

## Sleep Among Shiftworkers— *A Priority for Clinical Practice and Research in Occupational Health Nursing*

**I**t has been estimated that 20% of the U.S. work force is employed during non-standard hours or on some form of shiftwork schedule (21% of employed men and 19% of employed women) (Presser, 1999). Many studies have demonstrated that work performance is affected by inadequate sleep. Over time, poor sleep results in a state of chronic sleep loss and can influence physical health, mental health, and functional behaviors, including work performance (Edell-Gustafsson, 2002; Melamed, 2002; Ohayon, 2002). Poor sleep in shiftworkers is often a direct result of disrupted circadian rhythms and attempts to sleep out of phase with the dark cycle of the 24 hour day and be active out of phase with the light portion of the 24 hour day. Interventions to improve sleep and perfor-

mance have focused on either melatonin or phototherapy (use of bright light), and have had mixed results in terms of effectiveness and efficacy (Burgess, 2002). A complete review of shiftwork and alterations in circadian rhythms can be found in Burgess (2002), Rajaratnam (2001), or Rezens (1994).

Over time, sleep debt can result in excessive sleepiness and risk for injury and accidents or errors, both in the workplace and outside the work environment (Melamed, 2002). When shiftwork and its relationship to injuries and errors were examined in a survey of 635 Massachusetts nurses, individuals who rotated shifts had twice the risk of nodding off while driving to or from work, and twice the risk of an accident or error related to sleepiness (Gold, 2002). In a secondary analysis of data from nurses in California and Oregon, the authors sought to compare self reported frequencies of accidents, errors, and detriments in work performance for groups of women exposed to different shift schedules. The results are briefly reported in this Clinical Update.

### **METHODS AND ANALYSES**

A cross sectional survey using an investigator-developed question-

naire was conducted with questions involving forced choice answers related to work, family, health, and sleep. Copies of the survey were distributed in labeled envelopes to mailboxes at the worksite for all female registered nurses (RNs) working at least 4 days per week and 32 hours per week at one of seven community hospitals on the West Coast of the United States. Sites were selected at random after RN work schedules were determined to be either 8 hour or 10 hour shifts. Differences in sleep patterns for this sample have been reported elsewhere (Lee, 1992).

To estimate the frequency of accidents, errors, and indicators of poor work performance, women were asked to indicate how often, on a scale of 0 (never) to 9 (all the time), they had ever had "a problem with work performance because of sleepiness," "an accident at work because of sleepiness," or "made an error at work because of sleepiness." To measure other adverse effects of sleepiness, they were asked if they had ever "been in a car accident because of sleepiness," or "driven off the road because of sleepiness," and how often during the past month they "struggled to stay awake while driving a car" or

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Table  
**Adjusted\* Odds Ratios (OR) and 95% Confidence Intervals (CI) for Self Reported Accidents, Errors, and Indicators of Poor Work Performance in Employed Women by Type of Shift**

<i>Indicator</i>	<i>Day-Evening (no nights) (n = 110)</i>		<i>Day-Evening (past nights) (n = 303)</i>		<i>Night-Rotating (n = 238)</i>	
	<i>n (%)</i>	<i>OR</i>	<i>n (%)</i>	<i>OR (CI)</i>	<i>n (%)</i>	<i>OR (CI)</i>
Work performance	35 (34.3)	1.0	119 (42.3)	1.46 (.90, 2.37)	135 (57.2)	2.38 (1.45, 9.91)
Sleepy while driving	27 (26.5)	1.0	57 (20.1)	.70 (.41, 1.20)	108 (46.0)	2.23 (1.33, 3.75)
Error at work	19 (18.6)	1.0	59 (20.9)	1.16 (.65, 2.05)	83 (35.3)	2.39 (1.35, 4.20)
Accident at work	7 (6.9)	1.0	11 (3.9)	.48 (.17, 1.36)	23 (9.7)	1.31 (.54, 3.12)
Caring for patient	3 (3.0)	1.0	13 (4.6)	1.97 (.54, 7.24)	46 (19.5)	7.38 (2.23, 24.53)
Drive off the road	3 (2.9)	1.0	39 (13.8)	5.19 (1.56, 17.27)	46 (19.5)	7.36 (2.22, 24.44)
Car accident	2 (2.0)	1.0	9 (3.2)	1.45 (.30, 6.93)	14 (5.9)	3.04 (.67, 13.74)

