Staff Nurse Fatigue and Patient Safety

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Staff Nurse Fatigue and Patient Safety

Purpose: To evaluate the relationship of staff nurse fatigue to patient safety. More specifically, project objectives included 1) describing the work patterns of hospital staff nurses in terms of hours worked, duration of shifts, and amount of overtime worked; 2) determining how much overtime nurses are working, how often they work overtime, and if nurses are required to work overtime; and 3) determining if there is an association between errors and the hours worked by hospital nurses.

Scope: Two randomly selected national samples of full-time hospital staff nurses (n=905 registered nurses)

Methods: Participants in both the parent study (n=393) and the replication study (n=502) completed logbooks for 28 days, recording information about their sleep times, sleep quality, mood, caffeine intake, work hours, breaks, errors, sleepiness on duty, errors, and episodes of drowsy driving. Descriptive data, GEE equations, and multivariate regression models were used to examine the type of errors reported by participants as well as to determine the association between errors and a variety of factors, including shift duration, overtime, and sleep duration.

Results: Nurses routinely worked longer than scheduled, averaging 50-55 minutes overtime each shift. Working longer than 12.5 consecutive hours was associated with a significantly higher risk of error, as was working overtime and working > 40 hours/ week. Short sleep durations were also associated with an increased risk of making an error and difficulties remaining alert on duty. One third of the participants reported making an error, and only 58% of the errors involved medication administration.

Key Words: registered nurses, shiftwork, work schedules, sleep deprivation, errors.

2. Purpose

The purposes of the study[1,2] were to evaluate the relationship of staff nurse fatigue and patient safety and to pilot test a Fatigue Countermeasures Program for Nurses for improving the vigilance of nurses working night shift and/or for extended periods. Specific aims of the study included the following:

Specific Aim 1
To describe the work patterns of hospital staff nurses (e.g., shift hours, shift durations, days off between shifts, and number of consecutive shifts) in order to establish a database for determining the effect of fatigue and circadian rhythm disruptions on patient safety.

Specific Aim 2
To determine how much overtime nurses are working, how often they work overtime, when the overtime occurs (time of day), and if they are being required to work overtime (mandatory overtime).

Specific Aim 3
To determine if there is an association between the occurrence of errors and the hours worked by hospital nurses.

Specific Aim 4
To adapt strategies used by other industries to improve the vigilance of nurses working night shift and/or for extended work periods.

Specific Aim 5
To evaluate the efficacy of these strategies by measuring vigilance and sleep/wake patterns of nurses before and after implementation of protocols designed to minimize adverse effects of fatigue, sleep loss, and circadian rhythm disruption.

3. Scope

Background Studies in many industries have shown decreased productivity and increased errors when workers work for prolonged periods without rest or work at night.[3-5] Despite this documentation, and despite over 30 studies evaluating the effects of prolonged work hours on the performance of resident physicians,[6-9] there are only limited data on the effects of prolonged work periods on the quality of nursing care and attendant effects on patient safety.

After an initial period of research in the 1970s and 1980s, when many hospitals adopted compressed work weeks and 12-hour shifts to recruit and retain nurses, little attention has been paid to the hours worked by nurses. Earlier studies tended to focus on nurse satisfaction with the new schedule and only minimally addressed the increased risk of errors. No studies addressed nurse fatigue or difficulties maintaining vigilance during extended work periods, despite evidence that fatigue can lead to lapses in attention and contribute to medical error and healthcare mishaps.[10]

More than two thirds of medical errors (approximately 70%) are considered preventable; technical errors are the most common type of preventable error (44%), followed by errors in diagnosis (17%), failures to prevent injury (12%), and

medication errors (10%).[11] Other studies have shown that medication errors account for even higher percentages of injuries.[12, 13]

