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Pattern of shiftwork and health status among nurses in a university hospital in northeastern Thailand.

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Abstract

This study was aimed to explore shiftwork patterns and health status among nurses at a university hospital in northeastern Thailand. A descriptive study was conducted. The study population was 1,221. The data were collected via self-reported questionnaire including personal information and the last month shift schedule. Descriptive statistics were applied using STATA v 10. The response rate was 68.1 % (831/1,221) and completion rate was 59.1% (721/1,221). There were 82.2% (593/721) participants had performed shiftwork. The shiftwork patterns were (a) day shift plus over time, (b) day and evening shift, (c) day and night shift, and (d) rotational shift. All of rotational shift were fast rotation with irregular shift pattern (n=531; 89.5%). Even though there was no pure forward or backward rotations, the researcher divided the participants into three groups (namely, primarily forward, primarily backward, and evenly split between backward and forward). Most shift workers performed primarily backward rotational pattern (n=479; 90.2%). A minority (n=143; 24.1%) did extended shifts: median extended shift was once a month (IQR 1-3). The majority (n=523; 88%) of participants did quick return shifts (88%) (median=11 times/month, IQR7-13) Nearly one-third (28.0%) of participants had underlying diseases such as allergic rhinitis (7.9%), asthma (1.9%), and/or dyslipidemia (1.8%). Based on a BMI > 25 kg/m^2, 17.5 % of the participants were obese. Over one-tenth (12.2%) of the participants had a sleep disorder and 14.9% used sleepiness- or drowsiness-inducing medication. Most of the participants had no depression (86.4%) and were at low risk of obstructive sleep apnea (76.0%). Comparing characteristics of shift and non-shift personnel, median age, proportion of married nurses and caffeine needed were lower for shift workers than the non-shift workers. Working experiences were shorter in shift workers than the non-shift workers and there was a statistically significant difference among job position, task, work unit, and salary. Likewise, shift workers had fewer underlying diseases, using sleepiness or drowsiness drug and depression. In conclusion, there was a high proportion of shift workers represented in the study, and most nurses did rotational shift with primarily backward rotation, quick return and extended shifts which are associated with a higher health risk. The health effect from shiftwork on the current study could not be concluded however, nearly one-third revealed some kinds of underlying diseases. The association of effect from shiftwork will be presented elsewhere.

Keywords: Pattern of shiftwork, nurses, health workers, rotational shift

1. Introduction

The International Labour Organization defines shiftwork as "a method of organization of working time which the establishment can operate longer than the hours of work of individual workers". This term has been used generally to include any arrangement of daily working hours other than the standard daylight hours [1]. Seventeen percent of workers in the European Union and 15 percent of workers in the United States are shift-workers but in Thailand, the data on the proportion of shift worker remains unclear [1 & 2].

Even though shiftwork helped to manage working process, it negatively affected health, social, family, and work performance, and increased accidents at work and injury [3]. Concerning health effects, shiftwork increased the risk of cardiovascular diseases [4] obesity [5] diabetes [6 & 7], and sleep problems [8 & 9]. It was classified as a possible carcinogen (2A) by the IARC [1]. Circadian rhythm disturbance might be the main mechanism resulting in health problems [8 & 9]. There are many patterns of shiftwork scheduling, depending on: time of shift, shift rotation, work-rest ratios, and whether regular or predictable. Each respective shift schedule would have implications for safety, health, and productivity [10] such as most studies indicated that the backward rotation affected sleep quality [11-13].

Nurses were one of the groups of health personnel at risk of several types of occupational hazards including shiftwork. The Thai Nursing and Midwifery Council has a policy regarding working hours but shiftwork scheduling recommendation have not been established [14]. While there have been a few studies on shiftwork among nurses [15] in Thailand, the various patterns of shiftwork have not been explored. We aimed to study the patterns of shiftwork and health status that might relate with shiftwork among nurses at a university hospital in northeastern Thailand.

2. Study design

Descriptive study was conducted in this study.

Nomenclature

Pattern of shiftwork	the arrangement of shifts
Rotational shift	the switching between day (8 a.m. – 4 p.m.), evening (4 p.m. – 12 a.m.), and night (12 a.m. – 8 a.m.) shift
Direction of shift	the order of switching between shifts, including forward from day to evening to night and backward from day to night to evening
Speed of rotation	how often shifts were switched, including fast rotation every 1-2 days and slow rotation every 2-4 weeks
Irregular direction	the discontinuous rotation between shifts.
Primarily forward	irregular direction shift that has high tendency to be forward direction
Primarily backward	irregular direction shift that has high tendency to be backward direction
Evenly split	irregular direction shift that has equal proportion between forward and backward
Quick return	11 hours or less between 2 consecutive shifts
Extended shift	a shift longer than 8 hours.

