Mental Health Status, Shift Work, and Occupational Accidents among Hospital Nurses in Japan

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Abstract: Mental Health Status, Shift Work, and Occupational Accidents among Hospital Nurses in Japan: Kenshu Suzuki, et al. Department of Public Health, School of Medicine, Nihon University—A questionnaire survey was conducted with questions from the 12-item General Health Questionnaire, among others, targeting 4,407 nurses in 8 general hospitals in Japan, in the hope of improving the work environment of nurses and to provide data that will allow a discussion of the measures necessary for preventing medical errors, thus improving occupational health. For each type of accident, the percentage of those who had made medical errors was significantly higher for the “mentally in poor health” group than for the “mentally in good health” group (p<0.0001). The percentage of nurses in the “mentally in good health” and “mentally in poor health” groups who had experienced occupational accidents over the past 12 months (i.e., whether they were “with errors” or “without errors”) was calculated for each of the following four types of medical accident: (1) drug-administration errors, (2) incorrect operation of medical equipment, (3) errors in patient identification, and (4) needlestick injuries. For each type of accident, the percentage of those who had made medical errors was significantly higher for the “mentally in poor health” group than for the “mentally in good health” group (p<0.0001). Multiple logistic regression analyses revealed significant associations between experience of medical errors in the past 12 months and being mentally in poor health, with night or irregular shift work, and age.

(J Occup Health 2004; 46: 448–454)

Received May 23, 2004; Accepted Sep 21, 2004
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Key words: Mental-health status, General Health Questionnaire (GHQ-12), Occupational accidents, Shift work, Nurses, Japan

The number of women who work is increasing, but in Japan, nursing remains the profession that comprises the largest percentage of female workers. Female workers are generally exposed to more physical and mental stress than are male workers, because in addition to their jobs, additional burdens, such as household chores, childcare, pregnancy and childbirth tend to add to the stress. It is notable that nurses are particularly prone to mental health problems compared with those who are engaged in other types of jobs because they work night or irregular shifts more often than others, which affects the circadian rhythm and disturbs other biorhythms, leading to failure of various physiological functions. It is said that nurses are exposed to more mental stress than are other healthcare professionals because in addition to working in a more mentally stressful work environment, nurses are required to develop increasingly higher skill levels because of advances in medical care and technology. It is therefore very important from the viewpoint of personnel administration to clarify the mental health status of nurses.

Sleep problems among nurses are also important and must be addressed. In the case of nurses who work night shifts, their sleeping hours will inevitably be in the daytime, the activities of others often making it difficult to secure enough sleep. Nurses who live with their families tend to have a shorter sleep duration because of their family’s schedules, or they tend to wake up more often during sleep, and their quality of sleep tends to be poor because of noise and/or brightness. Occupational errors or accidents involving nurses have a direct and critical influence on the life and prognosis of their patients, as such it is clear that this is yet another important
issue that must be addressed. Moreover, as prevention of medical errors and accidents is an urgent issue to be addressed from the viewpoint of industrial hygiene, working conditions that may lead to occupational errors or accidents among nurses also began to be addressed through various advanced approaches. That is, attempts are being made to analyze the workplace problems that increase the risk of medical accidents. These analyses have been made under the assumption that such accidents represent specific and remediable hazards rather than problems with individual nurses, and include studies on the factors associated with the typical working state of nurses (e.g., hypoglycemia)\textsuperscript{10,11}, a study on subjective calculation methods for error rates\textsuperscript{12}, and error analyses based on the reporting system that is promoted by the Ministry of Health, Labor, and Welfare of Japan\textsuperscript{13}. But it is also important to analyze factors related to medical accidents that can be attributed to individual nurses, such as working style, mental health, and whether or not they have sleep problems. There are two main methods for assessing medical errors and accidents: one is to define only reported accidents as medical accidents and count them, and the other is to define all occupational-error or -accident cases that have been recognized as errors or accidents by the subjects themselves who participate in occupational-error or accidents that can be attributed to individual nurses, such as working style, mental health, and whether or not they have sleep problems.

