

The physiological effect of working the midnight shift

Introduction

Shift work has been around for an extremely long time, even in the days of ancient Rome, deliveries of goods were restricted to night hours to lessen traffic congestion. In a similar fashion, for many centuries the bakers of bread have been toiling in the early hours of the morning to have a fresh product for the day. The major feature of shift work that has change through the ages is the amount of people who are affected. Estimates of shift work for the United States are about 20% of the work force.

Today, 24-hour operations are necessary to meet the demands of society and the requirements of an industrialized global economy. These around the clock demands pose unique physiological challenges for the humans who remain central to safe and productive operations. Optimal alertness and performance are critical factors that are increasingly challenged by work schedules.

Shift work is not easy to study. Very often the most important variables are those that occur outside the work place for example the amount of day sleep quality, and many of the measures are subjective and maybe affected by each individuals preference for working 3rd shift, for example increase in pay or family situation.

Here at Kennedy Space Center, operations carry on 24 hours a day for an operational stand point (most of the big moves are done either late night or early mornings). It starts with the typical 7:00 to 4:00, 3:30 to 12:00, and 11:00 to 7:30. The majority of the contractors use a fixed quarterly rotation schedule, except for the entry control point workers who must have coverage on a 24/7/365 day schedule, they use a weekly shift change schedule.

My focus was on the 3rd shift Quality Assurance group for NASA, and the United Space Alliance Quality Control group. NASA's schedule is on a yearly rotation United Space Alliance uses the quarterly rotation. I used a survey to determine their, age, sleep pattern, how long they've work this shift, any social or health stresses, recommendations to better the shift, and if they had volunteer to work this shift.

Number of employees	Average age	Gender	Average time on shift
16	51.75	2 (F) 14(M)	10.9 yrs

In order to determine the alertness of the workers I posed the following questions:

1) On a normal work day how many hours of sleep do you get?

The average was 5.4, with the least being 3 the most being 7

2) Do you get sound sleep during this time?

No	10 out of 16
Sometimes	4 out of 16
Yes	2 out of 16

3) How often do you feel sleepy at work?

a) 1-2 times	10 out of 16
b) 3-5 times	3 out of 16
c) Never	3 out of 16

4) Do you know what a circadian rhythm is?

No	10 out of 16
Yes	6 out of 16

The first solution for this work force is an education in alertness management. From the above questions it can easily be determine that on average they only sleep 5.4 hours per day during normal working hours, they don't acquire sound sleep and most of them are not aware of what a circadian rhythm is.

Sleep is a vital physiological need. Sleep is necessary to maintain alertness and performance, positive mood and overall health and well being. Each individual has a basic sleep requirement that provides for optimal levels of performance and physiological alertness during the wakefulness. On average, individuals require eight hours sleep in a 24 hour period. Losing as little as two hours of sleep will result in acute sleep deficit, which will induce fatigue and degrade subsequent waking performance and alertness. Rather than attempt to eliminate fatigue, it maybe more useful to consider critical factors that can promote and optimize alertness management.

Scientific findings have clearly established that sleep is a complex, active physiological state that is vital to human survival.

When someone is deprived of sleep, the physiological response is sleepiness which is the brain's signal to prompt an individual to obtain sleep, a signal that specific physiological requirement has not been met. The sleepier the person, the more rapid and frequent the intrusions of sleep into wakefulness, thus the response of the above survey as how many times people felt the need to fall a sleep at work.

In order to minimize sleep loss, education and training programs will provide crucial support to the individuals on 3rd shift. Individuals should be aware and trained in taking the following preventive measures:

- Avoid stimulants, such as caffeine and nicotine, several hours before bed time.
- Develop and follow a sleep routine. Sleeping more than once (morning and evening), develop a regular pre-sleep routine in order to relax, use various physical and mental relaxation techniques (meditation, yoga, and muscle relaxation).
- Fit in a nap. When your daytime sleep is too short, taking a nap just before work or on a break during your night shift. Naps can acutely improve alertness; naps should be limited to less than 45 minutes to prevent the chances of entering deep sleep, because waking out of deep sleep may lead to feelings of grogginess and disorientation for several minutes.
- Sleep time needs to be given a priority and kept as free as possible from other commitments and activities.
- The environment can also affect sleep, a dark room is preferable, eye shades are a simple solution to light, earplugs can reduce noise, a cool room and a comfortable sleep surface are also important.

