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Health Consequences of Shift Work

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

HEALTH CONSEQUENCES

OF

SHIFT WORK

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ABSTRACT

This 30-month study, conducted by SRI International and sponsored by the National Institute for Occupational Safety and Health, investigated the effect of working unconventional hours, i.e., afternoon, night, and rotating shifts, on the psychological and physiological well-being of workers.

Data for a sample of about 1,200 nurses and a similar number of food processors were collected by review of health and accident files and from the administration of a lengthy questionnaire. Areas of inquiry included: basic subject demography (e.g., age, sex, race, marital status, and length of employment), incidence and prevalence of physical complaints and illness histories; eating patterns; sleep patterns; medication usage; life style and domestic patterns; and psychological profiles. The results of extensive computer analyses of the health and accident records and the questionnaire data are reported in separate sections of this report.

Findings confirm studies of European shift workers that demonstrate a significantly greater difficulty in adapting to work schedules experienced by all other categories of shift worker than by day shift workers. Rotating shift workers, who not only work at unconventional hours but who move from shift to shift, clearly encounter the most difficulty in adjusting their psychobiological rhythms and patterns to their work schedules. Shift work may well pose a distinct health hazard for certain rotating shift workers.

An adaptation index, developed in conjunction with the analyses of questionnaire results, indicates, among other things, that shift workers adapt best if (1) they are not too neurotic, (2) they are satisfied with their shift schedule, and (3) they are satisfied with the type of work they are doing.

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INTRODUCTION

Since the end of World War I, the prevalence of shift work systems in the industrialized countries of the West has been steadily increasing. Various estimates made during the last decade of the proportion of shift workers in Europe and in the United States tend to place this percentage at about 20% of all industrial workers in Europe and the United States (Maurice, 1975; Tasto & Colligan, 1977).

Dividing the 24-hour day into three, or occasionally two, equal divisions of work time is attractive for different reasons. For service industries, such as police and fire departments, transportation firms, public utilities, and hospitals, operating around the clock may be not only economically desirable but necessary to provide needed consumer services. In other industries, e.g., in steel, petroleum, or pulp and paper production, the nature of the technology involved requires continuous 24-hour operation. In other cases, the cost of equipment or its operation makes around-the-clock staffing economical; such is the case in the computer departments of certain large insurance companies. It may also happen in the near future that variable energy rates will greatly stimulate the use of energy during hours of low demand (Wall Street Journal, 10/18/77) and thus increase the use of shift work systems.

This report is the culmination of a 30-month investigation by SRI International and the National Institute for Occupational Safety and Health into the health effects of working shifts at unconventional hours. Because most of these health effects are directly or indirectly related to the disruption of circadian body rhythms (National Institute for Occupational Safety and Health, 1976), the report contains data of potential value not only to industry but to investigations of stress and human physiology.

In general, the kinds of questions considered in this report are: Does working a shift of hours other than the conventional daytime 8-hour span have an effect on health? Is this effect enhanced or ameliorated if the shift worker, rather than remaining assigned to a fixed shift, moves, or rotates, from one shift to another? Are there demographic, psychological, social, or behavioral factors associated with adaption to shift work? How can the adaptation of workers to shift systems be facilitated?

Two of our terms--"health" and "shift work"--may need some preliminary amplification. Health in this study comprises the physical and psychological well-being of the shift worker. We used information on a number of variables, gathered from shift worker records and from a questionnaire, to attempt to measure both health and safety. At the outset of the study, extensive medical measures were collected from shift worker personnel folders, but these turned out to be of little or no value without comparative sets of measures, either

taken before the individual began shift work, or, preferably, taken some time after he or she was employed. These comparative measures were not available. Most employees, it turned out, had only had one physical examination, given at the time of hire, and had not received one since. These records were, therefore, not used in the present study.

The term "shift work" can cover a broad spectrum of systems that make continuous operation of a plant or service possible by dividing 24 hours into two or three sequential or overlapping time spans (Maric, 1977). By far the most common division is into three 8-hour sequential shifts, usually starting at about 8:00 a.m., 4:00 p.m., and midnight, though there is some slight variation as to starting times within this system. In this study, all sites followed some variation of the three 8-hour shifts.

In addition to those shift workers who are permanently assigned to one of these three shifts, some workers, as mentioned earlier, move or rotate from shift to shift. This means that, although there are conventionally only three shifts, there are four classes of shift worker in this study: day shift workers, afternoon/evening shift workers, night shift workers, and workers who rotate among these shifts.

STUDY HISTORY

In June 1975, as part of its general interest in shift work patterns in the United States, the National Institute for Occupational Safety and Health (NIOSH) selected Stanford Research Institute (now SRI International) to examine the adaptation of workers to shift systems and to investigate the effects of shift work on their health (cf. NIOSH, 1976).

As originally conceived by NIOSH, the project was designed to identify major U.S. industries using shift work systems, describe those systems, select sites for surveying shift workers in these industries, and gather information from samples of shift workers both by questionnaire and by review of health and accident records. As a final step, it was anticipated that guidelines or recommendations for shift work industries and their employees might be developed from the project's results.

NIOSH initially specified these objectives for the study:

(1) Identify shift work systems within 11 major shift work industries.

(2) Identify two sites within each of the six shift work industries selected for study.

(3) Identify shift workers to be sampled at each selected site.

(4) Develop and administer survey questionnaires to designated shift workers, as well as to a subsample of their spouses.

(5) Develop and implement methods for collecting occupational health and accident data, and relate this information to demographic and epidemiological data.

(6) From the results, develop guidelines for optimum shift scheduling and recommended procedures for the most effective adaptation to shift work.

During the year following award of the contract to SRI, the nature and objectives of the project were considerably refined, and the scope and sequence of the research was revised. To date, modified versions of objectives 1 through 5 above have been accomplished. The original intention of sampling a total population of 2,400 shift workers at six sites was modified to allow sampling of the same number of shift workers--2,400--at only two sites. Changes were made largely because new insights gained in the first year of the project strongly implied new directions of inquiry. Also, it was found that the issue of access to shift worker health records could in some instances distress management, especially if it was concerned about impending labor negotiations.

The first objective was completed within the first three months of the project. NIOSH originally stated that shift work in the United States was concentrated in 11 major industries: food processing, the Postal Service, textiles, hospitals, chemicals and allied products, transportation equipment, police and fire departments, electrical equipment and supplies, primary metals, mass transit services, and energy production and conversion. SRI's preliminary analyses suggested expansion of this list to include additional industries.

Development of the questionnaire was also begun during the first three months of the project. The first draft, completed in October 1975, was then submitted to consultants for review.

During the following month, November 1975, SRI began to redefine the NIOSH identification of U.S. shift work industries to include others having equal, greater, or, in some cases, lower but significant concentrations of shift workers. Revisions to the questionnaire proposed by the consultants were incorporated into a second draft, which then was resubmitted for a second review.

By late February 1976, six industries had been tentatively selected for study. One month later, these had been narrowed to three: nursing, food processing, and coal mining. It was confirmed that a total sample of 2,400 shift workers --800 from each industry--would be studied. Each subsample of 800 was to be divided about equally among the four shift worker categories: day, afternoon/evening, night, and rotating.

For administrative reasons, it was also decided in March 1976 to consider separating the process of reviewing shift worker health and accident records from administration of the questionnaire. This was done in part because data collection from files could conveniently precede questionnaire administration, which required clearance by the U.S. Office of Management and Budget. Also, it was found that synchronizing record review and questionnaire administration so as to gather data from the same sample of shift workers and on the same shift assignments posed procedural and methodological complexities. During the almost inevitable interval between reviewing records and administering questionnaires, composition of the sample could be greatly altered by shift worker turnover and adaptation. The study was, in effect, divided into a record review component and a questionnaire component, and it was decided that analysis of the health and accident data would not be matched, on a one-to-one basis, with the questionnaire data. This decision was formalized in December 1976. Additional alterations to the original scope of work included:

- No collection of data from shift workers' spouses.
- A $5.00 payment to each questionnaire respondent.
- Extension of the project to a new termination date of March 1978.

Concurrent with the redefinition and selection of industries to be sampled was the evolution of the objectives of the study. As originally conceived, the project was to test certain hypotheses posed by NIOSH; however, it became clear that such an approach would be infeasible for practical and technical reasons.

It was determined that the study would be regarded as an exploratory analysis of numerous variables within fairly large populations, and that it would be directed at identifying variables to be considered in subsequent studies. This in turn made the generalizability of the results less of a concern; the samples are not strictly representative of the national population of shift workers in these two industries.

By the end of June 1976, an interim report on the distribution of shift work in the United States had been submitted to NIOSH (Tasto and Colligan, 1977). The task of identifying sites for questionnaire administration and health and accident file review had been undertaken. Subsequently, in August 1976, SRI found that health records in the U.S. coal mining industry are not maintained at on-site clinics--miners visit their private physicians for job-related health care--and in October 1976 the study was confined to a sampling of 1,200 nurses and 1,200 food processors.

By the end of 1976, health and accident information had been collected from the files of almost 1,000 food processors at four sites, and from most of the nurse sample.

As of March 1977, the record review for the entire sample of slightly more than 1,200 nurses was complete and analysis of this information had begun.

The records review for the sample of about 1,200 food processors was complete by May 1977, but it was found that the sample did not contain a sufficient proportion of rotating shift workers. To redress this imbalance, an additional 310 files were reviewed by August 1977, thus bringing the data collection for the records phase of the study to a close.

Results from the review of health and safety files for the entire sample of nurses were set forth and discussed in an interim report submitted to NIOSH in August 1977. By this same date, the questionnaire had been mailed to all potential respondents.

Coding, keypunching, and verification of all responses to the questionnaire was completed by September 1977. Of the 3,228 questionnaires mailed, 1,941 of those received could be analyzed. The response rate was about 60%.

Data analyses of questionnaire responses and preparation of this final report began in early October 1977.

LITERATURE REVIEW

There is an extensive literature on shift work systems; much of the work reported is experimental and directed at analyzing the relationship of shift work to shift worker health patterns. Although research on shift work was performed as early as 1927, the vast majority of European and American shift work studies have been undertaken since World War II. European studies conducted during the 1950s and 1960s typically are characterized by univariate approaches to samples that are often too constricted to permit generalization to the American shift worker.

Research design had become more sophisticated and studies more comprehensive by the late 1960s and early 1970s, but there continued to be a preponderant attention to European shift workers, resulting in a current dearth of comprehensive, well-designed research on the American shift worker.

SLEEP

Apparently, an inevitable effect of shift work is the reduction of the number of sleep hours (Carpentier and Cazamian, 1977). Rotating shift workers in a Scandinavian study (Bjerner, Holm and Swensson, 1948) averaged 6.5 hours of sleep, compared with 7.5 for workers permanently assigned to the day shift. During those intervals when the rotating shift workers were assigned to the night shift, their sleep was greatly disrupted: they averaged only 5.5 hours of sleep daily.

In 1953, Wyatt and Marriott found that British shift workers alternating between day and night shifts reported an average of less than 6.0 sleep hours when on the night shift. A 1969 Japanese study (Congress on Occupational Health, 1969) confirmed that shift workers alternating between day and night shifts reported less average sleep than the national average for male workers. Sergean subsequently observed (1971) that the order of rotation has an effect on the amount of sleep that rotating shift workers can obtain. Oddly enough, sequences that progressed from night to afternoon to day shifts appeared to promote more sleep than the seemingly more natural progression from day to afternoon to night.

Mott et al. (1965) found no significant differences in the amount of sleep obtained per night by workers on fixed shifts, but did find significant differences for workers who rotated from shift to shift. The latter group apparently slept the most when working afternoon shifts and the least when working night shifts.

A number of studies in the late 1960s found that sleep patterns are atypical during the daylight hours, as evidenced by EEG readings (Rechtschaffen and Kales, 1968; Weitzman et al. 1968; and Tune, 1968). Foret and Benoit noted

(1974) that the amount of sleep was lowest for rotating shift workers when they slept at times other than the conventional late-night to early-morning period.

Some rotating shift workers complain that though they usually get the same amount of sleep at atypical times, it is of inferior quality. Of Wyatt and Marriott's sample (1953), for instance, 83% reported that they felt most tired on night shifts. A survey of 1,700 Japanese nonday-shift workers (Morioka, 1969) concluded that they tended to regard their sleep as inadequate to allow recovery from fatigue. Power plant shift workers studied by Mann and Hoffman (1960) stated that sleep and eating disruption posed the most difficult aspects of working on rotating shifts. Other studies supporting these observations include those of Ulich (1957), Thiis-Evensen (1958), Van Loon (1958), and Bast (1960).

The major complaint about sleep at atypical times is noise. Rutenfranz and Knauth (1970) reported that 78.8% of workers sleeping during the day were bothered by noise, 77.9% were bothered by children, 67.2% by traffic, 57.5% by telephones, and 53.4% by aircraft. However, it has also been demonstrated that the response to noise of individuals sleeping at atypical times is to an important degree a function of adaptation and motivation (cf. Knauth and Rutenfranz, 1975; LeVere et al. 1972; Lukas and Dobbs, 1972; Williams and Williams, 1966; and Wilson and Zung, 1966).

GENERAL PHYSIOLOGICAL EFFECTS

Circadian variations are evinced by a number of bodily processes, including temperature, pulse, blood pressure, urine flow, some blood constituents, and certain endocrine functions (Weitzman, 1972; Weitzman et al., 1971; Mills, 1966; and Kris, 1957). Adjusting to a disruption of circadian cycles may take anywhere from a few days (Reinberg et al., 1976) to three weeks (Weitzman, 1972) or it may never occur (Aschoff, 1967; Rutenfranz, 1967). In those shift workers who do adapt to inversion of the sleep-wake cycle, other physiological and psychological rhythms often also invert (Beljan et al., 1972). It is possible that individuals who do not readily adjust to disrupted circadian rhythms may prefer to work on rapidly rather than slowly rotating shifts, as was apparently the case with air traffic controllers studied by Smith (1973).

Most recent studies of the physiological effects of shift work have approached the analysis in terms of stress (cf. Froberg and Akerstedt, 1974; Levi, 1972). Ghata (1971) has applied some of the findings to the phenomenon of jet lag.

Finally, Wojtezak-Jaroszowa (1978), in a series of laboratory studies conducted in cooperation with the National Institute for Occupational Safety and Health, has identified a number of basic physiological functions which follow a circadian cycle and bear directly upon worker performance and efficiency. Measures obtained from individuals performing fixed levels of tasks during day and night hours indicated that work capacity (as measured by oxygen uptake, carbon monoxide production, and cardiac work cost), sensory acuity, and neuromuscular activity were impaired during the night hours. The author concluded

that "the given external work was performed less 'economically' at night than during the daytime. In other words, its physiological cost was higher." (Wojtezak-Jaroszowa, 1978, p. 21.)

EATING HABITS AND DIGESTION

Next to sleep complaints, eating and digestion problems appear to cause shift workers the most discomfort and ill health. Van Loon (1958) reported that 20% of a sample of shift workers registered problems in regard to eating. Takagi (1972) found a decreased frequency in the number of meals eaten during evening and night shifts for nearly half his sample. Mott et al. (1965) found that the prevalence of appetite problems appeared to be least for day shift workers and highest for rotating shift workers. The prevalences of these problems for afternoon and night shift workers were about equal, and fell between the extremes of day and rotating shift workers. More recently, Debry and Bleyer (1972) found that nonday workers have different distributions of caloric intake over the 24-hour cycle, but that the total remains the same. They also observed that disruption in the social lives of nonday workers tends to foster an increase in alcohol consumption. Previous observers (e.g., Metz, 1964) have also noted increased consumption of alcohol, caffeine, and tobacco in nonday workers, all of which can contribute to gastrointestinal disorders.

Wyatt and Marriott (1953) showed that 43% of rotating shift workers in their sample took some form of medication for digestive problems, and that 74% of the shift workers reported that they enjoyed their meals most when working the day shift as opposed to 3% who preferred meals when working the night shift. Ulich (1957) has shown that 38% to 49% of German rotating shift workers implicated appetite disturbances as a major problem of their job hours. This figure, however, dropped to 4% when the rotation did not involve night work. It appears that after changing to night work, adaptation in terms of eating habits and appetite does occur in 3 to 6 days (Wyatt and Marriott, 1953; Mann and Hoffman, 1960).

Studies by Thiis-Evensen (1958) and Bast (1960) have shown a relationship between digestion and "nervousness." The trouble that night shift workers have in sleeping after a shift can lead to irritability and restlessness that, in turn, can have a detrimental effect upon digestion.

ELIMINATION

Mott et al. (1965) found more complaints of constipation among afternoon, night, and rotating shift workers than among day shift workers--rotating shift workers having the most complaints of any group. Also, Thiis-Evensen (1958) found 30% of a group of Danish night shift workers reported problems with constipation or colitis. Only 9% of the day shift workers in this latter study had such complaints.

GENERAL HEALTH PROBLEMS

Conclusions regarding the effects of shift work on general physical health are characterized by disagreement (Vernon, 1940; Brussgard, 1950; Doll et al., 1951;

Wyatt and Marriott, 1953; Bjerner and Swensson, 1955; Wade, 1955; Aanonsen, 1959 and 1964; McGirr, 1966). While some investigators report no detrimental effects, there is evidence that certain types of problems are related to shift work.

Thiis-Evensen (1958) found, for example, that 30% of a group of workers who had changed from nonday shift work to day work complained of gastritis. The majority of complaints came from workers who had been on shift work only a short time. Bjerner et al. (1948) found little difference between shift workers and day shift workers in complaints of gastritis and medical attention for gastritis. When these investigators, however, compared their data for day shift workers who had never worked shifts with those who had, an interesting pattern emerged. Day shift workers who had never worked other shifts had the least medical attention and hospitalization, current nonday shift workers had a slightly higher frequency, and day shift workers with previous experience on other shifts had the greatest number of problems.

Long-term studies of disease incidence in shift workers are rare. Those that have attempted to estimate long-term effects (e.g., Aanonsen, 1959) by including former shift workers in their samples have tended to find that individuals who leave shift work have the highest incidence of disease. Some investigators, noting that about 20% of shift workers are not able to continue shift work, feel that it may be considered a definite health risk to this group (Thiis-Evensen, 1969; Begoin, 1957).

There appears to be a connection between shift work and gastroduodenal ulcers, but the exact nature of the relationship is not clear. Studies by Thiis-Evensen (1958 and 1969) and Duesberg and Weiss (1939) have shown that the frequency of reported ulcers is from two to eight times greater amoung rotating shift workers than among day shift workers. Wyatt and Marriott hypothesized that the disruption in meal times "may be an important factor in the etiology of peptic ulcer," and Andlauer's study (1960) supports the view that gastroduodenal ulcers are more common among shift workers due to their eating, drinking, and smoking habits.

Although many other studies (Bonnevie and Anderson, 1960; Brussgard, 1949; Ensing, 1969; Bjerner, Holm, and Swensson, 1948; Wesseldijk, 1961) have shown higher frequencies of ulcers under shift work conditions, Mott et al. (1965) present data on this topic that appear to be inconsistent. These investigators found higher incidences of ulcers among workers on fixed day and afternoon shifts than among those working night and rotating shifts. Although their design did not allow for a specific test of the hypothesis, they strongly suggested the possibility that the day and afternoon shift workers with ulcers may have developed them during prior experience with night or rotating shifts.

One recent study by Walker and De La Mare (1971) examined the number of absent days and the causes of absence for a sample of fixed shift and day shift workers, matched by age, sex, job title, and so on. Nonday fixed shift workers, the study concluded, were absent from work more often than day shift workers for health reasons, primarily respiratory and digestive disorders.

Although ulcers and some other gastric-related problems appear to covary with shift work, little research exists on the relationship between shift work and other bodily ailments. The available research tends to suggest that for the majority of shift workers, general physical health is not detrimentally affected by shift work per se (Dirken, 1966; Taylor, 1967).

In a later study (1973), Taylor found that fixed night shift workers were healthier than rotating shift workers. Pocock et al. (1972) determined that changing from a conventional 7-day shift schedule to a rapidly rotating schedule produced a 36% increase in certified illness and a 29% increase in uncertified sick leave. Rotation appears to pose a greater health threat than do fixed shift systems. Unfortunately, no investigators to date have provided enough follow-up data to allow determination of the effects on health of adaptation to new schedules.

MEDICATION EFFECTIVENESS

Medications also tend to vary in effectiveness over the 24-hour cycle. The effect, for example, of digitalis is doubled when it is taken at night (Sollberger, 1965). On the other hand, antihistamines taken early in the morning will be effective for as long as 17 hours, but for only about half as long if taken in the evening (Reinberg and Sidi, 1966). The effects of a number of other common medications, such as aspirin, barbiturates, cold remedies, and appetite suppressants, also exhibit circadian variations (Luce, 1971).

ACCIDENTS

Industrial accidents apparently do tend to occur with greater frequency at certain times of the day, perhaps because worker performance is readily affected by disruption in circadian rhythms (Morgan et al., 1974). Although it is difficult to generalize across industries, Menzel (1950) found that most accidents in shift work systems seemed to occur between 10:00 p.m. and 2:00 a.m. Studies by Browne (1949) and Bjerner et al. (1955) of telephone operators and gas meter readers, respectively, demonstrated that there were clear circadian patterns in the frequency of mistakes, with the greatest number tending to occur during late afternoon and early morning hours. In a more recent study, Colquhoun (1971) experimented with shift worker performance on simple tasks and found that performance was worse on night than on day shifts and that, once the sleep-wake cycle had been disrupted, there was a sharp drop in worker efficiency during the first few days, which tended to level off after about one week.

EFFICIENCY

Colquhoun has also conducted some important studies of the relationship between body temperature, which follows a circadian rhythm, and performance efficiency (1968a, 1968b, 1969, 1970a, 1970b). These generally show that work efficiency and body temperature are directly related, i.e., when temperature is high, so is work efficiency. Recent research by Folkard et al. (1976) has refined this relationship somewhat through study of an additional variable, the demands of the task on short-term memory. If tasks include little or no short-term memory demand, the positive correlation between temperature and efficiency holds true.

However, if tasks impose a high demand on short-term memory, the relationship is inverted, and performance efficiency drops as temperature rises.

PSYCHOLOGICAL AND SOCIAL EFFECTS

Research on the psychological aspects of shift work is not extensive. What does exist typically focuses on job attitudes and tends to conclude that attitudes vary as a function of numerous interacting variables, e.g., type of work, skill level required, type of industry, length of time on the job, characteristics of workers' communities, and general needs and demands.

Investigators have documented both positive and negative attitudes toward shift work. In England, Wedderburn (1967) found that 53% of the men on a rapidly rotating shift liked shift work, as opposed to 15% who disliked it. In Canada, Blakelock (1960) found that 57% of rotating shift workers in an oil refinery liked shift work; 12% disliked it. Taylor (1967) reports greater job satisfaction among nonday shift workers than among day shift workers.

On the other hand, shift work is described by Banks (1956) as "resignation rather than adaptation" and by Downie (1963) as "acceptance rather than acclaim." Ulich (1957) found that 67% of a population of German shift workers had negative attitudes toward shift work, and Bast (1960) found that over 50% of his sample of shift workers and their wives had negative attitudes toward shift work. Generally negative attitudes about shift work have been documented in other studies (Philips Company, 1958; Mann and Hoffman, 1960).

Blakelock (1960) and Wedderburn (1975) have proposed that workers may have more positive attitudes toward shift work if a high number of other community residents participate in it, or if it has stimulated the growth of a special, supportive subculture.

Although the absolute percentages of satisfied versus unsatisfied subjects varies from study to study, close scrutiny of the data suggests certain trends. The degree of satisfaction is generally a direct function of length of time on shift work, and satisfaction with shift work appears to be inversely related to education and skill level (Mott et al., 1965). It also appears that preferences exist for rapidly rotating shifts over shifts of extended periods and that this preference is independent of age but not experience (Smith, 1973). While rapid rotation is preferred over slower rotation, fixed shifts seem to be preferred to rotating shifts (De La Mare and Walker, (1968).

Although the subject has not been studied in depth, there is evidence that certain psychological traits and emotional reactions correlate with shift work. Bast (1960) reported that job satisfaction decreased in shift workers as neuroticism increased (cf. Akerstedt, 1976). Ulich (1957) has reported that 36% to 50% of shift workers developed increased irritability, nervousness, and bad tempers, which they attributed to shift work. Mott et al. (1965) found that self-esteem, anxiety, and conflict-pressure were not directly related to the shifts people were working, but they did find that "the greater the role-difficulty the shift worker feels, the lower his self-esteem and the higher his anxiety and conflict-pressure." In a study of air traffic controllers,

Smith et al. (1971) found that controllers working evening and night shifts reported more fatigue, more sleepiness, and a less positive affect state than was associated with day shift work.

Adaptation to shift work may also be a function of personality. In a one-year study of 37 computer operators and data handlers, Ostberg (1972) measured body temperatures, sleep performance, physical fitness, time estimation, and food intake during morning, evening, and night shifts, which began at 8:00 a.m., 4:00 p.m., and midnight respectively. The study concluded that the night shift was the most difficult to adjust to and that "morning" people had more difficulty adapting to shift work than did "night" people (Kleitman, 1963).

Although research on shift work has produced more data in regard to its effect on biological phenomena than on social and family relationships, it does appear that family life as perceived by the shift worker reveals a number of consequences of shift work. Ulich (1957) reported that 74% of married shift workers complained of "disturbances in the family." Mott et al. (1965) have suggested that, based on data from their study and those of Bast (1960), we can "infer what seems to be the major problems in the shift worker's relationships with his wife and children...the absence of the shift worker from the home in the evening, sexual relations, and difficulties encountered by the wife in carrying out her household duties." Banks (1960), for instance, noted that almost 20% of the spouses in his sample stated that their husbands' employment disrupted meal times.

Some observers have noticed that, possibly because of the unique pressure on shift workers' families, feelings of cohesiveness and interdependence are more important to them than to other families (Caillot, 1959; Maurice and Monteil, 1965). And, conversely, the degree of job satisfaction that the shift worker feels may be to some extent a function of the attitudes about shift work held by his family. Mann and Hoffman (1960) have shown that when the family's attitudes toward shift work are positive, the job satisfaction of the shift worker tends to be higher. If the family's attitudes are negative, shift worker job satisfaction tends to be lower. These results are supported by the work of Bast (1960) and De La Mare and Walker (1968), who have also shown a relationship between the spouse's attitude about shift work and the shift worker's job satisfaction. The attitudes of married workers toward shift work seem to be more influenced by the financial benefits of shift work than those of single men (Van Loon, 1958), and it appears that, in fact, fewer single men and married men without children work night shifts than do men with four or more dependents (Walker and De La Mare, 1971).

We would expect that the social life of the shift worker would be affected by the nature of his/her work schedules. Both Bast (1960) and Blakelock (1960) have shown that shift workers, compared with day shift workers, participate less in organizations, attend fewer meetings, and are less likely to hold office. As for informal social contacts, Mann and Hoffman (1960) and Blakelock (1960) suggest that the frequency of social contacts among shift workers varies considerably as a function of the industry. Mott et al. (1965) have suggested that this variation can in part be attributed to the differences in the communities in which the studies were done. Perhaps social contacts are more easily established and maintained in smaller communities that are predominantly

composed of shift workers than in larger metropolitan areas where a shift worker's immediate neighborhood may be occupied mainly by nonshift workers.

As Aanonsen (1964) has pointed out, shift work can be viewed as an opportunity for certain kinds of leisure and recreational activities. Also, shift workers are beginning to actively seek to influence community and institutional patterns so as to accommodate their needs and schedules. For example, there is growing pressure for more flexible schedules for classes, stores, programs, union meetings, and so forth.

RECORDS COMPONENT

SUBJECTS

Nurses

The health and accident records of all 1,219 nurses in the sample were reviewed. All nurses in the study population were full-time, nonsupervisory employees. The sample included both RNs and LPNs (known as LVNs in California) employed at 12 separate hospitals (see Table 1). The distribution over the four shift categories was fairly even: 315 nurses worked fixed day shifts, 306 worked fixed afternoon/evening shifts, 289 worked fixed night shifts, and 309 were on rotating shifts. The nurse sample was 98.3% female. Of the 20 male nurses included, 40% worked on rotating shifts. As Table 1 shows, of the 12 hospitals surveyed, 7 employed only fixed shift employees, 1 depended solely on a rotating shift system, and 4 relied on some combination of both fixed and rotating shifts. All five rotational hospitals used oscillating systems (rotation between two shifts) except one, which rotated a few nurses among all three shifts. The length of time that a rotating nurse was assigned to a shift varied from one to four weeks.

Food Processors

Health and accident files for all 1,298 food processing workers in the records sample were surveyed. Of this total, 912 were men and 378 were women (8 files did not indicate the sex of the employee). The distribution of this population over the four basic shift categories is shown below.

Shift

Sex	Day	Aft/Eve	Night	Rotating
M	225 (68.2%)	215 (66.0%)	206 (63.6%)	266 (85.8%)
F	105 (31.8%)	111 (34.0%)	118 (36.4%)	44 (14.2%)

As the chart indicates, there are about two men to every woman on each of the fixed shifts, but the ratio of men to women is much higher--about 6:1--on rotating shifts.

