



Assessment of Occupation Induced Changes in Circadian Rhythm Pattern and Its Determinants among Frontline Workers in Chitradurga City

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ABSTRACT

Frontline workers are the backbone of the society, bravely facing challenges to keep safe and healthy especially during crisis like the pandemic situation. They deserve utmost respect and support. They usually work even in night shifts to ensure public safety and health. The sleep cycle may affect during their nightshifts. Assessment of their shift work sleep disorder is an important aspect. **Objectives:** To determine the prevalence of shift work sleep disorder among selected population of frontline workers (health care worker, police, security guard, bus driver) by using permitted questionnaire and to assess the sleep quality and determinants that affects sleep among frontline workers in Chitradurga city. **Materials and methods:** A permitted questionnaire with basic demographic details was used to assess shift-work sleep disorder. A questionnaire was provided to the participants to determine their sleeping pattern and to determine their determinants that affect sleep. Statistical data were analysed using SPSS IBM version 29, MS Excel spread sheet version 2016 and structured matrix. **Results:** The study assessed high risk of shift work disorder was seen about 10.6% and low risk of shift work disorder was seen about 89.4% among 274 frontline workers who was working in nonstandard shift in their respective department. Most participants were in the age group of 41-50 years old with a higher proportion of males. In the selected participants none of them consumed sedatives or hypnotics to induce sleep. Hypertension and diabetes mellitus was the most common co morbidity among 15% participants about 85% participants had no comorbidity. **Conclusion:** The study concludes that many of the frontline workers of selected population adjusted to their nonstandard shift work. Advised the participants with high risk of shift work disorder to consult the higher authority of their department to change their shift and not to self-drive the vehicles after their nonstandard shift. Participants with symptoms of insomnia and hypersomnia are advised to consult the physician.

Keywords: Shift work sleep disorder, Frontline workers, Nonstandard shift, Questionnaire based study

INTRODUCTION:

Sleep is a state of reduced mental and physical activity in which consciousness is altered and sensory activity is inhibited to some extent. The circadian rhythm is a biological process that regulate sleep-wake cycle.¹

The supra-chiasmatic nuclei, responsible for regulating circadian rhythm are highly responsive to light and dark signals. Night shift work is known to disrupts this circadian rhythm. Additionally, disturbances in the circadian rhythm can leads to alteration in level of ghrelin, leptin, insulin, cortisol, and melatonin among night shift workers. These changes contribute to a decline in sleep quality.

Globally nearly 20% of the workforce operates in shifts outside of standard work hours. Shift work sleep disorders affect an estimated 20- 30 % of these shift workers.¹ Shift work necessitate a sleep-wake schedule that often contradicts the natural internal rhythm of sleep and wake-fulness. When work hours leads to irregular sleep times it can induce circadian misalignment, this in turn disrupts sleep, leading to insomnia, significant sleep deficit and day time drowsiness, culminating in shift work sleep disorder^{1,2}.

Shift-work sleep disorder (SWSD) is a circadian rhythm disorder characterized by a chronic mismatch between a shift worker's sleep-wake schedule and his or her circadian clock. Night workers face a heightened risk of vehicular accidents, with decreased



alertness, cognitive function, and vigilance being significant factors. These factors not only contribute to more accidents but also lead to a higher rate of injuries, industrial accidents, quality control errors, decreased work capacity and an increased occurrence of reported injuries and near-misses. Shift work disorder is categorized as a primary sleep disorder with circadian rhythm sleep disorders. It manifests as excessive sleepiness or insomnia³. Studies show SWD affects social and family responsibilities especially in professions like health care, where shift work is common. Creating a healthy work environment is crucial for the nursing profession to thrive. Investigating SWD symptoms is essential for nurses to achieve their desired outcomes⁵.

The 2nd edition of the International Classification of Sleep Disorders sets out the following criteria to diagnose SWD: 1) complaints of insomnia or excessive sleepiness temporarily associated with a recurring work schedule that overlaps the usual time for sleep; 2) symptoms must be associated with the work schedule for at least one month; 3) evidence that the circadian and sleep-time misalignment were present for 7 days using sleep log or acti-graphic recording; and, 4) the sleep disturbance cannot be explained by another sleep, medical, neurological or mental disorder, or the result of medication or substance abuse.

