Published in final edited form as:

Sleep Breath. 2012 June ; 16(2): . doi:10.1007/s11325-011-0540-y.

Clinical Presentation of Shift Workers to a Sleep Clinic

Harneet K. Walia, MD¹, Amanda L. Hayes, BS², Kathryn A. Przepyszny³, Prudhvi Karumanchi, MD⁴, and Sanjay R. Patel, MD, MS⁵

¹Department of Family Medicine, University Hospitals, Cleveland, OH

²Frances Payne Bolton School of Nursing, Case Western Reserve University, Cleveland, OH

³Center for Clinical Investigation, Case Western Reserve University, Cleveland, Ohio

⁴Division of Geriatric Medicine, Loyola University Medical Center, Maywood, IL

⁵Division of Sleep Medicine, Brigham & Women's Hospital, Boston, MA

Abstract

Purpose—To assess the relationship between shift work (SW) history and symptom severity in a sleep clinic population.

Methods—A retrospective chart review of 1,275 employed adult patients referred to a sleep disorders clinic was performed. Patients were categorized as working day shift, fixed evening or night shift, or rotating shifts. Sleep related symptoms were assessed across three domains – sleepiness, insomnia, and apnea-related symptoms.

Results—The distribution of work shift was 69% day shift, 8% fixed evening or night shift and 23% rotating shifts. In general, sleepiness and insomnia symptoms were greatest in fixed shift workers. In analyses adjusted for age, sex, education, race, BMI, habitual sleep duration, marital status, education level, alcohol intake, and smoking history, fixed shift workers were 4.8 times (95% CI: 1.9-12.5) more likely to report sleep onset difficulties, 3.3 times (95% CI: 1.2-9.1) more likely to report excessive caffeine intake and 1.8 times (95% CI: 1.1-3.0) more likely to report drowsy driving as compared to day shift workers. In contrast rotating shift workers reported more difficulty with sleep onset (OR 2.7; 95% CI: 1.3-5.6) relative to day shift workers. No relationship between work shift and apnea-related symptoms was identified.

Conclusions—Among patients referred to a sleep disorders clinic, shift workers and in particular fixed shift workers, have greater difficulties with sleep onset, drowsy driving and excessive caffeine intake. Given the presence of effective treatments for SW related sleep symptoms, these findings suggest an under-utilization of sleep medicine specialists for the care of patients with symptoms related to SW.

Keywords

shift work; sleep disorder; insomnia; excessive sleepiness

Introduction

It has been estimated that 20% of the workforce in industrialized nations is employed in a job that requires shift work (SW)[1]. People doing SW often have their work hours

Corresponding Author: Harneet Walia MD, University Hospitals, Case Medical Center, 11000 Euclid Avenue, Cleveland, Ohio, harneet.walia@uhhospitals.org, Phone: 216-844-5128, Fax: 216-844-4998.

The other authors declare that they have no conflict of interest.

scheduled during their usual sleep time. As a result, SW can disrupt the sleep-wake cycle and its synchrony with circadian rhythms[2]. SW has been associated with excessive daytime sleepiness[3] that can result in drowsy driving related accidents[4]. SW is also associated with insomnia[5].

Complications of SW may be under-recognized by patients as well as physicians taking care of these patients. Physicians may not inquire about sleep problems and even if elicited, may consider both insomnia and sleepiness symptoms as an expected outcome for patients performing SW and consequently, may not refer these patients for treatment despite the presence of therapies for SW-related sleep disorder. Although most sleep disorder centers focus primarily on sleep apnea evaluation and management, because of the high prevalence of SW in the general population and its potential causal association with obesity[6], SW is common in patients with sleep apnea.

To our knowledge, there have been no prior studies examining the prevalence of sleep symptoms in shift workers among patients referred to a sleep clinic. The goal of this study was to assess the relationship between SW history and symptom severity in such a referral population. If the referring physicians base decisions on referral to a sleep clinic on the severity of symptoms of daytime sleepiness and/or insomnia, one would expect shift workers to have similar severity of symptoms as dayshift workers because once symptoms go over a minimum threshold, referral to a sleep clinic will be initiated. On the other hand, if referring physicians do not factor sleepiness and insomnia symptoms into their decision about sleep medicine referral but instead rely on other factors such as symptoms more specific to sleep apnea (e.g., history of snoring or witnessed apnea), then patients with SW would be expected to have more severe sleepiness and insomnia symptoms.

