

## Czeisler et al. (1982)

### *Rotating Shift Work Schedules That Disrupt Sleep Are Improved by Applying Circadian Principles.*

**Background and aim:** 26.8% of Americans work shifts, rotating between night, evening, and daytime. Previous research has shown that rotating shift workers are often dissatisfied with the features of their schedules that violate circadian principles. Prior to this study, three major strategies had been used to address the problems of adaptation to shift work: 1. Schedule workers on straight shifts without rotation; 2. Rapidly rotate from one shift to the next; 3. Take advantage of individual differences in biological rhythms and put those with the greatest tolerance on abnormal schedules. However, there are problems with each of the strategies. Czeisler et al.'s aim was to demonstrate that when schedules that consider properties of the human circadian system are introduced there will be a positive effect on workers – work schedule satisfaction and



health will improve, staff turnover decreases and worker productivity will increase.

The researchers aimed to take advantage of those properties of the circadian system that individuals share in common: the longer than 24-hour endogenous period and the limited range of entrainment, by comparing 33 workers who continued to change shifts each week and 52 others who rotated shifts by phase delay once every 21 days, on measures of job satisfaction, health indices, personnel turnover and productivity. Czeisler et al. suggests that work schedules that rotate should do so by successive phase delays and that the interval between phase shifts should be as great as is practical.

**Method:** The participants in this study were 85 male shift workers, aged between 19 and 68 who were on rotating shifts. There was also a control group of 68 male non-rotating day and swing shift workers with comparable jobs; they were aged between 19 and 56. All participants worked at The Great Salt Lake Minerals and Chemicals Corporation in Ogden, Utah. **Questionnaires** were given out to measure workers' satisfaction, health, personnel turnover, and productivity. This was measured before and after the introduction of new shift work schedules. As the researchers manipulated the shift work schedules of workers (**IV**), this study was also an **experiment**. 84% of workers completed the questionnaire. All staff attended a presentation on the circadian sleep-wake cycle that gave suggestions for adjusting their sleep time to their schedule. An educational booklet was also provided.

Prior to the study, weekly shifts at the factory were rotated with each crew working a given eight-hour shift for seven days before rotating to the preceding eight-hour shift. So the scheduled work time rotated in a phase advancing direction from midnight to 8 a.m., to swing (4 p.m. to midnight), to day (8 a.m. to 4 p.m). A rotating work schedule

was introduced: the design was based on circadian principles and focused on the direction of rotation and the interval between phase shifts. Shift workers on phase advance schedules were divided into two groups and placed on phase delay schedules: 33 workers continued to change shifts each week and 52 others rotated shifts by phase delay once every 21 days. This procedure stopped after a month; after this time an eight-hour phase delay was undertaken on every 21st day.

3 months after the introduction of the new schedules further questionnaires were completed and staff turnover was analysed; 6 months later plant productivity was analysed.

**Results:** Before the introduction of the new shift schedules, those on rotating shifts reported significantly more problems with insomnia than those who didn't rotate. 29% of rotators reported falling asleep at work at least once during the previous three months; 81% reported that it took two to four days or more for their sleep schedule to adjust after each phase advance; and 26% stated they weren't able to adjust at all. A major complaint was that the schedule changed too often. After the introduction of the new shift schedules - the workers clearly preferred the phase delay direction of rotation - complaints about the schedule dropped from 90% to 20% among workers on the 21-day phase delay rotation schedule. There was a large increase on the schedule satisfaction index, improvements in the health index and a reduction in personnel turnover. Furthermore, productivity in the plant increased over a period of time.

**Conclusions:** Shift work that implements phase delay with extended intervals between rotations is most compatible with the properties of the human circadian timing system' Such schedules can minimise negative consequences of circadian disruption. As a result of using these schedules, both shift workers' job satisfaction and health improves, while staff turnover decreases and productivity increases.

## Evaluation

**Usefulness:** Czeisler's research has been very useful as it has improved our understanding of the impact of shift work on biological rhythms. The negative effects on individuals' health, well-being and productivity are reduced through the principles of phase delay and therefore similar strategies should be implemented by other employers.

**Validity:** There are a number of methodological problems with this study which could make the findings less valid. Data was collected using the self-report method, whereby workers had to answer question on their health and job satisfaction. A possible problem here is **social desirability bias**: participants may not have answered honestly to make themselves look better. For example, they may have reported higher levels of satisfaction after the shift schedule changed as they thought this is what should have happened. However, measures of productivity and staff turnover were objective and unbiased and therefore more valid.

**Sampling bias:** The findings from a sample of all male shift workers from one factory in America **lacks population validity** and cannot be **generalised** to other groups. The study

is also over 25 years old and our lifestyles have changed hugely since then, so the results may not be relevant today.

### Exam Style Question

Using the research by Czeisler et al. (1982), explain the impact of the disruption of biological rhythms on our behaviour. (10)

Explain how the research by Czeisler et al. (1982) could be used to reduce the effects of jetlag or shiftwork. (10)

SAMPLE