening or night shift schedule, few workers remain on a nocturnal routine on their days off. Therefore even "permanent" systems must be considered as "rotating" between periods of work and days off.

### Shiftwork and its Effects on Workers at the Workplace

The difficulties some workers have adjusting to shiftwork can affect their work performance as well as their personal lives. Workers who can adjust to shiftwork stay, while those who can't, leave almost immediately. Clinical evidence suggests that only a limited number of workers are able to sustain shiftwork. After one to four months of shiftworking, ten percent of workers suffer from fatigue, sleep disturbance, or other problems and leave. Older workers seem less able to adjust to shiftwork and are more likely than younger workers to leave (Glazner, 1991).

Several authors have found a relationship between shiftwork and job-related stress. Storlie (1979) has suggested that allowing nurses to choose their shift schedule would reduce stress. Shubin (1978) advocates limiting nursing shifts to eight hours to relieve stress and prevent burnout. Hood and Milazzo (1984), in a study of nurses working in hospitals, found a relationship between shift work and stress symptoms. Nurses working nights and rotating shifts reported migraine headaches, gastritis, and were more likely than others to complain of trouble balancing work and family life.

Coffey and coworkers (Coffey, Skipper, & Jung, 1988) have also studied the effects of shiftwork on job-related stress, as well as its effect on job performance. Overall job performance was highest for nurses on the day shift, followed by the night, afternoon, and rotating shifts. This corresponds with research reported by Tasto et al (Tasto, Colligan, Skjei, & Polly, 1978), who found that nurses on the rotating and afternoon shifts were the least satisfied with their job performance, followed by the night and day shift nurses. Rotating shift nurses experienced the most job-related stress, followed by the afternoon, day, and night shift nurses. The rotating shift is believed to be the most stress-producing because nurses must interact with a different group of people on each shift they work, and may have difficulties dealing with the unique procedures and routines of different units at different times.

Coffey (Coffey, Skipper, & Jung, 1988) also noted that nurses assigned to the day shift had the highest perception of their job performance, followed by the night, afternoon, and rotating shifts. This study supported their previous findings that job performance is lowest on the rotating shift. When circadian rhythms are disturbed, a worker's efficiency, productivity, speed, alertness and general job performance are reduced. While shiftwork has an initial impact on nurses' job performance, over time they become better adjusted to changes in their schedules, if they always work the same hours. Since rotating shiftworkers are constantly required to change their schedules, they are never able to fully adjust their body's circadian rhythms. This is reflected in lower job performance. Hence, a nurse's job performance may be lowered slightly when her circadian rhythms are disturbed. Nurses appear to be less satisfied with their job performance when they are working rotating shifts and their work schedules are constantly changing.

Studies (Gordon, Cleary, Parker, & Czeisler, 1986) have shown that night and rotating shiftworkers are at excessive risk for involvement in accidents and injuries on the job. The incidence of errors and accidents is higher during the hours between 4:00 and 6:00 A.M. than at any other time during the day.

Gold and coworkers (Gold, Rogacz, Bock, Tosteson, Baum, Speizer, & Czeisler, 1992) studied shift work, sleep, and accidents among 635 hospital nurses. Rotators and night nurses reported fewer hours of sleep on work days than nurses rotating between the day and evening shift. Of the day/evening nurses, 92.2% obtained anchor sleep regularly compared to only 6.3% of night nurses and none of the rotators. Rotators had more sleep/wake cycle disruption and nodded off more at work than day/evening nurses. Rotators had twice the odds of nodding off while driving to or from work, and twice the odds of committing an accident or error related to sleepiness. Rotators as a group were younger and less experienced than day/evening nurses.

Coffey and coworkers (Coffey, Skipper, & Jung, 1988) note that job performance of shiftworkers has been measured in terms of productivity as well as performance. Studies of men which have measured job performance in terms of productivity indicate that the day shift typically has a higher production rate than either the night or the evening shift, and that the quality of work performance parallels the worker's circadian rhythms. However, the researchers noted that there may be a difference between factory work and work in a hospital. The type of work performed in factories may vary little by shift, whereas in hospitals the type of work performed by nurses on each shift varies considerably. Further, the effects of stress on shiftworkers take on a special meaning in the hospital, since almost all nursing service personnel work on shifts. The actual effects of shift work on patient care are of great significance.

### Adjusting To Shiftwork

Folkard and Haines (1977) studied two groups of ten hospital nurses assigned to the night shift. The two groups were of similar age, and both had worked the night shift for approximately thirty months. The full-time nurses worked four consecutive nights while the part-time nurses worked two consecutive nights each week. Each nurse took two-hourly readings of a variety of measurements for four night shifts. Differences were

found between groups in the degree of adjustment in oral temperature, psychological well-being, and thermal comfort. No differences were found in the nurses' ratings of how alert they felt, or in their ability to carry out a verbal reasoning task. The part-time nurses showed no evidence of adjustment of their circadian rhythm in oral temperature. The full-time nurses showed indications of both short-term (i.e., even on the first night shift) and long-term adjustment to night work. The full-time, but not the part-time nurses showed evidence of some long-term adjustment to night work, but this adjustment was not complete in all the variables studied.

In a pair of studies comparing nurses assigned to the day shift, permanent night shift, and part-time night shift by Folkard, Monk, and Lobban (1978) the researchers noted the difference between the short-term adjustment that takes place over successive night shifts, and the long-term adjustment that facilitates short-term adjustment. Even when the potential for greater short-term adjustment was controlled for, the full-time staff showed greater adjustment to night work, even on the first of a period of successive night shifts, as well as from the first to the second night shift. It was suggested that these differences in long-term adjustment may reflect differences in the degree to which the nurses scheduled their lives towards night work. It was apparent to the researchers that the part-timers were scheduling their lives to a predominantly day-oriented activity pattern. The full-timers, on the other hand, were committed to a nocturnal way of life. Further, fewer of the full-timers had children living at home with them. The authors concluded that long-term adjustment of circadian rhythms to shiftwork can occur, but that prolonged experience at shiftworking is not enough to ensure that it will. Rather, adjustment results from a commitment to night work in the way in which people schedule their lives, and in particular their sleeping habits.

Similar results were reported in a pilot study (Adams, Folkard, & Young, 1986) performed to understand factors conducive to tolerance of shift work. It was noted that in addition to commitment to night work, having a routine was important. Nurses who were most successful at adjusting to night work surrounded themselves with a large

number of external cues (or zeitgebers), both by day and by night. The authors recommend that workers who are being counselled about night work should be told that even if their physiological and personality constitutions are favorable, they must be willing to adopt suitable time-disciplines.

In their review of trends in the literature, Folkard and coworkers (Folkard, Minors, & Waterhouse, 1985) have suggested that increasing the speed of the shift rotation may facilitate adjustment to shift changes. Ehret (1981) has proposed a diet to speed adjustment. His methods include the programmed timing of meals, drugs, exercise and sleep which he says are effective in accelerating the shifting of the activity phase of circadian rhythms in humans.

Minors and Waterhouse (1980) have proposed a method that would use sleep to stabilize circadian rhythms. Although most of their sleep-wakefulness routine would remain irregular, workers would sleep for several hours at a regular time each day, including days off. This period of sleep would be known as "anchor sleep."

Factors that may predict how an individual will adapt to shiftwork have been studied. One of these factors is "morningness," a tendency to perform better in the morning. Morning types can be identified by body temperature and responses to particular questions. Further, morning types strongly notice lack of sleep and do poorly on shiftwork. Another predictor of maladjustment to shiftwork is flexibility/inflexibility of sleep habits as well as drowsiness (Glazner, 1991).

### Disruption of Appetite

The disturbances of appetite during night work are most likely caused by the rapidly changing schedule, the sequencing of meals, and the disruption of sleep. One reason for this is that shiftworkers try to keep their normal eating habits during their changing work periods, as well as on the days between night shifts. For many workers on the night shift there is no time of day or night when they want a hot dinner: not

when they have just gotten out of bed (perhaps at 5:00 or 6:00 P.M.), and also not just before they leave for work (Cook, 1954).

Shiftworkers frequently complain of loss of appetite, a decreased enjoyment of meals, and disturbances of digestion and normal elimination of body wastes. Workers report that it takes them several days to adjust to new mealtimes when they change to night work. Twenty-seven percent of workers take from one to three days, 12% take four to six days, and 24% need longer than six days. However, when changing back to day from nights, 61% said they adjust at once (Sergean, 1971).

Mott and coworkers (Mott, Mann, McLoughlin, & Warwick, 1965) reported that 58% of shiftworkers say their appetite is worse on nights, and 75% say their schedules affect their appetites. Others (Rutenfranz, Knauth, & Angersbach, 1980; Wyatt & Marriott, 1953) have reported similar findings but point out that although shiftworkers may be unhappy about having to eat food that is often cold, and that has to be taken outside the accustomed social environment or at unusual times, these disturbances of appetite don't necessarily lead to a decrease in caloric intake.

### Shiftwork Affects Health

Shiftworkers frequently complain about a general malaise and fatigue, but severe health problems have been noted also. Akerstedt (1988) noted that shiftworkers experience an earlier occurrence of gastrointestinal disease than day workers, and that the incidence of myocardial infarction as well as cardiovascular disease in general, is related to the cumulative experience of rotating shifts.

Researchers have noted increased cholesterol levels among shiftworkers even after only short periods of night work. Some factors, such as energy intake or alcohol consumption, are known to increase triglyceride levels. Romon and coworkers (Romon, Nuttens, Fievet, Pot, Bard, Furon, & Fruchart, 1992) studied shiftworkers and day workers at three work sites in France to determine if there was a relationship between

shiftwork and serum lipid levels. Although dietary habits, including energy, carbohydrate, fat, protein, coffee, and sucrose intakes were similar, shiftworkers had significantly higher levels of serum triglyceride, while cholesterol and HDL cholesterol were similar. Day workers had higher alcohol intakes. The authors suggest two possible explanations. One is that shiftworkers routinely consume snacks at night and that their triglyceride removal may be less efficient during the night, leading to a higher triglyceride level. The other possibility is that a stress reaction due to shiftwork might induce hypertriglyceridemia. The authors note that shiftwork is associated with higher catecholamine levels. Catecholamines increase mobilization from adipose tissue of free fatty acids. These free fatty acids are then incorporated into triglycerides. During short-term stress, changes in plasma triglyceride levels have been reported, and it has been demonstrated that triglycerides increased in a simulated stressful work situation.

Several researchers (Pocock, Sergean, & Taylor, 1972; Angersbach, Knauth, Loskant, Karvonen, Undeutsch, & Rutenfranz, 1980; Colligan, Frockt, & Tasto, 1979) have noted an increase in absences due to illness (certified and uncertified) by night workers and workers rotating onto the night shift. These workers were also sick for longer periods of time and with more serious illnesses. The most frequent illnesses reported were gastrointestinal and neurotic disorders.

Angersbach and coworkers (Angersbach, Knauth, Loskant, Karvonen, Undeutsch, & Rutenfranz, 1980) found that more shiftworkers than day workers consulted their company's clinic about gastrointestinal complaints. Shiftworkers also had a higher rate of gastrointestinal diseases and more severe ones, such as peptic ulcers.

Costa et al (Costa, Apostoli, d'Andrea, & Gaffuri, 1981) also found a significantly higher incidence of gastroduodenitis and peptic ulcer in shiftworkers with night work and in permanent night workers. There was a higher incidence of peptic ulcers in subjects over 31 years old who had worked shift work for nine to sixteen years. Neurotic disorders (anxiety and depression) were found most in workers on permanent night work, especially during the first years of shift work, regardless of age.

Gordon and coworkers (Gordon, Cleary, Parker, & Czeisler, 1986) analyzed data from the National Center for Health Statistics National Survey of Personal Health Practices and Consequences to determine the impact of variable shift schedules on the health-related behaviors of the United States workforce. They found that male shiftworkers were more likely to be heavy drinkers and somewhat more likely to use digestion aids on a regular basis, while female shiftworkers were significantly more likely to be heavier drinkers, and to use sleeping pills and tranquilizers on a regular basis. Men and women who worked variable shifts were more likely to report a great deal of job stress and severe emotional problems. Even after adjusting for age, income, and education, shiftworkers experienced greater job stress and emotional problems. No differences were found in rates of heavy cigarette smoking or coffee drinking, or hours of daily sleep.

Kleitman (1963) has demonstrated that bodily functions take anywhere from four days to two weeks to adjust to a new routine. This may account for the higher frequency of upper gastrointestinal disorders among rotating shiftworkers whose oscillating schedule never allows complete adaptation.

Hood and Milazzo (1984) found that night workers consumed greater amounts of coffee, cigarettes, alcohol, and medicine than day workers. Rotators either drank a lot of coffee, or very little, perhaps because they were prone to gastritis. Those with acid stomachs would avoid coffee; those who could tolerate it drank it to stay awake. They point out that night workers usually expect a bit of gastritis so are less likely to complain of it than day workers. This could explain why simple comparisons of day and night workers fail to show any significant differences in health problems. Also, day shifts are often highly populated by older workers and former night workers who moved to days because of health problems. Those who cannot adjust to shiftwork leave almost immediately and those who can, adjust.

As workers age they become less able to adjust to shiftwork and eventually leave. Aging can also negatively impact adjustment to shiftwork. The adverse effects of

shiftwork can be cumulative, and there can be a general decline in the worker's health and ability to cope with stressors. Workers can also develop a tendency toward sleep fragility or "morningness" (Glazner, 1991).

Garfinkel and Stellman (1986) reported that 23% of nurses smoke cigarettes, and another 26% are former smokers. Smoking rates for nurses are consistently higher than those for physicians and dentists, and are slightly lower than that for the U.S. adult population as a whole, which is 30% (Olive & Ballard, 1992). Haughey et al (Haughey, Kuhn, Dittmar, & Wu, 1992), surveyed 299 Critical Care Nurses and found that approximately 20% smoked at least one-half pack of cigarettes per day, and 24% had smoked as long as 21 years.

Colligan and coworkers (Colligan, Frockt, & Tasto, 1979) also pointed out that studying only the number of sick days taken by shiftworkers gives a distorted view of the comparative health of shift and day workers as rotating workers seem to get sicker and to develop more serious health problems than fixed-shift workers. Also, to a certain extent, shiftworkers seem to accept transient physical symptoms as part of their job.

A worker's physical condition can affect night sleepiness. Akerstedt (1988) noted that when rotating shiftworkers improved their physical fitness through a training program overall fatigue and alertness improved.

### Impact of Shiftwork on Meal Patterns

Changing shifts or working non-traditional shifts, such as the evening or night shift, can challenge a workers' attempts to consume a balanced diet. Takagi (1972) studied the effect of shift work on the time and frequency of meals of factory workers. Mealtime was affected most by the evening and night shifts, resulting in a decrease of meal frequency among up to nearly half of the workers. Many tended to omit either breakfast or a midday meal, but to take the evening meal at the regular hours. Mealtimes were also affected by a change in shifts. Again, breakfast and lunch were more likely

than the evening meal to be affected in all types of shift rotations. Workers tended to change the frequency of meals per day, especially when working evening or night shifts, but when working the day shift they adhered to the three-meal custom. The reduction in the number of meals taken while working the evening or night shift could affect the quantity and quality of nutrients consumed.

In a study of the patterns of food consumption by shiftworkers and their perceived relationship to health, Reynolds and coworkers (Reynolds, Hodges, & Shifflett, 1987) found that rotating shiftworkers ate fewer and less frequent meals and snacks than workers on fixed shifts. Consumption of the meal eaten during the 6:00 to 11:00 P.M. time slot was least affected by shift work. Most shiftworkers followed their day shift eating pattern on non-working days. Ninety six percent of all workers noted a change in their eating patterns since they began working their current schedule.

Takagi, Koizumi, and Takagi (1967) noted that workers on the evening shift ate their richest meal of the day at noon, while families ate their richest meal in the evening. Day and night workers would be able to eat the evening meal with their families.

Sato and Takagi (1972) surveyed textile workers on their meal times and appetites. Female workers on the first shift (5:00 A.M. to 1:30 P.M.) were more likely to eat three meals per day than those on the second shift (1:30 to 10:00 P.M.). Although the second shift workers claimed to have better appetites, they frequently ate no breakfast or lunch. Japanese women were not permitted to work the third shift (10:00 P.M. to 5:00 A.M.). Of male workers on the third shift, 60% ate a meal at midnight. Over 50% ate four meals per day, but were able to dine with their families only once each day, at the evening meal.

In a study on the effect of shiftwork on canteen food purchases, Stewart and Wahlquist (1985) concluded that shiftwork has the potential to alter food intake patterns in ways that may be unfavorable to health. Often a worker's place of employment will operate a canteen or cafeteria only during the day shift. Evening and night workers must either bring food from home or obtain it from vending machines. Workers who

depended on food brought from home for their meals eaten at work ate relatively less energy-dense foods than workers who included canteen foods in their diets. Intake of energy-dense foods was lower on the day shift than on the afternoon shift, and lower on the afternoon shift than on the night shift.

Fisher, Rutishauser, and Read (1986) interviewed oil refinery workers on short rotation shifts and found that the differences in frequency of food use was related to differences in the foods available on the different shifts. For workers on the afternoon shift, the evening meal was replaced by a sandwich brought from home.

Pearson, Capps, and Axelson (1985) found that shift work did not affect the dollar value, quantity in pounds, or nutritive value of foods used at home, but point out that this means only that the nutrient levels of food eaten at home or from home food supplies are not affected by shift.

### Impact of Shiftwork on Family Life

Although women now make up over half of the American workforce (Lee, 1992), most still maintain traditional family roles and have primary responsibility for child care and household chores at home. For female workers this means a "double work day." Many sleep studies have been performed on male workers and male shiftworkers, but the results of these studies may not apply to women. Fatigue, which is often a symptom of disturbed sleep, is more prevalent among women compared to men. In her survey of sleep disturbances in female nurses Lee found that, regardless of shift schedule, more of the younger nurses reported disturbed sleep because of child care responsibilities.

In many cases shiftwork proves incompatible with family demands. Mott (1976) noted that the attitudes of family members had a strong effect on the worker's ease or difficulty coping with shift work. Similarly, much of the problems coping with shift can be transferred to spouses and children.

Charles and Brown (1981) noted that the adjustment problems of female

shiftworkers are compounded when no concessions are made for problems which men do not have (such as menstrual problems and family responsibilities). Women with families meet the needs of their children at the expense of their own well-being. Women in this study reported that their sleep is the first thing to go if their children need anything. The need to look after their children in addition to working took precedence and their own problems were regarded as an unpleasant but unavoidable fact of life. Women work nights within the existing structure of the family; when men work nights the family structure adjusts around their schedule. Women bear the brunt of the contradiction between women's paid work outside the home and their unpaid work within it.

### Impact of Shiftwork on Family Meal Patterns

Several researchers (Sergean, 1971; Pearson, Capps, & Axelson, 1985) have studied shiftwork as it relates to nutritional status and food intake, and also the functioning of the family. The shiftworkers' family must adjust mealtimes, and the shiftworker must adjust his/her family role responsibilities. There are certain shifts that require that more meals be taken alone rather than with the family, and this may result in the consumption of meals that are less adequate nutritionally or eaten more hurriedly.

Maurice (1975) interviewed workers on a three-shift system, and found that 45% of those on the night shift ate with their families at the two main daily meals (lunch and dinner), even though this required the worker to break his sleep to be present at lunch. Twenty five percent of workers on the afternoon shift took no meals with their families.

In a study of shiftworking nurses, the number of meals eaten with family and friends was significantly higher among those on the day shift, and lowest among nurses on the afternoon shift and rotators (Tasto, Colligan, Skjei, & Polly, 1978).

## Nutritional Status of Shiftworkers

Since shiftwork can affect the meal patterns of shiftworkers, it follows that nutritional status may also be affected. Several researchers have studied the nutritional status of shiftworkers.

Debry et al (Debry, Barbier, Girault & Lefort, 1969) interviewed 200 male day workers and rotating shiftworkers. While on the day shift, workers ate the customary meals, usually with their families. Workers on the afternoon or night shift often went to bed when they got home without eating, and some of the night shift workers slept through the lunch hour. Food eaten outside of the families' mealtimes tended to be reheated and eaten quickly. Meals consumed on night shifts and days off were lacking in protein and carbohydrate, and high in fat. Energy intake from alcohol as a proportion of the total caloric intake was higher in rotating shiftworkers.

Froberg (1980) found that the appetites of workers on night shifts were diminished, and that very few night workers took a full meal on their break. Nutritional analysis indicated that their food habits were satisfactory, and equivalent to those of the average Swedish population.

Maxwell and Robitaille (1980) examined the nutritional status of industrial shiftworkers and found that 19% had diets that were adequate according to Canada's food guide. Workers on the night shift had higher nutritional intakes than those on other shifts.

Debry and coworkers (1969) on the other hand, found that the diets of night workers at a chemical factory were the least adequate. Although day workers usually ate the customary meals with their families, workers on the evening and night shifts often came home and went to bed without eating. Some night shift workers slept through the lunch hour. It has also been noted (Maxwell & Robitaille, 1980; Tasto, Colligan, Skjei, & Polly, 1978) that rotating shift workers drank significantly more alcohol than workers on other shifts.

Haughey and coworkers (Haughey, Kuhn, Dittmar, & Wu, 1992) surveyed critical care nurses about their dietary habits. Less than half (42%) reported eating breakfast every day, and a similar number (42%) reported eating between meals almost every day. More than half (54%) either did not drink coffee or drank two cups or less each day. Approximately 57% reported eating a variety of foods, but smaller numbers limited fat (40%), salt (48%) and sugar (41%). Forty-three percent of the nurses engaged in physical exercise on a regular basis. Twenty-six percent of the nurses abstained from drinking alcoholic beverages, 24% drank less than once a week, 42% drank once or twice a week, and 8% drank alcoholic beverages more than twice a week.

Much of the research on the diets and eating patterns of shiftworkers has been done on "blue-collar" males. A study of shiftworking nurses, a group that is female, educated and working in the health-care field where they would presumably be more aware of the importance of diet would contribute to our knowledge of alterations in meal patterns and the impact on nutritional status and health of shiftworkers. Questions posed would include whether their diets differ from those of their fixed-shift colleagues, and whether shift-working nurses make more of an effort to overcome the stresses and scheduling conflicts of shift work to consume a balanced and adequate diet. The purpose of this study is to examine these questions.

### The 24-Hour Diet Recall

The 24-hour recall has been one of the standard research instruments used in dietary studies as it requires less time, money, and subject cooperation than other dietary assessment techniques. The use and application of this method has been studied over a period of years, and its accuracy has been validated by several researchers (Linusson, Sanjur, & Erickson, 1974; Greger & Etnyre, 1978; Stunkard & Waxman, 1981).

Linusson, Sanjur, and Erickson (1974) compared the quantity of food consumed

(by weighing) with food recalled during an interview and found that the 24-hour recall was fairly accurate in estimating average intake for groups, but not for ascertaining quantity of food consumed. For all food groups there was a tendency to overestimate actual intake when consumption was low and underestimate it when it was high.

Krall and Dwyer (1987) surveyed nineteen volunteers participating in a metabolic study. They compared food frequency questionnaires and 3-day food diaries with the known values of the menu. In both the questionnaires and the diaries the foods omitted by the respondents tended to be those eaten in small amounts, so the estimates of calories and nutrients provided were not greatly affected. They also found that younger women had the best recall.

### Factors Affecting Accuracy

#### Number of Days

Many researchers have compared 24-hour dietary recalls with diet histories and records over longer periods. Marr and Heady (1986) found that the number of days of survey required for 80% accuracy for individuals ranged from two to three days for dietary components such as sugar or total carbohydrates, to two or three weeks for dietary cholesterol or fatty acids. A 24-hour recall was not 80% accurate for any nutrients for an individual.

Jackson and coworkers (Jackson, Dujovne, DeCoursey, Beyer, Brown, & Hassanein, 1986) analyzed the diet records of 18 outpatients to determine the minimum number of daily diet records that would be reliable for monitoring dietary adherence. It was found that seven consecutive days of food recording would meet a 95% confidence limit, but four consecutive days would be acceptable as a reasonable compromise for minimal, reliable monitoring. The authors agreed that a 24-hour recall is practical and adequate for surveying large groups for dietary trends, but when used to assess usual dietary intake of single subjects or small groups of subjects, large day-by-day variations

in individual food intake patterns may result in erroneous assumptions.

### Groups

Block (1982) voices the concern that 24-hour recalls may not adequately represent the usual intake of an individual over an extended period of time. It's value is in assessing the average intake of a group. Clear relationships have been shown between reported and weighed group mean values, and it has been demonstrated that group mean values do not vary significantly from day to day. Thus, the value of the 24-hour recall in estimating the average intake levels of groups seems to be reasonably well established.

Medlin and Skinner (1988) reviewed dietary intake methods and agreed that the 24-hour recall is a good method to determine food intake of groups. They state that even a one-day recall has been shown to be accurate for groups, and that self-reported data may be more accurate than researchers had thought. Furthermore, women are more accurate than men in reporting.

Chalmers and coworkers (Chalmers, Clayton, Gates, Tucker, Wertz, Young, & Foster, 1952) point out that a recall may more accurately reflect intake than a dietary record, since keeping a record may prompt subjects to alter their normal diet. If this is an important consideration, Young and coworkers (Young, Hagan, Tucker, & Foster, 1952) have stated that the 24-hour recall can be substituted for even a seven-day record under certain conditions. Citing the expense in time, money, and personnel, they showed that a one-day record or recall is most efficient when the relative importance of the number of days is compared to the number of subjects. For small groups it is possible to increase precision by increasing the number of days in the survey.

Karvetti and Knuts (1985) compared recalled and observed food and nutrient intake for 140 subjects, 15 to 57 years old. They concluded that validity was satisfactory on the group level but unsatisfactory on the individual level. They found that omissions, additions, and misidentifications of foods consumed were the major sources of error in their subjects' lists of recalled food items. Commonly consumed food items were easy

to recall, and less frequently consumed food items or side dishes were often forgotten. Omissions were more frequent than erroneous recalls. But the group means were generally rather good because the underestimations and overestimations canceled each other. They found that the most accurate recalled intakes were obtained from the 35 to 44 year-old age group. Within this age group women were more accurate than men.