There are two main methods for assessing medical errors and accidents: one is to define only reported accidents as medical accidents and count them, and the other is to define all occupational-error or -accident cases that have been recognized as errors or accidents by the subjects themselves who participate in self-administered questionnaire surveys\textsuperscript{9}. The latter method was adopted in the present study since it may yield data on otherwise unreported and unrevealed occupational errors or accidents.

We therefore conducted a questionnaire survey targeting 4,407 nurses in Japan, focusing on occupational accidents (medical errors), in order to (1) measure the actual mental health status among nurses, and (2) analyze associations between mental health and medical errors, in the hope of securing better working conditions for nurses and to provide data that would enable a constructive discussion of measures for preventing occupational accidents and thus improve occupational health for these workers.

**Methods**

**Subjects and method of data collection**

The subjects of this study were nursing staff working in eight general hospitals equipped with 400 beds or more that were located in Metropolitan Tokyo or other cities in Japan. The survey was conducted for one month during September 2003. The target hospitals were those in which the staff agreed to cooperate in our study, and they included four hospitals that are affiliated with medical colleges in Metropolitan Tokyo, two hospitals in other cities that are also affiliated with medical colleges, and two other public hospitals in other cities. The number of responses to the questionnaire was 4,407, and the collection rate was 94.0%. Of these, 4,279 female inpatient nurses were selected as subjects.

**Survey method**

First, the person in charge of the survey at each hospital (the director of nursing) explained the purposes of the present study and requested the cooperation of the person responsible for each ward of the hospital, who in turn asked for the cooperation of his or her subordinate nursing staff. The distribution and collection of questionnaires was also performed through the person in charge of the survey at each hospital. An anonymous self-administered questionnaire was used, and to protect the privacy of the subjects and obtain the most candid responses possible, it was stated clearly on the questionnaire that completed questionnaires would not be seen by the staff of the institutions and that they would be collected in sealed envelopes. This survey was approved by the Ethics Committee of Nihon University, prior to its commencement.

**Questionnaire**

Identical anonymous self-administered questionnaires were used at all eight participating hospitals. In addition to questions on mental health, sleep, and occupational accidents, there were questions on subject characteristics (age, gender) and the shift-work system that they worked under. The sleep-related items included: (1) a subjective evaluation of their own sleep, (2) sleep duration, (3) whether they were with/without difficulty in going to sleep, (4) whether they were with/without difficulty in maintaining sleep, and (5) early-morning awakening and difficulty in getting back to sleep. The actual questions, which were taken from the Japanese version\textsuperscript{14} of the Pittsburgh Sleep Quality Index (PSQI) questionnaire developed by Pittsburgh University, are shown here:

1. Do you get as much sleep as you need? (very sufficient/sufficient/insufficient/very insufficient/uncertain)—subjective sleep evaluation
2. On average, how many hours do you sleep?—sleep duration
3. Do you have difficulty falling asleep at night? (always/often/sometimes/seldom/never)—difficulty in going to sleep
4. Do you wake up too often during the night after you have gone to sleep? (always/often/sometimes/seldom/never)—difficulty in maintaining sleep
5. Do you wake up too early in the morning and have difficulty getting back to sleep? (always/often/sometimes/seldom/never)—early morning awakening

Since nurses can be involved in various types of occupational accident, the questionnaire included questions on whether or not they had experienced the four types of accident that are most commonly reported.
among nursing staff: (1) drug-administration errors, (2) incorrect operation of medical equipment, (3) errors in patient identification, and (4) needlestick injuries, in the past 12 months. The Japanese version of the 12-item General Health Questionnaire (GHQ-12) was used to measure mental health status.

**Analyses**

SPSS for Windows Version 11.0 was used for statistical processing. The GHQ-12 was used as a scale for measuring the mental health of the nurses. The reliability of the GHQ-12 is given by a Cronbach alpha coefficient of $\alpha=0.8606$, which means that the internal consistency and reliability of the question items of the GHQ-12 was sufficiently high\(^{15}\). A cutoff point of 3/4 was chosen.

