Chapter 6

CONSEQUENCES OF ALTERNATIVE WORK SCHEDULES

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INTRODUCTION

With our fast-paced society's current demand for immediacy, technology has responded by enabling businesses to provide products and services in record time. The trend for fast and immediate interactions has spurred the development of everything from the fax machine to telephone availability on airplanes. We truly can communicate with almost anyone, anywhere in the world, at any time. While increases in efficiency and productivity for organizations can in part be attributed to the current technological revolution, many people forget about the deleterious effects that such an age is having on a substantial and growing percentage of the population.

In order for companies to respond to demands for faster service and products, many have had to increase their hours of operation to 24 hours a day. Often, employees are required to work on a night or evening shift to accommodate the company's operating demands. Additionally, there are companies which, by the nature of their business, must remain open around-the-clock. Employees such as nuclear reactor operators, emergency room workers, and policemen are a few examples of occupations that are directly affected. These occupations have had to require some workers to work on a shift system.

This chapter will discuss consequences of shiftwork to the individual as well as to the employing organization. Such consequences include physiological, psychological, and performance-related phenomena. Suggestions for short- and long-term preventions, and interventions both for the individual
shiftworker as well as for the employing organization will be presented. Individual differences which predispose persons to tolerate the effects of shiftwork better than others will be identified. The specific design of the shift system has significant consequences for individual adjustment, and literature on this point will be given considerable attention. This review will also discuss in depth two other common alternative work schedules related to, but distinct from, shiftwork regarding the end goals of the system: compressed work weeks (also known as the ‘4/40’) and flextime. Finally, the manuscript will consider future research directions which include the study of new and innovative scheduling policies as well as research methodologies.

SHIFTWORK

Shiftwork, broadly defined as working day, evening, or night shifts, has been shown to have adverse effects on individuals and organizations (Adams, Folkard & Young, 1986; Akerstedt, 1990; Bohle & Tilley, 1989; Gadbois, 1984; Harrington, 1978; Rutenfranz, Haider & Koller, 1985; Walker, 1985). However, shiftwork is necessary in industries which require 24-hour operation. Shiftwork can vary in its specific characteristics; for example, continuous shift systems require weekend working whereas discontinuous systems occur in organizations which operate Monday through Friday. Shiftwork varies according to: start and stop times of employees; length of shifts; length of time off between shifts; and order of shift rotation. Shiftwork can be permanent where each crew works only one shift, or it can be rotating where each crew rotates their hours to include each type of shift. Rotating shifts, in particular, are increasing in popularity: in 1992, approximately one-third of the US labor market worked a rotating schedule (Mitter, 1992).

Regardless of the specific characteristics of the shiftwork system, a common problem with shiftwork is that an individual engages in activity (working) at a time of the day when he or she is supposed to be inactive (sleeping). One major source of difficulty for shiftworkers is the inversion of the rest and activity cycles from a ‘normal’ day orientation. Normally, temperature, sleep, metabolism, and production of most hormones all cycle close to a 24-hour, or circadian, pattern for most people. The biological clock, an endogenous ‘pace-maker’, in combination with exogenous environmental cues, keeps people synchronized to a 24-hour cycle. Each day, certain exogenous cues (zeitgebers) such as the day-night light cycle, ‘reset’ our bodies to synchronize with the 24-hour cycling of our world. Without these environmental cues, many of these rhythms would fall into a ‘free running’ pattern lasting closer to a 25-hour cycle.

We therefore have two types of cues, endogenous and exogenous, which interact to influence the timing of the physiological processing of our bodies. These influences strongly encourage a basic pattern of sleep at night and
activity during the day. When we continuously counter the natural tendencies of our bodies by, for example, working at night and sleeping during the day, the circadian system becomes disrupted or desynchronized, meaning that behavior and biological rhythms are out of phase. While this may appear inconsequential, circadian rhythms control many of the human body’s activities. When the natural order of the body is disrupted, there can be adverse physical and psychological consequences to the individual as well as negative effects for the employing organization.

Physical Consequences to the Individual

As mentioned above, engaging in night shiftwork can result in the disruption of an individual’s circadian rhythms. This disruption is mainly due to the body being active in the absence of light. The suprachiasmatic nucleus (SCN) in the hypothalamus is a structure which has been shown to be sensitive to light. The SCN reacts to the presence or absence of light as a cue to what time of the day it is. Through the course of time, the availability of light has been associated with activity, and the absence of light associated with inactivity. Thus, when an individual works at night in the absence of light, the body is receiving conflicting signals. These conflicting signals result in the disruption of many bodily functions. Also, desynchronization of the body’s circadian rhythms can lead to pervasive feelings of fatigue and malaise: ‘occupational jet lag’ (Mitler, 1992, p. 135). This section will discuss the major physical and physiological effects reported in the shiftwork literature.

Sleep

The problem of poor sleep quality is probably the most burdensome and pervasive consequence of shiftwork. Several studies and reviews (Akerstedt, 1990; Akerstedt & Gillberg, 1981; Costa, Lleove, Casalett, Gaffuri & Folkard, 1989; Minor, Healey & Waterhouse, 1994; Moore-Ede, 1993; Regestein & Monk, 1991; Skipper, Jung & Cowley, 1990; Smith & Folkard, 1993b; Torsvall, Akerstedt & Gillberg, 1981) have indicated that night shiftwork is related to poor quality of sleep, decreased duration of sleep, and fatigue. This is due, in large part, to the sleep of the shiftworker being shifted to a time of day that is least appropriate for sleep (Akerstedt & Gillberg, 1981). Experiments have also shown that total sleep time is longer and of much better depth and quality for workers on a day shift and/or non-rotators compared to those on a night shift and/or rotators (Czeisler, Moore-Ede & Coleman, 1982; Monk, 1990; Monk & Folkard, 1985; Rosa, Colligan & Lewis, 1989). The erratic sleep cycle, once initiated, is difficult to terminate as switching on and off different shifts makes it nearly impossible to adjust. Even permanent shiftworkers will experience sleep disturbances as there is greater environmental noise during the day which reduces both the duration and
quality of sleep for those on the night shift (Knauth & Rutenfrantz, 1975; Rutenfrantz, Colquhoun, Knauth & Ghata, 1977). This results in an accumulated sleep deficit toward the end of a shift series commonly referred to as 'sleep debt'.

Alertness/concentration

The second physical consequence is related to cognitive functioning and can result directly from poor sleep quality. Individuals engaged in night shiftwork and/or rotating shifts have reported lower levels of alertness, concentration, and vigor, and higher levels of fatigue and confusion (Akerstedt, 1988; Bohle & Tilley, 1993; Moore-Ede, 1993; Tasto, Colligan, Skiel & Polly, 1987). This consequence is particularly important to individuals whose work requires a high degree of monitoring, for example, a nuclear power plant employee or an intensive care nurse. While the importance is obvious for individuals who must continuously monitor, alertness/concentration problems are also evident in situations where an individual is producing a product where concentration problems can negatively impact the quality of production. These problems will be further discussed in the section on organizational consequences-performance problems.

Gastrointestinal problems

The third physical consequence is related to hormone levels in the body. Much research has indicated that a pervasive problem with shiftworkers is gastrointestinal disruption (Cervinka, 1993; Costa, Apostoli, d’Andrea, F. & Gaffuri, 1981; Gordon, Cleary, Parlan & Czeisler, 1986; Moore-Ede, 1993; Moore-Ede & Richardson, 1985; Skipper, Jung & Coffey, 1990; Tasto et al., 1978). Mitler (1992) suggests that approximately 20% of shiftworkers experience gastrointestinal disorders. At night when the body is normally inactive, hormone levels associated with gastrointestinal functioning are at their lowest levels. When an individual is active, hormone levels may increase, causing problems such as indigestion, chronic diarrhoea, and peptic ulcers, to name a few. Vener, Szabo and Moore (1989) review the effects of shiftwork on gastrointestinal functioning and literature regarding (a) the central nervous system control and integration of circadian rhythms; and (b) shiftwork and gastrointestinal symptoms/disease.

Research has also found an association between shiftwork and cardiovascular disease, musculoskeletal functioning, and peptic ulcers. While physical problems are discussed independently, taken together, one can see the toll that night shiftwork, either acute or chronic, can take on an individual. However, the true extent of working shifts on an individual’s physiological systems may still not be fully appreciated. Recent research (Spelten, Barton & Folkard, 1993) suggests that the shiftworkers themselves may not even realize
the toll that shiftwork is taking on their body, and may be underestimating its effects. For more comprehensive reviews of the physical consequences of shiftwork, see Angersbach, Knauth, Loskant et al. (1980); Costu, Cesana, Kogi and Wedderburn (1990); Costa et al. (1981); Harrington (1978); Mott, Mann, McLoughlin, and Warwick (1965); Rutenfranz, Haider, and Koller (1985); Tasto et al. (1978).