### Group Size

Young et al (Young, Hagan, Tucker, & Foster, 1952) recommended a group size of fifty or more when choosing the 24-hour recall over the more time-consuming seven-day record for describing the mean intake of a group as a whole. However, in their study the seven-day record and the 24-hour recall gave approximately the same estimates for dietary intake even with a group of only 28.

Gersovitz and coworkers (Gersovitz, Madden, & Smiciklas-Wright, 1978) observed that, with group sizes of 31 and 34, both the 24-hour recall and the seven-day record provided accurate estimates of the mean intake. Regression validity suggests that the recall is prone to over-reporting low intakes and under-reporting high intakes, a pattern known as the "flat-slope syndrome." This can result in a downward bias in the number of subjects with extremely low and extremely high intakes, which results in a false negative, i.e., failing to detect an actual difference between groups. They also caution that many participants drop out or fail to accurately complete a seven-day record.

## Research Questions

Based on the research described in the review of the literature, the following research questions were tested:

- 1.) Are the job satisfaction and health satisfaction levels of nurses who rotate shifts less than those of nurses who work fixed shifts?
- 2.) Are the diets of nurses who rotate shifts different in nutrient content from those of nurses who do not rotate shifts?
- 3.) Are the diets of nurses who rotate shifts less adequate than the diets of nurses who work fixed shifts?

## METHODOLOGY

Nursing administrative departments of eight selected hospitals, two military and six private, were contacted for participation in this research project. All except one were interested and supportive of the project, but four private hospitals either did not have a research protocol in place or had no means of retrieving nurse names according to schedule from their computer data base. Therefore, this research involved surveying nurses from four hospitals: a large military hospital, a small military hospital, a rehabilitation unit associated with a large southern community teaching hospital, and a large southern university hospital.

The subjects for this study were four groups of female nurses employed full-time at the four hospitals. Nurses working a fixed day schedule were assigned to the Control group, or Day Group. Nurses who worked fixed evening, night shift, or rotated between two or more shifts were assigned to the three experimental groups, Evening, Night, and Rotating, respectively.

### Selection of Population Sample

#### Hospitals and Subject Selection

Hospital A, located in Washington, D.C., was the largest hospital involved in this study. This military hospital had 828 beds and 647 nurses. Upon approval by the hospital's Research Review Board, the Office of Nursing Research provided the names of all nurses as they appeared on the ward schedule logs.

The nurses were assigned to one of two groups. The control group consisted of eighty nurses, selected from a pool of 160 nurses, who worked a permanent day shift. To select these nurses, the hospital's roster of supervisory nurses and the ward schedule logs were used. Starting with the list of supervisory nurses and then moving, in random order, to the ward rosters, a list was made of all of the nurses who worked a permanent

day shift. Starting in the center of the list, every second nurse was selected. Male nurses were rejected and replaced by the nurse whose name was listed next. Nurses in this group were primarily administrative, supervisory, and care-giving clinic nurses.

The experimental group consisted of eighty care-giving nurses, selected from 487 nurses, the majority of whom alternated between two or more shifts. Although there were some nurses within this group who were permanently assigned to a Night or Evening shift, it was not possible to know that when subjects were being selected. The majority of these nurses rotated between shifts. To assure that a representative sample of all of the nurses would be selected, a list of all the rotating shift nurses was compiled using the following system: first the names of nurses whose names were first on the ward schedules were listed, followed by the names of the nurses listed second, followed by the names of the nurses listed third. Finally all of the remaining nurses were listed by ward. From this list of nurses, every sixth name was chosen for the study, starting halfway through the list.

Male nurses were rejected and replaced by the nurse whose name was listed next. As the nurses were selected, they were given a numerical code (1 - 160) to identify returns of questionnaires and dietary recalls.

Hospital B is a small military hospital located on an army base in northern Virginia. The hospital had 120 beds and 53 nurses. After the study was approved by the hospital's Nursing Research Committee, the Nursing Education and Staff Development office provided the names of all full-time nurses as they appeared on the ward schedule logs. The same procedure was followed for selecting control and experimental subjects as with Hospital A with the following exceptions.

Fifteen nurses were assigned to the control group from a total of twenty-three administrative and supervisory nurses. To select nurses for the control group, a list was made of all of eligible nurses. Starting with the first name on the list, every second nurse was selected, resulting in eleven nurses. From the remaining names, every third name was selected until a total of fifteen nurses had been assigned to the control group.

Fifteen nurses also were assigned to the experimental group from the remaining ward nurses. These nurses, who rotated between shifts, were assigned to three groups according to whether their duties that week were on the Day, Evening, or Night shifts. Five Experimental group nurses were selected from a pool of twelve working the Day shift that week by starting with the second name on the list and choosing every second name. Five nurses were chosen from a pool of ten nurses working the Evening shift and five from a pool of eight working the Night shift that week by using the same method. Each nurse was assigned a numerical code, ranging from 400 to 418. This code was copied onto the survey and dietary recall.

Hospital C was actually a small rehabilitative unit associated with a large community teaching hospital in Alabama. This separate unit employed approximately ninety-three nurses. All contact with this hospital unit was made by telephone or by mail.

After the study was approved by the Institutional Review Committee, the nursing administration provided a list of nursing staff members. The nursing administration did not wish to exclude any nurses, so all staff members were invited to participate. The researcher spoke frequently with the nurse administrator, and followed up on mailings throughout the data collection period.

Nurses at Hospital C selected their own schedules using a computerized scheduling system. Subjects were assigned to the control group or experimental groups according to the schedule they worked. Bureau of Labor Statistics (BLS) definitions were used to assign nurses to study groups. Male responses received were not included in the study. Each nurse was given a numerical code (161 - 253) which was copied onto the questionnaire and dietary recall.

Hospital D is a large teaching medical hospital located in central Virginia. One small unit, the Health Sciences Center which employed 132 nurses, agreed to participate in this study. All contact with this hospital unit was made by telephone or by mail. The researcher spoke frequently with the Health Sciences Center's supervisory nurses

throughout the data collection period. Nurses who worked permanent day shifts were assigned to the Control group. The subjects were assigned to the Evening, Night, and Rotating shifts according to the schedule they were working during the period of the study. Each nurse was given a numerical code, 254 - 386, which was copied onto the questionnaire and dietary recall.

## Subjects

### Schedule Groups

In an attempt to recruit nurses, hospitals are offering more flexible scheduling systems. Some hospitals are offering a compressed work week, in which a nurse gets paid for 40 hours but works three twelve-hour shifts. Other hospitals require nurses to work four ten-hour shifts. At Hospital C, nurses are allowed to work seven consecutive days, then take seven days off. For this reason, nurses were considered full-time if they worked at least 36 hours. To participate in the study, the nurses were required to be on-duty during the period that the study took place. Descriptive and demographic data on the sample groups were collected by questionnaire.

### Control Group

The control group consisted of female nurses who were permanently assigned to the day shift. The specific days they worked did not matter: they could work a permanent schedule or the days could vary from week to week. In order to consolidate the various schedules offered by the hospitals in this study, the BLS definitions were applied. Thus, nurses working a twelve hour shift from 7:00 A.M. to 7:00 P.M. were assigned to the day shift and included in the control group.

### Experimental Groups

The experimental groups consisted of nurses whose schedules fell into three groups: fixed evening, fixed night, or rotating. At the military hospitals the evening shift began at 3:00 P.M. and ended at 11:00 P.M. The night shift began at 11:00 P.M. and ended at 7:00 A.M. Nurses who worked a twelve hour shift, from 7:00 P.M. to 7:00 A.M. were assigned to the night shift.

Nurses who rotated shifts were female nurses who rotated between two or more shifts. Although their shift could change, it was possible that the days they worked each week could be fixed.

### Hospital Involvement

To encourage participation at Hospital A, the Nutrition Directorate and the Office of Nursing Research announced the study at all nursing staff meetings before the study began. As the surveys, postcards, and follow-up packets were distributed, electronic mail messages were sent weekly to all ward and charge nurses. At staff meetings, supervisors were asked to encourage participants to return their questionnaires. A member of the Nutrition Directorate and a member of the Office of Nursing Research were designated as contacts within the hospital for participants with questions. Nurses were able to ask questions and have them answered over the hospital's electronic mail. The hospital representatives relayed questions to the researchers on behalf of participants.

At Hospital B, the Nursing Education and Staff Development office actively encouraged participation in the study and acted as a liaison between the participants and researchers. At Hospitals C and D the nursing administration also encouraged participation in the study and followed up on staff questions with the researchers.

## Assumptions

The participating nurses were provided detailed written instructions for the questionnaire and the dietary recall. For the purpose of this study, it was assumed that the subjects followed instructions in completing the questionnaire and the dietary recall and that their answers were accurate.

Certain answers to the questionnaire required adjustments. When nurses gave a range for the number of hours worked in a week instead of an exact number, the average was used (40-46 hours per week became 43 hours per week). This method was used for all answers requiring a fixed answer when a range was given by the respondents.

Assumptions were also made in coding the 24 hour dietary recall. When "milk" was listed, it was assumed to be whole milk. Others assumptions included: "bread" was assumed to be white bread, "cereal" was coded as Kelloggs Cheerios, "cheese" was coded as American cheese, "juice" was coded as orange juice, and "cola" was assumed to be regular cola, not diet cola.

## Data Collection

### The Survey

A questionnaire with three major sections was developed. Questions requested information pertaining to: 1.) the subjects' schedule, satisfaction with their schedule, related health factors, and diet; 2.) descriptive data; and 3.) a 24-hour dietary recall to record their food intake.

The survey packets for each subject contained a personal cover letter (Appendix A) explaining the study and inviting them to participate, and a volunteer consent form (Appendix B) to be signed and returned. The names and phone numbers of the researchers and at least one contact point at the hospital were given in the cover letter and the consent form. One hospital requested that the Volunteer Agreement Affidavit

it uses for research conducted at the hospital be used (Appendix C).

The questionnaire (Appendix D), printed on yellow paper, was designed to take no more than 20 minutes to complete; most of the questions required that the respondents simply circle or check the correct response.

The questionnaire's first section requested information about work and shift work history. Another series of questions focused on current schedule, shift changes over last four weeks, and adjustment periods. Other questions focused on physical changes resulting from shift work, general health complaints, and general satisfaction with schedules. Likert scales were used to find levels of satisfaction and beliefs about schedules and health practices. The last section of the questionnaire requested descriptive information such as age, marital status, number of children, and household income of the subjects.

Detailed written instructions for completing the 24-hour dietary recall (Appendix E) as well as a sample 24-hour diet recall (Appendix F) were included in the survey packet. Directions requested specific food descriptions such as the use of brand names whenever possible, the exact amounts, and portion size of all foods.

The nurses were instructed to complete the 24-hour dietary recall (Appendix G) on a day when they were working. The number of meals, snacks, and beverages consumed were recorded. Instructions and helpful hints for accurate recordings of the food items were also included at the top of the first page of the 24-hour recall form.

The participants were provided with a stamped, self-addressed envelope to return the completed forms. The final form included in the packet was a "check-off sheet" (Appendix H) to assist the subjects in returning the completed survey. Respondents were instructed to return the questionnaire, 24-hour dietary recall, and consent form. A summary of the results of the study was offered to all participants. To assure anonymity, they were instructed to write their name and address on the back of the enclosed envelope if they desired a copy of the results. When the surveys were received, the envelopes were separated from the questionnaires.

### Distribution of Questionnaires

At Hospital A the survey packets were taken by the researcher to each ward and given directly to the participants, their supervisors, or if neither were there, left for the subjects in their mail boxes. At Hospital B a member of the Nursing Education and Staff Development office delivered the survey packets to each nurse. The survey packets were mailed to the nursing administration of Hospitals C and D. At Hospital C the surveys and correspondence were attached to paychecks of the participants.

Two weeks later brightly colored reminder postcards (Appendix I) were delivered to participants at Hospitals A and B who had not yet responded. At Hospitals C and D the postcards, which had been delivered to the hospitals with the survey packets, were distributed by the administrative personnel to all subjects according to a predetermined schedule. As was the case with the cover letters in the original packets, these postcards were addressed to each nurse by name and signed by the researchers.

Six weeks after the postcards were delivered, complete questionnaire packets again were delivered to nurses who had not returned their questionnaires. These packets contained a personal letter (Appendix J) asking again for the nurses' participation. Hospital B was used as the pilot for the study so no follow-up packets were distributed there. (Since only one survey question was changed, the pilot group was added to the study.) Upon receipt of the completed survey, nurses were sent a thank you note (Appendix K).

### Analysis of the Data

Data from the questionnaires and 24-hour recalls were analyzed to determine if there were differences in satisfaction with schedule, health factors, and diet among nurses with permanent schedules and nurses with rotating schedules.

Schedule satisfaction was determined using a Likert Scale. A numerical score

ranging from 15 to 60 was assigned based upon the summation of 15 schedule satisfaction questions. Low scores (30 or less) indicated satisfaction, with a score of 15 being the most satisfied. High scores (45 or above) indicated dissatisfaction with the schedule.

A second scale was used to analyze perceived health conditions relative to shifts worked. A numerical score ranging from 13 to 52 was assigned based upon the summation of 13 health questions. High scores (39 or above) indicated satisfaction with health status. Low scores (26 or less) indicated dissatisfaction with health status, with a score of 13 being the least satisfied.

Group differences in the summated scores were determined by performing an Analysis of Variance and Multiple Comparison Procedures on the group means. Responses to individual questions were assessed using a Chi-square procedure (or when needed, a Mantel-Haenszel Chi-square procedure) to determine differences among the schedule groups.

To assess any physical changes noted according to the shift worked, an Anova and Multiple Comparison Procedure was completed comparing the day, evening, and night shifts successively with the rotating shift. Individual questions pertaining to topics such as smoking, amount of exercise, annual physicals, alcohol consumption, perceived stress, and personal characteristics, were assessed using a Chi-square to determine differences by schedule groups.

Diets were calculated using the Nutritionist IV Version 2.0 dietary computer program. The average daily intake was compared with the latest Recommended Daily Allowances (RDA, National Research Council, 1989) to determine adequacy of the following nutrients: protein, vitamin A, vitamin D, vitamin C, thiamin, riboflavin, niacin, vitamin B-6, vitamin B-12, calcium, phosphorus, magnesium, iron, and zinc. Intake of fat, carbohydrate, and cholesterol was compared to the U.S. Dietary Guidelines (Dietary Guidelines Committee, 1985).

Analysis of Variance procedures were performed to determine if there were

differences in intake among the schedule groups. To determine whether the mean intake of each nutrient was significantly different from the RDA, a T-test that compared group means against the RDA for each nutrient was calculated.

Additional questions that address diet were analyzed to determine differences among nurses with rotating schedules and nurses with permanent schedules. For questions with categorical responses, (e.g., time of eating, adjustment periods, skipping meals, location of eating), Chi-square analyses were conducted. For questions without categorical responses (e.g., number of meals, snacks, beverages), analyses of variances were completed.

Demographics and questions addressing scheduling were analyzed to determine differences among groups using Chi-square analyses. A profile of the nurses in each group was assessed.

### The Pilot

The pilot study was conducted at Hospital B. Thirty nurses, equally divided into control and the three experimental groups, were surveyed. The results of the questionnaire and dietary recall were calculated and analyzed. Only one question on the survey, pertaining to beverages consumed each day by the participants was reworded following the pilot study. The question originally asked the subjects how many beverages they drank each day. While some nurses listed the various beverages, others simply gave a numerical answer, i.e. "four." For the study this question was changed to ask the identity of each beverage consumed. Because the changes in the questionnaire and dietary recall did not require significant alterations, and because the selection of subjects for the pilot was similar to the other data collections, it was determined that the nurses who participated in the pilot study were no different from the other subjects and were added to the major study.

## RESULTS

### Responses

Of the questionnaires distributed to the 416 R.N.s in the four hospitals, 202 were returned for a 49% return rate. Of these, twenty-two were rejected (six respondents were male, thirteen worked less than 36 hours per week, one respondent was not a nurse, and two questionnaires were incomplete) resulting in 180 useable surveys or a 43% return. The return and completion rates ranged from 34% to 63% by hospital (Table 1).

Table 1. Survey Returns by Hospital.

Hospitals	Surveyed	Responded		Used	
	No.	No.	(%)	No.	(%)
Hospital A	160	81	(51)	78	(49)
Hospital B	30	19	(63)	19	(63)
Hospital C	93	45	(48)	38	(41)
Hospital D	133	57	(43)	45	(34)
Total	416	202	(49)	180	(43)

### Description of Subjects

Of 416 nurses surveyed, 180 female nurses returned useable surveys. Seventy-nine percent (142) of the respondents were registered nurses, while 15% (27) participants were licensed practical nurses (Table 2). Although significantly more nurses from each schedule group were registered nurses, the Evening shift group had the fewest registered nurses of the four schedule groups (56%, 10), while the Rotating shift group had the most (87%, 45).

Table 2. Educational Level and Employment Status of Subjects

Subjects	Shift Groups							
	Day N=81		Evening N=18		Night N=29		Rotating N=52	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
<b>Degrees Earned</b>								
RN	65	(80.3)	10	(55.6)	22	(75.7)	45	(86.5)
LPN	13	(16.1)	4	(22.2)	5	(17.2)	5	(9.6)
Nursing Assistant/LPN Certificate	3	(3.7)	6	(33.3)	1	(3.6)	3	(5.8)
High School/GED	11	(13.6)	4	(22.2)	7	(25.9)	5	(18.5)
Associates Degree/Diploma in Nursing	12	(14.8)	2	(11.1)	9	(30)	7	(23.3)
BS/N	23	(28.4)	4	(22.2)	7	(11.3)	28	(45.2)
MS/N	31	(38.3)	2	(11.1)	4	(14.3)	9	(17.3)
<b>Employment</b>								
Military	38	(47.5) <sup>a</sup>	2	(11.1)	3	(10.3) <sup>a</sup>	21	(40.4)
Civilian	42	(52.5) <sup>b</sup>	16	(88.9)	26	(89.7) <sup>b</sup>	31	(59.6)

<sup>a, b</sup>  $P \leq 0.0001$  (Mantel-Haenszel Chi-square)

Sixty-four percent (115) of the nurses were civilian nurses; thirty-six percent (64) were military nurses. Few (two and three subjects, respectively) of the nurses working permanent evening and night shift schedules were in the military. The Day shift group was almost equally divided between military and civilian nurses, whereas almost twice as many of the Rotating shift group nurses were civilian. Differences in employment status were significant at  $P \leq 0.0001$ , with observations being different than expected for the Day and Night shift groups. More nurses from the Day shift group than expected

were in the military whereas fewer nurses from the Night shift group were in the military than would be expected. Employment status is shown in Table 2.

### Educational Levels

The nurses were asked to relate the highest educational degree they had earned. Most of the subjects (34%, 60), held bachelor of science in nursing degrees. Twenty-two percent (39) held masters of science in nursing degrees. Thirty-eight percent (31) of Day shift nurses had advanced degrees, including one nurse with a Ph.D. Thirty percent (9) of the Night shift group nurses were diploma nurses (associate degrees in nursing) compared to 15% (12) of the Day shift group nurses, or 16% (30) of the entire group surveyed. These differences were not significant.

Some interesting trends were noted within the schedule groups. Of the Day shift nurses, the greatest number (38%, 31) had earned master's degrees; the largest group within the Evening shift (33%, 6) was the nurses who had earned nursing assistant or licensed practical nurse certificates. The greatest number of Night shift group nurses (30%, 9) were diploma nurses; the greatest number of Rotating shift nurses (45%, 28) had earned bachelors degrees. Degrees earned by group are listed in Table 2.

### Age

The Day shift group was the "oldest" of the four schedule groups, and the Rotating shift group was the "youngest." Only 7% (6) of the Day shift group nurses were in their twenties compared to 46% (24) of nurses from the Rotating shift group (Table 3). Most (46%, 37) Day shift nurses were in their forties and another 38% (31) were in their thirties. One-third (17) of the Rotating shift nurses also were in their thirties. Two-thirds of both the Evening (67%, 12) and Night shift group (69%, 20)

nurses were between thirty and fifty. No more than 11% of any schedule group (Day: 9%, 7; Evening: 11%, 2; Night: 10%, 3; Rotating: 2%, 1) had nurses age 51 years or older. A Mantel-Haenszel Chi-square calculation showed the differences in age to be significant at  $P \leq 0.0001$ . Differences were noted for the Day and Rotating shift groups in both the twenty and forty decade age groups. The Day shift group had more nurses in their forties and fewer in their twenties than expected, whereas the Rotating shift group had more nurses in their twenties than expected.

### Family Life

Sixty percent (108) of the nurses were married; 25% (45) were single. Thirteen percent (24%) were divorced and 2% (3) were widowed. Two times as many Rotating shift group nurses were single as those in the Day shift group. A Mantel-Haenszel Chi-square procedure showed significant differences ( $P \leq 0.05$ ) from expected values for the married and single nurses categories in the Day and Rotating shift groups. The Day shift group had more married nurses and fewer single nurses than expected, while the Rotating shift group had fewer married nurses and more single nurses than expected (Table 3).

Almost two-thirds (64%, 116) of the subjects surveyed had children. A significant difference existed ( $P \leq 0.01$ ) from expected values for the Rotating group, but not the other three, as to the presence of children in the household. Only 44% (23) of Rotating group nurses had children, compared to 73% (59), 72% (13), and 72% (21), of the Day, Evening, and Night shift groups, respectively (Table 3).

Table 3. Age, Marital and Family Status of Subjects

	Shift Groups							
	Day (N=81)		Evening (N=18)		Night (N=29)		Rotating (N=52)	
	No.	(%)*	No.	(%)*	No.	(%)*	No.	(%)*
<u>Years of Age:</u>								
20 - 30	6	(7.4) <sup>a</sup>	4	(22.2)	6	(20.7)	24	(46.2) <sup>a</sup>
31 - 40	31	(38.3)	6	(33.3)	13	(44.8)	17	(32.7)
41 - 50	37	(45.7) <sup>a</sup>	6	(33.3)	7	(24.1)	10	(19.2)
51+	7	(8.6)	2	(11.1)	3	(10.3)	1	(1.9)
<u>Marital Status:</u>								
Married	58	(71.6) <sup>b</sup>	13	(72.2)	16	(55.2)	21	(40.4) <sup>b</sup>
Single	10	(12.4) <sup>b</sup>	4	(22.2)	8	(27.6)	23	(44.2) <sup>b</sup>
Divorced	11	(13.6)	1	(5.6)	4	(13.8)	8	(15.4)
Widowed	2	(2.5)	0		1	(3.5)	0	
<u>Children:</u>								
Infants (up to age one)	4	(4.9)	1	(5.6)	1	(3.5)	4	(7.7)
Age 2-4	9	(11.1)	2	(11.1)	4	(13.8)	6	(11.5)
Age 5-10	20	(24.7)	3	(16.7)	6	(20.7)	6	(11.5)
Age 11-15	23	(28.4)	3	(16.7)	8	(27.6)	7	(13.5)
Age 16-21	22	(27.2)	4	(22.2)	9	(31)	4	(7.7)
Ages 21 and over	21	(25.9)	5	(27.8)	8	(27.6)	6	(11.5)

\* Percentages may not add up to 100% due to rounding.

<sup>a</sup>  $P \leq 0.0001$  (Mantel-Haenszel Chi-square).

<sup>b</sup>  $P \leq 0.05$  (Mantel-Haenszel Chi-square).

<sup>c</sup>  $P \leq 0.01$  (Chi-square).

## Comparison of Nurses By Shift Worked

Forty-five percent (81) of the nurses surveyed were permanently assigned to the day shift. These nurses made up the Control group. Sixty-four percent (115) of the nurses were on a permanent schedule, that is, they worked the same days and shift each week. Of the Experimental group, 29% (52) rotated shifts, 16% (29) worked the night shift, and 10% (18) worked the evening shift.

The number of days and hours worked by the subjects are presented in Table 4. Most of the nurses (68%, 122) worked five days each week. Forty-one percent (12) of the night shift nurses worked four days each week. In each of the other three schedule groups, the majority of nurses worked five days each week.

Within each schedule group most nurses worked 40 hours per week, but in the Day and Rotating shift groups, an additional one-fourth of the nurses in those groups worked between 46 and 50 hours each week. A Mantel-Haenszel Chi-square calculation showed the differences in hours worked each week to be significant at  $P \leq 0.05$ . Specifically, fewer Control group nurses reported working 40 hours per week, and more reported working between 46 and 50 hours per week than expected (Table 4).

To determine if the mean number of hours worked per week was statistically different among the four schedule groups, an Analysis of Variance procedure was performed. The results showed no difference. However, T-tests performed between the groups showed the Control group worked significantly more hours each week than the Rotating group ( $P \leq 0.05$ ). Control group nurses who worked a permanent day shift worked 47.3 hours per week compared to 43.8 hours worked each week by the Rotating group (Table 4).

Table 4. Number of Days and Hours Worked Each Week by Nurses.

	Schedule Groups							
	Day (N=81)		Evening (N=18)		Night (N=29)		Rotating (N=52)	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
<b>Number of Days Worked Each Week:</b>								
Three	3	(3.7)	0	(0)	4	(3.8)	3	(5.8)
Four	7	(8.6)	1	(5.6)	12	(41.4)	11	(21.2)
Five	68	(84)	13	(72.2)	9	(31)	32	(61.5)
Six	0	(0)	0	(0)	0	(0)	4	(7.7)
Seven	3	(3.7)	4	(22.2)	4	(13.8)	2	(3.9)
<b>Number of Hours Worked Each Week</b>								
36 - 38	2	(2.5)	0	(0)	2	(6.9)	3	(5.8)
40	27	(33.3) <sup>a</sup>	11	(61.1)	14	(48.3)	25	(48.1)
41 - 45	14	(17.3)	2	(11.1)	4	(13.8)	10	(19.2)
46 - 50	23	(28.4) <sup>a</sup>	1	(5.6)	2	(6.9)	13	(25)
51 - 55	5	(6.2)	0	(0)	0	(0)	0	(0)
56 - 60	9	(11.1)	2	(11.1)	5	(17.2)	1	(1.9)
63 - 80	1	(1.2)	2	(11.1)	2	(6.9)	0	(0)
<b>Mean Hours Worked Each Week</b>								
Mean	47.3 ± 7.6 <sup>b</sup>		47.8 ± 13.4		47.5 ± 11.8		43.8 ± 4.9 <sup>b</sup>	
	± S.D.							