Characteristics of the seven work sites at which record reviews were made for the food processor sample are shown in Table 2

Table 1

RECORD REVIEW SITES: NURSES

Site No.	Total Beds	Annual Admissions ($\times 10^3$)	Occupancy Rate (%)	Total Nurses	Fixed, Rotating, or Both	Turnover Rate (%)	Nurse Samples†					Annual Sick Leave (Days)
							Day	Aft/Eve	Night	Rotating	Total	
01	464	23.7	71	459	F	16.5	63	63	64	0	190	12
02	308	12.5	69	133	F	16.0	25	25	25	0	75	12
03	194	14.1	NA	187	B	33.0	7	5	7	25	44	10% of Total Days
04	489	13.8	93	291	B	NA	2	2	2	15	21	NA
05	450	16.5	75	433	B	16.0	3	2	4	107	116	12
06	798	21.3	77	401	B	24.8	13	13	13	56	95	12
07	357	13.8	74	254	F	NA	28	28	28	0	84	10 (for first 2 yrs)
08	448	21.1	85	290	F	NA	34	32	33	0	99	12
09	292	12.5	82	247	F	NA	33	33	33	0	99	NA
10	554	22.8	80	279	F	NA	26	26	26	0	78	12
11	426	14.7	89	412	R	50-55	0	0	0	106	106	12
12	710	30.9	78	664	F	NA	81	77	54	0	212	12

*Rotation is of the oscillating type.

†The size of the population surveyed for the three fixed shifts was determined by the total number of night shift nurses employed at a site; day and afternoon sample sizes were then set at approximately this number.

Table 2

RECORD REVIEW SITES: FOOD PROCESSORS

Food Processors Samples*										
Site	Total Food Processors	Turn-over Rate	Fixed, Rotating, or Both	Day	Aft/ Eve	Night	Rotating	Total	Clinic	Annual Sick Leave
01	553	5 in last yr	R	0	0	0	200	200	No	No sick days--Disability program
02	725	No longer take %	B	102	99	100	0	301	Yes	No sick days
03	666	10 per month	B	101	101	99	0	301	Yes	No official sick days
04	1100	20%	F	58	60	58	0	176	Yes	1 wk/each yr worked
05	455	No figures taken	F	70	69	68	0	207	Yes	No sick days given
06	484	No figures taken	R	0	0	0	76	76	Yes	40 hrs/yr
07	980	18%	B	0	0	0	37	37	Yes	1 wk/each yr worked

*The size of the population surveyed for the three fixed shifts was determined by the total number of night shift food processors employed at a site; day and afternoon sample sizes were then set at approximately this number.

PROCEDURES

The process of obtaining health and accident data was straightforward. Once the consent of participating hospitals or food processing plants was obtained, a research team visited each site, selected files randomly, and completed the form shown as Figure 1. Information was gathered on 30 items covering basic demographic characteristics, medical history, and both the prevalence of and reasons for the three outcome variables: sick leave, accidents, and visits to worksite clinics. Data on these three variables were collected for the six months prior to the date of the records review at each site.*

The medical history gathered in items 10 through 13 on Figure 1 covered prior illnesses, medication, disabilities, and operations. Prior illnesses were classified according to codes contained in the eighth revision of the International Classification of Diseases (ICD-8). From records of shift workers' last and next-to-last physicals, data on height, weight, X-rays, EKGs, blood pressure, and pulse were noted on items 14 through 27.

These measurements were collected with the expectation that they might allow development of a set of variables that could be used as indicators of health status and its relationship to shift patterns. However, the last physical for most subjects was that given to them when they were first hired at the surveyed site, so the medical histories in effect only describe health at the time of hiring. Therefore, with few exceptions, these data will not be discussed in this report. However, they may provide valuable base rate data for future studies on the prevalence of disease in this sample of shift workers.

Once the data were obtained, they were analyzed with programs from the statistical package for the social sciences (SPSS) on a CDC 6400 computer.

RESULTS

Subject Demography

Sex--
The sample of nurses was almost entirely female. Only 1.7% of this population was male. Of the 20 men whose records were reviewed, 40% worked on rotating shifts.

The sample of food processors comprised 912 men and 378 women. The sex of an additional 8 individuals was not shown on their files. On fixed shifts, the distribution of this population was about 3 men to 1 woman. On rotating shifts, this proportion increased to about 6 to 1.

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*Since collecting data at these sites spanned a period of some months, we have assumed that time of year either does not influence these variables, or, if it does, that it influences them uniformly for the four shift categories.

1. Site __ __ Subject __ __ __

2. Industry

RN	1
LVN	2
Coal mining	3
Food processing	4

3. Shift Schedule

Day	1
Afternoon	2
Night	3
Rotating	4

4. Today's date __ __ / __ __ / __ __

5. Birthday __ __ / __ __ / __ __

6. Hire date __ __ / __ __ / __ __

7. Sex

Male	1
Female	2

8. Marital status

Single	1
Married	2
Widowed	3
Divorced	4
Separated	5

9. Race

White	1
Black	2
Mexican-American	3
Oriental	4
Other	5

Medical History

10. Illnesses reported (not through work site): Note year if given.

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

11. Medications (if any, note)	12. Disabilities (non-work) (if any, note) i.e. broken bones, car accidents, allergies	13. Operations (if any, note) Note year if given.
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

FIGURE 1 SHIFT WORK HEALTH RECORDS FORM

Last physical		Next to last physical	
14. Date	__ __ / __ __ / __ __	21. Date	__ __ / __ __ / __ __
15. Height	__ / __ __	22. Height	__ / __ __
16. Weight	__ __ __	23. Weight	__ __ __
17.	Normal Abnormal Year	24.	Normal Abnormal Year
a. X-ray	1 2 __ __	a. X-ray	1 2 __ __
b. EKG	3 4 __ __	b. EKG	3 4 __ __
18. Systolic b.p.	__ __ __	25. Systolic b.p.	__ __ __
19. Diastolic b.p.	__ __ __	26. Diastolic b.p.	__ __ __
20. Pulse	__ __ __	27. Pulse	__ __ __

28. Total sick leave taken during last six months: __ __ __

Reasons for each day taken: _____

_____

_____

29. Accidents during the last six months - Total __ __

Date	Type of accident	Treatment
_____	_____	_____
_____	_____	_____

(record additional accidents)

30. Visits to company clinic during the last six months - Total __ __
(Other than work related accidents)

Date	Reason for visit	Treatment
_____	_____	_____
_____	_____	_____

(record additional visits)

FIGURE 1 SHIFT WORK HEALTH RECORDS FORM (Concluded)

Ethnicity--
The nursing sample population was almost exclusively (91.5%) White, though it should be noted that only about 50% of the files examined listed the nurse's race. Blacks constituted about 3% of the nurse population, and other ethnic groups combined represent about 4% of the sample.

Table 3 shows ethnic groupings of nurses by shift. Although there was a relatively proportional distribution over the four shift categories, minority groups are slightly under-represented on day and rotating shifts, and are slightly over-represented on afternoon and night shifts.

Table 3

PERCENTAGE OF NURSES IN EACH ETHNIC GROUP
(By Shift)

	Day	Aft/Eve	Night	Rotating
White	94.4%	86.4%	86.3%	95.4%
Black	2.2	0	5.9	4.0
Hispanic	1.2	5.7	3.9	0.6
Asian	1.1	4.5	2.9	0
Other	1.1	3.4	1.0	0
	100%	100%	100%	100%

About 22% of the food processor population was not racially or ethnically identifiable. The remainder was 62.8% White, 9.7% Hispanic, 5.2% Black, and 0.2% Asian and 0.1% Other.

The ethnic distribution of food processors over the four shift categories differed significantly ($p < 0.001$, chi square = 260.4, df = 12). As Table 4

Table 4

PERCENTAGE OF FOOD PROCESSORS IN EACH ETHNIC GROUP
(By Shift)

	Day	Aft/Eve	Night	Rotating
White	89.8%	82.0%	83.8%	40.7%
Black	4.3	8.2	9.9	0
Hispanic	5.9	9.2	5.3	57.5
Asian	0	0.3	1.0	1.8
Other	0	0.3	0	0
	100%	100%	100%	100%

indicates, White food processors were proportionally under-represented on rotating shifts, as were Blacks. Conversely, Hispanic food processors were heavily over-represented on rotating shifts.

Age--
The average nurse in the sample was 32.9 years old. The comparison shown below of the mean ages for the four shifts is revealing.

Nurses

	Day	Aft/Eve	Night	Rotating
Mean Age	34.8	32.9	36.7	27.5

Nurses on rotating shifts were significantly ($p < 0.001$) younger than the mean. Those on afternoon shifts were closest to the mean, and both day and night shift workers tended to be older than the overall mean age.

Comparable means for the food processor population are shown below.

Food Processors

	Day	Aft/Eve	Night	Rotating
Mean Age	42.4	35.8	36.0	37.5

The average age of food processors, 37.7 years, was almost 5.0 years more than the average for the nursing sample.

Marital Status--
There were similar numbers of married (44.9%) and unmarried (55.7%) nurses in the sample. The widowed, divorced, and separated nurses were pooled with the unmarried population, because they also tend to live alone. Although not directly assessable from the records, the distributions of married and unmarried along these lines provides a rough index of who is living alone and who is not--a variable of some relevance for shift work and health. As Table 5 shows, there are significant differences in marital status when comparisons are made between shifts. Both day and night shifts tend to contain more married than unmarried nurses. For day shifts, the percentage comparison of married to unmarried nurses is 51.7% to 48.3%. For night shifts, it is 50.8% to 49.2%. In contrast, there were significantly more unmarried (69.4%) than married (29.9%) nurses assigned to rotating shifts.

The sample of food processors was far less evenly divided between single and married shift workers (Table 6). Married exceed unmarried food processors by a ratio of 3 to 1. To determine if this large difference in marital status had statistical significance, analyses of variance on the outcome variables

Table 5

PERCENTAGE OF NURSES IN EACH MARITAL STATUS CATEGORY
(By Shift)

	Day	Aft/Eve	Night	Rotating	All
Unmarried*	48.3%	54.2%	49.2%	69.9%	55.6%
Married	51.7	45.8	50.8	30.1	44.4
	100%	100%	100%	100%	100%

* Includes widowed, divorced, separated

Table 6

PERCENTAGE OF FOOD PROCESSORS IN EACH
MARITAL STATUS CATEGORY
(By Shift)

	Day	Aft/Eve	Night	Rotating	All
Unmarried*	21.3%	34.5%	30.7%	9.6%	24.9%
Married	78.7	65.5	69.3	90.4	75.1
	100%	100%	100%	100%	100%

* Includes widowed, divorced, separated

(i.e., sick days, clinic visits, and accidents) were performed with marital status as an independent variable. Marital status was found, however, to be unrelated to any of the outcome variables.

Unmarried food processors (i.e., single, divorced, widowed, separated) are not found as often on rotating shifts, but tend to be over-represented on the afternoon and the night shifts. The distribution of married shift workers is much more even, with higher concentrations on day and rotating shifts.

Length of Employment--
The mean length of time that a nurse in the sample had been employed at the surveyed hospital was 4.14 years. Nurses who were permanently assigned to day or night shifts at the time of our records review exceeded this mean: day shift nurses had been employed for an average of 5.61 years and nurses on night

shifts for 5.23 years, on the average. The mean length of employment was lower--3.47 years--for nurses on fixed afternoon shifts, and lowest--2.3 years--for nurses working rotating shifts.

The average length of employment was about twice as high for the entire food processor sample: 8.6 years. Those on day shifts had been employed longest, 12.5 years, on the average. Rotating shift food processors had the next longest average tenure, 8.4 years. Afternoon shift workers had been employed for an average of 7.1 years, and night shift workers had the lowest average, 6.3 years.

Correlations

Nurses--

The relationships between a number of variables (e.g., age, sick days, number of clinic visits, accident rate, months on job) were examined, and several significant correlations were found. However, their significance was primarily due to the very large size of the sample; the magnitude of the coefficients was too low to have practical or clinical significance. For example, the correlation was $r = -0.04$ for accidents and age, indicating an extremely slight tendency in our sample of nurses for fewer accidents with increasing age. Since a correlational coefficient of this magnitude only accounts for 0.0016% of the common variance between the two variables, we will not report these correlations.

Food Processors--

Essentially the same results were found for the food processor population as for the nursing sample: some correlations were statistically significant, but all were too low to have practical significance. Age was correlated with sick days ($r = -0.11$, $p < 0.001$) and accidents ($r = -0.006$, $p < 0.05$), revealing a slight tendency for older shift workers to have fewer accidents and to take fewer sick days.

Outcome Variables

Three major variables obtained from the records review could be considered outcome variables: sick leave, clinic visits, and accidents. Sick days and clinic visits can be viewed as an index, although not a direct measure, of one's health status. Accidents are a measure of safety. In deciding how far back in the record to go to track these variables, we were faced with a dilemma: if we went back too far we would not be appropriately sampling recent hires. On the other hand, if we did not go back far enough, we would not be picking up reliable data since this kind of information is infrequently entered into records. Attempting to balance these considerations, we chose to go back six months. The data, therefore, on sick days, clinic visits and accidents are from a six-month sample of these variables with the exception of 289 food processors who were seasonal workers and thus did not have records going back six months. Because we felt that including this last group in the analysis of the outcome variables might bias the conclusions, we eliminated them from the analysis of outcome variables. This left us with sick leave, clinic visit and accident data on 1,009 food processors and 1,219 nurses. We also obtained the reasons given, if any, for sick leave and clinic visits. At several of the

sites, reasons for sick leave were not available, and the definition of sick leave, though it never included bereavement leave, vacation, military leave, or workmen's compensation/disability leave, did vary considerably among surveyed sites. For example, some sites consider time taken for physician or dental appointments as sick leave; others do not. Some use a category of "absent" for this kind of leave and for minor illness that do not require a physician's attention; in these cases, absent time was aggregated with sick leave for recording on the data collection form.

In attempting to analyze the data, our overall approach was to perform analyses of covariance to partial out any possible effects of age on the outcome variables. It was thought that age, since it is related to health status, may be an important covariate to control for, particularly since there were some differences in age among the various shifts. If the analyses of covariance indicated that age was not significantly related to a particular outcome variable, an analysis of variance was then performed. Some analyses of variance were two-way analyses with shift and marital status being the major independent variables. As it turned out, age was not highly correlated with any of the outcome variables. The relationship between age and the outcome variables was statistically significant in some cases, but only when it exceeded $\underline{r} = 0.10$ did we report the analyses of covariance.

There were two cases in which age correlated above $\underline{r} = 0.10$ with one of the outcome variables: age correlated ($\underline{r} = -0.1138$) with sick days for food processors and ($\underline{r} = -0.107$) with clinic visits for nurses.

When an analysis of variance or covariance was significant, Duncan's New Multiple Range and Scheffe's Post-Hoc Comparison tests were performed on the data. Duncan's test is somewhat liberal and Scheffe's is a little more conservative. Where the Scheffe's and Duncan's results were identical for a given level, the results of the Scheffe's were presented. Where the Duncan's test was significant for a given α level and the Scheffe's was not, the results of the Duncan's were used.

Sick Leave

Nurses--
Table 7 shows the number and relative percent of nurses taking sick leave by shift, and the amount of sick leave taken. Reasons given for taking sick leave that varied significantly among shifts are shown on Table 8.

Although the number of days of sick leave taken did not differ significantly over the four shift categories, one-way analysis of variance indicated that the difference approached significance ($\underline{p} < 0.14$). As the comparison below shows, rotating shift nurses tended to take more sick days than did nurses on fixed shifts. Of those on fixed shifts, night shift nurses tended to take more sick leave than those on afternoon shifts, who tended to take about the same amount of sick leave as day shift nurses. Over a six-month period, the mean for rotating shift nurses exceeds that for fixed shift nurses by one-half day. Because the standard deviations for number of sick days were relatively large, this difference was not statistically significant.

Table 7

NURSE SICK DAYS
(By Shift)

Number of Sick Days	Day	Aft/Eve	Night	Rotating
0	62 (19.7%)	66 (21.6%)	66 (22.8%)	51 (16.5%)
1	51 (16.2%)	43 (14.1%)	41 (14.2%)	45 (14.6%)
2	45 (14.3%)	51 (16.7%)	43 (14.9%)	30 (9.7%)
3	38 (12.1%)	39 (12.7%)	38 (13.1%)	50 (16.2%)
4	42 (13.3%)	31 (10.1%)	28 (9.8%)	38 (12.3%)
5	22 (7.0%)	22 (7.2%)	20 (6.9%)	18 (5.8%)
6	19 (6.0%)	14 (4.6%)	13 (4.5%)	22 (7.1%)
7	9 (2.9%)	9 (2.9%)	15 (5.2%)	12 (3.9%)
8	8 (2.5%)	10 (3.3%)	3 (1.0%)	10 (3.3%)
9	6 (1.9%)	2 (0.6%)	9 (3.1%)	6 (1.9%)
10 -90	13 (4.1%)	19 (6.2%)	13 (4.5%)	27 (8.7%)
Total	315	306	289	309
(Percent)	(100%)	(100%)	(100%)	(100%)

Table 8

REASONS FOR SICK DAYS
THAT DIFFERED SIGNIFICANTLY AMONG SHIFTS
AND NUMBER OF NURSES LISTING EACH REASON

	Day	Aft/Eve	Night	Rotating
Headaches	20	21	18	7
Common cold	41	44	30	3
Otitis external (inflamed ear)	9	4	8	0
Pharyngitis (sore throat)	37	28	26	0
Acute respiratory infection	10	5	11	52
Influenza	62	53	57	8
Cardiovascular and lymphatic symptoms	13	4	9	0
Joint and limb symptoms	7	9	7	0
Upper GI tract symptoms	31	16	20	49
Abdomen and lower GI tract symptoms	9	15	9	1

Note: All reasons significant at the .05 level or better.

Nurses

	Day	Aft/Eve	Night	Rotating
Mean Sick Leave (Days)	3.5	3.4	3.8	4.1

The reasons given by nurses for taking sick leave varied considerably (see Table 8) according to which shift the nurse was working. Fixed shift workers (i.e., those on fixed day, afternoon, or night shifts), tended to give similar reasons for taking sick leave (e.g., headaches, colds, flu). Nurses on rotating shifts offered different and apparently more serious reasons (e.g., acute respiratory infection) for taking sick leave. It should be noted that more total reasons were offered by fixed shift workers than by rotators. When this difference in the number of reasons is accounted for on a proportionate basis, all of the items in Table 8 remain significant, with the exception of headaches and joint and limb symptoms.

Food Processors--
Because a very small but significant correlation was found between age and the number of sick days taken ($r = -0.1138$, $p < 0.001$), analysis of covariance was employed to partial out the effect of age on sick leave. No significant differences in sick leave amounts taken among shifts were disclosed ($p < 0.5$).

One reason these differences were not significant was that the standard deviations greatly exceeded the means, generally by a factor of from 2 to 3, implying high variability among shift workers in the number of sick days taken, which tends to mask differences due to shift.

Food Processors

	Day	Aft/Eve	Night	Rotating
Mean Sick Leave (Days)	4.4	6.6	6.6	6.2

When the analysis of sick leave by shift was then also broken down by sex, it was found that there were significant differences in the number of sick days taken, with women taking more than men. A two-way analysis of covariance

Food Processors

Mean Sick Leave (Days)	Day	Aft/Eve	Night	Rotating
Men	2.98	6.01	4.87	6.13
Women	7.76	7.82	9.49	7.10

showed that the sex of the shift worker, not shift, accounted for differences in sick leave, $F(1, 989) = 15.54$ $p < 0.001$. There was no significant sex-by-shift interaction ($p < 0.5$).

Food processor sick leave is displayed in some detail on Table 9, which shows numbers and percentages of shift workers on each shift, ranked according to the amount of sick leave taken. Table 10 lists those sick leave reasons that varied significantly among shifts and the number of shift workers citing each complaint.

There was considerable variation between rotating and all fixed shifts among reasons for taking sick leave. Rotating shift food processors took many more days than did fixed shift workers for psychophysiological musculoskeletal disorders, ear disease, colds, sinusitis, pharyngitis, acute respiratory infections, flu, flu with digestive manifestations, dental problems, stomach aches, cardiovascular and lymphatic symptoms, abdomen and lower GI tract symptoms, and sprains.

Clinic Visits

Nurses--
As Figure 2 shows, clinic visits show the most striking disparity among shifts. (It should be noted that these percentages take into account the fact that certain hospitals did not have clinics available for nurses.) Table 11 displays the number of nurses in each shift with records of from zero to nine clinic visits. Note that, as Figure 2 suggests, rotating shift nurses have higher percentages of clinic visits than do nurses on fixed shifts. Reasons for visits that are statistically different among the four shift groups are shown on Table 12. The comparison below presents this information on the basis of mean number of visits per person over a six-month period.

	Nurses			
	Day	Aft/Eve	Night	Rotating
Mean Clinic Visits	0.06	0.08	0.10	0.76

The analysis of variance for the number of clinic visits by shift was highly significant, $F(3, 1215) = 56.15$, $p < 0.001$. The analysis of covariance used to account for the effect of age on the number of clinic visits ($r = -0.11$) remained comparably significant ($p < 0.001$). The Scheffe's test set at the 0.01 level of significance showed that rotating shift nurses have a significantly higher (almost tenfold) clinic visit rate than do fixed shift nurses. There were no differences in the clinic visit rate among the three fixed shifts.

As Table 12 shows, rotating shift nurses visit the clinics more frequently for flu, gastritis, menstrual disorders, eczema and dermatitis nervous disorders, and upper and lower GI tract symptoms than do fixed shift nurses.

Table 9

FOOD PROCESSOR SICK DAYS
(By Shift)

Number of Sick Days	Day	Aft/Eve	Night	Rotating
0	134 (49.1%)	90 (33.5%)	107 (40.1%)	56 (28.1%)
1	44 (16.1%)	39 (14.5%)	37 (13.9%)	20 (10.1%)
2	24 (8.8%)	23 (8.6%)	21 (7.9%)	14 (7.1%)
3	10 (3.7%)	18 (6.7%)	20 (7.5%)	17 (8.5%)
4	6 (2.3%)	13 (4.8%)	8 (3.0%)	13 (6.5%)
5	8 (2.9%)	10 (3.7%)	1 (0.4%)	9 (4.5%)
6	4 (1.5%)	5 (1.8%)	14 (5.2%)	11 (5.6%)
7	5 (1.8%)	5 (1.9%)	6 (2.2%)	5 (2.5%)
8	5 (1.8%)	6 (2.2%)	4 (1.5%)	8 (4.0%)
9	3 (1.1%)	8 (3.0%)	3 (1.1%)	10 (5.1%)
10 - 90	30 (10.9%)	52 (19.3%)	46 (17.2%)	36 (18.0%)
Total	273	269	267	199
(Percent)	(100%)	(100%)	(100%)	(100%)

Table 10

REASONS FOR SICK DAYS THAT DIFFERED SIGNIFICANTLY AMONG SHIFTS AND NUMBER OF FOOD PROCESSORS LISTING EACH REASON

	Day	Aft/Eve	Night	Rotating
Psychophysiological musculoskeletal disorders	1	0	0	15
Ear diseases	0	0	1	4
Colds	1	2	0	8
Sinusitis	0	0	0	3
Pharyngitis	0	1	0	10
Acute respiratory infections	1	2	2	22
Flu	2	3	3	48
Flu with digestive manifestations	0	0	0	4
Tooth problems	0	1	1	6
Stomach aches	0	0	1	30
Cardiovascular and lymphatic symptoms	1	0	0	13
Abdomen and lower G.I. tract symptoms	0	1	0	4
Sprains	2	8	3	18

Note: All reasons significant at the .05 level or better.

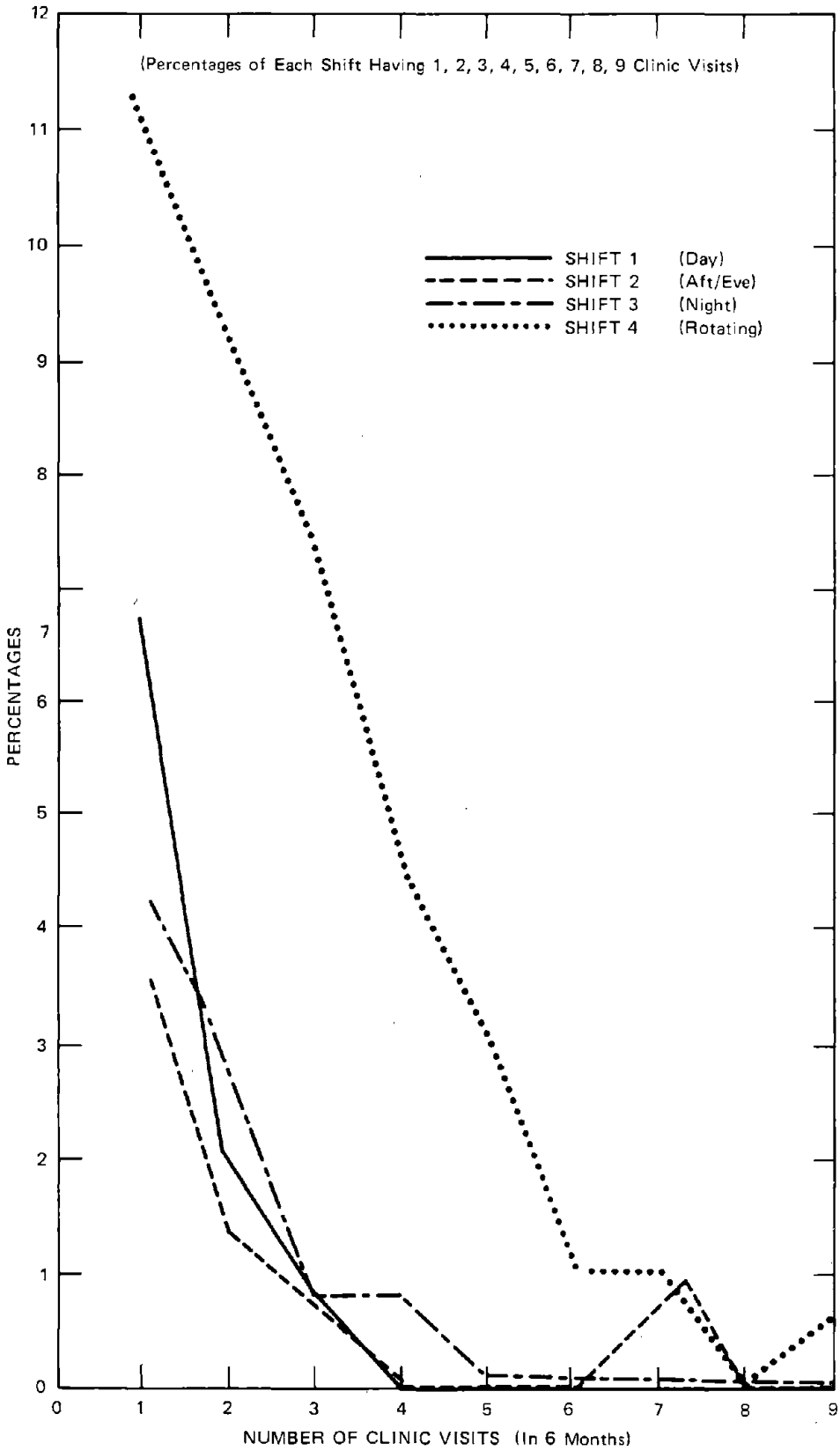

FIGURE 2 CLINIC VISITS — NURSES

Table 11

NURSE CLINIC VISITS
(By Shift)

Number of Visits	Day	Aft/Eve	Night	Rotating
0	133 (90.5%)	133 (93.7%)	135 (91.1%)	126 (62.0%)
1	10 (6.8%)	5 (3.5%)	6 (4.1%)	23 (11.3%)
2	3 (2.0%)	2 (1.4%)	5 (3.4%)	19 (9.4%)
3	1 (0.7%)	1 (0.7%)	1 (0.7%)	15 (7.4%)
4	0 -	0 -	1 (0.7%)	9 (4.4%)
5	0 -	0 -	0 -	6 (3.0%)
6	0 -	0 -	0 -	2 (1.0%)
7	0 -	1 (0.7%)	0 -	2 (1.0%)
8	0 -	0 -	0 -	0 -
9	0 -	0 -	0 -	1 (0.5%)
Total	147	142	148	203
(Percent)	(100%)	(100%)	(100%)	(100%)

Table 12

REASONS FOR CLINIC VISITS
THAT DIFFERED SIGNIFICANTLY AMONG SHIFTS AND
NUMBERS OF NURSES LISTING EACH REASON

	Day	Aft/Eve	Night	Rotating
Headaches	0	1	2	8
Common cold	0	0	2	9
Otitis external (inflamed ear)	1	0	0	5
Pharyngitis (sore throat)	3	1	2	27
Acute respiratory infection	0	1	1	7
Influenza	0	1	0	13
Influenza with digestive manifestations	0	0	1	5
Gastritis	0	0	1	8
Menstrual disorders	0	0	2	7
Eczema and dermatitis	0	0	0	3
Nervous symptoms	0	0	0	3
Upper GI tract symptoms	2	1	4	12
Abdomen and lower GI tract symptoms	2	0	1	10
Other general symptoms	0	0	0	5
Sprains and strains	2	2	1	9
Contusion and crushing of body parts	0	0	0	3

Note: All reasons significant at the .05 level or better.

