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WORK LOAD AND PERFORMANCE OF HEALTHCARE UNIT PERSONNEL WORKING IN ROTATING SHIFT

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ABSTRACT ■ The health care units remain open 24 hours a day, all the days in a year. Health care unit personnel must work in shifts to render proper service to the people. They have to respond properly, efficiently and effectively even in unforeseen situations. But work load in different shifts and impact of rotating shift upon the quality of performance and outcomes is an area that needs further exploration.

The purpose of this present study is to assess the relationship between demanding work schedule and job performance of the health care unit personnel. The study was conducted on 130 health care unit personnel in two different government hospitals of West Bengal. Heart rate monitoring, perceived exertion and alertness rating were done to evaluate the psycho-physiological load of the personnel working in different shifts. Different performance evaluation tests were also carried out to evaluate the ability to perform various repetitive tasks in different shifts.

It was observed that the nature of job demand in night shift is more in psychological domain rather than the physiological one due to disruption of biological rhythms. Perceived exertion ratings were found to be higher in night shifts and reaction time was found to be lower in both the morning and night shifts although there are individual variations in perception of shift work tolerance.

Word staffing based on job demand, shortening the length of the night shift, sufficient rest between shifts and providing lifestyle training would help shift workers reduce their work load and improve performance.

Key words: Health care unit, shift work, heart rate, perceived exertion, alertness, performance evaluation.

INTRODUCTION

Today shift work becomes a common feature in the labour force since the invention of electricity. Additionally, lifestyle changes have increased the demand for 24 hours of service, seven days a week, particularly within the service sector (Bohle et al., 2004). In developing countries, like India, there is always dearth for Governmental medical facilities and are always heavy demands for medical services and the healthcare unit personnel have to work in shifts to render proper service to the large number of people (Sahu et al., 2012). The challenges faced by the healthcare unit personnel are both psychological and physical (Pheasant et al., 2011). Olaleye (2002) in her study among nurses working in government (state-owned) hospitals found that job stress and burnout syndrome had greater effect on their health

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and coping ability at work. There are temporal variations of job demand in healthcare units in India (Sahu et al., 2012). Marshall (1980) mentioned that sources of nurses' stress vary with specialization, level in the organization, experience, type of hospital, and type of unit. Occupational or job stress has been found to be negatively related to job satisfaction in nursing. For instance, Achalu (1995) found that nurses that experienced high level of stress were less satisfied with their career, had higher absenteeism rate and significantly less career commitment. Proper and special organization, distribution and co-operative attitude of healthcare unit personnel are required for a better quality healthcare (Mathews, 1990; Sahu, 1997).

Reports from other countries also showed a relationship between job dissatisfaction of nurses due to workload (DHHS, 2004; Aiken et al., 2002). Perceived high job demand has been shown to be associated with job dissatisfaction, physical and mental exhaustion, staff turnover, and job-related illnesses and injuries (Clarke et al., 2001; Diaz and Carbrera, 1997; McNeese-Smith Nazery, 2001). Meredith et al., 2007 found that ICU nurses have an increased prevalence of Post-Traumatic Stress Disorder symptoms compared with other general nurses.

Various studies were found regarding the mental performance and working shifts among health care sectors. Wilkinson et al. (1975) found that 37% of British physicians thought that the long work hours impaired medical safety. Wu et al. (1991) found that fatigue (related to on-call work) was the second largest reported cause of their own past medical mistakes. Nocera and Khursandi (1998) analyzed (anonymously) self-reported mistakes by anesthesiologists and found that mistakes concerning dosage and control of equipment were due to fatigue. Cooper et al. (1984) made similar findings. Recently, a study on interns on call duty, showed high levels of medical mistakes when senior physicians were closely monitoring interns on call (Landrigan et al., 2004).

Åkerstedt, 2007 reported that altered sleep wake pattern due to shift work and night work affects mental performance especially psychomotor performance, vigilance performance, and cognitive performance (memory, addition, logical reasoning). The present study aimed at evaluating the relationship between rotating work schedule and job performance of the health care unit personnel.

METHODS AND MATERIALS

Subject: The study was conducted on 130 health care unit personnelin two different government hospitals of West Bengal. Among 130 health care unit personnel, 72 (26-45 years) were nursing staffs and 58 (21-42 years) were attendant and they have at least two years of experience in the present field. The subjects were free from physical abnormalities and any other chronic diseases. Written consent was taken from the subjects.