<sup>a</sup> P ≤ 0.05 (Mantel-Haenszel Chi-square).

<sup>b</sup> Values with same superscript differ significantly at P ≤ 0.05 (T-test).

## Years of Experience

The nurses participating in this survey had a considerable amount of nursing experience (Table 5). Overall, 38% (69) of the subjects had been working as nurses for at least sixteen years, and another 24% (43) had between ten and fifteen years of nursing experience. Almost one-fifth (33) of the nurses were relatively new in the profession with three years or less of experience.

In this study, the nurses who had the most years of experience worked the permanent day shift. To determine if differences in years of experience existed among the groups, a Chi-square procedure was calculated. There was a significant difference in values observed in years of experience ( $P \leq 0.0001$ ) for the Day and Rotating shift groups. There were fewer Day shift group nurses but more Rotating shift group nurses than expected with three years or less experience. On the other hand, Chi-square values from Day shift group nurses with 16 years or more of nursing experience were greater than expected while values observed from the Rotating shift group were less than expected. Overall, nurses in the Rotating group tended to have less nursing experience than nurses in the Day shift group. Of the 33 subjects with less than three years of nursing experience, 55% (18) were in the Rotating group. Only 16% (11) of the 69 subjects with 16 years or more nursing experience were in the Rotating group. Of 43 subjects with 10 - 15 years of experience, almost half (21 nurses) worked the day shift. Forty-five of the 69 nurses with sixteen years or more were assigned to a permanent day shift.

## History of Shift Work Among the Groups of Subjects

Sixty-six percent (118) of all the nurses had been assigned at some point to a permanent shift other than day shift. Significantly more Evening (94%, 16) and Night shift (100%, 29) nurses than expected reported working a non-day shift than Day

**Table 5. Years of Experience and Shift Experience of Nurses.**

<u>Items</u>	<u>Shift</u>									
	<u>Day</u> (N=81)		<u>Evening</u> (N=18)		<u>Night</u> (N=29)		<u>Rotating</u> (N=52)		<u>Total</u> (N=180)	
<u>Nursing Experience</u>										
<u>Years</u>	<u>No.</u>	<u>(%)</u>	<u>No.</u>	<u>(%)</u>	<u>No.</u>	<u>(%)</u>	<u>No.</u>	<u>(%)</u>	<u>No.</u>	<u>(%)</u>
± 3	5	(6.2) <sup>a</sup>	3	(16.7)	7	(24.1)	18	(34.6) <sup>a</sup>	33	(18.3)
4 - 9	10	(12.4)	5	(27.8)	7	(24.1)	13	(25)	35	(19.4)
10 - 15	21	(25.9)	5	(27.8)	7	(24.1)	10	(19.2)	43	(23.9)
16+	45	(55.6) <sup>a</sup>	5	(27.8)	8	(27.6)	11	(21.2) <sup>a</sup>	69	(38.3)
<u>Permanent (Other Than Day) Shift Experience</u>										
Subjects	47	(58)	16	(94.1) <sup>a</sup>	29	(100) <sup>a</sup>	26	(51)	118	(66.3)
<u>Previous Experience Rotating Shifts</u>										
Subjects	74	(91.4)	10	(58.8)	23	(79.3)	52	(100)	159	(88.8)
<u>Years Spent Rotating Shifts</u>										
None	6	(7.5)	7	(41.2) <sup>b</sup>	4	(14.3)	0	(0)	17	(9.7)
3 Or Less	8	(10) <sup>b</sup>	5	(29.4)	15	(53.6) <sup>b</sup>	21	(41.2) <sup>b</sup>	49	(27.8)
4 - 6	25	(31.3)	2	(11.8)	2	(7.2)	16	(31.4)	45	(25.6)
7 - 10	18	(22.5)	1	(5.9)	4	(14.3)	8	(15.7)	31	(17.6)
11 - 15	14	(17.5)	1	(5.9)	1	(3.6)	5	(9.8)	21	(11.9)
16 Or More	9	(11.3)	1	(5.9)	2	(7.1)	1	(2)	13	(7.4)

<sup>a</sup> P ≤ 0.0001 (Mantel-Haenszel Chi-square).

<sup>b</sup> P ≤ 0.01 (Mantel-Haenszel Chi-square).

(58%, 47) and Rotating (51%, 26) shift nurses ( $P \leq 0.0001$ ). A large number (89%, 159) of nurses had rotated shifts during their nursing careers. A majority of the Day, Evening, and Night shift group nurses had rotated shifts.

Of all nurses surveyed, 28% (49) had rotated shifts for up to three years over the course of their career whereas another 26% (45) had rotated shifts between four and six years. Over a third (36%, 65) of all nurses surveyed had rotated shifts for seven years or more, but generally the greatest number of nurses in the schedule groups had rotated

shifts no more than six years. Only 10% (5) of the nurses in the Rotating group had been working shiftwork for more than 11 years. A Mantel-Haenszel Chi-square procedure showed values for years of shiftwork experience were significant ( $P \leq 0.01$ ) among the Evening shift group and the Day, Night, and Rotating shift groups. Observed values were higher than expected for Evening shift nurses who had never rotated shifts, whereas values from Day, Night, and Rotating shift nurses who had rotated shifts three years or less were less than expected. History of shift work is shown in Table 5.

### Satisfaction With Schedule

To determine the level of satisfaction with their work schedule, the nurses were asked to respond to a series of statements pertaining to their schedule. For each statement they indicated whether they strongly agreed, agreed, disagreed, or strongly disagreed. Each response had a corresponding score, and these were totalled to provide a measure of each nurse's satisfaction with her schedule. The scores ranged from a possible low score of fifteen, representing the most satisfied, to a possible high of sixty, representing the least satisfied. The scores of all nurses in each group were averaged and the group scores compared.

An Analysis of Variance procedure performed to compare the satisfaction of the four groups revealed a significant difference ( $P \leq 0.0001$ ). Application of the Student-Newman-Keuls test showed the differences ( $P \leq 0.05$ ) to be between the Rotating shift group and the fixed shift groups. Nurses in the Rotating Group were the least satisfied, with a mean score (35.5) which was significantly higher than the Day (27.2), Evening (32), and Night (30.6) groups (Table 6). The mean satisfaction of Evening and Night groups were not significantly different from each other, however the scores appeared to indicate that these two groups were more satisfied with their schedules than nurses working the rotating shift.

Table 6. Mean Schedule Satisfaction Scores of Nurses by Shift Group.

Shift Group	N	Mean Satisfaction Score*
Day	81	27.2
Evening	18	32.0
Night	29	30.6
Rotating	52	35.5 <sup>a</sup>

<sup>a</sup> Value significantly different from all other groups at  $P \leq 0.05$  (Student-Newman-Keuls).

\* Most satisfied = 15.

Least satisfied = 60.

The Student-Newman-Keuls procedure showed that the means of the Control and Night shift groups were not significantly different from each other, but both means were significantly lower than those of the Evening and Rotating shift groups, indicating that Control and Night shift nurses were more satisfied with their schedules than Evening and Rotating group nurses. Thus, in order of satisfaction, the Control nurses were the most satisfied with their schedules, followed by the Night shift group, the Evening group, and finally, the Rotating shift group.

Individual questions were analyzed to determine if there were differences from the expected values of the groups. Statistical significance was noted, using a Chi-square test, in eight of the fifteen questions, indicating differences in satisfaction. Individual questions and responses are shown in Table 33 in Appendix L.

#### Individual Satisfaction With Personal Schedules

Three questions specifically addressed the nurses' satisfaction with their schedules and differences were significant ( $P \leq 0.0001$ ) for each of the questions. In the first statement, "I am happy with my schedule," 81% (146) of all nurses agreed. By group,

almost all (96%, 78) of the 81 Control group nurses agreed with this statement, followed by the 83% (24) of the Night shift nurses, 78% (14) of the Evening shift nurses and 58% (30) of the Rotating shift nurses. Observed Chi-square values differed from expected values for the Control and Rotating shift groups. More Control group nurses agreed with this statement than expected, whereas fewer Rotating shift nurses agreed than expected.

Similar results were found for the statement, "I would prefer to change my schedule." Chi-square values observed for the Day and Rotating groups were significant: only 19% (15) of the Day shift nurses wished to change their schedule, compared to 62% (32) of the Rotating shift group. Thirty-nine percent (7) of the Evening shift group, and 35% (10) of the Night shift group wished to change their schedules. Of the 64 nurses (36%) who agreed with this statement, half (32) were from the Rotating shift group.

Sixty-eight percent (122) of the nurses agreed with the statement, "If I have the opportunity to change my schedule I would take my present schedule by choice." Again, values for the Day and Rotating groups were significant with more Day shift group nurses (91%, 74) and less Rotating shift nurses (33%, 17) agreeing than expected. Most nurses from the Night (69%, 20), and Evening (61%, 11) shift groups also agreed with this statement.

### Energy

Energy levels as affected by schedule were calculated and differences in values expected were noted for the Day and Rotating shift groups ( $P \leq 0.0001$ ). A majority of the Rotating shift nurses (58%, 30) felt they had less energy on their schedule. A minority of the Evening (39%, 7), Night (24%, 57), and Day (12%, 10) shift nurses felt they had less energy on their schedules. Whereas only 54 nurses (30% of the entire group) agreed with the statement, "I have less energy on this schedule," 56% (30) of them were from the Rotating shift group.

### Personal Time

Three questions addressed the effects of schedules on off-duty time. Thirty-nine percent (70) of the entire group of nurses agreed with the statement, "My schedule does not give me enough time with my friends." Calculated Chi-square values differed from the expected for the Day, Evening, and Rotating shifts ( $P \leq 0.05$ ). More nurses from the Evening (61%, 11) and Rotating (48%, 25) shift groups agreed with this statement, while fewer nurses from the Day (30%, 24) shift agreed. Thirty-five percent (10) of the Night shift group agreed.

Surprisingly, 69% (124) of the entire group of nurses agreed with the statement, "My schedule fits well with my lifestyle and other commitments." Of those agreeing with this statement, 58% (71) were from the Day shift group. Observed values of the Day and Rotating shift groups differed from the expected ( $P \leq 0.0001$ ): 88% (71) of Day shift nurses agreed with the statement compared to only 41% (21) of the Rotating shift nurses. A majority of nurses from the Evening (72%, 13) and Night (66%, 19) shift groups also agreed that their schedules worked well with their lifestyles.

One-third (60) of the nurses agreed with the statement, "I am not satisfied with my work schedule because it affects quality time with my family." Of these nurses, 38% (23) were from the Rotating shift. Observed values of the Day, Evening, and Rotating shift groups differed from the expected ( $P \leq 0.0001$ ): 61% (11) of nurses from the Evening and 44% (23) of the Rotating shift groups agreed that family time was affected, compared to only 17% (14) of the Day shift group nurses. Forty-two percent (12) of the Night shift group agreed.

### Schedule Assignments

The nurses were asked to respond to the statement, "Schedules are assigned fairly." The majority (82%, 148) agreed. Calculated values differed from the expected in the Day and Rotating shift groups ( $P \leq 0.05$ ). More (91%, 74) Day shift nurses agreed that schedules were assigned fairly compared to 69% (36) of Rotating shift

nurses. Most nurses from the Evening (83%, 15), and Night (79%, 23) shifts also agreed that schedules are assigned fairly.

### Relationships With Supervisors

Questions posed to examine interpersonal relationships with supervisors indicated that calculated values differed from the expected for the Day shift group and the experimental groups (Mantel-Haenszel Chi-square,  $P \leq 0.05$ ). Ninety percent (162) of the entire group of nurses agreed with the statement, "Interpersonal relations with my supervisors are good on my schedule." Almost all of the nurses from the Day (96%, 78) shift group agreed with this statement, followed by 89% (16) of the Evening, 87% (45) of the Rotating and 79% (23) of the Night shift groups.

### Health Satisfaction

To determine the level of satisfaction with their health, the nurses were presented a series of statements relating their schedule to their health. For each they responded whether or not they strongly agreed, agreed, disagreed, or strongly disagreed. Each response had a corresponding score, and these were totalled to provide a measure of each nurse's satisfaction with her health status. The scores ranged from a possible high score of 52, representing the most satisfied, to a possible low score of 13, representing the least satisfied. The scores of all nurses in each group were averaged and the group scores compared.

Once again the Control subjects, with a group mean score of 35, were the most satisfied with the way they felt that their schedule affected their health, followed by the Evening shift group with a score of 33, the Night shift group with a score of 32, and finally the Rotating shift group, whose mean satisfaction score of 30 indicated that they were the least satisfied (Table 7).

Table 7. Mean Health Satisfaction Scores of Nurses by Shift Groups.

Shift Group	N	Mean Health Satisfaction Scores*
Day	81	35.0 <sup>a</sup>
Evening	18	33.0 <sup>c</sup>
Night	29	32.0 <sup>b</sup>
Rotating	52	30.0 <sup>bd</sup>

<sup>a,b</sup> Group scores with indicated superscripts were significantly different at  $P \leq 0.05$  (ANOVA).

<sup>c,d</sup> Group scores with indicated superscripts were significantly different at  $P \leq 0.05$  (ANOVA).

\*Higher scores represent greater satisfaction

A significant difference was noted ( $P \leq 0.0001$ ) when means were compared using an Analysis of Variance procedure. Multiple Comparison Procedures indicated significant differences ( $P \leq 0.05$ ) were between the Day shift group and the Night and Rotating shift groups, as well as between the Evening and the Rotating shift group (Table 7).

Individual questions were analyzed by a Chi-square procedure to determine if there were differences between the groups. These differences are presented in the following sections. Individual questions and group responses are shown in Table 34 in Appendix M.

### Maintaining Health

Three questions addressed the ease or difficulty of taking care of one's health. Although only 22% (39) of all the nurses surveyed agreed with the statement, "I find it difficult to maintain my health on this schedule," 52% (20) of the 39 nurses agreeing were from the Rotating shift group. Calculated Chi-square values differed ( $P \leq 0.01$ )

from the expected for the Day and Rotating shift groups. More (39%, 20) Rotating shift nurses found it difficult to maintain health on their schedules than Control nurses (11%, 9). Twenty-four percent (7) of the Night shift group and 17% (3) of the Evening shift group also agreed that it was difficult to maintain their health on their work schedule.

The question was repeated in a slightly different form as, "I think my health would be better if I worked a different shift." One-fourth of the nurses (45) agreed, and again the majority of those agreeing (56%, 25) were from the Rotating shift group. The Day and Rotating shift groups differed ( $P \leq 0.0001$ ) from the expected in their responses to this statement. Forty-eight percent (25) of the nurses from the Rotating shift group agreed, compared to only 5% (4) of the Day shift group nurses. Thirty-five percent (10) of the Night shift, and 33% (6) of the Evening shift agreed with the statement.

Although 43% (78) of all the nurses surveyed agreed with the statement, "I find it easy to take care of myself on this schedule," once again the greatest number of nurses agreeing with the statement (42%, 33) were from the Day shift group. Interestingly, this time 40% (31) of those agreeing were from the Rotating shift group. Values observed differed from the expected in the Rotating shift group and the fixed shift groups ( $P \leq 0.01$ ): a higher percentage (60%, 31) of the Rotating shift subjects found it easy to take care of themselves on their schedule, whereas a minority of nurses from the Day (41%, 33), Night (41%, 12), and Evening (11%, 2) shifts agreed.

A more general health statement presented was, "The way I feel changes with my work schedule." Sixty-five percent (117) of all nurses surveyed agreed. Observed values for the Day and Rotating group differed from the expected values ( $P \leq 0.001$ ). More nurses from the Rotating shift group (87%, 45), and fewer from the Day (57%, 46) shift group agreed than was expected. A smaller group of nurses from the Evening (67%, 12), and Night (48%, 14) shift groups agreed that the way they feel changes with their work schedule.

### Sleep

Two questions addressing sleep showed differences among the groups. Most (72%, 130) of the nurses agreed with the statement, "I sleep more hours on my day off than I do on work days." Calculated Chi-square values were found to be significantly less than expected ( $P \leq 0.05$ ) for the Evening shift group. Forty-four percent (8) of nurses from the Evening shift agreed that they slept more on their days off. Many more nurses from the Night (83%, 24), Rotating (79%, 41), and Day (70%, 57) shift groups reported sleeping more hours on their days off.

Forty-one percent (73) of the entire group agreed with the statement, "My schedule does not affect my sleep." Of those agreeing, 60% (44) were Day shift group nurses. Observed values were significantly different ( $P \leq 0.0001$ ) for the Day and Rotating shift groups, with responses from the Day shift group (54%, 44) being higher than expected, and Rotating shift group responses (25%, 13) being less than expected. Fifty-six percent (10) of the Evening and 21% (6) of the Night shift groups reported that their sleep was not affected by their work schedule.

### Quality of Life

Although only 35% (65) of the nurses felt their quality of life would be better if they worked a different schedule, 43% (27) of those who agreed came from the Rotating shift group. Differences ( $P \leq 0.0001$ ) in Chi-square values from the expected were noted for the Day and Rotating shift groups in their feelings about how their schedule affected their quality of life. More Rotating shift nurses (52%, 27) and fewer Day shift nurses (17%, 14) agreed than expected. A large portion of the Evening (50%, 9) and Night shift (45%, 13) groups also agreed that the quality of their life would improve if they changed their schedules.

### Good Health Practices

The nurses were asked their opinions about their current health status. Most felt that they were in good health (Table 8).

Table 8. Satisfaction With Health Status Reported by Nurses

Shift	N	Satisfied		Dissatisfied	
		No.	(%)	No.	(%)
Day	81	74	(91.3)	7	(8.6)
Evening	18	18	(100)	0	(0)
Night	29	26	(89.7)	3	(10.3)
Rotating	52	48	(92.3)	4	(7.7)

Fifty-five percent (99) of the nurses stated that they received a complete physical examination each year. At least half of each schedule group reported they got a physical annually, although the largest positive responses came from the Evening shift group, 72% (13) of whom reported getting a physical each year (Table 9).

Table 9. Annual Physical as Reported by Nurse Groups.

Shift Group	Physical Each Year		No Annual Physical	
	No.	(%)	No.	(%)
Day (N=81)	43	(53.1)	38	(46.9)
Evening (N=18)	13	(72.2)	5	(27.8)
Night (N=28)	15	(51.7)	14	(48.3)
Rotating (N=52)	28	(53.9)	24	(46.2)

Percentages may not total 100% due to rounding.

### Smoking

Only 14% (25) of the nurses surveyed smoked. Of the 155 nonsmokers, 34% (53) stated that they had smoked at one time but have since stopped smoking. By group, 28% (8) of the Night shift smoked, followed by 15% (8) of the Rotating, 11% (2) of the Evening, and 9% (7) of the Day shift group (Table 10).

Table 10. Smoking as Reported by Nurse Groups.

Shift Group	Smoke		Don't Smoke	
	No.	(%)	No.	(%)
Day (N=81)	7	(8.6)	74	(91.4)
Evening (N=18)	2	(11.1)	16	(88.9)
Night (N=29)	8	(27.6)	21	(72.4)
Rotating (N=52)	8	(15.4)	44	(84.6)

### Weight

Asked whether they considered themselves to be the correct weight, overweight, or underweight for their height, most of the Control (63%, 51) and Rotating (65%, 34) group nurses stated that they were of normal weight. Most Evening (59%, 10) and Night (55%, 16) shift nurses considered themselves to be overweight. Responses were not significant. Group data is listed in Table 11.

Table 11. Reported Weight Status by Nurse Groups.

Shift Group	Normal Weight		Overweight		Underweight	
	No.	(%)	No.	(%)	No.	(%)
Day (N=81)	51	(63.0)	30	(37.0)	0	(0)
Evening (N=17)	7	(41.2)	10	(58.8)	0	(0)
Night (N=29)	11	(37.9)	16	(55.2)	2	(6.9)
Rotating (N=52)	34	(65.4)	16	(30.8)	2	(3.9)

\*Percentages may not total 100% due to rounding.

### Exercise

Fifty-one percent (91) of the nurses stated that they do not exercise regularly. Of the 88 who do exercise, 47% (41) were from the Day shift group. Differences in regular exercise among the groups were not significant. Analysis of Variance and Multiple Comparison Procedures were used to calculate differences in the amount of exercise practiced by exercise participants among the groups. Duncan's Multiple Range test and T-tests found differences ( $P \leq 0.05$ ) between the Day and Evening shift groups, with Day shift group nurses (who exercise) exercising significantly more days per week than Evening shift group nurses (who exercise). Exercise data are shown in Table 12.

Table 12. Exercise Habits by Nurses.

Shift Groups	Exercise Regularly		Days Per Week of Exercise*	Do Not Exercise	
	No.	(%)	Mean $\pm$ S.D.	No.	(%)
Day (N=81)	41	(50.6)	3.5 $\pm$ 1.6 <sup>a</sup>	40	(49.4)
Evening (N=18)	8	(44.4)	2.3 $\pm$ 2.0 <sup>a</sup>	10	(55.6)
Night (N=28)	12	(41.4)	2.6 $\pm$ 1.10	17	(58.6)
Rotating (N=52)	27	(52.9)	3.2 $\pm$ 1.50	24	(47.1)

\*Calculated for exercise participants only.

<sup>a</sup> Numbers with superscript are significantly different at  $P \leq 0.05$  (T-test).

#### Alcohol Consumption

Only 30% (53) of all the nurses surveyed reported that they regularly consumed alcoholic beverages. A Chi-square procedure revealed that values observed for alcohol consumption differed ( $P \leq 0.05$ ) from the expected in the Day and Night shift groups. More Day shift group nurses reported drinking alcohol often or daily (37%, 30), and less (63%, 51) reported drinking alcohol rarely or never than would be expected, while more nurses from the Night shift group reported drinking alcohol rarely or never (86%, 25) than would be expected. Group data are shown in Table 13.

Table 13. Frequency of Alcohol Consumption of Nurses by Schedule Groups.

Schedule Groups	Often/Daily		Rare or None	
	No.	(%)	No.	(%)
Day (N=81)	30	(37.0) <sup>a</sup>	51	(63.0) <sup>a</sup>
Evening (N=18)	2	(11.8)	15	(88.2)
Night (N=28)	4	(13.8)	25	(86.2) <sup>a</sup>
Rotating (N=52)	17	(32.7)	35	(67.3)

<sup>a</sup> P ≤ 0.05 (Mantel-Haenszel Chi-square).

#### Diagnosed Diseases and Physical Conditions

The nurses were asked about any conditions having been diagnosed by a physician. Differences in the number of nurses who had been diagnosed with illnesses or physical conditions (high blood pressure, cancer, heart or cardio-vascular disease, premenstrual syndrome, allergies) among the groups were not significant. However, the number of subjects diagnosed with illnesses was greatest in the Day shift group, followed by the Rotating, Night, and Evening shift groups. Data on diagnosed diseases among the groups are shown in Table 14.

Table 14. Percent of all Nurses Diagnosed with Specific Illnesses.

Condition	Subjects Diagnosed With The Condition							
	Day		Evening		Night		Rotating	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
High Blood Pressure	13	(16.5)	2	(11.1)	4	(13.8)	0	(0)
Cancer	2	(2.5)	2	(11.1)	2	(6.9)	1	(1.9)
Heart or Cardio-Vascular Disease	6	(7.4)	2	(11.1)	0	(0)	2	(3.9)
Pre-Menstrual Syndrome	5	(6.2)	1	(5.6)	0	(0)	8	(15.4)
Allergies	25	(30.9)	4	(22.2)	8	(27.6)	18	(34.6)

### Stress

The nurses were asked whether they considered the daily stress level of their job to be low, average, or high. At least 50% of the nurses in each schedule group considered the daily stress level of their jobs to be average. Fifty percent (9) of the Evening shift group considered the stress level of their job to be high, as did 48% (25) of the Rotating shift group, 41% (12) of the Night shift group and 37% (30) of the Control group. The stress levels reported by group are shown in Table 15. Differences in perceived daily stress level were not significant.

Table 15. Daily Stress Levels Reported by Shift Groups.

Shift	Reported Job Stress Levels					
	High Daily		Average Daily		Low Daily	
	No.	(%)	No.	(%)	No.	(%)
Day (N=81)	30	(37.0)	47	(58.0)	4	(4.9)
Evening (N=18)	9	(50.0)	9	(50.0)	0	(0)
Night (N=28)	12	(41.4)	15	(51.7)	2	(6.9)
Rotating (N=52)	25	(48.1)	26	(50.0)	1	(1.9)

Percentages may not total to 100% due to rounding.

#### Effect of Shifts on Various Physical Conditions

The nurses were given a list of various physical conditions or ailments such as energy level, appetite, ability to concentrate, stomach problems, head and back pain, leg pain, eye strain, heartburn, sore throat, weakness, light-headedness, depression, and general malaise. The nurses were asked if they noticed having any changes associated with the shift that they worked, specifically: do these conditions improve, stay the same, or get worse when they worked day, evening, or night shift. The permanent shift nurses were asked to respond for the shift to which they are permanently assigned. The Rotating shift nurses were able to answer for all three shifts.

To obtain scores for comparisons, "improve" was scored as "1," "no change" was scored as "0," and "worsens" was scored as "-1." The mean score for each schedule group was compared to the mean score of the Rotating shift group for each schedule. In other words, the Evening shift group mean was compared to the evening shift mean of the Rotating shift group and the Night shift group mean was compared to the night shift mean of the Rotating shift group. Although not significant, the Rotating shift group

means were lower than scores for the Day shift and Evening shift nurses. It is interesting to note that the Rotating shift group mean for night shift was higher than that of the Night shift group nurses, and also that the physical complaint score of Night shift nurses was higher than that of Evening shift group nurses (Table 16).