Food Processors--
Clinics were not available for most of the rotating shift food processors. Some differences that approached statistical significance suggested a tendency for rotators and night shift workers to visit the clinic less often than day and afternoon shift workers. Contrasted with the nurses' data, these trends appeared to be the combined result of clinic inavailability at many of the sites where the rotators work as well as the fact that clinic personnel are frequently not present during the night shift.

Accidents

Nurses--
Table 13 shows the total number and relative percent of nurses in each shift who incurred up to four accidents over a six-month period of time. Figure 3 displays this distribution graphically. Table 14 lists the two reasons for accidents that differed significantly over the four shift categories.

Table 13

NURSE ACCIDENTS
(By Shift)

Number of Accidents	Day	Aft/Eve	Night	Rotating
0	277 (87.9%)	272 (88.9%)	251 (86.8%)	251 (81.2%)
1	34 (10.8%)	29 (9.5%)	36 (12.5%)	48 (15.6%)
2	3 (1.0%)	4 (1.3%)	2 (0.7%)	8 (2.6%)
3	1 (0.3%)	1 (0.3%)	0 --	2 (0.6%)
Total	315	306	289	309
(Percent)	(100%)	(100%)	(100%)	(100%)

The correlation between age and number of accidents was negligible ($r = -0.05$). One-way analysis of variance demonstrated that the four shifts differed significantly in the number of accidents reported for each, $F(3, 1215) = 3.59$, $p < 0.05$. Duncan's test set at the 0.05 level of significance showed that

	Nurses			
	Day	Aft/Eve	Night	Rotating
Mean Accidents	0.13	0.13	0.14	0.23

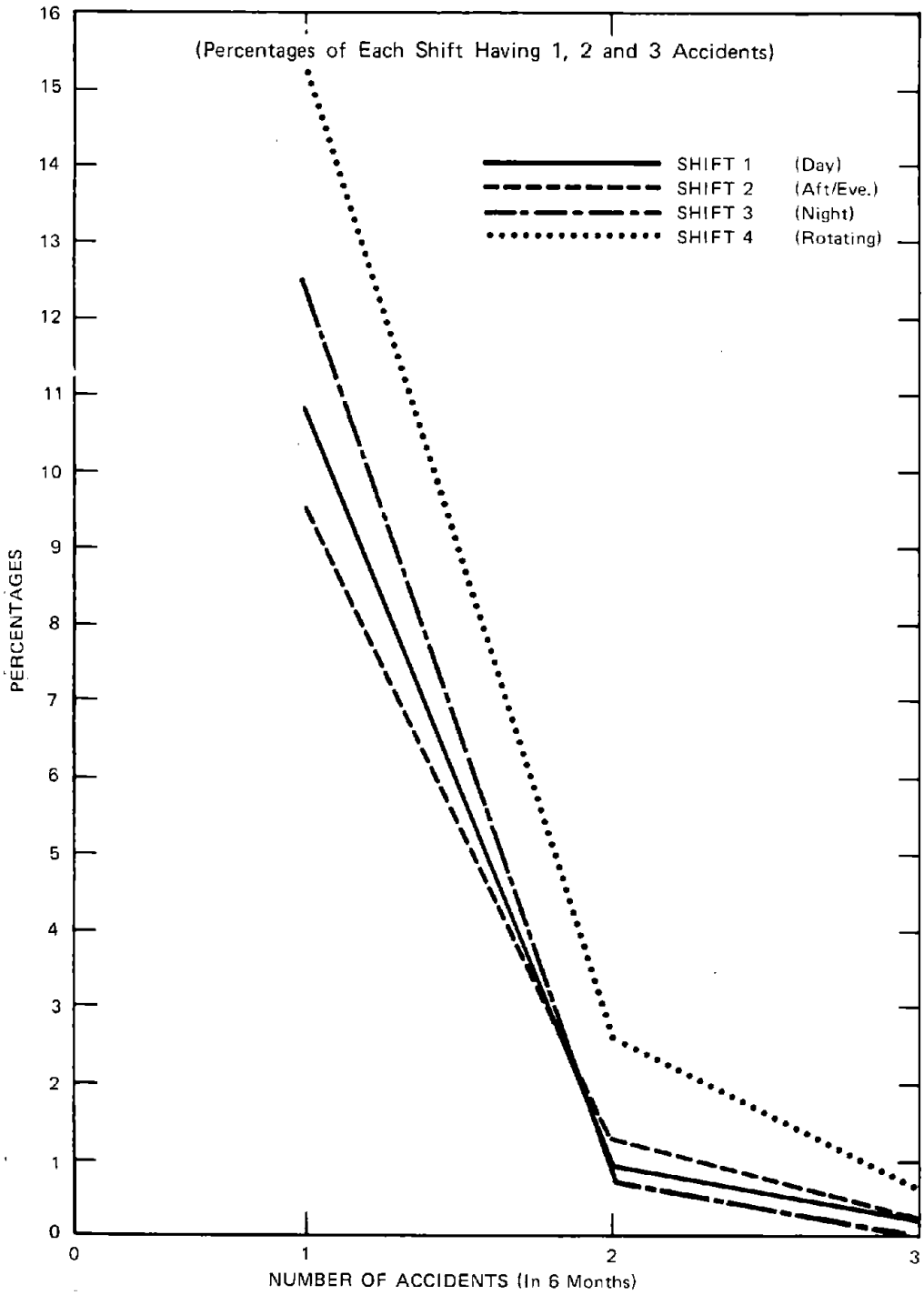

FIGURE 3 ACCIDENTS — NURSES

Table 14

REASONS FOR ACCIDENTS THAT DIFFERED SIGNIFICANTLY AMONG SHIFTS AND NUMBER OF NURSES LISTING EACH REASON

	Day	Aft/Eve	Night	Rotating
Finger injury	15	14	20	35
Superficial leg, hip, or foot injuries	0	0	5	2

NOTE: Reasons in Table 14 significant at the 0.05 level or better.

rotating shift workers suffered significantly more accidents than fixed shift workers. There was no significant difference in accident levels among the three fixed shifts.

Reasons for nurses' accidents varied considerably. Some of the causes not listed on Table 14 included sprains and strains, contusions and crushings, adverse reactions to medication, poisoning, falls, blows from objects, and cuts or punctures from instruments. As Table 14 shows, the accident most prevalent among rotating shift nurses was finger injuries. The number of contusions and crushings among rotators, compared with fixed shift workers, also approached statistical significance. More superficial leg, hip, and foot injuries were incurred by night shift nurses than by other shift workers.

Food Processors--
The pattern of accident occurrence for this population appears to closely parallel that for the sample of nurses. Table 15 shows the number of workers and relative percent in each shift who suffered up to seven accidents over a six-month period of time. Figure 4 displays this distribution graphically. Reasons for accidents that differed significantly among shifts are shown in Table 16. The correlation between age and number of accidents was again negligible ($r = -0.06$). One-way analysis of variance demonstrated that the four shifts differed significantly in the number of accidents reported for each, $F(3, 1005) = 18.93$, $p < 0.001$. Scheffe's test set at the 0.01 level for significance showed that rotating shift workers had significantly more accidents than fixed shift workers. There was no significant difference in accident rate among the three fixed shifts.

Food Processors

	Day	Aft/Eve	Night	Rotating
Mean Accidents	0.23	0.31	0.19	0.67

As with the number of accidents, the reasons for them varied somewhat by shift. Rotators reported significantly more sprains, strains, and superficial foot

Table 15

FOOD PROCESSOR ACCIDENTS
(By Shift)

Number of Accidents	Day	Aft/Eve	Night	Rotating
0	220 (80.6%)	211 (78.4%)	223 (83.5%)	122 (61.0%)
1	48 (17.5%)	37 (13.8%)	39 (14.6%)	51 (25.5%)
2	3 (1.1%)	16 (5.9%)	3 (1.1%)	15 (7.5%)
3	1 (0.4%)	5 (1.9%)	1 (0.4%)	5 (2.5%)
4	0 --	0 --	1 (0.4%)	2 (1.0%)
5	1 (0.4%)	0 --	0 --	2 (1.0%)
6	0 --	0 --	0 --	2 (1.0%)
7	0 --	0 --	0 --	1 (0.5%)
Total	273	269	267	200
(Percent)	(100%)	(100%)	(100%)	(100%)

and toe injuries than did fixed shift workers. Afternoon shift workers had significantly more accidents in the miscellaneous category.

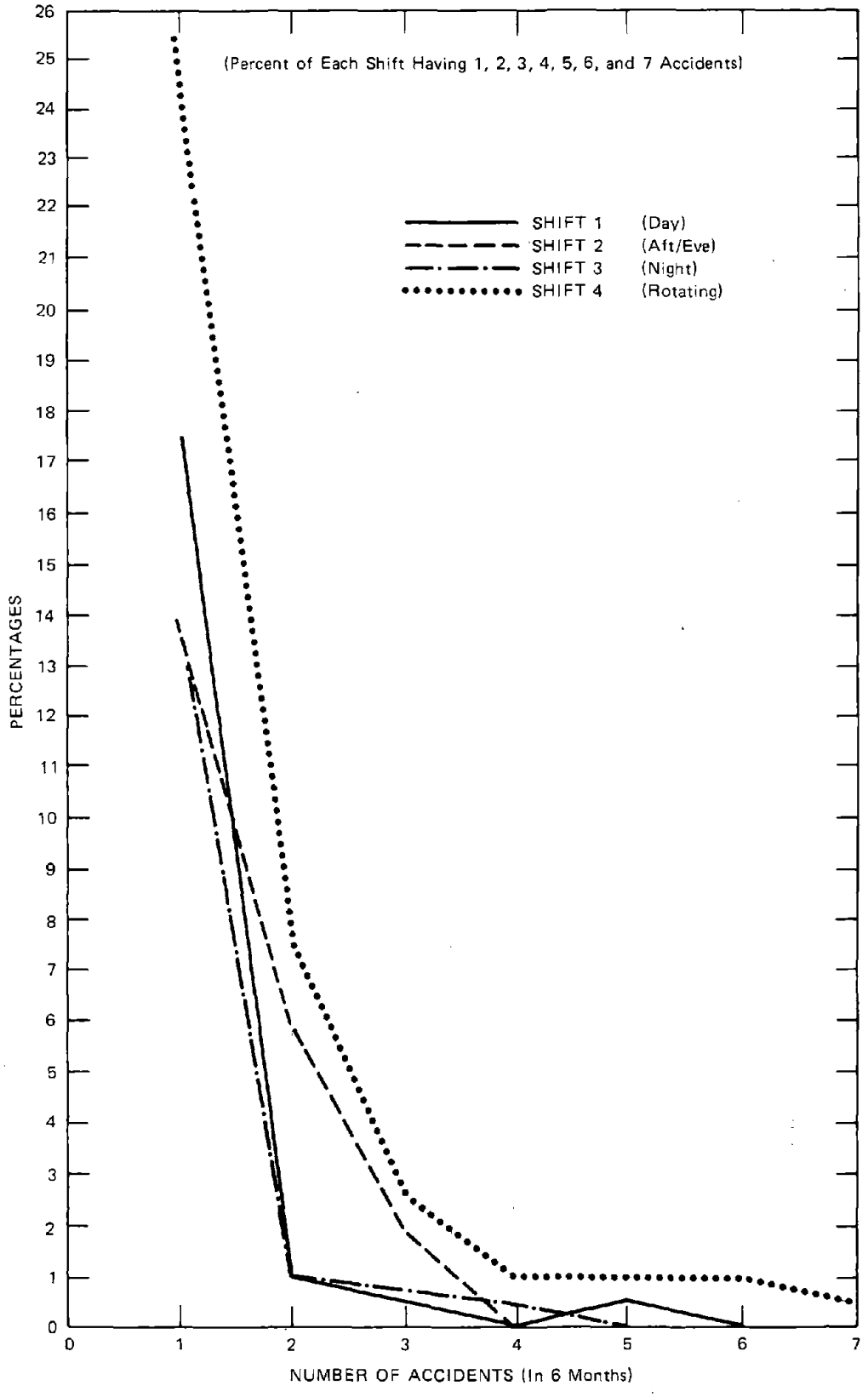

FIGURE 4 ACCIDENTS — FOOD PROCESSORS

Table 16

REASONS FOR ACCIDENTS THAT DIFFERED SIGNIFICANTLY AMONG SHIFTS AND NUMBER OF FOOD PROCESSORS LISTING EACH REASON

	Day	Aft/Eve	Night	Rotating
Sprains and Strains	19	21	12	30
Miscellaneous accidents	18	27	9	10
Superficial foot, toe injury	4	6	2	11

NOTE: All reasons significant at the 0.05 level or better.

QUESTIONNAIRE COMPONENT

Although the incidence of sick leave, clinic visits, and accidents may be used as gross measures of worker well-being, a thorough understanding of the potential impact of shift work on individual personal, social, and domestic adjustment requires a more direct approach. Many of the problems previously associated with shift work (such as sleeping and eating disturbances, somatic complaints, psychological distress, and marital disharmony) cannot be evaluated by an examination of employee health and accident records.

In tandem with the record search, therefore, a second phase of the present study involved a questionnaire survey of nurses and food processors randomly selected, and stratified by shift according to the sampling design previously described for the health and safety record examination.

The questionnaire (presented in Appendix A) was specifically designed to assess the physical health, psychological adjustment, and social adaptation factors most relevant for shift workers. In addition, it measures certain socio-demographic, work history, job satisfaction and job performance factors.

QUESTIONNAIRE ADMINISTRATION PROCEDURE

We initiated arrangements to administer questionnaires in the 18 different hospitals and food processing plants involved in this part of the study by first contacting a personnel officer--usually the Director of Personnel--at each site. We then sent this individual a copy of the questionnaire package that was to be distributed to participants, thus giving him/her an opportunity to learn more about the study and to become familiar with our confidentiality and privacy safeguards.

Next, each site provided us with a list of employees' names and home addresses, categorized by shift. Using a table of random numbers, we compiled a sample from this list.

Each prospective participant selected in this way was then mailed a packet containing: a cover letter briefly describing the project; a large envelope addressed to SRI, which was used by the respondent to return the completed questionnaire to us; and the questionnaire itself, each one of which had a small envelope stapled inside the front cover on which the name and address of the respondent was written. This envelope was used to mail the $5.00 payment to each participant after the completed questionnaire was received.

As completed questionnaires were received, the site and shift category of the respondent--but not his/her name--was coded onto the first page of the questionnaire. The small envelope was then detached, a check was enclosed, and it was mailed. Once this was done, there was no further way to match a respondent with a specific questionnaire.

A few questionnaires were received without the small envelope. These had to be discarded, since there was no other way to identify respondents and thus properly code their sites and shifts. In a few other cases, the shift assignment designated by the respondent's personnel officer failed to correspond with that indicated by the respondent. In these cases, we used the latter's designation.

SUBJECT DEMOGRAPHY

The population of nurses and food processors selected for questionnaire administration was very similar to that forming the sample for the records review component of the project. The total of 1,941 respondents included 1,049 nurses, 885 food processors, and 7 individuals who could not be appropriately classified. (The category of unclassified respondents was not included in the analyses of each separate sample of food processors or nurses, but was included in the merged sample for the other four phases of questionnaire data analysis.) Participants came from 10 hospitals and 8 food processing plants throughout the United States.

Of the 1,049 nurses, 184 worked day shifts, 213 worked afternoon shifts, 198 worked night shifts, and 454 rotated shifts (Table 17). Of the 10 hospital sites participating in the questionnaire study; 2 depended almost exclusively on rotating shift workers. Of the remaining 8, 3 depended almost entirely on fixed shift workers. The other 5 made use of all 4 shift categories, but at each site, the nurses worked either predominantly on fixed shifts or predominantly on rotating shifts, as Table 17 shows. Nine of the 10 sites participating in the questionnaire survey had been involved in the health/accident record phase of this study.

Of the 885 food processors, 238 worked day shifts, 181 worked afternoon shifts, 181 worked night shifts, and 285 worked rotating shifts (Table 18). Of the 8 sites of food processor questionnaire administration; 2 depended primarily on rotating shifts, 1 depended almost exclusively on fixed shifts, and the remaining 5 used both, as Table 18 shows. The target sites included all plants which had participated in the record phase of the study and one additional plant (Number 23, Table 18).

Age

Day shift food processors were older than those in all other shifts. Afternoon shift workers in this sample were significantly younger than workers on all other shifts.

Of the nurses, those on the fixed shifts were older than the rotators. The day shift was also significantly older than the afternoon shift.

The trend in both samples is for day shift workers to be oldest, probably because they tend to have the most seniority.

Children

Night shift nurses tended to have the most young children (under 13 years old) at home. Day shift nurses reported the next highest response to this question,

Table 17

QUESTIONNAIRE SITES: NURSES

Site	Turnover Rate	Respondents				Site Total	Clinic	Annual Sick Leave (Days)
		Day	Aft/Eve	Night	Rotating			
01	165%	22	21	19	0	459	Yes	12
04	NA	38	31	28	174	187	Yes	NA
05	16%	0	3	4	57	450	Yes	12
07	NA	11	13	11	2	357	No	10 (for first 2 years)
08	NA	18	32	43	22	448	Yes	12
09	NA	36	38	38	0	292	No	NA
10	NA	17	22	18	26	554	No	12
11	50-55%	1	1	0	90	710	No	12
20*	92%	15	36	27	58	338	No	12
21/6	24.8%	26	16	10	25	798	Yes	12

*No record search made

Table 18

QUESTIONNAIRE SITES: FOOD PROCESSORS

Site	Turnover Rate	Respondents				Site Total	Clinic	Annual Sick Leave
		Day	Aft/Eve	Night	Rotating			
13	5 in last yr	4	0	0	142	553	No	No sick days--disability program
14	NA	63	42	43	59	725	Yes	No sick days
15	10/mo	69	51	46	24	666	Yes	No sick days--compensatory program
16	20%	9	3	5	3	1100	Yes	1 wk/each yr worked
17	NA	62	68	74	2	455	Yes	No sick days
19	NA	7	0	1	16	484	Yes	40 h/yr
22	18%	17	13	4	17	980	Yes	1 wk/each yr worked
23*	20%	7	4	8	22	1100	Yes	1 wk/each yr worked

*No record search made

followed by afternoon shift workers, and, finally, rotators, who had the lowest response on this variable. No significant differences in the number of young children at home were expressed for food processors.

Income

Personal income levels differed across the shifts in each sample. Both day shift and rotating shift food processors reported significantly more personal income than afternoon and night shift workers, possibly reflecting the effects of seniority. Day shift nurses earned significantly more than all other shifts. Also, total family income for day shift nurses was significantly greater than for all other shifts.

Sex

The sex distribution in the samples varied considerably. In the nurse sample, approximately 3% were male and 97% female. In the food processor sample, approximately 37% were female and 63% male.

Nurses

	Day	Aft/Eve	Night	Rotating	All
Male	3 (1.6%)	11 (5.3%)	2 (1%)	14 (3.1%)	(2.9%)
Female	179 (98.4%)	198 (94.7%)	197 (99%)	437 (96.9%)	(97.1%)

Food Processors

	Day	Aft/Eve	Night	Rotating	All
Male	143 (60.3%)	95 (52.5%)	86 (47.8%)	234 (82.4%)	(63.3%)
Female	94 (39.7%)	86 (47.5%)	94 (52.2%)	50 (17.6%)	(36.7%)

Race

As the tables below indicate, Whites constituted the majority of both nurse and food processor samples: approximately 88% and 86%, respectively. Hispanics, Blacks, Asians, and American Indians were also represented in the sample in the proportions shown below. The second largest ethnic group of nurses was Asians (6.4%); Hispanics were the second largest ethnic group of food processors (5.6%).

Nurses

Percentage by Ethnic Group	Day	Aft/Eve	Night	Rotating	All
American Indian	0.6	1.0	0.5	1.4	1.0
Asian	3.4	9.4	7.2	5.9	6.4
Black	1.1	4.4	5.2	2.0	2.9
Hispanic	1.7	1.5	2.1	0.9	1.4
White	93.3	83.7	85.1	89.8	88.3

Food Processors

Percentage by Ethnic Group	Day	Aft/Eve	Night	Rotating	All
American Indian	3.1	1.1	1.7	3.3	2.5
Asian	2.7	2.3	2.9	3.3	2.8
Black	1.3	2.9	4.6	4.4	3.3
Hispanic	1.8	6.3	2.9	9.8	5.6
White	90.6	87.4	87.3	79.3	85.6

Job Tenure and Preference

At the time of questionnaire administration, day shift food processors had been working for their current employers significantly longer than had those on all other shifts. Rotating shift food processors had the next longest job tenure, significantly longer than afternoon or night shift workers. However, rotators had been on rotating shifts longer than other food processors had been on their shifts. Day shift workers had been on their shift next longest, followed by afternoon shift workers, and, finally, night shift workers.

Much the opposite was true of nurses: rotators had been on their shifts a significantly shorter time than those on all other shifts.

A significantly higher number of afternoon and night shift food processors had worked other shifts in the past five years than had rotators or day shift workers.

In both samples, when participants were asked what shift they would most like to be assigned to, a striking finding emerged: they universally tended to pick their current shift. Day shift workers reported greatest preference for the day shift, rotators for the rotating shift, and so on.

DATA ANALYSIS

Once all questionnaire responses had been tabulated, keypunched, and verified, they were analyzed with SPSS programs on a CDC 6400 computer. Because there were 1,941 questionnaires, each with some 600 bits of information, it became imperative to develop criteria for distinguishing between clinical and statistical significance: the large number of subjects meant that small mean differences

tended to yield significant alpha levels. A search was therefore instituted for ways to combine items in such a way as to derive logical as well as empirical subscales. The procedure that was eventually adopted interprets the data in five successive phases, each constituting a slight refinement of the preceding.

Phase I

It was decided to first broadly examine responses to almost every specific item in the questionnaire separately for each sample population of nurses and food processors. Only three sections were distilled into more manageable classifications:

- The Profile of Mood States (Appendix A, p. 96) was collapsed into its six subscales.
- The Eysenck Personality Inventory (Appendix A, p. 108) was also reduced to five subscales.
- The numerous subitems included under the first six questions of the Life Style section of the questionnaire (Appendix A, pp. 102-103) were refined into composite responses to each question.

Simple one-way analyses of variance, with the four shift categories constituting the independent variable, were then run on each questionnaire item for each sample. Those that yielded statistically significant analyses of variance were then refined by post hoc analyses (Duncan's New Multiple Range Test) set at the 0.05 level. The first analysis told us <u>if</u> there was a significant difference across shifts for a specific variable, and the second told us more exactly <u>what</u> the difference was, e.g., which shift(s) felt sleepier at work than which other shift(s). Any variable that did not show significant variations in a Phase I analysis of variance was excluded from further consideration in the examination of questionnaire response data.

Appendix A contains a sample copy of the questionnaire. The tables in Appendix B present means, standard deviations, and significance levels for those variables that differed significantly across shifts.

Separate analyses of incidence (i.e., the simple percentage of individuals in a shift who reported some occurrence of the item) and of severity (i.e., among those reporting the problem, the magnitude of the complaint) were also run for Phase I. In most cases, the findings simply confirmed those produced by analyses of variance and post hoc analyses. Where incidence and severity analyses provided refinement or entirely new information on significant differences, it is reported in the text.

To facilitate a readable narrative presentation of results, some minor departures from the sequences and system of categorization of variables as they appear in the questionnaire were introduced. For example, some of the responses to questions on Job Information seemed to fit more logically into a discursive section on Life Style. Questions on alcohol consumption and use of aids to digestion and other medications appear in a new section entitled Substance Usage.

In a very few cases, e.g., on shift worker commute modes, results may have been significant across shifts, but the item itself was judged to offer no real contribution to the study and so is not discussed.

Finally, although it frequently happened that responses on a specific variable that were significant for one sample were also significant for the other, there were instances when significance was found in the responses of only one of the two sample groups. In these cases, when results are discussed for one population only, the reader may assume that analyses revealed no significant differences across the shift categories of the other population for that variable.

Phase II

The extensive analyses of Phase I highlighted about 37 variables or combination of variables (see Table 19) that seemed to show particularly strong differences across shifts. The issue of shift worker adaptation to shift systems prompted us to consider whether long-term, experienced shift workers would respond differently on these variables than recently hired shift workers. Consequently, all respondent data were reanalyzed for Phase II by first merging food processors and nurses into one pool, then dividing this aggregate group into:

- Those having worked for more than one year on their current shifts.
- Those having worked for less than six months on their current shifts.
- Those with six months to one year of current shift tenure.

The last group was dropped from further analysis. Because analyses of variance ($p < 0.001$) revealed considerable differences among the four shift categories on age, sex, and marital status--all of which may be related to health--these variables were used as covariates in Phase II analyses. Marital status was again simply divided into married/unmarried.

Analyses of covariance were then run across the four shift categories for new (less than six months of shift tenure) and long-term (more than one year of shift tenure) workers. This created eight groups:

Shift (Nurses and Food Processors)

	Day	Aft/Eve	Night	Rotating
New	1	2	3	4
Long-term	5	6	7	8

For significant analyses of covariance, post hoc analyses (0.05 level) were run.

Phase III

The purpose of this analysis was to determine the extent to which previous shift work experience may have affected the responses of those workers currently included in the fixed day shift sample of the present study. Thus, we

Table 19

SELECTED VARIABLES FOR
PHASE II AND III ANALYSES

Questionnaire Identification No.	Variable
HI-1	General health
HI-2B	Number of days hospitalized during the past six months
HI-4	Total medication usage (summation of all subcategories)
HI-5	Total physical complaints during past year
HI-7	Total number of illnesses during past five years (summation of all 21 subcategories)
HI-10C	Number of hours women must lie down each month during menstrual periods
HI-11B HI-12B	Total number of work days missed due to accidents
HI-13* HI-14	Total amount of 200-proof ethyl alcohol consumed per week
HI-15	Increased/decreased amount of drinking lately
HI-16	Use of alcohol to facilitate sleep
HI-17A	Number of cigarettes smoked per day
MS-20	Six subscales scores from the POMS (Profile of Mood States): Tension-Anxiety, Depression-Dejection, Anger-Hostility, Vigor-Activity, Fatigue-Inertia, Confusion-Bewilderment
SP-12	Desired versus actual sleep (SP-1 minus SP-2)
SP-8	Frequency of feeling tired at work
SP-10	Frequency of medication used to facilitate sleep

(Continued)

* The amount of beer, wine, and liquor consumed was converted to the amount of ethyl alcohol, figuring beer to be 5%, wine 12%, and liquor 40% (80 proof). For each individual these were totaled and multiplied by the number of days per week that an individual drinks. The resulting number is the amount of ethyl alcohol consumed in an average week.

Table 19 (Concluded)

Questionnaire Identification No.	Variable
SP-12	Quality of sleep pattern
LS-1	Social support from others (summation of all subcategories)
LS-2	Expression of feelings toward work with others (summation of all subcategories)
LS-3	Satisfaction with time for personal activities (summation of all subcategories)
LS-4	Satisfaction with the amount of time for social activities (summation of all subcategories)
LS-5	Satisfaction with the amount of time available to spend with spouse (summation of all subcategories)
LS-6	Satisfaction with the amount of time available to spend with children (summation of all subcategories)
LS-7A	Satisfaction with assignment of responsibility for the children
LS-8	Worker satisfaction with the work schedule
LS-9	Family satisfaction with the work schedule
LS-10	Job satisfaction
LS-11	Self-rating of job performance
LS-12	Attitude to co-workers
LS-13	Interference with sexual activities
EP-3	Appetite
EP-6	Satisfaction with eating pattern
GI-1	Extroversion
GI-2	Neuroticism
GI-4	Impulsivity
GI-5	Sociability

HI = Health Information
MS = Mood Scale
SP = Sleep Patterns
LS = Life Style
EP = Eating Patterns
GI = General Information

were interested not only in the question of long-term adaptation as considered in Phase II, but also in the possibility that day shift responses might be unduly influenced by the presence of workers who had transferred to a day shift because of problems they had developed as a result of working a previous shift schedule. To control for these potential "carry-over" effects, analyses of covariance using the same variables (see Table 19) and covariates (age, sex, and marital status) as described in Phase II, were performed on the following groups of respondents:

- Recent shift workers--Afternoon, night, and rotating shift workers who began their shift schedule within the last six months.
- Long-term shift workers--Afternoon, night, or rotating shift workers who had been working their present schedule for more than a year.
- Recent ex-shift workers--Workers currently on a fixed day shift, but who had been working other shifts within the last six months.
- Long-term ex-shift workers--Workers currently on a fixed day shift, but who had worked other shifts between one and five years previously.
- Non-shift workers--Fixed day shift workers who had never worked any other shift.

