

Advantages of the Variable Shift System, and Effective Use of Break Time to Better Support the Work Engagement of Nurses on Extended Day Shifts

MIYAKO INOUE, MASAYO TAKANO*, CHIAKI UENO*, MIHOKO MORI, YOSHITAKA MORIMATSU, YUKI MATSUMOTO**, NANAE KUSHINO† AND TATSUYA ISHITAKE

*Department of Environmental Medicine, Kurume University School of Medicine, * Kurume University Hospital, Kurume 830-0011, ** National Institute of Mental Health, National Center of Neurology and Psychiatry, Kodaira 187-8553, †Occupational Therapy Course, Department of Rehabilitation, Faculty of Health Sciences, Tokyo Kasei University, Sayama 350-1398, Japan*

Received 24 August 2018, accepted 10 December 2018

J-STAGE advance publication 19 July 2019

Edited by NORIKO YOSHIDA

Summary: Objectives: The aim of this study is to clarify factors that support the work engagement of nurses, who bear the burden of extended day shifts, by focusing on the advantages of the variable shift system and work-day break activities.

Methods: Nurses who were working under a variable shift system were asked to complete a self-report questionnaire to examine the workload, work engagement, work stressors, stress-coping strategies, and stress-coping break time activities, as well as the advantages and disadvantages of the variable shift system. Nine break activities were classified into the following four categories: social activities, rest/relaxation, entertainment, and cognitive activities. The advantages or disadvantages of the variable shift system were scored by developing composite variables using principal component analysis. These variables were used to perform a multiple regression analysis with work engagement as the dependent variable.

Results: The advantage score was the variable most strongly correlated with work engagement. In contrast, “Quantitative workload” was negatively correlated with work engagement. Among break activities, in the social activities category correlations were observed in “Both conversation and Email/SNS” and “Conversation only”. Although in fact most nurses chose conversation as one of the break options, more than half of the nurses selected rest/relaxation as their ideal break activity.

Conclusion: Our study suggested that the variable shift system supported the work engagement of nurses who worked extended day shifts. The results also suggested that it would be useful to arrange the employee lounge environment so that employees could freely choose between “conversation” or “taking a rest” depending on the circumstances.

Key words work engagement, variable shift system, extended day shift, break activity

INTRODUCTION

Following the Guidelines Concerning Night Shift and

Shift Work for Nurses [1], an increasing number of medical institutions are adopting a non-conventional work shift system (variable shift system) with the goal

Corresponding Author: Miyako Inoue, Department of Environmental Medicine, Kurume University School of Medicine, 67 Asahi-Machi, Kurume, Fukuoka, 830-0011, Japan. Tel: +81-942-31-7552, Fax: +81-942-31-4370, E-mail: miyakoinoue0221@gmail.com

Abbreviations: AS(H)-CM(L), a high score on the active solution scale and a low score on the changing mood scale; AS(L)-CM(H), a low score on the active solution scale and a high score on the changing mood scale; AS(H)-CM(H), high scores on both scales; AS(L)-CM(L), low scores on both scales; BSCP, Brief Scales for Coping Profile for Workers; NJSS, Nursing Job Stressor Scale; UWES, Utrecht Work Engagement Scale.

of reducing the workload and achieving a better work-life balance. It has been reported that this shift system can reduce the workload per person by increasing the time slots and allocating as many people as required during the busiest hours, and can thus improve the employees' personal life by prolonging the inter-shift intervals [1].

On the other hand, it has been reported that the long work hours associated with extended day and night shifts tend to increase both the physical and mental fatigue of nurses, and many nurses feel overloaded, particularly on extended day shifts [2]. However, surveys conducted by different medical institutions indicate that many nurses support the variable shift system [2]. This may be partly attributed to the fact that the new shift system enables nurses to live a life that is closer to their biological rhythm, or that the benefits in their personal life provided by the system create positive emotions that help to maintain and improve their work engagement.

Many medical institutions have responded to the challenge of overload due to extended day shifts by adding a short 15- to 30-minute break in addition to the normally allocated break. Problems raised for extended day shifts include the prevalence of overtime work and the difficulty of securing time for a break [2]. If there is a lot of overtime work and little time for breaks, the institution would not achieve the goal of a "13-hour shift limit," as stipulated in the Guidelines Concerning Night Shift and Shift Work for Nurses. To prevent the accumulation of fatigue after an extended day shift, it would be important to reduce overtime work, to secure ample time for breaks, and to utilize those breaks effectively, so that nurses can be relieved from their duties and become refreshed.

In recent years, it has been suggested that, to improve the employees' work engagement, it is important to review the employees' life as a whole and provide comprehensive support. Among others, attention has been drawn to the "recovery experience" as a way of spending time outside of working hours, including after work and during holidays. This refers to the experience of activities in which the worker aims to recover from the acute stress response produced through stressful experiences during work or to restore psycho-social resources consumed by these experiences to the original level, by psychologically distancing him/herself from the work, through relaxation, personal development, and self-control during one's leisure time [3]. As for break time activities, some studies showed that progressive muscle relaxation [4], taking a walk in the park [5] and an afternoon nap [6]

contributed to recovery from fatigue, and helped maintain and improve concentration. Taking a short break during work can also contribute to recovering psycho-social resources and can indirectly enhance work engagement. On the other hand, some negative results have been reported indicating that performing cognitive activities [7] or using a smartphone [8] during break times is not useful. These findings suggest that the sense of burden could be reduced, even in individuals working extended day shifts, if a prescribed time for taking a break were secured and effective recovery from fatigue was accomplished. However, stress relief during breaktimes cannot by itself compensate for a heavy workload. A study that examined the relationship between stress and distraction demonstrated that the most effective way to reduce stress is to actively engage in problem solving and then to create a diversion [9]. The ability to cope with stress is also necessary in improving work engagement.

The defining factors of work engagement include "job resources" and "personal resources" (Fig. 1). Since changes in the shift system are effective in controlling one's duties and receiving support from one's superior or colleagues, this falls into the category of "job resources". In addition, the recovery experience during a break can be a "personal resource" as an active coping strategy. To sustain the novel shift system, it is vital to enhance work engagement by promoting the recovery experience through effective break time activities.