Questionnaire study:

Subjects were interviewed by the standard shiftwork questionnaire (Standard Shiftwork Index) (Barton et al., 1993), which sought information about the general biographical facts, sleep and fatigue, health and well-being, social and domestic situations, coping against various adverse effects of shift work of the healthcare unit personnel. Seventy nursing staffs completed the questionnaire study and the rest did not cooperate.

Physiological parameters:

Heart rate: Resting and working heart rate of the subjects were measured using a Polar heart rate monitor (S810i, Finland). The working heart rates (WHR) of the subjects

were recorded during the actual working conditions and measurements were taken throughout the shifts. Thirty eight staff nurses and thirty special attendants were studied.

Psycho-physiological studies:

Perceive exertion rating: Perceive exertion rating of the staff nurses and special attendants was done on every two hour interval during different shifts according to Borg (1973). Fifty two nursing staffs and forty special attendants completed the procedure.

Alertness rating: Subjective alertness was assessed at each two hour interval using a self-reported seven point scale (Hoddes et al., 1973). Fifty two nursing staffs and forty special attendants completed the task.

Performance evaluation:

Ruler drop test: Ruler drop test (Davis et al., 2000) was conducted two times in each shift to monitor the changes in reaction time of the healthcare unit personnel. Thirty four nursing staffs and thirty five special attendants were studied.

Letter cancellation test: To measure the ability to perform various repetitive tasks in different shifts and the effects of changes in shift on the performance, double letter cancellation test was conducted twice a shift according to the method of Diller et al. (1974).Thirty four nursing staffs were studied.

Statistical analysis: Data were presented in mean±SD. Student's t-test was performed to find the significant differences between the measured parameters for the chosen level of significance ($p<0.05$) (Das and Das, 2004).

The study was approved by the Board of Research Study of University of Kalyani.

RESULT AND DISCUSSION

The shift rotates weekly and the nursing staffs generally get four morning shifts (7 a.m. to 1 p.m.), two afternoon shifts (1 p.m. to 8 p.m.) and one day off per week. The nursing personnel have to do three successive night shifts (8 p.m. to 7 a.m.) followed by a day off in an interval of twelve days. On an average they have four days off per month. The nursing staffs generally informed two to three days prior to shift rotation by the authority. The shift timing of the special attendants is similar as that of the nursing staffs. The special attendants are recruited in different shifts according to the need of the patient party and have no fixed day off. They are paid on a daily basis and are not paid in days off.

Table: 1-Percent of data of nursing staffs (N=70) according to Standard Shiftwork Index (SSI) questionnaire

	None	Not very much	A fair amount	Quite a lot	Complete
1. To what extent do you feel you have control over the specific shift that you work?	5.7	25.7	42.9	20.0	5.7
2. To what extent do you feel you have control of the specific start and finish times of the shifts you work?	0.0	34.3	37.1	17.1	11.4

	None	Not very much	A fair amount	Quite a lot	Complete
3. How do you feel about the amount of sleep you normally get?	**Nowhere near enough**	**Could do with a lot more**	**Could do with a bit more**	**Get the right amount**	**Get plenty**
(a) Between successive morning shifts	8.6	14.3	31.4	45.7	0.0
(b) Between successive afternoon shifts	0.0	0.0	28.6	71.4	0.0
(c) Between successive night shifts	51.4	25.7	22.9	0.0	0.0
(d) Between successive days off	0.0	0.0	0.0	65.7	34.3
4. How well do you normally sleep?	**Extremely badly**	**Quite badly**	**Moderately well**	**Quite well**	**Extremely well**
(a)Between successive morning shifts	0.0	5.7	48.6	45.7	0.0
(b) Between successive afternoon shifts	0.0	0.0	17.1	57.1	25.7
(c) Between successive night shifts	20.0	54.3	25.7	0.0	0.0
(d) Between successive days off	0.0	0.0	20.0	20.0	60.0
5. How rested do you normally feel after sleep?	**Definitely not rested**	**Not very rested**	**Moderately rested**	**Quite rested**	**Extremely rested**
(a) Between successive morning shifts	0.0	25.7	54.3	20.0	0.0
(b) Between successive afternoon shifts	0.0	0.0	57.1	42.9	0.0
(c) Between successive night shifts	0.0	71.4	28.6	0.0	0.0
(d) Between successive days off	0.0	0.0	34.3	51.4	14.3
6. Do you have difficulty in falling asleep?	**Almost never**	**Rarely**	**Sometimes**	**Frequently**	**Almost always**
(a) Between successive morning shifts	5.7	20.0	40.0	34.3	0.0
(b)Between successive afternoon shifts	51.4	17.1	31.4	0.0	0.0
(c)Between successive night shifts	0.0	2.9	22.9	60.0	14.3
(d)Between successive days off	62.9	25.7	11.4	0.0	0.0
7. Do you ever feel tired on (a)Morning shifts	0.0	8.6	37.1	48.6	5.7
(b)Afternoon shifts	28.6	14.3	17.1	40.0	0.0
(c)Night shifts	0.0	0.0	0.0	82.9	17.1
(d)Days off	37.1	28.6	31.4	2.9	0.0