Table 16. Physical Complaint Scores of Different Shift Groups, Compared to Rotating Shift Group Scores.

Shift	Mean $\pm$ S.D.	Rotating Shift Group	Mean $\pm$ S.D.
Day (N=81)	+1.2 $\pm$ 4.5	Rotating Day Shift	+0.7 $\pm$ 3.6
Evening (N=17)	-0.9 $\pm$ 5.7	Rotating Evening Shift	-1.4 $\pm$ 3.7
Night (N=29)	-0.8 $\pm$ 7.6	Rotating Night Shift	+0.7 $\pm$ 3.6

### Diet

The nurses were asked a series of questions about their dietary habits. Because this survey was looking for information about the dietary habits of nurses who rotate shifts, it was important to know what shift the subjects worked the day the questionnaire was completed. It turned out that even some of the nurses who worked permanent shifts were working a different shift the day they completed this survey (Table 17). Seventy percent (126) of the nurses were working the shift that they were permanently assigned to.

Table 17. Shift Worked by Schedule Groups on Day Surveyed

Shift Group	Shift Worked							
	Day		Evening		Night		Other	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Day (N=81)	76	(93.8)	0	(0)	0	(0)	5	(6.2)
Evening (N=18)	0	(0)	18	(100)	0	(0)	0	(0)
Night (N=28)	0	(0)	1	(3.5)	24	(82.8)	4	(13.8)
Rotating (N=52)	22	(43.1)	11	(21.6)	13	(25.5)	5	(9.8)

Percentages may not total to 100% due to rounding.

#### Meal Consumption

The nurses were asked a series of questions about the number of meals they ate each day. Specifically, they were asked how many meals they ate over a 24-hour period while working this particular shift, how many meals they ate while at work, and how many meals they ate with their families. Results are shown in Table 18.

Table 18. Effect of Shift on Number and Location of Meals Consumed Each Day by Nurses

Shift Worked	N	Mean Number Of Meals		
		Each Day Mean $\pm$ S.D.	At Work Mean $\pm$ S.D.	With Families Mean $\pm$ S.D.
Day	98	2.49 $\pm$ 0.71 <sup>a</sup>	1.13 $\pm$ 0.49 <sup>bc</sup>	1.00 $\pm$ 0.41*
Evening	30	2.17 $\pm$ 0.79 <sup>a</sup>	0.97 $\pm$ 0.32 <sup>b</sup>	0.89 $\pm$ 0.77#
Night	37	2.27 $\pm$ 0.81	0.82 $\pm$ 0.62 <sup>bc</sup>	0.90 $\pm$ 0.66~
Other	14	2.36 $\pm$ 0.93	1.58 $\pm$ 1.09 <sup>b</sup>	0.72 $\pm$ 0.61

<sup>a</sup> Groups with same superscript differ significantly at  $P \leq 0.05$  (T-test).

<sup>b</sup> Groups with same superscript differ significantly at  $P \leq 0.001$  (ANOVA).

<sup>c</sup> Groups with same superscript differ significantly at  $P \leq 0.05$  (T-test).

\*N=86, #N=26, ~ N=30.

Nurses working the day shift consumed a higher mean number of meals each day than nurses working other shifts. An Analysis of Variance procedure showed no difference in the number of meals eaten among the nurses. However, a T-test procedure indicated that the mean number of meals consumed by the Controls was significantly higher than that of the Evening shift group ( $P \leq 0.05$ ).

An Analysis of Variance procedure revealed differences ( $P \leq 0.001$ ) in the number of meals eaten while at work. T-tests for this variable also indicated a significant ( $P \leq 0.05$ ) difference: nurses working the day shift ate more meals at work than nurses assigned to the night shift. Both the T-test and Student-Newman-Keuls ( $P \leq 0.05$ ) indicated that the nurses working a shift other than day, evening, or night had the greatest mean meal consumption while at work, but it is not known exactly what these "other" schedules were.

The nurses who worked the day shift ate a slightly greater number of meals with their families than the nurses on the other shifts, but these differences were not

significant. The mean number of meals consumed each day, at work, and with family are shown in Table 18.

### Meal Skipping

The nurses were asked if they ever skip meals while at work. In each schedule group, at least 55% of the nurses skipped meals sometimes (Table 19). Eleven percent or more of each group reported that they usually skip meals. Differences noted among the groups were not statistically significant.

Table 19. Frequency of Meal Skipping Reported by Subjects.

Schedule Groups	N	Never Skip Meals		Sometimes Skip Meals		Usually Skip Meals	
		No.	(%)	No.	(%)	No.	(%)
Day	81	21	(25.9)	45	(55.6)	15	(18.5)
Evening	18	4	(22.2)	12	(66.7)	2	(11.1)
Night	29	7	(24.1)	16	(55.2)	6	(20.7)
Rotating	52	7	(13.5)	29	(55.8)	16	(30.8)

Percentages may not total 100% due to rounding.

### Amount of Time Allowed For Meals

The nurses were asked how much time is allowed for their meals. It is interesting to note that although only 9% (7) of Control group nurses reported taking one hour for their meal, no other shift group of nurses reported that one hour was allowed for their meal. In other words, none of the nurses who work evening, night, or who rotate shifts reported taking one hour for their lunch.

Most nurses (68%, 123) reported that 15 to 30 minutes was allowed for their meals while at work. In fact, at least 54% of each schedule group reported taking between 15 to 30 minutes. Calculated Chi-square values differed significantly ( $P \leq 0.01$ ) from the expected for the Day and Rotating shift groups. Fewer Day shift nurses (54%, 44), and more Rotating shift nurses (87%, 45) took 15 to 30 minutes for their meal than expected, whereas more Day shift group nurses (20%, 16) took 45 minutes for their meal than was expected. Time allowed for meals is shown in Table 20.

Table 20. Amount of Time Allowed for Meals at Work as Reported by Schedule Group Subjects.

Schedule Groups	N	Time Allowed For Meals at Work (Minutes)							
		15-30		45		60		No Time/Other	
		No.	(%)	No.	(%)	No.	(%)	No.	(%)
Day	81	44	(54.3) <sup>a</sup>	16	(19.8) <sup>a</sup>	7	(8.7)	14	(17.3)
Evening	18	14	(77.8)	1	(5.6)	0	(0)	3	(16.7)
Night	29	20	(69)	8	(13.8)	0	(0)	5	(17.2)
Rotating	52	45	(86.5) <sup>a</sup>	3	(5.8)	0	(0)	4	(7.7)

<sup>a</sup>  $P \leq 0.01$  (Mantel-Haenszel Chi-square).

Percentages may not total 100% due to rounding.

#### Meals Eaten At Work

The nurses were asked where they ate their meals while at work. Several choices were offered and they were asked to mark all that applied. Most nurses (61%, 109) reported that they ate their meal in a lounge or break area, and 33% (60) reported that they ate at their desks. Of the 31 nurses who reported that they ate in the cafeteria or snack bar, 55% (17) were from the Control group (Table 21).

Table 21. Location of Meals

Schedule Groups	N	Location of Meals							
		Desk		Nurses Station		Snack Bar or Cafeteria		Lounge or Break Area	
		No.	(%)	No.	(%)	No.	(%)	No.	(%)
Day	81	51	(63) <sup>a</sup>	9	(11.1) <sup>b</sup>	17	(21)	37	(45.7) <sup>a</sup>
Evening	18	4	(22.2)	3	(16.7)	2	(11.1)	16	(88.9) <sup>a</sup>
Night	29	1	(3.5) <sup>a</sup>	12	(41.4) <sup>b</sup>	2	(6.9)	19	(65.5)
Rotating	52	4	(7.7) <sup>a</sup>	15	(28.9)	10	(19.2)	37	(71.3) <sup>a</sup>

<sup>a</sup> P ≤ 0.0001 (Mantel-Haenszel Chi-square).

<sup>b</sup> P ≤ 0.01 (Mantel-Haenszel Chi-square).

\*Columns may not add to 100% because of multiple choices.

Very few of the nurses who reported eating at their desks were from the experimental groups: 2% (1) were from the Night shift group, and 7% (4) were from each of the Evening and Rotating shift groups compared to 85% (51) from the Control group. Values observed by Chi-square calculations for this question showed differences (P ≤ 0.0001) from the expected. More Day shift group nurses (63%, 51) ate at their desks than was expected, while fewer Rotating (8%, 4) and Night (4%, 1) shift group nurses ate at their desks than was expected. Group responses are shown in Table 21.

Twenty-two percent (39) of the entire group of nurses reported taking their meals at the nurses station. Chi-square calculations on this question showed differences (P ≤ 0.01) from the expected in the Day and Night shift groups. More Night shift (41%, 12) and fewer Day shift (11%, 9) group nurses reported taking their meals at the Nurses station than was expected. Group responses are shown in Table 21.

Very few nurses, (17%, 31), reported that they ate in the hospital cafeteria or snack bar. Although only 21% (17) of Day shift group nurses reported eating in the

cafeteria, this represented 55% of all nurses who reported eating in the cafeteria. These differences were not significant.

Most nurses (61%, 109) reported eating in a lounge or break area. Values obtained by a Chi-square procedure performed on this question showed differences ( $P \leq 0.0001$ ) from the expected among the Day, Evening, and Rotating shifts. More Evening (89%, 16) and Rotating (71%, 37) shift nurses ate in the break area compared to Day (46%, 37) shift nurses. Group responses are shown in Table 21.

While at work, most nurses surveyed (53%, 96) ate with other staff members. By group, most Day shift group nurses (49%, 40) ate alone, but in the three experimental groups a majority ate with other staff members. These differences were not significant. Group figures are shown in Table 22.

Table 22. Effect of Shift Schedule on Sharing Meals by Nurses at Work.

Schedule Groups	N	Meals Shared					
		Alone		With Staff Members		Other/No Response	
		No.	(%)	No.	(%)	No.	(%)
Day	81	40	(49.4)	39	(48.2)	2	(2.5)
Evening	18	5	(27.8)	12	(66.7)	1	(5.6)
Night	29	10	(34.5)	18	(62.1)	1	(3.5)
Rotating	52	25	(48.1)	27	(51.9)	0	(0)

### Snack Consumption

To determine if snacking patterns varied among the different shift schedules, the nurses were asked how many snacks they ate in a day and also while at work (for the shift they were working the day they completed the survey). Nurses who worked the night shift consumed slightly more snacks each day than nurses working the evening and day shifts, but the differences were not significant. There were differences, however, in the number of snacks consumed while at work. An Analysis of Variance procedure ( $P \leq 0.001$ ) and T-tests ( $P \leq 0.05$ ) showed differences between the number of snacks consumed by nurses working the day and night shifts. Nurses who were working at night consumed the most snacks at work while nurses working the day shift consumed the least. Snack consumption is shown in Table 23.

Table 23. Daily Snack Consumption Practices of Nurses by Shift Worked.

Shift Worked	N	Mean Number of Snacks Eaten Each Day	
		Total Mean $\pm$ S.D.	At Work Mean $\pm$ S.D.
Day	98	1.5 $\pm$ 1.2	1.0 $\pm$ 0.9 <sup>a</sup>
Evening	30	1.5 $\pm$ 0.9	1.3 $\pm$ 0.9
Night	37	1.8 $\pm$ 1	1.5 $\pm$ 0.9 <sup>a</sup>
Other Shift	14	2.2 $\pm$ 1.4	2.1 $\pm$ 1.4

<sup>a</sup> Groups with same superscript differ significantly at  $P \leq 0.05$  (T-test).

### Times of Meal Consumption

The nurses were asked the time their first meal of the day was eaten. An Analysis of Variance procedure showed a significant difference ( $P \leq 0.01$ ) in the times of the first meal of the day (Table 24). T-tests showed the differences ( $P \leq 0.05$ ) were

between nurses working the day shift and evening and night shifts. Nurses working the day shift reported taking their first meal of the day earlier than nurses working the evening or night shift. Nurses working the day and night shift reported taking their first meal of the day after they reported to work while the nurses working the evening shift group took their first meal before reporting to work.

Table 24. Time Subjects Ate First Meal and Snack, by Shift Worked.

Shift Worked	N	Time of Consumption	
		First Meal Mean $\pm$ S.D.	First Snack Mean $\pm$ S.D.
Day	98	09:07:20 $\pm$ 03:56:23 <sup>a</sup>	09:18:30 $\pm$ 05:37:26 <sup>d</sup>
Evening	30	11:15:30 $\pm$ 03:06:19 <sup>b</sup>	16:01:00 $\pm$ 06:12:22 <sup>c</sup>
Night	37	11:09:32 $\pm$ 06:24:14 <sup>b</sup>	10:30:10 $\pm$ 10:05:19 <sup>d</sup>
Other	14	10:00:00 $\pm$ 06:14:19	09:50:00 $\pm$ 06:10:25

<sup>a</sup> Group differs significantly from <sup>b</sup> at  $P \leq 0.05$ .

<sup>c</sup> Group differs significantly from <sup>d</sup> at  $P \leq 0.05$ .

#### Times of Snack Consumption

The time of day of the first snack consumed by the nurses also varied by the shift worked. Nurses working the day shift reported their first snack came shortly after their first meal of the day, while nurses working the evening shift reported that their first snack came almost five hours after their first meal, shortly after they began their shift. Night shift workers took their first snack shortly before they reported to work. An Analysis of Variance procedure showed a significant difference ( $P \leq 0.0001$ ) in time of first snack. Using T-tests, the differences ( $P \leq 0.05$ ) were observed to be between the

time the first snack was consumed by nurses working the evening shift and nurses working the day and night shifts (Table 24).

Rotating shift nurses were asked if their snacking practices varied with the shift that they work. A Mantel-Haenszel Chi-square procedure showed differences ( $P \leq 0.0001$ ) from the expected in the Rotating shift nurses' snacking practices. In particular, a higher percent of Rotating shift nurses ate more snacks while working the day and night shift than was expected. Most (44%, 23) stated that they snacked more while working the Night shift. Twenty-five percent (13), snacked most when working the day shift, 19% (10) while working the evening shift, 8% (4) noticed no difference, and 4% (2) did not respond.

### Hunger

The four groups of nurses varied in the times of the day that they felt hungriest. Nurses working the day and evening shift reported that their peak hunger times came while they were at work, whereas nurses working the night shift reported peak hunger times shortly after they left work. An Analysis of Variance procedure showed a significant difference ( $P \leq 0.0001$ ) in reported peak hunger times. Multiple Comparison Procedures showed differences existed between nurses working the day shift and nurses working the evening and night shifts ( $P \leq 0.05$ ). Although 62% (107) of the nurses stated that there were times during the day that they did not want to eat, the times when they were not hungry did not vary significantly (Table 25).

Table 25. Peak and Least Hunger Times Reported by Nurses Working Various Shift.

Shift Worked	N	Times	
		Most Hungry Mean $\pm$ S.D.	Least Hungry Mean $\pm$ S.D.
Day	98	12:14:30 $\pm$ 04:36:17 <sup>a</sup>	11:05:40 $\pm$ 05:14:07
Evening	30	17:21:00 $\pm$ 05:15:35 <sup>b</sup>	11:35:10 $\pm$ 05:05:35
Night	37	09:08:10 $\pm$ 08:26:48 <sup>b</sup>	10:52:20 $\pm$ 05:27:38
Other Shift	14	08:36:10 $\pm$ 06:26:26	09:00:00 $\pm$ 05:23:05

<sup>a,b</sup> Groups with different superscripts are significantly different at  $P \leq 0.05$

#### Adjusting To New Meal Times

To determine if Rotating shift nurses perceive an effect on their meal patterns from their changing schedules, they were asked how long it took them to adjust to new meal times. A third (33%, 18) of the Rotating shift group adjusted to new meal times right away, but 22% (12) stated that they never adjusted. The remaining Rotating shift group nurses took between one day and one week to adjust (Table 26).

Table 26. Time Interval Required by Rotating Shift Nurses to Adjust to Changes in Meal Times.

Adjustment Times	N	Subjects %
Right Away	18	33.3
One Day	11	20.4
Two to Four Days	7	13.0
One Week	2	3.7
Never Adjust	12	22.2
No Response	4	7.4

Total response = 54. Subjects in groups other than Rotating Shift group responded to this question.

#### Beverage Consumption

To evaluate beverage consumption, the nurses were asked to list each beverage that they drink daily. Chi-square calculations of coffee consumption showed that the Day and Rotating shift nurses differed ( $P \leq 0.05$ ) from the expected values. Day shift group nurses (69%) drank more coffee each day than Rotating shift nurses (45%). Daily beverage consumption is shown in Table 27.

Thirty-six percent (62) of all nurses surveyed reported drinking sodas each day while 44% (75) reported drinking diet sodas daily. Values observed from Chi-square calculations showed differences ( $P \leq 0.05$ ) from the expected in soda consumption for Night and Rotating shift nurses. Twenty-one percent of Night shift group nurses drank sodas daily, whereas more Rotating shift group nurses (47%) than expected drank sodas each day (Table 27).

Table 27. Percent of Nurses Consuming Beverages Daily, by Schedule Group.

Beverages	Schedule Groups			
	Day (N=74) %	Evening (N=18) %	Night (N=29) %	Rotating (N=51) %
Water	81.1	83.3	62.1	74.5
Coffee	68.9 <sup>a</sup>	50.0	51.7	45.1 <sup>a</sup>
Diet Soda	52.7	38.9	41.4	33.3
Soda	29.7	55.6	20.7 <sup>a</sup>	47.1 <sup>a</sup>
Fruit Juice	32.4 <sup>b</sup>	22.2	34.5	62.8 <sup>b</sup>
Skim Milk	6.8	5.6	6.9	5.9
Whole Milk	16.2	27.8	27.6	35.3
2% Milk	0	5.6	0	3.9
Beer/Wine	2.7	0	3.5	0

<sup>a</sup>  $P \leq 0.05$  (Mantel-Haenszel Chi-square).

<sup>b</sup>  $P \leq 0.01$  (Mantel-Haenszel Chi-square).

Forty-one percent (70) of all nurses reported drinking fruit juice each day. A Chi-square procedure showed differences ( $P \leq 0.01$ ) in daily juice intake of Day and Rotating shift group nurses. Fewer nurses from the Day shift (32%) and more from the Rotating shift (63%) group drank fruit juice daily than was expected (Table 27).

Water was consumed on a daily basis by at least 62% of each schedule group. Very few nurses drank milk of any kind. Six percent of each group reported drinking skim milk. More drank whole milk: 35% of the Rotating group, 28% of the both the Evening and Night groups, and 16% of the Control group. Only 6% of the Evening and

4% of the Rotating shift groups reported drinking 2% milk. Two percent (3) of the nurses listed beer or wine as a beverage that they drink each day (Table 27). This is lower than what was reported by nurses when they were asked if they drank alcoholic beverages daily/often/rarely/never earlier in the survey (Table 13).

In addition to asking nurses what beverages they drank on a daily basis, they were specifically asked about coffee and soda consumption. To answer these questions, the nurses circled the number of cups of coffee or the number of sodas they drank each day; they were not asked to indicate the sizes of cups or if sodas were consumed in cans (i.e., 12 ounce cans) or glasses so exact quantities consumed are not known.

Most Control (40%, 32) and Night group nurses (38%, 11) drank two to three cups of coffee each day. The largest portion of Evening (44%, 8) and Rotating (35%, 18) shift nurses reported that they drank no coffee at all. Although these figures were not statistically significant, it is interesting to note that in each schedule group at least three-fourths of the nurses drank three cups of coffee or less each day. Daily coffee consumption by groups is shown in Table 28.

Questions also focused on the number of sodas the nurses drank each day. In all groups, at least 70% of the nurses drank three sodas or less each day. By group, 94% (76) of the Control group nurses drank no more than three sodas each day, followed by 91% (47) of Rotating, 83% (24) of Night, and 72% (13) of Evening shift group nurses. The remaining nurses drank between four and eight sodas each day, and one nurse drank thirteen. Daily soda intakes are shown in Table 28.

Table 28. Daily Consumption of Coffee and Soda by Nurses on Different Shifts.

Amount	Schedule Groups							
	Day (N=81)		Evening (N=18)		Night (N=29)		Rotating (N=52)	
Coffee (cups)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
0	21	(25.9)	8	(44.4)	10	(34.5)	18	(34.6)
1	14	(17.3)	3	(16.7)	1	(3.5)	11	(21.2)
2-3	32	(39.5)	3	(16.7)	11	(37.9)	16	(30.8)
4-5	10	(12.4)	4	(22.2)	4	(13.8)	4	(7.7)
6	2	(2.5)	0	(0)	3	(10.3)	2	(3.9)
10-15	2	(2.5)	0	(0)	0	(0)	1	(1.9)
Sodas	No.	(%)	No.	(%)	No.	(%)	No.	(%)
0	13	(16.1)	2	(11.1)	8	(27.6)	13	(25)
1	40	(49.4)	3	(16.7)	6	(20.7)	19	(36.5)
2-3	23	(28.4)	8	(44.4)	10	(34.5)	15	(28.9)
4-5	4	(4.9)	3	(16.7)	2	(6.9)	4	(7.7)
6-8	1	(1.2)	2	(11.1)	2	(6.9)	1	(1.9)
13	0	(0)	0	(0)	1	(3.5)	0	(0)

### Diets and Nutrient Intake

In addition to completing a 24-hour dietary recall the nurses were asked additional questions about their meal habits and dietary patterns. To determine if the nurses had any personal dietary beliefs or restrictions that might affect their intake, they were asked a series of questions about their dietary patterns.

Only 4% (7) of the group reported that they were on a prescribed diet, yet 44% (80) reported that they were personally restricting their diets. By group, almost half of the Day (48%, 39), Night (45%, 13), and Evening (44%, 8) shift nurses reported following self-imposed dietary restrictions, compared to a slightly lesser portion (39%, 20) of Rotating shift group nurses.

#### Purpose of the Diets

The nurses were also asked if they were following any self-imposed dietary restrictions. Subjects listed weight loss and caloric reduction as the major reasons for dietary restriction. Few followed diet regimens for medical or other reasons. Of all nurses responding, only 7% (12) reported following a certain diet as part of medical treatment (Table 29). This differed from the previously mentioned prescribed diets, because it included voluntary restrictions, such as watching one's sodium or cholesterol. Of these twelve nurses restricting their diets for medical reasons, 67% (8) were from the Day shift group, 17% (2) were from the Night shift group, and 8% (1) each were from the Evening and Rotating shift groups.

Sixteen percent (29) of the entire group of nurses were reducing their caloric intake. Of these nurses, most (55%, 16) were from the Day shift group. Group responses are shown in Table 29.

Diets followed to lose weight were reported by a third (60) of all nurses. Once again the greatest portion of nurses following a diet came from the Day shift group; in this case, 52% (31) of nurses following a diet to lose weight came from the Day shift group while only 5% (3) of nurses following weight loss diets came from the Evening shift group. Statistical analyses showed there were no differences among groups concerning dietary restrictions. Group responses are shown in Table 29.

Table 29. Purposes of Self-Imposed Dietary Restrictions by Nurses on Shift Work.

Groups	Purpose of Diet*					
	Medical Treatment		Reduce Calories		Lose Weight	
	No.	(%)	No.	(%)	No.	(%)
Day	8	(9.9)	16	(19.8)	31	(38.3)
Evening	1	(5.6)	2	(11.1)	3	(16.7)
Night	2	(6.9)	4	(13.8)	12	(41.4)
Rotating	1	(1.9)	7	(13.5)	14	(26.9)

\* Columns may not add to 100% because of multiple choices.

#### Types of Diets Followed

The nurses were shown eight types of diets and asked to circle any or all that they might be following. Only 1% (2) of the entire group of nurses were following a diabetic diet; 3% (6) were following a commercial diet plan such as Weight Watchers or Nutri-System. The low-fat diets were the most popular and were followed by 37% (67) of the nurses. No significant differences were found among groups relative to types of diet plans followed. Group responses to the different diets are shown in Table 30.

Table 30. Numbers of Subjects Following Various Types of Diets.

Type of Diet	Schedule Groups							
	Day		Evening		Night		Rotating	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Low Calorie	13	(16.1)	1	(5.6)	9	(31)	8	(15.4)
Low Fat	35	(43.2)	4	(22.2)	11	(37.9)	17	(32.7)
Vegetarian	7	(8.6)	1	(5.6)	1	(3.5)	2	(3.9)
Low Salt	17	(21)	3	(16.7)	4	(13.8)	6	(11.5)
Low Cholesterol	13	(16.1)	2	(11.1)	4	(13.8)	9	(17.3)
Diabetic	0	(0)	1	(5.6)	1	(3.5)	0	(0)
Commercial Diet Plan	5	(6.2)	0	(0)	0	(0)	1	(1.9)
Personal Diet Plan	7	(8.6)	3	(16.7)	2	(6.9)	6	(11.5)

\* Columns may not add to 100% because of multiple choices.

### Results of 24-Hour Dietary Recalls

To determine if there were differences in the nutrient intake of nurses who worked a permanent day shift and nurses who rotate shifts or work permanent evening or night shifts, each subject was asked to complete a 24-hour dietary recall. The recalls were evaluated using the computerized dietary program Nutritionist IV, Version 2.0.

To determine if there were differences among the groups, Analysis of Variance procedures were run for eighteen nutrients: protein, fat, carbohydrate, vitamin A, vitamin D, vitamin C, thiamin, riboflavin, niacin, vitamin B6, vitamin B12, calcium, phosphorus, magnesium, iron, zinc, calories, and cholesterol. There were no significant differences for any of these nutrients among the schedule groups. Results from Student-

Newman-Keuls, T-tests (LSD), and Duncan's Multiple Range Test for Variables also supported the findings of no difference among the schedule groups.