As few as 36 studies have been conducted in Japan or abroad on nurses' break time, and the findings are considered to be insufficient [10].

This study aimed to clarify the relationship between the novel shift system and work engagement and discuss effective ways to spend break time that would reduce the workload of extended day shifts.

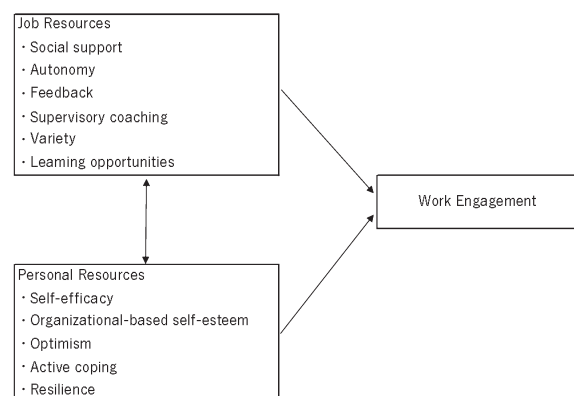


Fig. 1. Determinant factors of work engagement (Modified from Shimazu, 2010)

STUDY METHODS

1. Study Targets

This study was conducted in an advanced treatment hospital with multiple clinical departments. Traditionally, the hospital had adopted an eight-hour three-shift system; however, in 2014 it commenced implementation of a “variable shift system” in some wards on a trial basis, and completed its introduction in every ward in the hospital in 2017. The traditional three-shift system had five patterns: day shifts (8:00-16:30), twilight shifts (16:00-0:30), night shifts (0:00-8:30), early shifts (7:00-15:30), and late shifts (11:30-20:00). The variable shift system consists of seven patterns, by adding late swing shifts (10:00-18:30) and extended day shifts (8:00-20:00) to this scheme, and replaced night shifts with extended night shifts (19:30-8:30). As for shift planning, with the objective of not shortening the intervals between shifts, the shift schedule is shaped, in principle, around a four-day cycle; a day shift, followed by an extended day shift, then an extended night shift, and finally, a post-extended-night shift. A 60-minute single break was given to day shift workers, while two breaks with a total of 75 minutes – one 60-minute break and another 15-minute break – were given to extended day shift workers.

2. Survey Methods and Period

Eight hundred and five nurses (excluding head nurses,) who worked extended day shifts in the studied hospital, were asked to complete the self-report questionnaire. The questionnaire was distributed to each participant with the help of the head nurses and collected by visiting their homes. The survey period was from October to November 2017.

3. Survey Items

- 1) Characteristics of targets (age, sex, years of experience, marital status and child status).
- 2) Shift work (current shift plan, select the top three shift patterns in the order in which you feel most overloaded, and describe the reason for your selection in the free-response section).
- 3) Comparison to the three-shift system (respond to the item “I feel more comfortable than before” on a 5-point scale: Not at all, Very little, Somewhat, Fairly, Very strongly).
- 4) Level of fatigue (5-point scale: Not tired, Same as before, Slightly more tired than before, More tired than before, Far more tired than before).
- 5) Level of busyness (5-point scale: Not busy, Same as before, Slight busier than before, Busier than

before, Extremely busier than before).

- 6) About break time
 - Ease of taking a break (4-point scale: Difficult, Slightly difficult, Slightly easy, Easy).
 - Break-taking record (min) (Actual break time taken where workers were supposed to take one 60-minute and one 15-minute break).
 - Lunch intake status (4-point scale: Eat lunch every day, Sometimes eat lunch, Drink only, Do not eat lunch).
 - Select the top three activities you are engaged in during your breaks from the following options: Talk with others, Read books or magazines, Exchange emails or use LINE via a smartphone, Take a nap, Use a smartphone or some other device to enjoy games or videos, Listen to music, Do mild exercise, such as walking and stretching, Do a job, or Take a rest without doing anything in particular).
 - Select the most comfortable break time option that you think would invigorate you for your afternoon work (Spend time talking with others, Relax at a place where you can be alone, Sleep even for a short period, Try to improve yourself by actively studying and reading books, or Go back to work as quickly as possible to carry out urgent duties).
- 7) Nursing Job Stressor Scale (NJSS)

This stressor assessment scale developed by Higashiguchi et al. [11] consists of seven factors: stressors concerning “conflict with other nursing staff,” “nursing role conflict,” “conflict with physicians/autonomy,” “dealing with death and dying,” “quantitative workload,” “qualitative workload,” and “conflict with patients”. The scale is composed of 33 items and participants are asked to respond on a 5-point scale (Never occurs, Rarely, Sometimes, Often, Very often), and their responses are scored. A higher score is interpreted to mean that the participant experiences greater stress due to these stressors.
- 8) Utrecht Work Engagement Scale (UWES)

This scale defined by Schaufeli et al. [12] represents the willingness to invest efforts in one’s work, consisting of three subscales “Vigor,” “Dedication” and “Absorption.” Participants’ responses are assessed on a 7-point scale (Never, Almost never, Rarely, Sometimes, Often, Very often, Always) with higher scores indicating higher levels of work engagement. This study used the shortened 9-item version of UWES.
- 9) Brief Scales for Coping Profile for Workers (BSCP)

These scales developed by Kageyama et al. [13] are composed of 6 subscales, “active solution,” “seeking help for solution,” “changing one’s point of view,” “changing mood,” “emotional expression involving others,” and “avoidance and suppression,” in which participants are asked to respond to 18 items on a 4-point scale (Never, Seldom, Sometimes, Often), and are scored. A higher score is interpreted to mean that the participant tends to use the scales more often as a coping strategy.

- 10) Question concerning advantage and disadvantage of the variable shift system extracted from previous studies [2], consists of 27 items on a 5-point scale: Never felt, Rarely felt, Slightly felt, Moderately felt, Strongly felt).

