ORIGINAL ARTICLE

Evaluation of Stress Situation of Female Nurses Working in Wards Based on the Survey Data

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Abstract: In this study, the Brief Job Stress Questionnaire (BJSQ) survey data obtained from 927 female nurses were analyzed through two-group comparisons of high and low stressors, stress response, support, and satisfaction level, and through four-group comparisons of different family structures focusing on the marital and child status. Moreover, covariant structure analyses using the Multiple Indicators Multiple Causes (MIMIC) model was performed. Results revealed that individuals with high stressors had high-stress responses and low support. By contrast, individuals with high levels of satisfaction had low stressors, low-stress responses, and high support. Next, between the four groups based on family structure, significant differences were observed in stressors, such as “low degree of job control” and in stress responses, such as “physical complaints.” In the MIMIC model, the “status of stress” was mainly dominated by stressor factors compared to support factors.

Keywords: *Female nurses, Occupational stress, BJSQ*

1. INTRODUCTION

As interpersonal support, a nurse's job is to provide 24-hour care to individuals with illnesses, and such occupation involves numerous physical and mental stresses. In addition, advances in the field of medical care have been notable, and thus, the work has become more diverse. As life expectancy increases, the number of older patients increases, and care becomes more complex and diverse. The conditions behind the stress experienced by nurses include quantitative workload, lack of work control, and mental fatigue attributed to providing interpersonal support, leading to burnout [1,2]. Also, female nurses are more likely to experience conflicts in situations where they cannot flexibly respond to lifecycle events, such as marriage and raising children, due to 24-hour shifts and excessive workloads [3], thereby leading to repeated leaving and changing jobs [4]. Studies of stress in nurses have been conducted since the 1970s [5-9]. Stress-induced turnover leads to a shortage of personnel, which becomes a routine. The exhaustion continually experienced by nurses creates a vicious circle that makes ensuring user safety and providing necessary care difficult. Maintaining a work environment in which female nurses can maintain their mental health and can work for an extended period of time will lead to the maintenance and improvement of quality of care for patients.

In Japan, a stress checkup system for workers using the Brief Job Stress Questionnaire (BJSQ) became mandatory

in December 2015 [10]. The BJSQ comprises 57 questions covering stressors, stress responses, support, and satisfaction factor levels [11,12], which was developed by reference to the Job Demands Control Model [13,14] and the NIOSH Occupational Stress Model [15,16]. The BJSQ has been ensured its reliability and validity by application to about 12,000 workers [11], and conversion tables can be used based on occupations for the occupational stress scales [17]. As a preliminary study on the overall structure of the BJSQ, in the “Study Report on Stress in the Workplace and its Effects on Health” [18], a covariance structure analysis [19,20] of the results obtained from a survey on over 10,000 workers in 21 companies and organizations nationwide was performed using the Multiple Indicators Multiple Causes (MIMIC) model.

The number of studies about nurses that use the BJSQ is also gradually increasing [21-24]. A survey was conducted on 225 female nurses to assess the effects of differences in individual background on occupational stress, and the results suggested that there was a need to develop preventive measures against stress because nurses, who are in their 20s with less than 5 years of experience, living alone, and who had passive reasons for working, had a higher level of depression [21].

Under the background above, this study aimed to perform two-group comparisons of high and low stressors, stress response, support, and satisfaction level, focused on the BJSQ survey data obtained from 990 female nurses working in wards, as well as four-group comparisons of different family structures focusing on the marital

and child status. Moreover, we carried out covariance structure analyses of the survey data to check suitability for the MIMIC model. Based on the analysis results, the stress situation in female nurses and the ways on how to reduce stress were discussed.

