



Title	Effect of shift work on mental state of factory workers
Author(s)	Kaneko, Shin-Ya; Maeda, Takafumi; Sasaki, Akihiko; Sato, Akihiko; Tanaka, Kazuko; Kobayashi, Toshio; Tanaka, Masatoshi; Fukushima, Tetsuhito
Citation	Fukushima Journal of Medical Science. 50(1): 1-9
Issue Date	2004-06
URL	http://ir.fmu.ac.jp/dspace/handle/123456789/150
Rights	© 2004 The Fukushima Society of Medical Science
DOI	10.5387/fms.50.1
Text Version	publisher

This document is downloaded at: 2024-04-25T08:50:48Z

EFFECT OF SHIFT WORK ON MENTAL STATE OF FACTORY WORKERS

SHIN-YA KANEKO¹⁾, TAKAFUMI MAEDA¹⁾, AKIHIKO SASAKI¹⁾,
AKIHIKO SATO²⁾, KAZUKO TANAKA¹⁾, TOSHIO KOBAYASHI³⁾,
MASATOSHI TANAKA⁴⁾ and TETSUHITO FUKUSHIMA¹⁾

¹⁾*Department of Hygiene & Preventive Medicine, Fukushima Medical University,
School of Medicine, Fukushima*

²⁾*National Midorigaoka Hospital, Iwaki*

³⁾*Institute of Health Sciences, Faculty of Medicine, Hiroshima University, Hiroshima*

⁴⁾*Early Childhood Education, Fukushima College for Sincerity, Fukushima*

(Received September 4, 2003, accepted October 21, 2003)

Abstract: This paper examines the effects of shift work on the mental state of factory workers. As an indicator of the workers' mental condition, the authors used a scoring system (referred to below as the 'depression tendency score') based on the SRQ-D investigative report. The depression tendency score of the men was higher among the shift worker group than among the regular day worker group ($p < 0.01$). The depression tendency score of the male back-to-back shift workers was higher than that of the male regular day workers among skilled workers ($p < 0.05$). Among the women, no notable difference in depression tendency score was observed between the regular day worker group and the shift worker group. However, the depression tendency score of the female two-shift workers was higher than that of the female regular day workers among skilled workers ($p < 0.05$). We conclude that the mental health of men is easily affected by back-to-back shift work and that of women is affected by two-shift work because of the difference in modern societal/home role between man and woman.

Key words: Mental State, Factory workers, the regular day workers, the shift workers, SRQ-D

INTRODUCTION

Depression is known as 'a condition in which mental facilities are repressed, and a mental reaction which occurs in times of loss', and is chiefly associated with

金子信也, 前田享史, 佐々木昭彦, 佐藤晶彦, 田中かつ子, 小林敏生, 田中正敏, 福島哲仁
Correspondence to: Shin-ya Kaneko, Department of Hygiene & Preventive Medicine, Fukushima Medical University School of Medicine, Fukushima City 960-1295, Japan.
E-mail: s-kaneko@fmu.ac.jp

psychological symptoms. Physical symptoms, however, are inevitably present, as well. These symptoms have been regarded as psychosomatic, and have not been given much attention. The rate of depression has been increasing in recent years; a particular increase has been noted in cases resulting from stress. When information on the symptoms of depression is not forthcoming from the patient, there is a need to engage in active questioning in order to gain such information¹⁾. Existing research²⁾ reports that occupational stresses have an effect on the development of physical and mental problems, such as depression and nervous conditions, and the need for evaluations of, and measures to deal with, depression in labourers has been increasing in recent years³⁾.