4. Methods of Analysis

Females accounted for 92.7% of the participants. In light of the fact that research on nurses’ stress response [14] revealed that there was a gender difference, this study only included female nurses as our study target, while excluding males and those who did not specify their sex.

For pre-analytic groundwork, since the question concerning advantages and disadvantages of the variable shift system was an ordinal scale with more than five levels, it was taken as an interval scale, and synthetic variables were calculated using principal component analysis. Regarding ways to spend their breaks, a classification in a previous study [7] was modified and the break activities were divided into four types: “social activities,” “rest/relaxation,” “entertainment,” and “cognitive activities” (Fig. 2). Nine break activities were classified as shown in Fig. 2. For the sake of comparison, individuals were divided into two groups

based on their responses regarding break activity, which were either “included” or “not included” in the aforementioned four classification types. Regarding social activities, since the sample size between the two groups varied largely and since we wanted to see the difference in the effect that the use or non-use of the smartphone had on social activities, individuals were divided into four groups: “Conversation only,” “Email/SNS only,” “both Conversation and Email/SNS,” “neither Conversation nor Email/SNS.” For BSCP, to observe the difference in the intensities of two coping characteristics, the following steps were taken to divide individuals into groups based on their coping characteristics. Scores for active solution and scores for changing mood were both divided in half at a median of the response scale, to obtain four groups: individuals with “a high score on the active solution scale and a low score on the changing mood scale” (AS(H)-CM(L)), “a low score on the active solution scale and a high score on the changing mood scale” (AS(L)-CM(H)), “high scores on both scales” (AS(H)-CM(H)), and “low scores on both scales” (AS(L)-CM(L)). Regarding the ideal form of break activity, since only ten participants raised cognitive activities as their answer, this answer was eliminated and we obtained two groups: social activities and rest/relaxation. Stepwise multiple regression analysis was performed using variables with significant differences obtained by comparison between groups based on these characteristics in addition to the characteristics of targets, and variables correlated by rank correlation analysis between work engagement and NJSS, advantage score, and disadvantage score. SPSS Statistics 23.0 was used for analyses and the significance level was set to 5%.

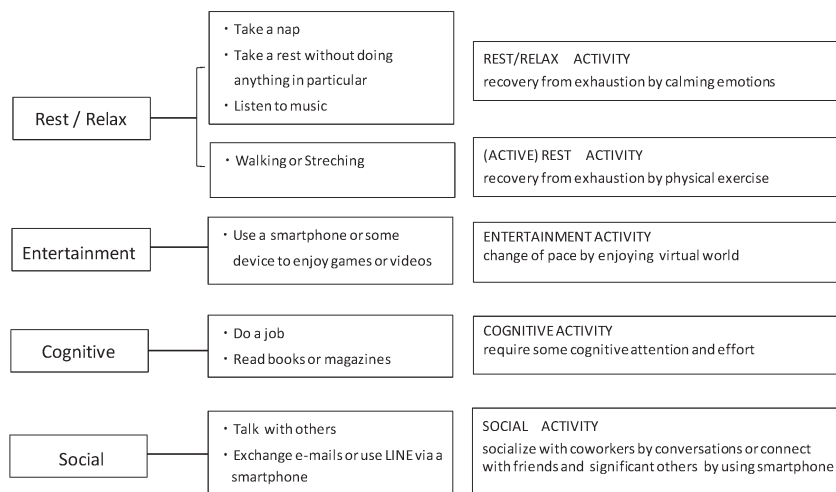


Fig. 2. Category of break activities

5. Ethical Considerations

A document that described the study's objectives, significance, details, methods as well as ethical considerations and the informed consent document was distributed with the questionnaire form to the study participants, and approval was obtained by collecting the consent document signed and sealed by these participants. This study was conducted with the approval of the Ethical Committee of Kurume University (Approval code: 17154).

RESULTS

1. Basic information on participants and a summary of their responses (Table 1)

Of the 850 people who received the questionnaire form, 604 persons responded (collection rate 71.1%), and the number of valid responses was 603. Among them, the number of females was 546. Regarding age and experience, those aged 41 or older and those with more than 6 years of experience comprised the largest population. They were less likely to be married or have children, as more than half of the participants were unmarried and childless. The shift type that struck them as most demanding was the "extended day shift" (67.6%). Regarding the sense of fatigue and busyness during the survey period, of the three choices ("mild" "moderate" "severe"), "severe" was the most common response. Regarding the comparison with the three-shift system, among "Easier," "Not easier," the ratio of answering "Easier than before," was over 70%. Regarding the ease of break-taking, among "Difficult" "Easy" the ratio of answering "Easy" was over 80%. In reference to rest/relax activities during the break, about half of the nurses chose "Take a rest without doing anything". As for cognitive activities, more than 10% selected "Do a job". In social activities, 13.2% selected "Conversation only" and 17.0% selected "Email and SNS only", while 61.4% selected "both Conversation and Email/SNS". As for the ideal break activity, more than half of the participants selected rest/relaxation.

Although not shown in the table, the following results were obtained by comparison based on years of work experience. When verifying the difference in response frequency of selected social break activities by years of experience, a significantly higher percentage of nurses with more than 6 years of experience chose "Conversation only" than did a group with 1-2 years of experience.

Comparing stressors by years of experience, the

strain score for "nursing role conflict," was higher in the group with more than 6 years of experience.

2. Group comparison for UWES (Table 2)

The median and interquartile ranges for each subscale are shown in the "Whole" field of the table. Significant differences observed in each scale were as follows.

Both "Vigor," "Dedication," and "Absorption," were high in the married group, the group with children, the group with more than 6 years of experience, the group that chose "easier than the previous three-shift system," the "Conversation only" group, and the "both Conversation and Email/SNS" group under the social activities category in break activities, and in the "AS(H)-CM(H)" group. On the other hand, "Vigor," was low in the group with a "severe," sense of fatigue and busyness. In addition, "Vigor" and "Absorption" were lower in the group that replied "neither Conversation nor Email/SNS," i.e., the group that did not select social activities, than in conversation-containing groups.