Methods

A retrospective chart review was performed of 2,298 consecutive adult patients seen between February 2007 and October 2009 in the Sleep Disorders Clinic and Laboratory at University Hospitals Case Medical Center, a tertiary care referral center. Of this cohort, 889 were excluded as they reported being retired or unemployed and another 134 were excluded for not reporting work hours, leaving 1,275 patients for this analysis. This study was reviewed and approved by the Institutional Review Board at University Hospitals Case Medical Center.

As part of their clinical evaluation, all patients completed a questionnaire that included demographic characteristics, work schedule, use of alcohol, tobacco and caffeine, usual sleep habits, symptoms related to sleep disorders, and co-morbid illnesses. Height and weight were measured by clinical staff and body mass index (BMI) was calculated as the ratio of height to weight squared. Average sleep duration was calculated as a weighted average of self-reported sleep duration during weekends and weekdays.

Employed patients were initially divided into four groups (day shift, evening shift, night shift and rotating shift) according to their usual work hours. Day shift was defined as typically working from 9 am – 5 pm, evening shift as typically working from 3 pm – 11 pm, night shift as typically working from 11 pm – 7 am, and rotating shift if work hours varied across these times. Because of the limited number of individuals working evening (n=58) and night (n=41) shifts, these two groups were combined for subsequent analyses.

Sleep related symptoms were assessed across three domains – sleepiness, insomnia, and apnea-related symptoms. Sleepiness was assessed in three ways: excessive daytime sleepiness defined as an Epworth Sleepiness Scale (ESS)[7] score above 10, excessive caffeine intake defined as the consumption of 6 more cups of coffee or other caffeinated

beverages per day, and drowsy driving defined as any instance of nodding off or falling asleep while driving. Insomnia-related symptoms included difficulty with sleep onset defined as an inability to fall asleep within two hours and difficulty with sleep maintenance defined as a report of 4 or more awakenings per night. Sleep apnea-related symptoms included self reported episodes of snoring and witnessed apnea, defined as any episode of stopping breathing evidenced by anyone.

Polysomnography was performed at our institution during the time period of the study in a subset of 705 patients. Attended overnight polysomnography was performed using Rembrandt polysomnographic system (Embla, Broomfield, CO). The recording montage included (F4-M1, C4-M1, O2-M1, F3-M2, C3-M2 and O1-M2) bilateral electrooculography, submental and bilateral anterior tibial electromyography, thoracic and abdominal respiratory inductance plethysmography and finger pulse oximetry. Nasal airflow and nasal pressure was measured using oro-nasal thermistor and nasal cannula respectively. Polysomnography was performed according to American Academy of Sleep Medicine (AASM) standards[8]. Sleep was scored manually in 30 second epochs and respiratory events were scored using AASM criteria⁸. In particular, apnea was defined as cessation of airflow for 10 seconds and hypopnea was defined as a 50% reduction in airflow accompanied by a 3% drop in oxyhemoglobin saturation and/or arousal as per the alternative criteria in the AASM scoring manual. The AHI was defined as the number of apneas and hypopneas and divided by the total sleep time.

Statistical Analysis

Descriptive data are presented as means $\pm$ standard deviation for continuous data and percentages for categorical data. Differences between groups were compared using one-way ANOVA and chi-squared tests for continuous and categorical data respectively. Logistic regression was used to assess the influence of work shift on sleepiness, insomnia and sleep apnea-related symptoms. Analyses adjusted for potential confounders including age, sex, race, BMI, education level, habitual sleep duration, married status, alcohol intake, and smoking history. For these analyses, each shift work group (fixed evening/night shift and rotating shift) were compared to day shift workers. A p-value < 0.05 was used to define statistical significance. All analyses were performed using SAS 9.1 (Cary, NC).

Results

Of the 1275 employed patient analyzed, 884 subjects (69%) worked day shift, 99 (8%) worked fixed evening or night shift, and 292 (23%) worked rotating shifts. Descriptive characteristics of the employed patients are summarized in Table 1. The mean age of the cohort was 46 yrs. In general, gender distribution, habitual sleep duration and alcohol intake did not vary across work shift category. However, those who worked fixed evening or night shifts were younger, more obese, and were more likely to be of non-white race, be married, have a lower level of education, and smoke. In contrast, rotating shift workers and day shift workers were fairly similar in demographic characteristics. Among those with a sleep study available, the mean AHI was 29 and similar across work schedules. Sleep apnea was extremely common with 83% of patients having an AHI ≥ 5 and 54% having an AHI ≥ 15 .