Errors can occur during prescription writing or transcription, dispensing from the pharmacy, and administration by nurses.[12, 14] Nurses not only administer drugs; they also play a key role in intercepting inappropriate or dangerous medication orders as well as transcription and dispensing errors. Indeed, although 39% of medication orders studied by Leape and his colleagues[14] contained serious errors, over half of these errors were intercepted before patients received the drugs. Registered nurses intercepted the majority of errors (85%), and pharmacists intercepted the rest. The most common errors were dosing errors (28%) followed by the wrong choice of drug and errors of frequency or timing. Thirty-eight percent of the 334 errors evaluated in a 1995 study[14] occurred when nurses administered medications. In these cases, the most common errors when administering medications were overdosage of antiemetics, mixing drugs in incompatible solutions, and overly rapid infusions of intravenous (IV) drugs.

The majority of physician ordering errors (60%) were attributed to lack of knowledge about the drug and lack of information about the patient. Other causes included rule violations (19%), simple slips or inattention errors and memory lapses (11%), and inadequate monitoring (8%).[14] Seventy-three percent of the transcription errors were attributed to slips (e.g., misprints) and memory lapses, followed by lack of knowledge about the drug (15%) and lack of information about the patient (especially failure to check allergy history).

Lack of knowledge also contributed to administration errors. Other errors included the misuse of infusion pumps and other parenteral delivery systems (13%), faulty drug identity checking (10%), faulty dose checking (10%), and interaction problems with other services (10%). Again, slips and memory lapses contributed to 12% of the administration errors.[14]

The number of errors attributed to slips and memory lapses when writing orders, transcribing orders, and administering medication suggests the possibility that fatigue may contribute to the occurrence of medication errors. Although earlier studies failed to report the time of day these errors occurred or to assess the fatigue level of the nurse, ward clerk, pharmacist, or physician who made the error, recent controlled studies have demonstrated that long work hours and insufficient sleep are significant contributors to errors made by resident physicians.[15-17]

Although the Commission on Graduate Medical Education recently began limiting the number of hours that a resident physician can work,[18] there are no limits in the number of hours that registered nurses can voluntarily work in a day or a week and only minimal limitations on mandatory overtime. Prior to the current study, only limited data were available about the number of hours being worked by hospital staff nurses, and no data were available about the frequency of mandated overtime or the effects of long work hours on errors made by nurses.

Physicians and nurses are not the only occupational groups to work long hours. About one third of businesses and industries that operate 24 hours a day now work 12-hour shifts (in the UK).[19] Extended work shifts are common in jobs that are sedentary, are automated, or require relatively more cognitive than physical activity.[5]

Although a variety of industries and professions have developed programs to reduce fatigue-related workplace errors,[10, 20 21] hospitals have not acknowledged that fatigue may be a contributor to errors made by nurses. Nor have they implemented programs to reduce workplace fatigue.

Measures designed to reduce fatigue usually involve a range of strategies and shared responsibilities. Six major areas are usually included in a comprehensive program to manage fatigue in work settings: 1) education and training programs, 2) hours of service, 3) scheduling practices, 4) countermeasures that can be instituted in the work setting, 5) design (e.g., ergonometrics) and technology (e.g., fail safe designs), and 6) research.[22]

Education and training programs often follow the model developed by the NASA Ames Research Center's Fatigue Countermeasures Program. An education and training module, developed in cooperation with the Federal Aviation Authority (FAA), includes information about physiological mechanisms, circadian rhythms, misconceptions, and countermeasures.[22] Although primarily oriented toward the airline industry, the information presented in this module has been used by all branches of the military, governmental agencies such as NTSB, other transportation industries (maritime, rail, and highway), shift workers (including those in working nuclear plants, petrol-chemical industries, and law enforcement agencies, including the FBI, US Customs, and state police departments).[23] During the second phase of the study, we planned to use the information gathered about nursing schedules and errors during phase I to devise and test a fatigue countermeasures program specifically tailored for nurses.

Settings Nurse participants completed the demographic questionnaire and logbooks in their own home.

Participants The original Staff Nurse Fatigue and Patient Safety Study included 393 registered nurse (RN) participants randomly selected from the membership roster of the American Nurses Association (ANA). Participants in the replication study included 502 RNs randomly selected from the membership roster of the American Association of Critical Care Nurses (AACN).