Table: 2-Classification of working heart rate of total working hours (%) in different shifts of staff nurses

Heart Rate (Beats/min)	Morning Shift (N=12)	Afternoon Shift (N=14)	Night Shift (N=12)
<90	44.4±6.27	49.7±5.12	58.3±5.65
90-110	28.2±4.29	25.0±6.08	24.4±4.76
111-130	19.0±4.56	18.4±4.30	12.2±3.25
>130	8.4±2.82	6.9±3.95	5.1±1.19

(Data were represented in mean±SD)

Table: 3- Classification of working heart rate of total working hours (%) in different shifts special attendants.

Heart Rate (beats/min)	Morning Shift (N=10)	Afternoon Shift (N=10)	Night Shift (N=10)
<90	26.4±4.26	38.5±5.83	59.9±8.34
90-110	31.9±4.95	30.0±6.81	21.8±5.57
111-130	28.1±5.37	21.8±3.98	14.5±3.67
>130	13.6±3.20	9.7±3.02	3.8±1.42

(Data were represented in mean±SD)

Table: 2 and 3 represents the percentage of total working hours in different heart rate intervals of staff nurses and special attendants respectively. Result shows that physical work load was more in morning and afternoon shifts in comparison with night shifts for both staff nurses and special attendants which also reflect the findings of the questionnaire study. Nicoletti et al. (2013) found that work pulse (average increase of heart rate over resting heart rate) was lower during night (27 bpm) compared to day shifts (34 bpm; $p < 0.01$). The WHR data indicated a moderate cardiac stress level throughout the shifts (Chen et al., 2011). Sahu et al. (2012) reported that the most challenging tasks for the special attendants were lifting of patients as most of the adult patients were over 50 kg of body weight. Nurses also have to perform activities like patients transfer from bed to bed, talk to patients' party and these activities were more frequent in the morning and afternoon shifts than that of night shift. Nursing personnel have a high prevalence of occupational over-exertion injuries related to patient transfers (Engkvist et al., 2000, 2001; Goldman et al., 2000; Retsas and Pinikahaba, 2000).

Much research on stress claims that job stress stems from the nature of nursing work. This includes many factors such as lack of guidance and consultation, heavy workload, role conflict and ambiguity, and so forth (Ratliff, 1988; Cherniss, 1980; Anderson et al., 1996; Marshall, 1980).

Table: 4 and 5 reveals the perceived exertion and alertness of the healthcare unit personnel. Perceived exertion of the health care unit personnel were found to be the highest in the night shift and lowest in the afternoon shift. Sahu et al. (2012) also reported similar kind of findings. High levels of job stress contribute to a decrease in perceived worker productivity (AbuAlRub, 2004; Weyers et al., 2006). Alertness of the healthcare unit personnel was also found to be lower in night

shift than that of the morning and afternoon shift. The alertness score was 3.93±1.59 and 3.5±1.05 for staff nurses and special attendants respectively in night shift. According to Hoddes et al. (1973) a result of 3-7 may indicate that one could be suffering from a lack of sleep. So, getting a better nights rest could improve his level of alertness and day to day performance. Natale and Cicogna (1996) reported that alertness derives from the interaction of circadian (body temperature) and homeostatic (sleep-wake cycle) processes. Table: 6, showed that there was a high significant difference ($p<0.0001$) in mean score of both perceived exertion and alertness between afternoon and night shifts among staff nurses. High significant difference was also found in the mean score of alertness between afternoon and night shifts ($p<0.001$) of special attendants and between morning and night shifts ($p<0.001$) of nurses.