In terms of sleepiness symptoms, the prevalence of drowsy driving was greatest in the fixed shift workers (43.9%) compared to rotating (34.3%) and day shift workers (28.3%); $p=0.002$ (Table 2). A similar pattern was seen with respect to the prevalence of excessive caffeine intake, which was highest in fixed shift workers (8.2%), intermediate in rotating shift workers (5.2%) and lowest in day shift workers (3.2%); $p=.03$ (Table 2). In contrast, no significant difference was noted for excessive daytime sleepiness. With regards to symptoms of insomnia, sleep maintenance complaints were equally common across work shift groups

but sleep onset problems were more common in fixed shift workers: 12.4% of fixed shift workers took >2 hours to fall asleep, while only 3.3% of day shift workers and 7.8% of rotating shift workers reported this problem ($p<0.001$). In contrast, there were no significant differences in the prevalence of more specific OSA symptoms such as snoring or witnessed apnea amongst the groups (Table 2).

Logistic regression analyses adjusting for age, sex, education, race, BMI, habitual sleep duration, marital status, education level, alcohol intake, and smoking history were performed to assess the impact of job shift on predicting each symptom independent of potential confounders. In adjusted analyses, when compared to day shift workers, fixed shift workers presenting to sleep clinic had 4.8 higher odds of sleep onset difficulties (95% CI, 1.86-12.53), 3.3 higher odds of excess caffeine intake (95% CI, 1.19-9.12), and 1.8 higher odds of drowsy driving (95% CI 1.09-3.02) (Table 3). Compared to day shift workers, rotating shift workers were 2.7 times more likely to report sleep onset difficulties (95% CI 1.28-5.64) in adjusted analyses. Work shift was not predictive of the presence of witnessed apnea, snoring, sleep maintenance or excessive daytime sleepiness between day shift workers and fixed or rotating shift workers. Additional adjustment for presence of moderate to severe sleep apnea in the subset with polysomnography data did not materially affect the results (data not shown).

Discussion

This study suggests that in comparison with day shift workers, those working fixed shifts in the evening or overnight hours presenting to a sleep clinic are more likely to report difficulties with sleep onset and also to have more sleepiness as assessed by excessive caffeine intake and reports of drowsy driving. Rotating shift workers also reported more difficulties with sleep onset. These findings are strikingly similar to those reported by studies evaluating the prevalence of sleepiness and insomnia in people doing SW[9-11]. In one such study, Harma et al demonstrated that insomnia was prevalent in approximately 46-47% of people working in 2nd shift and 3rd shift and excessive daytime sleepiness was seen in 20-37% of 2nd and 3rd shift workers.[12] Drake et. al showed that the prevalence of insomnia or excessive daytime sleepiness is 32% and 26% in night and rotating shift workers respectively[13]. In a study of a large sample of nurses, 79.5% of those working the night shift reported at least one drowsy driving incident, equal to an increased odds ratio (OR) of 3.96 (95% confidence limit [CI] = 3.24-4.84) relative to nurses working a day shift[14]. Smith and colleagues demonstrated that working a night shift increased on-road accidents by 50%^[15]. Ohayon and colleagues reported the prevalence of both difficulty initiating sleep (20.1% vs. 12.0%) was greater in rotating daytime shift workers (daytime and afternoon) compared to fixed night shift workers[5].

Our results indicate that even among patients referred to a sleep clinic, shift workers have greater symptoms of excessive daytime sleepiness and insomnia compared to other patients. These data suggest that primary care physicians are: 1.) under-utilizing sleep medicine expertise in the assessment and treatment of patients for SW sleep disorder; and 2.) are either basing decisions on referral for sleep apnea evaluation on sleep apnea-specific symptoms such as snoring and witnessed apnea rather than on symptoms of sleepiness and insomnia; or are accounting for the effect of SW on these symptoms in deciding whether the level of symptoms is abnormal for the patient. This accounting for the effect of SW may be occurring at the level of the physician but may also be at the level of the patient who decides that the symptoms they are experiencing are “normal” given their work schedule and so do not require evaluation or treatment. This dismissal of symptoms, particularly drowsy driving, because the cause is known, can prove catastrophic. As such, our findings suggest that both referring physicians and the general population, in particular, those performing

SW, need greater education about the existence of treatment options for sleep symptoms arising from SW.