**Psychological Consequences to the Individual**

When an individual chooses or is required to engage in night shiftwork, psychological consequences often arise. The psychological effects may or may not be related to the physical consequences associated with night shiftwork. Whatever the case may be, shiftwork is correlated with two main psychological problems: increased stress and affect or mood disturbances.

**Stress and strain**

Stress, both job- and non-job-related, is usually higher for rotating shiftworkers and night shiftworkers compared to non-rotating, daytime employees (Barton & Folkard, 1991; Bohle & Tilley, 1989; Coffey, Skipper & Jung, 1988; Gordon et al., 1986; Jamal & Baba, 1992; Skipper, Jung & Coffey, 1990). Research has also demonstrated that stress increases incrementally as the number and length of night shifts (called night shift dose) increase (Cervinka, 1993). The increased level of stress may be a result of several things. Stress may result from the physical strain the body is under due to the nightshift and/or nature of the work which consequently results in a disturbance of circadian rhythms. Lack of sleep and/or gastrointestinal disturbances may result in increased levels of stress. Here, the physical consequences contributes to a psychological consequence.

Another source of stress may come from strained social relationships. Several studies (Charles & Brown, 1981; Costa, 1996; Koller, Kundi, & Cervinka, 1978; Mott et al., 1965; Smith & Folkard, 1993; Tasto et al., 1978; Walker, 1985) have documented a relationship between night shiftwork and social relationship strains. Shiftworkers have trouble maintaining friendships and relationships with others who do not share their schedule. Furthermore, constant fatigue affects shiftworker's social lives as they often do not have the energy or motivation to participate socially. Finally, on a pragmatic level, membership of social organizations and participation in social activities may be difficult because of the meeting times; a shiftworker may not be able to attend weekly or monthly evening meetings if he or she works the evening shift. 'Shiftworkers are less likely than dayworkers to be members of organizations or to be office holders once they have joined' (Walker, 1985, p. 218).

Social relationship strain may also manifest itself through work–family conflict. Alternative work schedules, such as flextime and 4/40 have been thought
to reduce the degree of work-family conflict; however, night shiftwork may increase the degree of conflict. A shiftworking individual experiencing workfamily conflict feels increased stress due to work and family life conflicting with one another. Shiftwork interferes with family time; many studies report that relationships with spouses and children who are on a different time schedule than the shiftworking family members are inevitably compromised (Charles & Brown, 1981; Koller et al., 1978; Moore-Ede, 1993; Mott et al., 1965; Pleck, Staines & Lang, 1980; Tasto et al., 1978; Walker, 1985). Disruptions of social and family life magnify and compound the physical stress associated with shiftwork. Flexible schedules are thought to ease work-family conflict by allowing personal scheduling of work hours more congruent with family responsibilities. These schedules will be discussed later in the manuscript.

However, research has not been unequivocal in its findings regarding family life disruption due to shiftwork (Skipper, Jung & Coffey, 1990). In fact, some research has found that night shifts allow flexibility for families in that there is usually at least one parent home to care for the children, rather than the parents having to rely constantly on paid caregivers. This is supported by research which reports fewer domestic problems for night workers compared to day workers (Barton & Folkard, 1991). While these results may seem directly contradictory to previous literature, it actually illuminates one of the major problems with the shiftwork research: the sample characteristics from different studies may differ so substantially that the generalizability of the results from one study to another shiftworking population is questionable. Further, much early shiftwork research was conducted in industrial settings with males who had no choice regarding what shift they worked. A major question that arises is: do the results from this literature generalize to other very different groups of workers (e.g. predominantly female nurses who choose to work the night shift)? The issue of choice appears to have a great impact on whether employees experience adverse effects from shiftwork and will be discussed in depth.

Affect

The second psychological consequence is related to an individual’s affect. Psychological problems such as irritability, apathy, restlessness, and depression may arise due to an individual engaging in night shiftwork. While an individual may experience mood disturbances from normal working hours, individuals engaging in night shiftwork experience greater degrees of such problems (Healy, Minors & Waterhouse, 1993; Jamal & Jamal, 1982; MooreEde, 1993; Tasto et al., 1978). Additionally, because work-family conflict is related to depression (Thomas & Ganster, 1995), shiftwork which contributes to work-family conflict may also indirectly contribute to depression. There is even some indication that shiftwork, especially night shiftwork, may have
long-lasting severe consequences on some individuals. In a questionnaire/ interview study of 270 oil refinery workers, it was found in the ‘drop-out’ group that in certain individuals very long-lasting psychosomatic, pseudoneurotic, or sensitization reactions may develop (Koller, Kundu & Cervinka, 1978). Further, in telephone interviews with more than 2500 workers, Gordon et al. (1986) found evidence of ‘severe emotional problems’ due to shiftwork. These affect-related problems, while directly impacting the individual, may indirectly impact the organization via employee withdrawal behaviors (lateness, absenteeism, turnover), or a lack of extraorganizational behaviors, or ‘organizational citizenship behaviors’ (e.g. voluntarily helping a co-worker; staying late to finish a project; speaking highly of the organization to outsiders). These extrarole behaviors have been found to positively impact organizational productivity and profitability (Organ, 1988).

Drug use

The use of both legal and illegal drugs can be considered as a consequence of shiftwork as well as a treatment or prevention of the adverse consequences from shiftwork. Increased alcohol, caffeine and sleeping pill usage are potential consequences of shiftwork (Mitter, 1992; Moore-Ede, 1993). However, each of these drugs may also be used, and possibly even prescribed as a treatment (albeit questionable, and certainly short term) for different effects from shiftwork such as tension/irritability, sleepiness or fatigue at work, and sleeplessness/restlessness during off hours. To this end, there will be a brief discussion of the effects of drugs in both sections of the chapter.

While the literature on drug usage and shiftwork is particularly scant, there is some evidence for increased drug usage. Shiftworkers often will use caffeine as the ‘boost’ needed to get them through the seemingly everlasting night shift. Gordon et al. (1986) found much heavier use of caffeine by shift workers compared to non-shiftworkers. Additionally, these researchers found heavier alcohol consumption: 16% of men on variable shifts reported having more than four drinks daily (Gordon et al., 1986). The exploration of increased drug usage as a consequence of shiftwork appears to be ripe for inquiry.

As discussed, physical and psychological problems often reported by shiftworkers are multidimensional and diverse in nature: poor quality and not enough sleep; persistent fatigue; digestive/gastrointestinal trouble and disturbances; frequent mood changes; irritability and depression; and increased use or dependence upon sleeping pills, alcohol, and/or caffeine. Several of these effects can compound by interaction. For example, a worker is exhausted and finds himself grumpy and moody all the time due to lack of sleep. She has trouble in the early morning hours of work so she drinks coffee around 3:30 a.m. to keep her awake until her shift ends at 5:00 a.m. Since the effects of the caffeine have not yet worn off and she is trying to sleep at a time when her body is naturally awakening itself, she has trouble sleeping. She decides to buy sleeping pills.
She sleeps longer but soon becomes resistant to the effects of one pill and more of the drug to sleep. Additionally, no longer grumpy, she finds herself depressed during the night due to the traces of a depressant drug (the sedation) in her system. Finally, her stomach begins to hurt quite often due to digestive problems caused by the increased use of caffeine and drugs.

This section has discussed some of the consequences an individual may incur from working a night shift. The next section will discuss what consequences night shiftwork may have on the organization.

**Organizational Consequences**

The previous two sections have focused on the consequences to the individual of engaging in an alternative work schedule. This section deals with organizational consequences. While the organization may attempt to enhance the employees' quality of life, the organization must also be concerned with its own well-being. Some alternative work schedules such as flextime and 4/40, can help the organization via the individual; other alternative work schedules may not be dictated by the nature of the organization. As mentioned previously, hospitals, law enforcement agencies, and nuclear power plants by their very nature require around-the-clock shifts. The next two sections discuss several consequences resulting from shiftwork that directly impact the organization.

**Performance**

A company may find lower performance as well as more unsafe behaviors and accidents performed by the night shift crew or rotating shift personnel compared to the day shift and/or non-rotating personnel (Coffey, Skipper & Jung, 1988; Folkard, 1987, 1990; Moore-Ede, 1993; Skipper, Jung & Coffey, 1988; Tasto et al., 1978). It is known that the neural processes controlling alertness and sleep produce an increased sleep tendency and diminished capacity function during certain early morning hours (approximately 2–7 a.m.) regardless of whether one has slept or not (Miller, 1992). Studies have shown that individuals who engage in night shiftwork tend to have a greater number of performance failures and lower productivity and efficiency (Costa, 1987; Miller, 1992; Rosekind, Gander, Miller & Gregory, 1994; Scott, 1994). Braken (1990) claims that a company should expect a 5–10% decline in capacity for work during nocturnal work periods compared to daytime work periods, which will dissipate somewhat if workers maintain a consistent sleep-wake routine. However, Rosa, Colligan and Lewis (1989) also found performance decrements or increased errors (187%) for workers on a 12-hour compressed schedule compared to the same workers who had previously been on an 8-hour schedule, even after seven months of adjustment time.