3. Materials and Methods

3.1 Study population

The study population included nurses working at a university hospital in northeastern Thailand. The inclusion criterion was nurses who worked in in/out-patient department in all department and had worked at least 1 month in the hospital. The exclusion criterion was nurses who had a scheduled temporary modified shift (i.e., working in a unit under construction, being on study leave, sick leave, or maternal leave). There were 1,349 nurses met the inclusion criteria and 128 nurses were excluded. The study population after applying the inclusion and exclusion criteria was 1,221 nurses. The calculated sample size was at least 293 as per the finite population proportion as described by Ngamjarus et al. with 0.05% error and 95% confidence[16]. A total study population was applied.

3.2 Tool

The tool for collecting data was a questionnaire that included general working and health information, shifts schedule. Health information was collected using a self-reported questionnaire that included BMI, underlying diseases, sleep disorders, drowsiness as related to drug obstructive sleep apnea risk, and depression screening. Sleep apnea risk was screened using the modified Berlin questionnaire [17]. Depression was screened by questions Q2 and Q9 on depression screening [18]. The shift schedule data were collected from the nurses' previous 1 month schedule during March and May 2018. The shift schedule was classified by shiftwork features; including pattern of shift, rotational direction, quick return and extended shift. The tool was tested and validated to be valid by 10 nurses before collecting data.

3.3 Data collection

We collected data between March and May 2018 at a university hospital in northeastern Thailand. The study was reviewed and approved by the Khon Kaen University Ethics Committee for Human Research (HE 601463). A self-reported questionnaire was sent to all nurses in a hospital via chief of a unit. A consent method was an action consent by the participants. The participants had 2 weeks to complete the questionnaire then sent back directly to the researcher via sealed envelopes.

3.4 Data analyses

Descriptive statistics were reported and the results were presented as frequencies, percentages, medians, and interquartile range (as the data had a non-normal distribution). Inferential statistics were reported using the Fisher's Exact Test and the results were presented as a p-value. All analyses were performed using STATA (version 10.0, KKU license).

4. Results

4.1 Response rate

Eight hundred and thirty one nurses participated in the study (response rate 68.1%). One hundred and nine participants did not answer the questions about shiftwork so the completion rate was 59.1 % (721 nurses). All 721 of the participants were included into the study.

4.2 Demography and personal health issues

The study had 721 participants. The median age of the participants was 31 years (IQR27-43). The majority was female (96.1%) (Table 1). Nearly one-third (28.1%) of participants had an underlying disease including allergic rhinitis (7.9%), asthma (1.9%), and/or dyslipidemia (1.8%). Based on a BMI > 25 kg/m^2, 17.5 % of the participants were obese. Over one-tenth (12.2%) of the participants had a sleep disorder and 14.9% used sleepiness- or drowsiness-inducing medication. Most of the participants had no depression (86.4%) and were at low risk of obstructive sleep apnea (76.0%) (Table 2).

Table 1. Participant characteristics

Characteristics		N[721]	Percentage
Sex	Male	28	3.9
	Female	693	96.1
Age	(median 31 years, IQR (27-43)		
	20-29 years	302	41.9
	30-39 years	184	25.5
	40-49 years	130	18.0
	50-59 years	105	14.6
Married status	Single	414	57.4
	Couple	307	42.6
Smoking	Yes	2	0.3
	No	719	99.7
Alcohol needed	Yes	5	0.7
	No	716	99.3
Caffeine needed	Yes	280	38.8
	No	440	61.0
	Not declared	1	0.1

Table 2. Health status of the participants

Health status		N [721]	Percentage
BMI	>25 kg/m^2	126	17.5
	≤25 kg/m^2	595	82.5
Underlying diseases	Allergic rhinitis	57	7.9
	Asthma	14	1.9
	Dyslipidemia	13	1.8
	Migraine	12	1.7
	Hypertension	10	1.4
	Dyspepsia, peptic ulcer	10	1.4
	Cancer, tumor	8	1.1
	Diabetes mellitus	3	0.4
	Other diseases	61	8.5
Sleep disorder	Yes	88	12.2
	No	633	87.8
Sleepy or drowsiness related drug	Yes	108	15.0
	No	613	85.0
Obstructive sleep apnea risk	High risk	153	21.2
	Low risk	548	76.0
	Not declared	20	2.8
Depression	Mild	88	12.2
	Moderate	10	1.4
	No	623	86.4