#### Nutritional Status of Groups as Compared to the RDA

To determine if the nurses' diets met the Recommended Dietary Allowances (RDA, National Research Council, 1989) for each group, the mean intake of the nutrients for each group was compared to the RDA for that nutrient using a T-test procedure. The percent of calories in the diet coming from fat was compared to 30%, the recommendation of the U.S. Dietary Guidelines (Dietary Guidelines Advisory committee, 1985). In each group there were several nutrients that were significantly different from the RDA, but interestingly, most were significantly higher than the RDA! Nutrient intakes for each schedule group are shown in Table 31.

#### Nutrient Means of Day Shift Compared to the RDA

Of the fourteen nutrients that were being compared to the RDA (and in the case of cholesterol, the U.S. Dietary Guidelines), eight were significantly higher than the RDA and four were significantly lower than the RDA.

The nutrient means of the Day shift group for protein, vitamin A, vitamin C, thiamin, riboflavin, niacin, vitamin B12, and phosphorus were significantly higher than the RDA (according to the T-test) for those nutrients ( $P \leq 0.05$ ). The group means for vitamin D, calcium, iron, and zinc were significantly lower than the RDA for those nutrients ( $P \leq 0.01$ ). Although mean intakes of the four nutrients were statistically lower than the RDA, only the group intake of Vitamin D was below the "safety zone" of two-thirds of the RDA. Intake of vitamin D was 64% of the RDA, zinc was 76%, and calcium and iron intakes were both 80% of the RDA (Table 32)

Table 31. Nutrient Intakes of Nurses by Shift Groups.

Dietary Components	RDA	Shift Groups			
		Day	Evening	Night	Rotating
Protein, g.	50.0	78.4 <sup>a</sup>	64.7	71.9 <sup>a</sup>	73.1 <sup>d</sup>
Fat, g.	*	63.2	58.6	62.7	56.6
Carbohydrates, g.	*	212.1	224.9	242.1	204.6
Vitamin A, RE	800.0	1166.6 <sup>a</sup>	1148.1	1160.1	1549.0 <sup>d</sup>
Vitamin D, ug	5.0	3.2 <sup>b</sup>	3.0 <sup>b</sup>	2.5 <sup>c</sup>	3.2 <sup>e</sup>
Vitamin C, mg	65.0	114.2 <sup>a</sup>	111.8 <sup>a</sup>	113.1 <sup>a</sup>	126.2 <sup>d</sup>
Thiamin, mg	1.1	1.4 <sup>a</sup>	1.7 <sup>a</sup>	1.4 <sup>a</sup>	1.3
Riboflavin, mg	1.3	1.6 <sup>a</sup>	1.6 <sup>a</sup>	1.6 <sup>a</sup>	1.5
Niacin, mg Equiv	15.0	20.7 <sup>a</sup>	20.9 <sup>a</sup>	20.0 <sup>a</sup>	21.5 <sup>d</sup>
Vitamin B6, mg	1.6	1.6	1.5	1.5	1.4
Vitamin B12, ug	2.0	3.7 <sup>a</sup>	2.8	3.8 <sup>a</sup>	3.3 <sup>d</sup>
Calcium, mg	800.0	638.9 <sup>b</sup>	579.0 <sup>c</sup>	735.4	6748.4
Phosphorus, mg	800.0	1088.6 <sup>a</sup>	1047.7 <sup>a</sup>	1158.9 <sup>a</sup>	1048.1 <sup>d</sup>
Magnesium, mg	280.0	251.5	249.9	244.6 <sup>c</sup>	212.2 <sup>e</sup>
Iron, mg	15.0	12.0 <sup>b</sup>	13.7	11.7 <sup>c</sup>	11.7 <sup>e</sup>
Zinc, mg	12.0	9.1 <sup>b</sup>	10.7	9.6 <sup>c</sup>	7.7 <sup>e</sup>
Kilocalories	*	1714.3	1651.9	1791.4	1603.5
Cholesterol, mg	300.0#	257.2	155.2	196.4	195.0

\* No RDA for this variable

# U.S. Dietary Guidelines recommendation

<sup>a</sup> Nutrient intakes significantly ( $P \leq 0.05$ ) higher than RDA

<sup>b</sup> Nutrient intakes significantly ( $P \leq 0.01$ ) lower than RDA

<sup>c</sup> Nutrient intakes significantly ( $P \leq 0.05$ ) lower than RDA

<sup>d</sup> Nutrient intakes significantly ( $P \leq 0.01$ ) higher than RDA

<sup>e</sup> Nutrient intakes significantly ( $P \leq 0.001$ ) lower than RDA

Table 32. Selected Nutrients and Dietary Components of Nurses Working Shiftwork Expressed by Mean Percent of RDA.

Dietary Component	RDA	Schedule Groups			
		Day %	Evening %	Night %	Rotating %
Protein, g.	50.0	156.8	129.3	143.9	146.2
Vitamin A, RE	800.0	145.8	143.5	145.0	193.6
Vitamin D, ug	5.0	64.0	60.6	49.2	63.6
Vitamin C, mg	65.0	175.6	172.0	174.0	194.0
Thiamin, mg	1.1	122.7	151.0	130.0	118.0
Riboflavin, mg	1.3	120.0	120.8	123.0	116.0
Niacin, mg	15.0	137.7	139.6	133.6	143.3
Vitamin B6, mg	1.6	96.9	96.3	93.0	88.8
Vitamin B12, mg	2.0	182.5	140.0	191.5	165.0
Calcium, mg	800.0	79.9	72.4	91.9	84.3
Phosphorus, mg	800.0	136.0	131.0	144.9	131.0
Magnesium, mg	280.0	89.8	89.2	87.4	75.8
Iron, mg	15.0	80.1	91.4	77.9	77.7
Zinc, mg	12.0	76.0	89.0	80.1	64.5
Cholesterol, mg	300.0	85.7	51.7	65.5	65.0
Percent Kilocalories from fat, %	33.0	33.0	32.0	32.0	32.0

### Nutrient Means of Evening Shift Compared to the RDA

Intakes of vitamin C, thiamin, riboflavin, niacin, and phosphorus were significantly higher ( $P \leq 0.05$ ) than the RDA according to the T-test. Only two of the Evening shift nutrient means compared were significantly lower than the RDA according to the T-test: vitamin D ( $P \leq 0.01$ ), and calcium ( $P \leq 0.05$ ). Although calcium intake was statistically lower than the RDA the mean intake was actually 72% of the RDA, which falls within the safety zone. The Evening shift group's Cholesterol intake was the lowest of the four schedule groups. Nutrient intakes are shown in Table 31, Nutrient intakes as percent of the RDA are shown in Table 32.

### Nutrient Means of Night Shift Compared to the RDA

The nurses from the Night shift group had intakes statistically higher (according to the T-test) than the RDA for seven nutrients: protein, vitamin C, thiamin, riboflavin, niacin, vitamin B12, and phosphorus ( $P \leq 0.05$ ). Their intakes for vitamin D, magnesium, iron, and zinc were statistically lower ( $P \leq 0.05$ ) than the RDA for those nutrients (Table 31). Vitamin D intake was only 49% of the RDA, while the mean intakes of magnesium, iron, and zinc were all above 75% of the RDA (Table 32). Mean cholesterol intakes were lower than the maximum recommendation by the U.S. Dietary Guidelines.

### Nutrient Means of Rotating Shift Compared to the RDA

The means of ten nutrients consumed by the Rotating shift group were significantly different (according to the T-test) from the RDA for those nutrients. Six were significantly higher than the RDA ( $P \leq 0.01$ ): protein, vitamin A, vitamin C, niacin, vitamin B12, and phosphorus. Mean intakes of vitamin D, magnesium, iron, and zinc were significantly lower ( $P \leq 0.001$ ) than the RDA for those nutrients (Table 31). Mean intakes of Vitamin D and zinc fell below two-thirds of the RDA (Table 32). Cholesterol intake was within the limit recommended by the U.S. Dietary Guidelines.

### Nutritional Status Among the Groups

Surprisingly, the schedule group with the fewest number of nutrients statistically lower than the RDA (calculated by a T-test procedure) was the Evening shift group. This group was deficient only for vitamin D and calcium.

The Day, Night, and Rotating shift groups were significantly lower (according to a T-test procedure) than the RDA in four nutrients. In each group the nurses were deficient in vitamin D (intakes were below 66% of the RDA). The Control, Night, and Rotating groups were statistically deficient in iron, and zinc, but with the exception of the Rotating groups' zinc intake, their intakes were above 66% of the RDA. Magnesium intakes for both the Night and Rotating shift groups were statistically lower than the RDA (although above 66% of the RDA). The Control group intake of calcium was below the RDA (but above 66% of the RDA).

Each group had intakes statistically higher than the RDA in vitamin C, niacin, and phosphorus. The Control, Night, and Rotating shift groups were all significantly higher than the RDA in protein, and vitamin B12. The three fixed shift groups (Control, Evening, and Night) had intakes significantly higher than the RDA in thiamin and riboflavin. All four groups had intakes lower than the RDA (although not necessarily significantly) in vitamin D, calcium, magnesium, iron, and zinc.

### Fat Consumption

Finally, the percent of kilocalories coming from fat in the diets of the nurses was calculated. An Analysis of Variance procedure showed that fat intake did not differ significantly among the groups. Interestingly, all four groups came close to the U.S. Dietary Guidelines recommendation that no more than a 30% of the kilocalories consumed each day come from fat. The mean percent of kilocalories coming from fat for the Control group was 33%, while the Experimental groups had intakes of 32%.

## DISCUSSION

The purpose of this study was to determine if there were differences between nurses who work a "normal" day schedule, nurses who rotate between two or more shifts, and nurses who work a permanent shift other than a "normal" day schedule. The specific differences researched were satisfaction with work schedule, satisfaction with health, self-evaluated general health status, dietary habits, and nutritional intake.

### Responses

The best return rates were achieved by the two hospitals (Hospital A and Hospital B) that had personal contact with the researchers (Table 1). These hospitals requested detailed formal research proposals that were reviewed and approved by hospital research committees. This resulted in enthusiastic administrative support of the study. Participation was encouraged through electronic mail, announcements at nursing staff meetings, and personal contact with the researchers and hospital contacts.

Although the nursing administrations at Hospitals C and D were just as enthusiastic as the two military hospitals, the fact there was no personal contact with the researchers may explain the slightly lower response rate. Contact with these two hospitals was limited to telephone conversations. At one hospital the follow-up survey packets were misplaced and distributed a month late. Overall, the response rate was good and higher than expected.

The four schedule groups varied in size: there were 81 nurses in the Day shift group, 18 in the Evening shift group, 29 in the Night shift, and 52 in the Rotating shift group. The Evening shift group was smaller than expected. This could have been due to the way nurses were assigned to schedule groups. Nurses who worked twelve-hour shifts (most were from Hospitals C and D) were excluded from the Evening shift group:

those working from 7:00 A.M. to 7:00 P.M. were assigned to the Day shift group while nurses working from 7:00 P.M. to 7:00 A.M. were assigned to the Night shift group. Many of the nurses in the Rotating shift group came from Hospitals A and B, the two military hospitals. Many of the nurses at Hospitals C and D were allowed to pick their schedules.

The Control group nurses tended to be more educated. Most were registered nurses and most held masters of science in nursing degrees (Table 2). The majority of nurses in this group were older, married, and had children (Table 3). Most worked 40 hours a week, but almost as many worked between 46 and 50 hours per week (Table 4). The Control group nurses had the most nursing experience of the four groups (Table 5).

Most Evening shift group nurses were registered nurses, but a large number were nursing assistants or licensed practical nurses. Few had college degrees. Although the Night shift group nurses tended to be registered nurses, the majority had diplomas in nursing and a large portion had high school degrees (Table 2). These two groups were older than the Rotating shift group but younger than the Control group, with the majority of nurses from these groups being in their thirties and forties. The majority were married, but fewer night shift nurses were married than Control or Evening shift nurses. Most had children (Table 3). A larger number of Evening shift nurses worked five days per week while the majority of Night shift nurses worked four days per week. Most nurses from both groups worked forty hours per week (Table 4).

A larger number of nurses in the Rotating shift group were registered nurses with bachelor of science in nursing degrees (Table 2). This reflects changes in the nursing profession: many nursing programs are moving away from two-year degrees (diploma in nursing) to four-year bachelor of science degrees. Nurses from this group were the youngest of all four schedule groups, and tended to be single with no children (Table 3). Like the Control group, most Rotating shift nurses worked forty hours a week or more (Table 4). These nurses had the least nursing experience of the four groups: most had up to three years of experience and almost as many had between four and nine years of

experience (Table 5).

### Schedule Satisfaction

As nurses become more experienced they move from rotating shifts to working permanent shifts (Table 5). In this study, the nurses who had the most years of experience were assigned to a permanent day shift. Most nurses had rotated shifts during their career but they generally rotated shifts at the beginning of their careers while acquiring experience, then moved into fixed shift positions.

Significant differences were found between the Rotating shift group and the three fixed shift groups in schedule satisfaction (Table 6). The Control group was the most satisfied with the work schedules, followed by nurses from the Night, Evening, and Rotating shifts. It is not surprising that the Rotating shift nurses were less satisfied with their work schedules than the three other schedule groups. Rotating shifts is physically exhausting and socially restrictive. Surprisingly, nurses who were permanently assigned to the night shift were only slightly less satisfied with their schedules than the Day shift nurses, the most satisfied group. The Evening shift group ranked third in schedule satisfaction; that is, they were less satisfied with their schedules than the Day and Night groups but were more satisfied than the Rotating shift group nurses.

A possible reason for the relatively high satisfaction score of the Night shift group nurses was that they had requested a permanent assignment to that shift by choice. Nurses working a schedule that they selected would naturally be happier with it. Nurses were not asked if they had volunteered for their schedules. Hospitals C and D offer a variety of scheduling opportunities for their nurses, so it is likely that the majority of nurses at these two hospitals selected the night shift schedule. However, it is not known if the nurses truly preferred to work the night shift, if they chose it for financial reasons (some hospitals offer a pay differential for night work), or because it was the only schedule available.

Why would nurses working permanent evenings be less satisfied with their schedule than nurses working permanent nights? Again, it is possible that the night shift is staffed wholly by nurses who volunteered for the shift since the night shift is considered a more difficult shift to work. The Evening shift nurses, on the other hand, may have been assigned to their shift.

These results are similar to those of Tasto et al (Tasto, Colligan, Skjei, & Polly, 1978), who found that nurses on the rotating and afternoon (or evening) shifts were the least satisfied with their job performance, followed by the night and day shift nurses. Nurses who rotated shifts experienced the most job-related stress, followed by those working afternoon, day, and night shifts. Coffey (Coffey, Skipper, & Jung, 1988) also noted that day shift nurses had the highest perception of their job performance, followed by night, afternoon, and rotating shift nurses.

Some nurses in the present study indicated that they chose the evening shift to share child care with their husbands or so they could go to school during the day. But other nurses consider the evening shift to be the least desirable shift because they work while the rest of the world plays. Also, they miss out on time with their families, especially the evening meal. Indeed, in this study 61% (the highest of all four groups) of the Evening shift group reported that their schedule adversely affected quality time with their family. Curiously, 61% of Evening shift nurses also stated that if given the chance to change their schedule, they would choose to work the evening shift. Of course, one may choose a shift because it is necessary due to personal circumstances (child-care, spouse's work schedule, pay differential) and still be dissatisfied with the affect it has on family life.

Other research has noted that evening and rotating shiftwork interferes more with family and social roles than night work (Mott, 1976). Charles and Brown (1981) noted female shiftworkers experience more problems at work and at home because concessions are not made for their problems (such as family responsibilities). Women with families meet the needs of their children at the expense of their own. Further, more women work

alternate schedules (such as evenings or nights) within the existing structure of the family; when men work alternate schedules the family structure adjusts around their schedule.

Overall, the Control group was most satisfied with their schedules and how it affects their daily lives. The one area in which the Control group nurses were the least satisfied was taking care of personal matters before and after work. Because the Day shift group works during regular business hours, they would have more trouble doing business during the day than the other schedule groups who could generally do errands before or after work.

More nurses in the Evening shift group than any other schedule group felt that they received constant support from their families in handling personal chores and business matters. Most women who work outside the home depend on their families for help with chores. For the most part Day shift nurses work while family members are at work or at school and Night shift nurses work while their families sleep. The Evening shift nurses, on the other hand, are at work while their families are at home. The families must prepare and eat the evening meal without them, and household chores such as school work and housekeeping must be performed in their absence. It would appear that for operations in the household to run smoothly, family members of evening and rotating shift workers must contribute more than the families of nurses on day or night shift schedules. Rotating shift group nurses were less likely to have children than the other groups. Also, because they were least satisfied with their schedules, these nurses could be expected to have the most difficult time combining work with family life, due to the added burden of a constantly changing schedule. Responses to questions on schedule satisfaction are shown in Table 33 in Appendix L.

## Health and Satisfaction With Health Status

A very large number (92% overall) of the nurses felt that they were in good health (Table 8). Over half received a complete physical examination each year (Table 9), indicating that they consider preventive health measures to be important. Although only a small number of the nurses smoked, it was interesting to note that over half of the smokers came from two groups: Rotating and Night shifts (Table 10).

As observed in Table 11, over half of all subjects considered themselves to be at the correct weight for their height; however, more were from the Control and Rotating shifts than from the Evening and Night shift groups. Many nurses in the Control group were in administrative positions and worked a traditional schedule. Half reported exercising on a regular basis (Table 12). Fifty-three percent of the Rotating shift group nurses reported exercising regularly; but because they were younger as a group than the other schedule groups, it may have been easier for them to maintain their correct weight. Night shift nurses were more likely to describe themselves as being overweight (55%) as well as to smoke cigarettes (28%), (Tables 9 and 8, respectively).

As with schedule satisfaction, there were significant differences among the groups relative to the perceived effect that schedules had on their health. The Control group nurses were the most satisfied with the way their work schedule affected their health (Table 7). Nurses working from the Evening, Night, and Rotating shift groups perceived that schedule had a greater negative impact on health.

A larger number of the Day shift group nurses stated that it was easier to maintain their health than the other schedule groups. The Rotating shift group nurses found it the most difficult. Rotators also felt that their general health and well-being changed with their work schedule. These results are similar to those of other researchers who found that disruption of circadian rhythms can result in headaches, gastrointestinal irregularities, fatigue, and lowered resistance to disease (Felton & Patterson, 1971). Others (Pocock, Sergean, & Taylor, 1972; Angersbach, Knauth, Loskant, Karvonen,

Undeutsch, & Rutenfranz, 1980; Colligan, Frockt, & Tasto, 1979) have noted that shiftworkers have more absences from work due to illness, and are sick for longer periods of time.

Interestingly, more nurses (60%) from the Rotating shift group than the other groups reported having time for personal care. Forty-one percent of both the Control group and Night shift nurses reported that it was easy to schedule personal time, but only a small percent (11%) of Evening shift nurses were positive about scheduling personal time (Table 34 in Appendix M). These responses differed from those to the similar question regarding "maintaining one's health." In the latter the Rotating shift group (39%) found it most difficult, followed by Night shift group (24%), Evening shift group (17%), and Control group (11%). Responses are shown in Table 34 in Appendix P. The differences noted among the groups in response to the two questions may have been the result of the statements not being worded precisely enough for accurate differentiation. Responses to questions regarding Health Satisfaction are shown in Table 34 in Appendix M.

### Sleep

Lee (1992) reported that female nurses working night and rotating shifts had higher incidences of sleep disturbances and excess sleepiness than nurses working the day and evening shifts. Matsumoto (1978) found that nurses who slept during the day slept less than nurses who slept at night.

The findings of this study are similar. More of the Night (66%, 19) and Evening (56%, 10) group nurses reported that they do not get enough sleep, compared to the Rotating (54%, 28) and Control (44%, 36) group nurses (Table 34 in Appendix M).

The Night (83%, 24) and Rotating (79%, 41) groups had the largest percentage of nurses reporting that they slept more hours on their days off, followed by the Control

(70%, 57) and Evening (44%, 8) groups. The Night and Rotating groups also reported that their sleep was affected by their schedule (79%, 23 and 75%, 39, respectively) while less than half of the Control and Evening groups (46%, 37 and 44%, 8) reported this.

Night shift nurses, even though they work a permanent shift, most probably revert to a "day" schedule on their days off. Therefore, both the Night and Rotating shift nurses' sleep patterns may never adjust to a schedule of continual changes in their schedules. Both of these groups reported a detrimental effect on their sleep from their schedule. Groups who work late shifts and keep changing sleep/awake patterns also have more trouble falling asleep, more midsleep awakenings, problems arousing from the end of a sleep period, and problems maintaining wakefulness (Lee, 1992).

A major cause of night work sleepiness is the circadian regulation of sleep/wakefulness. If the circadian rhythm were flexible, there would be no problem in adjusting to the phase shift required by night shift work. However, this rhythm is not flexible, and shift workers do not adjust completely to the night shift unless commitment to night work is total. Sleepiness on the night schedule can be improved by making changes in the shift schedules and in the work tasks/work environment, application of personal strategies, or artificial manipulation of sleep/wake regulation.

Akerstedt (1988) recommended several strategies to combat sleepiness and ease the effects of rotating shifts. A schedule with minimum sleepiness should have a short night shift, rotate clockwise, have the night shift at the end of series of shifts, and have a slow rotation. The latter is contrary to the general view on good shift schedules, but is based on the observation that at least some adjustment occurs across successive night shifts. Very rapid rotation may be preferable with respect to general health but will incur more sleepiness than necessary, since no adjustment is accomplished and since the first (and maybe only) night shift will be associated with maximum sleepiness because of the extended prior waking.

With respect to work tasks and the environment, one should strive for as stimulating and nonsedentary tasks as possible. The climate should be cool and the

lighting good. High levels of irregular noise would help reduce sleepiness but should be excluded on other grounds.

Among personal strategies, one is napping, particularly before the night shift. This would reduce subsequent night shift sleepiness somewhat. Taking a break does not seem to have any lasting effects on sleepiness, however. One could also start delaying one's circadian phase before the actual night shift is due. This may, however, interfere with one's social life and should be resorted to only when high night shift alertness is of outstanding importance.

### Quality of Life

Half of the Evening shift and Rotating shift group nurses reported that their quality of life would improve if they worked a different schedule. Results from the Night shift group was similar with 45% agreeing, but only 17% of the Control group stated that their quality of life was adversely affected by their schedule (Table 34, Appendix M).

An important factor considered in quality of life is relationships with family and friends. Working a schedule that changes from one day to the next, or working during the hours when most social activities take place would prevent individuals from joining in these activities. Night shift workers could take part in some social activities immediately before they report to work, but Evening shift workers would be able to participate only on their off days. Tasto et al (Tasto, Colligan, Skjei, & Polly, 1978) reported that nurses working evening or rotating shifts ate fewer meals with family and friends than those who worked the day shift.

## Energy and Fatigue

Akerstedt (1988) reported that shiftworkers report more fatigue than day workers. Similarly, in this study, the Rotating group had the greatest number of subjects who reported feeling tired all the time, tired at work, and required their days off to recuperate. Although the Evening group was least likely to report feeling a general lack of energy and being worn out by the end of the week, they ranked close to the Rotating group in feeling tired at work and needing their days off to recuperate (Table 34, Appendix M).

## Smoking

Although Gordon et al (Gordon, Cleary, Parker, & Czeisler, 1986) found no differences between male and female shiftworkers in smoking behavior, the results of this and other studies differ. In this study, 14% of all nurses smoked, and 34% of the nonsmokers were former smokers (Table 10). Garfinkel and Stellman (1986) reported that 23% of nurses smoked, and another 26% were former smokers. In a study performed by Haughey et al (Haughey, Kuhn, Dittmar, & Wu, 1992), 20% of Critical Care Nurses admitted to smoking. The greatest number of smokers in the present study came from the Night (28%) and Rotating (15%) groups (Table 10). In fact, 64% of all smokers came from these two groups. Hood and Milazzo (1984) also found that night workers smoked more cigarettes than workers from other groups.

## Consumption of Alcoholic Beverages

Less than a third of all the nurses surveyed reported that they drank alcohol regularly. The Control and Rotating groups contained the greatest number of nurses who reported drinking, 37% and 33% respectively, whereas the Night and Evening groups contained the fewest, 14% and 12% respectively (Table 13). Nurses assigned to the Evening and Night groups work during the hours when alcohol is traditionally consumed. Furthermore, Night group nurses would probably abstain from drinking alcohol during traditional social hours because they have to go to work afterwards. The Rotating shift group contained the largest number of young nurses who may have more active social lives which included drinking alcohol. An interesting observation was that, in all four schedule groups, more nurses reported not drinking or drinking alcohol only rarely than the number who reported drinking often or daily. Altogether, 70% of nurses in this study reported that they did not drink alcohol, or drank it rarely. This may be expected from a group of well-educated health professionals. However, these results differed from those of Haughey and coworkers (Haughey, Kuhn, Dittmar, & Wu, 1992) who reported that 26% of Critical Care Nurses surveyed reported abstaining from alcohol. Other researchers (Gordon, Cleary, Parker, & Czeisler, 1986; Hood & Milazzo, 1984; Debry, Barbier, Girault, & Lefort, 1969) have reported that shiftworkers consume more alcohol than day workers.

## Diagnosed Diseases and Physical Conditions

Health problems related to shiftwork have been documented by several researchers. Reports (Costa, Apostoli, d'Andrea, & Gaffuri, 1981; Akerstedt, 1988; Angersback, Knauth, Loskant, Karvonen, Undeutsch, & Rutenfranz, 1980) have documented that shiftworkers had higher rates of gastrointestinal diseases, peptic ulcers, cardiovascular disease, and neurotic disorders than day workers.

Results of this study did not fully support those findings. Although differences in the mean number of subjects with diagnosed diseases among the four schedule groups were not significant, the Control group, who were permanently assigned to the day shift, had a greater mean number of illnesses than the other three groups (Table 14).