The second solution is to educate individuals in what a circadian rhythm is, as you can see most of them had no idea of what it is.

What is a circadian rhythm? Humans are hard wired with a circadian pacemaker that programs us to sleep at night and to be awake during the day, on a 24 hour schedule. This internal clock coordinates an organism's physiology and

psychological behavior, including the sleep/wake hormone and body temperatures with the external environment. One of the most powerful time cues is the light/dark cycle. Working the 3rd shift disrupts the circadian clock, because the individual is maintaining wakefulness in direct opposition to physiological programming to be a sleep, and is for this reason that individuals on 3rd shift must pay attention to time cues and routines in order to adjust their circadian system. Ideally to reset the circadian systems it takes well over a week and many researchers maintain that complete realignment or adjustment seldom occurs, even in permanent night workers, in order for it to occur there would have to be a nocturnal sub-culture that maintained a continuous nocturnal orientation of their circadian system by retaining that orientation during their days off, but most night workers make this impossible as is all too easy to revert to day time activities during the two or three days of a weekend break.

The more regular the routine is, the more powerful it will be in helping the circadian system to be appropriately aligned to the work routine. These recommendations should be followed:

- Go to bed as soon as possible after the end of the night shift, get home have a light meal and go to bed.
- Avoid daylight illumination levels on the drive home from work. Wear dark glasses especially if driving into the sunrise.
- Try and take a regular three meals a day and try to keep them as predictable as possible.

The important thing to remember is that the circadian system has no magical way of telling which is night and which is day. All the system can go on is the information given and in order to maintain suitable sleep/wake patterns this flow of information into the circadian system must be manipulated in order to improve the chances of obtaining the desired effect.

The next set of questions evaluated the individuals for stress of working the 3rd shift.

1. Have you experienced any health problems related to this shift?

No 10 out of 16

Yes 6 out of 16

2. Do you have work related health stress?

No 10 out of 16

Yes 6 out of 16

3. Did you volunteer for this shift?

No 2 out of 16

Yes 14 out of 16

4. Do you feel social and domestic strains?

No 5 out of 16

Yes 11 out of 16

A major worry facing workers working the 3rd shift, even those coping well with this shift is that their health and longevity might be compromised by their shift working routine. 3 out of the 6 that said they had health stress are all dealing with high blood pressure. Blood pressure normally decreases at night while you sleep. When you get out of bed in the morning, your blood pressure starts to increase and peaks about midafternoon. In the late afternoon and evening your blood pressure starts to decrease again. According to researchers, people who sleep for only short periods of time, less than six hours increase their average 24 hour blood pressure and heart rate, and over time this may lead to high blood pressure.

We can reduce the strain experienced by this shift, if we can help these workers with coping strategies, education, and health care provision, then it is possible that the health risk can be reduced.

I categorized 14 out of these 16 workers as promoting their own self imposed stress, because 14 of them have decided to stay on this shift. Of the 14 the least amount of time spent on this shift has been 2 years, and the longest time spent on this shift is 23 years. For 2 of the 16 this month will be their last month on this shift, they will be leaving the shift after 1 year, they can not cope with their short term problems in sleep, and other matters. By and large 3rd shift workers are a survivor population. Those who are unable to cope with shift work will transfer back to another shift. The self imposed stress that I refer to is strain from not aligning your circadian system, strain from sleeping problems, and strain from social and domestic situations. Stress is an encompassing term that includes anything and everything that places a strain on an individual's ability to perform at his very best. The effects of stress grow, and must be overcome by the bodies

compensatory mechanism, and these 2 individuals were not able to cope with the related stress.

Why do these 14 individuals put themselves through this stress? Here are some of their answers:

“I enjoy the extra pay (night differential)”

“I hate the hours, but love the people and the work, and most of all the lack of chicken sh__ during the night shift”

“It’s a choice I made 18 years ago”

“I’m more relaxed, less stressful people on this shift”

“I love not having to deal with traffic “

“I see my family more on this shift than when I worked 2nd shift”

I would say that the majority of these workers have for the most part adapted to their schedule, by controlling their three basic areas of stress: circadian system, sleep and social/domestic, all three of these are interrelated, so all three must be functioning well for strain to be entirely absent.