2. MATERIALS AND METHODS

2.1 Target data

Using the BJSQ questionnaire, the target data for this study were primarily obtained from female nurses working in general hospitals with over 400 beds in Japan in 2009. The investigation method was as follows: Research request letters and questionnaire survey samples were sent to the director of the nursing department of the hospital. The survey was conducted on 990 nurses from 47 wards of 13 hospitals nationwide who consented to the research. The number of respondents was 927 and its hospital breakdown was as follows: 30(2), 41(2), 40(2), 66(3), 235(11), 49(2), 87(4), 49(2), 33(2), 99(6), 41(2), 54(3), and 103(6) (The figure in parentheses shows the number of wards by hospital). The number of targets for analyses without blank answers to questions on stressors, stress responses, support, and level of satisfaction was 897.

2.2 Details of the survey

1) Basic attributes

The following information was requested: age, educational background, nursing history, ward/department

where the nurses' work, work schedules (2-shift, 3-shift, and day-shift system), marital status, and child status.

2) BJSQ

The 57 questions in the BJSQ [17] are as follows: Questions A1–A17 (4-point Likert scale from 1 (yes) to 4 (no)) are about the factors considered the cause of stress (stressors); Questions B1–B29 (4-point Likert scale from 1 (almost always) to 4 (almost never)) are about the physical and mental responses to stress (stress responses); Questions C1–C9 (4-point Likert scale from 1 (very) to 4 (not at all)) are about other factors affecting stress responses (support); and Questions D1–D2 (4-point Likert scale from 1 (satisfied) to 4 (dissatisfied)) are about the satisfaction with daily job and life (level of satisfaction).

The four levels of measurement were scored from 1 to 4, and the measurement scale values were determined according to the composition of the questions shown in Table 1. The scores for each scale were set. Thus, when the score is higher, the degree is greater. For example, the stressor “stress from interpersonal relationships in the workplace” consists of three questions: A12: There are differences in opinions within respondent's department, A13: The respondent's department does not get on well with other departments, and A14: The atmosphere at work is welcoming. In calculating the scores for these scales, since the direction of stress is reversed for A12 and A13 compared to A14, when calculating the score from the four levels of measurement, the following is observed: $10 - (A12 + A13) + A14$.

Table 1: Composition of Factors Analyzed Using the BJSQ

Scale name	Individual components
Factors that may cause stress (stressors)	
Psychological burden of work (quantitative)	15 - (A1+A2+A3)
Psychological burden of work (qualitative)	15 - (A4+A5+A6)
Degree of subjective physical burden	5 - A7
Stress from interpersonal relationships in the workplace	10 - (A12+A13) + A14
Stress due to work environment	5 - A15
Low degree of job control	A8 + A9 + A10
Low degree of skill utilization	5 - A11
Low degree of job suitability	A16
Lack of job satisfaction	A17
Physical and mental responses to stress (stress responses)	
Low vigor	15 - (B1+B2+B3)
Irritability	B4+B5+B6
Tiredness	B7+B8+B9
Anxiety	B10+B11+B12
Depression	The total of B13 to B18
Physical complaints	The total of B19 to B29
Factors affecting stress responses (support)	
Supervisor support	15 - (C1+C4+C7)
Colleague support	15 - (C2+C5+C8)
Support from family & friends	15 - (C3+C6+C9)
Degree of satisfaction	
Degree of satisfaction with job and life	10 - (D1+D2)

2.3 Analytical methods

1) BJSQ analyses

The following were performed: two-group comparisons of the high and low groups of stressors, stress response, support, and satisfaction levels as well as four-group comparisons of different family structures focusing on the marital and child status. Here, the scope was expanded comprehensively based on the limited scope in our previous study [25]. The IBM Statistical Package for the Social Sciences software (version 22) was used for the analyses.

2) Structural analyses of covariance with the MIMIC model

For the MIMIC model used in this study, only one latent variable (a variable that cannot be directly observed) was introduced and used as the mediator variable in the assessment of causal relationships between observation variables (a variable that is directly observed). For the concrete model, “status of stress” was assumed as the latent variable, and the causes of stress, including “each stressor scale,” “each support scale,” and “age,” were considered as observational variables, and “each stress response scale” was considered as the indicator (result) of stress. The IBM Amos version 22 was used for the analyses.