While it may be tempting based on our findings to conclude that SW produces greater effects on sleepiness and insomnia than sleep apnea, it is important to remember that the vast majority of patients in this cohort had sleep apnea. Thus, the comparisons being made in this report may be more accurately interpreted as SW plus sleep apnea compared to sleep apnea alone.

To the best of our knowledge this is the first study evaluating sleep disturbances in people who do shift work presenting to a sleep clinic. Strengths of this study include the large and diverse cohort examined and the standardized data collection utilized. In addition, we were able to separately evaluate the effects of fixed evening/night SW from rotating SW.

Limitations of the study should also be noted. We were not able to assess the indication for referral in each patient. However, the vast majority of patients referred to this Sleep Disorders Clinic are for evaluation and management of obstructive sleep apnea. We also cannot exclude the possibility of confounding due to unmeasured factors that influenced both work schedule and sleep related symptoms. Socioeconomic status is strongly associated with work schedule as well as health outcomes. We adjusted for level of education but this may not completely measure socioeconomic status.

In summary, our results suggest that among patients referred to a Sleep Disorders Clinic, shift workers and in particular fixed evening or night shift workers, have greater difficulties with sleep onset and drowsy driving. Given the presence of effective treatments for SW related sleep symptoms[16], these findings suggest an underutilization of sleep medicine specialists for the care of patients with symptoms related to SW. Campaigns to increase both knowledge of the adverse impact of SW on sleep as well as awareness of the resources available to treat these symptoms are needed. These should be aimed at educating shift workers, their employers, and physicians who care for shiftworkers.

Acknowledgments

Dr. Patel has received research funding from HealthRight Products and Philips Respironics.

References

1. Haus E, Smolensky M. Biological clocks and shift work: circadian dysregulation and potential long-term effects. *Cancer Causes Control*. 2006; 17(4):489–500. doi:10.1007/s10552-005-9015-4. [PubMed: 16596302]
2. Barger LK, Lockley SW, Rajaratnam SM, Landrigan CP. Neurobehavioral, health, and safety consequences associated with shift work in safety-sensitive professions. *Curr Neurol Neurosci Rep*. 2009; 9(2):155–164. [PubMed: 19268039]
3. Akerstedt T. Sleepiness as a consequence of shift work. *Sleep*. 1988; 11(1):17–34. [PubMed: 3283910]
4. Richardson GS, Miner JD, Czeisler CA. Impaired driving performance in shiftworkers: the role of the circadian system in a multifactorial model. *Alcohol Drugs Driving*. 1989; 5-6(4-1):265–273. [PubMed: 11538713]
5. Ohayon MM, Lemoine P, Arnaud-Briant V, Dreyfus M. Prevalence and consequences of sleep disorders in a shift worker population. *J Psychosom Res*. 2002; 53(1):577–583. [PubMed: 12127174]
6. Antunes LC, Levandovski R, Dantas G, Caumo W, Hidalgo MP. Obesity and shift work: chronobiological aspects. *Nutr Res Rev*. 2010; 23(1):155–168. [PubMed: 20122305]

7. Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep*. 1991; 14(6):540–545. [PubMed: 1798888]
8. Iber, C.; Ancoli-Israel, S.; Chesson, A.; Quan, SF. The AASM manual for the scoring of sleep and associated events: rules, terminology, and technical specifications. 1st ed.. American Academy of Sleep Medicine; Westchester, IL: 2007.
9. Akerstedt T. Shift work and disturbed sleep/wakefulness. *Occup Med (Lond)*. 2003; 53(2):89–94. [PubMed: 12637592]
10. Akerstedt T. Shift work and disturbed sleep/wakefulness. *Sleep Med Rev*. 1998; 2(2):117–128. [PubMed: 15310506]
11. Tepas DI, Carvalhais AB. Sleep patterns of shiftworkers. *Occup Med*. 1990; 5(2):199–208. [PubMed: 2203155]
12. Harma M, Tenkanen L, Sjoblom T, Alikoski T, Heinsalmi P. Combined effects of shift work and life-style on the prevalence of insomnia, sleep deprivation and daytime sleepiness. *Scand J Work Environ Health*. 1998; 24(4):300–307. [PubMed: 9754862]
13. Drake CL, Roehrs T, Richardson G, Walsh JK, Roth T. Shift work sleep disorder: prevalence and consequences beyond that of symptomatic day workers. *Sleep*. 2004; 27(8):1453–1462. [PubMed: 15683134]
14. Scott LD, Hwang WT, Rogers AE, Nysse T, Dean GE, Dinges DF. The relationship between nurse work schedules, sleep duration, and drowsy driving. *Sleep*. 2007; 30(12):1801–1807. [PubMed: 18246989]
15. Smith L, Folkard S, Poole CJ. Increased injuries on night shift. *Lancet*. 1994; 344(8930):1137–1139. [PubMed: 7934499]
16. Morgenthaler TI, Lee-Chiong T, Alessi C, Friedman L, Aurora RN, Boehlecke B, Brown T, Chesson AL Jr, Kapur V, Maganti R, Owens J, Pancer J, Swick TJ, Zak R. Practice parameters for the clinical evaluation and treatment of circadian rhythm sleep disorders. An American Academy of Sleep Medicine report. *Sleep*. 2007; 30(11):1445–1459. [PubMed: 18041479]