Phase III, therefore, consisted of an elaboration of the analyses performed in Phase II in order to allow a comparison of the day shift workers who had never worked any other shift schedule with those having recent or remote previous shift experience.

Phase IV

Although recombining shift workers into new, experienced, and ex-shift day workers in Phases II and III produced ample information on life style, eating-pattern, and sleep-pattern variables, almost nothing on physical health topics was disclosed. Therefore, we decided to run analyses of covariance on each physical complaint listed in the questionnaire under Health Information (question 5) as well as the physical illness histories (question 7) of the same section (see Appendix A, pp. 91-93). The samples were again combined, the same four shift categories were used, as well as the same covariates: age, sex and marital status. In the case of the complaint responses (HI 5), analyses were performed for severity as well as incidence. Post hoc analyses (0.05 level) were run for significant analyses of covariance.

Phase V

The last phase of analysis of questionnaire data was directed at identifying as carefully as possible those variables that seemed most closely related to employee adaptation to shift work. An adaptation index was devised (see Appendix C), and the following analyses were performed.

- Analysis of intercorrelations among items constituting the adaptation index.

- Analyses of covariance of the overall adaptation index for sex and marital status.*
- Analyses of covariance of overall adaptation for the four shift categories.*
- Analyses of covariance of each adaptation subindex for the four shift categories.*
- Development of a correlation matrix of the adaptation index by number of questionnaire item.
- Stepwise regression analysis on those variables in the correlation matrix with correlations of at least .25.

Phase I: Univariate Analysis of Questionnaire Variables for Both Sample Populations

Health--
Numerous differences in disease or physical disorders appeared among shifts in both samples. Nurses on rotating shifts, for example, experienced more leg cramps† than all other shifts and had significantly more difficulty with their feet and legs when standing for long periods of time than did those on afternoon shifts. They also had more trouble with colds, sore throats, fainting, and dizziness than did either day or night shift workers. Alarming chest pains or pressures were experienced by rotating shift nurses significantly more often than by afternoon or night shift workers.

However, rotators had significantly less high blood pressure than afternoon and night shift workers, and less history of high blood pressure in the immediate family than day or afternoon shift workers. They also had significantly less arthritis than did day or night shift workers and less of a history of diabetes in the immediate family than afternoon shift workers reported. (It should be noted that these differences for rotators disappeared when age was later used as a covariate.)

Of the food processor sample, rotators had significantly more acid indigestion, heartburn, and acid stomach than did any other shift. Afternoon shift workers in this sample reported a tight feeling in the stomach more often than day or night shift workers did. Subsequent incidence analysis showed that significantly more afternoon shift food processors than all other shifts felt some kind of stomach pain.

Significantly more day and rotating shift nurses experienced a bloated or full feeling than did afternoon or night shift nurses. More rotators and afternoon shift nurses suffered from gastritis than did day shift workers, as incidence analysis later revealed. There was also a significantly higher incidence in the rotating shift nurse group of trouble digesting food than appeared in the afternoon or day shift nurse respondents.

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*The covariates were age, sex, and marital status.

†Underscored phrases paraphrase the item that appeared in the questionnaire.

Food processors on night shifts and nurses on afternoon shifts were significantly less constipated than all other shifts.

Nausea or vomiting was reported more frequently by rotating shifts than by day shift nurses. Afternoon shift food processors experienced more nausea or vomiting than did rotating shift food processors.

Day shift food processors had slightly more thyroid disorders than rotating shift workers in their sample.

Day shift food processors also reported significantly more hospitalization during the preceding six months than did night or rotating shift workers in this sample.

Irregular menstrual periods were experienced significantly more often by rotating and night shift food processors than by day or afternoon shift workers. Day shift nurses experienced a significantly higher incidence of this irregularity than night shift and rotating shift nurses. All fixed shift nurses reported a significantly higher incidence of menstrual cramps than did rotating shift nurses. However, night shift and rotating shift nurses spent significantly more time lying down due to menstrual cramps than did afternoon shift nurses. Night shift nurses also spent more time lying down for this reason than did day shift nurses. However, rotating shift nurses suffered more tension, nervousness, weakness, and sickness at menstruation than did all other shifts, as well as significantly longer menstrual periods than all other shifts.

Just the opposite was found to be true of the food processor sample, as incidence analysis disclosed: more fixed shift female workers felt tense and nervous at menstruation than rotators. Incidence analysis of the food processor sample also showed that a higher percentage of day and night shift workers than rotators no longer menstruated. Of those who did, significantly more afternoon and night shift workers felt the same during menstruation as at any other time.

Incidence analyses also disclosed a number of additional somatic complaints that had not been revealed by previous Phase I analyses. For example, significantly more afternoon shift food processors reported experiencing rapid heart arrythmia and fainting spells or dizziness than any other shift. Also, more afternoon shift food processors indicated feeling nervous or shaky than did day or rotating shift workers. Both afternoon and rotating shift food processors reported a higher incidence of ringing or buzzing in their ears than did day shift workers in this sample. More rotators experienced wheezing in the chest than did night shift food processors.

In the nurse sample, however, a significantly higher incidence of nervousness and shaky feelings were found among rotators than in afternoon or night shift workers. Night shift nurses also indicated feeling drier mouths than afternoon or day shift workers did, as severity analysis showed. Day shift nurses, on the other hand, felt sweatier or trembled more than any other shift. A greater incidence of day and rotating shift nurses felt periods of fatigue and exhaustion than did afternoon shift nurses.

Substance Usage--
Participants were asked to indicate approximately how often during the preceding month they had used such medications as aspirin; antacids and other aids to digestion; laxatives; cough, cold, or sinus medicines; stimulants and other pep medications; depressants, or other medicines to slow them down; and any other prescription medication.

Of the food processor sample, rotators reported significantly greater use of aids for stomach or digestive problems than did day or afternoon shift workers. Incidence analysis confirmed this finding and also showed that significantly fewer night shift workers as well used such aids, in comparison with rotators.

Night shift workers in the food processor sample used significantly more stimulants than did day or afternoon shift workers. Incidence analysis again confirmed this finding, as well as showing that significantly fewer rotators than night shift workers used stimulants. Also, significantly more rotating than afternoon shift nurses were found to be using stimulants.

Afternoon and night shift food processors reported using more aspirin than day shift workers.

Participants were also asked several questions about their use of alcohol, including how often they drank, whether they drank on work days, and if so whether they drank before or after work, how much they drank, and whether they drank to help get to sleep.

The only difference found in the total sample of food processors was in the amount of beer consumed: afternoon and night shift workers drank significantly more beer than rotators. (However, as noted later, rotators also reported the highest usage of medication to aid sleep; it may be that other substances are more effective soporifics than alcohol in adjustment to sleep inversion.)

The pattern was different for nurses. Rotating and afternoon shift nurses drank significantly more beer than day shift nurses. Rotators also drank more liquor of all kinds than did night shift nurses, who understandably reported drinking before work more often than any other shift, but who also reported drinking fewer days per week than all other shifts. Both day and rotating shift nurses indicated greater likelihood of drinking on work days than afternoon or night shift workers.

Incidence analysis subsequently showed that fewest day shift food processors drank before work, followed by afternoon and rotating shift workers combined, and finally night shift workers.

Subsequent analysis of severity indicated that rotators and day shift food processors drank more, if not more often, than night shift workers.

Mood Scales--
Two instruments were used to measure worker psychological states; the Profile of Mood States (POMS) and the Eysenck Personality Inventory (EPI).*

*POMS and EPI, Educational and Industrial Testing Service, San Diego, CA.

The POMS is a 65-item, 5-point adjective checklist with 6 scales, derived through factor analysis: Tension-Anxiety, Depression-Dejection, Anger-Hostility, Vigor-Activity, Fatigue-Inertia, and Confusion-Bewilderment. Internal consistency reliabilities for the 6 factors range from 0.84 to 0.95 and test-retest reliabilities from 0.65 to 0.74. Several validity studies have shown that the POMS is sensitive in the appropriate directions to the effects of therapeutic intervention as well as to the experimental manipulation of emotion-inducing conditions. Concurrent validity studies indicate that the subscales have very respectable correlations with Hopkins Symptom Distress Scales and acceptable correlation with a variety of other established scales.

For computer purposes, the 4-point scale on each item of the POMS was converted from a range of 0 through 4, as appears on the questionnaire, to a range of 1 through 5, by simply adding a constant of 1 to each sample item response. The addition of a constant to all numbers in a series leaves the variances and standard deviations unaffected. However, the average and total subscale scores are raised by this procedure and these increases are reflected in the mean subscale presented in this report.

EPI Form B consists of 57 items and measures dimensions for extroversion, introversion, and neuroticism. In addition, other scales have been developed to measure impulsivity and sociability. Test-retest reliabilities range from 0.84 to 0.94 for internal consistencies of estimates ranging from 0.85 to 0.95.

On the first of the POMS scales, Tension-Anxiety, rotating shift nurses reported significantly higher scores than did either night or afternoon shift workers.

Food processors working afternoon shifts indicated feeling significantly more Depression-Dejection than day or rotating shift workers. For nurses, however, the shift reporting the highest scores on this scale was the rotating shift, which indicated more depression than day or night shift workers.

On the Anger-Hostility scale, afternoon shift food processors indicated feeling these emotions significantly more than did day shift workers.

Rotating shift nurses reported significantly less Vigor and more Fatigue than all other shifts. Day and night shift nurses indicated feeling significantly more fatigue than afternoon shift workers.

Of the food processor population, afternoon shift workers felt significantly more Confusion-Bewilderment than did day shift workers. Of the nurses, rotators felt more confused than all other shifts.

On the EPI, significant differences were found for neuroticism and sociability subscales for the nurse sample. Rotating shift nurses were significantly more neurotic than workers from any other shift. Day shift nurses were found to be significantly less sociable than afternoon or night shift nurses.

Sleep Pattern--
Night shift workers in both groups reported the least overall satisfaction with the general adequacy of their sleep patterns. Rotating shift workers also

indicated significantly greater dissatisfaction with sleep adequacy than day or afternoon shift workers, both of whom have conventional sleep periods available to them.

When food processors were queried as to the amount of sleep obtained and the amount desired, an interesting finding emerged: afternoon shift workers reported both desiring and obtaining significantly more sleep than all other shifts. It would seem that those working the one shift with the opportunity to get more sleep than all other shifts not only do indeed sleep more than others do, but also want more sleep.

Afternoon shift nurses also reported obtaining significantly more sleep than all other shifts. There was no significant difference in the nurse sample on the amount of sleep desired by the four shift categories. Night shift nurses reported obtaining the least amount of sleep every 24 hours.

Day shift food processors reported significantly less difficulty falling asleep at bedtime than all other shifts. It also took significantly longer for rotators in the food processor sample to fall asleep than it did for night shift workers.

Day shift nurses took the shortest time to fall asleep, afternoon shift nurses the longest.

Both rotating and night shift food processors experienced more awakenings after sleep onset and more trouble falling asleep again if they woke up during the sleep period.

In the nurse sample, night and rotating shift workers, in that order, also reported significantly more trouble falling asleep again once they had awakened, and the reported pattern of number of awakenings after sleep onset paralleled that indicated by food processors: night shift nurses experienced the greatest number of reawakenings of all shift categories. Also, rotators reported significantly more awakenings than did afternoon shift nurses.

Day shift food processors reported the least significant incidence of waking up tired or sleepy. For the nurse sample, night shift and rotating shift nurses experienced waking up tired or sleepy significantly more than did afternoon or day shift workers.

Rotating shift food processors used medication to aid sleep significantly more than all other shifts. No significant differences on this item were found for the sample of nurses.

Night shift nurses were more able to rest or relax at work than all other shifts. Along with rotating shift nurses, they reported feeling significantly greater tiredness at work than did afternoon or day shift workers. Afternoon shift nurses indicated feeling the least tired of all shift categories.

For food processors, the night shift reported more feelings of tiredness at work than all other shifts.

Night shift workers in both samples reported feeling significantly more tired and sleepy after work than those on all other shifts. Of the nurse sample, afternoon shift workers felt the least tired or sleepy after work.

Eating Patterns--
In both samples, day shift workers reported having significantly better appetites than all other shift workers. Although day shift food processors expressed significantly more overall satisfaction with eating habits than all other food processor shifts, it was the afternoon shift in the nurse sample that indicated the most satisfaction on this question.

Night shift nurses reported fewer meals needed in 24 hours than all other shifts. Day shift nurses reported needing the most. Rotating shift nurses indicated significantly more snacking than day shift nurses.

The number of meals eaten with family or friends differed significantly across shifts in the nurse sample. Day shift nurses indicated the highest number, afternoon and rotating shift workers the least.

Life Style--
For both food processor and nurse samples, rotating shift workers reported significantly less satisfaction with their overall work schedule than any other shift. Day shift workers in both samples were the most satisfied.

The same pattern was found in levels of satisfaction expressed by workers' families about shift schedules: rotators' families were least satisfied, night and afternoon shift workers' families were more satisfied, and day shift families were most satisfied.

Both afternoon shift and rotating shift nurses indicated lower levels of satisfaction with their performance at work than did day shift nurses.

Not surprisingly, day shift nurses and food processors reported having more friends and neighbors with the same work hours than any other shift. Night shift workers had the least, and rotators the next fewest, in both samples.

When asked about their level of satisfaction with the time spent with their spouses, all other food processor shifts reported significantly less satisfaction on this item than day shift food processors. This was generally true of nurses also: rotators and night shift workers were more dissatisfied on this item than afternoon shift workers, who were in turn more dissatisfied than day shift workers.

Of the food processors, more full-time jobs were held by rotators' spouses than any other shift's. Night shift food processors reported having the lowest frequency of work schedules that matched their spouses'. The trend to dissimilar work hours, which moved from least dissimilarity for day workers to most for night shift workers, was paralleled by the trend of reported dissatisfaction by the shift worker's spouse. The spouses of day shift workers were most satisfied with shift workers' schedules, afternoon shift workers' spouses slightly less satisfied, night shift workers' spouses still less satisfied, and rotators' spouses least satisfied. The incidence of spouses'

complaints ran from a low on the part of day shift spouses to a high expressed by the spouses of rotating shift workers in this sample.

More or less the same trend held true for the nurse sample. Night shift workers were least likely to have work schedules matching those of their spouses. Night and rotating shift spouses were most dissatisfied; afternoon and day shift spouses most satisfied. Rotating shift nurses reported most complaints from spouses. Day shift nurses had the highest incidence of similar schedules as well as the fewest complaints and the least dissatisfaction expressed by their spouses.

Every shift of food processors differed significantly from every other shift in estimating the amount of interference of their work hours with their sexual activities. Night shift workers in this sample reported the most interference, followed in order by rotators, afternoon shift workers, and day shift workers.

The same pattern applies to nurses: night shift workers reported the most interference with sexual activities, followed in order by rotators, afternoon shift workers, and day shift workers.

All other food processor shift categories were more dissatisfied than were day shift workers with the amount of time they had to spend with their children. Afternoon and rotating shift food processors were the least satisfied. This was true of nurses also; rotators, though, were clearly the most dissatisfied group in this sample. When asked about childrearing and disciplining, night shift food processors indicated the most involvement with these responsibilities, and rotators the least. The afternoon shift of the nurse sample assumed least such responsibility, probably because these shift hours occupy the time of maximum contact in most families between children and parents. The food processor day shift was most satisfied with its role in disciplining children.

Responses to questions on recreational items showed that afternoon shift food processors were significantly less satisfied than all other shifts with the amount of time work schedules allowed for personal activities. Day shift food processors indicated the most satisfaction. All other shift categories were less satisfied than day shift workers with time available for sports and social activities: afternoon and rotating shift workers were the least satisfied.

The same pattern characterized the nurse sample: rotators and afternoon shift workers were the least satisfied with the time available for personal activities, sports, and social activities. Day shift nurses were the most satisfied on these variables.

Phase II: Analysis of Selected Variables for Merged Sample Adaptation

Few instances of significant differences implying adaptation or non-adaptation were found in the second phase of the data analysis, where the two sample populations were first merged into one pool, then separated into short-term and long-term workers.

In only four cases were the responses of experienced shift workers significantly different than those of their short-term counterparts:

- Recently employed day, night, and rotating shift workers expressed less overall satisfaction with their jobs than their experienced counterparts did.
- Short-term rotators were more confused than long-term rotators.
- Recent night shift workers felt more positive toward their co-workers than did long-term night shift workers.
- New female day shift workers needed more rest during menstrual periods than their experienced counterparts.

All other findings of any significance were found across the four shifts within the subcategories of either short- or long-term shift workers.

In terms of general satisfaction with overall work hours and schedules, recent night shift workers were less satisfied than recent day shift workers. Of the pool of experienced employees, those on afternoon shifts were also less satisfied than day shift workers.

Short-term night shift workers reported sleeping less adequately than recent rotators, who in turn reported less adequate sleep than recent afternoon shift workers. In the experienced group, night shift workers did not sleep as well as rotators.

Experienced rotators indicated using more sleep medications than experienced day or afternoon shift workers.

Experienced rotators also reported feeling less confused than long-term afternoon shift workers.

Newly employed afternoon shift workers were less tired than new rotators or night shift workers. Experienced rotators, however, seem to be the most readily fatigued group, indicating that they felt more fatigue than did experienced afternoon or night shift workers.

Recently employed day shift workers tended to be more satisfied with the time they had available for personal, social, and family activities than were recent afternoon or rotating shift workers. There was a similar pattern in the long-term pool, but the trend here indicated that night shift workers fell between day shift workers on the one hand and both afternoon and rotating shift workers, combined, on the other. Experienced night shift workers, it would seem, are able to adjust their personal and domestic lives to their schedules.

Responses to the question on interference with sexual activities turned up an interesting pattern. The recent pool's responses could be ranked, in increasing order of interference, as: day shift workers, followed by afternoon shift workers and rotators combined, followed by night shift workers ($1 > 2, 4 > 3$). In the experienced pool, the pattern was almost identical, with one revealing exception: rotators were now significantly less satisfied than afternoon shift workers, making the pattern: day shift workers, followed by afternoon shift workers, followed by rotating and night shift workers ($1 > 2 > 4, 3$). Rotators,

it would seem, suffer more infringement of their sex lives the longer they stay on shift work.

Of the experienced shift workers, the trend was, not surprisingly, for the families of rotating shift workers to feel the most dissatisfaction with the worker's schedule, for families of afternoon shift workers to feel slightly less dissatisfaction, and for day shift families to report the least dissatisfaction. The same trend applied to the pool of recent shift workers.

Newly hired female night shift workers reported needing more rest during menstrual periods than did recent rotating shift workers.

Short-term rotators consumed more alcohol than did recent afternoon shift workers.

Finally, long-term day shift workers had better appetites than all other experienced shift workers.

Table 20 presents means and other statistical information for Phase II.

Phase III: Analysis of Selected Variables for Day Shift Confounding of Merged Sample Adaptation

When the sample of short- and long-term shift workers was further refined so as to identify those workers who had never worked shifts or who had either recently or some time ago left shift work, the effect was to create these five subgroups of the pooled sample.

(1) Recent shift workers--those who began shift work within the last six months.

(2) Long-term shift workers--those who had been working shifts for more than one year.

(3) Recent ex-shift workers--those currently working day shifts, but who had been working other shifts within the last six months.

(4) Long-term ex-shift workers--those currently working days, but who had experience working other shifts between one and five years previously.

(5) Non-shift workers--those currently working days, and who had never worked any other shift.

Notice that the first two groups are those discussed in Phase II; in effect, Phase III simply adds a further degree of refinement to the responses of the day shift workers in the pooled sample.

The only variables that showed significant differences in this third phase of analysis were some of those for sleep patterns, eating patterns, and life style.

Sleep patterns--
Non-shift workers reported a significantly lower discrepancy between desired and obtained sleep than did long-term shift workers. Long-term shift workers

Table 20

MEANS AND STATISTICAL SIGNIFICANCE FOR RECENT VERSUS LONG-TERM WORKERS ON ALL SHIFTS
(Shift effects as a function of length of time on a given shift)[a]

		Shifts											
		Recent (less than 6 months on same shift)				Long-Term (over 1 year on same shift)							
Questionnaire Item		Day	Aft/Eve	Night	Rotating	Day	Aft/Eve	Night	Rotating	F	df	p Value	Duncan's (.05)
HI-10C	Hours/month females lie down during menstrual period	2.95	1.96	2.97	1.44	1.30	1.09	2.40	1.83	2.99	7&878	.01	3,1 > 5,6; 3 > 4
HI-15	Change in alcohol consumption[b]	2.89	3.06	2.95	2.77	2.89	2.94	2.99	2.92	2.18	7&1554	.05	2,7 > 4
MS-5	Fatigue (POMS)[c]	14.10	13.12	13.75	15.00	14.00	13.46	13.72	14.98	2.99	7&1703	.01	4,8 > 7,6,2
MS-6	Confusion (POMS)[c]	11.80	12.99	11.82	12.88	11.81	12.25	11.57	11.37	3.59	7&1702	.01	2,4 > 8; 2,6 > 7; 6 > 8
SP-12	Desired versus actual sleep	1.11	.32	1.31	1.01	.99	.71	1.49	1.27	14.69	7&1687	.001	7 > 8,1,4,5 > 6 > 2
SP-8	Tired at work[c]	3.74	3.38	4.03	3.75	3.54	3.40	4.07	3.86	7.98	7&1687	.001	7,3,8 > 5,6,2
SP-10	Frequency of medication use for sleep[c]	1.10	1.12	1.16	1.16	1.17	1.20	1.20	1.21	2.10	7&1706	.05	8 > 6,5
SP-12	Perceived adequacy of sleep pattern[e]	2.23	2.00	2.63	2.34	2.00	2.07	2.67	2.43	23.49	7&1688	.001	7,3 > 8,4 > 6,5,2
LS-2	Conversations with co-workers on feelings toward work[c]	2.78	2.68	2.82	2.73	2.90	2.81	2.71	2.89	3.82	7&1703	.001	5,8 > 4,7,2
Satisfaction in amount of time schedule permits:													
LS-3	Personal leisure activities[f]	2.42	2.91	2.63	2.73	2.30	2.66	2.53	2.71	5.55	7&1701	.001	2 > 7,1; 2 > 5
LS-4	Social activities[f]	2.72	3.58	3.10	3.42	2.43	3.36	2.99	3.44	17.14	7&1699	.001	2,8,4,6 > 7,1; 2,8,4,6 > 5; 7 > 5
LS-5	Marital-related activities[f]	2.54	3.23	3.25	3.29	2.18	2.77	3.07	3.13	14.02	7&1005	.001	4 > 6; 3,2,8,7,6 > 1,5; 4 > 5
LS-6	Children-related activities[f]	2.22	3.43	2.77	3.17	2.36	3.32	2.82	3.23	8.30	7&801	.001	2,6,8,4 > 5,1
LS-8	Satisfaction with work schedule[f]	2.40	2.77	3.00	3.18	2.05	2.56	2.68	3.37	22.71	7&1599	.001	8 > 2; 4 > 7; 3 > 6,1; 6 > 5
LS-9	Family satisfaction with work schedule[f]	2.48	3.08	3.64	3.40	2.14	2.91	3.20	3.62	26.13	7&1407	.001	3,8,4 > 6; 7,2 > 1; 6 > 5
LS-10	Job satisfaction[f]	2.41	2.16	2.19	2.16	1.98	1.95	1.84	1.97	2.60	7&1630	.01	1,3,4 > 5,8,6,7
LS-12	Feelings about fellow workers[f]	1.49	1.37	1.46	1.28	1.33	1.31	1.28	1.30	2.16	7&1621	.05	1,3 > 6,8,4,7
LS-13	Interference with sexual activities[f]	3.47	3.03	2.69	3.01	3.61	3.30	2.80	2.99	21.67	7&1553	.001	5 > 6; 1,6 > 2,4,8,7; 3,4,8 > 3; 5 > 3
EP-3	Appetite[g]	1.62	1.74	1.73	1.73	1.54	1.69	1.71	1.68	2.25	7&1696	.05	2,7,6,4,6,8 > 5
EP-6	Satisfaction with eating habits[f]	2.87	2.83	2.82	2.99	2.56	2.58	2.82	2.99	3.39	7&1696	.001	
GI-1	EPI Lie Scale	14.72	15.10	14.66	14.77	14.91	14.81	15.10	15.01	2.65	7&1705	.01	7 > 3

[a] Data corrected for age, sex, and marital status

[b] Lower numbers represent increase in consumption

[c] Higher values indicate greater amounts of item

[d] Lower values represent less discrepancy between sleep desired and sleep obtained

[e] Lower values indicate positive perception

[f] Lower values represent increased amounts of item

[g] Lower values represent better appetite

also reported feeling tired at work significantly more often than long-term ex-shift workers did.

The only other significant difference in sleep patterns was that found between all shift workers, both long- and short-term, and those day shift workers who had never worked other shifts or who had stopped working other shifts at least one year previously. The shift workers in this comparison rated their general sleep patterns as less adequate than did both non-shift and long-term ex-shift workers. Recent ex-shift workers responses on this variable fell between shift and the other non- or ex-shift groups, but were not significantly different from either. This would appear to confirm past findings on the disruptive effect of shift work on sleep patterns. The length of experience with shift work does not seem to encourage adaptation, at least not to such a degree that sleep quality is comparable to that reported by workers with no recent experience with shift work. However, the disruptive effect appears to be dispelled shortly after a shift worker returns to day shift work.

Life Style--
Significant differences emerged in Phase III analyses for a number of questions regarding a shift worker's interactions with family and friends. For example, we found that long-term shift workers of all three categories, i.e., shift, ex-shift, and non-shift, talked with others about their feelings toward work more than did recent shift workers. However, this is undoubtedly more a function of familiarity with co-workers than anything else.

Day shift workers were more satisfied with the time they had available for personal, social, and family activities than were either short- or long-term afternoon, night, and rotating shift workers.

All three categories of day shift workers reported significantly more satisfaction with their work hours than new or experienced shift workers on afternoon, night, and rotating shifts. Also, the families of nonday shift workers were more dissatisfied than were the families of day shift workers.

There was some indication that length of time on the job differentiates between satisfied and unsatisfied shift workers: the longer they stay on a given shift, the more likely shift workers are to become satisfied. Both recent shift and ex-shift workers reported the most job dissatisfaction, and non-shift workers seem to be most satisfied. Since age was used as a covariate in these analyses, differences cannot be accounted for on this basis.

Workers with long tenure on day shifts reported the least amount of interference with their sexual activities; recently employed workers on nonday shifts reported the most. Day shift workers who had recently worked shifts fell between these two extremes.

Eating Patterns--
We found that recently hired shift workers uniformly reported poorer appetites than those who had long tenure on day shifts, whether they were non- or ex-shift workers. Also, workers in the long-term shift category did not differ from recent shift workers on this variable, so the detrimental effect on appetite of working afternoon, night, or rotating shifts is not a temporary phenomenon.

This finding was confirmed by a question on general satisfaction with eating habits. It appears that working other than day shifts disrupts appetite and decreases satisfaction with eating habits.

Table 21 presents means and statistical significance data for Phase III variables. None of the findings seem to support the possibility that day-shift worker responses from ex-shift workers have any particular confounding effect on reports of day shift workers in general.

Phase IV: Analysis of Merged Sample Health Variables

Because Phase II and III analyses revealed no significant findings on any physical health variables, we decided to run separate analyses of covariance on the incidence and severity of each symptom subitem listed under question 5, Health Information, on the questionnaire. Also, since many of the illnesses listed under question 7 in the same section of the questionnaire have been referred to in past studies on shift work and health, we decided to also run analyses of covariance on their incidence.

The two sample populations were once again merged into one pool, which was then categorized by the four shift categories. Age, sex, and marital status were again the covariates. Post hoc tests were performed for significant analyses of covariance.

Incidence analyses of covariance on HI 5 subitems showed significant differences across shifts for these six symptoms:

- Racing or pounding heart
- Leg cramps
- Periods of severe fatigue and exhaustion
- Bloated or full feeling
- Trouble digesting food
- Difficulty with feet and legs when standing for long periods.

Statistical information for the variables in this section appears in Table 22.

Post hoc tests indicated that a greater incidence of racing or pounding heart was found in the afternoon shift than in the rotating shift. Leg cramps appear more often in the rotating shift than in either the afternoon or night shifts, neither of which differed from the other on this item. Periods of fatigue were reported more often by rotators than by afternoon shift workers. Day and rotating shifts experienced a bloated, full feeling more frequently than night shift workers did. Rotators reported more difficulty with digestion more frequently than night, afternoon, or day shift workers and more frequent leg and foot problems after standing for a long time than night or afternoon shift workers.