2.4 Ethical considerations

The investigational review board of the University of Hyogo approved the research in 2009, and additional research was approved by the ethics committee of UHGSAL-2017-02 in 2017. The purpose of the survey was explained, and the participants were assured that they could withdraw from the study. Only individuals who provided consent were instructed to answer the questionnaire. Responses were anonymized, and the respondents were instructed to seal the envelope for the survey forms themselves to ensure anonymity.

3. RESULTS

3.1 Basic data

1) Age

The age distribution of the respondents is shown in Figure 1. Nearly half of the respondents were in their 20s, and the number gradually decreased as age increased.

2) Nursing history

The nursing history is as shown in Figure 2. Nurses with 1–5 years of experience were the majority, and the numbers decreased with age.

3) Work schedule

As for the work schedule, most nurses were on a 3-shift system, working either the day, night, or midnight shift, accounting for 86.7% of all nurses.

4) Ward affiliations (clinical departments)

The wards (clinical departments) to which the respondents were affiliated are shown in Figure 3, and the number of nurses in the internal medicine department were twice as many, followed by those in the surgical department and combined departments.

5) Marital and child status

The participants were grouped according to the marital and child status as follows: no spouse/no child group (n=458), no spouse/child present group (n=60), spouse present/no child group (n=69), and spouse/child present group (n=282). Considering that nearly half of the respondents were in their 20s, it is reasonable that most nurses belong the no spouse/no child group.

Figure 1: Frequency distribution of age

Figure 2: Frequency distribution of nursing history

Figure 3: Frequency distribution of wards (clinical departments)

3.2 Analysis of stressors, stress responses, support, and level of satisfaction

A total of 897 individuals were included in the analyses.

1) Analyses in the high- and low-stressor groups

The distribution of total scores for stressors is shown in Figure 4. The points of 47 or less were defined as the low-stressor group ($n=472$), and 48 or more were defined as the high-stressor group ($n=425$) based on the median. Figures 5 and 6 show the comparison of the stress response and support in the high- and low-stressor groups, respectively. Significant differences were observed in the total scores for stress response and support between the low- and high-stressor groups (both $***p<0.001$). The low-stressor group had lower stress responses and higher support than the high-stressor group.

Figure 4: Frequency distribution of the total scores for stressors

Figure 5: Comparison of stress responses in the high- and low-stressor groups

Figure 6: Comparison of support in the high- and low-stressor groups

Figure 7: Comparisons of each stress response in the high- and low-stressor groups

Figure 8: Comparisons of each support scale in the high- and low-stressor groups

In addition, analyses of each stress response and support in the high- and low-stressor groups revealed significant differences in all stress response scales, including low vigor, irritability, tiredness, anxiety, depression, and physical complaints, as shown in Figure 7 ($***p<0.001$). In terms of support, as shown in Figure 8, significant differences were observed in supervisor support, and colleague support ($***p<0.001$), and the significance was lower for support from family/friends than for workplace support from supervisors and colleagues ($**p<0.01$).

2) Analyses in the high- and low-stress response groups

The distribution of the total scores for stress responses is shown in Figure 9. The points of 65 or less were defined as the low-stress response group ($n=452$), and 66 or more were defined as the high-stress group ($n=445$) based on the median. Figures 10 and 11 showed the comparison of stressors and support in the high- and low-stress response groups, respectively. Significant differences in both the total scores for stressors and support were noted between the low- and high-stress response groups (both $***p<0.001$). The low-stress response group had lower stressors and higher support than the high-stress response group.

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Figure 9: Frequency distribution of the total scores for stress responses

Figure 10: Comparison of stressors in the high- and low-stress response groups

Figure 11: Comparison of support in the high- and low-stress response groups

As shown in Figure 12, analyses of each stress response and support factor in the high- and low-stressor groups revealed significant differences in stressors, such as psychological burden of work (quantitative), psychological burden of work (qualitative), degree of subjective physical burden, stress from interpersonal relationships in the workplace, low degree of job control, low degree of job suitability, and lack of job satisfaction ($***p<0.001$), whereas no significant differences were observed in the low level of skill utilization ($**p<0.05$). In addition, as shown in Figure 13, in terms of support, significant differences were observed in support from supervisors and colleagues ($***p<0.001$). Support from family and friends was not as high as that for the support from supervisors and colleagues ($**p<0.01$).