	ANA Sample (n=393)	AACN Sample (n=502)
Gender		
Female	92%	93%
Male	8%	7%
Mean age (range)	44.8 ± 8.8 years (22-66 years)	44.3 ± 8.0 (23-66 years)
Ethnicity		
American Indian	1.3%	0.8%
Asian	10.8%	8.1%
African American	7.2%	3.0%
Caucasian	78.7%	86.7%
Hispanic	1.5%	1.2%
Hawaiian/Pacific Islander	0.5%	0.2%
Mean years experience as an RN (range)	17.2 ± 9.9 years (1-41 years)	18.4 ± 8.5 years (1-40 years)
Hospital size		
< 100 beds	10.5%	8.6%
100-300 beds	40.3%	41.7%
> 300 beds	49.3%	49.7%
Type of community		
Urban area	55.7%	51.8%
Suburban area	19.1%	26.7%
Small town	18.3%	14.9%
Rural area	7.0%	5.8%
Marital status		
Single	26.9%	27.0%
Married or living with a partner	73.1%	73.0%
Dependant Care Responsibilities		
No dependant care responsibilities	50.3%	49.7%
Living with children under 18 years of age	34.2%	32.3%
Caring for elderly parent	8.1%	7.4%
Caring for both an elderly parent and children under 18	7.4%	6.0%
Currently working a second job	18.6%	16%

Table 1 Sample Characteristics

Both samples of registered nurses were predominantly female, Caucasian, and middle aged (See Table 1). All participants worked full time (at least 36 hours/week) as hospital staff nurses. Half the participants in the ANA and AACN samples reported working in hospitals with over 300 beds; only 8.5% of the sample (85/994 subjects) reported working in a hospital with fewer than 100 beds. The majority of participants were employed at hospitals located in urban or suburban areas (77%). The remaining participants worked in hospitals located in small towns (16%) or rural areas (6%).

Both samples were representative of the larger nursing population.[24]

4 Methods

Part 1 of the study (Specific Aims 1-3) originally involved a randomly selected sample of 750 full-time hospital staff nurses. The quasi-experimental design, shown in Figure 1, was selected for the pilot study in Part 2 of the study (Specific Aims 4-5). Over the 4-year study period, there were two major modifications in the design. Thanks to a Minority Supplement (from AHRQ), we were able to add another team member, Linda Scott PhD, RN, and replicate Part 1 of the study using a second randomly selected sample of hospital staff nurses. Unfortunately, the working conditions in most hospital settings (e.g., the near universal absence of regular breaks and meal periods,[25] the almost daily needs for overtime,[26] and significant resistance on the part of many nurses to the idea of obtaining more sleep), convinced us that attempts to institute a Fatigue Countermeasures Program for Nurses would be futile.

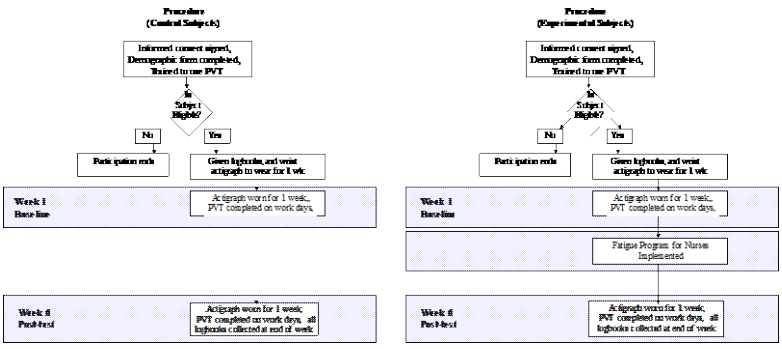

Figure 1 Study Design for Part 2 of the Staff Nurse Fatigue Study

Data Sources/Collection A cover letter explaining the study and a demographic questionnaire was mailed to 4320 randomly selected members of the American Nurses Association during winter 2002; 1725 nurses expressed interest by returning their completed demographic questionnaire to the Survey Research Institute at Temple University in Philadelphia. Two logbooks covering a 2-week period each, instructions for completing the logbooks, and postage-paid envelopes were mailed to 891 eligible subjects (unit-based hospital staff nurses working full time). Three hundred sixty-two subjects returned both logbooks, and 31 completed only one of the two logbooks, for a return rate of approximately 40 percent.