(1) The mental health of the nurses who took part in the survey was examined first. The distribution, mean value, and median of the GHQ-12 scores were calculated.

(2) The associations between night or irregular shift work and mental health were examined. The rates of those who were mentally in poor health in the “with shift work” group and “without shift work” group were compared. Chi-squared test was used, and the level of statistical significance was set at 5%. In addition, the mean values of the GHQ-12 scores for the “with shift work” group and “without shift work” group were compared. As the GHQ-score distribution was normal, Student’s t test was used, and the level of statistical significance was set at 5%.

(3) The associations between mental health and occupational accidents in the past 12 months were examined. A comparison of the “mentally in good health” group and the “mentally in poor health” group was conducted with respect to whether or not the participating nurses had experienced any of the following four types of occupational accidents: (i) drug-administration errors, (ii) incorrect operation of medical equipment, (iii) errors in patient identification, and (iv) needlestick injuries. Chi-squared test was used, and the level of statistical significance was set at 5%. In addition, the mean values of the GHQ-12 scores in the “with errors” group and “without errors” group were compared. Student’s t test was used, and the level of statistical significance was set at 5%.

(4) Finally, univariate analyses and multiple logistic regression analyses were conducted with regard to medical errors experienced in the past 12 months. Those who had experienced any of the four types of error analyzed in the present study in the past 12 months were assigned to a “with errors” group, and those who had not were assigned to a “without errors” group. We took “with errors” and “without errors” as dependent variables, and we took mental health (in good health, in poor health), subjective sleep evaluation (insufficient, sufficient), with/without difficulty in maintaining sleep, with/without difficulty in going to sleep, difficulty in maintaining sleep, with/without early-morning awakening, age (in their 20s, 30s, 40s and 50s or older), with/without spouse, and with/without night/irregular shift work as independent variables. Univariate analyses and multiple logistic regression analyses were conducted to produce odds ratios and 95% confidence intervals. With regard to subjective sleep evaluation, those who answered “3. insufficient” or “4. very insufficient” were assigned to an “insufficient sleep” group, and those who answered “1. very sufficient” or “2. sufficient” were assigned to a “sufficient sleep” group.

**Results**

**Characteristics of the survey participants**

Of the entire subjects, 63.0% were 20–29 yr old, 20.8% were 30–39 yr old, 1.5% were 40–49 yr old, and 6.0% were 50 yr old or older. The average (SD) age was 30.3 (8.9) yr. Tokyo was the workplace of 62.8% of the participants, and the remaining 37.2% worked in other cities in Japan. With regard to marital status, 75.1% of participants were not married, and the remaining 24.9% were married (Table 1). The type of hospital, its location, number of beds, number of nurses, average age of the nurses, number of married nurses, and the response rate at each participating facility are given in Table 2.

**GHQ-12 scores of the survey participants**

The percentage of those who scored 3 points or less (considered to be mentally in good health) was 31.2%; the remaining 68.8% scored 4 points or more (considered to be mentally in poor health; Table 3). The mean (SD) GHQ-12 score was 5.42 (3.29), and the median was 5.0.

**Night/irregular shift work and mental health**

Of the “with shift work” group, 69.8% were mentally

**Table 1. Attributes of targets analyzed**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Age</th>
<th>Marital status</th>
<th>Residence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20–29 yr</td>
<td>30–39 yr</td>
<td>Not married</td>
</tr>
<tr>
<td></td>
<td>63.0%</td>
<td>20.8%</td>
<td>75.1%</td>
</tr>
<tr>
<td></td>
<td>30–49 yr</td>
<td>10.2%</td>
<td>Married</td>
</tr>
<tr>
<td></td>
<td>6.0%</td>
<td></td>
<td>Total (N=4279)</td>
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<td>Total (N=4279)</td>
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in poor health, compared to 55.6% in the “without shift work” group; the difference was significant (p<0.0001). Furthermore, the mean GHQ-12 score of the “with shift work” group (5.49) was significantly higher than that of the “without shift work” group (4.53; p<0.0001).