Table: 4-Perceived exertion rating of the staff nurses and special attendants in different shifts

	Staff Nurse			Special Attendant		
Perceived Exertion	Morning Shift (N=16)	Afternoon Shift (N=22)	Night Shift (N=14)	Morning Shift (N=12)	Afternoon Shift (N=18)	Night Shift (N=10)
	13.9±3.23	10.6±2.85	15.8±3.12	12.3±3.65	10.8±3.08	13.9±2.43

(Data were represented in mean±SD)

Table: 5-Alertness rating of the staff nurses and special attendants in different shifts

	Staff Nurse			Special Attendant		
Alertness	Morning Shift (N=16)	Afternoon Shift (N=22)	Night Shift (N=14)	Morning Shift (N=12)	Afternoon Shift (N=18)	Night Shift (N=10)
	2.1±0.96	1.6±0.68	3.9±1.59	1.8±0.71	1.4±0.52	3.5±1.05

(Data were represented in mean±SD)

Table: 6- Statistical analysis of Perceived Exertion and Alertness of staff nurses and special attendants in different shifts

	Staff Nurse			Special Attendant		
	MS vs AS	MS vs NS	AS vs NS	MS vs AS	MS vs NS	AS vs NS
Perceived Exertion	$p<0.01$	NS*	$p<0.0001$	NS*	NS*	$p<0.05$
Alertness	NS*	$p<0.001$	$p<0.0001$	NS*	$p<0.01$	$p<0.001$

(MS=Morning Shift, AS=Afternoon Shift, NS=Night Shift, NS*=Not Significant)

Table: 7- Reaction time of the staff nurses in different shifts

Ruler Drop Test	Morning Shift (N=14) (Reaction time in sec)	Afternoon Shift (N=10) (Reaction time in sec)	Night Shift (N=10) (Reaction time in sec)
Early hour	0.1816±0.0127	0.1569±0.0140	0.1743±0.0116
Late hour	0.1519±0.0131	0.1659±0.0146	0.2047±0.0137

(Data were represented in mean±SD)

Table: 8- Reaction time of the special attendants in different shifts

Ruler Drop Test	Morning Shift (N=12) (Reaction time in sec)	Afternoon Shift (N=15) (Reaction time in sec)	Night Shift (N=8) (Reaction time in sec)
Early hour	0.1706±0.0145	0.1615±0.0155	0.1820±0.0216
Late hour	0.1568±0.0156	0.168±0.0090	0.2154±0.0129

(Data were represented in mean±SD)

Table: 9- Statistical analysis of reaction time of staff nurses and special attendants in different time of shifts

	Early mornig shift vs late morning shift	Early afternoon shift vs late afternoon shift	Early night shift vs late night shift
Nursing staff	$p<0.0001$	NS	$p<0.0001$
Special Attendant	NS	NS	$p<0.05$

(NS-Not Significant)

Table: 7 and 8 represents the reaction time of staff nurses and special attendants respectively. Data in both the tables reveals that the reaction was most severe in late night shifts. Statistical analysis revealed that for staff nurses the time taken to respond to ruler drop test was significantly higher ($p<0.0001$) in early hour in comparison with late hour in both morning and night shifts. For special attendants significant ($p<0.05$) difference was found only between early and late night shift. In early studies the forenoon was thought to be the optimum time for mental performance (Laird, 1925). Other research groups demonstrated higher daytime performance with lower levels in the morning and evening for reaction time and computation speed (Poppel et al., 1970; Wever, 1979).