Six months later, demographic questionnaires and cover letters describing the study were sent to 5261 critical care nurses randomly chosen from the American Association of Critical Care Nurses membership list. Again, interested nurses were asked to return their completed demographic questionnaire in a postage-paid envelope to the Survey Research Center at Temple University, where the eligibility of 1148 participants was confirmed. A total of 502 critical care nurses participated in the study, for a final response rate of 43.7%.

As a result, our final dataset included data from over 900 full-time hospital staff nurses and over 22,000 days of data, including data from over 12,000 work shifts.

Measures Spiral-bound logbooks were used to collect information about hours worked (both scheduled and actual hours), time of day worked, overtime, days off, and sleep/wake patterns. Subjects completed 17 to 40 (ANA Sample) or 41 items (AACN Sample) per day; all 40 (or 41) questions were completed only on days the nurses worked. Questions regarding errors and near errors were included, and space was provided for nurses to describe any errors or near errors that might have occurred during their work periods. Participants in the AACN sample were also asked to indicate if they discovered someone one else's error during their work shift. On days off, nurses were asked to complete the first 17 questions about their sleep/wake patterns, mood, and caffeine intake.

Participants also completed a demographic questionnaire that asked them to provide basic demographic information about themselves (e.g., age and gender, their living situation [marital status, whether or not they had children ≤ 18 years of age living at home, whether or not they were caring for elderly family members], and their work setting [e.g., hospital size, type of unit, type of shifts they worked, and whether or not they worked more than one job]).

Limitations The major limitation of the study is its reliance on self-report data. Although data about sleep recorded in daily logbooks has been shown to be quite comparable to data collected from objective measures, such as wrist actigraphy and polysomnography,[27, 28] using logbooks to collect data about medical error is less well established. All errors, near misses, and discovered errors (errors made by others and discovered by nurses) were obvious deviations from current practice standards.

Because the purpose of the study was to determine the relationship of fatigue and errors, no attempt was made to determine how many actual errors participants made during the data-gathering period or to determine if the errors reported by study participants actually harmed patients. We recognize that not all errors made by study participants were reported. Subjects might not have been aware of making errors, and thus not been able to report those errors, or they may have failed to report errors because they feared reprisal. Because we avoided collecting any data that could potentially identify where participants worked, we believe fears of disciplinary actions were minimal.

Finally, only a small number of nurses participated in this study. Despite somewhat lower than normal response rates,[29] both samples appear to be representative of the larger nursing population in the United States[24] in terms of age, gender, marital status, ethnicity, and many other factors. Moreover, there were no significant differences between responders (those that returned at least one logbook) and nonresponders (and eligible subject who did not return any logbooks).

5 Results

Principal Findings of this study include findings associated with current nurse work schedules as well as the impact of these work schedules on error, vigilance, and sleep durations.

Nurse work hours were often long and unpredictable. The majority of nurses no longer work 8-hour day, evening, and night shifts Instead, the majority of hospital staff nurses (75%) are being scheduled for 12-hour day or night shifts. Fourteen of the 11,329 shifts (0.3%) examined in this study were scheduled for ≥ 20 consecutive hours, and 123 exceeded 20 consecutive hours (1.1%). The longest shift worked was 23 hours and 50 minutes.[26, 30]