A study finding suggests that stigma, stress and the nature of night shift work led workers to use substances like alcohol and non-prescribed sleeping pills to cope. Anti-stigma efforts and mental health screening could help mitigate these harmful behaviors and improve hospital care²⁹.

The factors that influence the development of sleep disorders in shift workers were mentioned in many pieces of literature like; age > 50 years and female gender, being married, middle income and a length of service between 5 and 10 years or 10 years, night shift work, long working hours, short sleep and rotating shifts were reported to be associated with shift work sleep disorder. Strategies to improve adaptation to night shift schedules based on sleep and circadian principles commonly manipulate sleep timing and light exposure patterns.

MATERIALS AND METHODS:

Study site and participants:

This study was conducted in Hospital (Basaveshwara Medical College and Research Centre, District government hospital), Police station (Kote police station, Nagara police station, Badavane police station), KSRTC bus stand and SJM security agency in Chitradurga city, for a period of 6 months. The study population included 274 participants who met inclusion criteria and provided consent for the study were taken into consideration. Individuals who were not having non-standard shift during the study were excluded from the study.

Ethical approval:

i. Statement of ethical approval: The study was approved by the SJM College of Pharmacy Institutional Ethics Committee on human subjects' research. Ref No. SJMCP/98/2023-24 dated on 06th May 2023. Subject confidentiality was maintained during and after data collection.

ii. Statement of informed consent: Informed consent was obtained from all individual participants included in the study.

Data collections and study procedure:

Prior to data collection, ethical clearance was obtained from the institutional ethics committee. For data collection a permitted questionnaire form was obtained and included all the necessary demographic details such as age, gender, occupation, social habits, level of education, medical condition and address of the participant. Questions which are related to sleeping pattern, duration of nonstandard shift work and screen time of electronic gadgets. A questionnaire consisting of 26 permitted questions were provided to the participants to determine their sleep cycle patterns, sleep quality and to measure prevalence of shift work sleep disorder. They were required to fill the forms provided by signing consent form, followed by writing the demographic details and ticking the responses for all the questionnaire with appropriate choices as provided in the data collection form. By employing structured matrix spread sheet, we aimed to objectively measure the prevalence of high-risk shift work disorder and low risk shift work disorder among the participants in our study. Data was obtained directly from the participants by providing the purpose of the study. Responses were documented in questionnaires and subjected to statistical analysis.

Validation of questionnaire:

A questionnaire-based study was initiated after receiving the approval from the institutional Ethics committee. A validated and permitted questionnaire was prepared and used to collect the information³². To validate the questionnaire for SWD a preliminary



version based on the international Classification of sleep disorders, second edition (ICSD-2) criteria, drawing from a previous study of 4957, North American police officers. A comprehensive set of question air item was initially developed and compiled from this police study. The questionnaire consisted questions for evaluating shift work sleep disorder and sleep quality.

Statistical analysis:

In this study, we analysed the overall prevalence of shift work sleep disorder, assessed the determinants that affected the sleep cycle pattern and also evaluated the overall sleep quality among frontline workers. The collected data was entered and analyzed by using SPSS IBM Version 29 software, Microsoft excel 2016 version. Analytical method was applied to obtain the frequency and percentage.

RESULTS:

In this questionnaire based cross sectional study, data were collected from a total of 274 front line workers. Demographic details, including age, gender, non-standard shift work timings and total hours of non-standard shift work, for duration of 6 months period. Similarly, comprehensive information regarding sleep quality and its determinants was recorded. Additionally, a thorough assessment of sleeping pills and medical condition was undertaken." All data were collected utilizing a well- structured data collection form tailored to the study's objectives.

Section-A: Demographic details of study participants

Table 1:

Variables	Frequency (n+274)	Percentage (%)
Age in years		
21-30	73	26.6
31-40	88	32.1
41-50	93	33.9
51-60	20	7.3
Gender		
Male	80	29.2
Female	194	70.8
Occupation		
Drivers	103	37.6
Health care workers	100	36.5
Police	54	19.7
Security	17	6.2
Medical condition		
Diabetes Mellitus	13	
Diabetes mellitus &Hypertension	9	
Hypertension	11	
Nil	235	
Obesity &Hypertension	3	
Obsessive compulsive disorder	3	



Section-B: Response given by participants who are working in night-shift:

Table 2:

Questions	Response	Percentage (%)
Q.1) Participants working in non-standard shift. (n=274)	Yes	100
	No	0
Q.2) Nonstandard shift / week. (n=274)	6-7 times/week	65.0
	5 times/week	8.8
	4 times/week	5
	3 times/week	8.4
	less than 3 times/week	12.8
Q.3) Started working non-standard shift. (n=274)	2-3 Years	33.2
	3-4 Years	9.5
	4-5 Years	10.2
	More than 5 Years	47.1
Q.4) Total hours of working non-standard shift. (n=274)	12 Hours	53.3
	11 Hours	0.7
	10 Hours	6.2
	9 Hours	2.2
	8 Hours	22.3
	7 Hours	10.4
	6 Hours	4.9

Section-C: Response given by participants regarding sleep quality in past month while working in nonstandard shift:

Q.5) While working non-standard shift overall quality of sleep. (n=274)	Sufficient	49.6
	Slightly sufficient	10.6
	Somewhat insufficient	10.6
	Very insufficient	29.2
Q.6) While working non-standard shift experiencing sleepiness. (n=274)	None	41.6
	Mild	16
	Considerable	10.6
	Intense	31.8
Q.7) While working non-standard shift problem falling asleep at bed time. (n=274)	No problem	53.3
	Minor problem	12
	Considerable problem	13.5
	Serious problem	21.2
Q.8) While working non-standard shift problem of staying asleep. (n=274)	No problem	47.4
	Minor problem	12.1
	Considerable problem	13.1
	Serious problem	27.4
Q.9) While working non-standard shift physical and mental functioning during awake. (n=274)	Normal	67.9
	Not at all	10.9
	Slightly decreased	9.2
	Somewhat decreased	12
Q.10) Consumption of substance use and stimulants while working in non-standard shift. (n=274)	Caffeinated beverages	86.5
	Caffeinated beverages and tobacco consumption	2.9
	Nil	8.8
	Non caffeinated beverages	1.8
Q.11) Average screen time spent by the participants in electronic gadgets. (n=274)	More than 3 hours	20.1
	1-2 hours	20.1
	2-3 hours	15.3
	Less than 1 hour	44.5



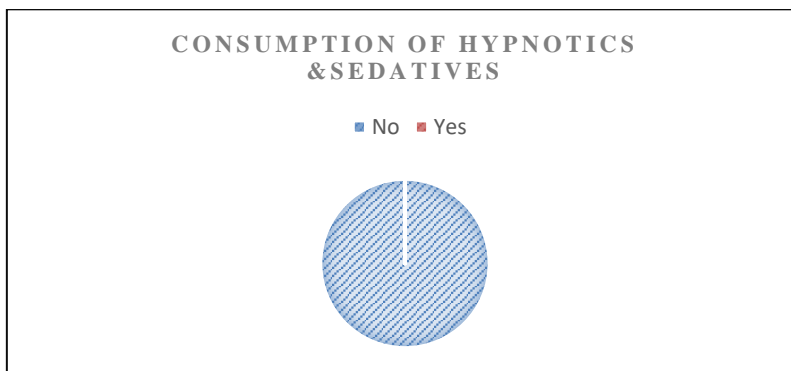
Section-D: Response given by participants for assessment of high-risk shift work disorder and low- risk shift work disorder.

Q.12) While working non-standard shift Problem with waking up too early and not being able to get back to sleep. (n=274)	Normal Slightly decreased Somewhat decreased Very decreased	67.9 10.9 9.1 12.1
Q.13) While working non-standard shift sense of well-being during awake (n=274)	Not at all Slight chance Moderate chance Highly likely	72.6 11.4 9.8 6.2
Q.14) While working non-standard shift Doze off at work during your non-standard shift. (n=274)	Not at all Slight chance Moderate Highly likely	74.1 9.9 5.8 10.2
Q.15) Doze off or fall asleep while driving after at least two days off from work. (n=274)	Not at all Slight chance Highly likely Not applicable	2.9 1.5 0.4 95.2

Section E: Results of the study.



Out of 274 participants 89.4 % affected by low shift work disorder and 10.6% affected by high-risk shift work disorder.



Out of 274 participants None of them consumed hypnotics and sedatives.