4.3 Work characteristics

The median work experience was 2.3 years (IQR 4.08-20). Most of the participants worked in the in-patient unit (83.8%), and most provided nursing service (83.2%), followed by management and nursing service (14.0%). Some of the participants had other part-time work (15.5%) (55.4% worked in hospital vs. 25.0% worked in other places). Most of the participants reported having sufficient income and saving (47.4% and 40.6%) (Table 3).

Table 3. Working information of participants

Working information		N[721]	Percentage
Working experience	(median 2.33 years, IQR 4.08-20)		
	<1years	24	3.3
	1-10 years	417	57.8
	10-20 years	112	15.5
	20-30 years	95	13.2
	30-40 years	46	6.4
	Not declared	27	3.7
Position	Chief	39	5.4
	General	682	94.6
Task	Nursing	600	83.2
	Managing	14	1.9
	Nursing and Managing	101	14.0
	Not declared	6	0.8
Work unit	Inpatient Units	604	83.8
	Outpatient Units	117	16.2
Part time jobs	Yes	112	15.5
	No	609	84.5
Part time job types	Inside studied hospital	62	55.4
	Outside studied hospital	28	25.0
	Not identified	22	19.6
Salary	Enough	342	47.4
	Not enough	81	11.2
	Saving	293	40.6
	Not declared	5	0.7
Shiftwork	Yes	593	82.2
	No	128	17.8

The majority of participants had done shiftwork (593; 82.2%). There were four patterns of shiftwork, including day shift plus over time job (6.1%), day and evening shift (3.7%), day and night shift (0.7%), and rotational shift (89.5%). A significant minority (143 participants) had extended shifts (24.1%). The median extended shift was 1 time per month (IQR 1-3). The majority of participants had quick return shifts (523; 88.0%). The median quick return shift was 11 times per month (IQR7-13). To identify the direction of the rotational shift, they were all irregular directional shifts with fast rotations. Even though there were no pure forward or backward rotations, the researchers divided the participants into 3 groups (namely, primarily forward, primarily backward, and evenly split between backward and forward). Most shift workers worked in a primarily backward rotation pattern (479; 90.2%). followed by a primarily forward direction (6.4%) (Table 4).

Table 4. Shiftwork characteristics of the participants

Shift feature		N[593]	Percentage
Night shift	Yes	535	90.2
	No	58	9.8
Pattern of shift	Day shift with overtime	36	6.1
	Day shift with evening shift	22	3.7
	Day with night shift	4	0.7
	Rotational shift (Day, Evening, Night)	531	89.5
Extended shift	Yes	151	25.5
	No	431	72.7
	Not declared	11	1.8
Quick return	Yes	523	88.0
	No	59	9.9
	Not declared	11	1.8
Rotational shift direction		N[531]	Percentage
	Primarily forward	34	6.4
	Primarily backward	479	90.2
	Evenly split between backward and forward	7	1.3
	Not declared	11	2.1
Extended shift frequency (Median 1 time per month, IQR 1-3)		N[151]	Percentage
	1 time per month	86	57.0
	2 times per month	20	13.2
	3 times per month	7	4.6
	4 times per month	7	4.6
	5 times per month	6	4.00
	>5 times per month	25	16.6
Quick return frequency (Median 11 times per month, IQR 7-13)		N[523]	Percentage
	1-3 times per month	43	8.2
	4-6 times per month	70	13.4
	7-9 times per month	101	19.3
	10-12 times per month	143	27.3
	13-15 times per month	100	19.1
	>15 times per month	66	12.6

Comparing characteristics of those who worked shifts with those who did not using the Fisher's exact test, median age, proportion of married nurses and caffeine needed was lower for shift workers (Table 5). Working experience was shorter among shift workers and there was a statistically significant difference among working job position (chief/general), task (nursing/managing/nursing and managing), work unit (OPD/IPD), and salary (enough/not enough/saving) (Table 6). Likewise, shift workers had lower proportion of underlying diseases, using sleepiness or drowsiness and depression measurements (Table 7).