Shift work is now indispensable in many factories and offices⁴⁾. Various papers have examined the effects of shift work on the health of workers. The adverse physiological effects of shift work are thought to be rooted in the fact that such labour requires changes in the worker's circadian rhythm. Workers cannot easily adapt themselves to changes in this life rhythm, and, as long as the worker is engaged in shift work, a particular burden is placed on the worker's body⁵⁾. Today, with more and more women entering the workforce⁶⁾, the number of female shift workers is increasing. There remains, however, little research focussed specifically upon females engaged in shift work, and the effects of shift work on the health of such workers remains unclear. Reports examining both men and women's depression and mental health levels in factories that adopt a variety of employment patterns are few. Through a comparison of fixed-hour, 'regular' labourers and labourers working irregular shifts, the authors examined the effects of shift work on the psychological state of factory employees including females.

MATERIALS AND METHODS

Since assignment of shift work had been changed, especially the back-to-back shift work had been experimentally introduced to females in 2001, for the purposes of this research, the authors conducted a two-year, SRQ-D-based survey (conducted at the time of the workers' annual health inspection) among workers at a certain electronics factory in 2000 and 2001. We investigated the same group for two years except for the absentee. This field survey consisted of a self-report questionnaire which was distributed to the workers before the day of their medical examination, and collected on the examination day. In addition, the questionnaire was distributed after obtaining the full consent of the workers to participate in this research.

In the first survey year (2000), replies were received from 542 of 565 workers (318 men, average age \pm standard deviation; 38.3 ± 8.0 years old, and 224 women, 37.5 ± 7.0 years old)—a recovery rate of 95.9%. From among the returnees, the authors selected the 488 workers that completed the questionnaire in full to be the final research targets. In the second survey year (2001), the authors obtained questionnaire responses from 472 out of 571 workers (256 males, aver-

age \pm standard deviation: 38.3 \pm 7.4 years old, and 216 females, 38.6 \pm 6.9 years old)—a recovery rate of 82.7%. From the 472 returnees, 5 receptionist staffs were eliminated.

The actual working hours of each of the above categories breaks down as follows. 'Regular' day work was from 8:15 AM to 4:50 PM, while back-to-back shift work ran on a cycle from 6:30 AM to 6:30 PM on the first work day, and 6:30 PM to 6:30 AM on the second, followed by two break days. This cycle repeats, inclusive of Saturdays and Sundays. Two-shift work runs on a repeating weekly cycle, with work being between the hours of 6:30 AM and 2:30 PM during the first week, and between 2:30 PM and 10:30 PM during the second. Daytime back-to-back shift labourers worked between 6:30 AM and 6:30 PM for two consecutive days. This was followed by two break days. This schedule also repeats, inclusive of Saturdays and Sundays. Night shifts ran between 4:35 PM and 11:00 PM, 11:00 PM and 8:30 AM, and 4:35 PM and 1:45 AM.

To indicate the mental state of the workers, computations were made through a 12-question depression tendency examination, designed by the authors and based upon the SRQ-D investigative report (Table 1). Each question could be answered by

Table 1. The question item of depression tendency investigation

Question	No	Yes		
		Sometimes	Often	Always
1. Do you have difficulty waking up and feel unrefreshed in the morning?				
2. Do you have difficulty working efficiently in the morning?				
3. Do you worry about various aspects of your health?				
4. Do you feel overwhelmed by your work?				
5. Are you easily irritated by trivialities?				
6. Do you feel anxious for no apparent reason?				
7. Do you feel lonely, even among large groups of people?				
8. Do you feel unrefreshed and weary?				
9. Do you waver between ideas, unable to reach a decision?				
10. Do you feel unenthusiastic about even about things you like? Do these things seem like a bother?				
11. Do you have difficulty sleeping?				
12. Do you suffer from loss of appetite?				

checking 'yes' or 'no', and, in the case of a 'yes' answer, the subjects were directed also to indicate whether they experienced the symptom 'sometimes', 'often' or 'always'. A 'no' answer was valued at 0 points, 'sometimes' at 1, 'often' at 2 and 'always' at 3. The total points were then taken as the worker's 'depression tendency score'. The Unpaired Student's *T*-Test or the Mann-Whitney U-Test was utilized in comparing male and female workers and when making comparisons in terms of shift type. The significance level was set at less than 5%.

