ANALYSIS OF HEALTH RECORDS OF DAY AND
SHIFT FURNACE MAINTENANCE WORKERS

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Health insurance records for two years of 85 day and 85 shift workers engaged in furnace maintenance of an iron works were analysed. The two groups of workers were matched with respect to jobs, age, work duration and marital status. The mean frequency of falling ill was 2.84 for dayworkers and 2.45 for shiftworkers, the difference being insignificant. Only for diseases of the gastrointestinal system, the shiftworkers fell ill more frequently (51.8% in the two-year period) than dayworkers (36.5%). Results of a questionnaire answered by these workers showed that shiftworkers had more frequent complaints about insufficient sleep, gastrointestinal symptoms, and daily life difficulties. When the rates of these complaints were compared between those having had treatment for gastrointestinal diseases in the past two years and those without such treatment, the rates were higher for the former as to gastrointestinal symptoms, complaints of localized muscle fatigue, and insufficient sleep. As the job contents of the day and shift workers of this study were equal, these higher frequencies of gastrointestinal illnesses and related symptoms among the shiftworkers were clearly ascribable to the disruption of circadian rhythms.

Shiftworkers appear to be exposed to a special risk to the gastrointestinal system. This risk is significant when the shiftworkers work frequent night shifts. It is thus known that night-shift workers generally suffer from gastrointestinal symptoms more frequently than dayworkers (AANONSEN, 1964; ANDERSEN, 1960; ANGERSBACH et al., 1980; COSTA et al., 1981; TAYLOR, 1967; THIIS-EVENSEN, 1958). Usually, a variety of symptoms are complained of. Only part of them actually fall ill on account of disorders of the gastrointestinal system and are given medical care. These disorders include gastric and duodenal ulcers and various other intestinal diseases. In addition, shiftworkers tend to suffer also more frequently than dayworkers from some other diseases such as motor organ diseases.
There lack, however, sufficient data about the relation between subjective complaints of shiftworkers and incidence of disorders requiring medical care. Since conditions of work other than shift work, such as hours of work, workload, work environment, age and selection of workers, also influence incidence rates of disorders, these rates must be compared between day and shift workers doing similar jobs whose age, family status, work experiences, and general welfare conditions are also similar.

We have recently studied medical records of workers engaged in maintenance of furnaces, part of them working a three-shift system and others working in the daytime only. This paper intends to report differences found between the day and shift workers based on matching of jobs, sex, age and marital status, and to discuss the relation between medical records and subjective complaints.

METHODS

A questionnaire study was carried out on furnace maintenance workers of a medium-sized company. The company sends these workers to an iron works for maintenance of furnaces and gutters. Of 565 workers, 526 male workers replied to the questionnaire. Dayworkers accounted for 49.2% or 259 workers and three-shift workers 48.3% or 254 workers. Thirteen workers were on other shift systems. Age distribution was similar between the day and three-shift workers; age below 30, 8.5 and 7.1%, age 30-34, 7.3 and 7.9%, age 35-39, 10.4 and 7.1%, age 40-44, 14.7 and 22.4%, age 45-49, 26.6 and 28.0%, age 50-54, 30.5 and 27.2%, and age 55 or more, 1.9 and 0.4%, respectively.

In order to match the job and marital status, we have selected married workers doing either of three jobs, furnace repair, gutter repair, and bricklaying. Age was also matched between the group of dayworkers and that of shiftworkers so that in each group 10 were age 35-39, 15 were age 40-44, 30 were age 45-49 and 30 were age 50-54. Each group thus consisted of 85 workers randomly chosen from these age groups. The duration of employment was accordingly similar between the two groups; 5-9 years in 35.3%, 10-14 years in 60.0% and 14-19 years in 4.7% of dayworkers, and 5-9 years in 30.6% and 10-14 years in 69.4% of shiftworkers.

Morbidity of those 170 workers were examined using the health insurance records of these workers for two years between May 1980 and April 1982. These insurance records had been sent to the insurance fund for the payment of medical costs (Aoyama et al., 1970, Aoyama et al., 1971).

Results of the above-mentioned questionnaire were then examined for these two groups. Percentages of these claiming daily life difficulties and those complaining of various symptoms were compared between day and shift workers.
RESULTS

Illness on medical records

Figure 1 gives the number of workers by frequency of falling ill during the two-year period for day and shift workers. Twelve day workers and 13 shift workers had had no incidence of falling ill in the two years. There was no significant difference in the frequency distribution between the two groups.

![Graph showing frequency of illness](image1)

Fig. 1. Frequency of falling ill between May 1980 and April 1982 among day and shift workers.

![Graph showing distribution of medical treatment duration](image2)

Fig. 2. Distribution of the duration of medical treatment between May 1980 and April 1982 among day and shift workers.

* The difference statistically significant at the 0.05 level.
The distribution of the number of days of treatment differed between the two groups, as shown in Fig. 2. The total number of workers medically treated was similar between both groups; 75 dayworkers and 73 shiftworkers among 85 each. The number of those who were treated for less than 30 days was 50 (58.8%) among dayworkers, but 63 (74.1%) among shiftworkers. This difference was significant at the 0.05 level. This was mainly because the frequency of dayworkers treated for 30–99 days was larger than that of shiftworkers. Those dayworkers were being treated for various diseases, only in a small part for gastrointestinal diseases.

The illness diagnosed by the treating physicians are given in Fig. 3 for the day and shift workers. Those treated for the corresponding category of diseases during the two-year period are indicated as percentages of the day or shift workers.