Table 5. Comparing general characteristics of shifts with non-shifts

Characteristics		Shift[593] N(%)	Non shift[128]N(%)	p-value
Sex	Male	25 (4.2)	3 (2.3)	0.451
	Female	568 (95.5)	125 (97.6)	
Median age (IQR)		29.0 (26-34.8)	51.5 (44-55)	<0.001
Married status	Couple	215 (36.3)	91 (71.1)	<0.001
	Single	377 (63.6)	37 (28.9)	
	Not declared	1 (0.2)		
Smoking	Yes	2 (0.3)	0 (0.0)	1.000
	No	591 (99.7)	128 (100.0)	
Alcohol needed	Yes	4 (0.7)	1 (0.8)	1.000
	No	589 (99.3)	127 (99.2)	
Caffeine needed	Yes	214 (36.1)	66 (51.6)	0.001
	No	378 (63.7)	62 (48.4)	
	Not declared	1 (0.2)		

Table 6. Comparing working information among participants

Characteristics		Shift[593] N(%)	Non shift[128] N(%)	p-value
Working experience (median, IQR)		7.0 (4.0-11.1)	23.0 (18.0-30.9)	<0.001
Job position	Chief	4 (0.7)	35 (27.3)	<0.001
	General	589 (99.3)	93 (72.7)	
Task	Nursing	524 (88.4)	76 (59.4)	<0.001
	Managing	3 (0.5)	11 (8.6)	
	Nursing and Managing	63 (10.6)	38 (29.7)	
	Not declared	3 (0.5)	3 (2.3)	
Work unit	In-patient Unit	540 (91.1)	64 (50.0)	<0.001
	Out-patient Unit	53 (8.9)	64 (50.0)	
Salary	Enough	299 (50.4)	43 (33.6)	<0.001
	Not enough	75 (12.6)	6 (4.7)	
	Saving	216 (36.4)	77 (60.2)	
	Not declared	3 (0.5)	2 (1.6)	

Table 7. Comparing participant health information

Characteristics		Shift[593] N(%)	Non shift[128] N(%)	p-value
BMI	>25	98 (16.5)	28 (21.9)	0.158
	≤25	495 (83.5)	100 (78.1)	
Underlying diseases	Yes	125 (21.1)	60 (46.9)	<0.001
	No	468 (78.9)	68 (53.1)	
Type of underlying diseases				0.106
	Allergic rhinitis	43 (7.2)	15 (11.7)	0.035
	Asthma	9 (1.5)	6 (4.7)	0.003
	Dyslipidemia	6 (1.0)	7 (5.5)	0.483
	Migraine	12 (2.0)	1 (0.8)	0.006
	Hypertension	5 (0.8)	6 (4.7)	0.228
	Dyspepsia, peptic ulcer	11 (1.8)	0 (0.00)	0.001
	Cancer, tumor	3 (0.5)	6 (4.7)	1.000
	Diabetes mellitus	4 (0.7)	0 (0.0)	0.000
	Other disease	38 (6.4)	23 (18.0)	
Sleep disorder	Yes	67(11.3)	21 (16.4)	0.135
	No	526(88.7)	107 (83.6)	
Using sleepiness or drowsiness medication				
	Yes	77(13.0)	31 (24.2)	0.002
	No	516(87.0)	97 (75.8)	
Obstructive sleep apnea risk				
	High risk	132(22.8)	21 (17.2)	0.187
	Low risk	447(77.2)	101 (82.8)	
Depression	Yes	88(14.8)	10 (7.8)	0.034
	No	505(85.2)	118 (92.2)	

5. Discussion

Shiftwork plays an important role in organizations where it has to be done 24 hours a day. Nurses are health workers who generally have shiftwork. Previous studies about shiftwork among nurses revealed an association with health effects and work performance, including sleep quality, traffic accidents, patient safety, and burnout [19–21]. Although there were many previous studies about shiftwork problems among nurses in Thailand, few studies considered shift work pattern scheduling [15, 22-23]. Better pattern shift scheduling could, therefore, decrease the risk of health problems and increase work performance.

The current study was aimed to explore the pattern of shiftwork among nurses in Thailand. The study revealed the high prevalence of shift work during the collecting period between March and May 2018 (82.2%) (Table3); similar to a previous study in Chiang Mai University Hospital (68.0%) [15]. Most participants had worked in an in-patient unit (83.8%) (Table 3) and performed nursing service tasks (83.2%) (Table 4), which was correlated with a high prevalence of shiftwork (Table 6). Some of the participants worked part-time job (15.5%)—mostly in-hospital jobs (55.4%) (Table 3). The current study also included part-time jobs when assessing shiftwork characteristics (Table 4).