3 Principal component analysis

3.1 Results on advantage-disadvantage of the variable shift system (Table 3)

The advantages consisted of 15 items, and the disadvantages included 12 items. Cronbach's α reliability coefficient was 0.91 for advantage items and 0.84 for disadvantage items. Principal component analysis was used to calculate the loadings for principal components. In the advantage items, the Eigenvalues of up to the third principal component were greater than 1 with the cumulative contribution rate of 61.3%. Since the first principal component had all positive loadings of at least 0.4, this component was interpreted as the comprehensive "advantage score." Of the disadvantage items, the Eigenvalues of up to the second principal component were greater than 1 with a cumulative contribution rate of 54.3%. Since the first principal component had all positive loadings of at least 0.4, this component was interpreted as the comprehensive "disadvantage score." Since most items showed small principal component loading, except for the first principal component in both the advantage score and the disadvantage score, we did not interpret them.

3.2 Group comparisons for each score (Table 4)

<The advantage score> was lower in the group with more than 6 years of experience, than in the group with 3 to 5 years of experience, the group with a

TABLE 1.
Distribution of characteristics and responses of the participants

			N=546	(%)		
Characteristics	Age(years)	20-25	118	(21.6)		
		26-30	114	(20.9)		
		31-35	85	(15.6)		
		26-40	64	(11.7)		
		41+	165	(30.2)		
	Marital status	married	184	(33.9)		
		unmarried	358	(66.1)		
	Having children	yes	152	(28.1)		
		no	388	(71.9)		
	Work experience (years)	1-2	77	(14.1)		
3-5		99	(18.2)			
6+		369	(67.7)			
Work	most overloaded shift	long day shift	369	(67.6)		
		long night shift	105	(19.2)		
		day shift	26	(4.8)		
		late shift	16	(2.9)		
		twilight shift	7	(1.3)		
		early shift	7	(1.3)		
	Sense of fatigue	mild	148	(27.1)		
		moderate	177	(32.4)		
		severe	221	(40.5)		
	Sense of busyness	mild	193	(35.3)		
moderate		135	(24.7)			
severe		217	(39.7)			
comparison with three shift system	easier	408	(77.4)			
	not easier	119	(22.6)			
Break time	Ease of taking a break	easy	433	(80.3)		
		difficult	106	(19.7)		
	lunch intake status	eat every time	520	(96.5)		
		others(sometimes,drink only, no eat)	19	(3.5)		
	break-taking record (60min)	60 minites	396	(76.3)		
		less than 60 minites	123	(23.7)		
		15minites	480	(91.6)		
	break-taking record (15min)	less than 15 minites	44	(8.4)		
		break activities (select top three)	1) take a nap	rest/relax	39	(7.1)
			2) take a rest without doing nothing	rest/relax	260	(47.6)
	3) listen to music		rest/relax	5	(0.9)	
	4) walking, stretching		rest/relax	5	(0.9)	
	5) games or videos(use a smartphone)		entertainment	161	(29.5)	
	6) read books or magazines		cognitive	21	(3.8)	
	7) do a job		cognitive	69	(12.6)	
8) talk with others	social		407	(74.5)		
9) exchange emails or SNS(use a smartphone)	social		428	(78.4)		
category of break activities	rest/relax included		298	(54.6)		
	not included		248	(45.4)		
	entertainment included		157	(28.8)		

		not included		389 (71.2)
	cognitive	included		88 (16.1)
		not included		458 (83.9)
	social	included		500 (91.6)
		not included		46 (8.4)
	[conversation only		72 (13.2)
		email/SNS only		93 (17.0)
		both conversation and email/SNS		335 (61.4)
		neither conversation nor email/SNS		46 (8.4)
ideal break activities (select one)	1) relax at a place where you can be alone	rest/relax		203 (37.7)
	2) sleep even for a short period	rest/relax		106 (19.7)
	3) try to improve yourself by actively studying and reading books	cognitive		0 (0.0)
	4) go back to work as quickly as possible to carry out duties that bother you	cognitive		10 (1.9)
	5) spend time talking with others	social		208 (38.7)

Note that the total number of subjects for each variable may not be 546 due to the missing data

“mild” sense of fatigue, the group that chose “Easier,” in comparison with three shift system, the group that chose “easy to take breaks,” and the group that chose social activities as the ideal break activity.

<The disadvantage score> was high in the group with more than 6 years of experience, the group with a “severe” sense of fatigue, the group with a “severe” sense of busyness, the group that chose “Not easier,” in comparison with three shift system, the group that chose “difficult to take breaks,” and the group that chose rest/relaxation as the ideal break activity.

4. Multiple regression analysis using working engagement as a dependent variable (Table 5)

A rank-correlation analysis was performed between UWES and NJSS, the advantage score, and the disadvantage score. The item that was most highly correlated with work engagement was the advantage score ($r=0.324, p<0.01$), followed by the strain due to quantitative workload ($r=-0.177, p<0.01$) and the strain due to nursing role conflict ($r=0.165, p<0.01$). In light of these results, marital status, child status, years of experience, whether or not to engage in social activities or cognitive activities during the break, coping characteristics, advantage score, strain due to nursing role conflict, and strain due to quantitative workload were applied to examine their relationships with work engagement using multiple regression analysis, with the following results in order of standardized partial regression coefficient: the advantage score ($\beta=0.284, p<0.001$), strain due to nursing role conflict ($\beta=0.243, p<0.001$), “both Conversation and Email/

SNS” under the social activities category in break activities ($\beta=0.187, p<0.001$), more than 6 years of experience ($\beta=0.176, p<0.001$), coping characteristic “AS(H)-CM(H)” ($\beta=0.113, p<0.005$), “Conversation only” in the social activities category in break activities ($\beta=0.104, p<0.029$), having children ($\beta=0.101, p<0.021$), and strain due to quantitative workload ($\beta=-0.216, p<0.001$).