Associations between mental health and experience of occupational accidents in the past 12 months

With regard to (1) drug-administration errors, (2) incorrect operation of medical equipment, (3) errors in patient identification, and (4) needlestick injuries, the rates of those with or without medical errors in the “mentally in good health” and “mentally in poor health” groups were compared. The rates for those with medical errors were significantly higher in the “mentally in poor health” group than in the “mentally in good health” group for all four error types. In addition, the mean (SD) GHQ-12 score of the group of subjects who had made any of the four types of medical error included in the present study over the past 12 months was significantly higher at 5.69 (3.25) than for the group of those who had not [4.70 (3.21), p<0.0001; Table 4].

Factors related to occupational accidents experienced in the past 12 months

Significant associations were observed between experience of medical accidents over the past 12 months and being mentally in poor health, without a spouse, with
night/irregular shift work, and age (with the value for the 20–29 yr age group as a reference, associations were observed in the 40–49 and 50–59 yr age groups; Table 5).

**Discussion**

Few systematic surveys have been conducted on associations between mental health or sleep disorders and occupational accidents among nurses in Japan. Indeed, to our knowledge, no such report exists. The present report therefore represents the first such large-scale study.

The GHQ-12 questionnaire is the criterion developed by Goldberg in the United Kingdom as a screening test for nonorganic, nonpsychosis mental disorders\cite{16-18}. It was reported that two factors that had been extracted from a factor analysis of a study on the GHQ-12 targeting workers (mental anguish and social dysfunction)\cite{10,11}, and the GHQ-12 was considered to be appropriate for use in the present study. Fukunishi reported that the sensitivity, specificity, and error rate of the GHQ-12 were 85.6%, 66.9%, and 22.1%, respectively, for a cutoff point of 1/2, 74.2%, 88.5%, and 18.9%, respectively, for a cutoff point of 2/3, and 74.2%, 88.5%, and 19.9%, respectively, for a cutoff point of 3/4\cite{19}. Furthermore, Mari et al. reported that when a cutoff point of 3/4 was chosen, the sensitivity and specificity were 85% and 79%, respectively\cite{20}. As a consequence of these findings, a cutoff point of 3/4 was employed in the present study.

The rate of those who scored 3 points or less (i.e., considered to be mentally in good health) was only 31.2%, but that of those who scored 4 points or more (i.e., considered to be mentally in poor health) was 68.8%. The mean (SD) value of the GHQ-12 scores was 5.42 (3.29), and the median was 5.0. These results suggest that mental health of the target nurses was quite poor. It has already been established that nursing is a personal

| Table 5. Univariate and multiple logistic regression analyses regarding factors related to occupational accidents in the past 12 months |
|---|---|---|---|---|
| Factor | N | Univariate Unadjusted OR | 95% CI | Multivariate Adjusted OR | 95% CI |
| Mental health | | | | | |
| In good health | 1,191 | 1.00 | | 1.00 | |
| In poor health | 2,627 | 1.72 | 1.48–1.99 | 1.55 | 1.32–1.82 |
| Subjective sleep evaluation | | | | | |
| Insufficient | 2,105 | 1.00 | | 1.00 | |
| Sufficient | 1,713 | 0.87 | 0.74–0.98 | 1.00 | 0.86–1.18 |
| Difficulty in initiating sleep | | | | | |
| Without | 2,890 | 1.00 | | 1.00 | |
| With | 928 | 1.17 | 0.99–1.38 | 0.96 | 0.79–1.16 |
| Difficulty in maintaining sleep | | | | | |
| Without | 2,921 | 1.00 | | 1.00 | |
| With | 897 | 1.07 | 0.90–1.26 | 0.99 | 0.81–1.12 |
| Early-morning awakening, difficulty in getting back to sleep | | | | | |
| Without | 3,389 | 1.00 | | 1.00 | |
| With | 429 | 1.06 | 0.84–1.32 | 1.03 | 0.80–1.33 |
| Age | | | | | |
| 20s | 2,441 | 1.00 | | 1.00 | |
| 30s | 785 | 0.69 | 0.58–0.83 | 0.96 | 0.81–1.14 |
| 40s | 379 | 0.49 | 0.39–0.62 | 0.66 | 0.52–0.85 |
| 50s or older | 213 | 0.34 | 0.26–0.46 | 0.62 | 0.45–0.85 |
| Spouse | | | | | |
| Without | 2,883 | 1.00 | | 1.00 | |
| With | 935 | 0.59 | 0.50–0.69 | 0.90 | 0.74–1.09 |
| Shift work* | | | | | |
| Without | 274 | 1.00 | | 1.00 | |
| With | 3,544 | 2.54 | 1.99–3.25 | 1.78 | 1.35–2.34 |