To determine if the shift worked had any effect on nurses' health they were given a list of fourteen physical conditions or ailments, such as heartburn, eye strain, and back pain, and asked if they noticed any changes in these conditions associated with the shift they worked. The mean score obtained for each group was called their "physical complaint score" and measured the effect of the subjects' work schedule on various physical conditions.

The Control group's physical complaint score (+1.2) was higher than the scores of the experimental groups, indicating a positive relationship between the day shift and the fourteen physical factors mentioned (Table 16). The physical complaint scores of the Rotating subjects were best (+0.7, interestingly, the scores were the same) when they were assigned to the day and night shift. In fact, Rotating nurses had less physical problems while working the night shift than did the Night shift group nurses, which may indicate the negative health effects of permanent night work. Both the Evening (-0.9) and Night (-0.8) groups had low mean scores, indicating that these physical factors worsened when they worked their assigned shifts.

Although the Rotating subjects had a positive mean score when they worked the day shift, their mean score (+0.7) was still lower (worse) than that of the Control group (+1.2), indicating a negative effect of shiftwork on health. Results showed that the Evening shift was the most physically difficult. Mean scores for nurses permanently assigned to this shift (-0.9) were the lowest of the three permanent shifts, and the Rotating shift nurses scored lowest (-1.4) when assigned to the evening shift. A possible reason for this is fatigue. Nurses working the evening shift may keep the same hours as nurses who work the day shift, but they go to work at the end of the day and work until 11:00 P.M. Even nurses who sleep late in the morning might have trouble feeling fresh

when they start work at 3:00 P.M. Furthermore, the evening shift may be more physically stressful given the smaller staffs present on the evening shift.

Why would the Control nurses have a slightly higher mean number of illnesses than the experimental groups? One reason could be their age. The Day shift nurses were older as a group than the experimental groups, especially the Rotating shift nurses. Others (Hood & Milazzo, 1984; Colligan, Frockt, & Tasto, 1979) noted that the day shift is often highly populated by older workers who may have some health problems related to their age, and former shift workers who may have moved to days because of health problems. However, none of the subjects in this study reported being transferred to a different shift because of health problems. Workers who can work in the evening or at night, or who can rotate shifts without problems, often remain on those shifts while workers who cannot are transferred to the day shift. A survey of health records thus may indicate no difference in health between day workers and shiftworkers because the day shift ends up overpopulated with workers who became ill while rotating shifts, or were allowed to move to the day shift due to their seniority.

## Stress

In all four schedule groups, most nurses considered the stress levels of their jobs to be either high or average; only 4% of all nurses considered stress levels to be low (Table 15). But the question may be asked, "What is average to a nurse?" Nurses expect a certain amount of stress in their jobs. Day shift nurses in supervisory and management positions may find their responsibilities as managers to be stressful, while the staff nurses may find the patient care to be stressful.

Study participants frequently commented that the day shift is extremely busy. Evening and Night shift groups worked with less supervisory assistance and smaller staffs. Members of the Night shift group often commented that at times they were the only nurse on the ward. The Night shift group is on duty while patients should be

sleeping, but in many hospital wards patients find it difficult to sleep. Each group has a unique set of stressors.

The Evening shift group had the highest number (50%) of nurses reporting high stress. The evening shift may be more stressful than the night shift (41% of Night shift nurses considered their jobs to be stressful), because Night nurses were working while the patients were (or should have been) sleeping. Evening shift nurses are responsible for evening meals and medications, but do not have the administrative support that day nurses have. Evening and night workers work with a "skeleton crew."

A similar number of Rotating shift nurses (48%) considered their jobs to be stressful. The very act of rotating among shifts is stressful; in addition, nurses who rotate shifts are constantly having to adjust to working with different staff members and changing duties.

Several authors reported a relationship between shiftwork and job-related stress (Storlie, 1979; Shubin, 1978). Hood and Milazzo (1984) reported that nurses who worked nights or rotated shifts reported more migraine headaches and gastritis, and reported having trouble balancing work and family life. Other researchers (Coffey, Skipper, & Jung, 1988; Tasto, Colligan, Skjei, & Polly, 1978) reported that nurses on the day shift were more satisfied with their job performance than rotating and evening shift nurses. Rotating shift nurses also experienced the most job-related stress. The rotating shift was believed by these researchers to be more stress-producing because nurses must interact with different groups of people each shift.

A common problem in nursing is burnout. Nurses can become disillusioned with nursing, or become exhausted from helping others while neglecting their own needs. To prevent burnout, workers are advised to take care of themselves, take breaks while on duty, exercise, and eat a balanced diet. Some authors attribute burnout to rotating and assigned shifts (Storlie, 1979; Shubin, 1978).

## Supervisory Support

Relationships with supervisors would have some effect on the nurses' stress and perception of their job performance. In general, the nurses seemed to have good relationships with their supervisors: 90% of all subjects reported that interpersonal relationships with their supervisors were good. Almost all (96%) of the Control group agreed with this statement, compared to 79% of the Night shift. Nurses also reported receiving helpful support from their supervisors. By group these were: Control, 91%; Evening, 72%; Night, 83%; Rotating, 83%. The Control group may have felt more positively towards their supervisors because they actually worked with them while Evening and Night nurses would have worked without direct supervision. Responses to questions about supervisory support are shown in Table 33 in Appendix L.

## Diet

### Meal And Snack Consumption

Previous researchers have reported that non-traditional schedules make it difficult for workers to consume a balanced diet. Several (Takagi, 1972; Reynolds, Hodges, & Shifflett, 1987; Sato & Takagi, 1972) have reported that shiftworkers eat fewer meals per day and also fewer meals with their families than day workers. The results of this study were similar. Control subjects ate more meals per day and more meals while at work than the experimental groups (Table 18), but they ate the fewest snacks (Table 23). The Night shift group consumed the lowest mean number of meals while at work, but had the highest mean number of snacks while at work. These "snacks" may be taking the place of meals, especially since there may be no cafeteria or snack bar open where they could purchase a meal. Indeed, only 7% of Night shift nurses reported eating a meal in a snack bar or cafeteria while at work (Table 21).

Control subjects reported consuming one meal each day with their families. The

nurses who worked evening and night shifts reported eating slightly less than one meal each day with their families (Table 18). Control group nurses would be expected to share at least the evening meal with their families. Given their schedules, it is surprising that nurses from the experimental groups would be able to eat as many meals with their families as they do.

Only one-fifth of all nurses surveyed reported that they never skip meals. Not surprisingly, the Rotating shift had the highest percentage of nurses (31%) who reported that they usually skip meals. At least 55% of each shift schedule reported that they sometimes skip meals (Table 19). Since at least 16% of each schedule group reported that no time is set aside for their meals while on duty (Table 20), it appears that most nurses simply grab a snack when they can. Skipping meals may increase fatigue, especially with the Experimental group nurses who were primarily care-givers.

#### Amount of Time Allowed For Meals

A common complaint from subjects in this study was that their shift or hospital was understaffed. Many of the nurses commented that they were so busy on their shifts that they often did not have time to sit down to eat. Instead, they ate while they were charting or conferring with other nurses. One nurse commented that although she was very conscious of the need to eat a healthy diet, certain nutritious foods such as salads "took too long to eat." Therefore, she packed sandwiches or yogurt for lunch and would duck behind the nurses' station to eat. Another nurse commented that since she was the only nurse on her shift, there were nights when she didn't even have time to use the bathroom, let alone sit down and eat a meal.

In this study, the nurses were asked how much time was allowed for their meals. Fourteen percent of all nurses participating in the study reported that no time was scheduled for their meal. The amount of time allowed by a hospital for employee meals may be different from the amount of time that the nurses actually are able (due to their workload) to take for their meals.

The majority of nurses in each schedule group reported that between 15 and 30 minutes were allowed for lunch. Even though the Control group was the only shift that reported that one hour was allowed for their lunches, only 9% of the Day nurses gave this response (Table 20).

### Location of Meals

Perhaps because meals and snacks are taken in such a haphazard fashion, it is not surprising that few nurses (17% of all nurses surveyed) took their meals in a cafeteria or snack bar, which would require more time away from their workstation (Table 21). Of the four shift groups, more subjects from the Control group (21%) took their meals in a cafeteria. Evening (11%) and Night shift nurses (7%) may not eat in the cafeteria simply because it is closed during their work hours. Stewart and Wahlquist (1985) noted that evening and night workers were more dependent on food brought from home or purchased from vending machines because canteens or cafeterias do not operate during their shifts. They noted that workers who brought meals from home consumed meals that were lower in calories than those who depended on vending machines. No subjects in this study mentioned vending machine foods, nor was it always possible to distinguish foods brought from home from foods purchased from a cafeteria or canteen.

While most nurses in the Control group ate their meals at their desks, most of the nurses in the Experimental groups ate with other staff members in a lounge or break area, or the nurses station. Many of the Control group nurses were in administrative positions, presumably with their own offices, whereas nurses in the experimental groups were generally assigned to the wards.

### Beverage Consumption

The three beverages consumed the most by all four schedule groups were water, coffee, and sodas (Table 27). Only the Rotating shift group drank more fruit juice than coffee and soda. Evening and Rotating shift nurses consumed more milk (skim, 2%, and

whole milk consumption combined) than diet sodas. However, they consumed more regular sodas than milk. In all groups, more nurses reported consuming water each day than any other beverage. For busy nurses, water is the beverage most easily obtained. With the exception of alcohol and coffee, researchers have not reported beverage consumption, so information on specific beverage consumption by shiftworkers is lacking.

### Coffee

Much of the research on coffee consumption by shiftworkers has focused on the negative effects on a shiftworker's health, such as a cause of gastritis. Hood and Milazzo (1984) observed that night workers drink more coffee than day workers. They also noted that shiftworkers who could tolerate coffee drank a great deal while those who could not, due to gastritis, avoided it.

The results of this study differed. Subjects were asked to list the different beverages that they drank each day (Table 27) as well as how many cups of coffee they drank each day (Table 28). More than half of all the nurses surveyed drank coffee daily. The Control group had the largest number of nurses (69%) who reported drinking coffee each day. The Rotating shift, the group with the fewest daily coffee drinkers, had 45% of its subjects consuming coffee each day (Table 27).

There were some discrepancies between the responses to the questions regarding beverage intake. For example, as stated above, 45% of Rotating shift group nurses reported that they drank coffee on a daily basis. Yet when asked how many cups of coffee they drank each day (Table 28), 65% of Rotating nurses responded that they drank one or more cups of coffee each day. Over half of all Rotating nurses drank one to three cups of coffee per day. This was more than the amount consumed by the Evening and Night groups but slightly less than the consumption of the Control group. Fourteen percent of Rotating nurses drank more than four cups each day, the smallest percentage of any of the schedule groups.

Over a third of the Rotating and Night nurses drank no coffee at all, a response which was greater than that of the Control group and less than that of the Evening group. These findings are consistent with the results reported by Haughey et al (1992), who reported that 28% of Critical Care Nurses reported drinking no coffee, while 27% drank one to two cups per day.

The greatest percentage of nurses in the Control group (almost 40%) drank two to three cups of coffee each day, while most Evening nurses, (44%) drank no coffee at all (Table 28). Again, subjects' responses to questions about the numbers of cups of coffee consumed (Table 28) do not agree precisely with the responses reported in Table 27. The two greatest responses from the Night and Rotating shift groups were also nurses drinking no coffee and nurses drinking two to three cups a day. These results differ somewhat from research that reported that night and rotating shiftworkers consumed more coffee than day workers. Much of the research in the literature involves male shiftworkers, who may consume more coffee than their female counterparts.

Coffee consumption by the Control, Night, and Rotating shift nurses decreased after three cups, whereas it increased for the Evening shift group. Twenty-two percent of Evening shift nurses drank four to five cups of coffee each day. This was the highest percentage of coffee-drinking nurses for the Evening group. The Night group also had a large number of nurses drinking more than three cups of coffee each day. In fact, although coffee consumption for all groups (except the Evening shift group) decreased after three cups, 10% of Night shift nurses drank seven cups or more of coffee each day compared to a very small percentage of nurses from the Control, Evening, and Rotating shift groups.

Coffee consumption by nurses is of interest since coffee contributes no nutrients to the diet and may displace more nutritional beverages, such as fruit juices and milk. However, black coffee contributes no calories, which may be of interest to nurses watching their weight.

### Diets and Nutrient Intake

Most of the nurses surveyed reported that they consider themselves to be in good health, so it was not surprising that only four percent of them were on medically prescribed diets. Although 58% of all nurses surveyed considered themselves to be at the correct weight for their height, 44% were voluntarily restricting their diet in some way. In each group, the largest number of nurses restricting their diets were following a low-fat diet in order to lose weight. Following a low-fat diet and watching their weight may simply be two ways that health professionals stay healthy.

### Results of the 24-Hour Dietary Recalls

The objective of the 24-hour dietary recall was to determine if the diets of the control group would differ from the diets of the experimental groups. The hypothesis was that not only would the diets differ, but that the diets of the Rotating shift group would be less adequate than the diets of the control group.

The nutrient intakes were averaged for each group, analysed, and compared to the RDA. The RDA is set at 130% of the mean of recommended intake, which means that an intake of 75% of the RDA will meet the needs of half of a particular population while an intake of 65% of the RDA will meet the needs of 17% of a given population (Guthrie, 1989). Two-thirds of the RDA is also a commonly used "safety zone."

The Rotating shift group did not differ from the other three schedule groups in nutrient intake. Although there were no statistical differences in nutrient intakes among the four schedule groups when analyzed by Analysis of Variance and T-test procedures, the data showed trends among groups.

None of the schedule groups met the RDA for every nutrient studied, but vitamin D was the only nutrient for which consumption by all four groups fell below the "safety zone, or 75% of the RDA. The intake of calcium by the Evening shift group also fell below 75% of the RDA. Daily milk consumption by all four schedule groups was low, ranging from 23% of Control nurses reporting drinking milk each day to 45% of the

Rotating shift group. Nurses who do not drink milk each day would have to carefully monitor their diets in order to consume a diet adequate in calcium and vitamin D.

All four schedule groups had intakes lower than 97% of the RDA for vitamin B6, calcium, magnesium, iron, and zinc. Intakes for all groups were greater than 100% of the RDA for protein, vitamin A, vitamin C, thiamin, riboflavin, niacin, vitamin B12, and phosphorus.

None of the groups exceeded 1800 kilocalories for the day reported, and the percent of calories coming from fat for all four groups was 33% or less. This may be because 37% of the nurses reported that they follow low-fat diets. The cholesterol intake of the Control group was 257 mg, but intakes of the three experimental groups was below 197 mg (Table 32).

Several researchers (Linusson, Sanjur, & Erickson, 1974; Gersovitz, Madden, & Smiciklas-Wright, 1978) have reported that the dietary recall is prone to over-reporting low intakes and under-reporting high intakes, a pattern known as the "flat-slope syndrome." This can result in a failure to detect differences between groups due to a downward bias in the number of subjects with extremely low and extremely high intakes.

Nutrient intakes for each of the schedule groups in this study were quite good. With the exception of three nutrients (vitamin D, calcium, and zinc), all groups exceeded 75% of the RDA, and in many cases they exceeded 100% of the RDA. The nutrient intakes of individual subjects within groups varied widely, but the nutrient intakes among the four groups did not. This could be due to averaging the standard deviation, or the "flat-slope syndrome. Mean intakes of dietary components are shown in Table 35 in Appendix N.

Dietary intake studies of shiftworkers have been done primarily on male factory workers. Debry, Barbier, Girault and Lefort (1969) found that rotating shiftworkers often skipped meals and consumed diets that were low in protein and carbohydrate and high in fat. Froberg (1980) reported that, although night workers' did not consume a complete meal on their break and had decreased appetites, their dietary intakes were

equivalent to the average population. Maxwell and Robitaille (1980) reported that only 19% of shiftworkers consumed adequate diets. Debry et al (Debry, Barbier, Girault & Lefort, 1969) reported that the diets of night workers were least adequate (compared to the day and evening workers), and that evening and night workers often skipped meals.

When the dietary recalls were completed by Rotating shift nurses, they would have been working a day, night, or evening shift. It is possible that if a nurse's diet is better when working the day shift, the nutrient intake may be better on that particular day than when the night shift is worked. If this is the case, the Rotating shift group nurses may "cancel each other out," that is, the nurses whose diets are better because of the particular shift assigned would cancel out the nurses whose diets are worse because of the shift they are working.

At least 55% of the nurses in each schedule group in this study reported that they sometimes skipped meals (Table 19). The mean number of meals consumed each day by each of the four schedule groups was less than three. Yet the average diets of the four groups were quite adequate, if not excellent, in all but two nutrients, calcium and vitamin D. Furthermore, the average cholesterol and fat intakes of the Experimental groups (cholesterol intake of the Control group was 257 mg, which is higher than recommended) were either within or close to the U.S. Dietary Guidelines.

The nurses in this study were well-educated; 85% reported educational levels above a high school diploma. Almost 60% of the nurses in this study were under age forty. Fifty-seven percent reported that they were at the recommended or normal, weight for their height and 49% reported that they exercise regularly. Thirty-seven percent of all nurses surveyed reported they were following a low-fat diet, 17% were following a low-salt diet, and 16% were following low-cholesterol diets.

The subjects of this study were professional females, a group that may feel some expectations to monitor in a positive way the eating habits of their families. Also, it has been noted that women are more accurate in reporting their food intakes (Medlin & Skinner, 1988; Karvetti & Knuts, 1985) perhaps because they take more interest in what

they eat. It is also possible that some of the subjects have taken nutrition courses as part of their training, and that they see nutrition as a treatment and/or intervention strategy.

The health impacts of poor dietary habits are well-known and nurses in a hospital setting are exposed to them daily. In general, nurses as a group are highly educated and health conscious. These unique qualities of the subjects surveyed could explain the lack of differences in nutrient intakes among the schedule groups, and the adequacy of the nurses' diets as a group.

## SUMMARY AND CONCLUSIONS

Four hundred and sixteen full-time nurses from four hospitals were invited to participate in a research project to determine if there are differences in the diets, schedule satisfaction, and health satisfaction of nurses who are permanently assigned to a day shift, nurses who rotate shifts, and nurses who are permanently assigned to the evening or night shifts. One hundred and eighty nurses (43%) returned useable surveys and diet recalls.

Although the overall subject response in this study (49% response rate) was good, it might have been better if direct, personal contact with Hospitals C and D, rather than via telephone and mail had been possible.

Almost 80% of the participants were registered nurses. There were some differences in educational levels among the groups: the majority of the Control group had their master's degrees, while most Evening and Rotating shift nurses had bachelor's degrees. The majority of Night shift nurses were diploma (associate degree) nurses.

The Control group was the "oldest" of the four groups while the Rotating shift was the "youngest." Most Control nurses were in their forties while most Rotating shift nurses were in their twenties. These differences were significant. Nurses in the Rotating group tended to have less nursing experience than nurses in the Day shift group.

Significant differences were noted in schedule satisfaction. As a group, the Control subjects were the most satisfied with their work schedules, followed in order of satisfaction by the Night, Evening, and Rotating shift nurses, who were the least satisfied.

The Day Shift nurses were also the most satisfied with the way they felt their schedule affected their health and their ability to maintain their health, followed by the Evening, Night, and Rotating shift groups. These results were significant.

Relative to health status, most nurses within each group reported having a physical examination each year. Although a minority within each group smoked

cigarettes, more nurses from the Night shift group smoked than those from any other group.

Within each shift over half of the nurses rated the stress level of their jobs as average, with slightly less than half rating their jobs high-stress. More Evening and Rotating shift nurses rated their jobs high stress than Control and Night shift nurses.

Some differences were found among the schedule groups in meal consumption patterns and nutrient intakes. The Control subjects consumed significantly more meals each day and more meals with their families than experimental group subjects. More Rotating shift nurses reported skipping meals than nurses from the other groups, with the fewest skipped meals being from the Control subjects.

Differences in the amount of time taken for meals were noted. The Controls had more time for their meals than any of the other groups. Fewer Control group nurses took 15 to 30 minutes for their meals and more took 45 minutes for their meals, whereas more Rotating shift nurses took 15 to 30 minutes. Within each schedule group most nurses (at least 54% of each group) reported taking 15 to 30 minutes for their meals while at work. Seventeen percent of nurses from the Control, Evening and Night shift groups reported that no time was allowed for their meals. Nurses who worked the night shift consumed the most snacks each day as well as the most snacks at work. The Control nurses consumed the least number of snacks. Differences in snack consumption at work were significant.

One-third of the Rotating shift nurses reported that they adjust right away to changes in their meal times, but 22% reported that they never adjust. Twenty percent reported that it takes them one day to adjust.

Analyses of dietary recalls revealed no significant differences for the major nutrients among the schedule groups. When group means were compared to the RDA, each of the four groups had intakes of Vitamin D below 75% of the RDA. The calcium intake of each group was below the RDA, although only the Evening group's intake was below 75% of the RDA. All groups were below the RDA for magnesium, iron, and

zinc.

The results of this study confirmed the hypothesis that the job satisfaction and health satisfaction levels of shiftworking nurses would be less than those of nurses who work fixed shifts. Results also showed that nurses who work evening and night shifts had lower satisfaction levels than the Control and Rotating subjects.

The hypotheses that the diets of shiftworking nurses would differ from and be less adequate than the diets of permanent day and fixed-shift nurses were not confirmed. The diets of the four groups did not differ from each other, and with a few exceptions (vitamin D intake for all schedule groups, the Evening shift group's calcium intake, and the Rotating shift group's zinc intake) were adequate.

The differences in personal characteristics of the four groups may affect dietary intake. A study controlling for these characteristics would need to be designed to determine the specific effect shift alone has on diet.

Some of the nurses in the study worked twelve-hour shifts and some worked eight hour shifts. This may affect dietary intake and, to be accurate, different types of schedules should be compared to each other, keeping certain variables constant. It may be preferable to limit a study to one type of schedule, i.e., only eight hour shifts.

One-third of the nurses were active duty military personnel. The armed forces have strict weight and fitness requirements. If these nurses exercised more and were more conscious of their diet in order to meet these standards, it could possibly affect the results.

This study confirmed previous research that shiftworking negatively affects workers. Shiftworking nurses were less satisfied with their schedules, with the impact of their work schedule on their personal and family life, and with the impact of their schedule on their health. Although nutrient intake did not seem to be affected, it was noted that nurses working evenings and nights ate fewer meals and more snacks than day workers, and were more likely to skip meals.

Shiftworking nurses answered their surveys according to the day they were

actually filling out the form. More direct comparisons would be possible if the diets of individual shiftworking nurses when they work day, evening, or nights were investigated for differences in their individual behaviors.

## REFERENCES

1. Adams, J., Folkard, S., Young, M.: Coping Strategies Used by Nurses on Night Duty. *Ergonomics* 29(2): 185-196, 1986.
2. Akerstedt, T.: Sleepiness as a Consequence of Shift Work. *Sleep* 11(1): 17-34, 1988.
3. Akerstedt, T., and Gillberg, M.: Sleep Disturbances and Shift Work. IN Reinberg, A., Vieux, N., and Andlauer, P.: Night and Shift Work. Oxford: Pergamom Press: 127-135, 1981.
4. Angersbach, D., Knauth, P., Loskant, H., Karvonen, M., Undeutsch, K., and Rutenfranz, J.: A Retrospective Cohort Study Comparing Complaints and Diseases in Day and Shift Workers. *Int Arch Occup Environ Health* 45: 127-140, 1980.
5. Block, G.: A Review of Validations of Dietary Assessment Methods. *Am J Epidemiol* 115(4):492-505, 1982.
6. Charles, N., Brown, D.: Women, Shiftwork and the Sexual Division of Labour. *Sociological Review* 29(4): 685-704, 1981.
7. Chalmers, F.W., Clayton, M.M., Gates, L.O., Tucker, R.E., Wertz, A.W., Young, C.M., Foster, W.D.: The Dietary Record - How Many and Which Days? *J Am Dietet Assoc* 28:711-717, 1952.
8. Coffey, L.C., Skipper, J.K., Jung, F.D.: Nurses and Shift Work: Effects on Job Performance and Job-Related Stress. *J Adv Nursing* 13: 245-254, 1988.
9. Colligan, M.J., Frockt, I.J., and Tasto, D.L.: Frequency of Sickness Absence and Worksite Clinic Visits Among Nurses as a Function of Shift. *Appl Erg* 10(2):79-85, 1979.
10. Cook, F.P.: Shiftwork. London: Institute of Personnel Management, MacDonald and Evans, 1954.

11. Costa, G., Apostoli, P., d'Andrea, F., and Gaffuri, E.: Gastrointestinal and Neurotic Disorders in Textile Shift Workers. IN Reinberg, A., Vieux, N., and Andlauer, P.: Night and Shift Work. Oxford: Pergamon Press, 1981.
12. Debry, G., Barbier, J.M., Girault, P., Lefort, J.M.: Eating Habits of Shiftworkers. *Nutr Abstracts & Reviews* 39(2): 543-544, 1969.
13. Dietary Guidelines Advisory Committee: Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans. Hyattsville, MD: Human Nutrition Information Service, 1985.
14. Ehret, C.F.: New Approaches to Chronohygiene for the Shift Worker in the Nuclear Power Industry. IN Reinberg, A., Vieux, N., and Andlauer, P.: Night and Shift Work. Oxford: Pergamon Press: 263-270, 1981.
15. Felton, G., Patterson, M.G.: Shift Rotation is Against Nature. *Am J Nursing* 71(4): 760-763, 1971.
16. Fisher, M., Rutishauser, I.H.E., Read, R.S.D.: The Dietary Patterns of Shiftworkers on Short Rotation Shifts. *Comm Health Studies* 10(1): 54-56, 1986.
17. Folkard, S., Condon, R., Herbert, M.: Night Shift Paralysis. *Experientia* 40: 510-512, 1984.
18. Folkard, S., Haines, S.M.: Adjustment to Night Work in Full and Part-time Night Nurses. *J. Physiol* 267: 23P, 1977.
19. Folkard, S., Minors, D.S., Waterhouse, J.M.: Chronobiology and Shift Work: Current Issues and Trends. *Chronobiology* 12:31-54, 1985.
20. Folkard, S., Monk, T.H., Lobban, M.C.: Short and Long-term Adjustment of Circadian Rhythms in 'Permanent' Night Nurses. *Ergonomics* 21(10): 785-799, 1978.
21. Froberg, J.E.: Shift Work and Irregular Working Hours in Sweden: Research Issues and Methodological Problems. IN Johnson, L.C. et al: *Biological Rhythms, Sleep and Shiftwork*. New York: Spectrum Pubs, 1980.
22. Garfinkel, L., Stellman, S.D.: Cigarette Smoking Among Physicians, Dentists, and Nurses. *CA* 36:2-8, 1986.