I was reluctant in asking the next question, because it dealt with safety and performance, and since we work at NASA safety is the #1 concern, so I didn’t know how they would handle it, but I was surprised with their honesty and all of them answered the question.

1. Are you concerned with safety due to lack of sleep?

No 8 out of 16

Yes 8 out of 16

2. Is your performance affected due to lack of sleep?

No 8 out of 16

Yes 8 out of 16

Of the workers who answered yes, to the questions above, most felt compelled to explain why they thought that safety and performance had been compromised. Most of the workers explained that if the job was monotonous or there was lack of interaction, they felt like they were dosing off.

Performance, mood and alertness are all impaired when one has to attend a task in the middle of the night and with insufficient sleep. It would, indeed be very surprising if performance and safety were not compromised by shift work. While there are occasionally greater environmental risk associated with shift work than with day work (because of no day light) these are usually outweighed by the reduction in the number of people around (human traffic), this is one of the main reasons why here at the Kennedy Space Center, we do most of the heavy lifting or hazardous operations late at night or early mornings (3:00 AM).

Just as you can take steps to ensure a good day's — sleep, you can try these steps to stay alert on the job:

Take short breaks throughout the shift.

Try to work with a "buddy."

Talking with co-workers can help keep you alert. And co-workers can be on the lookout for signs of drowsiness in each other.

Try to exercise during breaks.

Use the employee lounge, take a walk, shoot hoops in the parking lot, or climb stairs.

Try to eat three normal meals per day. Eat healthy snacks, avoiding foods that may upset your stomach.

If you consume caffeine (coffee, tea, soda, energy drinks, gum, mints), do so early in the shift, e.g., before 3 a.m. for the night worker.

Don't leave the most tedious or boring tasks to the end of your shift when you are apt to feel the drowsiest.

Night shift workers hit their lowest period around 4 a.m.

Exchange ideas with your colleagues on ways to cope with the problems of shift work.

Set up a support group at work so that you can support and learn from each other.

What can the employer do to improve shift work?

Although there are certain things that an individual shift worker can do about improving their situation, in many areas the individual is unable to act, and must rely upon the interventions of the company or organization he works for.

Consider the task the shift worker is being asked to perform. Task involving immediate retention and high memory loads will be performed relatively well during the night shift.

Shift workers should be counseled to use sleep schedules and time cues which will aid in the process.

Install bright lights in the work areas. A well-lit workplace signals the body that it is time to be awake and alert. Provide vending machines with healthy food choices.

Schedule shifts to allow sufficient breaks and days off, especially when workers are re-assigned to different shifts. Plan enough time between shifts to allow employees to both get enough sleep and also attend to their personal life. Don't promote overtime among shift workers.

Develop a napping policy. Encourage napping by providing a sleep-friendly space and time for scheduled employee naps. A short break for sleep can improve alertness, judgment, safety, and productivity.

Be concerned about employee safety going to and from work. Encourage the use of carpools, public transportation, rested drivers, and even taxis.

Develop a shift work awareness program, having both medical and safety departments involved. Concentrating on educating management and the employee, while developing a support service and self-help groups.

Conclusion

It is a false assumption that like machines, people can perform just as well as they can in the middle of the night as they can during the day. And even though shift differential is paid to compensate for the discomfort of being on an odd shift. Employers must realize that a person who can not cope with shift work should not be the 'victim' of not doing the right thing (not getting enough sleep, showing up to work late or being absent). Because the fact that most humans are not easily adaptable to shift work, should not be conveniently ignored by the employer.

These are some of the factors to consider when planning a night shift:

How long a shift might be.

How many shifts are worked before a rest day.

How many rest days are on weekends.

Whether there is overtime.

How much rest is taken between shifts.

How much rest is taken during the shift.

Whether the work schedule is regular and predictable

It is clear that, for the employer, as it is for the employee, the approach must be a multifaceted one. Not only in allowing shift selection, but also work place design, employee education and the provision of clinical and nutritional resources must be considered part of the HFE countermeasure package.

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