The performance problems associated with night shiftwork may be result of the previously mentioned physical and psychological consequence
For example, fatigue, which may contribute to lower levels of alertness and concentration, may also contribute to performance failure and lower levels of productivity/efficiency. Rosa, Colligan, and Lewis (1989) as well as Tepas and Monk (1987) feel that performance problems are due to increased fatigue and decreased alertness due to an ever-accumulating sleep debt. This sleep debt contributes to a chronic state of exhaustion for some workers which often ends in the worker falling asleep on the job. In fact, in surveys of 1500 workers in a variety of industrial sites, over 55% of them admitted to falling asleep on the job during a given week (Militer, 1992). In a study of locomotive engineers, regarding night trips, 11% admitted to ‘dozing off on most trips’, while 59% admitted to falling asleep at least once (Akerstedt, 1988). Thus, increased individual errors, lower levels of productivity/efficiency, as well as falling asleep at work will obviously impact the overall performance of the organization.

The consequences of performance problems vary according to the type of organization. For example, an individual’s performance failure while working a night shift at an assembly facility may result in a defective product, while an individual’s performance failure working at a nuclear power plant may result in contaminated water being released into the environment. While either of these occurrences may take place on any shift, it is the night shift where the likelihood is greatest.

withdrawal behaviors

Attendance, tardiness, and turnover problems are potential negative consequences of shiftwork. While most alternative work schedules are designed with the intent of reducing withdrawal behaviors of employees, night shiftwork, particularly rotating schedules, may result in increased absenteeism, tardiness, and even turnover (Costa, Micciolo, Bertoldi & Tommasini, 1990; Moore-Ede, 1993). Jamal’s research (1990; Jamal & Baba, 1992; Jamal & Jamal, 1982) reports that nurses on rotating shifts have higher absenteeism and tardiness, and report higher rates of turnover intention compared to nurses on non-rotating shifts. The increase in withdrawal behaviors of employees may be the result of physical problems and or psychological problems. If an individual is apathetic about an upcoming night shift, he/she may choose to call in sick or be late in reporting to work. Furthermore, if an individual is experiencing fatigue due to night shiftwork, the individual may call in sick to an upcoming day shift. In fact, research (Nicholson, Jackson & Howes, 1978) has demonstrated a relationship between shiftworkers’ absence and day of the week: absences are higher for shiftworkers on days of the week when rest days are several days in the future. So not only is the nightshift staffing impacted by night shiftwork, it is possible day and evening staffing are also impacted.

An interesting feature of the absence and withdrawal literature with regard to shiftwork, is that not all of the research has shown detrimental effects. In
fact, Taylor, Pocock and Sergaen (1972) demonstrated the absence rate of shiftworkers to be lower than that of their counterparts who worked during the day. Some researchers have suggested that there is, in fact, a moderating influence of certain sample characteristics regarding whether or not they will show negative effects due to shiftwork. In particular, those workers who voluntarily choose to work the night shift or rotating shift may not experience the adverse effects. This topic will be explored further later in the manuscript.

**COMPRESSED, 4/40 WORK WEEK**

The compressed, or ‘4/40’ work week, where employees work four fixed days per week, 10 hours per day, is an alternative work schedule related to shiftwork and length of shifts in that in some organizations, the length of the required shift can be 10 or 12 hours, or even longer. In fact, many organizations utilize 12-hour shifts to ‘make up’ for requiring employees to work at night: an increase of hours worked on each shift in exchange for fewer afternoons, evenings, and weekends worked. The term compressed refers to any schedule where employees are working a regular number of hours (usually 40) in less than the normal five days. Thus, employees working the night shift can just as easily work compressed schedules (and often do) as those in more ‘traditional’ organizations without evening and night shifts. In fact, some organizations offer their employees compressed schedules as a ‘perk’. The advantage of such schedules is that employees get a three-day weekend every week, or every other week, depending on the particular characteristics of the schedule. As evidence substantiating that employees do, indeed, view compressed schedules as a perquisite, is research reporting that the primary reasons cited for favoring 4-40 schedules are associated with extra leisure and social participation/time and the long weekend (Knauth & Rutenfranz, 1982; Nollen, 1979; Steele & Poole, 1970).

Compressed schedules have been found to have other advantages for the employee. For example, Williamson, Gower, and Clarke (1994) found that when 75 computer operators changed from a predominantly 8-hour shift to a 12-hour shift, improvements in health, especially psychological, and reduced feelings of tiredness were reported, and these changes were not detrimental to job attitudes (job satisfaction, in particular). However, the shift change also included a change from an 8-hour irregular shift to a 12-hour regular or relatively permanent shift. Since some research has found that permanent shifts result in fewer adverse effects, it is unknown in this study whether the longer time interval (the compressed schedule) or the regularity of the shift was responsible for the reported positive effects.

Not all reports in the research regarding compressed schedules are positive. Workers on a compressed schedule may suffer from many of the same problems as shiftworkers. Individuals are more fatigued, especially toward the end
of the shift (Goodale & Aagaard, 1975; Kenny, 1974) compared to those working shorter shifts, and are often working shifts longer than is appropriate in terms of their body’s physical capacities and limitations. Older workers, particularly, who are more susceptible to fatigue may suffer the most from compressed schedules and thus be ‘less than enthusiastic’ about its implementation (Nollen, 1979; Northrup, Wilson & Rose, 1979).

Perhaps an obvious expected consequence of compressed work schedules is an increase in employee job attitudes, particularly job satisfaction. Indeed, some literature supports this: Hartman and Weaver (1977) and Steele and Poor (1970) claimed positive effects on job satisfaction due to the 4/40 schedules. Further, Ivancevich and Lyon (1977) found that over a 12-month period, employee job satisfaction showed a significant improvement. Northrup, Wilson and Rose (1979) report in field surveys of managers in 50 plants in the United States and Canada, that one of the most important effects of the 12-hour shift was a significant improvement in employee morale which did impair job efficiency, job safety, or workers’ health. Also, much research (Breaugh, 1983; Dunham, Pierce & Castaneda, 1987; Foster, Latack & Reindl, 1979; Harrick, Vanek & Michlitsch, 1986; Northrup, Wilson & Rose, 1979) reports that worker satisfaction with schedules is improved with compressed schedules.

The impact of compressed work schedules in performance is not clear. Many organizations fear that productivity will be negatively impacted due to a rise in accidents from increased fatigue. Yet the research has not borne this out. In fact, in a survey of U.S. and Canadian managers, Northrup, Wilson, and Rose (1979) reported that none of the 50 locations surveyed reported increased accidents as a result of 12-hour shifts; indeed, four locations were experiencing the longest periods in their history without time lost because of injuries. Some research has even reported productivity increases (Hartman & Weaver, 1977; Wheeler, 1970). Dunham, Pierce, and Castaneda (1987) reported improvement in six of seven organizational effectiveness measures, (although improved client service was the only change which was statistically significant) when employees switched from a 5:40 schedule to a 4/40 schedule. These researchers also guarded against the Hawthorne effect as the measures showed a subsequent decrease when employees switched back to a 5:40 schedule. Foster, Latack, and Reindl (1979) also found higher productivity in both quantity and quality of computer operations personnel working a 3/38 schedule compared to those working a 5:40 schedule. Ivancevich and Lyon (1977) found improved quality of performance over a 12-month period, as indexed by supervisor ratings of quality, quantity, and overall performance. The compressed work week may further impact productivity indirectly through reduced absenteeism and turnover. Northrup, Wilson and Rose (1979) report that both absenteeism and turnover, if impacted at all by the introduction of a 12-hour shift, showed reductions. Harrick and colleagues (1986) as well as Latack and Foster (1985) also report a reduction in sick leave, personal leave, and annual leave due, in part, to compressed schedules.
However, there is research which reports productivity decreases or increased error rates. Rosa and Colligan (1988) examined a group of data entry personnel working on a compressed work week schedule (a 12-hour, four-day week). Job performance was measured with a data entry task operated throughout the day. Performance deficits were indicated by progressively higher error rates over the four-day work week. However, an interesting thing happened on the final workday. There was an increase in performance which the researchers called the ‘end-spurt’. It was suggested that the anticipation of the extended weekend motivated the employees to perform better. Rosa and Bonnett (1991) also examined the effects of a compressed work week schedule at another facility (a natural gas utility) and found consistent results: after ten months of transition from a traditional 8-hour, 5-7-day schedule to a 12-hour, 2-4-day schedule, employees continued to experience decrements in performance and alertness. In a review of fitness factors regarding shiftwork, Bonnett (1990) summarizes data which suggest that decreases in physical capacity to perform night work will be magnified on longer, 12-hour shifts.