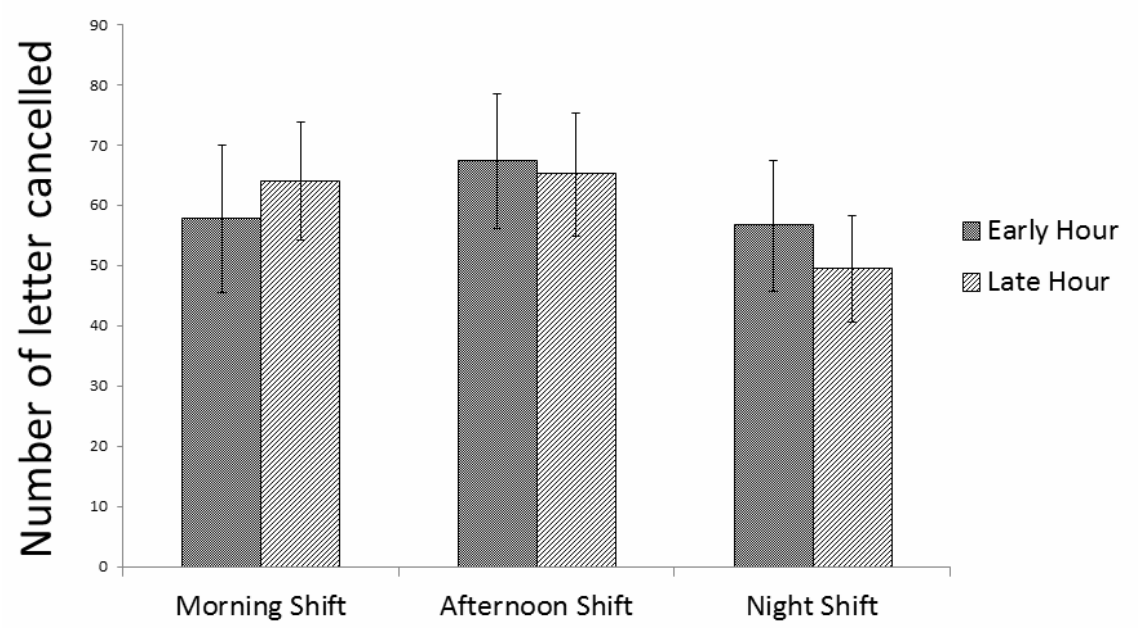

Figure: 1- Letter cancellation test of the staff nurses in different shifts

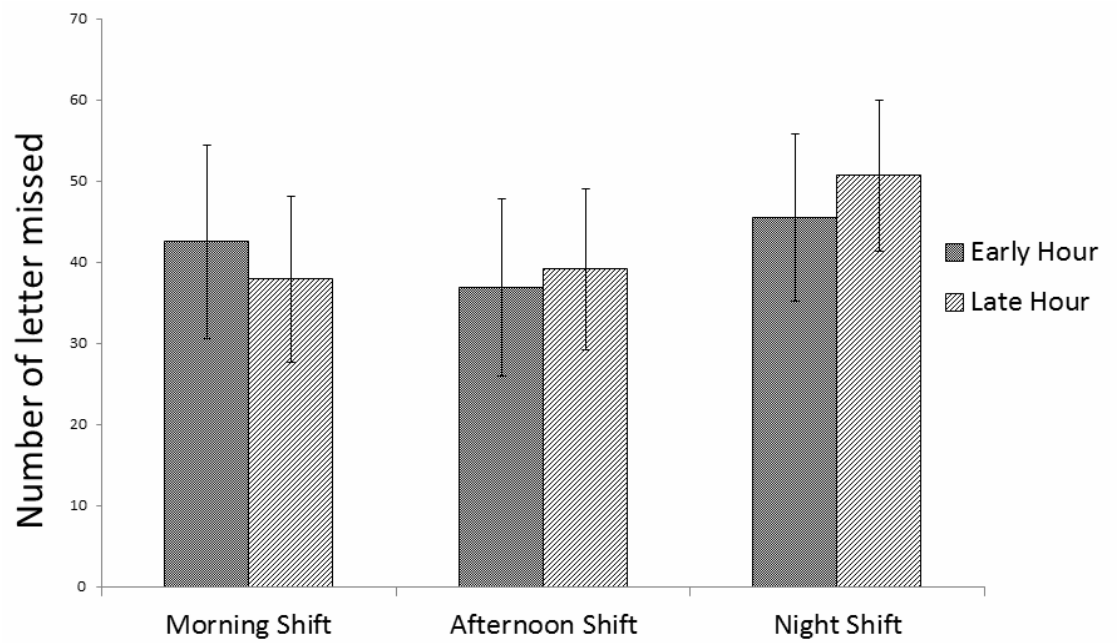

Figure: 2- Number of letters missed by the staff nurses in different shifts during letter cancellation test