Respiratory diseases were commonly frequent in both groups (54.1% among dayworkers and 51.8% among shiftworkers). Gastrointestinal diseases were also frequent, but the rate was significantly higher for shiftworkers (51.8%).

![Graph showing rates of diseases](image)

**Fig. 3.** Rates of those having each category of diseases medically treated between May 1980 and April 1982 among day and shift workers. *The difference statistically significant at the 0.05 level. Upper rows: dayworkers, lower rows: shiftworkers.
than for dayworkers (36.5%). The third common category of diseases was that of motor organ diseases including low back pain, which accounted for 38.8% of both day and shift workers. For all the other categories, the rates were similar between both groups. Thus, excluding the gastrointestinal diseases, there were found no significant differences in rates of diseases between day and shift workers.

Among these gastrointestinal diseases, the rates for gastric and duodenal ulcers showed no significant differences between day and shift workers. If ulcers are excluded, however, the rates for gastritis and other gastroenteric diseases were highly significantly different between the two groups at the significance level of 0.01.

Complaints of day and shift workers

As for general fatigue and general health status, there were no differences between day and shift workers, but the percentage of those complaining of insufficient sleep was significantly higher for shiftworkers than for dayworkers (Fig. 4).

When the rates of those complaining of various subjective symptoms were compared, the difference between day and shift workers was significant only for a few symptoms, as shown in Fig. 5. These symptoms included “suffering from diarrhea or constipation,” “recently told that countenance was bad” and “sometimes cannot sleep well recently.”

Then the number of workers complaining of any of the four gastrointestinal symptoms was compared. These included, in addition to “suffering from diarrhea or constipation,” “appetite is poor recently,” “often feel nausea,” and “feel pain in the stomach area.” The number of workers complaining of those symptoms was significantly larger for shiftworkers (29 workers) than for dayworkers (16 workers). The shiftworkers’ complaints may thus be said to concentrate on sleep deficit and gastrointestinal symptoms.

Figure 6 shows percentages of workers complaining of problems of working life connected with work schedules. Shiftworkers were obviously complaining

![Figure 4](image)

**Fig. 4.** Subjective feeling about the present health condition, fatigue caused by daily work, and sleeping conditions.

** The difference statistically significant at the 0.01 level.
more frequently of problems related to resting conditions, irregular schedules, and sleep than dayworkers. The difference between the two groups was significant for the following items: “lack of time to rest,” “less time to enjoy family gathering,” “troubled due to the shortage of manpower, the management calls me to do a temporary duty,” “diet becomes irregular,” “irregular work brings extra burden to family members,” “due to work, hard to lead a satisfactory con-
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Fig. 6. Comparison of the rates of those having problems connected with the working life among day and shift workers.

* The difference statistically significant at the 0.05 level; ** the difference statistically significant at the 0.01 level. Upper rows: dayworkers, lower rows: shiftworkers.

- Fig. 6. Comparison of the rates of those having problems connected with the working life among day and shift workers.

- Relation between medical records and complaints

So as to examine the relationship between medical records and complaints, the rates of various complaints were compared between those having had such diseases in the past two years and those who had had no such diseases during the period.

Figure 7 gives the results for subjective symptoms. Interestingly, workers having had gastrointestinal diseases complained more frequently than those who had not such diseases of gastrointestinal symptoms, localized muscular fatigue and insufficient sleep. These included “often feel nausea,” “feel pain in the area of stomach,” “have stiff shoulders,” and “sometimes cannot sleep well recently.”
Fig. 7. Rates of subjective symptoms among those having had gastrointestinal diseases and those having had no such diseases.

* The difference statistically significant at the 0.05 level. Upper rows: those having had gastrointestinal diseases; lower rows: those having had no gastrointestinal diseases.

Figure 8 shows similar results for various complaints about working life. While the differences between day and shift workers are remarkable, the rates were not significantly different between those having had gastrointestinal diseases and those without such diseases except for the complaint of “irregular work brings extra burden to family members.”
Fig. 8. Comparison of complaints about problems connected with the working life among those having had gastrointestinal diseases and those having had no such diseases.

* The difference statistically significant at the 0.05 level. Upper rows: those having had gastrointestinal diseases; lower rows: those having had no gastrointestinal diseases.

CONCLUSION

The medical records of day and shift workers were strikingly similar if they were well matched as to jobs, age, work duration and marital status. Only significant differences were found for diseases of the gastrointestinal system. The three-shift workers fell ill more frequently with gastrointestinal diseases than dayworkers. This was quite remarkable for the subjects selected and matched, as this was the only positive difference. This difference, on the other hand, was apparently reflected in the rates of subjective gastrointestinal symptoms. Shiftworkers complained more frequently than dayworkers of sleep shortage and gastrointestinal disorders.

When the rates of these complaints were compared between those having had treatment for gastrointestinal diseases in the past two years and those without
such treatment, the rates were higher for the former as to gastrointestinal symptoms and insufficient sleep.

These results support the previous reports on higher frequencies of gastroenteric disorders among shiftworkers doing night work. As the job contents of our day and shift workers were substantially the same, these higher frequencies should clearly be ascribable to the disruption of circadian rhythms in the shiftworkers. It appears important that the individual ill-health is well reflected in the frequency of subjective complaints at least for these gastrointestinal disorders. Since numerous reports have confirmed a higher prevalence of gastroenteric complaints among shiftworkers and its relation to abnormal work schedules, more careful attention must be paid to conditions of shiftwork enhancing gastroenteric disorder. The frequency of night shifts, among others, should be lowered as much as possible as a priority area of improvement (Rutenfranz et al., 1977; Shift Work Committee, Japan Association of Industrial Health, 1979).

REFERENCES