Some research reported no significant productivity changes (Calvasina & Boxx, 1975; Goodale & Aagaard, 1975) or offsetting positive and negative effects (Harrick, Vanek & Michlitsch, 1986). Finally, there is research which has reported mixed results: Ivancevich (1974) found a one-year performance increase following the introduction of a 4/40 schedule, but a 24-month follow-up (Ivancevich & Lyon, 1977) showed no long-term impact on performance. This highlights one of the problems with the compressed work week literature: How long will results last? Are they only short term? Ivancevich (1974; Ivancevich & Lyon, 1977) suggests that conversions to the 4/40 work week may not be as beneficial as originally hoped. Certainly more research comparing short- and long-term effects is warranted.

Regarding the employing organization, there do not appear to be any major administrative or overhead costs (except possibly providing supervision across the longer shift) associated with longer shifts. In fact, if management cooperates with employees when implementing longer shifts, longer shift schedules are seen as a bar to unionism (Northrup, Wilson & Rose, 1979). Latack and Foster (1985) found that a critical variable in successful implementation of compressed schedules was employee participation in the decision to implement. Therefore, it is often the situation where both management and workers alike must support the implementation of compressed schedules, in order for it to be successful. Northrup, Wilson and Rose (1979) report that generally employers have supported 12-hour shifts given the following four contingencies:

- continued employee support
- no increased difficulty in administration (e.g. covering overtime)
- no decrease in productivity and efficiency, and
- no increase in accidents and no violations of OSHA regulations
Most reports of the compressed work weeks appear positive. Of the negative consequences and effects reported, the majority appear to be related to the longer nature of the shifts and how it disrupts sleep and physiological processes, much as with shiftwork. The next section of this chapter discusses prevention of deleterious effects and intervention strategies to combat negative consequences of shiftwork and/or compressed schedules.

**INTERVENTION AND PREVENTION OF ADVERSE EFFECTS TO THE INDIVIDUAL**

The primary purpose of physical interventions/preventions is to readjust an individual’s circadian rhythms. As noted before, this problem mainly stems from night work. However, there is a caveat: much research has suggested that full adjustment can never really take place (Daniel, 1990; Folkard, 1988, 1990; Knauth & Rutenfranz, 1992). No matter how much time a worker has to adjust, the circadian systems will never completely adapt to the night schedule; indeed, complete adaptation is ‘practically impossible’ (Daniel, 1990). This is due, partly, to the probability that on their days off, most workers try to maintain a normal societal 24-hour schedule such that they sleep at night and are active in the morning. Thus, each week, the worker becomes entrained, or readjusted, to the night schedule again. Daniel (1990) found that it takes 10 to 20 days of continuous night work to come close to a complete reversal of circadian rhythms.

Currently, the two most popular means of circadian adjustment are light therapy and melatonin therapy. Each approach uses the circadian characteristics of individuals to counteract potential problems.

**Light Therapy**

Light therapy as a physical intervention/prevention seeks to simulate the overall availability of light in a normal day. The goal of light therapy is to trick the body into believing it is day time even when it is actually night time. The premise behind this therapy is that simulated light will entrain an individual’s circadian rhythm via the SCN. This therapy can be given in two ways. The first type of light therapy is increasing the intensity of light in the work area. This type of therapy may be appropriate in organizational settings where individuals are not required to move around a great deal, for example an assembly line. The second type of light therapy involves wearing what looks like a sun visor. Immediately above an individual’s eyes on the visor are two lights which focus light on the individual’s eyes. This type of therapy may be more appropriate for organizational settings where individuals are required to move about, for example a hospital.

Numerous studies have shown that availability of light can entrain circadian rhythms. Furthermore, several studies (Czeisler, Johnson & Duffy, 1990;
Dawson & Campbell, 1991; Dawson, Encel & Lushington, 1995; Elmore Betrus, & Burr, 1994; Wever, 1989) have been conducted to examine the relationship between light therapy and night shiftwork. The summary results of these studies are: light is an important cue for entraining an individual’s circadian rhythm; light therapy can lessen the problems associated with sleep and alertness; and light therapy can suppress melatonin secretion (this implication will be discussed in the next section). While light therapy by itself seems to counteract some of the problems associated with night shiftwork, it can be used in conjunction with other interventions. The next section will examine melatonin as a means of counteracting problems associated with night shiftwork.

Melatonin

Currently, melatonin is being billed as a wonder drug that does everything from improving quality of sleep to reversing the aging process. Much of melatonin’s popularity is rooted in its use to counteract problems associated with circadian disruption. As society suddenly became more global, mainly via airline travel, melatonin was utilized to counteract jet lag. Travellers using melatonin reported decreases in jet lag, and thus a phenomenon was born.

Melatonin is a hormone responsible for seasonal rhythms in animals. The chief production of it usually occurs at night (or in the absence of light): there is an increase in the production rate of a factor anywhere from 10 to 50 after dusk (Lewy, Ahmed, Jackson & Sack, 1992). Studies have shown that melatonin has a circadian periodicity and thus is controlled by the overall circadian rhythm. Additionally, light therapy has been shown to suppress melatonin secretion (Eastman, 1990; Lewy et al., 1992).

Melatonin therapy would involve the administration of low doses of melatonin taken after the shift to simulate the onset of night, or lack of light, and thus sleep. Oral melatonin actually shifts forward (phase advance) or shifts backwards (phase delay) the body’s production of natural melatonin (Lewy et al., 1992). These phase shifts run counter to, and to some extent, override the zeitgeber from the competing light–dark cycle. If examined in conjunction with light therapy, there is a possibility for shiftwork disorders to be treated with appropriately timed bright light exposure in combination with an appropriately timed administration of melatonin. One can begin to see how you can trick your body into thinking it is another time. Cassone (1990) found that sleep can even be induced via the administration of melatonin in the late afternoon and early evening. While melatonin is riding a popularity wave, it does seem to help counteract some problems associated with night shiftwork and is a promising possible therapy for circadian clock dysfunction. It should be noted that melatonin tends to counteract many of the secondary effects (poor sleep quality and duration) of night shiftwork.
Drug Therapy

One very prevalent, common drug that might counteract some of the primary effects (decreased alertness, cognitive functioning, concentration, and increased fatigue) of night shiftwork is caffeine. Decreased cognitive functioning includes decreased computational speed, and slower reaction times. In an organizational context, decreased cognitive functioning may be the most important side-effect of circadian rhythm desynchronization because of the inherent safety and performance implications. Caffeine has been shown to increase subjectively reported levels of alertness during shiftwork (Schweitzer, Muehlbach & Walsh, 1992). One thing to note is that, as with any drug, one may become tolerant or unresponsive to its effects. While caffeine may provide a short-term fix by addressing levels of alertness, it fails to do anything as regards synchronizing circadian rhythms.

In a similar vein of research, other investigators have examined the effects of administering drugs which alter circadian rhythms. In particular, the benzodiazepine drug triazolam is a commonly prescribed hypnotic drug which is used to treat depression. The benzodiazepines are the drugs of choice for anxiety and stress-related conditions as well as sleep disorders; basically any disorder where there is some disruption of the normal circadian rhythms (Turek & Reeth, 1988). Triazolam can shorten the time it takes for the activity rhythm to be resynchronized to new lighting schedules following a shift change. Therefore, it is possible to restore normal rhythmic patterns of people whose endogenous and exogenous cycles have become desynchronized with the appropriately timed administration of certain drugs.

However, the use of drugs, including caffeine and alcohol, to combat the problems may, in the long run, be worse for the shiftworker as dependence may develop. Additionally, drugs affect many other functions such as mood and performance and do not seem to be a very viable solution.

Stress Interventions

While problems with alertness and concentration are important on the job, problems associated with stress influence individuals both on and off the job. Preventions for problems associated with stress from alternative work schedules can be either short- or long-term solutions. Short-term solutions to stress include flexibility in work schedules, work break activities, and sensory stimulation. Flexible work schedules prevent stress and lessen work-family conflict by allowing individuals to determine working times (within a set range identified according to the company’s needs) which minimize strain (Cervinka, 1993; Knauth, 1993; Knauth & Rutenfranz, 1982). For example, delaying the starting time of a shift by even two hours allows a parent either to be at home for breakfast and to send the children
to school (day shift); to be at home when children return from school and to have dinner together (evening shift); or to be at home when children go to sleep (night shift). The design of the shift system has the potential to exacerbate or alleviate stress and will be discussed in extensive detail later in the chapter.