Figure 12: Comparison of each stressor scale in the high- and low-stress response groups

Figure 13: Comparison of each support scale in the high- and low-stress response groups

3) Analyses in the high- and low-support groups

The distribution of the total scores for support is shown in Figure 14, and the points of 25 or less were defined as the low-support group ($n=446$), and 26 or more were defined as the high-support group ($n=451$) based on the median. Figures 15 and 16 show the comparison of stressors and stress responses in the high- and low-support groups, respectively. Significant differences were observed in the total scores of both stressors and stress responses between the low- and high-support groups (both $***p<0.001$). The high-support group had lower stressors and stress responses than the low-support group.

In addition, in the analyses of each factor of stressor and stress response in the high- and low-support groups, as shown in Figure 17, highly significant differences were observed in stressors, such as stress from interpersonal relationships in the workplace, stress due to work environment, low degree of job control, low degree of job suitability, and lack of job satisfaction ($***p<0.001$), and a modest but still significant difference was noted in low degree of skill utilization ($**p<0.01$). However, no significant differences were observed in psychological

burden of work (quantitative), psychological burden of work (qualitative), or degree of subjective physical burden ($p>0.05$).

Figure 14: Frequency distribution of the total support scores

Figure 15: Comparison of the stressors in the high- and low-support groups

Figure 16: Comparison of the stress responses in the high- and low-support groups

Figure 17: Comparison of each stressor scale in the high- and low-support groups

Also, in terms of stress responses, as shown in Figure 18, highly significant differences were observed in low vigor, irritability, tiredness, anxiety, and depression ($***p<0.001$). Although the difference in physical complaints was not as high as that of other scale items, a significant difference was still observed ($**p<0.01$).

4) Analyses in the high- and low-level satisfactions groups

The distribution of the total satisfaction scores is shown in Figure 19. Based on the double of 2.5 points (for two questions), which is the middle of 2 points, somewhat unsatisfactory and 3 points, fairly satisfactory, points of 5 or less were defined as the low-satisfaction group ($n=470$) and points of 6 or more were defined as the high-satisfaction group ($n=427$). The results of the analyses showed significant differences in the total scores for stressors, stress responses, and support between the low- and high-satisfaction groups (all three groups, $***p<0.001$). In terms of stressors (low-satisfaction group points: 49.0, high-satisfaction group points: 45.0) and stress responses (low-satisfaction group points: 72.7, high-satisfaction group points: 59.2), the average value was higher in the low-satisfaction group than in the high-satisfaction group. In terms of support, the score in the low-satisfaction group was 24.3, and that of the high-satisfaction group was 27.3. The average value was lower in the low-satisfaction group than in the high-satisfaction group. In addition, in the analyses of each stressor, stress response, and support factor in the high- and low-satisfaction groups, significant differences were observed in all factors.

Figure 18: Comparison of each stress response scale in the high- and low-support groups

Figure 19: Frequency distribution of the total satisfaction scores

5) Analyses between family structures

Tukey's (T) multiple comparisons were conducted following a one-way analysis of variance (ANOVA) on the average total scores for each stressor, stress response, and support scale in four groups based on family structure (no spouse/no child group [n=458], no spouse/child present group [n=60], spouse present/no child group [n=69], and spouse present/child present group [n=282]).

The one-way ANOVA analysis of the average scores for each stressor in the four groups according to family structure showed a significant difference in the "stress due to work environment" ($p<0.05$) and a tendency for significance for the "low degree of job control" and "low degree of job suitability" ($+p<0.1$). Also, the multiple comparisons showed that the "stress due to work environment" was more likely to be higher in the [spouse present/no child] group than in the [no spouse/no child] group ($+p<0.1$). Furthermore, "low degree of job control" was significantly higher in the [no spouse/no child] group than in the [spouse present/no child] group ($*p<0.05$), and a higher tendency for significance was noted in the [no spouse/no child] group than in the [spouse present/no child] group for low degree of job suitability ($+p<0.1$) (Figure 20).