5. Reasons for selecting extended day shifts as the most demanding shift pattern (excerpt)

The reasons for those who chose extended day shifts (410 respondents) as most demanding included the following: “I cannot maintain my physical strength”; “Though the number of nurses declines after day shift nurses go home, there are still emergencies and surgeries to be handled”; “As a head nurse of the team, I have to coordinate many operations”; “I have heavy responsibilities”; “Work start time is too early”; “Overtime work occurs frequently and I cannot leave work on time”; “Too much care and treatment”; “While patients are awake, every case must be attended to”; “I have a strong sense of fatigue”; “I have poor concentration”; “I cannot look after my children and my aging parents”. More than half of them replied, “It is tough because it keeps me busy for long periods of time.”

DISCUSSION

Multiple regression analysis showed considerable association between advantages of the variable shift

TABLE 2.
UWES score in relation to characteristics and responses of the participants

		UWES									
		Vigor			Dedication			Absorption			
		MD	IQR	p value	MD	IQR	p value	MD	IQR	p value	
	Total	7	5-9		9	7-10		7	5-9		
Marital status	married	8	6-9	0.001	9	8-11	0.001	7	6-9	0.002	
	unmarried	6	5-8		9	7-10		7	5-8		
Having children	yes	8	6-9	0.001	9	8-11	0.001	8	6-9	0.001	
	no	6	5-8		9	7-10		7	5-8		
Work experience (years)	1-2	6	5-8	0.002	8	6-9	0.001	6	4-7	0.001	
	3-5	6	5-8		9	7-9		6	4-8		
	6+	7	5-9		9	7-11		7	6-9		
Sense of fatigue	mild	7	5-9	0.027	8	7-10		6	5-8		
	moderate	7	6-9		9	8-10		7	6-9		
	severe	7	5-8		9	7-10		7	5-9		
Sense of busyness	mild	6	5-8	0.043	8	7-10		6	4-9		
	moderate	7	7-9		9	9-10		7	7-9		
	severe	7	5-9		9	7-10		7	5-9		
Comparison with three shift system	easier	7	6-9	0.001	9	7-10	0.001	7	5-9	0.001	
	not easier	6	4-8		8	6-9		6	4-8		
Ease of taking a break	easy	7	5-9		9	7-10		7	5-9		
	difficult	6	5-8		9	7-10		7	4-8		
Category of break activities	rest/relax	included	7	5-9		9	7-10		7	5-9	
		not included	7	5-9		9	7-10		7	5-9	
	entertainment	included	7	5-9		8	7-10		6	5-8	
		not included	7	5-9		9	7-10		7	5-9	
	cognitive	included	6	5-8	0.045	9	7-10		6	4-8	
		not included	7	5-9		9	7-10		7	5-9	
	social	[conversation only	8	6-9	0.001	9	7-11	0.001	7	6-9
email/SNS only			6	3-8	8		6-9	6		3-8	
both conversation and email/SNS			7	5-9	9		7-10	7		6-9	
neither conversation nor email/SNS			6	3-8	9		6-10	6		3-8	
Coping characteristics	AS(H)-CM(H)	7	5-9	0.013	9	7-11	0.001	7	6-9	0.003	
	AS(H)-CM(L)	7	5-8		9	7-11		7	5-8		
	AS(L)-CM(H)	7	5-8		8	7-9		6	5-8		
	AS(L)-CM(L)	6	4-7		7	6-9		6	3-8		

Mann-Whitney U test, Kruskal-Wallis test (Tukey's multiple comparison test) $p < 0.05$ IQR, Interquartile range

TABLE 3.
Principal component analysis of advantages and disadvantages from work schedule of variable shift system

Advantages		Principal component I	Principal component II	Principal component III
Principal component loading	1) Rest time before a night shift has increased.	0.660	-0.350	0.273
	2) Time available for housework or childcare before a night shift has increased.	0.556	-0.262	0.534
	3) I can make good use of my time before a night shift for my private life.	0.695	-0.318	0.353
	4) When on a night shift, I commute to my workplace safely.	0.606	-0.106	0.286
	5) Overtime work on day shift has decreased to reduce the work of nurses in charge of working on the night of the same day.	0.471	0.026	-0.312
	6) Consecutive holidays have increased.	0.610	-0.251	-0.417
	7) My life cycle has been organized more easily.	0.793	-0.219	-0.165
	8) I have been able to change the mode between work and rest more easily.	0.783	-0.217	-0.242
	9) I can ensure a nap time on a night shift.	0.633	-0.214	-0.196
	10) I have no consecutive night shifts and feel physically comfortable.	0.737	-0.124	-0.253
	11) The hand over to the staff of the next shift has done more efficiently because its frequency and time have reduced.	0.711	0.136	-0.004
	12) Staff's awareness of work improvement has increased.	0.691	0.493	-0.007
	13) Organization and work improvement in wards have promoted.	0.649	0.546	0.029
	14) I better understand the conditions of patients because I can get information before patients go to sleep.	0.702	0.389	0.011
	15) Patients feel assured when the same nurse is available before sleep and at the time of awaking.	0.599	0.516	0.199
Contribution ratio		44.206	9.998	7.107
Cumulative contribution ratio		44.206	54.205	61.312
Cronbachs coefficient alpha' 0.91				
Disadvantages		Principal component I	Principal component II	
principal component loading	1) A long day shift makes me tired.		0.552	-0.539
	2) A long day shift sometimes requires overtime.		0.661	-0.471
	3) I get so tired when successively entering a long day shift and a long night shift.		0.649	-0.472
	4) Overtime has increased due to acute deterioration or emergency hospitalization.		0.716	-0.120
	5) Increased attentive patients in a day shift have became a burden to me.		0.726	0.067
	6) A long night shift makes me tired.		0.679	-0.372
	7) I feel too busy because enough staff are not available in morning.		0.663	0.085
	8) Shift exchange is not done smoothly.		0.559	0.138
	9) The opportunity that preceptor and preceptee share the same time has reduced.		0.420	0.341
	10) It is difficult to identify where responsibility of each service lies.		0.611	0.515
	11) It is the case that an incident may occur due to insufficient communication between a pair of long day shift staff and day shift staff.		0.593	0.477
	12) It is difficult to make holistic observation of a patient because services have been diversified and dispersed.		0.626	0.530
Contribution ratio			39.243	15.052
Cumulative contribution ratio			39.243	54.295
Cronbachs coefficient alpha' 0.84				