23. Gersovitz, M., Madden, J.P., Smiciklas-Wright, H.: Validity of the 24-Hr Dietary Recall and Seven-Day Record for Group Comparisons. *J Am Dietet Assoc* 73:48-55, 1978.
24. Glazner, L. K.: Shiftwork: Its Effect on Workers. *Am Assoc Occup Health Nurses* 39 (9): 416-21, 1991.
25. Gold, D.R., Rogacz, S.R., Bock, N., Tosteson, T.D., Baum, T.M., Speizer, F.E., Czeisler, C.A.: Rotating Shift Work, Sleep, and Accidents Related to Sleepiness in Hospital Nurses. *Am J Public Health* 82: 1011-1014, 1992.
26. Gordon, N.P., Cleary, P.D., Parker, C.E., Czeisler, C.A.: The Prevalence and Health Impact of Shiftwork. *Am J Public Health* 76(10): 1225-1228, 1986.
27. Guthrie, H.A.: Interpretation of Data on Dietary Intake. *Nutr Rev* 47 (2):33-38, 1989.
28. Greger, J.L., Etnyre, G.M.: Validity of 24-Hour Dietary Recalls by Adolescent Females. *Am J Public Health* 68:70-72, 1978.
29. Haughey, B.P., Kuhn, M.A., Dittmar, S.S., Wu, Y.B.: Health Care of Critical Care Nurses. *Heart & Lung* 21(3): 203-208, 1992.
30. Hedges, J.N., and Sekscenski, E.S.: Workers on Late Shifts in a Changing Economy. *Monthly Labor Review* 102 (9):14-22, 1979.
31. Hood, J.C. and Milazzo, N.: Shiftwork, Stress and Well-Being: How Workers and Their Families Cope With Shiftwork. *Pers Admin* 29(12):95, 1984.
32. Jackson, B., Dujovne, C.A., DeCoursey, S., Beyer, P., Brown, E.F., Hassanein, K.: Methods to Assess Relative Reliability of Diet Records: Minimum Records for Monitoring Lipid and Caloric Intake. *J Am Dietet Ass* 86:1531-1535, 1986.
33. Karvetti, R., Knuts, L.: Validity of the 24-Hour Dietary Recall. *J Am Dietet Assoc* 85:1437-1442, 1985.
34. Kleitman, N.: *Sleep and Wakefulness*. Chicago: U. of Chicago Press, 1963.
35. Krall, E.A., Dwyer, J.T: Validity of a Food Frequency Questionnaire and a Food Diary in a Short-Term Recall Situation. *J Am Dietet Ass* 87:1374-1377, 1987.

36. Lee, L.A.: Self-Reported Sleep Disturbances in Employed Women. *Sleep* 15(6): 493-498, 1992.
37. Linusson, E.I., Sanjur, D., Erickson, E.C.: Validating the 24-Hour Recall Method as a Dietary Survey Tool. *Arch Latinoam Nutr* 24(2): 277-294, 1974.
38. Margolick, D.: The Lonely World of Night Work. *Fortune* Dec 15:1088-114, 1980.
39. Marr, J.W., Heady, J.A.: Within- and Between-Person Variation in Dietary Surveys: Number of Days Needed to Classify Individuals. *Hum Nutr: Appl Nutr* 40A:347-364, 1986.
40. Matsumoto, K.: Sleep Patterns in Hospital Nurses Due to Shift Work: An EEG Study. *Waking and Sleeping* 2: 169-173, 1978.
41. Maurice, M.: *Shiftwork: Economic Advantages and Social Costs*. Geneva: International Labour Office, 1975.
42. Maxwell, C., Robitaille, E.: Food Habits of An Industrial Society. *J Canadien Diet Assoc* 41(4): 317, 1980.
43. Medlin, C., Skinner, J.D.: Individual Dietary Intake Methodology: A 50-Year Review of Progress. *J Am Dietet Assoc* 88:1250-1257, 1988.
44. Minors, D.S., and Waterhouse, J.M.: Anchor Sleep as a Synchronizer of Rhythms on Abnormal Routines. IN Johnson, L.C.: *Biological Rhythms, Sleep, and Shift Work*. New York: Spectrum Publications: 493-515, 1980.
45. Mott, P.E.: Social and Psychological Adjustment to Shift Work. IN Rentos, P.G., Shepard, R.D.: *Shiftwork and Health*. Washington, D.C. HEW (NIOSH) Pub # 76-203: 145-150, 1976.
46. Mott, P., Mann, F., McLoughlin, Q., and Warwick, D.: *Shift Work: The Social, Psychological and Physical Consequences*. Ann Arbor, MI: The U. of MI Press. 1965.
47. National Research Council: *Recommended Dietary Allowances*. Washington, D.C. National Academy Press. 1989.

48. Olive, K.E., Ballard, J.A.: Attitudes of Patients Toward Smoking by Health Professionals. *Public Health Reports* 107(3): 335-339, 1992.
49. Orton, D.I., Gruzelier, J.H.: Adverse Changes in Mood and Cognitive Performance of House Officers After Night Duty. *Br Med J* 298: 21-23, 1989.
50. Patterson, M., Felton, G.: Those Nurses Who Won't Rotate Shifts May Know What's Good For Them - and Their Patients. *Modern Hospital* 116(4): 123-128, 1971.
51. Pearson, J.M., Capps, Jr., O., Axelson, J.: Food Use in Households In Three Work-Shift Categories. *Home Econ Res J* 13(4): 400-408, 1985.
52. Pocock, S.J., Sergean, R., and Taylor, P.J.: Absence of Continuous Three-Shift Workers: A Comparison of Traditional and Rapidly Rotating Systems. *Occup Psych* 46: 7-13, 1972.
53. Reynolds, S.M., Hodges, P.A.M., Shifflett, P.A.: Eating Patterns and Health Perceptions of Shiftworkers: An Exploratory Study. Dept of Human Nutrition and Foods, VPI & SU, Blacksburg, VA. Unpublished thesis, 1987.
54. Romon, M., Nuttens, M., Fievet, C., Pot, P., Bard, J., Furon, D., Fruchart, J.C.: Increased Triglyceride Levels in Shift Workers. *Am J Med* 93: 259-262, 1992.
55. Rutenfranz, J., Knauth, P., and Angersbach, D.: Shift Work Research Issues. IN Johnson, L.C. : *Biological Rhythms, Sleep, and Shift Work*. New York: Spectrum Publications, 1980.
56. Sato, S., Takagi, K.: Studies on the Effect of Shiftwork on the Meal-time (Pt. 3). *J Science Labour* 48(5): 283-287, 1972.
57. Sergean, R.: *Managing Shiftwork*. London: Gower Press, 1971.
58. Shubin, S.: Burnout: The Professional Hazard You Face in Nursing. *Nursing* 78 8(7): 22-27, 1978.
59. Stewart, A., Wahlquist, M.: Effect of Shiftwork on Canteen Food Purchase. *J Occup Med* 27:552, 1985.

60. Storlie, F.J.: Burnout: The Elaboration of a Concept. *Am J Nursing* Dec 79: 2108-2111, 1979.
61. Stunkard, A.J., Waxman, M.: Accuracy of Self-Reports of Food Intake. *J Am Dietet Assoc* 79:547-551, 1981.
62. Takagi, K.: Influence of Shift Work on Time and Frequency of Meal-taking. *J Human Ergo* 1:195-205, 1972.
63. Takagi, K., Koizumi, S., Takagi, N.: Studies on the Effect of Shift Work on the Meal-time (Pt. 2). *J Science Labour* 43(9): 520-525, 1967.
64. Tasto, D.L., Colligan, M.J., Skjei, E.W., and Polly, S.J.: Health Consequences of Shift Work. NIOSH Technical Report. USDHEW, 1978.
65. Wyatt, S., Marriott, R.: Night Work and Shift Changes. *Brit J Ind Med* 10: 164-172, 1953.
66. Young, C.M, Hagan, G.C., Tucker, R.E., Foster, W.D.: A Comparison of Dietary Study Methods. II. Dietary History vs. Seven-Day Record vs. 24-Hr. Recall. *J Am Dietet Assoc* 28:218-221, 1952.

## APPENDIXES



Cover Letter to Subjects

Office of the Dean

College of Human Resources  
Blacksburg, Virginia 24061-0426

Date

Captain Jane Doe  
Walter Reed Army Medical Center  
Washington, DC 20307-5001

Dear Captain Doe:

Your hospital has agreed to collaborate in a research study about the impact of shiftwork on dietary intake and subjective health factors of nurses. Nursing is a physically, emotionally, and intellectually demanding profession, and one that is most important to the lives and health of the clients served. Research done on the effects of rotating shifts on workers indicates that various aspects of the worker's life are affected. Very few studies have been done on food intake and behavior of shiftworkers and even fewer have been completed using women subjects. There are very few studies of nurses as shiftworkers, and we have found only three which gave any food intake data. Therefore, a study such as this one can make a major contribution to a limited knowledge base.

We are asking you to participate in this study. The attached questionnaire and 24-hour recall form are used to collect the information from nurses on various types of shifts at a military hospital in the Washington/Virginia area and a private medical teaching hospital in Alabama. Data will be pooled and reported as group data. Thus, no individual will be identified, and the information gathered will be held in strict confidence.

The results of this study will be used by Ms. Marianne Gravely for a thesis in partial fulfillment of a master's degree in nutrition at Virginia Tech. She previously worked in a hospital and has worked in the health field for several years. Therefore, we both know and certainly appreciate the demands on your time.

The completion of the forms will take 30-45 minutes of your time. We ask that you write comments in the margins or in the space provided at the end when you have additional remarks or questions about how to answer items. Please feel free to contact us for any questions you may have about the forms or study. Our phone numbers are listed on the following page. The contact person at your hospital is \_\_\_\_\_. We will send you a summary of the results after the study is completed if you put your name and address on the return envelope as indicated. A separate sheet with these instructions is attached for your convenience.

Captain Doe  
Page 2  
Date

We would appreciate your participation. Your help will be a most important contribution to the success of this project. Thank you in advance for your help and consideration.

Sincerely yours,

Marianne H. Gravely  
Graduate Student  
Home: (703) 491-5258 (Wed. & Fri.)  
Work: (202) 690-0351

Vera J. Wall, Ph.D., R.D., C.H.E.  
Professor and Associate Dean  
Work: (703) 231-5380

INFORMED CONSENT  
SUBJECT PARTICIPATION IN RESEARCH PROJECT

I, \_\_\_\_\_, have received oral and written information describing this research project which is designed to learn the impact of shift work on the nutritional status and dietary habits of nurses at two selected hospitals. I voluntarily agree to participate in the study by completing the questionnaire and a 24-hour dietary recall. I understand that the time required for me to complete the forms is approximately 30 minutes. I will complete the questionnaire on my personal time to insure detailed attention and accuracy.

Furthermore, I understand there are no risks to me by my participation in the study. My name will not be used on any of the forms and all identifying information will be removed after information that I supply has been coded. I understand that the information will be combined as group data and reported in that form. Information that I give will be kept confidential and will not be given to any other agency, but will be used only by the investigators in analyzing the results of this study.

Also, I understand that, at my request, a summary of the results will be furnished to me following the completion of the study. I concur that the value of the research will contribute to the knowledge about the nutritional status of nurses on shift work and will help improve the deficit of knowledge on female shift workers. I also understand that, if I decide not to be involved in the project, I can withdraw and it will not harm my relationship with the investigators or any other agency.

If I have questions at any time during the study, I can contact one of the following persons, or the individual named at my hospital who is associated with the research project.

Mrs. Marianne Gravely  
2744 Bloomsbury Court  
Woodsbridge, Virginia 22192  
Home: (703) 491 5258 (Wed & Fri)  
Work: (202) 690-0351

Dr. Vera J. Wall  
260 Wallace Hall  
Virginia Tech  
Blacksburg, Virginia 24061  
(703) 231-5380

\_\_\_\_\_  
(Signature of Participant)

\_\_\_\_\_  
(Date)

(Return this signed form with your questionnaire to the research project contact person at your hospital. Thank you.)

\* \* Revised July 24, 1992

## VOLUNTEER AGREEMENT AFFIDAVIT

For use of this form, see AR 70-25 or AR 40-38, the proponent agency is OTSG

## PRIVACY ACT OF 1974

**Authority:** 10 USC 3013, 44 USC 3101, and 10 USC 1071-1087.

**Principal Purpose:** To document voluntary participation in the Clinical Investigation and Research Program. SSN and home address will be used for identification and locating purposes.

**Routine Uses:** The SSN and home address will be used for identification and locating purposes. Information derived from the study will be used to document the study, implementation of medical programs, adjudication of claims, and for the mandatory reporting of medical conditions as required by law. Information may be furnished to Federal, State and local agencies.

**Disclosure:** The furnishing of your SSN and home address is mandatory and necessary to provide identification and to contact you if future information indicates that your health may be adversely affected. Failure to provide the information may preclude your voluntary participation in this investigational study.

## PART A(1) - VOLUNTEER AFFIDAVIT

## Volunteer Subjects in Approved Department of the Army Research Studies

Volunteers under the provisions of AR 40-38 and AR 70-25 are authorized all necessary medical care for injury or disease which is the proximate result of their participation in such studies.

I, \_\_\_\_\_, SSN \_\_\_\_\_, having full capacity to consent and having attained my \_\_\_\_\_ birthday, do hereby volunteer/give consent as legal representative for \_\_\_\_\_ to participate in THE EFFECT OF ALTERED MEAL PATTERNS ON DIETARY INTAKE OF NURSES (Research Study)

under the direction of LTC JUDITH REED, SP conducted at WALTER REED ARMY MEDICAL CENTER, WASHINGTON, DC 20307-5001 (Name of Institution)

The implications of my voluntary participation/consent as legal representative; duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by

LTC JUDITH REED, SP, STAFF, NUTRITION CARE DIRECTORATE, (202) 576-1336

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights/the rights of the person I represent on study-related injury, I may contact

CENTER JUDGE ADVOCATE OFFICE - (202) 576-2538 or Autovon 291-2538  
at WALTER REED ARMY MEDICAL CENTER, WASHINGTON, DC 20307-5001 (Name, Address and Phone Number of Hospital (Include Area Code))

I understand that I may at any time during the course of this study revoke my consent and withdraw/have the person I represent withdrawn from the study without further penalty or loss of benefits; however, if/the person I represent may be required (military volunteer) or requested (civilian volunteer) to undergo certain examination if, in the opinion of the attending physician, such examinations are necessary for my/the person I represent's health and well-being. My/the person I represent's refusal to participate will involve no penalty or loss of benefits to which I am/the person I represent is otherwise entitled.

## LIMITATIONS TO MEDICAL CARE ARE DESCRIBED IN PART B.

## PART A (2) - ASSENT VOLUNTEER AFFIDAVIT (MINOR CHILD)

I, \_\_\_\_\_, SSN \_\_\_\_\_, having full capacity to assent and having attained my \_\_\_\_\_ birthday, do hereby volunteer for \_\_\_\_\_ to participate in \_\_\_\_\_ (Research Study)

under the direction of \_\_\_\_\_ conducted at \_\_\_\_\_ (Name of Institution)

(Continue on Reverse)

**PART A(2) - ASSENT VOLUNTEER AFFIDAVIT (MINOR CHILD) (Cont'd.)**

The implications of my voluntary participation; the nature, duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights I may contact

at

(Name, Address and Phone Number of Hospital (Include Area Code))

I understand that I may at any time during the course of this study revoke my assent and withdraw from the study without further penalty or loss of benefits; however, I may be requested to undergo certain examination if, in the opinion of the attending physician, such examinations are necessary for my health and well-being. My refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled.

**PART B - TO BE COMPLETED BY INVESTIGATOR**

INSTRUCTIONS FOR ELEMENTS OF INFORMED CONSENT: (Provide a detailed explanation in accordance with Appendix C, AR 46-26 or AR 70-25.)

NATURE OF STUDY

You are being asked to participate in a research project designed to learn the impact of shift work on the nutritional status and dietary habits of nurses at this hospital. This research will contribute to the knowledge about the nutritional status of nurses on shift work and will improve the deficit of knowledge on female shift workers.

If you agree to participate, you will be asked to complete a questionnaire and a 24-hour dietary recall. The forms will take approximately 30-45 minutes to complete. To ensure detailed attention and accuracy, please complete them on your own personal time. The information will be combined and reported as group data.

At your request, a summary of the results will be furnished following the completion of the study.

DURATION OF PARTICIPATION

Your participation will include the time it takes to complete the questionnaire and the dietary recall, approximately 30-45 minutes. You will be asked to participate in this study during a period when you are on duty; however, to ensure detailed attention and accuracy, you are asked to complete the questionnaire on your own time.

I do  do not  (check one & initial) consent to the inclusion of this form in my outpatient medical treatment record.

SIGNATURE OF VOLUNTEER	DATE	SIGNATURE OF LEGAL GUARDIAN (if volunteer is a minor)	
PERMANENT ADDRESS OF VOLUNTEER	TYPED NAME OF WITNESS		
	SIGNATURE OF WITNESS		DATE

REVERSE OF DA FORM 5303-R, MAY 89

FORESEEABLE RISKS OR DISCOMFORTS

None.

BENEFITS TO SUBJECTS

There are no direct benefits to you from your participation in this study.

CONFIDENTIALITY OF SUBJECT IDENTITY/RESEARCH RECORDS

Research records of your participation in this study will be maintained by the Principal Investigator. These records may be reviewed by the WRAMC Department of Clinical Investigation and/or the WRAMC Human Use Committee/ Institutional Review Board as part of their responsibilities for ensuring the protection of research volunteers, but confidentiality will be strictly maintained. You will not be identified by name in any publication or presentation resulting from this study.

LIMITATIONS TO MEDICAL CARE

Medical care is limited and will be within the scope authorized for Department of Defense health care beneficiaries. Necessary medical care does not include domiciliary care.

SIGNATURE OF VOLUNTEER	DATE SIGNED	SIGNATURE OF LEGAL GUARDIAN (if volunteer is a minor)
PERMANENT ADDRESS OF VOLUNTEER	TYPED OR PRINTED NAME AND SIGNATURE OF WITNESS	DATE SIGNED

Revised by DA FORM 5503-R, APR 64

## THE EFFECT OF ALTERED MEAL PATTERNS ON DIETARY INTAKE OF NURSES

This questionnaire has five sections. Most questions require an answer to be checked. Please answer each question as completely as you can. All information received will be held strictly confidential. If conditions vary, respond in general or in the average.

### SCHEDULE

The following questions address the days and shift you work each week. Please answer each question carefully and completely.

1. How many days do you work each week on your current schedule? \_\_\_\_\_
2. How many hours do you work each week on your current schedule? \_\_\_\_\_
3. In your work as a nurse, have you
  - a. ever rotated shifts?
    - 1) Yes \_\_\_\_\_ 2) No \_\_\_\_\_
  - b. worked a permanent shift other than a day shift?
    - 1) Yes \_\_\_\_\_ 2) No \_\_\_\_\_
4. For how many years over the course of your career have you rotated shifts?
 

a. None _____	c. 4-6 _____	e. 11-15 _____
b. 3 or less _____	d. 7-10 _____	f. 16 or more _____
5. How long have you been employed on your current shift schedule? (Please state the years and months.)
 

a. Years _____	c. Other (please describe): _____
b. Months _____	
6. How many other nurses in your unit work on your shift with you? \_\_\_\_\_
7. A. Are you on a PERMANENT schedule; that is, do you work the SAME DAYS AND SHIFT each week?
  1. Yes \_\_\_\_\_ (If YES, answer parts B, C and H)
  2. No \_\_\_\_\_ (If NO, answer Parts D through H)

(RETURN PAGES 1-13)

B. If you have a PERMANENT schedule, circle the days you work each week.

1. Monday      2. Tuesday      3. Wednesday      4. Thursday  
5. Friday      6. Saturday      7. Sunday

C. What SHIFT do you work? (Please put an "X" by the correct shift.)

1. Day \_\_\_\_\_ 2. Evening \_\_\_\_\_ 3. Night \_\_\_\_\_  
4. Other (Please describe.) \_\_\_\_\_

D. What shifts did you work? For each time period, please check every shift that you worked that week.

	Day	Evening	Nights	Other (Please Specify)
Last Week				
2 Weeks Ago				
3 Weeks Ago				
4 Weeks Ago				

E. If you work more than one shift during one week, do you ALWAYS have at least ONE DAY OFF before making a shift change?

1. Yes \_\_\_\_\_ 2. No \_\_\_\_\_

F. Does your employer allow at least one day off when you are changing from evening shift to day shift?

1. Yes \_\_\_\_\_ 2. No \_\_\_\_\_

G. Does your employer allow at least one day off when you are changing from night shift to day shift?

1. Yes \_\_\_\_\_ 2. No \_\_\_\_\_

H. On the average, how much time does your employer allow between change of shifts? Explain \_\_\_\_\_

- I. Please mark the appropriate column if you notice a difference in any of the following physical conditions when you are on ROTATING shifts or when you work DAYS, EVENINGS OR NIGHTS. (Persons on rotating shifts may need to mark various columns; those on permanent shifts would mark only the appropriate column.) Put a "+" if it improves, a "-" if it is worse, and a "0" if there is no change:

	DAYS	EVENINGS	NIGHTS
ENERGY LEVEL			
APPETITE			
CONCENTRATION			
STOMACH PROBLEMS			
HEADACHES			
BACKACHES			
LEG PAIN			
EYE STRAIN			
HEARTBURN			
SORE THROAT			
WEAKNESS			
LIGHTHEADEDNESS			
DEPRESSION			
GENERAL MALAISE			

### SATISFACTION WITH SCHEDULE

Please indicate the extent to which you agree with the following statements by circling the number in the space under the heading that indicates how you feel: Strongly Agree (SA), Agree (A), Disagree (D), or Strongly Disagree (SD):

	SA	A	D	SD
1. I am happy with my schedule.	1	2	3	4
2. I would prefer to change my schedule.	1	2	3	4
3. Interpersonal relations with my supervisors are good on my schedule.	1	2	3	4
4. I have less energy on this particular schedule.	1	2	3	4
5. My schedule does not give me enough time with my friends.	1	2	3	4
6. I receive helpful support and supervision from the nursing management on my shift.	1	2	3	4
7. My schedule fits well with my lifestyle and other commitments.	1	2	3	4
8. This hospital has a scheduling system that provides good coverage for the patients.	1	2	3	4
9. If I have the opportunity to change my schedule I would take my present schedule by choice.	1	2	3	4
10. With my current schedule, there is plenty of time to take care of personal matters either before or after work, or on my days off.	1	2	3	4
11. I am not satisfied with my work schedule because it affects quality time with my family.	1	2	3	4
12. Schedules are assigned fairly.	1	2	3	4
13. Interpersonal relations with other nurses are good on my schedule.	1	2	3	4
14. I have some input into my schedule assignment.	1	2	3	4
15. I receive constant support from my immediate family members in personal chores and business matters.	1	2	3	4

## HEALTH

Please indicate the extent to which you agree with the following statements by circling the number in the space under the column heading that indicates how you feel: Strongly Agree (SA), Agree (A), Disagree (D), or Strongly Disagree (SD):

	SA	A	D	SD
1. I feel that I am in good health.	1	2	3	4
2. I am tired and often do not have much energy.	1	2	3	4
3. I feel better at the beginning of the week than at the end of the week.	1	2	3	4
4. I don't get enough sleep.	1	2	3	4
5. I find it difficult to maintain my health on this schedule.	1	2	3	4
6. The way I feel changes with my work schedule.	1	2	3	4
7. I sleep more hours on my day off than I do on work days.	1	2	3	4
8. Sometimes I am so tired, I can barely finish my shift.	1	2	3	4
9. I really need my days off to recuperate from the work week.	1	2	3	4
10. My schedule does not affect my sleep.	1	2	3	4
11. My quality of life would be much better if I had a different schedule.	1	2	3	4
12. I think my health would be better if I worked a different shift.	1	2	3	4
13. I find it easy to take care of myself on this schedule. (exercise, personal, grooming, family, appointments, pets, etc.)	1	2	3	4

Please answer each of the following questions by putting an "X" in the correct space.

1. Do you get an annual physical?
  - a. Yes \_\_\_\_\_
  - b. No \_\_\_\_\_
2. Do you smoke?
  - a. Yes \_\_\_\_\_
  - b. No \_\_\_\_\_

3. If NO, have you ever smoked?

a. Yes \_\_\_\_\_ b. No \_\_\_\_\_

If YES, how long have you abstained from smoking:

a. Years \_\_\_\_\_ b. Months \_\_\_\_\_

4. Do you exercise regularly?

a. Yes \_\_\_\_\_ b. No \_\_\_\_\_

If YES, how often and how long?

a. Number of days per week \_\_\_\_\_ b.) Minutes \_\_\_\_\_

5. Do you drink alcohol?

a. Yes \_\_\_\_\_ b. No \_\_\_\_\_

If YES, do you drink:

a. Daily \_\_\_\_\_ b. Occasionally \_\_\_\_\_ c. Rarely \_\_\_\_\_

6. Are you pregnant?

a. Yes \_\_\_\_\_ b. No \_\_\_\_\_

7. Have you ever been diagnosed by a physician as having the following?  
(Please place an X in front of all that apply.)

a. High blood pressure \_\_\_\_\_

b. Cancer \_\_\_\_\_

c. Heart or cardiovascular disease \_\_\_\_\_

d. PMS \_\_\_\_\_

e. Allergies \_\_\_\_\_

f. Other chronic conditions. Please list: \_\_\_\_\_  
\_\_\_\_\_

8. Are you currently taking prescription medication?

a. Yes \_\_\_\_\_ b. No \_\_\_\_\_

If YES, what is your condition?:

a. Chronic \_\_\_\_\_ b. Temporary \_\_\_\_\_

9. On a daily basis, what is the stress level of your job?  
a. Low \_\_\_\_ b. Average \_\_\_\_ c. High \_\_\_\_
10. Were you transferred to your current schedule as a result of health problems?  
a. Yes \_\_\_\_ b. No \_\_\_\_

## DIET

Please answer the following questions according to the schedule you are working today.