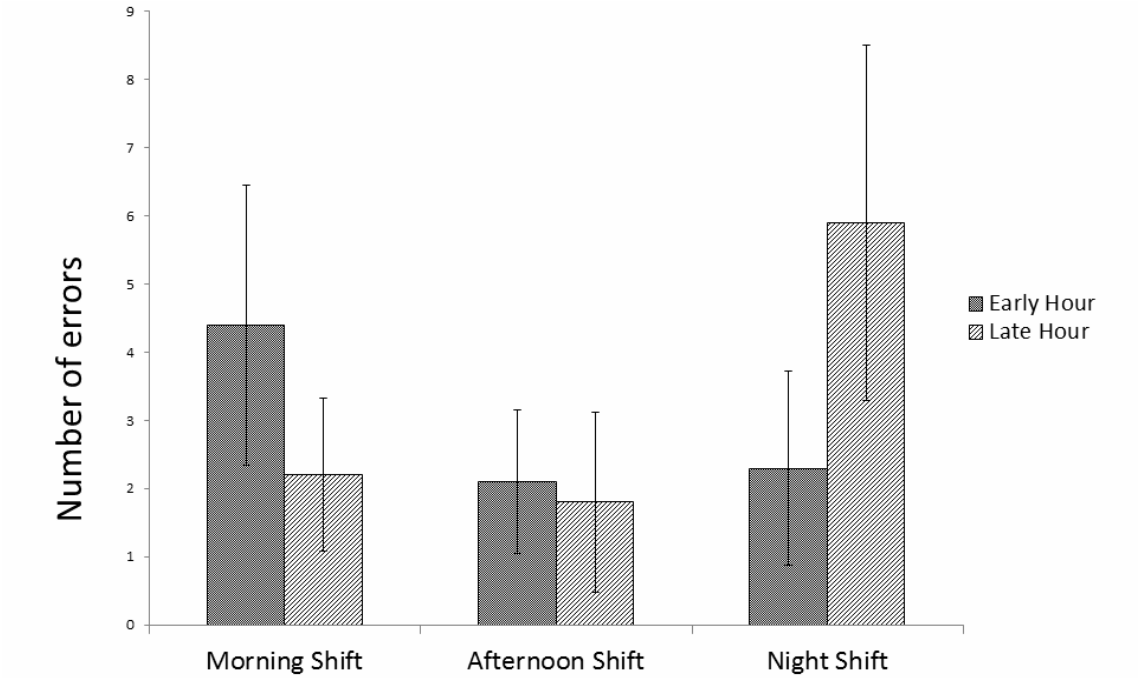

Figure: 3- Number of errors caused by the staff nurses in different shifts during letter cancellation test

Table: 10- Statistical analysis of the errors caused by the staff nurses in different shifts during letter cancellation test

	Early mornig shift vs late morning shift	Early afternoon shift vs late afternoon shift	Early night shift vs late night shift
Nursing staff	$p<0.01$	NS	$p<0.01$

(NS-Not Significant)

The Double Letter Cancellation Test (DLCT) is used to evaluate the presence and severity of visual scanning deficits of the health care unit personnel. The more the score the better is the performance i.e. the ability to perform various repetitive tasks is better in the respective shifts. Result showed that the mean score was maximum (67.3 ± 11.20 and 65.1 ± 10.22 in early and late hour respectively) in the afternoon shiftand minimum (56.6 ± 10.88 and 49.4 ± 8.85 in early and late hour respectively) in the night shift.Number of missed letter was highest (50.7 ± 9.29) in the late night shift and errors caused by the staff nurses during letter cancellation test were higher in both late night shift (5.9 ± 2.60) and early morning shift (4.4 ± 2.06). Statistical analysis showed that there was a significant difference in the errors caused by the staff nurses during letter cancellation test ($p<0.01$) in early hour in comparison with late hour in both morning and night shifts. Kleitman (1933) found that in simple repetitive tasks like card dealing performance was higher in daytime in comparison with the morning and evening. Colquhoun and his group (1971)

developed this research into more performance tasks-visual search, logical reasoning, and digit symbol substitution.