\* Adjusted for age (< 35 years versus ≥ 35 years), months in health care (< 12 versus ≥ 12), and use of alcohol to get to sleep (yes versus no).

“struggled to stay awake while taking care of a patient.” The three questions related to driving were not limited to driving to and from work.

Differences in work performance were first analyzed by current shift worked and history of working nights. Because there were no significant differences in work performance variables between permanent day and evening workers, these two groups were combined as the reference group and compared with nurses who worked permanent nights or rotated shifts. Self reported frequencies of seven work performance measures were dichotomized as absent (0) or present (1 to 9). The Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL) was used to calculate Mantel-Haenszel  $\chi^2$ , odds ratios (OR), and 95% confidence intervals (CI).

**RESULTS**

The sample consisted of 651 non-managerial RNs between ages 22 and 64, including 110 permanent day and evening nurses, 303 permanent day and evening shift nurses who had worked nights in the past, and 238 nurses currently working permanent night or rotating shifts. Younger women (< 35 years) reported all seven performance measures

more frequently than older women. Women employed in health care fewer than 12 months reported five of the seven performance measures more frequently than those with more experience. More women who used alcohol to fall asleep, regardless of age or months in health care, had errors at work (32.5%) and injury related health care visits (26.6%), compared to those who did not report drinking alcohol to fall asleep (23.3% and 16.7%, respectively).

Five sleepiness variables were significantly associated (OR ≥ 2) with night or rotating shifts (see Table). Adjusting for age and length of experience did not change the findings. The strongest associations (adjusted OR > 7) were found for “ever driven off the road because of sleepiness” and “during the past month struggled to stay awake while taking caring of a patient.” Nurses currently working permanent days or evenings with a history of working night shift had five times the risk of “ever driving off the road because of sleepiness” compared to day and evening nurses with no past night shift experience.

**DISCUSSION**

This survey included a cross section of nurses in Northern Cali-

fornia and Oregon with results supporting Gold’s (2002) findings from nurses in Massachusetts. Taken together, these results indicate a geographically widespread risk to nurses working permanent night shifts or rotating shifts of injury to themselves or their patients because of sleepiness.

Interventions for sleepiness in the workplace have been suggested and continue to be tested in research studies. These interventions include scheduled naps at the worksite and phase shifting with the use of phototherapy, or melatonin; however, much more research is needed to understand effective doses of these therapies. For instance, when and how long to nap is currently debated, and individualized intervention strategies need to be tested. Although more than 90% of adults believe lack of sleep leads to poor job performance and higher risk for injury, many report typically sleeping fewer than 7 hours (National Sleep Foundation, 2002) and fail to consider potential strategies to overcome their sleepiness. They may be thinking that any sleep loss can be recovered on weekends or days off, but delay may be too late and consequences may be fatal.

**2003 NATIONAL SLEEP DISORDERS RESEARCH PLAN**

The 129 page Sleep Research Plan recently approved by the Sleep Disorders Research Advisory Board specifies 10 priorities for sleep research in the next 5 years and all are important to improving health and safety on highways and in workplaces. Within this plan, shiftwork is specifically mentioned many times and areas for research and training of health care professionals are identified. Occupational health nurses are urged to read this plan, available at the National Institutes of Health, National Heart, Lung, and Blood Institute website: [www.nhlbisupport.com/sleep/research/research-a.htm](http://www.nhlbisupport.com/sleep/research/research-a.htm).

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