Analyses of covariance on the severity of physical symptoms indicated shift differences for jaundice and for acid indigestion. Post hoc tests of the former showed that night shift workers experienced more severe jaundice than

Table 21

MEANS AND STATISTICAL SIGNIFICANCE FOR PHASE III CATEGORIES

	Means	Non-Shift	Recent Ex-Shift	Long-Term Ex-Shift	Recently Hired Shift	Long-Term Shift	F	df	P value	Duncan's (.05)
SP-2 (desired vs actual sleep)	$\bar{x}$	0.92	1.10	1.05	0.93	1.18	3.441	4 & 1692	.01	5 > 1
SP-8 (tired at work)	$\bar{x}$	3.61	3.76	3.47	3.72	3.79	2.468	4 & 1702	.05	5 > 3
SP-12 (adequacy of sleep)	$\bar{x}$	1.94	2.22	2.03	2.34	2.39	14.798	4 & 1693	.001	5,4 > 3,1; 2 > 1
LS-2 (talking to others at work)	$\bar{x}$	2.90	2.78	2.90	2.74	2.82	2.623	4 & 1708	.05	3,1,5 > 4
LS-3 (time for Personal activities)	$\bar{x}$	2.30	2.41	2.30	2.75	2.66	7.772	4 & 1706	.001	4,5 > 1,3, 4 > 2
LS-4 (time for social activites)	$\bar{x}$	2.41	2.69	2.46	3.38	3.30	24.641	4 & 1704	.001	4,5 > 2,3,1
LS-5 (time with spouse)	$\bar{x}$	2.15	2.52	2.21	3.26	3.01	22.314	4 & 1009	.001	4 > 5 > 2,3,1
LS-6 (time with children)	$\bar{x}$	2.24	2.20	2.49	3.15	3.11	11.383	4 & 805	.001	4,5 > 3,1,2
LS-8 (satisfaction with work schedule)	$\bar{x}$	2.04	2.38	2.06	3.01	2.96	22.697	4 & 1604	.001	4,5 > 2,3,1
LS-9 (family satisfaction with schedule)	$\bar{x}$	1.99	2.44	2.26	3.37	3.32	36.302	4 & 1412	.001	4,5 > 2,3,1
LS-10 (job satisfaction)	$\bar{x}$	1.81	2.47	2.12	2.17	1.93	5.73	4 & 1635	.001	2,4 > 5,1; 3 > 1
LS-13 (interference with sexual actitity)	$\bar{x}$	3.69	3.26	3.57	2.93	3.02	26.537	4 & 1558	.001	1,3 > 2,5,4
EP-3 (appetite)	$\bar{x}$	1.48	1.63	1.59	1.74	1.69	4.079	4 & 1701	.01	4,5 > 3,1
EP-6 (satisfaction with eating pattern)	$\bar{x}$	2.58	2.79	2.56	2.92	2.84	2.412	4 & 1701	.05	4 > 1,3; 5 > 3

Notes: SP = Sleep Patterns; LS = Life Style; EP = Eating Patterns

Means presented in this table are adjusted for the covariates of age, sex, and marital status.

Only the significance of main effects is presented. Significance of covariates are not included because they were used primarily for control purposes.

Standard deviations are not presented because the standard covariate analysis computes only a pooled standard deviation.

Table 22

INCIDENCE AND SEVERITY OF PHYSICAL SYMPTOMS AND DISEASE BY SHIFT

Physical Sympton (H15)	Day	Aft/Eve	Night	Rotating	F	df	P value	Duncan's (.05)
Incidence								
Racing pounding heart	.25	.31	.27	.23	3.05	3 & 1881	.05	2 > 4
Leg cramps	.43	.39	.38	.48	4.26	3 & 1879	.01	4 > 2, 3
Periods of fatigue	.50	.44	.51	.53	2.56	3 & 1882	.05	4 > 2
Bloated full feeling	.57	.50	.48	.55	2.99	3 & 1877	.05	1, 4 > 3
Difficulty digesting	.14	.15	.15	.21	3.83	3 & 1885	.01	4 > 3, 2, 1
Difficulty standing for long periods of time	.55	.50	.52	.59	2.91	3 & 1885	.05	4 > 3, 2
Severity								
Jaundice (yellow eyes or skin)	2.01	2.05	4.10	2.41	5.43	3 & 13	.01	3 > 4, 2, 1
Acid indigestion	2.13	2.16	2.23	2.24	3.39	3 & 932	.05	4, 3 > 1
Disease Incidence (H17)								
Gastritis	.02	.06	.04	.07	4.03	3 & 1888	.01	4 > 3, 1; 2 > 1

Note: Incidence expressed in percentages.

the other three shifts, none of which differed significantly from any other. Rotating and night shifts experienced more severe acid indigestion than the day shift. No other shift differences were noted.

Analyses of covariance on the incidence of illness by shift (HI 7, questionnaire) disclosed significant differences for gastritis only. Rotators suffered from this disorder to a greater degree than night or day shift workers, and the afternoon shift reported a higher incidence than the day shift group.

Phase V: Adaptation Index Analyses

The first step in identifying adaptation variables was the formation of an adaptation index, which is more fully described in Appendix C. Briefly, subindices for health, eating, sleeping, life style, and psychological variables were formed, each was normalized, and a total index was computed. The weighting scheme employed gives equal consideration to physical and behavioral indices.

Following subindex calculations, intercorrelations among the variables comprising the index were determined. As Table 23 shows, we found that each subindex correlated significantly with the other subindices. The largest correlations were found between health and psychological adaptation (r = .43), sleep and life style adaptation (r = .42), and psychological and sleep adaptation (r = .41).

Table 23

INTERCORRELATIONS OF VARIABLES COMPRISING THE ADAPTATION INDEX

	Psychological Adaptation	Sleep Pattern	Life Style	Eating Pattern
Health Status	.43	.34	.21	.22
Psychological Adaptation		.41	.37	.30
Sleep Pattern			.42	.33
Life Style				.31

Analyses of variance were also performed on the overall adaptation index to find out whether sex, age, or marital status affected adaptation. We found that the worker's sex and marital status were not significantly related to overall adaptation. A significant but low correlation was found, however, for age and inability to adapt, indicating a slight tendency for younger shift workers to have more adaptation difficulty.

Analyses of covariance run on the overall index with sex, age, and marital status as covariates revealed significant adaptation differences across the four shifts (see Table 24). Post hoc analyses disclosed that day shift workers had significantly less difficulty adapting than the other three shifts did.

Table 24

SHIFT EFFECTS ON ADAPTATION

Adaptation Index	Day	Aft/Eve	Night	Rotating	F	df	P value	Duncan's (.05)
Total Adaptation Score	9.74	9.95	10.04	10.15	12.85	3 & 1594	.001	4, 3, 2 > 1; 4 > 2
Sleep	9.57	9.41	10.72	10.19	55.10	3 & 1864	.001	3 > 4 > 1, 2
Life style	8.60	10.15	10.24	10.83	35.62	3 & 1666	.001	4 > 3, 2 > 1
Eating	9.73	9.92	10.08	10.13	7.75	3 & 1880	.001	4 > 2, 4, 3 > 1

Note: Values expressed as means.

Within these other shifts, afternoon shift workers had less difficulty adapting than rotators, who had the highest index score, indicating the most adaptation difficulty.

Analyses of covariance with the same three covariates were also performed for each of the five adaptation subindices across the four shifts. No significant shift differences were found for health or psychological adaptation, but sleep, life style, and eating indices did show significant variations.

Post hoc analyses were used to determine that night shift workers had more trouble adapting sleep patterns than the other three shifts, and that rotators had more such difficulty than afternoon or day shift workers.

Rotators also had more trouble with life style adaptation than the other shifts, and night and afternoon shift workers had higher scores (i.e., more difficulty) than day shift workers.

Rotating and night shift workers had more trouble adjusting eating patterns than did day shift workers. Rotators alone also had more trouble than afternoon shift workers.

An overall adaptation score was also calculated: it showed that workers in all nonday shifts had significantly more trouble adapting than day shift workers, and that of those in the three nonday shifts, rotators had significantly more trouble adapting than afternoon shift workers did.

At this point, we decided to investigate possible correlations between the total adaptation index and selected questionnaire variables, without reference to possible variations across shifts. Computing these correlations showed the relationships of r greater than .20 between non-adaptation and:*

- Frequency of medication use (r = .28)
- Decreased use of alcohol as sleep enhancer (r = .22)
- Frequency of spouse complaints regarding work schedule (r = .39)
- Greater differences between sleep desired and actual sleep obtained (r = .28)
- Negative attitude toward work hours (r = .56)
- Negative attitude of spouse toward work schedule (r = .40)
- Job dissatisfaction (r = .44)
- Negative feelings toward co-workers (r = .23)
- Neuroticism (r = .59)
- Introversion (r = .25)
- Lower impulsivity (r = .25)

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*These variables are presented so that as the non-adaptation index score increases, they do too.

For detailed information on the directionality of correlations see Table 25.

Smaller but significant correlations were also found between non-adaptation and:

- Poor health of spouse (r = .15)
- Increased rest during menstrual periods (r = .19)
- Decreased sleep (r = .17)
- Fewer individuals helping make life easier (r = .19)
- Fewer friends working the same shift (r = .14)
- Fewer neighbors working the same shift (r = .17)
- Lower self-rating of work ability (r = .18)
- More snacking (r = .12)
- Fewer meals eaten with family (r = .13)
- Less sociability (r = .12)
- Younger age (r = .13)
- Lower total family income (r = .10)
- Daily cigarette smoking (r = .10).

Because a number of variables had a significant relationship with adaptation, we decided to look at the amount of variance that combining these variables could account for in adaptation scores. Although spouse complaints about work schedules, spouse attitude about work schedules, and family satisfaction with work schedules had significant correlations with adaptation, they were initially removed from the analysis because they limited the sample to consideration of only those shift workers who were married and had families. In a second analysis, these three variables were included.

A stepwise regression analysis was then performed on those variables that correlated .25 or greater with adaptation. In addition, age, sex, and marital status were included since they had been consistently used as covariates in previous analyses of covariance.

The results of these analyses, with and without spouse and family variables, appear in Tables 26 and 27.

As can be seen by comparing these tables, inclusion of the spouse and family variables makes almost no difference, suggesting that, though spouse and family variables are correlated with adaptation, they are probably a function of shift worker variables. That is, if a worker is not satisfied with his or her shift, the spouse and family will probably not be either. Their dissatisfaction is very likely the result of the shift worker's dissatisfaction.

As can be observed in Table 26, all items together yield a multiple correlation of .802 with adaptation scores. Excluding sex, age, and marital status, which had little to do with adaptation, the first six variables in the analysis still yield a multiple of r of .801: these six variables alone account for 64% of

Table 25

CORRELATIONS BETWEEN INABILITY TO ADAPT AND SELECTED QUESTIONNAIRE ITEMS

Item	Description	r
HI-2B	Days hospitalized	-.04
HI-4	Frequency of medication use	.28†
HI-6	Weight change	.01
HI-9[a]	Health of spouse	-.15†
HI-10C	Rest during menstrual periods	.19†
HI-12	Accidents off job	.08†
HI-14	Amount of alcohol used	.01
HI-16	Use of alcohol for sleep	-.22†
HI-17A	Daily cigarette consumption	.10†
JI-1	Length of time with present employer	-.07*
JI-5	Length of time on present schedule	-.03
JI-9/10	Time spent traveling to and from work	-.03
JI-13/15	Overtime	.07†
JI-16	Marital status	.01
JI-18[a]	Spouse attitude toward work schedule	-.40†
JI-19	Frequency of spouse complaints regarding work schedule	.39†
SP-2	Amount of sleep	-.17†
SPD-1/2	Sleep difference	.28†
SLS-1	Make life easier	-.19†
SLS-2	Talk to others about work	.01
LS-8	Satisfaction with work hours	-.56†
LS-9	Family attitude toward hours	-.50†
LS-9A[a]	Friends work same shift	-.14†
LS-9B[a]	Neighbors work same shift	-.17†
LS-10[a]	Job satisfaction	-.44†
LS-11[a]	Self-rating of work ability	-.18†
LS-12[a]	Feelings toward co-workers	-.23†
EP-4	Snacks	.12†

Table 25 (Concluded)

Item	Description	r
EP-5	Number of meals with family	-.13†
SGI-1	Introversion	.25†
SGI-2	Neuroticism	-.59†
SGI-4	Impulsivity	.25†
SGI-5	Sociability	-.13†
BI-1	Sex	-.03
BI-3	Education	-.08†
BI-4	Age	-.11†
BI-8	Total family income	-.10†
BI-9	Personal income	-.06*

Notes:

*.01

†.001

No correlate listed above was included in the computation of the adaptation index.

[a]The signs of these correlations were reversed to coincide with the item descriptions and ratings on the questionnaire.

Table 26

MULTIPLE STEPWISE REGRESSION ANALYSIS OF VARIABLES
CORRELATED WITH OVERALL ADAPTATION SCORE
(Spouse and Family Variables Excluded)

Variables		Multiple r	r Square	r Square Change	Simple r (Absolute Value)
GI-2	Neuroticism	.588	.345	.345	.588
LS-8	Satisfaction with work hours	.745	.555	.209	.562
LS-10	Job satisfaction	.771	.595	.040	.431
HI-4	Total medication usage	.788	.620	.026	.276
SP-1/2	Desired versus actual sleep	.796	.634	.014	.282
GI-1	Extroversion	.801	.641	.007	.252
BI-1	Sex	.802	.643	.002	.035
J1-16	Marital status	.802	.644	.001	.010
BI-4	Age	.802	.644	.000	.106

Table 27

MULTIPLE STEPWISE REGRESSION ANALYSIS OF VARIABLES CORRELATED WITH OVERALL ADAPTATION SCORE
(Spouse and Family Variables Included)

Variables		Multiple r	r Square	r Square Change	Simple r (Absolute Value)
GI-2	Neuroticism	.591	.349	.349	.591
LS-8	Satisfaction with work hours	.748	.560	.211	.567
LS-10	Job satisfaction	.772	.595	.035	.401
HI-4	Total medication usage	.790	.623	.028	.319
JI-19	Spouse complaints about work schedule	.800	.640	.017	.384
SP-1/2	Desired versus actual sleep	.808	.652	.013	.315
GI-1	Extroversion	.813	.661	.008	.257
LS-9	Family satisfaction with work schedule	.815	.664	.003	.524
JI-18	Spouse satisfaction with work schedule	.815	.664	.001	.394
BI-1	Sex	.815	.664	.000	.024
JI-16	Marital status	.815	.664	.000	.025
BI-4	Age	.815	.664	.000	.097

the variance in adaptation scores. Neuroticism contributes considerably to the adaptation score, followed by worker satisfaction with work schedule, and job satisfaction.

In other words, it appears that adaptation to shift work is best when the shift worker is not too neurotic, is satisfied with his/her work schedule, and is satisfied with the type of work he/she is doing.

The fourth correlate in the regression analysis was total medication use, which could probably best be interpreted as an effect of non-adaptation rather than a cause. The difference between desired and obtained sleep, as well as the introversion-extroversion scale, also accounted for portions of the variance in adaptation scores.

As a final point, it should be noted that a cross-sectional survey of this nature does not provide data which permit inferences to be drawn regarding cause and effect. Some of the factors which were treated as predictors of shift work adaptation in the present study (e.g., neuroticism), could just as easily be viewed as outcome variables (i.e., as consequences of poor adaptation rather than causes). For this reason it is best to view the adaptation index as a profile or composite of the characteristics of the poorly adapted shift worker. Future research, using a longitudinal design, may then focus on these factors to ascertain the direction of causality.

SUMMARY AND CONCLUSIONS

The study was conducted in two stages. In the first, we reviewed shift worker health and safety files for some 1,200 nurses and 1,200 food processors and compiled information on three major outcome variables--sick days, clinic visits, and accidents. Each of the two sample groups was composed of approximately equal numbers of day, afternoon, night, and rotating shift workers. Rotators tended to come from different organizations altogether than the fixed day, afternoon, and night shift workers because individual companies do not, by and large, combine fixed shift systems with rotating shift systems. The entire 24-hour span can be covered by either assigning workers permanently to each of the three basic shifts, or by having them rotate among them. Although few companies now use a blend of both systems, we feel, as we discuss below, that such a mixed system might help improve worker adaptation to shift work.

In the first study phase, we first looked at the sick day variables for the nurse sample. Our analyses showed that rotating shift nurses tended to take slightly more sick days than all other shift workers, i.e., those assigned to a fixed shift, regardless of which shift that happened to be. But the difference between rotators and fixed shift workers was not statistically significant, indicating that rotators were not taking many more sick days than were fixed shift workers.

We then looked at the reasons that nurses gave for taking sick leave, and we noticed that again there was a clear difference between rotators and all fixed shift workers: rotators tended to give more serious reasons for taking sick days than did fixed shift workers. Also, in the fixed shift group (i.e., the group comprising all permanently assigned day, afternoon, or night shift workers), the reasons for sick leave tended to be the same: headaches, colds, earache, and so forth. But rotators tended to give more serious reasons, such as acute respiratory infection and upper-GI-tract distress.

The same pattern prevailed in the food processor sample: the total number of sick days taken was about the same for rotating and fixed shift workers, but the rotators gave what appear to be much more serious reasons for taking time off.

It was only when we then looked at information on clinic visits that our data began to seem quite revealing. Not only did rotators tend to go to worksite clinics much more often than did shift workers who were assigned to fixed shifts, they tended to do so for the same reasons that fixed shift workers gave as excuses for taking sick time.

In short, it seemed that because rotators generally suffered more serious health disorders, they were forced to use their sick leave for graver complaints and to visit clinics at the worksite, during work hours, for the same

reasons that caused fixed shift workers to stay home. Rotators did not take more sick time because sick time is limited for all workers.

We concluded that the number of sick days taken was not a reliable indicator of health problems. One must also carefully analyze the reasons given for sick leave, the total amount of sick leave allowed, and the attendance patterns at onsite health clinics, where these are available to all workers.

Unfortunately, we were unable to analyze corresponding clinic visit data for food processors because most sites that used a rotating shift system did not maintain clinics.

Essentially similar patterns were confirmed by our data on accidents. Rotating shift workers in both the nurse's and food processor's sample had more total accidents than did fixed shift workers. About 20% more rotators than fixed shift workers reported having at least one accident during the six months prior to our records review.

Our examination of the kind of accidents reported was not particularly fruitful. Rotators tended to have significantly more finger injuries and night shift workers more superficial leg, hip, and foot injuries, but we concluded that, by and large, it was not the type so much as the small increase in incidence of all types of accidents that differentiated rotators from fixed shift workers.

In the second component of the study, we distributed a questionnaire to about 3,500 shift workers, again dividing our distribution equally among day, afternoon, night, and rotating shift categories. The response rate was slightly under 60%; about 2,000 questionnaires were returned to us.

Analysis of the questionnaire data highlighted a number of general areas on which rotating shift nurses or food processors, or both, showed a significantly higher incidence of response when the effects of age and marital status were controlled for:

- Digestion trouble
- Leg and foot cramps
- Colds
- Chest pains
- Menstrual problems
- Nervousness
- Wheezing
- Alcohol consumption
- Inadequate sleep patterns/use of a sleep-enhancing medication
- Use of stimulants
- Fatigue
- Less satisfactory domestic and social life

- Less satisfactory psychological health
- Less satisfactory work performance.

In additional subphases of questionnaire data analysis, we found first that there seemed to be few differences between long- and short-term shift workers, suggesting that there is little or no tendency to adapt over time; the critical variable is shift assignment, not length of shift tenure.

Second, we did not find that our day shift sample responses had in any way been confounded by the presence of maladaptive ex-shift workers--those who transferred to day shifts because they could not adjust to other schedules.

The fatigue and digestion problems of rotators were confirmed in a third analysis subphase of the questionnaire data.

Finally, we concluded that the shift worker with less difficulty adapting to shift work can be characterized as: less neurotic; more impulsive; more extroverted; possessing a more positive attitude toward hours, job, and co-workers; using less medication; using alcohol as a sleep enhancer more often; and as having a spouse who complained less about the shift worker's schedule.*

The results of the study seem to support the view that there is a tendency for shift work to have a deleterious effect on the physical and psychological well-being of some shift work employees, particularly on their sleep patterns, digestion, mood, and personal, social, and domestic activities. These effects seem to become more severe with greater departures from the conventional daytime work schedule: we found that rotators and night shift workers reported significantly more dissatisfaction and discomfort on most variables than did afternoon or day shift workers. Not surprisingly, day shift workers reported the least ill effects.

Rotators seem to consistently fare the worst, followed closely by night shift workers. They tend to have more serious physical complaints, more accidents, more clinic visits, more digestive problems, worse sleeping problems, more fatigue, more menstrual problems, to use alcohol more, to encounter more interference with their sex lives, and to find less satisfaction in their personal and domestic pursuits than do other shift workers. Our findings tend to identify rotation as being a scheduling system that imposes excessive physical and psychological costs on shift workers.

Some of our findings tend to be supported by the conclusions of earlier studies. For example, Taylor (1967) observed in his study of refinery workers that fixed shift employees suffered fewer illnesses than those on rotational shifts. Bast's study (1960) anticipated our conclusion that shift worker neuroticism plays a primary role in job dissatisfaction: we found that rotating shift nurses were significantly more confused, depressed, and anxious than other

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*We were unable to determine, within the design constraints of this study, whether any of these variables were primarily effects or antecedents of shift work experience.

nurses. Mott et al. (1965) found that greater role difficulty led to lowered worker self-esteem, greater anxiety, and increased job conflict.

Previous research (e.g., Mott et al., 1965; Maurice, 1975) has also suggested that the connection of rotational shift work to maladaptation may be due to the disruption of circadian rhythms. Researchers have suggested that body temperature and adrenal and plasma corticosteroid concentrations may be associated with alertness, and that they follow a circadian rhythm pattern that can be adapted to by fixed shift workers, even most of those on night shifts, but that rotating shift workers are often switched too quickly from one shift to another to allow these rhythms to stabilize, thus causing a decrease in alertness and more accidents. This strongly suggests that future research concerning the impact of shift schedule on worker health, safety, and efficiency should take into account the nature of the job being performed. It appears plausible that the disruption of circadian rhythms and the subsequent impairment of alertness and concentration arising from a rotating shift schedule might have differential effects on workers engaged in cognitive vs. manual tasks. The former might be more susceptible to health problems and mental errors stemming from heightened vigilance demands, the latter might be more susceptible to accidents arising from physical fatigue. Much research remains to be done in terms of the effects of the shift-by-task interaction on a variety of outcome variables.

There is wide disagreement about the optimum interval of rotation, if rotational systems are used. The most common interval of rotation in American shift work industries is one week. Teleky recommended in 1943 that workers assigned to rotation should not change shifts more often than once a month. More recent research by Smith (1973) reports that air traffic controllers prefer to rotate at very frequent intervals. Apparently they find it more tolerable to remain in a state of constant somatic disruption than to periodically readjust to new but temporary circadian rhythms. Maurice (1975) also cites studies emphasizing the advantages of rotating as rapidly as every 2 to 3 days.

Rotating shift systems do offer the one advantage of impartiality; fixed shift systems, by contrast, consign some workers to always work at odd hours, but every rotator gets to work a conventional schedule one-third of the time.

Since our study found that worker satisfaction played a major role in worker adjustment to shift work, we believe that a plausible strategy for employers wishing to encourage worker adaptation to shift work would be to attempt to maximize worker shift preference. This could, in our opinion, be accomplished by offering the widest possible range of shift choices, including both fixed shift and rotating assignments, and by offering both rapid and slow intervals for the latter. Shift workers with the most seniority might be given first choice as to their shift assignment; others would then have less scope for selection. An afternoon shift worker whose spouse works days may want to move to the night shift. Single employees may wish to choose any shift but the afternoon shift so as to leave their evening hours free for social activities. Some individuals, like the air traffic controllers mentioned above, may even prefer to rotate quite rapidly from shift to shift. This may be physically disruptive, but it can lead to concentrations of free time in one part of the week.

It should be relatively easy to assess shift worker preferences and then to maximize a successful match between those choices and all the possible permutations of shift work scheduling. The complications of monitoring and assessing shift worker selections should be offset by what we believe would be a clear improvement in worker morale. Mixing rotation and fixed assignments would, we believe, also contribute to reducing turnover rates.

Future studies in this field would, in our opinion, be well advised to focus on small numbers of shift workers from relatively few firms, rather than 2,000 or so shift workers from some 20-odd sites. Multiple measures, including blood chemistry, medical examination, and other physiological data, should be taken over a more prolonged time period than was possible with our one-shot design. Assessment of sample groups should include closer monitoring of workers who drop out of shift work assignments. Studies conducted along these lines would, we feel, make it possible to considerably refine our current understanding of the health consequences of shift work.

BIBLIOGRAPHY

Aanonsen, A. Medical problems of shift work. Industrial Medicine and Surgery, 28, 422-427, 1959.

_____ Shift work and health. Oslo: Norwegian Monographs on Medical Science, 1964.

Akerstedt, T. Interindividual differences in adjustment to shift work. Proceedings of the Sixth Congress of the International Ergonomics Association, Edge Park, Maryland, July 11-16, 1976.

Andlauer, F. The effect of shift working on the worker's health. TU Information Bulletin, European Productivity Agency, 29, 1960.

Aschoff, J. Human circadian rhythms in activity, body temperature, and other functions. In A. H. Brown and F. G. Favorite (eds.), Life sciences and space research. Amsterdam: North Holland, 1967.

Banks, O. Continuous shiftwork: The attitudes of wives. Occupational Psychology, 30, 69-84, 1956.

Banks, O. The attitude of steel workers to technical changes. Liverpool: The University Press, 1960.

Bast, G. H. Ploegenarbeid in de Industry. Contractgroepvoering Productivitieit, Van Loghum Slaterus, Arnkem, 1960.

Begoin, J. La Neurose des Téléphonistes et des Mécanographes. Paris: Thesis, 1957.

Beljan, J. R., L. S. Rosenblatt, N. W. Hetherington, et al. Human performance in the aviation environment. Washington, D.C.: NASA Report No. NAS2-6657, 1972.

Bjerner, B., A. Holm, and A. Swensson. Om Natt-Och Skiftarbete. Statnes Offentliga Utredningar Stockholm 51, 1948.

Bjerner, B., A. Holm, and A. Swensson. Studies on night and shiftwork. In A. Aanonsen, Shiftwork and health. Oslo: Scandinavian University Books, 1964.

Bjerner, B. and A. Swensson. Shiftwork and rhythm. Acta Medica Scandinavica, Supplement 278, 102-107, 1953.

Bjerner, B., A. Holm, and A. Swensson. Diurnal variation in mental performance: A study of three shift workers. British Journal of Industrial Medicine, 12, 103-110, 1955.

Blakelock, E. A. A new look at the new leisure. Administrative Science Quarterly, 4, 446-467, 1960.

Blakelock, E. A. A study of some social and psychological effects of rotating shift work. Doctoral Dissertation, University of Michigan, 1967.

Bohr, R. H. and A. B. Swertloff. Work shift, occupational status, and the perception of job prestige. Journal of Applied Psychology, 53, 3 Pt. 1, 227-229, 1969.

Bonnevie, P. and J. E. Andersen. Shiftwork and health. Oslo: Scandinavian University Books, 1960.

Browne, R. C. The day and night performance of teleprinter switchboard operators. Occupational Psychology, 23, 121-126, 1949.

Brussgard, A. Shiftworkers. Recommendations on the shortening of working hours in certain occupations, Ministry of Local Government and Labour, HMSO, England, 1949.

Brussgard, A. An investigation of inquiry on health problems in shift work in the Norwegian paper industry. AMA Archives of Industrial Hygiene and Occupational Medicine, 2, 465, 1950.

Caillot, R. Consequence sociale du travail a feu continu. Economie et Humanism, 122, 62-72, 1959.

Cameron, C. Fatigue problems in modern industry. Ergonomics, 14, 6, 713-720, 1971.

Carpentier, T. and P. Cazamian. Night Work. Geneva: International Labour Office, 1977.

Cleland, C. C., S. Seitz, and W. F. Patton. Birth order and ruralism as potential determinants of attendant tenure. Mental Deficiency, 72, 3, 428-434, 1967.

Colquhoun, W. P., M. J. F. Blake, and R. S. Edwards. Experimental studies of shift-work I: A comparison of "Rotating and Stabilized" 4-hour shift systems. Ergonomics, 11, 437-453, 1968a.

Colquhoun, W.P., M. J. F. Blake, and R. S. Edwards. Experimental studies of shift work II: Stabilized 8-hour shift systems. Ergonomics, 11, 527-546, 1968b.

Colquhoun, W. P., M. J. F. Blake, and R. S. Edwards. Experimental studies of shift work III: The stabilized 12-hour shift system. Ergonomics, 12, 865-882, 1969.

Colquhoun, W. P. Circadian rhythms of body temperature in shift workers at a coalface. British Journal of Industrial Medicine, 27, 266-272, 1970a.

Colquhoun, W. P. Circadian rhythms, mental efficiency, and shift work. Ergonomics, 13, 558-560, 1970b.

Colquhoun, W. P. (Ed.), Biological Rhythm and Human Performance. London: Academic Press, 1971.

Congress on Occupational Health (XVI International). Occupational Health in Japan. Tokyo, 1969.

Debry, G. and R. Bleyer. Influence du rythme des 3 X 8 sur l'alimentation des travailleurs. In G. Debry and R. Bleyer (Eds.), Alimentation et Travail. Paris: Masson, 174-179, 1972.