Most of the shift workers worked night shift (90.2%) and most did rotational shiftwork (89.5%). Based on other studies, rotational shiftwork was associated with health problems; especially sleep disturbance [24 & 25] albeit we did not encounter this issue in our population. Rotational shiftwork could be divided by the direction of shift, including forward from day to evening to night vs. backward from day to night to evening [2]. Most studies indicated that the backward rotation affected sleep quality [11–13] especially in a fast rotation where the rotation occurs every day [26]. All of the participants in the current study had an irregular shift pattern. Even though there were no pure forward or backward rotations, the researchers divided the participants into 3 groups (namely, primarily forward, primarily backward, and evenly split between backward and forward). Most of the participants had the primarily backward pattern (90.4%) (Table 4), which might be associated with sleep problems just as with the backward rotation. Extended shiftwork was one of important shift feature that were related with health problem and working performance [19].

Working more than 8.5 hours a day could lead to working errors and poorer quality of sleep [19]. Almost one-

fourth of participants did extended shift once a month with a maximum of 22 times per month. Since there is still no evidence or recommendation on how many times per month a worker can do an extended shiftwork without health problems, further study on the subject is needed. A quick return was a shift with a recovery time between shifts of less than 11 hours [27]. Based on previous studies, a quick return is associated with sleep problem when it was done more than 30 time per year [20]. The current study showed a very high prevalence of quick return (88.0%) for a median of 11 times per month; we might thus expect a high prevalence of poor sleep.

The results of the current study showed that most of the participants were young female (median age 31 years, IQR 27-43) (Table 1). The median age among shift workers was younger than that of non-shift workers (median 29 years, IQR 26-34.75 and 51.5 years, IQR 44-55) consistent with the finding that work experience among shift workers was shorter than that of non-shift workers (7.00,IQR 4.00-11.08 and 23.00,IQR 18.00-30.87) (Table 5); possibly because older nurses tend to quit shiftwork after gaining seniority. Proportion of smoking and alcohol needed were very low but caffeine needed was almost 40%. (Table 1) as Thai nurses normally do not drink and smoke. The proportion of caffeine needed among non-shift workers was higher than that of shift workers (Table 5). As with other studies, there was a relationship between shiftwork and health problems [4-9].

The prevalence of nurses who had underlying disease were as follow; allergic rhinitis (7.9%), asthma (1.9%), and dyslipidemia (1.8%) (Table 2).The prevalence of all diseases among non-shift workers were higher than those of shift workers perhaps because non-shift worker were older or may be some of them had done shiftwork before (Table 7). The current study cannot, however, conclude that the relationship between shiftwork with any diseases because of the un-match study design. The current study also revealed that the prevalence of depression among shift workers was higher than those in non-shift workers (Table 7). In another study, it remained unclear why/how shiftwork or night work might be developed depression or not [28]. Shiftwork was also related to sleep problems. In the previous study, about 15% of physician on shiftwork had sleep disorder [29] nearly with 11.3% of the current study (Table 7). The sleep disorder caused by shift work call "shift work sleep disorder" which had diagnostic criteria (International Classification of Sleep Disorders) [30]. The current study, however, focused on the sleep disorder prevalence from self-declaration which could not identify the prevalence of shift work sleep disorder: this should be the subject of further research by diagnosed or measureable tools.

The pattern of shiftwork among the participants in the current study may have health consequences as was found in other studies. The association between pattern of shiftwork and health effects particularly quality of sleep should be studied further. The comparing between various shift-pattern such as direction of rotation, how many times of quick return or extended shift per month that could cause health effect might be of interest. The current study may have had a recall bias since it was based on a self-reported questionnaire; the researchers countered that the participants needed to verify their schedules rather than depending on their memories.

6. Conclusion

There was a high proportion of shift worker represented in the study, and most nurses did rotational shift with primarily backward rotation, quick return and extended shifts even though they are associated with a higher health risk. The health effect from shiftwork on current study could not be concluded but the information of shift pattern was useful to study further. The comparing between various shift-pattern such as direction of rotation, how many time of quick return or extended shift per month that could cause health effect might be of interest.

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8. Potential conflict of interest

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