Nurses reported leaving work at the end of their scheduled shift less than 20% of the time during the study period (ANA Sample 19%, AACN Sample 13%). Although overtime was reported at the end of all types of shifts, the proportion of shifts involving overtime was significantly higher when 8-hour shifts were compared to shifts scheduled for 8 to 12 hours and 12 hours or longer. Participants worked, on average, 49-55 minutes longer than scheduled each day, and all participants worked beyond their scheduled work shift (overtime) at least once during the 28-day data-gathering period. Despite all the publicity about mandatory overtime, only 5.5% of the shifts were mandated (n=623). The remaining 8756 shifts involved voluntary overtime, although nurses reported that 295 of these shifts involved being "coerced" to work voluntary overtime. Even though participants in the ANA Sample worked approximately 4 days per week, averaging 40.2 (±12.9) hours per week (range 8–97.2 hours per week), one quarter worked more than 50 hours per week for 2 or more weeks of the 4-week period.[26]

When we examined the data from the ANA Sample, we found there were 534 shifts (10%) when nurses reported having no opportunity to sit down for a break or meal and another 2249 shifts (43.1%) when nurses reported having the time for a break or to eat a meal but were not relieved from patient care responsibilities. Nurses were completely free of patient care responsibilities during a break and/or meal periods in less than half of the shifts they worked (2429 shifts, 46.6%). Although nearly 40% of the shifts were more than 12 hours, nurses working longer shifts were no more likely to be able to take a break than nurses working shorter shifts. In fact, the percentage of shifts with breaks free of patient care responsibilities decreased to 30% when nurses worked 20 or more consecutive hours. The mean duration of meal periods/rest breaks free of patient care responsibilities was 23 minutes.[25]

Errors and Near Misses Over one quarter of the participants (27.9%) reported making an error during the 28-day data-gathering period.[26, 30] Thirty-five percent of the participants also reported catching themselves in the process of making an error. There were 423 errors and 563 near misses reported during the data-gathering period. Table 2 shows the number and types of errors reported by participants.

	ANA Sample (n=199)[1]	AACN Sample (n=224)[2]
Medication Errors	114 (57.3%)	127 (56.7%)
Wrong patient	9	6
Wrong drug	20	13
Wrong dose	27	26
Wrong route	3	5
Wrong time	38	48
Omission	18	28
Unable to categorize	0	1
Procedural Errors	37 (18.6%)	44 (19.6%)
Charting Errors	22 (11.1%)	3 (1.3%)
Transcription Errors	13 (6.5%)	2 (0.9%)
Unable to categorize	12 (6.0%)	48 (21.4%)

Table 2 Number and Type of Errors reported by 905 Hospital Staff Nurses

Shift Duration and Errors The risk of errors increased significantly when participants worked ≥ 12.5 hours, worked longer than scheduled, or worked more than 40 hours per week. As shown in Table 3, working longer 12.5 hours or more tripled the risk of making an error for ANA participants and almost doubled the risk of making error among critical care nurses (AACN Sample).

	ANA Sample*			AACN Sample**		
Work Duration (hours)	No. shifts (%)	No shifts with at least one error (%)	OR (p value)	No. shifts (%)	No shifts with at least one error (%)	OR (p value)
< 8.5	771 (14.4%)	12 (1.6%)	1.0	543 (9%)	11 (2%)	1.0
>8.5 and <12.5	2484 (46.8%)	77 (3.1%)	1.85 (0.06)	1720 (29%)	46 (3%)	1.43 (0.304)
≥12.5	2057 (38.9%)	103 (5%)	3.29 (0.0001)	3748 (62%)	146 (4%)	1.94 (0.028)
Total	5312	192		6011	203	

* Rogers et al (2004) Staff nurse work hours and patient safety.
** Scott et al (in press) The effects of staff nurse work hours on vigilance and patient safety

Table 3 The Association of Shift Duration and Risk of Making an Error

Working longer than scheduled (overtime) also had an adverse effect on errors, particularly when the overtime was associated with 12-hour shifts. Findings for the AACN Sample were similar to those shown in Table 4 for the ANA Sample.