TABLE 4.
Principal component score in relation to characteristics and responses of the participants

		advantage score			disadvantage score		
		MD	IQR	p value	MD	IQR	p value
Total		-0.04			0.01		
Marital status	married	0.01	-0.4-0.6		-0.05	-0.8-0.7	
	unmarried	-0.06	-0.7-0.6		0.07	-0.8-0.7	
Having children	yes	0.01	-0.5-0.6		-0.12	-0.9-0.6	
	no	-0.05	-0.7-0.6		0.08	-0.7-0.7	
Work experience (years)	1-2	0.03	-0.9-0.7	0.001	-0.37	-1.0-0.4	0.001
	3-5	0.33	-0.4-1.2		-0.12	-1.0-0.7	
	6+	-0.12	-0.7-0.5		0.09	-0.7-0.8	
Sense of fatigue	mild	0.13	-0.4-1.1	0.001	-0.46	-1.1-0.2	0.001
	moderate	-0.01	-0.6-0.7		-0.16	-0.9-0.6	
	severe	-0.18	-0.9-0.5		0.49	-0.3-1.0	
Sense of busyness	mild	0.03	-0.4-0.8	0.001	-0.36	-1.0-0.5	0.001
	moderate	-0.04	-0.6-0.9		-0.25	-1.0-0.5	
	severe	-0.17	-0.7-0.5		0.44	-0.3-1.0	
Comparison with three shift system	easier	0.14	-0.3-0.9	0.001	-0.36	-0.8-0.7	0.001
	not easier	-1.02	-1.4--0.4		0.52	-0.6-1.0	
Ease of taking a break	easy	0.03	-0.5-0.7	0.001	-0.12	-0.9-0.6	0.001
	difficult	-0.48	-1.0-0.4		0.65	-0.4-1.2	
Ideal break activities	social	0.09	-0.39-0.72	0.006	-0.09	-0.77-0.53	0.021
	rest/relax	-0.15	-0.74-0.54		0.11	-0.78-0.83	

Mann-Whitney U test, Kruskal-Wallis test(Tukey's multiple comparison test) $p < 0.05$ IQR, Interquartile range

TABLE 5.
Multiple regression analysis of the independent factors for work engagement

	partial regression coefficient	standardized partial regression coefficient	p value	95% CI
(Constant)	19.281		.000	15.435 - 23.127
Advantage score of variable shift system	2.085	0.284	0.001	1.499 - 2.672
Years of experience(more than 6)	2.756	0.176	0.001	1.384 - 4.129
Having children(Yes)	1.631	0.101	0.021	0.243 - 3.019
Nursing role conflict	0.544	0.243	0.001	0.348 - 0.740
Quantitative work load	-0.575	-0.216	0.001	-0.805 - -0.345
Coping characteristics AS(H)-CM(H)	1.644	0.113	0.005	0.504 - 2.783
Break(social-both conversation and email/SNS)	2.803	0.187	0.001	1.442 - 4.165
Break(social-conversation only)	2.200	0.104	0.029	0.229 - 4.172

adjusted $R^2=0.255$

system and work engagement. Amongst break activities, “conversation-containing activities,” i.e., “Conversation only,” “both Conversation and Email/SNS” under the social activities category showed a positive correlation with work engagement, which supports the importance of conversation. In contrast, “Quantitative workload” was negatively correlated with work engagement. This result may suggest that increases in the workload due to extended work hours can reduce work engagement. Although among the answers describing actual break activities, most nurses chose “conversation containing activities,” as one of the options, more than half of the respondents chose rest/relaxation as the ideal break activity. We suppose that the current situation involving breaks may be problematic because of the difference between actual break activity and ideal break activity. In what follows, we will discuss the relationship between the shift pattern and work engagement, as well as the most effective ways to take breaks.

1. Relationships between the variable shift system and work engagement

The new shift system allows more workers to be assigned during the busiest time of the day, and helps reduce the level of fatigue in nurses by eliminating demanding shift patterns with a shorter interval between shifts, such as a day-shift to night-shift pattern and a twilight-shift to day-shift pattern. In addition, it reduces the number of night shifts so that workers can live more in accordance with their biological rhythm. This creates a great advantage for workers, as they do not have to take extra rest in their personal life and can effectively use their spare time. This seems to support our study finding that more than 70% of the survey respondents answered that it made their work easier compared to the previous three-shift system. We will discuss the relationship with each factor.

For questionnaire items regarding advantages, the principal component loading was especially high with “My life cycle has been organized more easily” and “I have been able to change the mode between work and rest more easily” implying that they felt their work and life to become more balanced than before.

Regarding work engagement, the score for “vigor” was low when the sense of fatigue and the sense of busyness were “severe” suggesting that tiredness and busyness are associated with vigor in work. In addition, “vigor,” “dedication,” and “absorption” were all high in the group with more than 6 years of experience, the married group, and the group with children. This is consistent with previous studies [15] [16] in

which work engagement improved as years of experience increased. Interestingly, the group with more than 6 years of experience had high strain score and a higher level of work engagement compared to other groups with different years of experience, despite having a lower advantage score derived from the new shift system. A previous study also found cases in which both psychological stress response and work engagement were high [17]. Since job satisfaction is known to enhance work engagement despite the presence of stressors and stress reaction, it is effective in counteracting stress. Furthermore, individuals with more than 6 years of experience are assumed to be highly stressed, and they do not enjoy many benefits that the new shift system could offer. Nevertheless, they were able to sustain a high level of work engagement because of their roles at work and at home. In contrast, “Quantitative workload” was negatively correlated with work engagement. The open-response section filled out by those respondents, who chose the extended day shift as most demanding, showed many quantitative problems derived from prolonged work hours. An extended day shift is 12 hours of work, and if overtime work occurs, it necessarily increases the amount of duties. Moreover, it has been shown that mental and physical fatigue would be exacerbated over time [18]. It can be predicted that if no recovery is feasible during the work day, work performance will decline and stress will increase.