De La Mare, G. and J. Walker. Factors influencing the choice of shift rotation. Occupational Psychology, 42, 1-21, 1968.

Dirken, J. M. Industrial shift work: Decrease in well-being and specific effects. Ergonomics, 9, 115-124, 1966.

Doll, R., F. A. Jones, and M. M. Buckatzsch. Occupational factors in the aetiology of gastric and duodenal ulcers, with an estimate of their incidence in the general population. London: Medical Research Council, Special Report Series No. 276, 1951.

Downie, J. H. Some social and industrial implications of shiftwork. London: Industrial Welfare Society, 1963.

Duesberg, R. and W. Weiss. Reichsgesundheitsblatt, Arbeitsschutz, 3, No. 8, 1939.

Ehrenstein, W., W. Muller-Limmroth, and K. Schaffler. An electrophysiological contribution to investigation on the effect of 7-chloro-1, 3-dihydro-3-hydroxy-5-phenyl-2H-1, 4-benzodiazepin-2-one on the sleep during daytime following a night shift. Technical College, Institute of Labor Physiology, Munich. Arzneimittel-Forschung, 19, 10, 1656-1659, 1969.

Ensing, H. Occupational aspects of peptic ulcer. T. Soc. Geneesk, 47, 178-186, 1969.

Folkard, S., P. Knauth, T. H. Monk, and J. Rutenfranz. The effect of memory load on the circadian variation in performance efficiency under a rapidly rotating shift system. Ergonomics, 19, 4, 479-488, 1976.

Foret, J. and O. Benoit. Sleep patterns of workers on rotating shifts. Electroencephalography and Clincial Neurophysiology, 37, 337-344, 1974.

Froberg, J. E. and T. Akerstedt. Night and shiftwork effects on health and well-being. Laboratory for Clinical Stress Research, Stockholm, 1974.

Ghata, J. La chronobiologie appliqué â l'environment. Archives des Maladier Professionnelles de Medicine du Travaillet Securite Sociale, 32, 385-393, 1971.

Insel, P. M. and R. Moos. Work environment scale. Palo Alto, California: Psychologist Press, 1973.

Kleitman, N. Sleep and Wakefulness (2nd ed.), University of Chicago Press, 1963.

Knauth, P. and J. Rutenfranz. The effects of noise on the sleep of night-workers. In P. Colquhoun, S. Folkard, P. Knauth, and J. Rutenfranz (Eds.), Experimental studies of shiftwork. Opladen: Westdentseher Verlag, 66-73, 1975.

Kripke, D. F., B. Cook, and O. F. Lewis. Sleep of night workers: EEG recordings. Psychophysiology, 7, 3, 377-384, 1971.

Kris, C. Diurnal variation in periorbitally measured eye potential level. Electroencephalography and Clinical Neurophysiology, 9, 382, 1957.

LeVere, T. E., R. T. Bartus, and R. D. Hart. EEG and behavioral effects of nocturnally occurring jet sounds. Aerospace Medicine, 45, 384-389, 1972.

Levi, L. Stress and distress in response to psychosocial stimuli. Acta Medica Scandanivica, 191, Supplement 528, 1972.

Ley, R. Labor turnover as a function of worker differences, work environment, and authoritarianism of foremen. Applied Psychology, 50, 6, 479-500, 1966.

Luce, G. L. Body time. New York: Pantheon Books, 1971.

Lukas, J. S. and M. E. Dobbs. Effects of aircraft noise on the sleep of women. Washington, D.C.: NASA Report No. CR-2041, 1972.

Mann, F. C. and L. R. Hoffman. Automation and the worker. New York: Henry Hold and Company, 1960.

Maric, D. Adapting working hours to modern needs. Geneva: International Labour Office, 1977.

Maurice, M. and C. Monteil. Vie quotidienne et honaire de travail: enqûete psychosocialogue sur le travail en equiper successiver. Paris Institut des Sciences Socialer du Travail, 1965.

Maurice, M. Shift Work. Geneva: International Labour Office, 1975.

McGirr, P. O. M. Health consideration. In The benefits and problems of shift working. Product Engineering Research Association Symposium, Section 5, 1-6, 1966.

Menzel, W. Zur Physiologie und Pathologie des Nacht und Schichtarbeiters. Arbeitsphysiologie, 14, 304-318, 1950.

Metz, B. Les boissons en milieu industriel. Bulletin, Société scientifique d'hygiene alimentaire et d'alimentation rationelle de l'homme, 52, 4-5-6, 145-156, 1964.

Mills, J. N. Human circadian rhythms. Physiological Reviews, 46, 128-171, 1966.

Moos, R. Family environment scale. Palo Alto, California: Consulting Psychologist Press, 1974.

Morgan, B. B., Jr., B. R. Brown, and E. A. Alluisi. Effects on sustained performance of 48 hours of continuous work and sleep loss. Human Factors, 16, 406-414, 1974.

Morioka, M. Physiological burden to shiftworkers: A study of their sleeping hours. XVIth International Congress on Occupational Health, Tokyo, 1969.

Mott, P. E., et al. Shiftwork: The social, psychological and physical consequences. Ann Arbor: University of Michigan Press, 1965.

Murrell, K. F. H. Ergonomics: Man in his working environment. London: Chapman and Hall, 1965.

Murrell, K. P. Some considerations in the organization of work. Revue de Psychologie et de Sciences de l'Education, 5, 3, 268-285, 1970.

National Institute for Occupational Safety and Health. Shift work and health, Washington, D.C., 1976.

Ostberg, O. Interindividual differences in circadian fatigue problems of shift workers. Report No. 1972:24 of the Laboratory of Environmental Hygiene and Ergonomics, Stockholm, Swedish Cooperative Union and Wholesale Society, 1972.

Phillips Company. Ploegenarbeid: Medissche, Maatschappellijke en Psychologische Gerolgen van Ploegenarbeid. Eindhoven, Holland. Prepared by a study group, 1958.

Pocock, S. J., R. Sergean, and P. J. Taylor. Absence of continuous three shift workers: A comparison of traditional and rapidly rotating systems. Occupational Psychology, 46, 7-13, 1972.

Popescue-Neveanu, F., M. Mamali, and P. Ene. Aspects of operators' fatigue determined by night work and shift work. Revista de Psihologie, 12, 3, 345-366, 1966.

Raffle, P. A. B. Automation--another change in working environment. Abstracts of World Medicine, 41, 657-670, 1967.

Rechtschaffen, A. and A. Kales (Eds.), A manual of standardized terminology, techniques, and scoring system for sleep stages of human subjects. Washington, D.C.: Public Health Service, Government Printing Office, 1968.

Reinberg, A. and E. Sidi. Circadian changes in the inhibitory effects of an antihistaminic drug in man. Journal of Investigations in Dermatology, 46, 415-419, 1966.

Reinberg, A., N. Vieux, A. Laporte, J. Ghata, and C. Migraine. Rapid adjustment of circadian rhythms in shift workers. Proceedings of the Sixth Congress of the International Ergonomics Association, College Park, Maryland, July 11-16, 1976.

Rose, K. D., et al. Physiological evidence for variations in intellectual circadian periodicity. College Health Association, 20, 2, 135-140, 1971.

Rutenfranz, J. Psychological aspects of night and shiftwork. Arbeitsmedizin-Sozialmedizin-Arbeitshygiene, 2, 17-23, 1967.

Rutenfranz, J. and P. Knauth. Investigation of the problems concerning influences upon the sleep of shift workers. In A. Swensson (ed.), Proceedings of the Second International Symposium on Night and Shift Work. Stockholm: Institute of Occupational Health, 58-65, 1970.

Sergean, R. Managing Shiftwork. London: Gower Press, 1971.

Sergean, R. The medical research council, industrial psychology research unit, 1958-1967. England Occupational Psychology, 44, 261-266, 1970.

Sergean, R. and J. Brierly. Absence and attendance under noncontinuous three-shift systems of work. Nature, 219, 5153, 536, 1968.

Smith, R. C. Comparison of the job attitudes of personnel in three air traffic control specialties. Aerospace Medicine, 44, 8, 918-927, 1973.

Smith, R. C. Job attitudes of air traffic controllers: A comparison of three air traffic control specialties. Industrial Medicine and Surgery, FAA Office of Aviation Medicine Report, No. 73-2, 1973.

Smith, R. C., C. E. Melton, and J. M. McKenzie. Affect adjective check-list assessment of mood variations in air traffic controllers. FAA Office of Aviation Medicine Report, No. 71-21, 1971.

Sobczyk, W. and L. Markiewizs. Catecholamines excretion in urine during work with high emotional load. Acta Physiologica Polonica, 23, 1, 59-65, 1972.

Sollberger, A. Biological rhythm research. New York: Elsevier Publishing Company, 1965.

Takagi, K. Influence of shift work on time and frequency of meal taking. Human Ergology, 1, 195-205, 1972.

Tasto, D. L. Self-report schedules and inventories. In A. R. Ciminero, K. S. Calhoun, and H. E. Adams (Eds.), Handbook for Behavioral Assessment. New York: Wiley, 153-193, 1977.

Tasto, D. L. and M. J. Colligan. Shift work practices in the United States. Washington, D.C.: National Institute for Occupational Safety and Health, 1977.

Taylor, P. J. Shift and day work: A comparison of sickness absence, lateness, and other absence behavior at an oil refinery from 1962 to 1965. British Journal of Industrial Medicine, 24, 93-102, 1967.

Taylor, P. J. and A. J. Fairrie. Chronic disability in men of middle age: A study of 165 men in a general practice and a refinery. British Journal of Preventative Social Medicine, 22, 183-192, 1968.

Taylor, P. J. The effects of shift work on worker health. Industrial Medicine and Surgery, 10, 164-172, 1973.

Teleky, L. Problems of night work: Influences on health and efficiency. Industrial Medicine, 12, 4, 758-779, 1943.

Thiis-Evensen, E. Shift work and health. Industrial Medicine and Surgery, 27, 493-497, 1958.

Thiis-Evensen, E. Shift work and health. In A. Swensson (Ed.), Proceedings of the First International Symposium on Night and Shift Work. Stockholm: Institute of Occupational Health, 81-85, 1969.

Tune, G. S. A note on the sleep of shift workers. Ergonomics, 11, 2, 183-184, 1968.

Tune, G. S. The human sleep debt. Science Journal, 4, 67-74, 1968.

Ulich, E. Zur Frage der Belastung des Arbeitenden Menschen durch Nacht und Schicktarbeit. Psychologische Rundschau, 8, 42-61, 1957.

Van Loon, J. H. Enkele psychologische aspecten van ploegenarbeid. Mens Orderneming, 12, 357-365, 1958.

Vernon, H. M. The health and efficiency of munition workers. London: Oxford University Press, 1940.

Wade, L. Human relations approach to sickness, absenteeism, and other employee problems. Archives of Industrial Medicine, 12, 592-608, 1955.

Walker, J. and G. De La Mare. Absence from work in relation to the length and distribution of shift hours. British Journal of Industrial Medicine, 28, 36-44, 1971.

Walker, J. and G. De La Mare. Absence from shift work in relation to length and distribution of shift hours. British Journal of Industrial Medicine, 28, 36-44, 1971.

Wedderburn, A. A. I. Social factors in satisfaction with swiftly-rotating shifts. Occupational Psychology, 41, 85-107, 1967.

Wedderburn, A. A. I. Studies on shift work in the steel industry. Edinburgh: Herriot-Watt University, 1975.

Weitzman, E. D. Periodicity in sleep and waking states. In M. H. Chase (Ed.), The sleeping brain. Los Angeles Brain Research Institute UCLA, 1972.

Weitzman, E. D., et al. Twenty-four hour pattern of the episodic secretion of cortisol in normal subjects. Journal of Clinical Endocrinology and Metabolism, 33, 14-22, 1971.

Weitzman, E. D., D. Goldmacher, D. Kripke, et al. Reversal of sleep-walking cycle: Effect on sleepstage pattern and certain neuroendocrine rhythms. Transactions of the American Neurological Association, 93, 153-157, 1968.

Wesseldijk, A. T. G. The influence of shiftwork on health. Ergonomics, 4, 281-282, 1961.

Williams, W. H. and C. L. Williams. Nocturnal EEG profile and performance. Psychophysiology, 3, 164-175, 1966.

Wilson, W. P. and W.W.K. Zung. Attention, discrimination, and arousal during sleep. Archives of General Psychiatry, 15, 423-428, 1966.

Wojtezak-Jaroszowa, J., 1978, Physiological and Psychological Aspects of Night and Shift Work. DHEW (NIOSH) Publication, Library of Congress No. 77-600069. Washington, D.C.: U.S. Government Printing Office.

Wyatt, S. and R. Marriott. Night work and shift changes. British Journal of Industrial Medicine, 10, 164-172, 1953.

OMB Clearance No. 68-S77010
Expiration Date May, 1978

Appendix A

General Health and Adjustment Questionnaire

CONSENT FORM

I. PROJECT DESCRIPTION

Title and Number: Health Consequences of Shift Work, Contract Number 210-75-0072.

Sponsor: National Institute for Occupational Safety and Health (NIOSH)

Purpose and Benefits: This project is studying physical and behavioral aspects of the individual worker's adaptation to his work schedule. Workers in industries that employ shift workers under different work conditions and settings are being studied, including workers of the day shift, afternoon shift, night shift and rotating shift. From this study, we hope to be able to identify advantages and disadvantages of each shift and define specific characteristics associated with the individual's adjustment – or non-adjustment – to each shift schedule.

II. CONSENT TO PARTICIPATE

I am 18 or older and hereby volunteer to participate in this project. This project has been explained to me and I have been given a copy of this Consent Form. I understand that:

- My participation is completely voluntary. I am free to withdraw from this project at any time.
- I will fill out a questionnaire but will not write down my name, Social Security number, or any other information that would identify me. I may refuse to answer any questions on the questionnaire. My employer and co-workers will never know how I answer this questionnaire. The responses from all the questionnaires will be summarized and published in a final report, but my individual responses will not be disclosed.
- My participation in this project will in no way affect my job.
- If I have any questions about this project, I can contact:

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GENERAL HEALTH AND ADJUSTMENT QUESTIONNAIRE

A study on health and adjustment in several industries throughout the United States is being conducted by Stanford Research Institute and sponsored by the National Institute for Occupational Safety and Health. The questionnaire which follows is designed to help us better understand the adjustment problems of workers in a variety of work settings and work conditions.

The success of this program depends upon people like yourself who are willing to answer the questions which follow. Answers to all questions on the attached questionnaire are voluntary, anonymous, and completely confidential. Neither your co-workers nor your employer will ever know how you answered any of the questions. Your answers will be combined with those of others and summary results will be reported for this study.

You are knowledgeable on your own health and adjustment. We, therefore, hope that you will be willing to provide us with the information requested in the questionnaire.

INSTRUCTIONS

1. You should use a pencil so you can erase an answer if you change your mind.

2. Answer the questions on the questionnaire itself.

3. Most questions can be answered by circling one of the answers. Other questions can be answered by writing in your answer in the blank spaces provided.

4. Feel free to write in any explanations that make your answers more complete.

5. This is NOT a test, so there are no right or wrong answers. Take your time and answer each question to the best of your ability.

Date _____

HEALTH INFORMATION

1. In general, how would you describe your health?

   Excellent 1
   Good 2
   Fair 3
   Poor 4

2. During the past 6 months, have you been hospitalized for any reason?

   Yes 1
   No 2

   A. IF "YES": How many times: _____ Times

   B. For a total of how long? _____ Days

   C. Why were you hospitalized? _____

3. During the past month, about how many days of sick leave did you take? _____ Days
   (PLEASE WRITE "0" IF NONE)

4. PLEASE INDICATE ABOUT HOW OFTEN YOU USED EACH OF THE FOLLOWING MEDICATIONS DURING THE PAST MONTH:

Medications	Not at all	Less than once a week	1-2 times a week	3-4 times a week	Every day
a. Aspirin or headache medicine	1	2	3	4	5
b. Aids for stomach or digestion problems	1	2	3	4	5
c. Laxatives	1	2	3	4	5
d. Cough, cold or sinus medicine	1	2	3	4	5
e. Medication to pep you up	1	2	3	4	5
f. Medication to calm you down	1	2	3	4	5
g. Prescription medicines:					
1. _____ (Please specify)		2	3	4	5
2. _____ (Please specify)		2	3	4	5
3. _____ (Please specify)		2	3	4	5

5. THE FOLLOWING QUESTIONS CONCERN YOUR BODY FUNCTIONS. PLEASE TRY TO ANSWER EACH QUESTION BY CIRCLING A NUMBER TO INDICATE HOW OFTEN YOU HAVE EXPERIENCED EACH OF THE FOLLOWING ITEMS WITHIN THE PAST YEAR.

	Never	Occasionally	Frequently	Constantly
1. Shortness of breath or trouble breathing	1	2	3	4
2. Frequent colds or sore throats	1	2	3	4
3. Persistent cough and spitting up sputum	1	2	3	4
4. Coughing up blood	1	2	3	4
5. Fever, chills, and aching all over	1	2	3	4
6. Hay fever or sinus trouble	1	2	3	4
7. Wheezing in your chest	1	2	3	4

		Never	Occasionally	Frequently	Constantly
8.	Jaundice, yellow eyes or skin	1	2	3	4
9.	Itching skin, skin rash, allergic skin reactions	1	2	3	4
10.	Swollen or painful muscles and joints	1	2	3	4
11.	Back pain	1	2	3	4
12.	Pain or stiffness in your arms or legs	1	2	3	4
13.	Tearing or itching of eyes	1	2	3	4
14.	Persistent numbness or tingling in any part of your body	1	2	3	4
15.	Ringing or buzzing in ears	1	2	3	4
16.	Severe headaches	1	2	3	4
17.	Fainting spells or dizziness	1	2	3	4
18.	Nervous or shaking inside	1	2	3	4
19.	Times when you feel sweaty or trembly	1	2	3	4
20.	Increased urination	1	2	3	4
21.	Painful urination	1	2	3	4
22.	Bloody urine	1	2	3	4
23.	Alarming pain or pressure in your chest	1	2	3	4
24.	Pain down your arms	1	2	3	4
25.	"Racing" or pounding heart	1	2	3	4
26.	Leg cramps	1	2	3	4
27.	Periods of severe fatigue or exhaustion	1	2	3	4
28.	Acid indigestion, heartburn, or acid stomach	1	2	3	4
29.	Diarrhea for more than a few days	1	2	3	4
30.	Gas or gas pains	1	2	3	4
31.	Nausea or vomiting	1	2	3	4
32.	Blood in your bowel movement	1	2	3	4
33.	Constipation	1	2	3	4
34.	Tight feeling in stomach	1	2	3	4
35.	Bloated or full feeling	1	2	3	4
36.	Feeling of pressure in the neck	1	2	3	4
37.	Hemorrhoids or piles	1	2	3	4
38.	Trouble digesting food	1	2	3	4
39.	Blurred vision	1	2	3	4
40.	Dryness in the mouth	1	2	3	4
41.	Stomach pains	1	2	3	4
42.	Belching	1	2	3	4
43.	Difficulty with feet and legs when standing for long periods	1	2	3	4

6. Have you gained or lost weight in the past six months?

No 1
Yes, I've gained 2
Yes, I've lost 3

A. IF "YES": How many pounds? _____

B. IF "YES": Was this change in weight deliberate?

No 1
Yes 2

7. Within the past 5 years has a doctor ever treated you for, or told you that you had: (please circle)

	No	Yes	(If yes, give approximate date when symptoms first appeared)	Don't know
1. Diabetes	1	2	/ Year/Mo.	3
2. Cancer	1	2	/ Year/Mo.	3
3. Hernia or rupture	1	2	/ Year/Mo.	3
4. Tuberculosis	1	2	/ Year/Mo.	3
5. Asthma	1	2	/ Year/Mo.	3
6. "High" blood pressure	1	2	/ Year/Mo.	3
7. Heart disease	1	2	/ Year/Mo.	3
8. Arthritis	1	2	/ Year/Mo.	3
9. Epilepsy	1	2	/ Year/Mo.	3
10. Glaucoma of the eyes	1	2	/ Year/Mo.	3
11. Paralysis, tremor, or shaking	1	2	/ Year/Mo.	3
12. Kidney or bladder trouble	1	2	/ Year/Mo.	3
13. Lung or breathing problems	1	2	/ Year/Mo.	3
14. Stroke	1	2	/ Year/Mo.	3
15. Anemia	1	2	/ Year/Mo.	3
16. Gall bladder, liver, or pancreas trouble	1	2	/ Year/Mo.	3
17. Thyroid trouble or goiter	1	2	/ Year/Mo.	3
18. Insomnia	1	2	/ Year/Mo.	3
19. Gastritis	1	2	/ Year/Mo.	3
20. Colitus	1	2	/ Year/Mo.	3
21. Stomach ulcer	1	2	/ Year/Mo.	3

8. Has a member of your immediate family (mother, father, brothers, sisters, children) ever:

1. Committed suicide: No ____ Yes ____
2. Suffered a "nervous breakdown"? No ____ Yes ____
3. Had high blood pressure? No ____ Yes ____
4. Had a heart attack? No ____ Yes ____
5. Had diabetes? No ____ Yes ____

HI

9. Describe the general physical health of your wife/husband:

Health generally good _____
Health average _____
Health generally fair _____
Health generally poor _____
Not applicable _____

10. The following questions to be answered by FEMALES ONLY:

A. During the past 6 months have you ever had painful periods or cramps?
No ____ Yes ____
If yes, do they keep you from work?
No ____ Yes ____

B. During the past 6 months have you ever had irregular periods?
No ____ Yes ____

C. If you have menstrual periods, how long must you usually lie down each month because of them?
_____ (hours)

D. Describe how you feel at the time of your period:
(Check all that apply)

Same as other times _____
Tense, nervous _____
Angry _____
Weak, sick _____
Hot and cold flashes
before period _____
No longer have periods _____

11. During the past 6 months, have you had any on the job accidents which caused you to miss work?

Yes 1
No 2

A. IF "YES": How many accidents have you had? _____
Accidents

B. How long total were you off work? _____
Days

12. During the past 6 months, have you had any off the job accidents which caused you to miss work?

Yes 1
No 2

A. IF "YES": How many? _____
Accidents

B. How long total were you off work? _____
Days

13. During a typical week, on approximately how many days do you drink alcoholic beverages? _____ Days
(Mark 0 if you do not drink alcoholic beverages)

A. If you drink, do you ever drink on those days when you work?

Yes 1
No 2

B. IF "YES": Do you normally drink . . .(Circle all that apply).

Before going to work 1
After finishing work 2
During lunch breaks 3
During rest breaks when at work 4

14. On those days when you do drink, about how many of each of the following do you usually drink:
(Mark 0 if you do not drink alcoholic beverages)

a. Bottles of beer_____Bottles
b. Glasses of wine_____Glasses
c. Shots of liquor (shot = 1½ oz.)_____Shots

15. Would you say that the amount of alcohol you have been drinking lately has . . . . .

Increased 1
Decreased 2
Remained about the same 3
Don't drink 4

16. Would you say that you use alcohol to help you get to sleep?

Frequently 1
Occasionally 2
Seldom 3
Never 4

17. On an average day, how many of each of the following do you smoke? (Mark 0 if you don't smoke).

a. Cigarettes _____Cigarettes
b. Cigars _____Cigars
c. Pipefuls of tobacco _____Pipefuls

18. IF YOU WORK ROTATING SHIFTS, do you notice any ailments more often during one particular shift?

Yes, day shift 1
Yes, afternoon shift 2
Yes, night shift 3
No 4
DON'T ROTATE SHIFTS 5

19. IF YOU WORK ROTATING SHIFTS, do you take more medication during one particular shift?

Yes, day shift 1
Yes, afternoon shift 2
Yes, night shift 3
No 4
DON'T ROTATE SHIFTS 5

MOOD SCALE

20. THIS IS DESIGNED TO HELP DETERMINE YOUR MOODS, SINCE THE WAY YOU FEEL IS A PART OF YOUR HEALTH. THE LIST OF WORDS BELOW DESCRIBES FEELINGS PEOPLE HAVE. PLEASE READ EACH ITEM AND CIRCLE ONE NUMBER FOR EACH WORD WHICH DESCRIBES HOW YOU HAVE BEEN FEELING DURING THE PAST WEEK, INCLUDING TODAY.

	Not at all	A little	Mod-erately	Quite a bit	Ex-tremely
Friendly	0	1	2	3	4
Tense	0	1	2	3	4
Angry	0	1	2	3	4
Worn out	0	1	2	3	4
Unhappy	0	1	2	3	4
Clear-headed	0	1	2	3	4
Lively	0	1	2	3	4
Confused	0	1	2	3	4
Sorry for things done	0	1	2	3	4
Shaky	0	1	2	3	4
Listless	0	1	2	3	4
Peeved	0	1	2	3	4
Considerate	0	1	2	3	4
Sad	0	1	2	3	4
Active	0	1	2	3	4
On edge	0	1	2	3	4
Grouchy	0	1	2	3	4
Blue	0	1	2	3	4
Energetic	0	1	2	3	4
Panicky	0	1	2	3	4
Hopeless	0	1	2	3	4
Relaxed	0	1	2	3	4
Unworthy	0	1	2	3	4
Spiteful	0	1	2	3	4
Sympathetic	0	1	2	3	4
Uneasy	0	1	2	3	4
Restless	0	1	2	3	4
Unable to concentrate	0	1	2	3	4
Fatigued	0	1	2	3	4
Helpful	0	1	2	3	4
Annoyed	0	1	2	3	4
Discouraged	0	1	2	3	4
Resentful	0	1	2	3	4
Nervous	0	1	2	3	4

	Not at all	A little	Mod-erately	Quite a bit	Ex-tremely
Lonely	0	1	2	3	4
Miserable	0	1	2	3	4
Muddled	0	1	2	3	4
Cheerful	0	1	2	3	4
Bitter	0	1	2	3	4
Exhausted	0	1	2	3	4
Anxious	0	1	2	3	4
Ready to fight	0	1	2	3	4
Good-natured	0	1	2	3	4
Gloomy	0	1	2	3	4
Desperate	0	1	2	3	4
Sluggish	0	1	2	3	4
Rebellious	0	1	2	3	4
Helpless	0	1	2	3	4
Weary	0	1	2	3	4
Bewildered	0	1	2	3	4
Alert	0	1	2	3	4
Deceived	0	1	2	3	4
Furious	0	1	2	3	4
Efficient	0	1	2	3	4
Trusting	0	1	2	3	4
Full of pep	0	1	2	3	4
Bad-tempered	0	1	2	3	4
Worthless	0	1	2	3	4
Forgetful	0	1	2	3	4
Carefree	0	1	2	3	4
Terrified	0	1	2	3	4
Guilty	0	1	2	3	4
Vigorous	0	1	2	3	4
Uncertain about things	0	1	2	3	4
Bushed	0	1	2	3	4

MAKE SURE YOU HAVE ANSWERED EVERY ITEM

JOB INFORMATION

1. How long have you worked for your present employer? ____/____
   Yrs/Mos

2. What is your title? _____

3. Please describe your duties: _____

   _____

   _____

4. Which of the following statements best describes your work schedule:

   I work day shift only 1
   I work afternoon shift only 2
   I work night shift only 3
   I rotate shifts: days/afternoons 4
   I rotate shifts: days/nights 5
   I rotate shifts: afternoons/nights 6
   I rotate shifts: days/nights/afternoons. . 7
   I rotate shifts: days/afternoons/nights. . 8
   Other: _____ 9
   (Please specify)

5. How long have you worked the scheduled you circled above? ____/____
   Yrs/Mos

6. Have you worked any shift schedules in the past 5 years other than the one you circled above? (See 4 above)

   Yes 1
   No 2

   A. IF "YES": Please indicate below what these work schedules were and the approximate dates that you worked them.

		From (Mo./Year)	To (Mo./Year)
1.	Fixed day shift	_____	_____
2.	Fixed afternoon shift	_____	_____
3.	Fixed night shift	_____	_____
4.	Rotating shift	_____	_____

7. If you had a choice, would you prefer to work days, afternoons, nights, or rotating shifts?

   Days 1
   Afternoons 2
   Nights 3
   Rotating shifts 4
   No preference 5

8. How far away from your job do you live? _____
   Miles

9. How long does it usually take you to get to work? _____
   Minutes

10. How long does it usually take you to get home after work? _____ Minutes

11. How do you usually get to and from work?

Ride with others in a carpool	1
Drive myself	2
Bus/train/subway	3
Bicycle	4
Walk	5
Other: _____ (Please specify	6

12. How many hours per week do you usually work at your regular job? _____ Hours
(DO NOT INCLUDE OVERTIME)

13. How much overtime per week do you usually work at your regular job? _____ Hours

14. How much overtime per week would you like to work at your regular job? _____ Hours

15. How many hours per week do you usually work on any other job?
(PLEASE WRITE "0" IF NO OTHER JOB). _____ Hours

16. Are you . . .

Married	1
Single	2
Separated	3
Divorced	4
Widowed	5

17. IF YOU ARE NOW MARRIED, is your husband/wife employed outside the home?

Yes	1
No	2
NOT MARRIED	3

A. IF "YES": How often does he/she work the same hours you do . . .

All the time	1
Quite often	2
Sometimes	3
Not very often	4
Never	5

B. IF "YES": Is his/her job . . .

Part-time	1
Full-time	2

18. IF YOU ARE NOW MARRIED, how does your husband/wife feel about your work schedule?

Likes it very much	1
Likes it somewhat	2
Dislikes it somewhat	3
Dislikes it very much	4
NOT MARRIED	5