Work Duration (hours)	Overtime	No of Shifts ≥ 1 error (%)	OR (p value)
< 8.5	No	8/377 (2.1%)	1.00
	Yes	64/2075 (3.1%)	1.34 (0.42)
>8.5 and <12.5	No	6/246 (2.4%)	1.0
	Yes	36/937 (3.8%)	1.53 (0.36
≥12.5	No	6/360 (1.7%)	1.0
	Yes	70/1263 (5.5%)	3.26 (0.005)
Total		191/5258	

Rogers et al (2004) Staff nurse work hours and patient safety.

Table 4 Association of Overtime and Errors (ANA Sample)

Vigilance on Duty Difficulties remaining awake and alert on duty were quite common. Over half the nurses (57.5%) participating in our study reported struggling to remain awake at work at least once during the 28-day data-gathering period, and 16.8% of the participants (152 nurses) reported falling asleep on duty. Nurses reported struggling to stay awake once every five shifts worked (2285/11,329 shifts) and falling asleep on duty once every 25 shifts worked (449/11,329 shifts).

Although decreased vigilance was more common at night, drowsiness and sleep episodes were not confined to the night shift (See Figure 2).

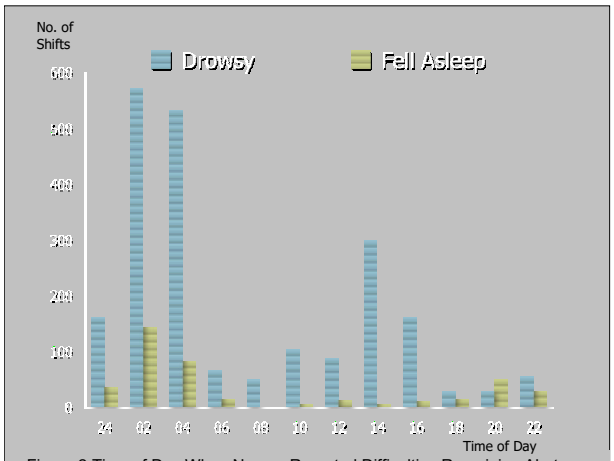

Figure 2 Time of Day When Nurses Reported Difficulties Remaining Alert

Although most of the falling asleep episodes (n=444) occurred between the hours of midnight and 6 a.m., nurses were equally likely to report struggling to stay awake (n=2188) during the daytime hours (6 a.m. to midnight) as they were at night (midnight to 6 a.m.). In fact, over half of the nurses who worked exclusively day or evening shifts (54.9%) reported struggling to stay awake at work at least once during the 28-day data-gathering period.

Nurses who reported struggling to stay awake on duty and/or actually falling asleep on duty obtained significantly less sleep than nurses who were able to remain alert during their work shift (See Table 5).

	ANA Sample			
	Number of Shifts (%)	Sleep Duration Mean (SD)	OR (95% CI)	p value
Struggling to Stay Awake				
No	4167 (80%)	6.9 ± 1.2 hr	1.0	<0.0001
Yes	1059 (20.1%)	6.2 ± 2.1 hr	0.85 (0.80-0.90)	
Fell Asleep on Duty				
No				0.0176
Yes	4918 (95%)	6.8 ± 1.7 hr	1.0	
	267 (5%)	6.1 ± 2.2 hr	0.90 (0.83-0.98)	
	AACN Sample			
	Number of Shifts (%)	Sleep Duration Mean (SD)	OR (95% CI)	P-value
Struggling to Stay Awake				
No	4765 (80%)	6.7 ± 1.7 hr	1.0	<0.0001
Yes	1199 (20.1%)	6.3 ± 2.2 hr	0.91 (0.86-0.95)	
Fell Asleep on Duty				
No	5782 (97%)	6.6 ± 1.8 hr	1.0	0.9752
Yes	176 (3%)	6.6 ± 2.6 hr	1.89 (0.83-1.13)	

Table 5 Relationship between Sleep Duration and Ability to Remain Awake on Duty

Critical care nurses (AACN Sample) who worked 12-hour shifts were also more likely to have difficulties remaining alert on duty than critical care nurses who worked shorter shifts (See Table 6). Nursing working 12-hour shifts not only were more likely to report struggling to stay awake, they also were 2.4 times more likely to fall asleep than nurses who worked fewer consecutive hours.