2. Relationship between the stress coping, break activities and work engagement

Several previous studies reported that a combination of multiple coping techniques could produce an effect different from a single coping technique [19] [20]. The subscales of BSCP are classified as either problem-focused coping or emotion-focused coping [13]. In a longitudinal study that was focused on “changing mood,” one of the emotional-focused coping techniques that could promote problem-focused coping demonstrated that when change of mood was incompletely achieved, the more frequent use of a problem-focused coping technique resulted in an increased stress response after one year. On the other hand, when change of mood was fully achieved, the more frequent use of a problem-focused coping technique resulted in a decreased stress response after one year. It has been shown that a commitment to using an emotion-focused form of coping without using a problem-focused form would not solve the fundamental problems of stress, hence, it is not effective [9]. In light of this, the present study, albeit a longitudinal

one, made a group comparison between the “active solution” score and the “changing mood” score in order to observe the relationship between the concurrent use of two forms of stress coping and work engagement. As a result, work engagement was high in the group with “AS(H)-CM(H).” These findings suggest that the use of the active solution combined with a complete change of mood would increase the degree of health, and improve performance at work.

Regarding the relationship between ways to spend break time and work engagement, “Vigor,” “Dedication” and “Absorption” were all higher in the conversation-containing groups, “Conversation only” and “both Conversation and Email/SNS,” that engaged in some form of conversation compared to the remaining two non-conversation groups. On the other hand, “Vigor” and “Absorption” were lower in the group that replied “neither Conversation nor Email/SNS,” i.e., the group that did not select social activities, than in conversation-containing groups. These results indicate that work engagement is lower in the two groups, “Email/SNS only” and “neither Conversation nor Email/SNS,” that do not engage in any form of conversation, than in the two groups that did engage in conversation. We suspect that conversation during breaks could restore resources consumed due to a stressful work experience.

As shown in the results, a smaller number of individuals selected “Conversation only” in the social activities category in younger age groups. The trend for the younger generations’ preference for “Email/SNS only” over “Conversation only” is apparent in a survey concerning use of the Internet on juveniles carried out by the Ministry of Internal Affairs and Communications [21]. This survey was targeted at youth from elementary school to young adults under 25, and it was shown that the ownership rate and the purpose for use of the smartphone in young adults did not greatly differ from those of high school and college students. The recent spread of information devices has increased their utilization among youth, and over-dependence on such devices could be said to characterize the young generation. In this survey report, 6.4% of the participants responded that “the number of my actual friends and acquaintances declined due to the use of the Internet,” and 4.2% agreed that “my relationships with my friends, sweetheart, family and colleagues got worse due to the use of the Internet”. It thus suggests the possibility that higher electronic dependency could affect actual interpersonal relationships to some degree.

3. *Effective ways to spend break time*

It would be ideal for workers to be able to take breaks for a set duration, and for them to use the duration as an opportunity to increase “personal resources” so as to enhance work engagement after the break. In this study, groups that were correlated with work engagement were the groups that answered “Conversation only” or “both Conversation and Email/SNS” in the social activities category for break activities, which supports the importance of conversation. The unmarried group, the group without children, and the group with 1 to 2 years of experience showed a tendency to select “Email/SNS” over “Conversation.” Although this may reflect the current means of communication among young people, support from their superiors or colleagues is necessary in order to enhance their work engagement and rejuvenate the nursing system. Furthermore, work engagement would be elevated if the individual has richer “personal resources,” such as self-efficacy and self-esteem. In order to converse during breaks as a means of recovery and to increase “personal resources,” a work environment where it is easy to talk to others regardless of age and years of experience is required. In recent years, as a technique of reducing stress at work and enhancing stress coping characteristics of individuals, a participatory approach has increasingly been adopted [22]. This approach uses thank you cards to express one’s gratitude toward other staff members and okay-cards to mutually acknowledge the strength of each staff member in order to strengthen ties among staff, and to develop a pleasant working environment. One study on nurses found that this participatory approach reduced their stress response [23]. These mutual appreciations or acknowledgements during work may enhance the self-efficacy and self-esteem of each individual, and the positive emotions arising out of these interactions may facilitate conversation during break time. A high frequency of smartphone use may cause interpersonal problems. We believe it is necessary to foster a work climate in which workers can release stress, receive empathy from others, and consult others without being overly dependent on “Email/SNS” by encouraging a moderate amount of conversation. One study on support from superiors highlighted the importance of the manager taking responsibility for the working environment of the entire department and creating, to the best of his/her ability, the circumstances in which new employees are comfortable talking to others [24].

For break activities, while groups with “conversation-containing” social activities were associated

with higher work engagement scores, more than half of the individuals selected “Have a place where you can be alone” or “Take a nap no matter how short it is” as their ideal break activity. Medical care personnel (physicians and nurses, etc.) who had more opportunities to have direct contact with patients tended to select “quantity or quality of work” and “occupational aptitude” as the stressors compared to other paramedics who had less direct contact with patients [25]. Furthermore, it has been reported that those who are most prone to burnout tend to be personal assistance staff with humanistic, rather than so-called mechanistic ways of thinking, and have personality traits that make them easily understand others empathetically; therefore, their personality traits acquired from their profession may themselves become the sources of stress for them [26]. The question regarding ideal ways to take breaks used in this study focused on whether they involved others or not. It was assumed that if personality traits acquired from the profession increase workers’ stress, many of them would desire no involvement with others during their time outside of work. The survey responses of our study participants testified to this notion. To enhance “personal resources,” an effective recovery experience is required. Essentially, what changes the mood and what constitute a break activity that helps one to recover from fatigue varies depending on the circumstances. When a person feels severe physical strain or when his or her psycho-social resources are exhausted, he/she may want to be alone or take a rest. It would be important to make a work environment in which workers feel comfortable talking with one another, and then to create a space which simultaneously enables workers to talk with others and to take a rest without the need of being involved with others. If break time activities could take place in an environment that allows workers to enjoy both social activities and rest/relaxation, the sense of burden after an extended day shift would be reduced.