19. IF YOU ARE NOW MARRIED, how often does your husband/wife complain to you about your work schedule?

Never	1
Occasionally	2
Frequently	3
Always	4
NOT MARRIED	5

20. IF YOU ROTATE SHIFTS, which shift are you now working?

Day shift	1
Afternoon shift	2
Night shift	3
DON'T ROTATE SHIFTS	4

A. IF YOU ROTATE SHIFTS, how long have you been on this shift? ____ Weeks ____ Days

21. IF YOU ROTATE SHIFTS, how often do you change shifts?

About every 1 or 2 days	1
About every week	2
About every 2 weeks	3
About every month	4
About every 3 months	5
DON'T ROTATE SHIFTS	6

SLEEP PATTERNS

1. How much sleep would you like to get every 24 hours? _____ Hours

2. About how much sleep do you actually get during every 24 hours? _____ Hours

3. How long does it usually take you to get to sleep? _____ Minutes

4. About how often do you awaken each time you sleep? (PLEASE WRITE "0" IF YOU DON'T AWAKEN DURING SLEEP) _____ Times

5. Which of the following statements best describes how you sleep?

   I sleep a few hours at a time 1
   I take naps in addition to a longer sleep. . 2
   I just sleep one time during 24 hours . . . 3
   I have a different pattern for each shift. . 4

6. How often do you usually wake up tired or sleepy?

   Not at all 1
   Occasionally 2
   Frequently 3
   Always 4

7. How often do you wake up after a few hours sleep and have trouble going back to sleep?

   Usually not at all 1
   Occasionally 2
   Frequently 3
   Always 4

8. About how often do you feel tired or sleepy at work?

   Never 1
   Less than once a month 2
   Once or twice a month 3
   Once a week 4
   2 or 3 times a week 5
   About every day 6

9. About how often do you feel tired or sleepy after completing your work?

   Never 1
   Less than once a month 2
   Once or twice a month 3
   Once a week 4
   2 or 3 times a week 5
   About every day 6

10. About how often do you take pills or medication in order to go to sleep?

    Never 1
    Occasionally 2
    Frequently 3
    Always 4

11. Do you have the kind of job that allows you to rest, relax or catch some sleep while at work?

Yes 1
No 2

12. How would you describe your sleep pattern in general?

Excellent 1
Good 2
Fair 3
Poor 4

13. IF YOU WORK ROTATING SHIFTS, how long does it usually take you to adjust to a new time to get to sleep?

I adjust right away 1
About a day 2
2 to 4 days 3
About a week 4
About 2 to 4 weeks 5
I never adjust 6
DON'T ROTATE SHIFTS 7

14. IF YOU WORK ROTATING SHIFTS, do you have more trouble sleeping when working one particular shift?

Yes, day shift 1
Yes, afternoon shift 2
Yes, night shift 3
No 4
DON'T ROTATE SHIFTS 5

15. IF YOU WORK ROTATING SHIFTS, do you take sleeping pills more often when working one particular shift?

Yes, day shift 1
Yes, afternoon shift 2
Yes, night shift 3
No 4
DON'T ROTATE SHIFTS 5

16. IF YOU WORK ROTATING SHIFTS, do you wake up tired or sleepy more often when working one particular shift?

Yes, day shift 1
Yes, afternoon shift 2
Yes, night shift 3
No 4
DON'T ROTATE SHIFTS 5

17. IF YOU WORK ROTATING SHIFTS, do you feel tired or sleepy more often when working one particular shift?

Yes, day shift 1
Yes, afternoon shift 2
Yes, night shift 3
No 4
DON'T ROTATE SHIFTS 5

LIFE STYLE

1. How often does each of these people go out of their way to do things to make life easier for you? (CIRCLE ONE NUMBER FOR EACH ITEM)

	Not at all	Seldom	Sometimes	Often	No such person(s)
a. Your immediate supervisor	1	2	3	4	5
b. Other people at work	1	2	3	4	5
c. Your spouse	1	2	3	4	5
d. Relatives and other freinds	1	2	3	4	5
e. Children	1	2	3	4	5

2. How often do you talk with the following people about your feelings toward work? (CIRCLE ONE NUMBER FOR EACH ITEM)

	Not at all	Seldom	Sometimes	Often	No such person(s)
a. Your immediate supervisor	1	2	3	4	5
b. Other people at work	1	2	3	4	5
c. Your spouse	1	2	3	4	5
d. Relatives and other friends	1	2	3	4	5
e. Children	1	2	3	4	5

3. How satisfied are you with the amount of time your work schedule allows you to: (CIRCLE ONE NUMBER FOR EACH ITEM)

	Very satisfied	Moderately satisfied	Slightly satisfied	Slightly dissatisfied	Moderately dissatisfied	Very dissatisfied	Am not interested in these activities
a. Engage in hobbies or fix things	1	2	3	4	5	6	7
b. Run errands, such as going to the bank, hardware store, or barber or beautician	1	2	3	4	5	6	7
c. Attend school or training classes	1	2	3	4	5	6	7
d. Attend union or professional meetings	1	2	3	4	5	6	7
e. Watch T.V. at home	1	2	3	4	5	6	7
f. Listen to music	1	2	3	4	5	6	7
g. Read	1	2	3	4	5	6	7

4. How satisfied are you with the amount of time your work schedule allows you to: (CIRCLE ONE NUMBER FOR EACH ITEM)

	Very satisfied	Moderately satisfied	Slightly satisfied	Slightly dissatisfied	Moderately dissatisfied	Very dissatisfied	Am not interested in these activities
a. Attend weddings, parties, and other social get-togethers	1	2	3	4	5	6	7
b. Participate in group sport activities such as joining a bowling or golf team	1	2	3	4	5	6	7
c. Participate in membership organizations such as the church, the P.T.A. or the Elks	1	2	3	4	5	6	7
d. Spend holidays and days off with relatives and friends	1	2	3	4	5	6	7

5. IF YOU ARE MARRIED, how satisfied are you with the amount of time your work schedule allows you to spend with your husband or wife in: (CIRCLE ONE NUMBER FOR EACH ITEM)

	Very satisfied	Moderately satisfied	Slightly satisfied	Slightly dissatisfied	Moderately dissatisfied	Very dissatisfied	Am not interested in these activities
a. Discussing family and personal problems	1	2	3	4	5	6	7
b. Working and helping around the house	1	2	3	4	5	6	7
c. Entertaining relatives and friends	1	2	3	4	5	6	7
d. Shopping and relaxing together	1	2	3	4	5	6	7
e. Going out together to movies, for dinner, etc.	1	2	3	4	5	6	7
f. Having sexual relations	1	2	3	4	5	6	7
g. Simply sleeping together	1	2	3	4	5	6	7

6. IF YOU HAVE CHILDREN, how satisfied are you with the amount of time your work schedule allows you to spend with them: (CIRCLE ONE NUMBER FOR EACH ITEM)

	Very satisfied	Moderately satisfied	Slightly satisfied	Slightly dissatisfied	Moderately dissatisfied	Very dissatisfied	Am not interested in these activities
a. Discussing their problems or talking about things that interest them	1	2	3	4	5	6	7
b. Relaxing together by watching T.V. or working on a project	1	2	3	4	5	6	7
c. Attending P.T.A. meetings, Boy Scout groups, ball games, school plays, etc.	1	2	3	4	5	6	7
d. Attending church or other family social activities	1	2	3	4	5	6	7

7. IF YOU HAVE CHILDREN under 18 years of age, who has the major responsibility for disciplining your children, checking on their school work, handling their personal problems, etc?

My spouse has all the responsibility 1
My spouse has most of the responsibility. 2
We share the responsibility about equally 3
I have most of the responsibility 4
I have all of the responsibility 5
I HAVE NO CHILDREN 6

A. How satisfied are you with this arrangement?

Very satisfied 1
Moderately satisfied 2
Slightly satisfied 3
Slightly dissatisfied 4
Moderately dissatisfied 5
Very dissatisfied 6
NOT APPLICABLE 7

8. In general, how do you feel about your work hours or work schedule?

Very satisfied 1
Moderately satisfied. 2
Slightly satisfied 3
Slightly dissatisfied 4
Moderately dissatisfied 5
Very dissatisfied 6

9. In general, how does your family (or the people you live with) feel about your work hours or work schedule?

Very satisfied 1
Moderately satisfied 2
Slightly satisfied 3
Slightly dissatisfied 4
Moderately dissatisfied 5
Very dissatisfied 6
I LIVE ALONE 7

9A. How many of your friends work the same kind of schedule as yourself?

All of them do 1
Most of them do 2
Some of them do 3
None of them do 4

9B. How many of your neighbors work the same kind of schedule as yourself?

All of them do 1
Most of them do 2
Some of them do 3
None of them do 4

10. How do you feel about the kind of work you do at your job?

Very satisfied	1
Moderately satisfied	2
Slightly satisfied	3
Slightly dissatisfied	4
Moderately dissatisfied	5
Very dissatisfied	6

11. How good a worker do you think you are?

I am an excellent worker	1
I am a good worker	2
I am a fair worker	3
I am a poor worker	4

12. How do you feel about most of the people you work with?

I like them very much	1
I like them a little	2
I dislike them a little	3
I dislike them very much	4

13. Does your work schedule interfere with your sexual activities?

Most of the time	1
Often	2
Sometimes	3
Rarely	4

EATING PATTERNS

1. Which of the following statements best describes your eating pattern?

   Light meal in morning, lunch mid-way, large meal in evening 1
   Light meal in morning, large meal mid-way, light meal in evening . . 2
   Large meal in morning, light meal mid-way, light meal in evening. . . 3
   Different pattern for each shift 4
   Other: _____ 5
   (Please specify)

2. How many meals do you think you need to eat in 24 hours? _____
   (Meals)

3. How would you describe your usual appetite?

   Excellent 1
   Good 2
   Fair 3
   Poor 4

4. How often do you eat snacks?

   Never 1
   Several times a month 2
   Several times a week 3
   About one time a day 4
   Several times a day 5

5. How many meals a week do you usually eat with family (or friends)? _____
   (Number)

6. How satisfied are you with your eating habits and overall eating pattern?

   Very satisfied 1
   Moderately satisfied 2
   Slightly satisfied 3
   Slightly dissatisfied 4
   Moderately dissatisfied 5
   Very dissatisfied 6

7. IF YOU WORK ROTATING SHIFTS, do you snack more often when working one particular shift?

   Yes, day shift 1
   Yes, afternoon shift 2
   Yes, night shift 3
   No 4
   DON'T ROTATE SHIFTS 5
   Other: _____ 6
   (Please specify)

8. IF YOU ROTATE SHIFTS, do you ever find that your appetite is worse when working any one particular shift?

   Yes, day shift 1
   Yes, afternoon shift 2
   Yes, night shift 3
   No 4
   DON'T ROTATE SHIFTS 5

9. IF YOU WORK ROTATING SHIFTS, how long does it take you to get used to new meal times?

I adjust right away	1
About a day	2
2 to 4 days	3
About a week	4
About 2 to 4 weeks	5
I never adjust	6
DON'T ROTATE SHIFTS	7

GENERAL INFORMATION

HERE ARE SOME QUESTIONS REGARDING THE WAY YOU BEHAVE, FEEL AND ACT. PLEASE CIRCLE YES OR NO FOR EACH STATEMENT. WORK QUICKLY, AND DON'T SPEND TOO MUCH TIME OVER ANY QUESTION; WE WANT YOUR FIRST REACTION, NOT A LONG DRAWN-OUT THOUGHT PROCESS.

1. Do you like plenty of excitement and bustle around you? Yes No
2. Have you often got a restless feeling that you want something but do not know what? Yes No
3. Do you nearly always have a "ready answer" when people talk to you? Yes No
4. Do you sometimes feel happy, sometimes sad, without any real reason? Yes No
5. Do you usually stay in the background at parties and "get-togethers"? Yes No
6. As a child did you always do as you were told immediately and without grumbling... Yes No
7. Do you sometimes sulk? Yes No
8. When you are drawn into a quarrel, do you prefer to "have it out" to being silent hoping things will blow over? Yes No
9. Are you moody? Yes No
10. Do you like mixing with people? Yes No
11. Have you often lost sleep over your worries? Yes No
12. Do you sometimes get cross? Yes No
13. Would you call yourself happy-go-lucky? Yes No
14. Do you often make up your mind too late? Yes No
15. Do you like working alone? Yes No
16. Have you often felt listless and tired for no good reason? Yes No
17. Are you rather lively? Yes No
18. Do you sometimes laugh at a dirty joke? Yes No
19. Do you often feel "fed-up"? Yes No
20. Do you feel uncomfortable in anything but everyday clothes? Yes No
21. Does your mind often wander when you are trying to attend closely to something? Yes No
22. Can you put your thoughts into words quickly? Yes No
23. Are you often "lost in thought"? Yes No
24. Are you completely free from prejudices of any kind? Yes No
25. Do you like practical jokes? Yes No
26. Do you often think of your past? Yes No
27. Do you very much like good food? Yes No
28. When you get annoyed do you need someone friendly to talk to about it? Yes No
29. Do you mind selling things or asking people for money for some good cause? Yes No
30. Do you sometimes boast a little? Yes No
31. Are you touchy about some things? Yes No
32. Would you rather be at home on your own than go to a boring party? Yes No
33. Do you sometimes get so restless that you cannot sit long in a chair? Yes No
34. Do you like planning things carefully, well ahead of time? Yes No
35. Do you have dizzy spells? Yes No
36. Do you always answer a personal letter as soon as you can after you have read it? Yes No
37. Can you usually do things better by figuring them out alone than by talking to others about it? Yes No
38. Do you ever get short of breath without having done heavy work? Yes No
39. Are you an easy-going person, not generally bothered about having everything "just-so"? Yes No
40. Do you suffer from "nerves"? Yes No
41. Would you rather plan things than do things? Yes No
42. Do you sometimes put off until tomorrow what you ought to do today? Yes No
43. Do you get nervous in places like elevators, trains or tunnels? Yes No
44. When you make new friends, is it usually you who makes the first move, or does the inviting? Yes No
45. Do you get very bad headaches? Yes No
46. Do you generally feel that things will sort themselves out and come right in the end somehow? Yes No
47. Do you find it hard to fall asleep at bedtime? Yes No
48. Have you sometimes told lies in your life? Yes No
49. Do you sometimes say the first thing that comes into your head? Yes No
50. Do you worry too long after an embarrassing experience? Yes No
51. Do you usually keep "yourself to yourself" except with very close friends? Yes No
52. Do you often get into a jam because you do things without thinking? Yes No
53. Do you like cracking jokes and telling funny stories to your friends? Yes No
54. Would you rather win, than lose a game? Yes No
55. Do you often feel self-conscious when you are with superiors? Yes No
56. When the odds are against you, do you still usually think it worth taking a chance? Yes No
57. Do you often get "butterflies in your stomach" before an important occasion? Yes No

BACKGROUND INFORMATION

1. What is your sex?

Male	1
Female	2

2. What is your ethnic background?

American Indian or Alaskan Native	1
Asian or Pacific Islander	2
Black, not of Hispanic Origin	3
Hispanic	4
White, not of Hispanic Origin	5

3. What was the highest grade you completed in school?

No schooling	01
1st-6th grade	02
7th-8th grade	03
9th-11th grade	04
High school degree	05
Vocational, business, or technical school	06
Some college	07
Junior college degree	08
Bachelor's degree	09
Graduate degree	10
Other _____ (Please specify such degrees as RN, LPN, LVN, etc.)	11

4. How old were you on your last birthday? _____ Age

5. How tall are you? ___/___ Ft/In

6. How much do you weigh? _____ Lbs

7. Including yourself, how many people living in your household are . . .

   A. Under 13 years of age? _____

   B. Between 13 and 17? _____

   C. 18 years or older? _____

8. What was your total family income last year? Include income from all sources — wages, salaries of all family members, stocks, pensions, disability, etc.

Less than $2,000	1
$2,000 to $3,999	2
$4,000 to $5,999	3
$6,000 to $7,999	4
$8,000 to $9,999	5
$10,000 to $11,999	6
$12,000 to $13,999	7
$14,000 to $15,999	8
$16,000 to $17,999	9
$18,000 to $19,999	10
$20,000 to $21,999	11
$22,000 or more	12

9. How much did you personally make last year?

Less than $2,000	1
$2,000 to $3,999	2
$4,000 to $5,999	3
$6,000 to $7,999	4
$8,000 to $9,999	5
$10,000 to $11,999	6
$12,000 to $13,999	7
$14,000 to $15,999	8
$16,000 to $17,999	9
$18,000 to $19,999	10
$20,000 to $21,999	11
$22,000 or more	12

10. What do you like best about your work schedule?

11. What do you like least about your work schedule?

12. Do you have any additional comments? (Feel free to use the back of this page if you need more space.)

Appendix B

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS FOR QUESTIONNAIRE ITEMS

Appendix B

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS FOR QUESTIONNAIRE ITEMS

Tables B-1 through B-9 present means, standard deviations, and other statistical information for the food processor population. Parallel data for the same categories of variables appear in Tables B-11 to B-19 for the nurse sample. (In order to have comparable data in Tables 1 and 11, 2 and 12, 3 and 13, etc. there is no Table 10.)

Asterisks denote variables that were found to be significant to both populations.

Table B-1

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR HEALTH INFORMATION VARIABLES OF ALL SHIFTS

(Food Processors)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
HI-2 During past 6 months been hospitalized	$\bar{x}$	.14	.11	.06	.08	3.875	3 & 23	.05	1 > 3,4
	SD	.03	.31	.24	.27				
HI-4(a) Aspirin or headache medicine	$\bar{x}$	1.90	2.10	2.16	2.04	3.859	2 & 74	.05	2,3 > 1
	SD	.89	1.02	1.08	.98				
HI-4(b) Aids for stomach or digestion	$\bar{x}$	1.38	1.33	1.47	1.62	3.844	4 & 60	.01	4 > 1,2
	SD	.84	.76	.95	1.04				
HI-4(e) Pep Medicine	$\bar{x}$	1.05	1.04	1.17	1.10	3.829	2 & 78	.05	3 > 1,2
	SD	.35	.25	.61	.52				
HI-5(28) Acid indigestion,etc	$\bar{x}$	1.56	1.68	1.68	1.83	5.82	3 & 864	.001	4 > 2,3,1
	SD	.61	.69	.75	.81				
*HI-5(31) Nausea or Vomiting	$\bar{x}$	1.22	1.27	1.19	1.13	4.01	3 & 868	.01	2,1 > 4
	SD	.44	.49	.45	.34				
*HI-5(33) Constipation	$\bar{x}$	1.09	1.11	1.02	1.12	3.691	3 & 872	.05	4,2,1 > 3
	SD	.33	.39	.15	.43				
HI-5(34) Tight Feeling in Stomach	$\bar{x}$	1.24	1.39	1.27	1.32	3.146	3 & 866	.05	2 > 3,1
	SD	.48	.59	.48	.60				
HI-7(17) Thyroid or Goiter	$\bar{x}$	1.06	1.03	1.03	1.01	3.873	3 & 02	.05	1 > 4
	SD	.23	.17	.16	.10				
*HI-10B Past 6 months Irregular Periods	$\bar{x}$	1.346	1.437	1.181	1.238	4.991	3 & 281	.01	2,1 > 4,3; 4 > 3
	SD	.48	.50	.39	.43				
*HI-14A Bottles of Beer Consumed	$\bar{x}$	1.974	2.449	2.449	1.856	2.617	3 & 559	.05	2,3 > 4
	SD	2.36	2.62	2.76	1.91				

Table B-2

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR MOOD SCALE VARIABLES OF ALL SHIFTS

(Food Processors)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
*MS-20 Depression	$\bar{x}$	21.65	24.05	21.71	21.56	3.876	3 & 98	.008	2>4,1,3
	SD	8.04	10.50	7.79	7.52				
*MS-20 Confusion	$\bar{x}$	11.93	13.09	12.17	12.33	3.875	2 & 96	.05	2 >1,3,4
	SD	3.90	4.24	3.87	4.19				
MS-20 Anger-Hostility	$\bar{x}$	18.48	20.65	19.46	19.53	3.874	2 & 86	.05	2 >1,3,4
	SD	6.91	8.03	7.47	7.58				

Table B-3

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR JOB INFORMATION VARIABLES OF ALL SHIFTS

(Food Processors)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
JI-1 Length of Time with current employer	$\bar{x}$	11.98	6.21	5.68	8.63	3.881	33 & 70	.001	1 > 4 > 2,3
	SD	8.06	5.90	5.80	8.02				
*JI-5 Time on Current Shift	$\bar{x}$	78.83	47.07	47.63	94.21	3.865	21 & 55	.001	4 > 1 > 2,3
	SD	73.45	57.39	50.22	96.46				
JI-6 In past 5 years worked other shifts	$\bar{x}$	.57	.67	.67	.34	3.864	25 & 12	.001	2,3 > 1 > 4
	SD	.50	.47	.47	.47				
*JI-7(1) Prefer Day Shift	$\bar{x}$	.92	.49	.51	.84	3.847	60 & 09	.001	1 > 4 > 2,3
	SD	.27	.50	.50	.32				
*JI-7(2) Prefer Aft/Eve Shift	$\bar{x}$	.05	.47	.07	.10	3.847	69 & 27	.001	2 > 1,3,4
	SD	.22	.50	.26	.30				
*JI-7(3) Prefer Night Shift	$\bar{x}$	.03	.03	.39	.03	3.847	87 & 80	.001	3 > 4,1,2
	SD	.16	.17	.49	.16				
*JI-7(4) Prefer Rotating Shifts	$\bar{x}$	0	.01	.02	.03	3.847	3 & 48	.05	4 > 1,2
	SD	0	.08	.15	.18				
JI-9 Time (mins) to get to work	$\bar{x}$	16.18	17.92	15.44	13.35	3.880	10 & 54	.001	2 > 1; 3 > 4
	SD	8.41	10.58	7.91	8.62				
*JI-10Time (mins) to get home from work	$\bar{x}$	18.16	22.26	16.82	14.13	3.881	9 & 93	.001	2 > 1,3,4
	SD	9.23	30.00	9.38	9.20				
JI-11(1) Carpool to Work	$\bar{x}$	.09	.06	.07	.03	3.844	2 & 89	.05	1 > 2,3,4
	SD	.29	.24	.25	.17				
JI-11(4) Bicycle to Work	$\bar{x}$	0	0	0	.06	3.844	12 & 89	.001	4 > 1,2,3
	SD	0	0	0	.24				

Table B-3 (Concluded)

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR JOB INFORMATION VARIABLES OF ALL SHIFTS

(Food Processors)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
*JI-17A Same Shift as Spouse	$\bar{x}$	1.88	3.31	3.90	3.27	3.387	35 & 59	.001	3 >4; 2 >1
	SD	1.39	1.75	1.64	1.17				
JI-17B Spouse work Part-time/Full-time	$\bar{x}$	1.84	1.89	1.89	1.68	3.357	6 & 43	.001	1,3,2 >4
	SD	.37	.31	.31	.47				
*JI-18 Spouse Attitude on Work Hours	$\bar{x}$	1.51	2.27	2.60	2.97	3.653	98 & 04	.001	4 >3 >2 >1
	SD	.74	.95	1.02	.89				
*JI-19 How often Spouse complains about work hours	$\bar{x}$	1.47	1.74	1.77	2.17	3.659	33 & 56	.001	4 >2; 3 >1
	SD	.59	.69	.78	.81				

Table B-4

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS FOR SLEEP PATTERNS VARIABLES OF ALL SHIFTS

(Food Processors)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
SP-1 Amount of Sleep Desired	$\bar{x}$	7.93	8.17	7.86	7.91	3.876	3 & 65	.05	2 > 1,4,3
	SD	.86	1.19	1.06	.85				
*SP-2 Actual Sleep you got	$\bar{x}$	7.93	8.17	7.86	7.91	3.876	3 & 65	.05	2 > 1; 4 > 3
	SD	.86	1.19	1.06	.85				
*SP-3 How long to get to Sleep	$\bar{x}$	13.828	18.849	16.080	20.229	7.895	3 & 851	.001	4 > 3,1; 2 > 1
	SD	10.94	17.92	13.08	18.83				
*SP-4 How often awake each time you Sleep	$\bar{x}$	1.204	1.177	1.702	1.556	6.324	3 & 846	.001	3,4 > 1,2
	SD	1.29	1.42	1.55	1.51				
*SP-6 Wake up Tired or Sleepy	$\bar{x}$	2.184	2.350	2.411	2.362	4.58	3 & 878	.003	3,4,2 > 1
	SD	.67	.68	.73	.68				
*SP-7 How often wake up after few hours & have trouble falling asleep again	$\bar{x}$	1.558	1.538	1.972	1.862	16.892	3 & 878	.001	3,4 > 1,2
	SD	.68	.66	.88	.79				
*SP-8 How often feel Sleepy/Tired at work	$\bar{x}$	3.59	3.75	4.15	3.82	3.873	5 & 82	.001	3 > 1,2,4
	SD	1.42	1.43	1.17	1.45				
*SP-9 How often feel Sleepy/Tired after work	$\bar{x}$	3.97	4.10	4.79	4.23	3.871	10 & 98	.001	3 > 4,2,1
	SD	1.56	1.63	1.39	1.47				
SP-10 How often take medication to sleep	$\bar{x}$	1.109	1.100	1.088	1.189	3.616	3 & 879	.05	4 > 1,2,3
	SD	.36	.37	.30	.44				
*SP-12 Describe your sleep pattern	$\bar{x}$	2.114	2.177	2.711	2.533	25.005	3 & 874	.001	3 > 4 > 2,1
	SD	.81	.77	.89	.81				

Table B-5

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR LIFE STYLE VARIABLES OF ALL SHIFTS

(Food Processors)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
*LS-3 Satisfied with after work hours for personal activities	$\bar{x}$	2.26	2.88	2.56	2.67	3.875	11 & 31	.001	2,4,3 >1; 2 > 3
	SD	1.06	1.21	1.15	1.11				
*LS-4 Satisfied with after work hours for social activities	$\bar{x}$	2.15	3.17	2.87	3.22	3.875	29 & 79	.001	2,4 >3 >1
	SD	1.21	1.49	1.43	1.48				
*LS-5 Satisfied with after work hours for time with spouse	$\bar{x}$	2.14	2.84	2.99	3.07	3.668	20 & 45	.001	4,3,2 >1
	SD	1.12	1.36	1.35	1.39				
*LS-6 Satisfied with after work hours for children	$\bar{x}$	2.23	3.62	2.89	3.30	3.617	25 & 36	.001	2,4 > 3 >1
	SD	1.26	1.62	1.61	1.52				
*LS-7 Child rearing responsibilities	$\bar{x}$	3.08	3.00	3.24	2.78	3.526	5 & 76	.001	3 > 4
	SD	.86	.95	1.11	.94				
LS-7A How satisfied with arrangement	$\bar{x}$	1.89	2.35	2.54	2.38	3.549	4 & 37	.01	3,4,2 >1
	SD	1.32	1.72	1.71	1.55				
*LS-8 Feelings about work hours	$\bar{x}$	1.98	2.78	2.84	3.43	3.853	36 & 33	.001	4 >3,2 1
	SD	1.28	1.64	1.67	1.64				
*LS-9 Family like work schedule	$\bar{x}$	2.07	3.02	3.30	3.75	3.808	49 & 73	.001	4 >3; 2 >1
	SD	1.34	1.65	1.59	1.61				
*LS-9A How many Friends have same work schedule	$\bar{x}$	2.36	2.93	3.07	2.92	3.856	41 & 52	.001	3,2,4 >1; 3 > 4
	SD	.77	.69	.79	.66				
*LS-9B How many Neighbors have same work schedule	$\bar{x}$	2.73	3.51	3.65	3.50	3.842	82 & 04	.001	3,2 >4,1; 4 >1
	SD	.92	.54	.57	.59				
*LS-13 Work hours interfere with sexual activities	$\bar{x}$	3.56	3.31	2.65	2.86	3.830	39 & 55	.001	1 >2 > 4,3
	SD	.79	.87	1.14	.96				

Table B-6

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR EATING PATTERNS VARIABLES OF ALL SHIFTS