Regarding the individual, coping strategies associated with any stress are critical. These strategies include physical exercise, cognitive restructuring, meditation, and relaxation, to name a few. However, research has not consistently demonstrated that organizationally sponsored stress management programs work. Ganster, Mayes, Sime and Tharp (1982) used an experimental design to assess the effects of the stress reduction interventions of cognitive restructuring and progressive relaxation. In a field experiment with public agency employees, results were promising: depression and epinephrine levels (which increase in response to stressful situations) were lower for the experimental group compared to the control group, even at 4-month follow-up times. However, the treatment effects were not replicated in a subsequent intervention with the control group. The researchers suggest that adoption of stress management programs such as these is questionable for the following reasons: the effect sizes are small, the efficacy of such programs when implemented by less specialized management consultants is questionable (they employed a clinical psychologist who specialized in cognitive therapy techniques who was assisted by an exercise and stress physiologist); and training employees to ‘better tolerate poorly designed organizations’ is a less desirable strategy than one that attempts to make the organization less stressful (Ganster et al., 1982). Thus, we agree with Ganster and colleagues in that stress management programs may be most advantageous as supplements to organizational change programs.

One potential reason for lack of strong empirical support for stress management programs may be the inherent individual differences associated with stress reduction techniques. If organizations do offer stress reduction techniques to their employees, at best they will probably offer one or two different types. Many employees may not see the one or two chosen types as viable or desirable options for them. A stress reduction program should be very individualized according to the particular person’s needs, problems, and preferences. However, an interesting caveat is that an individual needs to match the coping strategy according to whether cognitive or somatic functioning is most disrupted (Schwartz, Davidson & Coleman, 1978). In a study designed to separate the cognitive from somatic components of anxiety and consequent coping mechanisms, Schwartz and colleagues (1978) found that physical exercise was most necessary for anxiety which manifested itself somatically; and meditation was most helpful for cognitively manifested anxiety. We therefore advocate that in terms of coping with stress, the individual should employ stress reduction techniques best suited to his/her lifestyle needs and desires. For reviews of stress management techniques, see Kahn and Byosiere (1992); Newman and
INDIVIDUAL DIFFERENCES IN SHIFTWORK TOLERANCE

Several studies have identified individuals who are ‘shift intolerant’ (Costa et al., 1989; Daniel, 1990; Knauth & Harma, 1992; Motahashi, 1992) and exhibit higher levels of adverse reactions such as gastrointestinal problems and sleep disturbances than do ‘shift tolerant’ persons. Healy and Waterhouse (1991) suggest that there is a certain type of predisposition to shiftwork intolerance which is very similar to the profile of a person with an affective disorder. These researchers propose a mismatch between exogenous and endogenous influences on circadian rhythmicity, which causes dysphoria, lethargy, and listlessness found both in clinical depression and in poor adjustment to shiftwork. The implication is that persons with an affective disorder may be particularly intolerant to shiftwork. These observations by Healy and Waterhouse (1991) coincide with results found by Costa et al. (1989) that persons with lower manifest anxiety had better tolerance to shiftwork.

Personality Variables: Morningness, Introversion

One individual difference variable, ‘morningness’, has been studied extensively and has been shown to be a reliable predictor of desynchronization; that is, the more of a ‘morning’ type a person is, the more trouble the worker will have adjusting to a night work schedule and will then show more physiological disruption (Akerstedt & Froberg, 1976; Folkard, Monk & Lobban, 1979; Monk & Folkard, 1985; Motahashi, 1992; Ostberg, 1973). In a study of computer operators, Ostberg (1973) found that the night shift was associated with the worst sleep–wake patterns of the morning types (‘larks’), who slept best when they were on the morning shift; and night shift was associated with the best sleep–wake patterns of the evening types (‘owls’).

An additional personality trait which may predict adjustment is that of introversion vs extraversion in the Eysenck-type classification scheme. Introverts are generally more emotionally unstable and this variable has been implicated in predicting people with poorer adjustment (Costa et al., 1989; Folkard, Monk & Lobban, 1979; Monk & Folkard, 1985; Nachreiner, 1975).
Physical Characteristics: Age, Physical Fitness

Physical characteristics of individuals have also been implicated in the study of circadian disruption. Since sleep patterns of older persons differ significantly from those of younger persons with decreased delta-wave amplitude, increased number and length of arousals from sleep, and increased daytime napping (Monk & Folkard, 1985), it is natural to think that older workers may adjust differently to shiftwork than younger workers. Indeed, older workers (over 50 years of age) have been found to be more inflexible in their circadian system functioning and thus to experience more problems due to shiftwork (Harma, Knauth, Ilmarinen & Ollila, 1990; Matsumoto & Morita, 1987; Torsvall, Akerstedt & Gillberg, 1981). According to Monk and Folkard, ‘as the shiftworker enters his 50s, things start to get dramatically worse’ (1985, p. 228). Age effects corroborate research regarding morningness, since age and morningness scores are positively correlated (Monk & Folkard, 1985). When studied individually, these two variables have similar effects on circadian rhythm desynchronization.

The decreased flexibility of the circadian system might possibly be attributed to older workers generally being less physically fit and therefore less able to withstand strong physical pressure and disruption (Monk & Folkard, 1985). Intuitively, a physically fit person should be more resistant to deleterious effects, but this has not been directly supported by research. However, indirect positive effects have been found. For example, in a study by Atkinson, Coldwells, Reilly, and Waterhouse (1993), participants who were physically fit had higher rhythm amplitudes than the non-physically fit. The amplitude of circadian rhythms is associated with the ability to adjust circadian rhythms. The implication is that the more active an individual is, the higher their circadian rhythm amplitudes, the better the individual will be able to adjust to changes in circadian rhythms. Harma, Ilmarinen, and Yletyinen (1982) also found larger circadian rhythm amplitudes as well as lower heart rates and less perceived exertion for physically fit workers compared to workers of average fitness. Fitness may also influence adjustment through increased positive mood states. People who are more physically fit overall, have a better mood which counters some of the negative forces (Bonnet, 1990).

Sleeping Patterns

Research has found that flexible sleeping patterns and vigor, or ability to overcome drowsiness, are individual difference variables which are extremely important not only in short-term circadian adjustment, but are critical in long-term adjustment as well (Bohle & Tilley, 1993; Costa et al., 1989; Folkard, Monk & Lobban, 1979; Vidacek, Kalitema, Rodosevic-Vidacek & Prizmic, 1990). The next two sections will consider both short- and long-term organizational intervention and prevention strategies.
INTERVENTION AND PREVENTION OF ADVERSE EFFECTS TO THE ORGANIZATION

Short-term Solutions

Short-term solutions attempt to address consequences associated with performance. Decreases in productivity and efficiency as well as increased performance failures can be counteracted by the organization. As mentioned previously, increasing light intensity in the work area or providing light visors may increase alertness and concentration enough to minimize detrimental performance consequences. Additionally, some research (Bonnet, 1990; Schweitzer, Muchhback & Walsh, 1992; Motohashi & Takano, 1993) has suggested that night-time napping contributes to increased alertness and performance. 'Prophylactic naps' have been shown to ameliorate negative effects and assist the adjustment process (Bonnet, 1990). This type of nap is one which is taken prior to a period of sleep loss and helps to maintain alertness as opposed to a nap taken subsequent to a sleep loss which is intended to make up for lost sleep. We have suggested several measures organizations can employ to reduce short-term consequences associated with alternative work schedules. The organization also has several options which are more critical to long-term adjustment.

Long-term Solutions

Selection

Selection in organizations requiring night and evening shiftwork would entail organizations selecting employees for their ability to stay awake (Muller, 1992) or who would be predicted to be shift tolerant (Czeisler, Moore-Ede & Coleman, 1982; Folkard, Monk & Lucban, 1979) or stress resistant (Cervinka, 1993). The Standard Shiftwork Index (SSI; Folkard, Barton, Costa et al., 1993) is a set of questionnaires specifically designed to assess the severity of health, sleep, and social disruption experienced as a result of shiftwork, as well as the individual differences which may predict the disruption. The questionnaire is composed of the following variables: chronic fatigue; psychological well-being; physical health; cognitive and somatic anxiety; neuroticism; sleep quality and disturbances; social and domestic disruption; general job satisfaction; flexibility and languidity (measures of circadian type); morningness; reasons for working shifts; and biographical information (Barton, 1994). However, a company might find itself defending its employment practices in a court of law due to the questionable moral and ethical ramifications of selecting individuals on a basis of sleep factors and social disruption. Further, laws (in the United States) such as the Age Discrimination in Employment Act and the Americans With Disabilities legally prohibit discrimination in selection.
procedures based on age factors (which would be relevant since sleep pat-
of older persons are related to shiftwork intolerance) and disabilities, v
include mental disabilities as well as physical disabilities. Thus, selection-
shift tolerance is not likely to be a feasible solution for most organization-
to the legal restrictions.