DISCUSSION:

A multi-centred cross-sectional study was carried out among frontline workers to assess their sleeping pattern affecting the work. The total 274 participants were enrolled in the study. We have categorized the subjects based on demographic details like age, gender and occupation. In our study of 274 frontline workers, there was different age group that is 21-30 years (23.8%), 31-40 years (28.7%), 41-50 years (30.3%) and 51-60 (6.5%), Where similar studies carried out by Adane A *et al.*, showed age group less than or equal to 29 years (35.7%), 30-34(36.2%) years and more than or equal to 35(28.1%) years.¹ In our study of 274 frontline workers, there were majority of male participants 194 (70.8%) compared with female participants 80 (29.2%) ,Which is similar to the study



carried out by Evangelia Nena *et al.*,³ The result showed less male participants 22 (11.3%) compared with female participants was 172 (88.7%). And the study conducted by Adane A *et al.*,¹ concluded those 186 (46.7%) male participants and 212 (53.3%) female participants.

CONCLUSION:

It can be concluded from the study findings that, high risk SWSD is seen in descending order police man who is brown collar worker, health care worker who is white collar worker and bus driver who is blue collar worker. Many of the selected population subjects got adjusted to their non-standard shift work. The prevalence of high risk SWSD is about 11% and the prevalence of low risk SWSD is about 89% was seen in this study. No one of the selected population were using any medications to get sleep or avoid sleep when the study was conducted.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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REFERENCES:

1. Adane A, Getnet M, Belete M, Yeshaw Y, Dagneb B. Shift-work sleep disorder among health care workers at public hospitals, the case of Sidama national regional state, Ethiopia: A multicenter cross-sectional study. *PLOS ONE*.2022;17(7):270-80.
2. Waage S, Pallesen S, Moen BE, Mageroy N, Flo E, Di Milia L, *et al.* Predictors of shift work disorder among nurses: A longitudinal study. *Sleep Med*. 2014; 15:1449–55
3. Nena E, Katsaouni M, Steiropoulos P, Theodorou E, Constantinidis TC, Tripsianis G. Effect of Shift Work on Sleep, Health, and Quality of Life of Health-care Workers. *Indian J Occup Environ Med*. 2018 Jan-Apr;22(1):29-34.
4. Huang Q, Tian C, Zeng XT. Poor Sleep Quality in Nurses Working or Having Worked Night Shifts: A Cross-Sectional Study. *Frontiers in Neuroscience*.2021;15:655-62.
5. Barger LK, Ogeil RP, Drake CL, O'Brien CS, Ng KT, Rajaratnam SMW. Validation of a questionnaire to screen for shift work disorder. *SLEEP* 2012;35(12):1693-1703
6. Chinoy, E. D., Harris, M. P., Kim, M. J., Wang, W. & Dufy, J. F. Scheduled evening sleep and enhanced lighting improve adaptation to night shift work in older adults. *Occupational and Environmental Medicine*.2016;73:869-76.
7. Reynolds AC, Ferguson SA, Appleton SL, Crowther ME, Melaku YA, Gill TK, *et al.* Prevalence of Probable Shift Work Disorder in Non-Standard Work Schedules and Associations with Sleep, Health and Safety Outcomes: A Cross-Sectional Analysis. *Nature and Science of Sleep*.2021;13:683–93.
8. Zhang C, Yang L, Liu S, Ma S, Wang Y, Cai: - Survey of Insomnia and Related Social Psychological Factors Among Medical Staff Involved in the 2019 Novel Coronavirus Disease Outbreak. *Frontiers in Psychiatry* 2020;11.242-54.
9. Ganesan S, Magee M, Stone JE, Mulhall MD, Collins A, Howard ME, *et al.* The Impact of Shift Work on Sleep, Alertness and Performance in Healthcare Workers. *Scientific Reports*. 2019;9(1).597-605.
10. Wickwire EM, Geiger-Brown J, Scharf SM, Drake CL. Shift Work and Shift Work Sleep Disorder: Clinical and Organizational Perspectives. *Chest*. 2017; 151(5):1156–72.
11. Sateia MJ. International classification of sleep disorders-third edition: highlights and modifications. *Chest*. 2014; 146(5):1387–94
12. Fadeyi B, Ayoka A, Fawale M, Alabi Q, Adeniyi O, Omole J. Prevalence, predictors and effects of shiftwork sleep disorder among nurses in a Nigerian teaching hospital. *Sleep Science and Practice*.2018;2(1):1-9.
13. Di Milia W, Gamble Karen L., Lee Siri Pallesen Stale Bjorvatn Bjorn. Shift Work Disorder in a Random Population Sample—Prevalence and Comorbidities. *PLoS One*. 2013;8(1):553-606.
14. Yang Y, Luo X, Paudel D, Zhang J, Li SX, Zhang B. Effects of e-aid cognitive behavioural therapy for insomnia (eCBTI) to prevent the transition from episodic insomnia to persistent insomnia: study protocol for a randomised controlled trial. *BMJ Open*. 2019; 9(11).334-57.