CI: Confidence interval  OR: Odds Ratio, Adjusted for other factors in multiple logistic regression analysis with stepwise elimination, *Night/split/irregular

R²(Nagelkerke)=0.52
service caring for patients who have become emotionally unstable because of their health problems, and that it involves excessively heavy work with night or irregular shift work, which may lead to irregular life patterns, usually with a lot of overtime and a heavy work load. In addition, shift work has been shown to increase the risk of suffering from one of several diseases. Associations between shift work and physical and mental diseases therefore deserve further attention in future studies.

The factor that has the strongest association with experience of medical errors in the past 12 months was night/irregular shift work. It was reported in a study conducted in the USA targeting hospital nurses that nurses working in rotating shifts tended to have more accidents while working and driving, and made more errors during work. The results of our study are in accord with these findings, and lead us to the conclusion that improvement of mental health among the nurses is of critical importance.

Estryn-Behar et al. established associations between occupational stress among hospital workers and sleep disorders. Since nursing is a profession that typically involves shift work, sleep problems are also critical for nurses. In the present survey, however, no association was observed between shift work and occupational accidents. In some studies, associations have been found between sleep disorders and occupational accidents, but in others, no such associations were noted. This discrepancy may be attributable to differences in the type of job, classification of occupational accidents, and the definition of occupational accidents used.

There are many reports on associations between night-shift work and sleep problems among nurses all over the world. Gold et al. pointed out that the percentage of those experiencing daytime sleepiness was higher among nurses who worked night-and-day shift schedules. Escriba et al. noted a decrease in sleep duration and a degradation of sleep quality that was attributable to night-shift work. In Japan, Ohida et al. reported that there was no association between sleep problems and night-shift work. Takahashi et al. focused on differences between two-shift and three-shift systems, and reported that with regard to sleep problems, there were no significant differences between them. Since the results of studies on associations between sleep problems and night-shift work are equivocal, further investigations are necessary.

The present study is significant from a public health point of view. There are, however, several limitations to this survey. First, a self-administered questionnaire was used, and as such there may be a reporting bias. In addition, the methods used for recognizing occupational accidents were subjective; more objective ones must be used in the future. Case-control studies must be conducted to examine the associations observed in the present study between occupational accidents and various risk factors for accidents. Although the reliability and validity of the GHQ-12 are uncertain in Japan, for the present study, we chose to use a cutoff point of 3/4 for analyses, referring to the findings of previous studies. In addition, since the present study was a cross-sectional study, causal relationships between poor mental health and occupational accidents remain to be determined. Finally, it is well known that organization factors are associated with medical errors. This probably induced medical errors through personnel administration problems, but this study directly investigated the organization factors underlying medical errors. These limitations need to be borne in mind when interpreting the results of this study.

In conclusion, the results of the present study have revealed that the mental health of the hospital nurses studied was quite poor, as shown by the quite high mean GHQ-12 score (5.42), and that mental health is a factor that appears to be associated with occupational accidents among nurses. To ameliorate such conditions, it may be urgently required to take measures such as adopting stress-coping programs as one of the strategies for personnel administration. These findings represent the first step toward establishing measures for preventing medical errors among nurses and for improving their occupational health.

Acknowledgments: We would like to express our appreciation to all of the people in the medical institutions who took part in or cooperated with this study, and in particular the nurses who completed the questionnaires. We would also like to thank Ms. Hiromi Sekine for her contribution in preparing this report.

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