	Struggling to Stay Awake on Duty		Fell Asleep on Duty	
Work Duration (hours)	No. shifts (%)	OR (p value)	No. shifts (%)	OR (p value)
< 8.5	77 (14%)	1.0	4 (0.7%)	1.0
>8.5, and <12.5	279 (16%)	1.1 (0.695)	30 (1.8%)	1.9 (0.043)
≥12.5	847 (23%)	1.15 (0.007)	44 (3.9%)	2.40 (0.014)
Total	1203		178	

Scott et al (in press) The effects of Critical Care Nurse Work Hours and Vigilance

Table 6 Association between Work Shift Duration and Difficulties Remaining Alert on Duty

Sleep Duration and Errors Nurses who made errors reported obtaining significantly less sleep than nurses who did not make an error (See Table 7). Nurses making errors obtained on average 30 minutes less sleep than those who did not make an error (ANA Sample). Critical care nurses (AACN Sample) making errors averaged only 12 minutes less sleep than those who did not make errors. Although the mean sleep times of

nurses reporting errors appear quite similar (e.g., 6 hours 18 minutes [ANA Sample] and 6 hours 24 minutes [AACN Sample]), critical care nurses (AACN Sample) not reporting errors obtained on average only 6 hours 36 minutes sleep compared to the 6 hours 48 minutes obtained by members of the ANA sample.

	ANA Sample			
	Number of Shifts (%)	Sleep Duration Mean (SD)	OR (95% CI)	p value
Error				
No	5089 (96%)	6.8 ± 1.7 hr	1.0	0.0008
Yes	190 (4%)	6.3 ± 1.9 hr	0.85 (0.78-0.94)	
	AACN Sample			
	Number of Shifts (%)	Sleep Duration Mean (SD)	OR (95% CI)	p value
Error				
No	5788 (97%)	6.6 ± 1.8 hr	1.0	0.0323
Yes	202 (3%)	6.4± 1.7 hr	0.93 (0.87-0.99)	

Rogers et al (under review) A Diary-Based Examination of Nurse Sleep Patterns and Patient Safety

Table 7 Sleep Durations and Errors

Discussion This study documented that long hours are the norm rather than the exception for hospital staff nurses and that few nurses are given the rest breaks and meal periods take for granted by most workers in the United States. It is no surprise that the risk of errors is significantly increased when nurses work ≥ 12.5 hours. Several large scale studies, including one involving 1.2 million German workers compensation records and another involving 110,236 job records, have shown that injuries are more likely during the last 4 hours of a 12-hour shift[31, 32] and that working 12 hours/day was associated with a 37% increase hazard rate among US workers.[33]

The high frequency of which nurses reported struggling to stay awake and/or actual falling asleep on duty is of concern. Approximately two thirds of the participants reported struggling to remain awake at work at least once during the 28-day data-gathering period, a rate similar to that recently reported for critical care nurses.[30] All earlier studies reported drowsiness on duty as occurring at much lower rates (e.g., 20-26%)[34-36] or only occurring during night shift.[34, 35] Laboratory studies have suggested that performance is impaired by drowsiness or sleep,[37] a finding borne out by the increased error rates reported by nurses who were struggling to stay awake or actually fell asleep on duty.

Self-reported sleep times for hospital staff nurses have decreased dramatically over the past 15 years. In 1990, when Lee[35] surveyed 760 registered nurses who worked at least 4 days and 32 hours/week in four San Francisco Bay area hospitals, sleep durations on work days ranged from an average of 7.1 ± 1.3 hours (rotating shift nurses) to an average of 8.8 ±2.8 hours for night shift nurses. Night shift workers in our sample obtained on average 128 to 138 minutes less sleep on workdays than nurses working night shifts in 1990 (6.5 or 6.6 hours compared to 8.8 hours). Although the differences in sleep times were not as dramatic for non-night shift nurses, they were still notable. For example, nurses in the current study who worked day or evening shifts averaged 6.7 or 6.8 hours of sleep on workdays compared to the 7.1 to 7.9 hours of sleep reported by rotating and evening shift nurses in 1990.