RESULTS

The age of the participants in each year according to gender and type of work is indicated in Table 2. When observed on the whole, no differences along gender lines are apparent. Significant differences according to gender can be observed, however, among the regular day workers (clerical workers) in 2000, the skilled back-to-back shift workers and the skilled two-shift workers in 2001.

The depression tendency score of all targets is shown in Figure 1. The depression tendency score of the shift work group was higher than that of the regular day work group in 2000 and 2001.

Table 2. Age by gender and working style

Annual	2000 [488]		2001 [467]	
Gender	Male [298]	Female [190]	Male [254]	Female [213]
Regular day work (clerical work)	39.5±7.4 ^{ab} [92] ^c	34.2±5.6 ^{ab} [34]	40.1±7.3 [68]	37.8±7.0 [53]
Regular day work (engineering work)	34.2±5.5 [42]	[0]	36.2±6.4 [58]	[0]
Regular day work (skilled work)	36.8±6.7 [45]	38.2±6.8 [112]	38.5±7.9 [58]	39.7±7.0 [110]
Regular day work	37.6±7.1 [179]	37.2±6.7 [146]	38.4±7.4 [184]	39.1±7.0 [163]
Back-to-back shift work (skilled work)	35.4±7.1 [61]	[0]	36.8±7.2 [55] ^{abc}	42.5±4.5 [8]
Two shift work (skilled work)	35.5±8.3 [20]	32.9±6.2 ^{ab} [11]	42.9±7.7 [12] ^{abc}	35.2±5.7 ^{ab} [13]
Daytime back-to-back shift work (skilled work)	[0]	36.4±6.6 [33]	40.7±4.9 [3]	36.0±5.7 ^{ab} [29]
Shift work	35.5±7.3 ^{aa} [81]	35.5±6.6 [44]	38.0±7.5 [70]	36.8±6.0 ^{aa} [50]
Night work (skilled work)	43.1±6.6 ^{ab} [38]	[0]	[0]	[0]
Total	37.7±7.4 [298]	36.8±6.7 [190]	38.3±7.4 [254]	38.6±6.9 [213]

Each value is mean±SD and [number of subjects]. * and ** represent significant difference at $p < 0.05$ and $p < 0.01$.

a, Comparison with Regular day work; b, Comparison with Regular day work (skilled work); c, Comparison between Male and Female.

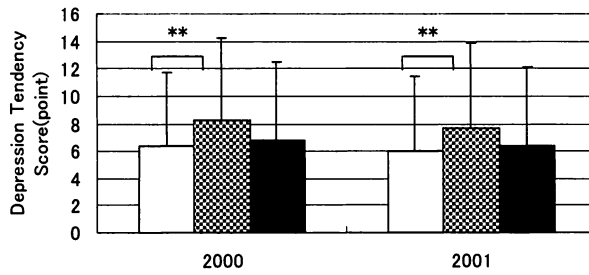


Fig. 1. The depression tendency score of all targets.
□, regular day work ; ▨, shift work ; ■, total ** : $p < 0.01$

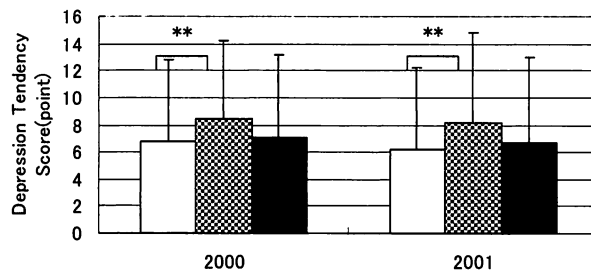


Fig. 2. The depression tendency score of the male workers.
□, regular day work ; ▨, shift work ; ■, total ** : $p < 0.01$