15. M. Stepanek, M., Taylor, J., Troxel, W. M. & Van Stolk, C. Why sleep matters—the economic costs of insufficient sleep. Europe: RAND Corporation. 2016;6(4):582-90.
16. Rajaratnam, S. M. Sleep loss and circadian disruption in shift work: Health burden and management. *The Medical Journal of Australia*. 2013; 199:11-15.
17. Ftouni, S. *et al.*, Objective and subjective measures of sleepiness, and their associations with on-road driving events in shift workers. *Journal of Sleep Research*. 2013; 22:58-69.
18. Murray, J. M. *et al.*, Prevalence of circadian misalignment and its association with depressive symptoms in delayed sleep phase disorder. *Sleep*. 2017;40(1):109-12.
19. Zhang Y. *et al.*, Digital circadian and sleep health in individual hospital shift workers: A cross sectional telemonitoring study. *E-Biomedicine*. 2022; 81:104-121.
20. Alsaqri S, Liego J, Pangket P, *et al.*, The prevalence of symptoms of shift work disorders (SWD) among nurses in the north western region, Saudi Arabia. *International journal of medical research and health science*. 2020;9(1):20-26.
21. Hu Y, Stephenson K, Kiare D. The dynamic relationship between daily caffeine intake and sleep duration in middle aged and older adults. *Journal of sleep research*. 2020; 10:129-196.
22. Pallensen S, Bjorn B, Waage S, Harris A, Sæge D. Prevalence of shift work disorder a systematic review and meta-analysis. *Frontiers in psychology*. 2021; 12:252-638.
23. Krishnaswami M U, mamta S, *et al.*, Excessive sleepiness, sleep hygiene, and coping strategies among night bus drivers: a cross sectional study. *Indian journal of occupational and environmental medicine*. 2016;20(2):197- 526.
24. Frosztega W, *et al.*, The effect of coffee and black tea consumption on sleep bruxism intensity based on polysomnographic examination. *Heliyon*. 2023; 9:2405-8440.
25. Yi J N, Ming Z C, Sivam H, *et al.*, Association between caffeinated beverages consumption and sleep quality of undergraduate medical students: A cross sectional study. *Asian journal of medical principles and clinical practice*. 2022;5(4):119-127.
26. A D, Kalmbach, Pillai V, Cheng P, Arnedt T J, Drake L C. Shift work disorder, depression, and anxiety in the transition to rotating shifts: the role of sleep reactivity. *Sleep medicine*. 2015; 16:1532-38.
27. Francy A, Nisha c, Abraham J. Prevalence of shift work disorder among nurses working in a tertiary care hospital in Thrissur district, Kerala, India. *International print/ online journal*. 2019;2(4):320-25.
28. Fadeyi B, Abiodun, Ayoka, Fawale B M, *et al.*, Prevalence predictors and effect of shift work sleep disorder among nurses in a Nigerian teaching hospital. *Sleep science and practice*. 2018;2(6):406-16.
29. Rajaratnam S, Sleep loss and circadian disruption in shift work: health burden and management. *Sleep disorders*. 2013; 199:11-15.
30. Milia L D, Waage S, *et al.*, Shift work disorder in a random population sample prevalence and comorbidities. *Plos one*. 2013;8(1):306-55.
31. Deirdre A, Arnedt T, *et al.*, Sleep and substance use disorders: an update. *Sleep disorders*. 2014; 16:487-90.
32. Cousin L, Roacoux G, *et al.*, Perceived stigma, substance use and self-medication in night shift health care workers: a qualitative study. *BMC health service research*. 2022; 22:698-710.
33. Nag K, Datta A, *et al.*, Sleep disturbance and its effect on work performance of staffs following shifting duties: A cross sectional study in a medical college and hospital of Tripura. *Medical journal*. 2019; 12:211-6.

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