(Food Processors)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
*EP-1(1) Light in AM, lunch mid-way, Large evening	$\bar{x}$	.67	.18	.30	.20	3.877	63 & 82	.001	1 > 3 > 2,4
	SD	.47	.39	.46	.40				
*EP-1(2) Light in AM, Large mid-way, Light in evening	$\bar{x}$	.03	.36	.13	.05	3.877	47 & 5	.001	2 > 3 > 1,4
	SD	.17	.48	.34	.22				
*EP-1(3) Large in AM, Light mid-way, Light in evening	$\bar{x}$	.04	.09	.09	.02	3.877	4 & 89	.01	2,3 > 4,1
	SD	.20	.29	.29	.16				
*EP-1(4) Different pattern each shift	$\bar{x}$	.04	.04	.07	.64	3.877	211 & 95	.001	4 > 1,2,3
	SD	.19	.21	.26	.48				
*EP-1(5) Misc.	$\bar{x}$	.22	.33	.40	.08	3.877	27 & 22	.001	2,3 > 1 > 4
	SD	.41	.47	.49	.27				
*EP-3 Appetite	$\bar{x}$	1.648	1.850	1.812	1.897	6.055	3 & 875	.001	4,2,3 > 1
	SD	.63	.72	.67	.72				
*EP-6 How satisfied with eating habits	$\bar{x}$	2.16	2.67	2.75	2.70	3.876	8 & 84	.001	3,4,2 > 1
	SD	1.27	1.39	1.53	1.39				

Table B-7

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR GENERAL INFORMATION VARIABLES OF ALL SHIFTS

(Food Processors)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
GI-9 Moody	$\bar{x}$	1.567	1.424	1.435	1.452	3.875	3 & 912	.01	1 > 4,3,2
	SD	.50	.50	.50	.50				
GI-33 Restlessness	$\bar{x}$	1.426	1.394	1.338	1.315	3.878	2 & 675	.05	1 > 4
	SD	.50	.49	.47	.46				
GI-47 Difficulty falling asleep	$\bar{x}$	1.881	1.736	1.761	1.752	3.874	6 & 14	.001	1 > 3,4,2
	SD	.32	.44	.43	.43				

Table B-8

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS FOR BACKGROUND INFORMATION VARIABLES OF ALL SHIFTS

(Food Processors)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
BI-1 What is your sex	$\bar{x}$	1.40	1.48	1.52	1.18	3.878	26 & 49	.001	1,2,3 > 4; 3 1
	SD	.49	.50	.50	.38				
*BI-4 Age	$\bar{x}$	41.22	33.83	35.20	36.25	3.877	15 & 89	.001	1 > 4,3,2; 4,3 > 2
	SD	12.11	11.97	12.17	11.50				
BI-5 Height	$\bar{x}$	67.64	67.02	67.11	68.87	3.875	12 & 48	.001	4 > 2,3,1
	SD	3.58	4.21	4.06	3.33				
*BI-6 Weight	$\bar{x}$	167.44	156.88	157.87	169.95	3.875	7 & 34	.001	4,1 > 2,3
	SD	40.91	34.31	37.86	31.54				
*BI-7B Between 13 and 17	$\bar{x}$	.44	.36	.65	.38	3.879	4 & 25	.01	3 > 2,4,1
	SD	.78	.75	1.19	.78				
*BI-9 Personal Income	$\bar{x}$	7.36	6.31	6.25	7.55	3.869	12 & 80	.001	4,1 > 2,3
	SD	2.65	2.75	3.02	2.77				

Table B-9

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR INCIDENCE AND SEVERITY OF MEDICATION USE AND PHYSICAL COMPLAINTS
AND FOR INCIDENCE OF ILLNESSES FOR ALL SHIFTS

(Food Processors)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
HI-4(b) Aids for stomach or digestion	$\bar{x}$	.24	.21	.25	.34	3.844	3 & 94	.01	4 > 1,2,3
	SD	.43	.41	.44	.48				
*HI 4(e) Pep Medicine	$\bar{x}$	.03	.03	.09	.05	3.829	3 & 26	.05	3 > 1,2,4
	SD	.61	.17	.29	.21				
HI-5(7) Wheezing in Chest	$\bar{x}$	.22	.22	.14	.26	3.871	3 & 1	.05	4 > 3
	SD	.41	.41	.35	.44				
HI-5(15) Ringing or buzzing in Ears	$\bar{x}$	.32	.44	.35	.43	3.869	3 & 81	.01	2,4 > 1
	SD	.47	.50	.48	.50				
*HI-5(17) Fainting Spells, Dizziness	$\bar{x}$	.16	.24	.15	.13	3.870	3 & 44	.05	2 > 1,3,4
	SD	.36	.43	.36	.34				
*HI-5(18) Nervous Shaking	$\bar{x}$	.33	.44	.38	.32	3.869	2 & 66	.05	2 > 1,4
	SD	.47	.50	.49	.47				
HI-5(25) "Racing" or pounding Heart	$\bar{x}$	.27	.37	.28	.22	3.871	4 & 40	.01	2 > 1,4,3
	SD	.44	.48	.45	.41				
HI-5(28) Acid indigestion, etc.	$\bar{x}$	2.14	2.20	2.26	2.35	3.482	4 & 44	.01	4 > 1,2
	SD	.35	.47	.55	.59				
*HI-5(31) Nausea or Vomiting	$\bar{x}$	.21	.26	.18	.13	3.868	3 & 90	.01	1,2 > 4
	SD	.41	.44	.39	.34				
*HI-5(33) Constipation	$\bar{x}$	.09	.11	.02	.09	3.872	3 & 47	.05	1,4,2 > 3
	SD	.29	.31	.15	.29				
HI-5(41) Stomach Pains	$\bar{x}$	.31	.46	.36	.36	3.867	3 & 4	.05	2 > 1,4,3
	SD	.46	.50	.48	.48				

Table B-9 (Concluded)

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR INCIDENCE AND SEVERITY OF MEDICATION USE AND PHYSICAL COMPLAINTS
AND FOR INCIDENCE OF ILLNESSES FOR ALL SHIFTS

(Food Processors)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
HI-7(17) Thyroid trouble or Goiter	$\bar{x}$	.06	.03	.03	.01	3.873	3 & 02	.05	1 > 4
	SD	.23	.17	.16	.01				
HI-10B Past 6 months Irregular Periods	$\bar{x}$	.64	.56	.85	.73	3.281	6 & 16	.001	3 > 1,2; 4 > 2
	SD	.48	.50	.36	.45				
HI-10D During Period feel same as other times	$\bar{x}$	.10	.19	.21	.07	3.881	9 & 68	.001	2,3 > 1,4
	SD	.30	.39	.41	.25				
HI-10D No longer have Periods	$\bar{x}$	.11	.07	.13	.03	3.881	6 & 66	.001	1,3 > 4
	SD	.32	.26	.33	.17				
HI-10D Feel tense and nervous during Period	$\bar{x}$	.12	.17	.15	.06	3.881	4 & 89	.01	1,3,2 > 4
	SD	.33	.37	.36	.24				
HI-13B(1) Drink before going to work	$\bar{x}$	0	.08	.13	.04	3.881	11 & 87	.001	3 > 2; 4 > 1
	SD	0	.27	.33	.20				
HI-15 Amt of drinking changed lately	$\bar{x}$	-.12	-.24	-.31	-.13	3.586	4 & 31	.01	4,1 > 3
	SD	.55	.55	.54	.50				

Table B-11

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS FOR HEALTH INFORMATION VARIABLES OF ALL SHIFTS

(Nurses)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
HI-5(2) Colds, Sore Throats	$\bar{x}$	1.65	1.70	1.64	1.78	3.1033	3 & 91	.01	4 > 1,3
	SD	.56	.59	.55	.61				
HI-5(17) Fainting Spells, Dizziness	$\bar{x}$	1.12	1.14	1.11	1.20	3.1033	3 & 51	.05	4 > 1,3
	SD	.34	.36	.33	.44				
HI-5(23) Chest Pain	$\bar{x}$	1.06	1.05	1.05	1.10	3.1038	2 & 77	.05	4 > 2,3
	SD	.26	.24	.22	.33				
HI-5(26) Leg Cramps	$\bar{x}$	1.42	1.36	1.36	1.56	3.1037	9 & 40	.001	4 > 1,2,3
	SD	.57	.52	.50	.62				
HI-5(27) Fatigue or Exhaustion	$\bar{x}$	1.60	1.43	1.59	1.67	3.1035	6 & 97	.001	4,1,3 > 2
	SD	.66	.56	.67	.65				
*HI-5(31) Nausea or Vomiting	$\bar{x}$	1.31	1.40	1.34	1.42	3.1035	2 & 66	.05	4 > 1
	SD	.49	.50	.47	.52				
*HI-5(33) Constipation	$\bar{x}$	1.66	1.47	1.62	1.59	3.1040	3 & 00	.05	1,3,4 > 2
	SD	.77	.60	.74	.68				
HI-5(35) Bloated or Full Feeling	$\bar{x}$	1.66	1.53	1.51	1.65	3.1034	4 & 45	.05	1,4 > 2,3
	SD	.55	.56	.59	.62				
HI-5(43) Trouble Standing for Long Periods	$\bar{x}$	1.64	1.53	1.66	1.71	3.1035	2 & 71	.05	4 > 2
	SD	.74	.68	.74	.73				
HI-7(6) "High" Blood Pressure	$\bar{x}$	.07	.09	.08	.03	3.1039	3 & 77	.01	2,3 > 4
	SD	.26	.28	.27	.17				
HI-7(8) Arthritis	$\bar{x}$	.08	.06	.09	.04	3.1039	2 & 66	.05	3,1 > 4
	SD	.27	.24	.28	.19				
HI-8(3) Immediate Family have High Blood Pressure	$\bar{x}$	.55	.56	.48	.42	3.1036	5 & 52	.001	2,1 > 4
	SD	.50	.50	.50	.49				

Table B-11 (Concluded)

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR HEALTH INFORMATION VARIABLES OF ALL SHIFTS

(Nurses)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
HI-8(5) Immediate Family have Diabetes	$\bar{x}$	.19	.16	.23	.14	3.1030	3 & 16	.05	3 > 4
	SD	.39	.37	.42	.34				
HI-10A Past 6 months Painful Periods/ Cramps	$\bar{x}$	.45	.48	.47	.33	3.978	6 & 10	.001	2,3 > 4
	SD	.50	.50	.50	.47				
*HI-10B Past 6 months Irregular Periods	$\bar{x}$	.71	.67	.70	.60	3.970	2 & 94	.05	1,3 > 4
	SD	.46	.47	.46	.49				
HI-10C Necessary to lie down each month, if so, how many hours	$\bar{x}$	1.40	1.11	2.49	2.02	3.828	4 & 18	.01	4,3 > 2; 3 > 1
	SD	3.18	2.76	6.04	3.36				
HI-10D Tense, Nervous	$\bar{x}$	.36	.34	.31	.46	3.1045	6 & 10	.001	4 > 1,2,3
	SD	.48	.47	.46	.50				
HI-10D Weak, Sick	$\bar{x}$	.16	.18	.18	.28	3.1045	5 & 48	.001	4 > 2,3,1
	SD	.37	.38	.38	.45				
HI-10D No longer have periods	$\bar{x}$	.14	.11	.15	.03	3.1045	12 & 00	.001	3,1,2 > 4
	SD	.34	.32	.36	.17				
HI-13 Days drink alcoholic beverage	$\bar{x}$	1.20	1.31	.76	1.06	3.989	4 & 17	.01	2,1,4 > 3
	SD	1.69	2.02	1.25	1.45				
HI-13A Drink on Work Days	$\bar{x}$	.75	.61	.40	.72	3.805	18 & 71	.001	1,4 > 2,3; 2 > 3
	SD	.44	.49	.49	.45				
HI-13B Drink Before Going to Work	$\bar{x}$	.01	.03	.14	.03	3.1045	16 & 52	.001	3 > 4,2,1
	SD	.07	.17	.34	.17				
*HI-14A Bottles of Beer Consumed	$\bar{x}$	.57	1.01	.75	1.09	3.478	3 & 97	.05	4 > 3,1; 2 > 1
	SD	1.07	1.18	1.31	1.35				
HI-14C Shots of Liquor Consumed	$\bar{x}$	1.18	.97	.91	1.23	3.563	2 & 81	.05	4 > 3
	SD	1.10	1.10	1.16	1.10				

Table B-12

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS FOR MOOD SCALE VARIABLES OF ALL SHIFTS

(Nurses)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
*MS-20 Depression	$\bar{x}$	21.03	21.40	21.15	22.60	3.1044	3 & 08	.05	4 > 3,1
	SD	7.33	7.59	7.06	7.62				
*MS-20 Confusion	$\bar{x}$	11.48	11.68	11.15	12.36	3.1043	6 & 66	.001	4 > 2,1,3
	SD	3.40	3.61	2.99	3.70				
MS-20 Vigor	$\bar{x}$	25.85	26.26	25.33	24.27	3.1045	6 & 52	.001	2,1,3 > 4
	SD	5.88	5.97	5.77	6.17				
MS-20 Tension,Anxiety	$\bar{x}$	16.77	15.98	15.68	17.12	3.1045	4 & 56	.05	4 > 2,3
	SD	5.71	5.02	4.90	5.28				
MS-20 Fatigue	$\bar{x}$	14.22	12.88	14.09	15.55	3.1044	10 & 48	.001	4 > 1,3; 3 > 2
	SD	5.89	5.35	5.77	6.22				

Table B-13

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR JOB INFORMATION VARIABLES OF ALL SHIFTS

(Nurses)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
*JI-5 Time on Current Shift	$\bar{x}$	52.44	44.75	46.50	22.33	3.1025	21 & 72	.001	1,3,2 > 4
	SD	65.81	55.44	64.35	31.08				
*JI-7(1) Prefer Day Shift	$\bar{x}$	.92	.25	.40	.70	3.1018	98 & 87	.001	1>4>3>2
	SD	.27	.44	.49	.46				
*JI-7(2) Prefer Aft/Eve Shift	$\bar{x}$	.06	.70	.08	.09	3.1018	213 & 30	.001	2 > 1,3,4
	SD	.23	.46	.27	.28				
*JI-7(3) Prefer Night Shift	$\bar{x}$	.01	.00	.48	.02	3.1018	197 & 84	.001	3 > 1,2,4
	SD	.11	.07	.50	.13				
*JI-7(4) Prefer Rotating Shifts	$\bar{x}$	.01	.02	.04	.17	3.1018	27 & 05	.001	4 > 1,2,3
	SD	.07	.14	.19	.38				
*JI-10 Time it takes to get home from work (mins)	$\bar{x}$	27.34	17.99	22.38	25.45	3.1038	16 & 25	.001	1,4 > 3 > 2
	SD	15.17	10.36	17.38	15.78				
JI-11(5) Walk to Work	$\bar{x}$	.06	.05	.04	.13	3.906	6 & 49	.001	4 > 3,2,1
	SD	.23	.23	.21	.34				
JI-13 How much Overtime Worked (hours) each week	$\bar{x}$	2.29	1.08	1.22	2.65	3.1007	8 & 54	.001	4,1 > 3,2
	SD	4.86	1.68	2.11	5.55				
*JI-17A Same Shift as Spouse	$\bar{x}$	2.24	3.87	4.54	2.87	3.388	60 & 86	.001	3>2>4>1
	SD	1.44	1.52	1.10	.94				
*JI-18 Spouse Attitude on Work Hours	$\bar{x}$	1.73	2.25	2.61	2.74	3.418	26 & 91	.001	4,3 > 2 > 1
	SD	.77	.97	.96	.90				
*JI-19 How often Spouse complains about work hours	$\bar{x}$	1.56	1.63	1.81	1.99	3.419	10 & 18	.001	4,3,2 > 1; 4 > 2,3
	SD	.56	.69	.70	.68				

Table B-14

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR SLEEP PATTERNS VARIABLES OF ALL SHIFTS

(Nurses)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
*SP-2 Actual Sleep you get	$\bar{x}$	6.82	7.54	7.33	6.68	3.1034	52& 57	.001	4 > 3
	SD	.81	1,10	1,13	1,03				
*SP-3 How long to get to Sleep	$\bar{x}$	16.27	22.65	17.67	19.77	3.1014	4& 75	.05	2,4,3 > 1; 2 > 3
	SD	14.16	23.50	16.67	16.49				
*SP-4 How often awake each time you sleep	$\bar{x}$	1.11	.94	1,91	1.29	3.1014	21 &4	.001	3 > 4,1,2; 4 > 2
	SD	1.15	1.12	1.55	1.27				
*SP-6 Wake up Tired	$\bar{x}$	2.33	2.24	2.51	2.48	3.1035	9 &83	.001	4,3 > 1,2
	SD	,61	.64	,62	.62				
*SP-7 How often wake up after few hours & have trouble falling asleep again	$\bar{x}$	1.40	1.33	1.89	1.65	3.1039	28 &97	.001	3>4 > 1,2
	SD	.56	.53	.79	.73				
*SP-8 How often feel Sleepy/Tired at work	$\bar{x}$	3.40	3.07	3.96	3.93	3.1037	31 &15	.001	3 > 4,1,2
	SD	1.24	1.13	1.29	1.20				
*SP-9 How often feel Sleepy/Tired after work	$\bar{x}$	4.42	4.07	5.15	4.72	3.1040	27 &84	.001	3>4>1>2
	SD	1.32	1.40	0.12	1.20				
SP-11 Sleep,rest, relax at work	$\bar{x}$	1.91	1.90	1.78	1.94	3.1035	12 &44	.001	4,1,2 > 3
	SD	.29	.31	.42	,25				
*SP-12 Describe your sleep pattern	$\bar{x}$	1.93	1.87	2.61	2.29	3.1029	43 &72	.001	3>4 > 1,2
	SD	.71	.68	.79	.76				

Table B-15

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS FOR LIFE STYLE VARIABLES OF ALL SHIFTS

(Nurses)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
*LS-3 Satisfied with after work hours for personal activities	$\bar{x}$	2.373	2.518	2.556	2.814	3.1041	8 & 826	.001	4 > 3,2,1
	SD	1.06	1.10	1.11	1.08				
*LS-4 Satisfied with after work hours for social activities	$\bar{x}$	2.660	3.763	3.171	3.719	3.1039	29 & 511	.001	2,4 > 3 > 1
	SD	1.39	1.53	1.43	1.42				
*LS-5 Satisfied with after work hours for time with spouse	$\bar{x}$	2.317	2.953	3.349	3.355	3.433	15 & 42	.001	4,3 > 2 > 1
	SD	1.08	1.25	1.38	1.31				
*LS-6 Satisfied with after work hours for children	$\bar{x}$	2.63	2.79	2.64	3.35	3.248	3 & 77	.05	4 > 2,3,1
	SD	1.26	1.62	1.32	1.48				
*LS-7 Child rearing responsibilities	$\bar{x}$	3.85	3.32	3.67	3.77	3.209	2 & 96	.05	1,4,3 > 2
	SD	.87	.90	.91	.85				
*LS-8 Feelings about work hours	$\bar{x}$	2.18	2.54	2.61	3.32	3.944	30 & 59	.001	4> 3,2,1
	SD	1.23	1.50	1.50	1.49				
*LS-9 Family like work schedule	$\bar{x}$	2.42	2.94	3.29	3.48	3.763	18 & 91	.001	4,3,2 >1; 4 > 2
	SD	1.34	1.58	1.57	1.45				
*LS-9A How many Friends have same work schedule	$\bar{x}$	2.67	3.05	3.34	2.94	3.962	29 & 31	.001	3,2,4 > 1; 3 > 4
	SD	.76	.64	.66	.70				
*LS-9B How many Neighbors have same work schedule	$\bar{x}$	3.05	3.70	3.82	3.69	3.932	63 & 45	.001	3,2,4 >1; 3 > 4
	SD	.89	.46	.39	.56				
LS-11 Feeling about kind of work you do	$\bar{x}$	1.49	1.61	1.54	1.61	3.975	2 & 66	.05	2,4 > 1
	SD	.52	.50	.51	.52				
*LS-13 Work hours interfere with sexual activities	$\bar{x}$	3.50	3.22	2.92	3.09	3.914	13& 52	.001	1,2,4 > 3
	SD	.70	.87	1.06	.87				

Table B-16

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR EATING PATTERNS VARIABLES OF ALL SHIFTS

(Nurses)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
*EP-1 (1) Light in AM, Lunch mid-way, Large evening	$\bar{x}$	.59	.19	.20	.20	3.1012	43 & 21	.001	1> 2,3,4
	SD	.49	.40	.40	.40				
*EP-1(2) Light in AM, Large mid-way, Light in evening	$\bar{x}$	.07	.25	.04	.04	3.1012	31 & 70	.001	2 > 1,3,4
	SD	.26	.43	.20	.19				
*EP-1(3) Large in AM, Light mid-way, Light in evening	$\bar{x}$	.06	.09	.03	.02	3.1012	7 & 89	.001	2 > 3; 1 > 4
	SD	.22	.29	.17	.13				
*EP-1(4) Different pattern each shift	$\bar{x}$	.03	.02	.04	.64	3.1012	263&13	.001	4 > 2,1,3
	SD	.18	.15	.20	.48				
*EP-1(5) Misc.	$\bar{x}$	.24	.44	.69	.11	3.1012	100&51	.001	3>2>1>4
	SD	.43	.50	.46	.31				
EP-2 How many meals needed in 24 hours	$\bar{x}$	2.61	2.50	2.35	2.47	3.1029	4 & 59	.05	1,2,4 > 3; 1 > 4
	SD	.62	.71	.73	.71				
*EP-3 Appetite	$\bar{x}$	1.43	1.57	1.60	1.57	3.1036	2 & 64	.05	1> 2,4,3
	SD	.60	.62	.72	.66				
EP-4 Eat Snacks	$\bar{x}$	3.39	3.53	3.58	3.65	3.1031	2 & 80	.05	4 > 1
	SD	1.08	.97	1.10	1.03				
EP-5 Meals eaten in week with family/friends	$\bar{x}$	7.11	4.52	5.88	5.02	3.1013	10 & 18	.001	1>3>2,4
	SD	4.99	4.24	7.61	3.89				
*EP-6 How satisfied with eating habits	$\bar{x}$	3.10	2.73	3.06	3.30	3.1030	6 & 37	.001	4,1,3 > 2
	SD	1.66	1.54	1.69	1.56				

Table B-17

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS FOR GENERAL INFORMATION VARIABLES OF ALL SHIFTS

(Nurses)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
GI-Sociability Subscale	$\bar{x}$	7.00	6.82	6.81	6.94	3.1041	2& 9	.05	1> 2,3
	SD	.73	.77	.76	.81				
GI-Neuroticism Subscale	$\bar{x}$	37.63	37.36	37.50	36.22	3.1041	7& 05	.001	2,3,1> 4
	SD	4.71	4.32	4.60	4.41				

Table B-18

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR BACKGROUND INFORMATION VARIABLES OF ALL SHIFTS

(Nurses)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
*BI-4 Age	$\bar{x}$	34.21	32.07	33.70	27.35	3.1035	35 & 88	.001	1,2,3 > 4;
	SD	9.97	10.93	11.96	6.69				1 > 2
*BI-6 Weight	$\bar{x}$	139.48	133.67	138.12	132.15	3.1028	4 & 35	.05	1,3 > 4; 1 > 2
	SD	27.19	26.95	31.89	24.55				
BI-7A Under 13	$\bar{x}$	.33	.25	.48	.17	3.1028	4 & 35	.05	1,3 > 4;
	SD	.71	.65	.92	.50				3 > 1,2
*BI-7B Between 13 and 17	$\bar{x}$	.16	.11	.22	.10	3.1043	3 & 01	.05	3 > 2,4
	SD	.51	.43	.63	.41				
BI-8 Family Income	$\bar{x}$	9.21	8.19	8.34	8.11	3.988	6 & 73	.001	1 > 3,2,4
	SD	2.52	2.99	2.95	2.79				
*BI-9 Personal Income	$\bar{x}$	6.76	5.91	5.84	6.00	3.1024	9 & 38	.001	1 > 4,2,3
	SD	1.76	2.00	2.01	1.83				

Table B-19

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR INCIDENCE AND SEVERITY OF MEDICATION USE AND PHYSICAL COMPLAINTS
AND FOR INCIDENCE OF ILLNESSES FOR ALL SHIFTS

(Nurses)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
*HI-4E Pep Medicine	$\bar{x}$	.02	.01	.03	.05	3.991	3 & 12	.05	4 > 2
	SD	.13	.07	.17	.21				
*HI-5(17) Fainting Spells, Dizziness	$\bar{x}$	.11	.13	.11	.18	3.1033	3 & 27	.05	4 > 1,3
	SD	.31	.34	.31	.39				
*HI-5(18) Nervous Shaking	$\bar{x}$	.36	.30	.29	.40	3.1039	3 & 22	.05	4 > 2,3
	SD	.48	.46	.46	.49				
HI-5(19) Feel Sweaty or Trembly	$\bar{x}$	2.13	2.05	2.03	2.02	3.335	4 & 42	.01	1 > 4,3,2
	SD	.34	.22	.16	.14				
HI-5(23) Chest Pain	$\bar{x}$	.05	.05	.05	.10	3.1038	2 & 91	.05	4 > 2,3
	SD	.23	.21	.22	.30				
HI-5(26) Leg Cramps	$\bar{x}$	.38	.34	.35	.50	3.1037	7 & 55	.001	4 > 2,3,1
	SD	.49	.47	.48	.50				
HI-5(27) Fatigue or Exhaustion	$\bar{x}$	.50	.39	.49	.58	3.1035	6 & 63	.001	4 > 2,3; 1 > 2
	SD	.50	.49	.50	.49				
*HI-5(31) Nausea or Vomiting	$\bar{x}$	.30	.40	.34	.41	3.1035	2 & 62	.05	4 > 1
	SD	.46	.49	.48	.49				
*HI-5(33) Constipation	$\bar{x}$	2.32	2.11	2.28	2.19	3.495	3 & 64	.05	1 > 4,2; 3 > 2
	SD	.55	.35	.52	.46				
HI-5(35) Bloated or Full Feeling	$\bar{x}$	.62	.50	.46	.58	3.1034	4 & 77	.01	1,4 > 2,3
	SD	.49	.50	.50	.49				
HI-(38) Trouble Digesting Food	$\bar{x}$	.13	.13	.15	.20	3.1037	2 & 65	.05	4 > 2,1
	SD	.33	.34	.36	.40				

Table B-19 (Concluded)

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCE LEVELS
FOR INCIDENCE AND SEVERITY OF MEDICATION USE AND PHYSICAL COMPLAINTS
AND FOR INCIDENCE OF ILLNESSES FOR ALL SHIFTS

(Nurses)

		Day 1	Aft/Eve 2	Night 3	Rotators 4	F	df	p value	Duncan's (.05)
HI-5(40) Dryness in the Mouth	$\bar{x}$	2.03	2.04	2.21	2.17	3.224	2 & 86	.05	3> 2,1
	SD	.17	.21	.51	.38				
HI-5(43) Trouble Standing for Long Periods	$\bar{x}$	.51	.44	.52	.56	3.1035	2 & 62	.05	4 > 2
	SD	.50	.50	.50	.50				
HI-7(19) Gastritis	$\bar{x}$	.02	.07	.05	.08	3.1037	3 & 15	.05	2,4 > 1
	SD	.13	.26	.22	.27				

Appendix C

FORMATION OF THE ADAPTATION INDEX

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FORMATION OF THE ADAPTATION INDEX

The adaptation index, Z, was formed from subindices ZHI, ZEP, ZSP, ZLS, and ZSMS.

The subindex ZHI is a health adaptation subindex formed from questions HI-1 and HI-5. First, question HI-1 was normalized. Then question HI-5 was summed over the 43 possible body function disorders and normalized. Finally, ZHI was computed as

$$ZHI = ZHI + ZH5.$$

The subindex ZEP is an eating pattern adaptation subindex, formed from questions EP-3 and EP-6. First, questions EP-3 and EP-6 were normalized. Finally, ZEP was computed as

$$ZEP = EP3 + EP6.$$

The subindex ZSP is a sleeping pattern adaptation subindex formed from questions SP-8 and SP-12. Questions SP-8 and SP-12 were normalized and then ZSP was computed as

$$ZSP = SP8 + SP12.$$

The subindex ZLS is a life style adaptation subindex formed from questions LS-3, LS-4, LS-8, LS-10 and LS-13. First, the responses for LS-3 were summed. Then the responses for LS-4 were summed. Then each of the questions was normalized. Finally, ZLS was computed as

$$ZLS = LS3 + LS4 + LS8 = LS10 = LS13.$$

The subindex ZSMS is a psychological adaptation subindex (Mood Scale) formed from subindices SMS1 through SMS6. Each subindex, SMS1 through SMS6, was normalized. The ZSMS was computed as

$$ZSMS = SMS1 + SMS2 + SMS3 - SMS4 + SMS5 + SMS6.$$

In the computation of the index Z, each of the subindices ZHI, ZEP, ZSP, ZLS and ZSMS was normalized. Then Z was computed as

$$Z = 1/4ZHI + 1/8ZEP + 1/8ZSP + 1/4ZLS + 1/2SMS.$$

This weighting scheme gives equal weight to the physical indices (ZHI, ZEP and ZSP) and the behavioral indices (ZLS and ZSMS). Within the physical

indices, health is weighted equally with combined eating and sleeping. Within the behavioral indices, life style and mood score are equally weighted.

None of the correlational variables were included in the adaptation index scores in order to prevent the possibility of spuriously inflating the correlations by simply correlating items with themselves.