Results of the comparisons of average scores for each stress response scale in the four groups based on the family structure are shown in Figure 21. The one-way ANOVA analysis showed that among the stress responses, a highly significant difference was observed in physical complaints ($**p<0.01$) and a tendency for significance for depression ($+p<0.1$). In addition, based on the multiple comparisons, physical complaint was significantly higher in the no spouse/child present group than in the spouse present/child present group ($**p<0.01$), and a higher

tendency was noted in the no spouse/child present group than in the spouse present/no child group ($+p<0.1$).

Figure 22 shows the comparison of average scores for each support scale in the four groups based on family structure. The one-way ANOVA analysis did not show any significant differences in any of the support scales. In addition, the results of multiple comparisons showed that support from families and friends was more likely to be higher in the spouse present/no child group than in the no spouse/child present group ($+p<0.1$).

Figure 21: Comparison of the average scores of each stress response based on family structure

Figure 22: Comparison of the average scores of each support scale based on family structure

Figure 20: Comparison of the average scale scores for each stressor based on family structure

3.3 Structural analyses of covariance with the MIMIC models

Analyses were performed on 871 respondents, excluding data from 26 respondents who were missing age information. Observation variables in the model are shown as squares and latent variables as ovals. The standardizing coefficient accompanying the arrow (path) from the observation variable to the latent variable corresponds to weighting, indicating the degree of involvement of the latent variable. Among the nine stress factors, psychological burden of work (quantitative), psychological burden of work (qualitative), stress from interpersonal relationships in the workplace, low degree of job control, and low degree of job suitability + lack of job satisfaction were adopted as observation variables. As in the previous study [24], among the five factors that have only one question in the BJSQ, low degree of job suitability and lack of job satisfaction were pooled and adopted as one factor because correlation coefficients

were high ($r=0.53$) for those two factors, and the other three factors were excluded to maintain data reliability.

As the basic structure of the MIMIC model, as shown in Figure 23, paths were set from the observation variable nodes including the five stressor factors, three factors (support from families/friends, colleague support, and supervisor support), and “age”, to the latent variable nodes of “status of stress”. Further, paths to the observation variable nodes of the six factors of stress response were set through “status of stress.” The analysis showed that the fitness of the model was low, with a normed fit index (NFI) of 0.573, comparative fit index (CFI) of 0.584, and root mean square error of approximation (RMSEA) of 0.147. Next, data were reanalyzed by introducing covariance (covariance relationship) between the five stressor and three support factors used as observational variables. Similar to Figure 24, results showed that an NFI of 0.835, CFI of 0.849, and RMSEA of 0.096 indicated that the fitness of the model significantly improved.

Figure 23: Results of the analyses using the MIMIC model of occupational stress in female nurses

Figure 24: Results of the analysis (if covariance is introduced) using the MIMIC model of occupational stress in female nurses

4. DISCUSSION

4.1 Comparisons of the high- and low-stress, stress response, support, and satisfaction level groups

When the results of the two-group comparison based on the high and low stressor, stress response, and support were combined, those with high stress factors had high stress responses and low support. Conversely, individuals with low stress factors consistently had low stress responses and high support. In addition, individuals with high satisfaction levels had low stressors and stress responses and high support. Conversely, those who with low satisfaction had high stressors and stress responses and low support. Based on these findings, the questions for stressors, stress responses, support, and level of satisfaction remained consistent; thus, the relationships were reasonable [26].

At the factor level, among the nine stressors, “psychological burden of work (quantitative)”, “psychological burden of work (qualitative)”, and “degree of subjective physical burden” had an average value of 3 or more out of a maximum factor value of 4, whereas the values of the other factors were not high and less than 3. The fact that these three stressors did not show significant differences between high- and low-support groups suggested that the workload female nurses actually feel cannot be easily reduced even if there is support from colleagues and supervisors.