Moore-Ede (1993) discusses how many of the laws and regulations in-
tence now aggravate and intensify problems from shiftwork. For example
line pilots are not supposed to take naps in the cockpit according to
regulations. This regulation makes sense: Who wants his/her pilot sleep-
However, a multitude of airline accidents have been caused by fatigued
who either unavoidably end up falling asleep at the controls, or who enter a
of stupor due to the erratic schedules and lack of sleep. Anecdotal evidence
well as controlled experiments establish that naps, even 15-minute ones ap-
propriately timed, can alleviate fatigue and keep a pilot alert and safe. It is
easy to conceive of a schedule where the pilots take turns allowing each oth-
take short naps. In cockpits where the captain allows this (against regulate
the instances of accidents are much less frequent (Moore-Ede, 1993).

Self-selection/choice

An alternative possibility, rather than the organization selecting individual
shiftwork, or requiring employees to work certain shifts, is to allow the
ployees to self-select for shiftwork. Employees vary in their shift preference:
example, many nurses who work the night shift do so to enable them to sp-
time with their young children during the day (Gadbois, 1981; Robson
Wedderburn, 1990; Skipper, Jung & Coffey, 1990). Barton’s research (1
Barton & Folkard, 1991; Barton, Smith, Totterdell, Spelten & Folkard, 1
has consistently demonstrated that when nurses specifically choose to work
night shift, rather than being mandated to, the health, sleep, social and dom-
disturbances usually associated with night shiftwork are minimized. When pe-
choose to work permanent night shifts, they are able to structure their work
non-work lives to reduce disruption, and subsequently may experience fi
problems associated with shiftwork (Barton & Folkard, 1991; Knaut
Rutenfranz, 1982; Skipper, Jung & Coffey, 1990; Verhaegen, Cober, De St
et al., 1987). Regarding nurses in particular, systematic reduction in particu-
tion (reduced work schedules) is an important source of nursing resource for
some hospitals (Wise, 1993). Perhaps if nurses were allowed to choose their
own schedules, these hospitals would not experience such losses.

While the research results regarding choice seem to be promising, free
of choice may be denied in certain instances. For example, many compa-
have night shifts that have to be filled; if there are not enough ‘volunteer-
fill them, some workers will be forced to work night shifts or will be out-
job. Furthermore, some industries, such as hospitals, are moving away fr
permanent day and night work toward an internal rotation system wh
requires both day and night work (Sadler, 1990). Choice, therefore, may not always be a viable option for organizations.

If we examine the type of work performed, we find many more predictors of desynchronization. Certain types of tasks are more fit for night-time performance than others, and certain types are particularly inappropriate for late night hours. Vigilance or monitoring type tasks, such as an air traffic controller might perform, are especially dangerous when performed at night. Unless the worker has some intermittent type of attention-demanding activity, he or she will inadvertently and unavoidably become fatigue and lapses in attention may occur as a result (Mitler, 1992). However, memory tasks, because they tax the cognitive load of a person and force functioning, are resistant to lapses in attention which produce poor performance and can thus be performed relatively safely at later night hours. According to Monk (1990) vigilance tasks follow a cyclical type of rhythm with troughs in performance occurring in the early hours of the morning and peaks in mid-to-late evening. However, memory-type tasks follow the opposite pattern with the worst performance occurring at night and the best performance in the early morning.

Therefore, a simple recommendation is to avoid performing vigilance tasks during the late night/early morning hours. It would be nice if it were as simple as this; yet it is impossible for the types of activities which must be performed around-the-clock like most monitoring tasks. You simply cannot tell a nuclear reactor operator to 'do something else' during those hours.

Moore-Ede (1993) in his book The Twenty-four Hour Society reviews many problems caused by the technological revolution. He discusses how most of the catastrophic events not caused by natural forces, such as Chernobyl and the Exxon Valdez have been caused at some level by fatigued operators and workers, which inevitably produced lapses in attention. Mitler (1992) also discusses dangers of accumulated sleep loss. Coping mechanisms such as physical activity and dietary stimulants may temporarily mask the sleep debt. However, when 'defenses are "let down,"' such as a period requiring immobility, overwhelming sleepiness ensues' (Mitler, 1992, p. 132). These instances may account for the seemingly incomprehensible times when individuals have fallen asleep in situations that caused great danger for themselves and others. To compound the problem, companies and engineers design workspaces in an effort to increase the comfort and decrease the workload demand. Unfortunately, this approach may actually exacerbate situations and now, by design, workers are required to do less in a more comfortable environment at a time when their bodies are craving sleep. This problem is not difficult to discern.

The Design of the Shift System

Alternative work schedules are often designed to accommodate individual needs. Organizations requiring around-the-clock operation can reduce
problems from shiftwork by designing schedules that take advantage of established circadian rhythm principles. There are two primary factors regarding the design of the shift schedule which need to be considered: rotation of the shifts and number of recovery days. The direction of rotation will predict circadian adjustment: a forward rotation which involves phase delays (days, evenings, nights), rather than backward rotation involving phase advances (nights, evenings, days), predicts much better adjustment due to circadian rhythm synchronization (Barton & Folkard, 1993; Czeisler, Moore-Ede & Coleman, 1982; Knauth, 1993; Knauth & Kiesswetter, 1987; Knauth & Rutenfranz, 1982; Monk, 1990; Mitler, 1992; Monk & Folkard, 1985). Individual adjustment may lead to organizational productivity. In fact, Czeisler, Moore-Ede and Coleman (1982) reported productivity increases for the plant when a work schedule was redesigned to rotate forward rather than backward, every 21 days instead of every week. In this particular study, it is difficult to discern whether the direction or speed of rotation (or a combination of the two) was responsible for the productivity increase. However, one principle is clear from this body of literature: if a company must have rotating night shifts, it should make sure that the shift is scheduled in a forward rotating manner to induce phase delays rather than phase advances.

The speed of a shift rotation is a matter of debate. Europeans regard the problems with the circadian disharmony due to partial temporal adjustment as being most harmful and thus they rotate workers very rapidly during a week since the problem does not occur until later in the week (Knauth, 1993; Knauth & Kiesswetter, 1987; Knauth & Rutenfranz, 1982; Monk, 1990). The intention is that by rapidly rotating the workers, the disharmony problems will not have a chance to develop. By working only a few consecutive night shifts (one or two), the circadian disruption is minimized and the development of a chronic sleep debt is avoided (Barton, 1994; Knauth, 1993; Knauth & Kiesswetter, 1987; Knauth & Rutenfranz, 1982). Knauth (1993) advocated reducing the requirement to work the night shift as much as possible since it is the most disruptive of all shifts in terms of physiological adjustment, sleep/fatigue, and alertness.

Conversely, North Americans generally view the inappropriate phasing problem as most harmful and therefore have less rapid rotation, or a slower speed (three weeks days, three weeks evenings, and three weeks nights vs three days days, three days evenings, and three days nights) thus allowing the phasing problem to occur less frequently. As discussed above, Czeisler, Moore-Ede and Coleman (1982) found that a slower rotation may have positively impacted the overall productivity of the plant. Barton (1994; Barton & Folkard, 1991; Barton et al., 1993) has found that nurses on permanent night shifts report fewer health, sleep, social and domestic complaints compared to nurses working on rotating-shift schedules. Czeisler, Moore-Ed and Coleman (1982) also found that a significantly greater percentage (65%) of continually rotating shiftworkers reported poor quality of sleep compared to reports of
non-rotating workers (20%). Additionally, Jamal and Baba (1992) found that nurses on fixed schedules reported less job stress, higher job satisfaction and organizational commitment, and less of an intent to leave the organization. Wilkinson (1992) also strongly argues in favor of a permanent night shift which will maximize adaptation and minimize disruption. Neither schedule is free from problems, however. As previously mentioned, even when allowed to adapt for quite long periods of time, workers still never fully recover because of the weekend ‘rebonding’ of other opposing patterns of activity. For more comprehensive recent reviews of the rotation debate see Monk (1986); Folkard (1992); Wedderburn (1992) and Wilkinson (1992).

Mitler (1992) discusses how management’s primary concern in designing a rotating schedule should be to alleviate the biological problems. Mitler (1992) reports a study conducted by the Center for the Design of Industrial Schedules (CDIS), a non-profit organization affiliated with Harvard University, where a new schedule was designed for Philadelphia police officers to combat circadian adjustment problems. The CDIS recommended a schedule which had the following characteristics: (a) the direction of rotation was changed from backward to forward; (b) the rate of rotation was reduced from one week to three weeks; and (c) the six-day work week was reduced to four or five work days in a row. Results after 11 months were that the officers reported a four-fold decrease in the frequency of poor sleep; officers reported a 25% decline in number of sleep episodes on the night shift; officers reported using less alcohol and fewer sleeping pills; officers’ families reported nearly five-fold increase in satisfaction with their work schedule; and twice as many officers preferred the improved schedule over the old schedule (Mitler, 1992). Mitler’s 1992 research corroborated Knauth and Kiesswetter’s 1987 research which found that a forward rotating system reduced sleep difficulties (compared to a backward rotating system), and a majority of workers (83.9%) favored the new system. *Despite a loss of money* from less overtime.