1. What shift are you working today?
  - a. Day \_\_\_\_\_ b. Evening \_\_\_\_\_ c. Night \_\_\_\_\_
  - d. Other (please explain) \_\_\_\_\_
  - e. Is this shift permanent \_\_\_\_\_ or rotating \_\_\_\_\_?
  
2. How many meals per 24 hours do you typically eat when you are working this shift? (Please circle one number.)
 

1    2    3    4    5    6    More than 6    None
  
3. Of these, how many meals do you eat at work each day? (Please circle one number.)
 

1    2    3    4    5    6    More than 6    None
  
4. How many meals do you eat with your family each day? (Please circle one answer.)
 

1    2    3    None    Not Applicable
  
5. How many snacks do you typically eat when you are working this shift? (Please circle one number.)
 

1    2    3    4    5    6    7    8    More than 8    None
  
6. How many of those snacks do you eat at work? (Please circle one number.)
 

1    2    3    4    5    6    7    8    More than 8    None
  
7. At approximately what time do you eat your first meal of the day when you work this shift? (Please circle one time, and indicate if it is AM or PM.)
 

1:00   2:00   3:00   4:00   5:00   6:00   7:00   8:00   9:00   10:00   11:00   12:00

AM or PM
  
8. At approximately what time do you eat your first snack of the day when you work this shift? (Please circle one time, and indicate if it is AM or PM.)
 

1:00   2:00   3:00   4:00   5:00   6:00   7:00   8:00   9:00   10:00   11:00   12:00

AM or PM

9. If you rotate shifts, during which shift do you snack more? (Please mark one response.)

- a. Don't rotate shifts
- b. Day
- c. Afternoon
- d. Night
- e. No difference in snacking

10. At approximately what time do you eat your last meal of the day when you work this shift? (Please circle one time, and AM or PM.)

1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00  
AM or PM

11. At what time of the day do you feel hungriest when you work this shift? (Please circle one time, and AM or PM.)

1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00  
AM or PM

12. Is there any time of the day when you do not want to eat?

- a. Yes
- b. No

If yes, when? (Please circle one time, and AM or PM.)

1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00  
AM or PM

13. If you rotate shifts, how long does it take you to get used to new meal times? (Please mark one response.)

- a. I don't rotate shifts
- b. I adjust right away
- c. About a day
- d. 2-4 Days
- e. About a week
- f. 2-4 Weeks
- g. Never Adjust

14. In the space below, please list each type of the different beverages that you drink every day.

_____	_____	_____
_____	_____	_____
_____	_____	_____

15. Please estimate how many total ounces of liquid you drink in a day (mark one response):

- a. 0-8 oz
- b. 9-16 oz
- c. 17-24 oz
- d. 25-32 oz
- e. 33-40 oz
- f. 41-48 oz
- g. 49-56 oz
- h. More than 56 oz

16. How many cups of coffee do you drink each day? (Please circle one number.)

- 1   2   3   4   5   6   7   8   9   10   11   12   13   None

17. How many sodas do you drink each day? (Please circle one number.)

- 1   2   3   4   5   6   7   8   9   10   11   12   13   None

18. Do you ever skip meals while at work?

- a. Never
- b. Sometimes
- c. Usually
- d. Always

19. How much time is allowed for your meal at work?

- a. 15 minutes
- b. 30 minutes
- c. 45 minutes
- d. 1 hour
- e. No meal time is scheduled
- f. Other (please indicate) \_\_\_\_\_

20. Where do you eat when at work? (Please check all that apply.)

- a. At my desk
- b. At the nurses station
- c. In the cafeteria/snack bar
- d. In a lounge/ break area
- e. Other (please explain) \_\_\_\_\_

21. Do you **MOST OFTEN** eat alone or with other staff members? (Please choose only ONE response.)

- a. By myself
- b. With other staff members
- c. Other (please explain) \_\_\_\_\_

22. Are you on a prescribed diet?

- a. Yes
- b. No

23. A. Are you following any self-imposed dietary restrictions?

- 1) Yes
- 2) No

B. If YES, what type of diet are you following? (Please circle all that apply.)

- 1) Low calorie
- 2) Low fat
- 3) Vegetarian
- 4) Low salt
- 5) Low cholesterol
- 6) Diabetic
- 7) Commercial diet plan (Weight Watchers, Nutri-System, etc.)
- 8) A personal diet plan for health purposes
- 9) Other - please explain:

---



---

C. The purpose of this diet is: (Please mark all that apply.)

- |                       |       |                              |       |
|-----------------------|-------|------------------------------|-------|
| 1) To reduce calories | _____ | 3) Part of medical treatment | _____ |
| 2) Weight loss        | _____ | 4) Other (please explain)    | _____ |

---

24. Please share any further information that you think will help me interpret your questionnaire. (Examples: single parent, additional support systems, occasional second jobs, problems with child care, adverse situations at work, health practices or problems, etc.)

## GENERAL BACKGROUND INFORMATION

Please answer each question as accurately as possible by putting an "X" in the correct blank.

1. A. Professional training:

1) RN \_\_\_\_\_ 2) LPN \_\_\_\_\_ 3) Other \_\_\_\_\_

B. Highest degree earned:

1) HS/GED Diploma \_\_\_\_\_ 3) MS/N \_\_\_\_\_ 5) Other \_\_\_\_\_  
 2) BS/N \_\_\_\_\_ 4) PhD \_\_\_\_\_

2. Years spent working as a nurse:

a. 3 or less \_\_\_\_\_ c. 7 - 9 \_\_\_\_\_ e. 13 - 15 \_\_\_\_\_  
 b. 4 - 6 \_\_\_\_\_ d. 10 - 12 \_\_\_\_\_ f. 16 or more \_\_\_\_\_

3. Employment type. (Please check one.)

Military \_\_\_\_\_  
 Civilian \_\_\_\_\_

4. Department of your hospital where you work. (Example: pediatrics, ICU, etc.)

---

5. Sex: F \_\_\_\_\_ M \_\_\_\_\_

6. Age:

a. 20 - 25 \_\_\_\_\_ d. 36 - 40 \_\_\_\_\_  
 b. 26 - 30 \_\_\_\_\_ e. 41 - 45 \_\_\_\_\_  
 c. 31 - 35 \_\_\_\_\_ f. 46 - 50 \_\_\_\_\_  
 g. 51 or older \_\_\_\_\_

7. Marital status:

a. Single \_\_\_\_\_  
 b. Married \_\_\_\_\_  
 c. Divorced \_\_\_\_\_  
 d. Widowed \_\_\_\_\_

8. A. Do you have children?

1) Yes \_\_\_\_\_ 2) No \_\_\_\_\_

B. If you answered YES, please write the number of children you have in the appropriate age categories.

- |                      |       |                |       |
|----------------------|-------|----------------|-------|
| 1) 0 - 1 yr (Infant) | _____ | 4) 11 - 15 yr  | _____ |
| 2) 2 - 4 yr          | _____ | 5) 16 - 21 yr  | _____ |
| 3) 5 - 10 yr         | _____ | 6) Over 21 yrs | _____ |

9. A. Are you at the specified range of weight for your height?

- 1) Yes \_\_\_\_\_ 2) No \_\_\_\_\_

B. If you answered NO, mark the correct description.

- 1) Overweight \_\_\_\_\_ 2) Underweight \_\_\_\_\_

10. What is your household's overall take-home pay?

- |                        |       |                        |       |
|------------------------|-------|------------------------|-------|
| a) Less than \$9,999   | _____ | f) \$40,000 - \$49,999 | _____ |
| b) \$10,000 - \$14,999 | _____ | g) \$50,000 - \$59,999 | _____ |
| c) \$15,000 - \$19,999 | _____ | h) \$60,000 - \$69,999 | _____ |
| d) \$20,000 - \$29,999 | _____ | i) Over \$70,000       | _____ |
| e) \$30,000 - \$39,999 | _____ |                        |       |

Proceed to the 24-Hour Dietary Recall and record your dietary intake. Please read the instructions carefully before starting.

## INSTRUCTIONS FOR RECORDING 24 HOUR DIET RECALL

On the next page I would like you to record everything you ate and drank in the past 24 hours. What you record is very important to this study. To interpret this information I will be using a database with an extensive list of foods, including brand names and fast foods. Please be very specific! Record as accurately as possible the food item, its' size of measure, how it was cooked, and any condiment, such as butter, that was added during cooking or serving. For your quick reference, I am listing these helpful hints below:

Use **BRAND NAMES**: McDonald's Big Mac, Campbell's Chicken and Rice soup, Kellogg's Corn Flakes, etc.

**AMOUNTS** are very important: 1/8 Pizza Hut thick & chewy pepperoni pizza, 1 large McDonald's French fries, 1 cup Cheerios with 1/2 cup 2% milk, 1 large apple, etc.

**Describe sizes of foods**: 2" x 3" square of cornbread, 1 slice thin sandwich bread, 1/6 slice of 9 inch coconut creme pie, 1 large slice of pizza (Pizza Hut 13" supreme), etc.

**Combination foods**: Please give as much information as you can for food mixtures/casseroles: 2 cup bowl navy bean soup; or, sandwich: 2 slices white sandwich bread with 2 slices bologna, lettuce, one slice American cheese, mustard; or 1 cup tuna noodle casserole: tuna, noodles, onions, milk and cheese sauce.

**MILK**: Please be very specific about the type of milk and the amount: 6 oz whole milk (1%, 2%, Skim milk), 6 or 8 oz Dannon low-fat strawberry yogurt, 1/4 cup Light & Lively 4% cottage cheese, etc.

**FRUITS/VEGETABLES**: Describe the kind and the size: 1 large banana, 1 tangerine, 1/2 large pink grapefruit, 1/2 cup steamed zucchini, 1 medium ear of corn with 2 tsp Parkay low-fat spread, 1/4 cup applesauce, etc.

**BEVERAGES**: Be sure to tell me what size you drank: 12 oz can Diet Coke, 6 oz cup tea, 8 oz mug coffee with sweet and low, 8 oz glass milk, 6 oz glass orange juice, 1/2 pint skim milk, etc.

Although I am giving you a standard form to record your day's intake, you may rearrange the foods as eaten during the day. The TIME the meal was eaten is important.

SEE EXAMPLE ON BACK OF THIS PAGE.

## Appendix F

The following is an example of a 24 Hour diet recall.

DATE: April 27, 1992

HOURS WORKED: 7 AM - 3 PM

FOOD	BRAND NAME	AMOUNT	OFFICE USE ONLY	
			CODE	QUANTITY
BREAKFAST	TIME 6:30 AM	PLACE Cafeteria		
fried eggs		2 eggs		
1 english muffin butter, jelly (Apple)	Thomas's English muffins	1 muffin 2 Thap. 1 pat butter Jelly		
Grapefruit		1/2 large		
Coffee with Sweet + low		6 oz cup, 1 envelope		
SNACK	TIME 9:30 AM	PLACE Nurses' station		
potato chips	Lay's	1 oz bag		
Diet Coke		12 oz can		

**TWENTY FOUR HOUR RECALL**

Please think back over the last 24 hours and try to remember everything you ate and drank. Please write down what you ate, how much you ate, where you ate it, and at approximately what time you ate. Recalling with whom you ate will also help you recall the details of your food intake. Be very specific about amounts consumed (1/2 cup rice, 1 large apple, 6 oz cup of coffee, 1 slice apple pie - 1/6 of a 9" pie, etc.) Don't forget to include any cream or sugar added to coffee, butter, mayonnaise or other condiments used, black coffee or diet sodas, hard candies, etc. Be sure to include all snacks eaten in the morning, afternoon, and night. Please give as much information as you can.

DATE: \_\_\_\_\_

HOURS WORKED: \_\_\_\_\_

FOOD	BRAND NAME	AMOUNT	OFFICE USE ONLY	
			CODE	QUANTITY
<b>BREAKFAST</b>	<b>TIME</b>	<b>PLACE</b>		
<b>SNACK</b>	<b>TIME</b>	<b>PLACE</b>		
<b>LUNCH</b>	<b>TIME</b>	<b>PLACE</b>		

FOOD	BRAND NAME	AMOUNT	CODE	QUANTITY
<b>SNACK</b>	<b>TIME</b>	<b>PLACE</b>		
<b>DINNER</b>	<b>TIME</b>	<b>PLACE</b>		
<b>SNACK</b>	<b>TIME</b>	<b>PLACE</b>		

**REQUEST FOR RESULTS**

1. To assure anonymity, please write your name and address on the enclosed envelope **IF YOU WOULD LIKE TO RECEIVE A COPY OF THE RESULTS OF THIS STUDY**. When received, I will separate the envelope from your questionnaire to do the coding.
2. Have you checked your diet record for content of each meal and snacks? Did you answer all questions on your questionnaire? Below is a list to help you in returning all the information in your packet:

**FORMS TO RETURN**

1. Questionnaire \_\_\_\_\_
2. 24-hour dietary recall \_\_\_\_\_
3. Consent form, signed \_\_\_\_\_

3. Please place your questionnaire, 24-hour diet recall, and consent form in the enclosed, stamped, self-addressed envelope and return by mail as soon as completed.

***THANK YOU VERY MUCH*** for your help, your time, and your participation! This research would not have been possible without your helpful input.

***First Reminder: notice/postcard follow-up to subjects***

***Dear***

***Recently you received a questionnaire and a 24-hour dietary recall form to complete for a research project on the effect of shift rotation on the dietary intake and health factors of nurses. Because you were specially selected from the nurse employees at your hospital, your participation is most important to the success of this study. Will you please complete the forms and return them as soon as possible in the envelope which was provided.***

***Thank you.***

***Mary Ann Gravely  
Graduate Student  
Home: (703) 491-5258 on  
Wed. & Fri.  
Work: (202) 690-0351***

***Vera J. Wall, Ph.D., R.D., C.H.E.  
Professor and Associate Dean  
Work: (703) 231-5380***

SECOND REMINDER: Letter

Dear :

Recently you were contacted about participating in a research study about the effects of shiftwork on adequacy of food intake and meal patterns of nurses. Employed nurses who work on various types of shifts at two hospitals have been asked to be subjects. You were one of the nurses from your hospital selected to participate. Because a random sampling technique was used to select the subjects, only certain nurses were selected to participate in the study. Therefore, the quality of the project and the results of the study are affected by the number of questionnaires and 24-hour dietary recalls that are returned by the nurses who were selected as subjects.

Many of the questionnaires that were distributed have been returned, but yours is one that has not yet been received. It will only take 30-40 minutes of your time to complete the forms. Will you not please help us by filling out the forms now? Another copy of the survey forms are enclosed in case the original ones were misplaced or lost. A self-addressed, stamped envelope is enclosed for your convenience in returning the questionnaire to us.

The results of this study will be of special interest to nurses and should be especially important because most studies are done on men. Very little information is available on women shiftworkers and even less on nurses. If you have not mailed your questionnaire, I hope that you will agree about its importance and will find time to participate in the study. If you have already returned your survey forms, thank you for your help.

Please feel free to contact us if you have questions. The contact person at your hospital is (insert name of contact person). We look forward to receiving your survey. Thank you in advance for your participation.

Sincerely,

Marianne H. Gravely  
Graduate Student  
Home: (703) 491-5258 (Wed. & Fri.)  
Work: (202) 690-0351

Vera J. Wall, Ph.D., R.D., C.H.E.  
Professor and Associate Dean  
Work: (703) 231-5380

Enclosures: Questionnaire  
Self-addressed, stamped envelope

**THANK YOU LETTER TO BE MAILED TO PARTICIPANTS**

**Dear :**

**You participated in a research study on the impact of shiftwork on the nutritional status and health of nurses. We want to take this opportunity to thank you for your interest and help. We appreciate the time you had to take out of your busy schedule to complete the questionnaire and dietary recall.**

**The data is being compiled. When it is finished, a summary of the results and their implications will be sent to you, if you requested a copy.**

**We believe that the results of this study will be useful to nurses and other shiftworkers, and certainly to other investigators interested in research on women. Again, thank you for your participation. Your interest and cooperation helped make the study possible.**

**Sincerely,**

**Marianne H. Gravely  
Graduate Student**

**Vera J. Wall, Ph.D., R.D., C.H.E.  
Professor and Associate Dean**

Appendix L. Satisfaction With Schedule of Nurses by Schedule Groups

Questions	Schedule Groups Percent Agreeing With Statement			
	Day N=81	Evening N=18	Night N=29	Rotating N=52
I am happy with my schedule.	96.3 <sup>a</sup>	77.8	82.8	57.7 <sup>a</sup>
I would prefer to change my schedule.	18.5 <sup>a</sup>	38.9	34.5	61.5 <sup>a</sup>
Interpersonal relations with my supervisors are good on my schedule.	96.3 <sup>b</sup>	88.9	79.3	86.5
I have less energy on this particular schedule.	12.4 <sup>a</sup>	38.9	24.1	57.7 <sup>a</sup>
My schedule does not give me enough time with my friends.	29.6 <sup>b</sup>	61.1 <sup>b</sup>	34.5	48.1 <sup>b</sup>
I receive helpful support and supervision from the nursing management on my shift.	91.4	72.2	82.8	82.7
My schedule fits well with my lifestyle and other commitments.	87.7 <sup>b</sup>	72.2	65.5	40.4 <sup>a</sup>
This hospital has a scheduling system that provides good coverage for the patients.	75.3	77.8	65.5	67.3
If I have the opportunity to change my schedule I would take my present schedule by choice.	91.4 <sup>a</sup>	61.1	69.0	32.7 <sup>a</sup>
With my current schedule, there is plenty of time to take care of personal matters either before or after work, or on my days off.	56.8	72.2	72.4	61.5
I am not satisfied with my work schedule because it affects quality time with my family.	17.3 <sup>a</sup>	61.1 <sup>a</sup>	41.4	44.2 <sup>a</sup>
Schedules are assigned fairly.	91.4 <sup>b</sup>	83.3	79.3	69.2 <sup>b</sup>
Interpersonal relations with other nurses are good on my schedule.	93.8	88.9	93.1	84.6
I have some input into my schedule assignment.	93.8	83.3	89.7	88.5
I receive constant support from my immediate family members in personal chores and business matters.	79.0	88.9	69.0	80.8

<sup>a</sup> P ≤ 0.0001 (Mantel-Haenszel Chi-square).

<sup>b</sup> P ≤ 0.05 (Mantel-Haenszel Chi-square).

Appendix M. Health Satisfaction of Nurses by Schedule Groups

Questions	Schedule Groups Percent Agreeing			
	Day N=81	Evening N=18	Night N=29	Rotating N=52
I feel that I am in good health.	91.4	100.0	89.7	92.3
I am tired and often do not have much energy.	33.3	27.8	44.8	51.9
I feel better at the beginning of the week than at the end of the week.	69.1	50.0	62.1	55.8
I don't get enough sleep.	44.4	55.6	65.5	53.9
I find it difficult to maintain my health on this schedule.	11.1 <sup>b</sup>	16.7	24.1	38.5 <sup>b</sup>
The way I feel changes with my work schedule.	56.8 <sup>c</sup>	66.7	48.3	86.5 <sup>c</sup>
I sleep more hours on my day off than I do on work days.	70.4	44.4 <sup>a</sup>	82.8	78.9
Sometimes I am so tired, I can barely finish my shift.	18.5	27.8	24.1	28.9
I really need my days off to recuperate from the work week.	81.5	83.3	79.3	92.3
My schedule does not affect my sleep.	54.3 <sup>d</sup>	55.6	20.7	25.0 <sup>d</sup>
My quality of life would be much better if I had a different schedule.	17.3 <sup>c</sup>	50.0	44.8	51.9 <sup>c</sup>
I think my health would be better if I worked a different shift.	4.9 <sup>d</sup>	33.3	34.5	48.1 <sup>d</sup>
I find it easy to take care of myself on this schedule. (exercise, personal, grooming, family, appointments, pets, etc.)	40.7	11.1	41.4	59.6 <sup>b</sup>

<sup>a</sup> P ≤ 0.05 (Chi-square).

<sup>b</sup> P ≤ 0.01 (Chi-square).

<sup>c</sup> P ≤ 0.001 (Chi-square).

<sup>d</sup> P ≤ 0.0001 (Chi-square).

Appendix N. Mean Intake of Selected Dietary Components by Twenty-four Hour Recall of Nurses on Shiftwork.

Dietary Components	RDA	Schedule Groups							
		Day Mean $\pm$ S.D.	Evening Mean $\pm$ S.D.	Night Mean $\pm$ S.D.	Rotating Mean $\pm$ S.D.				
Protein, g	50.0	78.4 $\pm$	69.5 $\pm$	64.7 $\pm$	30.7 $\pm$	71.9 $\pm$	30.2 $\pm$	73.1 $\pm$	58.6 $\pm$
Fat, g	*	63.2 $\pm$	39.4 $\pm$	58.6 $\pm$	30.6 $\pm$	62.7 $\pm$	24.5 $\pm$	56.6 $\pm$	36.0 $\pm$
Carbohydrate, g	*	212.1 $\pm$	81.8 $\pm$	224.9 $\pm$	105.3 $\pm$	242.0 $\pm$	100.0 $\pm$	204.6 $\pm$	98.1 $\pm$
Vitamin A, RE	800.0	1167.0 $\pm$	1157.0 $\pm$	1148.0 $\pm$	1365.0 $\pm$	1160.0 $\pm$	1336.0 $\pm$	1549.0 $\pm$	2067.0 $\pm$
Vitamin D, ug	5.0	3.2 $\pm$	4.1 $\pm$	3.0 $\pm$	5.3 $\pm$	2.5 $\pm$	2.8 $\pm$	3.2 $\pm$	2.6 $\pm$
Vitamin C, mg	65.0	114.1 $\pm$	81.4 $\pm$	111.8 $\pm$	90.2 $\pm$	113.1 $\pm$	182.0 $\pm$	126.2 $\pm$	131.7 $\pm$
Thiamin, mg	1.1	1.4 $\pm$	0.8 $\pm$	1.7 $\pm$	1.1 $\pm$	1.4 $\pm$	0.6 $\pm$	1.3 $\pm$	0.8 $\pm$
Riboflavin, mg	1.3	1.6 $\pm$	1.0 $\pm$	1.6 $\pm$	1.2 $\pm$	1.6 $\pm$	0.7 $\pm$	1.5 $\pm$	0.9 $\pm$
Niacin, mg	15.0	20.7 $\pm$	18.5 $\pm$	20.9 $\pm$	13.9 $\pm$	20.0 $\pm$	10.9 $\pm$	21.5 $\pm$	17.8 $\pm$
Vitamin B6, mg	1.6	1.6 $\pm$	1.1 $\pm$	1.5 $\pm$	1.3 $\pm$	1.5 $\pm$	0.7 $\pm$	1.4 $\pm$	1.1 $\pm$
Vitamin B12, mg	2.0	3.7 $\pm$	4.8 $\pm$	2.8 $\pm$	4.0 $\pm$	3.8 $\pm$	4.4 $\pm$	3.3 $\pm$	2.8 $\pm$
Calcium, mg	800.0	638.9 $\pm$	438.5 $\pm$	579.0 $\pm$	355.5 $\pm$	735.4 $\pm$	382.5 $\pm$	674.4 $\pm$	483.6 $\pm$
Phosphorus, mg	800.0	1089.0 $\pm$	669.5 $\pm$	1047.0 $\pm$	599.7 $\pm$	1158.0 $\pm$	366.0 $\pm$	1048.0 $\pm$	591.5 $\pm$
Magnesium, mg	280.0	251.5 $\pm$	152.0 $\pm$	249.9 $\pm$	198.5 $\pm$	244.6 $\pm$	75.3 $\pm$	212.2 $\pm$	131.0 $\pm$
Iron, mg	15.0	12.0 $\pm$	5.1 $\pm$	13.7 $\pm$	11.4 $\pm$	11.7 $\pm$	4.5 $\pm$	11.7 $\pm$	7.1 $\pm$
Zinc, mg	12.0	9.1 $\pm$	9.5 $\pm$	10.7 $\pm$	10.5 $\pm$	9.6 $\pm$	5.3 $\pm$	7.7 $\pm$	6.3 $\pm$
Kilocalories	*	1714.0 $\pm$	765.2 $\pm$	1651.0 $\pm$	710.2 $\pm$	1791.0 $\pm$	593.7 $\pm$	1603.0 $\pm$	8730.0 $\pm$
Cholesterol, mg	**	257.2 $\pm$	361.7 $\pm$	155.2 $\pm$	95.1 $\pm$	196.4 $\pm$	107.8 $\pm$	195.0 $\pm$	226.1 $\pm$

\* No RDA

\*\*U.S. Dietary Guidelines recommend 200 mg

## VITA

Marianne Hastoglis Gravely was born October 10, 1957 in Abington, PA. She graduated from Bishop England High School in Charleston, SC in 1975. In 1979 she received a bachelor of science degree in home economics, with an emphasis in foods and nutrition, from Hood College in Frederick, MD. She worked as a public health nutritionist for the Women, Infants, and Children (WIC) program in Norfolk, VA, and was the program manager for the Virginia Beach WIC program. In 1984 she moved to Japan and was the Home Economist for the Navy Family Service Center at the Yokosuka Naval Base. Since 1988 she has been employed as a Home Economist at the U.S. Department of Agriculture's Meat and Poultry Hotline in Washington, D.C.

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