Though in real shift work situations performance changes have been less pronounced (Åkerstedt, 2007) but the result of the letter cancellation test suggest impairments in cognitive performance among nursing staffs in the early morning and late night shift. This is a major area of concern which may ultimately lead to mistake and patients' safety would be compromised.

CONCLUSION

There were temporal variations of job demand in healthcare unit. Though time duration was shorter in comparison with night shift but physiological work demand was more in the morning and afternoon shifts. The nature of job demand in night shift is more in psychological domain rather than the physiological one due to disruption of biological rhythms. Alertness and Performance of the healthcare unit personnel were most affected in the late night shift as well as in the early part of the morning shift.

RECOMMENDATION

In view of the findings of the above study it can be said that the length of the shift particularly night shift should be minimized and a brief period of rest within a shift may assist allay exertion and improve alertness of the healthcare unit personnel. This will in turn demand recruitment of more staffs and proper patient-staff ratio can be maintained which will eliminate the problem of understaffing that is one of the reason to deteriorate both quality and output of medical services. Proper counselling and lifestyle training may help the personnel to cope up with the increased job demand and improve performance.

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CONFLICT OF INTEREST

None

REFERENCE

AbuAlRub RF (2004). Job stress, job performance, and social support among hospital nurses. J Nurs Scholar, 36: 73-78.

Achulu E (1995). "Occupational Stress: Your Job can be dangerous to your health." Nigeria Sch Hlth J, 8: 46-49.

Aiken LA, Clarke SP, Sloane DM, Sochalski J, Silber JH (2002). Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. JAMA, 16: 1987-93.

Åkerstedt T (2007). Altered sleep/wake patterns and mental performance. Physiol Behav, 90: 209–18.

Anderson W, Cooper C, Willmott M (1996). Sources of Stress in the National Health Services: a comparison of seven occupational groups. Work Str, 10: 88-95.

Barton J, Folkard S, Smith LR, Spelten ER, Totterdell PA (1993). Standard Shiftwork Index Manual. The University of Sheffield, Sheffield. pp. 25.

Bohle P, Quinlan M, Kennedy D, Williamson A (2004).Working hours, work-life conflict and health in precarious and "permanent" employment. Revista De Saude Publica, 38: 19-24.

Borg GAV (1973). Perceived exertion: A note on history and methods. Med Sci Sports, 5: 90-95.

Chen J, Davis LS, Davis KG, Pan W, Daraiseh NM (2011). Physiological and behavioural response patterns at work among hospital nurses. J Nurs Manag, 19: 57-68.

Cherniss C (1980). Staff Burnout. Beverly Hills (CA): Sage Publication Inc.

Clarke SP, Sloane DM, Aiken LH (2001). The effects of hospital staffing and organizational climate on needle stick injuries to nurses. Am J Pub Hlth, 92: 1115-19.

Colquhoun WP (1971). Circadian variations in mental efficiency, in Biological rhythms and human performance.In: Colquhoun WP, ed. London Academic Press, pp. 39–107.

Cooper JB, Newbower RS, Kitz, RJ (1984). An analysis of major errors and equipment failures in anesthesia management: considerations for prevention and detection. Anesthesiology, 60:34–42.

Das D, Das A (2004).Statistics in Biology and Psychology.4th ed. Academic Publishers.Calcutta. pp. 367.

Davis B, Bull R, Roscoe RD (2000). Physical Education and the study of sport.4th ed. Harcourt, Spain, pp. 130.

Diaz RI, Carbrera DD (1997). Safety climate and attitude as evaluation measures of organizational safety. Accidents Annals Prev, 29: 643-50.

Diller L, Ben-Yishay Y, Gerstman LJ, Goodin R, Gordon W, Weinberg J (1974). Studies in scanning behavior in hemiplegia. Rehabilitation Monograph No. 50, Studies in cognition and rehabilitation in hemiplegia. New York: New York University Medical Center, Institute of Rehabilitation Medicine.

Division of Nursing, Bureau of Health Professions, Health Resources and Services Administration (DHHS). The registered nurse population: findings from the national sample survey of registered nurses. Available at: http://bhpr.hrsa. gov/ healthworkforce.rnsurvey (accessed 15 February 2004).