4.2 Comparison of stressors, stress responses, and support between family structure groups

In the differences between four groups based on family structure, “low degree of job control” was significantly higher in the [no spouse/no child] group than in the [spouse present/child present] group, which is likely due to a higher number of inexperienced young nurses who are not able to work at their own pace in the former group. Moreover, the stress response “physical complaints” was significantly higher in the [no spouse/child present] group than in the [no spouse/no child] and the [spouse present/child present] group, which is attributed to the fact that single mothers who work and raise a child become extremely busy; thus, there should be a burden on physical fitness.

The findings above indicated that young nurses who are inexperienced should work at an appropriate pace to acquire knowledge and skills with the support from their supervisors and colleagues. In addition, nurses who are single mothers require enhancements to the support system to reduce physical complaints.

4.3 Structural analyses of covariance using the MIMIC model

The fitness of the MIMIC model significantly improved after performing a reanalysis by setting a covariance between stressors and support set as observation variables. The standardizing coefficient from each observation variable to “status of stress” was 0.09 to 0.32 for the five stressor factors, -0.05 to -0.09 for the three support factors, -0.08 for age, and 0.47–0.87 for the six stress response factors, indicating that “status of stress” is mainly mediated by stressors and stress response factors. In addition, since the standardizing coefficient from “colleague support” to “status of stress” was low at -0.05 and was not significant ($p=0.22$), the contribution of support from colleague to “status of stress” was considered weak compared to that of support from supervisors and family and friends.

5. SUMMARY AND FUTURE CONCERNS

Occupational stress in female nurses working in large-scale hospitals in Japan was assessed by three means of analyzing the BJSQ survey data, through two-group comparisons of high and low stressor, stress response, support, and satisfaction level, four-group comparisons of family structure focusing on the marital and child status, and covariant structure analyses using the MIMIC model. These analytical approaches can be further developed as a more useful analytical method for BJSQ survey data by improving a covariant structure model from the existing MIMIC model. It is also possible to examine the correlation between occupational stress and avoidant coping behaviors in female nurses by taking into account the survey data of avoidant coping behavior collected simultaneously with the BJSQ from 927 female nurses.

The similar analyses with this study will be applied to the BJSQ data on female nurses under the stress check system introduced in 2016, and the effect of work environment on stress situation in female nurses will be examined through the comparison with the results in this study.

ACKNOWLEDGEMENTS

We are grateful to the nurses cooperated with our questionnaire survey.

CONFLICT OF INTEREST

There are no conflicts of interest to declare.