Czeisler, Moore-Ede and Coleman’s (1982) research also demonstrated how workers’ satisfaction, health, attendance, and productivity were all improved by designing systems which incorporated known circadian principles. In their study, the researchers designed a schedule which incorporated phase delays, rather than advances, and also gave workers a longer interval between shift schedules than they had had previously. Thus organizations can also help adjustment by giving employees plenty of time for their bodies to adapt. Because physiological adaptation to shiftwork takes place very slowly (Daniel, 1990), research has consistently shown that the longer a worker has to adjust to the night schedule, the fewer problems occur as a result. Also, research has demonstrated that the interval between phase shifts should be as great as possible and practical to the organization to allow workers maximum time for adjustment (Barton & Folkard, 1993; Czeisler, Moore-Ede & Coleman, 1982; Knauth & Rutenfranz, 1982).

One simple thing an organization can do is to adjust the start times of shifts to be most advantageous to the worker. Knauth (1993; Knauth & Rutenfranz,
reviews literature regarding shift start times and concludes that early-starting morning shifts (especially before 7.00 a.m.) appear to be linked with higher accident and error rates. Increasing the number of work breaks during the evening and night shifts has also been shown to reduce adverse effects of shiftwork. A final measure organizations can take to minimize consequences of shiftwork is to allow a recovery day. This entails giving the individual the day off after a night shift in order to synchronize his/her life and thus his/her circadian rhythms.

Common sense seems to be a theme: encouraging comfort and lower workload will increase the tendency toward drowsiness; prohibiting naps will increase fatigue; monotonous tasks are performed worse when the body needs excitement to keep awake. The best advice for the shiftworker is to keep as regular a schedule as possible and to arrange the environment to facilitate sleep by reducing noise distractions. Companies need to examine their policies and practices as well as their work demands, keeping the known circadian principles in mind. If the company chooses not to, it may find itself in the undesirable position of being forced to by law; some countries are beginning to recognize the consequences of shiftwork and are enacting legislation to combat the adverse effects. Cervinka (1993) reports that Austria enacted legislation in 1981 entitled ‘Night Shift Hard Labour Law’ which contains a variety of preventive regulations such as additional work breaks, additional days off, funding for earlier retirement for employees who work more than 60 night shifts per year. Monk (1988) provides an excellent review of various countries’ legislation efforts to make shiftwork safe and less negative for the shiftworker.

One consistent theme that has surface is for the company to allow flexibility in scheduling (Burke & Greenglass, 1987; Cervinka, 1993; Knauth, 1993; Knauth & Rutenfranz, 1982; Staines & Pleck, 1986). Staines and Pleck (1986) found that there was a buffering effect of flexibility against the negative effects, particularly on family life, of alternative, or non-standard, work schedules. Flexible scheduling ideas have contributed to a very popular trend in many organizations, including both those with shifts as well as those companies which do not require shiftwork: Flextime.

**FLEXTIME**

Flextime was first introduced in West Germany in the late 1960s. The original intentions were to ease commuting and energy problems as well as to attract skilled mothers back into the labor force during a time of labor shortage. Today, flextime and flexible scheduling have grown in popularity as employees, particularly single mothers/fathers, and dual-career couples with children, express the need for more flexibility in their jobs. With increases in work-family conflict (described above) due in part to both parents in most
households working, employees are finding that a rigid workday schedule is not acceptable.

Flextime (a.k.a. flexitime or flexitour) refers to any schedule which allows employees to vary work arrival and departure times (e.g. employees may arrive any time between the band hours of 7-9 a.m., with the earliest arrivers eligible to depart at 3.30 p.m.). Usually, there is a company-prescribed 'core time' (e.g. 10 a.m.-3 p.m.) which coincides with the busiest part of the workday, when all employees must be on the job. For comprehensive reviews of the different types or models of flextime, see Baum and McEwan Young (1974); Ronen (1984); Rubin (1979); and Swart (1978).

Individual Effects from Flextime

Many reports have indicated overwhelming positive effects from implementing flextime. The freedom to set their own schedules often enables employees to spend less money on childcare services, as well as to spend more time with the family in the evening. Flextime may also broaden work opportunities for individuals who are unable to work in fixed schedule jobs (Coltrin & Barendse, 1981). Data indicate that flextime may enhance the quality of family relationships (Bohen & Viveros-Long, 1981; Nollen, 1979) and reduce work-family conflict (Nollen, 1979; Shinn, Wong, Simko & Ortiz-Torres, 1989; Walker, Fletcher & McLeod, 1975) which is why flextime is usually included in reference to 'family-friendly', 'family-supportive', work environments and policies.

Employee work attitudes such as job satisfaction may also be improved (Bohen & Viveros-Long, 1981; Dunham, Pierce & Castaneda, 1987; Narayanan & Nath, 1982b; Nollen, 1979; Nollen & Martin, 1978; Orpen, 1981) as employees' higher order needs for control and growth are more fulfilled than with schedules where the employee has no choice in when he or she works (Allenspach, 1972; Elbing, Gadon & Gordon, 1973; Kraus & Hermann, 1991; Ronen, 1984; Thomas & Ganster, 1985). Some authors have suggested flextime is a type of job enrichment policy because it allows employees more autonomy (Huse & Cummings, 1985; Narayanan & Nath, 1982b; Pierce & Newstrom, 1980; Ronen, 1981a). Due to reduced supervisory control over employees' time, flextime may also improve supervisor-employee relations (Buckley, Kicza & Crane, 1987; Narayanan & Nath, 1982b).

Organizational Effects from Flextime

Research has not consistently demonstrated that 'bottom line' organizational productivity is improved as a result of flextime implementation (Harrick, Vanek & Michlitsch, 1986; McGuire & Liro, 1986; Schein, Mauner & Novak, 1977). Some studies do report performance increases (although negligible)
from flexible work schedules (Kim & Campagna, 1981; Orpen, 1981). In a
study on claims processed in an insurance company, Walsh and Gordon
(1980) reported a significant increase in annual productivity following imple-
mentation of flextime. Similar increases in productivity are reported in the
literature by Craddock, Lewis, and Rose (1981), Golembiewski and Hilles
Nollen (1979) reports that, based on approximately 40 case studies and sur-
evys, a conservative estimate is that flextime yields productivity increases for a
third to a half of organizations that implement it. A major problem with many of
the reported productivity increases is that they are anecdotal in nature and
do not contain an experimental design to rule out alternative explanations.

However, research has consistently reported that organizational perfor-
ance is improved indirectly as indexed by less absenteeism, tardiness, and
turnover as well as less use of sick leave and overtime (Baum & McEwen
Young, 1974; Coltrin & Barendse, 1981; Dalton & Mesch, 1990; Golem-
biewski, Hilles & Kagno, 1974; Harrick, Vanek & Michlitsch, 1986; Kim &
Campagna, 1981; Narayanan & Nath, 1982a; Nollen, 1979; Ralston, An-
thony & Gustafson, 1983; Ralston & Flanagan, 1985; Ronen, 1984; Swart,
1978). In fact, a recent meta-analysis of 92 organizations concluded that
absenteeism, tardiness, and turnover were reduced as a result of alternative
work schedules which included flextime (Pierce, Newstrom, Dunham & Bar-
ber, 1989).

Yet still other research has concluded that the magnitude of the problems
encountered with dual-career or single-parent households cannot be alleviated
much by 'minor changes in daily work schedules' (Bohen & Viveros-Long,
1981). Some authors (Buckley, Kicza & Crane, 1987; Krausz & Hermann,
1991; Ronen, 1981a, b) have noted that flextime is not the 'universal panacea'
its been touted: 'Reports of flextime success can be matched invariably with
examples of flextime failure' (Buckley, Kicza & Crane, 1987, p. 260). Not all
workers are even in favor of the practice. In fact, workers (particularly young,
single, childless) who do not have a need for the flexibility, may react nega-
tively to the schedule. Flextime often reduces overtime which may be par-
ticularly essential for unionized workers and workers who have increased their
standard wages through overtime (Coltrin & Barendse, 1981; Nollen, 1979;
Rubin, 1979). In addition, administration and/or management may regard
flextime as problematic because it requires more time and effort on their part
to coordinate work schedules and, while employees gain some control and
autonomy, supervisors inevitably lose some control over employees (Buckley,
Kicza & Crane, 1987; Krausz & Hermann, 1991; Nollen, 1979). Finally, the
costs of implementing flextime (e.g. administrative, overhead, maintenance
and security) can also be a major deterrent and create obvious negative con-
sequences, even though costs may not inevitably rise (Buckley, Kicza &
Crane, 1987; Ronen, 1984). In fact, fear of increased costs is a major reason
cited why flextime is not used more frequently (Bohlander, Werther & Wolfe,
1980). Therefore, organizations need to anticipate both positive and negative flextime outcomes before choosing implementation (Buckley, Kicza & Crane, 1987). Swart (1978) recommends that instead of implementing a flextime system in all departments of an organization, one or more representative work units should be used as a pilot study.