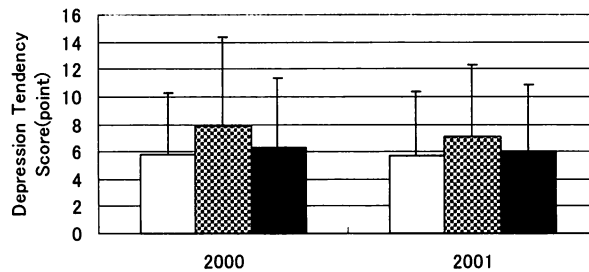


Fig. 3. The depression tendency score of the female workers.
□, regular day work ; ▨, shift work ; ■, total

The depression tendency score of the male workers is indicated in Figure 2. The depression tendency score of the shift work group was higher than that of the regular day work group in 2000 and 2001.

The depression tendency score of the female workers is indicated in Figure 3. No significant score differential between the regular day workers and the shift workers could be observed in each of the given years.

The depression tendency score of the workers according to gender and working style is indicated in Table 3. When the genders and the working styles were analyzed separately, the skilled female two-shift workers in 2000, and the skilled

Table 3. Depression score by gender and working style

Annual	2000 [488]		2001 [467]	
Gender	Male [298]	Female [190]	Male [254]	Female [213]
Regular day work (clerical work)	6.8±6.3 [92]	6.6±3.5 [34]	5.8±5.3 [68]	4.6±3.6 [53]
Regular day work (engineering work)	6.4±4.2 [42]	[0]	6.3±5.8 [58]	[0]
Regular day work (skilled work)	7.4±6.9 [45]	5.6±4.7 [112]	6.5±7.1 [58]	6.3±5.0 [110]
Regular day work	6.8±6.0 [179]	5.8±4.5 [146]	6.2±6.0 [184]	5.7±4.7 [163]
Back-to-back shift work (skilled work)	8.7±6.2 [61]	[0]	8.1±6.3 ^{ab} [55]	5.9±5.8 [8]
Two shift work (skilled work)	7.4±4.9 [20]	10.0±6.4 ^{ab} [11]	8.6±9.3 [12]	8.8±7.2 [13]
Daytime back-to-back shift work (skilled work)	[0]	7.2±6.4 [33]	6.3±1.5 [3]	6.6±3.9 [29]
Shift work	8.4±5.9 ^a [81]	7.9±6.5 [44]	8.1±6.7 ^a [70]	7.1±5.2 [50]
Night work (skilled work)	5.6±6.2 [38]	[0]	[0]	[0]
Total	7.1±6.1 [298]	6.3±5.1 [190]	6.7±6.3 [254]	6.1±4.8 [213]

Each value is mean±SD and [number of subjects]. * represents significant difference at $p < 0.05$.

a, Comparison with Regular day work ; b, Comparison with Regular day work (skilled work).

male back-to-back shift workers in 2001 showed high depression tendency scores in comparison to the skilled regular day workers.

In terms of gender-based differences, no gender-based difference in depression tendency was observed.

DISCUSSION

There are very few companies in Japan that have age restrictions on shift work in place⁷⁾. Since reports indicate that fatigue resulting from shift work increases rapidly after age 40⁸⁾, the authors think it necessary to introduce age restrictions on shift work. However, no differences in the depression tendency score could be seen comparison to the skilled regular day workers even though the average age of the skilled male two-shift workers, the skilled male daytime back-to-back shift workers, and the skilled female back-to-back shift workers in 2001 was over 40. These results show that the men can relatively adapt themselves to two-shift work and the women can relatively adapt themselves to back-to-back shift work.