STUDY LIMITATION

Since this survey was conducted on nurses working in a single medical facility, a comparison with other medical facilities is required to generalize the results. Moreover, responses were received at a fixed time point, it would thus be necessary to carry out a longitudinal survey in the future in order to check the impact of fatigue and busyness. As for the comparison with the three-shift system, since our study participants were mixed, with some coming from a hospital ward in which several years had passed since the im-

plementation of the new shift system, and others coming from a hospital ward in which less than one year had passed, we need to recognize the possibility of recall bias.

CONCLUSION

Our study suggested that the advantages brought about by the variable shift system supported the work engagement of nurses who worked extended day shifts. Although “conversation-containing activities,” showed a positive correlation with work engagement, fewer individuals selected “Conversation-containing” in the social activities category in younger age groups. We think it is desirable to encourage mutual conversation among staff regardless of years of experience and age barriers. Additionally, our results suggested that the environment of the employee lounge should be arranged such that employees can freely choose conversation” or “taking a rest” depending on given circumstances.

ACKNOWLEDGEMENTS: We would like to extend our deep gratitude to all the nurses who participated in our study survey.

REFERENCES

1. Association JN. Night shift/shift work guideline. 2013.
2. Nakamura F, Sato E, Aoyama M, and Yamakado M. Effects and challenges resulting from the introduction of a 13-h shift limit for nurses working in Japanese hospitals 5-year literature review between 2011 and 2015. The bulletin of science-of-nursing research. 2016; 4(1):43-53.
3. Shimazu A, Sonnentag S, Kubota K, and Kawakami N. Validation of the Japanese version of the recovery experience questionnaire. J Occup Health 2012; 54(3):196-205.
4. Krajewski J, Wieland R, and Sauerland M. Regulating strain states by using the recovery potential of lunch breaks. J Occup Health Psychol 2010; 15(2):131-139.
5. Sianoja M, Syrek CJ, de Bloom J, Korpela K, and Kinnunen U. Enhancing daily well-being at work through lunchtime park walks and relaxation exercises: Recovery experiences as mediators. J Occup Health Psychol 2018; 23(3):428-442.
6. Hayashi M CT. Short nap vesus short rest:recuperative effects during VDT work. Ergonomics 2004; 47:1549-1560.
7. Kim S, Park Y, and Niu Q. Micro-break activities at work to recover from daily work demands. J Organ Behav 2017; 38:28-44.
8. Rhee H and Kim S. Effects of breaks on regaining vitality at work:An empirical comparison of ‘conventional’ and ‘smart phone’ breaks. Comput Human Behav 2016; 57:160-167.
9. Shimazu A and Schaufeli WB. Does distraction facilitate problem-focused coping with job stress? A 1 year longitudinal study. J Behav Med 2007; 30(5):423-434.

10. Wendsche J, Ghadiri A, Bengsch A, and Wegge J. Antecedents and outcomes of nurses' rest break organization: A scoping review. *Int J Nurs Stud* 2017; 75:65-80.
11. Higashiguchi K, Morikawa Y, and Miura K. The Job Stressor Experienced by Hospital Nurses: Development of the Nursing Job Stressor Scale and Examination of Psychometric Properties. *Jpn J Health Psychol* 1998; 11(1):64-72.
12. Schaufeli WB, Salanova M, González-Romá V, and Bakker A. The measurement of engagement and burnout: A two sample confirmative analytic approach. *J Happiness Stud* 2002; 3:71-92.
13. Kageyama T, Kobayashi T, Kawashima M, and Kanamaru Y. Development of the Brief Scales for Coping Profile (BSCP) for workers: basic information about its reliability and validity. *J Occup Health* 2004; 46(4):103-114.
14. Yoshida E, Yamada K, and Morioka I. Sense of coherence (SOC), occupational stress reactions, and the relationship of SOC with occupational stress reactions among male nurses working in a hospital. *J Occup Health* 2014; 56(5):152-161.
15. Nakamura M and Yoshioka S. Factors related to work engagement among nursing staffs working in a university hospital. *J Yonago Med* 2016; 67(1-2):17-28.
16. Sato Y and Miki A. Influences of Job Stress, Coping Profile and Social Support on Work Engagement among Hospital Nurses. *J Sci Labour* 2014; 90(1):14-25.
17. Suzuki A and Kosugi S. Study on Work Engagement and Job Stress Research. *Job Stress Res* 2006; 13(4):201-205.
18. Inoue M. Impact Analysis of the Implementation of the "Variable Shift System" for Nurses in Hospitals : Focusing on the Long Day Shift. *J Kurume Med Assoc* 2017; 80(6):150-164.
19. Shimazu A and Kosugi S. Job stressors, coping, and psychological distress among Japanese employees: Interplay between active and non-active coping. *Work Stress* 2003; 17(1):38-51.
20. Gaudreau P and Blondin J-P. Differential Associations of Dispositional Optimism and Pessimism With Coping, Goal Attainment, and Emotional Adjustment During Sport Competition. *Int J Stress Manag* 2004; 11(3):245-269.
21. Institute for Information and Communications Policy, Ministry of Internal Affairs and Communications. Survey on Internet usage and dependency trend among young people 2013 (in Japanese).
22. Kawakami N, Shimazu A, and Tsuchiya M. Primary prevention of occupational stress: scientific evidence and its application in practice. *Occup Health Rev* 2008; 20(4):175-196.
23. Yoshida E, Yamada K, and Morioka I. Effect of a "Like!" seal on the stress reactions of nurses in a hospital. *J Occup Health* 2016; 58(1):1-10.
24. Omori M, Teraoka S, and Ito M. Role Behaviors of Nurse Managers in On-the-Job Training for Newly Graduated Nurses in Japan : A Literature Review. *Kawasaki Med Welf J* 2017; 26(2):160-173.
25. Inaoka F. Research: sources for psychological and interpersonal factors in hospital settings leading to burnout among nurses. *Kango Kenkyu* 1988; 21(2):173-179 (in Japanese).
26. Kubo M and Tao M. Burn Out; Concepts and Methods. *Japanese Psychological Review* 1991; 34:412-431.