REFERENCES

1. McCranie, E. W., Lambert, V.A., and Lambert, C.E.; Work stress, hardiness and burnout among hospital staff nurses, *Nursing Research*, 36(6), pp.374-378, 1978.
2. Escribà-Agüir, V., Martín-Baena, D., and Pérez-Hoyos, S.; Psychosocial work environment and burnout among emergency medical and nursing staff, *International Archives of Occupational and Environmental Health*, 80(2), pp.127-133, 2006.
3. Greenhaus, J. H., and Beutell, N. J.; Source of conflict between work and family roles, *Academy of Management Review*, 10(1), pp.76-88, 1985.
4. Tyler, P., and Cushway, D.; Stress, coping and mental well-being in hospital nurses, *Stress & Health*, 8(2), pp.91-98, 1992.
5. Maslach, C., and Jackson, S.E.; The measurement of experienced burnout, *Journal of Organizational Behavior*, 2(2), pp.99-113, 1981.
6. Maslach, C., Jackson, S.E., and Schwab, R.L.; Maslach burnout inventory manual, 2nd ed., Consulting Psychologists Press, Palo Alto, CA, 1986.
7. Duarte, J., Pinto-Gouveia, J., and Cruz, B.; Relationships between nurses' empathy self-compassion and dimensions of professional quality of life, A cross sectional study, *International Journal of Nursing Studies*, 60, pp.1-11, 2016.
8. Quinal, B., Harford, S., and Rutledge, D.N.; Secondary traumatic stress in oncology staff, *Cancer Nursing*, 32(4), pp.1-7, 2009.
9. Young, J. L., Derr, D. M., and Cicchillo, V. J.; Compassion satisfaction, burnout, and secondary traumatic stress in heart and vascular nurses, *Critical Care Nursing Quarterly*, 34(3), pp.227-234, 2011.
10. Ministry of Health, Labor and Welfare; Stress check system implementation manual based on the occupational safety and health act, Industrial Safety and Health Department, Labor Standards Bureau, 2015. (in Japanese)
11. Shimomitsu, T., Yokoyama, K., Ono, Y., Maruda, T., Tanigawa, T., Haratani, T., Iwata, N., Otani, Y., and Odagiri, Y.; Making of a simple and easy questionnaire for the stress measurement in the workplace, Research Report about the Prevention of the Disease Work-Related in Department of Labor, pp.107-115, 1998. (in Japanese)
12. Ibaraki Occupational Health Promotion Center; The brief job stress questionnaire [English version], <http://www.ibarakis.johas.go.jp/outline/magazine/attach/150803-2.pdf> (accessed 2019.12.08).
13. Karasek, R., A.; Job demands, job decision attitude, and mental strain: implications for job redesign, *Administrative Science Quarterly*, 24(2), pp.285-308, 1979.
14. Kivimäki, M., et al. (IPD-Work Consortium); Job strain as a risk factor for coronary heart disease: a collaborative meta-analysis of individual participant data, *Lancet* 380(9852), pp.1491-1497, 2012.
15. Hurrell, J.J., and McLaney, M.A.; Exposure to Job stress: a new psychometric instrument, *Scandinavian Journal of Work, Environment & Health*, 14(Suppl 1), pp.27-28, 1988.
16. Stansfeld, S., and Candy, S.; Psychosocial work environment and mental health - a meta-analytic review, *Scandinavian Journal of Work, Environment & Health*, 32(6), pp.443-462, 2006.
17. Department of Tokyo Medical University; The brief job stress questionnaire, <http://mental.m.u-tokyo.ac.jp/jstress/BJSQ/index.htm> (accessed 2019.05.16). (in Japanese)
18. Kato, M.; Working papers about the stress in the place of the "Study on prevention labor of the work-related disease" and the healthy influence, the Department of Labor, pp.117-164, 2000. (in Japanese)
19. Koito, M.; Pass analysis by first covariance structure analysis: Amos, 2nd ed., Tokyo Syoseki Press, 2014. (in Japanese)
20. Byrne, B.M.; Structural equation modeling with AMOS: basic concepts, applications, and programming, 3rd ed., Routledge, UK, 2016.
21. Koizumi, H., Kawano, A., Sankai, C., and Saeki, Y.; Demographic factors, resilience, and occupational stress symptoms among female nurses in Japan, *Medicine and Biology*, 157(2), pp.191-200, 2013. (in Japanese)
22. Katakura, K., and Tochimoto, C.; Relationship between mental health and social support among female nurses working in a hospital, *Bulletin of Faculty of Nursing of Chukyo Gakuin University*, 5(1), pp.1-16, 2015. (in Japanese)
23. Fukuoka, E., Ueda, K., Kawaguchi, A., and Mimura, M.; Fact-finding about the occupational stress of the nursing staff, *Bulletin of Niimi College*, 28, pp.157-166, 2007. (in Japanese)
24. Tanaka, I., Uchino, K., and Inoue, K.; During the present conditions - child care of stress and the coping action of the vice-nursing divisional commander of the Kyushu jurisdiction, *Japanese Nursing Society Memoir, Nursing Management*, 42, pp.391-393, 2012. (in Japanese)

25. Furuya, H., Mizuno-Matsumoto, Y., Ishigaki, K., and Nishimura, H.; Influence of family composition and support of others on the mental health of female nurses, Transactions of Japan Society of Kansei Engineering, 16(5), pp.449-456, 2017. (in Japanese)
26. Lazarus, R. S., and Folkman, S.; Transactional theory and research on emotions and coping, European Journal of Personality, 1(3), pp.141-169, 1987.

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