It has generally been thought that there is no gender-based difference in the physiological burdens brought about by shift work and night work⁹⁾. No gender-based difference in depression tendency could be observed in this research. Depression tendency could be observed in the male back-to-back shift workers in compari-

son with the male regular day workers among skilled workers. These results of the male workers are congruent with those reported that there are more individuals suffering a high degree of depression among shift workers than among regular day workers, regarding the relationship between shift work and the degree of depression⁹⁾. According to research on insomnia and symptoms of depression among Japanese male shift workers engaged in various shift patterns¹⁰⁾, rather than interpreting the situation as being one in which shift work causes depression directly, it is more natural to conclude that shift work instead directly causes insomnia, and it is this insomnia that brings about the depressive state. The depression tendency score of the skilled male back-to-back shift workers in 2000 was high, but no notable difference could be observed between the skilled male regular day workers and the skilled male back-to-back shift workers because the depression tendency score of the skilled male regular day workers in 2000 was also high. We conclude that this is because there was much overtime for the skilled male regular day workers this year. The advance of women into the workplace is being accompanied by a rise in the number of organizations which employ women in shift-work roles. However, it is impossible to state with certainty that current social conditions in Japan provide for a sufficient support structure for these workers. According to research on the mental condition of healthy housewives¹¹⁾, when compared in terms of age and employment situation, working women in their late twenties to early thirties were reported to have particularly poor mental health. This is thought to be due to the fact that working women of this age, in addition to office responsibilities, must also perform non-employment duties including housework, pregnancy, childbirth, and child-rearing, making their physical and mental health particularly susceptible to damage. The ability of workers to adapt to shift work is thought to be determined by the mutual influences of the circadian rhythm factor, the sleep factor, and the societal/home factor¹²⁾. In research on the circadian rhythm for which night shift work was performed for 21 consecutive days¹³⁾, it was noted that, since alignment in body temperature took two weeks, the realignment of body rhythms takes time. It is thought that misalignments in this and other physiological rhythms cause adverse effects in the body and mind. The skilled female two-shift workers in 2000 showed high depression tendency scores, this is thought to be due to the fact that, in addition to increasing various kinds of responsibilities, although complete realignment of the physiological rhythm takes 1-2 weeks¹⁴⁾, by the time their physiological rhythms have caught up to their new life patterns, the female two-shift workers have again been put on completely different work schedules with no time allowed for their bodies to adjust. This brings about various lifestyle aggravations that result from misalignment in physiological rhythms and unfavourable physical and mental conditions. It would appear that the influence of two-shift work might be little for the female two-shift workers who have been replaced by the other female workers in late thirties who had decreasing housekeeping duties in 2001.

Results of this study indicate that men can't adapt themselves to rapidly rotating back-to-back shift work, and women can't adapt themselves to weekly rotating two-shift work because of the difference in the role of men and women in the home. Saito *et al.*¹⁵⁾ report that when married women perform even a minimal amount of overtime, rest and sleep time suffer due to existing housekeeping duties, and recovery from fatigue becomes difficult. Married female two-shift worker must be able to balance both shift work and the domestic responsibilities of child-rearing and household chores. It is feared that this will lead to sleep and the circadian rhythm being sacrificed. We believe that the two-shift work might be a burden for married female workers. Since back-to-back shift work runs on a short cycle, it does not bring about the disruptions in internal rhythms and the worsened physical and mental states that two-shift work is thought to cause. However back-to-back shift work concludes night work, since it is impossible for the circadian rhythm to fully adjust to a night-work schedule—no matter how long such work is performed¹⁶⁾—man cannot physiologically adapt completely to night work. We propose that follow-up investigation should be continued. In order to bring about improvements in shift-work employment conditions, it is important to take as a starting point the recognition that, while the employee may seem able to adjust to shift work in the short term, physiological and social realities state that there is a limit to long-term adaptation. The suitability of back-to-back shift work for male workers and the suitability of two-shift work for female workers should be reexamined in future studies.

ACKNOWLEDGMENTS

I wish to sincerely thank all those who took the time to respond to the complicated questionnaire that constituted the base for this research. I also wish to thank Ms. Hiroko Yokoyama, Ms. Akiko Sugawara and Ms. Kiiko Otomo for their friendly cooperation.