Engkvist I-L, Kjellberg A, Wigaeus Hjelm E, Hagberg M, Menckel E, Ekenvall, L (2001). Back injuries among nursing personnel-identification of work conditions with cluster analysis. Safety Sci, 37: 1–18.

Engkvist I-L, Wigaeus Hjelm E, Hagberg M, Menckel E, Ekenvall L (2000). Risk factors for reported over-exertion back injuries among female nursing personnel. Epidemiology, 11: 519–22.

Goldman RH, Jarrard MR, Kim R, Loomis S, Atkins EH (2000). Prioritizing back injury risk in hospital employees: application and comparison of different injury rates. JOEM, 42: 645–52.

Hoddes E, Zarcone V, Smythe H, Phillips R, Dement WC (1973). Quantification of sleepiness: a new approach. Psychophysiology, 10: 431–36.

Kleitman N (1933). Studies on the physiology of sleep. VIII. Diurnal Variation in Performance. Am J Physiol, 104: 449–56.

Laird DA (1925).Relative performance of college students as conditioned by time of day and day of week. J ExpPsychol, 8: 50–63.

Landrigan CP, Rothschild JM, Cronin JW, Kaushal R, Burdick E, Katz, JT (2004). Effect of reducing interns' work hours on serious medical errors in intensive care units. N Engl J Med, 351:1838–48.

Marshall, J. (1980). Stress among nurses. In: Ceoper CL, Marshall J, ed. White collar and professional stress. Chichester: Wiley.

Mathews A (1990). In charge of the ward. UK: Blackwell Scientific Publications.

McNeese-Smith DK, Nazery M (2001). A nursing shortage: building organizational commitment among nurses: practitioner application. J Healthcare Mngmt, 46: 173-87.

Natale V, Cicogna PC (1996). Circadian regulation of subjective alertness in morning and evening type.PersIndiv Differ, 20: 491-97.

Nicoletti C, Spengler CM, Läubli T(2013). Physical workload, trapezius muscle activity, and neck pain in nurses' night and day shifts: A physiological evaluation. Appl Ergon., pii: S0003-6870(13)00208-1. doi: 10.1016/ j.apergo.2013.09.016.

Nocera A, Khursandi DS (1998). Doctors' working hours: can the medical profession afford to let the courts decide what is reasonable? Med J Aust, 168:616–18.

Olaleye BA (2002). Psycho-Social Effects of Job Stress and Burn-out Syndrome Among Nurses in State-Owned Hospitals in Oyo State. M.S.W. Project, (Unpublished) University of Ibadan, Nigeria.

Pheasant S, Holmes D, Stubbs D (2011). Back pain in nurses: some ergonomic studies. In: Contemporary Ergonomics. Lovesey EJ, ed. London: Taylor and Francis.

Poppel E, Aschoff JC, Giedke H (1970). Circadian variations in choice reaction time. Z Exp Angew

Psychol, 4: 537–52.

Ratliff N (1988). Stress and Burnout in the Helping Professions. Soc Casework, 68: 147-54.

Retsas A, Pinikahaba J (2000). Manual handling activities and injuries among nurses: an Australian hospital study. J AdvNurs, 4: 874–83.

Sahu S. (1997). Ergonomics studies on personnel working in different healthcare units for improvement of efficiency, occupational health and safety. Ph. D thesis (Unpublished). University of Calcutta.

Sahu S, Gowsami S, Haldar P, Sett M (2012). An ergonomic evaluation of tasks of healthcare unit personnel in different shifts in General Hospitals in West Bengal.Int JOccup Safety Hlth, 2: 1-9.

Wever R (1979). The circadian system of man: Results of experiments under temporal isolation. New York: Springer-Verlag.

Weyers S, Peter R, Boggild H, Jeppesen HJ, Siegrist J (2006). Psychosocial work stress is associated with poor self-rated health in Danish nurses: A test of the effort-reward imbalance model. Scand J Caring Sci, 20: 26-34.

Wilkinson RT, Tyler PD,Varey, CA (1975). Duty hours of young hospital doctors: effects on the quality of work. J Occup Psychol, 48:219–29.

Wu AW, Folkman S, McPhee SJ, Lo B (1991). Do house officers learn from their mistakes? J Am Med Assoc, 265:2089–94.