Table 1
Demographic characteristics

Characteristic	Type of shift work			p-value
	Day (n=884)	Fixed (n=99)	Rotating (n=292)	
Age (yrs)	46.5 ± 12.2	43.1 ± 13.0	45.8 ± 14.9	0.04
Caucasians	58.9%	24.0%	56.2%	< 0.001
Male	46.4%	49.5%	51.0%	0.36
Sleep Duration (hours)	6.2 ± 1.8	5.8 ± 1.5	6.2 ± 1.7	0.17
BMI (kg/m ²)	35.3 ± 9.0	38.7 ± 9.6	35.2 ± 9.8	0.002
Married	42.6%	62.6%	50.0%	< 0.001
Regular Alcohol Use ($\geq$ 7drinks/week)	17.7%	9.1%	16.0%	0.09
College Degree	45.4%	14.9%	40.1%	<0.001
Current Smoker	9.9%	20.4%	11.6%	0.007
AHI *	27.9±29.1	30.1±28.1	28.0±31.7	0.89
AHI $\geq$ 15 *	53.6%	59.6%	53.7%	0.73

All values expressed as mean ± standard deviation or percentages

BMI-Body Mass Index

* N(total)=705, including 494 day shiftworkers, 47 fixed evening/night shiftworkers, and 164 rotating shiftworkers.

Table 2
Comparison of sleep related characteristics by work shift

Characteristic	Type of shift work			p-value
	Day (n=884)	Fixed (n=99)	Rotating (n=292)	
Snoring	88.3	87.9	83.5	0.11
Witnessed apneas	46.8	49.5	45.7	0.82
Sleep maintenance difficulties	15.0	21.2	15.5	0.27
Sleep onset difficulties	3.3	12.4	7.8	<0.001
Dozing when driving	28.3	43.9	34.3	0.002
Excessive daytime sleepiness	48.3	56.5	48.4	0.32
Excessive caffeine intake	3.2	8.2	5.2	0.03

All values expressed in percentages

Table 3
Odds of sleep –related symptoms by shift when compared to day shift

	Evening/Night				Rotating			
	Unadjusted		Adjusted*		Unadjusted		Adjusted*	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Stop Breathing	0.90	0.59-1.37	1.20	0.70-2.05	1.04	0.80-1.37	0.93	0.67-1.27
Snoring	0.96	0.51-1.82	0.65	0.28-1.49	0.67	0.46-0.98	0.86	0.55-1.36
Sleep Maintenance Difficulties	1.53	0.91-2.57	1.67	0.87-3.21	1.04	0.72-1.51	0.99	0.64-1.55
Sleep Onset Difficulties	4.20	2.06-8.55	4.83	1.86-12.53	2.51	1.41-4.45	2.69	1.28-5.64
Dozing while Driving	1.98	1.30-3.03	1.82	1.09-3.02	1.32	0.99-1.75	1.29	0.94-1.77
Excessive Daytime Sleepiness	1.39	0.90-2.15	1.28	0.77-2.14	1.00	0.76-1.32	0.95	0.71-1.29
Excessive Caffeine Intake	2.72	1.20-6.15	3.29	1.19-9.12	1.65	0.87-3.13	1.14	0.53-2.45

OR: odds ratio; CI: confidence interval.

* Adjusted for age, sex, education, race, body mass index, habitual sleep duration, marital status, education level, alcohol intake, and smoking history.