REFERENCES

1. Nakajima T. The neurochemical and pharmacological bases and clinical aspects of anxiety and depression. (in Japanese with English abstract) *Jpn J Psychosom Med*, **37**: 11-19, 1997.
2. Kawakami N, Araki S, Kawashima M. Effects of job stress on occurrence of major depression in Japanese industry: A case-control study nested in a cohort study. *J Occup Med*, **32**: 722-725, 1990.
3. Iwasaki A, Higashi T, Aizawa A, Nakano S, Tanaka K, Akiyama H, Ihara K, Masaki M, Nakamura K, Muraoka Y. Relationship between depressive state and occupational stress in middle aged workers—A survey using CES-D by interview—. (in Japanese) *Sangyou Eiseigaku Zasshi*, **41** (suppl): 172, 1999.

4. Saito Y. The effects of night-and shiftwork upon social life of the workers. (in Japanese with English abstract) *J Science of Labour*, **57** : 243-256, 1981.
5. Kogi K. Shift work. The burden of shift work. *In* : Miura T, Ikeda M, Sakurai H et al., eds. Handbook of occupational health (second edition). (in Japanese) The Institute for Science of Labour, Kanagawa, 1223-1227, 1994.
6. Ishizu S. Female labour. *In* : Miura T, Ikeda M, Sakurai H et al., eds. Handbook of occupational health (second edition supplement). (in Japanese) The Institute for Science of Labour, Kanagawa, 292-296, 1994.
7. Sakai K, Watanabe A, Temmyo Y, Nishioka A. Current situation of shiftwork systems and their improvement. (in Japanese with English abstract) *J Science of Labour*, **68** : 560-585, 1992.
8. Fujiwara O, Kakimoto Y, Okaue M, Nakamura A, Aruga H, Takeuchi Y, Tajima F, Sakurai I, Shimizu S. A study on fatigue of shiftworkers in air traffic control and weather service groups in JASDF. (in Japanese with English abstract) The reports of aeromedical laboratory, **25** : 65-85, 1984.
9. Horiguchi J, Tanaka A, Sukegawa T, Igaue M, Takasuka Y, Yano K, Inoue H. A study on trait of sleep-wake complaints and depression in the shift-workers. (in Japanese) *Seishin Igaku*, **34** : 1113-1118, 1992.
10. Kobayashi T, Kageyama T, Kaneko S, Tanaka M. A cross-sectional survey on insomnia and depressive symptoms in Japanese male shift workers with various shifts patterns. (in Japanese) *Kiyou*, School of nursing, Yamaguchi Prefectural University, (6), 21-27, 2002.
11. Ikeda Y, Kambayashi Y, Kohno Y, Nishikawa Y, Narita T, Imada Y, Hirata M, Morioka M, Otoyama S, Yaguchi M, Ito K, Ito K. A study on mental health of Japanese house wives. (in Japanese) *Journal of Mental Health*, **30** : 33-54, 1983.
12. Monk TH. Shift work. *In* : Kryger MH, Roth T, Dement WC, eds. Principles and Practice of Sleep Medicine. 2nd ed. WB Saunders, Philadelphia, 471-476, 1994.
13. Monk TH, Knauth P, Folkard S, Rutenfranz J. Memory based performance measures in studies of shift work. *Ergonomics*, **21** : 819-826, 1978.
14. Takahashi Y. Entrainment of circadian rhythm and disorders. (in Japanese with English abstract) *Shinshin-Igaku*, **30** : 279-288, 1990.
15. Saito H. The problem of the female laborers who have two incomes. Handbook of occupational health (second edition). (in Japanese) The Institute for Science of Labour, Kanagawa, 1370-1371, 1994.
16. Saito Y. The effects of night-and shiftwork upon social life of the workers—A review on results of surveys conducted in European countries and the United States—. (in Japanese with English abstract) *J Science of Labour*, **57** : 243-256, 1981.