Other Effects from Flextime

One of the original intentions was that flextime would reduce traffic congestion and commuting times which translates into time and gas saved for employees. In support of this, the Environmental Protection Agency found that flexible working schedules resulted in a reduction of energy consumption by commuters because of increased travel speed from improved traffic flow (Swart, 1978). Additionally, Petersen (1980) found that flextime cut employee commuting time by more than 75%. Thus, rush hour traffic is reduced which leads to less road abuse and more tax savings (Swart, 1978). Working at off-peak hours can also reduce congestion in the work environment itself (Swart, 1978). Less congestion leads to less noise pollution. The list could go on indefinitely; the point is that there are potentially many positive benefits beyond those to the employees and the employing organization.

Clients and customers external to the employing organization, as well as other organizations with whom the company conducts business, may also be positively impacted. Customer service may increase as a result of flextime due to there being more hours in the day in which to contact an organization (Coltrin & Barendse, 1981). Communication over time zones may be improved in organizations with flexible bandwidths of time. An employee who stays late into the evening, or who comes in very early, may be more able to talk to companies across continents during their regular business hours.

FUTURE RESEARCH DIRECTIONS

Other Alternative Work Schedules

While this review was intended to be fairly comprehensive regarding alternative work schedules, there are still many other alternative or 'non-standard' schedules which we did not discuss. The reason is that the research and literature of these other schedules is so scant, most likely because they are either relatively new in concept, or they have increased in importance and emphasis in the last decade.

Part-time workers have been studied more recently as researchers have begun to realize that they are a distinct type of employee who do not necessarily have the same work attitudes, needs, and goals as full-time employees. Also, as organizations are looking for ways to cut costs and overheads, they are
utilizing part-time workers more (who don’t usually receive benefits). Part-time workers thus represent an understudied group and the literature is beginning to reflect this.

Job sharing is related to part-time work and is a concept that is gaining popularity as it offers an alternative for many employees who may not be able to commit to an organization full time. Job sharing involves two or more people splitting up a 40-hour-per-week job. Many organizations are letting people who wish to share a job to do so if the employees agree to be responsible for coordinating the administration and logistics of the schedule. The literature, particularly experimentally designed studies, is particularly sparse regarding job sharing. Related to job sharing is a notion called ‘flexible working years’ which involves the coordination of two or more employees working alternative years at a particular job. We only found one reference in the literature to such a schedule.

Finally, there is a relatively new concept called ‘telecommuting’ (also home-based work, flexible place, flexiplace) which involves the employee working out of his or her home. Telecommuting appears to be particularly amenable to jobs that entail mainly computer work (e.g. data entry), or phone work (e.g. phone sales/solicitation). The most obvious major concern with telecommuting is the monitoring of the system.

Family-friendly Policies

Actually, what all of the alternative schedules have in common is that at some time they have all been referred to or categorized as ‘family-friendly’ policies an organization can implement. As discussed, shiftwork can enable parents to work when their children are sleeping and thus to be at home for mealtimes; compressed schedules often have extended weekends as an advantage; and flextime enables a parent to adjust work hours to coincide with when they need to be home in the mornings and/or afternoons. Part-time work and job sharing are considered family-friendly in that they enable people (often a parent who does not want to work full time because of family commitments) to work who cannot or will not commit full time to a job. Telecommuting offers obvious advantages for families as it allows a parent to be home continuously. Other family-friendly policies which are gaining in popularity, yet have relatively little research support, are company-sponsored wellness/fitness programs and on-site or company-sponsored childcare centers.

Methodological Considerations

As mentioned in the text of this review, one of the main concerns regarding the literature on alternative work schedules is the generalizability of the results from different samples. This is especially a concern for the shiftwork literature as much of the research has been conducted with either nurses or mostly male-
dominated industrial workers. Replications of some of the major research findings in more diverse settings thus appears to be warranted.

Another concern involves the criterion measures: much of the data is from questionnaires and surveys and revolves around a handful of dependent variables (i.e., job satisfaction and satisfaction with work, withdrawal behaviors, health and sleep symptoms). There is a gap in the literature linking alternative work schedules to much of the recent work in the last decade in organizational attitudes and behaviors. We feel that a notable addition to the literature would be studies involving more behaviorally based criterion measures. A particularly fruitful avenue for further exploration is the impact of alternative work schedules on organizational citizenship behaviors (OCBs). Other suggestions include a consideration of the impact of alternative work schedules on the organizational attitudes of perceived organizational support and organizational commitment.

Finally, we feel that longitudinal studies are particularly necessary in this field. A few studies made mention that some of the adverse effects of shiftwork appeared to be very long-lived; however, a majority studied a snapshot in time. While the consequences discussed are important regardless of whether they are acute or chronic, long-term effects, particularly physical and mental health-related ones, are much more onerous. Established long-term consequences would also help with legislation efforts to make shiftwork, in particular, more safe.

In a related vein, some researchers mentioned that jet lag was similar to shiftwork in its physiological disruptions to the individual, yet distinct because jet lag benefits from time cues that encourage adjustment, and it is usually acute rather than chronic (Regestein & Monk, 1991). It would be very interesting to utilize the jet lag literature and test some preventions for jet lag with shiftworkers. A melding of the two literatures may further shed light on the distinction between acute and chronic problems resulting from shiftwork.

Related to the nature of longitudinal studies is the notion of studying persons who drop out of shiftwork. At first blush this may seem akin to asking researchers to do more studies on turnover and who left the organization and why; the difficulties of such research are readily apparent. Yet, with alternative work schedules, persons who drop out of the particular schedule may actually stay with the organization. Thus, it would be possible to study those who have "quit shiftwork" but continued working for the employing organization. The variables of perceived organizational support, organizational citizenship behaviors, and organizational commitment would all seem to be logically related to reasons why persons drop out.

Finally, it is possible that the people who drop out of shiftwork could have been either counseled on strategies to prevent adverse consequences, or deterred from entering into shiftwork in the first place. In fact, the question of clinical management of individual problems from shiftwork has recently arisen in the literature (e.g. is the poor sleep that shiftworkers experience to be
considered a sleep disorder? Regestein & Monk, 1991). Clinical and counseling strategies for shiftworkers thus seems to be another potential avenue for future research.

CONCLUDING REMARKS

Before an organization implements any alternative work schedule, it should carefully evaluate its own scheduling needs, the needs of its employees, and the work environment. While this may sound like elementary advice, many organizations implement such policies based on anecdotal evidence from other organizations and reports from non-research-based journals. According to Dunham and Pierce (1983; Dunham, Pierce & Castaneda, 1987), most users of alternative work schedules have chosen one based on intuition or have copied the practices of other organizations. If those in administration have strong expectations about what the implementation of the schedule will accomplish, they may be setting themselves up for disappointment and possibly failure. As Buckley, Kicza and Crane (1987) point out, it is erroneous to assume that 'what worked in one organization will work in another'.

The organizational culture, then, will be a major determining factor in whether a particular work schedule is needed and/or accepted in a particular organization (Buckley, Kicza and Crane, 1987). For example, telecommuting may not be a viable option for organizations which have established excellent reputations based on quality, personal, face-to-face service (e.g. banks, accounting firms). Thus, if an organization makes a commitment to family-friendly policies and decides to implement an alternative work schedule, they may have the task of actually changing their organization's culture. Organizations need to consider if this is an additional challenge they are willing to tackle. In summary, we offer five critical concerns management must evaluate before implementing any alternative schedule.

- Policy Adoption Issues: What is the impetus behind adopting this particular schedule? Is it due to hunch, intuition, or because another organization reported 'amazing' effects? Implementation should be based on a sound assessment of one's own operating needs, the needs and desires of one's employees; and the feasibility of the proposed schedule: not all jobs and/or positions are amenable to alternative schedules.
- Administrative and Financial Issues: How will the administration of the system be monitored? Will the organization incur extra overhead cost for utilities, support services such as cafeteria and security, or personnel administration? Often organizations choose to implement schedules without realizing the extra administrative time and overhead expenses.
- Union and Legal Issues: Is there likely to be union opposition? Does the chosen schedule have potential to adversely impact any protected classes
of employees? Organizations may find legal consultation extremely advantageous in preventing future legal battles.

- Design of the System: Is the design of the chosen system threatening to employees' physical and/or mental health? Will measures be taken to reduce adverse consequences? Keeping known circadian rhythm principles in mind when designing the system will prevent and alleviate deleterious effects.

- Long-term Monitoring: What procedures are in place to ensure that the system continues to meet organizational and employee needs? Long-term monitoring and adjustments to the system are critical in enabling organizations to capitalize on potential value added.

REFERENCES