The shorter sleep times reported by hospital staff nurses mirror those of other Americans. Several recent polls and studies have suggested that few adults obtain sufficient sleep. Sleep times have decreased significantly since the National Sleep Foundation began conducting their annual Sleep in America polls.[38, 39] In fact, their most recent poll revealed that only 26% of the 1506 adults surveyed obtained ≥ 8 or more hours of sleep per night.[39] Their participants averaged 6.8 hours sleep per day during the week, a sleep duration quite similar to that reported by participants in the ANA study for workdays (6.8 hours) and somewhat more than mean sleep durations on workdays reported by participants in the AACN study (6.64 hours).

Median sleep times on workdays were 6.8 hours and 6.5 hours, with the shorter sleep times being reported by critical care nurses (AACN Sample). Only one quarter of the nurses participating in these two studies (n=233) always obtained at least 6.0 hours sleep when they worked, and 4.5% of the participants reported going without any sleep on a workday at least once during the 28-day data gathering period. These findings suggest that three quarters of our nurse participants may have worked at least once when they were at high risk of making fatigue-related errors.

Several other findings also suggest that participants were not obtaining enough sleep to provide safe patient care. Participants averaged 1.4 to 1.45 hours more sleep on their days off, with some participants reporting sleep durations of up to 18 hours on their first day off after working several consecutive 12-hour shifts. Although shorter sleep times are often reported on workdays compared to weekends, the difference reported for nurses more twice that reported for employed adults in the US (0.6 hours).[39]

Although shorter sleep times are undesirable in terms of effects on the nurses' heath and mood, the effects of sleep deprivation on patient safety is of greater importance. Most adults require at 6-8 hours sleep to function adequately at work,[40-42] Nurses need to be awake and alert to detect changes in their patients condition. Yet, two thirds of the nurses participating in our studies reported struggling to stay awake on duty at least once during the 28-day data-gathering period. Sleep durations of those who reported struggling to stay awake on duty averaged only 6.2 to 6.3 hours and averaged 6.1 hours for the participants in the ANA study who reported falling asleep on duty. Participants in the AACN study who reported falling asleep on duty obtained on average 6.6 hours sleep, the same amount as those who were able to remain awake, a finding that remains puzzling.

Conclusions Current nursing schedules are hazardous to patient safety. The 12-hour shifts worked by most hospital nurses are associated with higher risks of error, reduced sleep times, and reduced vigilance.

Significance This study is first study to document that the majority of hospital staff nurses are now working 12-hour shifts, that nurses rarely leave work at the end of their scheduled shift, and that their long work hours are associated with reduced sleep, difficulties staying awake on the job, and increased errors. It also demonstrated that nurses rarely obtain adequate amounts of sleep and that reduced sleep times are also associated with increased risks of making an error.

Implications Although 12-hour shifts are popular with nurses and managers, the wisdom of continuing this type of scheduling pattern is questionable. Errors and near misses are more likely when hospital staff nurses work 12 or more hours. Because more than three fourths of the shifts scheduled for 12 hours exceeded that time frame, routine use of 12-hour shifts should be curtailed, and overtime—especially that associated with 12-hour shifts—should be eliminated. Regulations limiting the amount of time nurses are allowed to work in a 24-hour period and in a 7-day period may be necessary.

Finally, nurses, like most Americans, need to be encouraged to obtain more sleep. Our findings revealed that sleep deprivation is widespread among hospital staff nurses and adversely effects patient safety. Nurses, either individually or as a profession, can no longer afford to ignore data from laboratory and field studies showing that sleep loss is associated with performance deficits.

6. Publications and Products

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