

Shiftwork Sleep Disorder

The Role of the Nurse
Understanding SWSD for You and Your Patients



Welcome

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SWSD: Understanding its Symptoms and Risk Factors

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Role of the Nurse: Integrating SWSD Interventions for You and Your Patient

Outline

- **Circadian Rhythm Sleep Disorders**
 - Phase delay syndrome (teenager)
 - Phase advance syndrome (elders)
- **Shift Work Sleep Disorder**
 - Prevalence
 - Symptoms
 - Risk factors
 - Occupations at risk
 - Effects of type of shift schedule
 - Job satisfaction
 - Individual differences

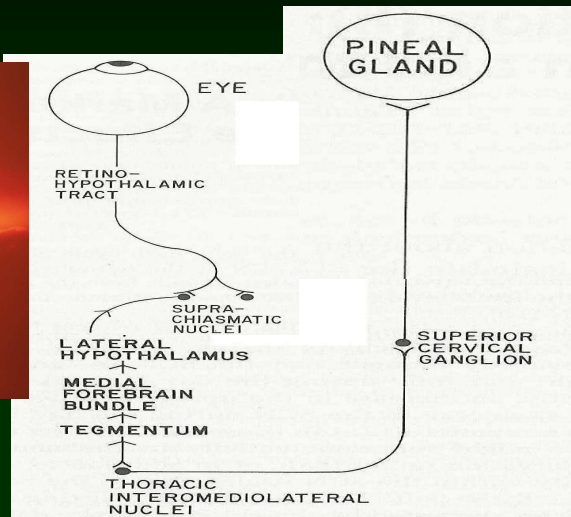


Circadian Preference - Chronotype

- Morningness – Lark
 - Phase advance syndrome (elderly)
- Eveningness – Owl
 - Phase delay syndrome (teenager)
- Desynchronization: chronotype out of phase with lifestyle or environment
 - Jet lag
 - Night shift



Light, the Pineal Gland, and Melatonin





Circadian Rhythm Sleep Disorders

- Restless Legs Syndrome (RLS) – evening symptoms in relation to circadian rhythms for dopamine and iron metabolism
- REM sleep disorders and REM paralysis
- Phase Advance Syndrome (early acrophase peak)
 - Short sleeper, elders, <24 hr rhythm
 - Earlier bed time and rise time
- Phase Delay Syndrome (later acrophase peak)
 - Teenagers, >24 hr rhythm
 - Later bed time and rise time



Shiftwork Sleep Disorder

- *Shift work* – work that occurs between 7 pm and 6 am¹
- Shift-work tolerance²
 - Ability to *adapt* (short term) to shift work without adverse consequences
 - No problems with fatigue, sleepiness, or digestion
 - Not the same as *adjustment* (biological response) to shift work
- Shift-work intolerance ~ shift work sleep disorder

1. Saksvik IB, Bjorvatn et al *Sleep Med Reviews* 2011;15(4): 221-235.
2. Andlauer P, Reinberg A et al *J Physiol (Paris)*. 1979;75(5):507-512.



Shift Work Sleep Disorder

- SWSD – Definition:
 - Insomnia or excessive sleepiness, temporally associated with work period during habitual sleep phase.
 - Shift work is an essential component.
- Insomnia: past month; severe 6+ (1–10 score) past 3 months
 - Difficulty falling asleep
 - Difficulty staying asleep
 - Nonrestorative sleep
- Excessive Sleepiness:
 - Epworth Sleepiness Scale (13+, rather than 10+)

Drake CL, Roehrs T, et al. *Sleep* 2004; 27(8),1453-1462



Shift Work Sleep Disorder

- Prevalence¹ (Detroit tri-county general population)
 - 0% day shift (n = 1,950)
 - 8% rotating (n = 337)
 - 14% night shift (n = 162)
 - 10% total Detroit tri-county sample (n = 2,449)
- Prevalence in nurses on 8-hr shifts²
 - 0% day shift (n = 316)
 - 0% evening shift (n = 194)
 - 4.3% rotating (n = 71)
 - 4.0% night shift (n = 178)
 - 4% total San Francisco Bay Area nurses sample (n = 760)

1. Drake CL, Roehrs T, et al. *Sleep* 2004; 27(8), 1453-1462.
2. Lee KA *Sleep* 1992;15(6), 493-498.



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

Indicator	Day-Evening (no nights) (n = 110)		Day-Evening (past nights) (n = 303)		Night-Rotating (n = 238)	
	n (%)	OR	n (%)	OR (CI)	n (%)	OR (CI)
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).

Lee KA & Lipscomb J AAOHN Journal 2003; 51(10), 418-420.



Shift Work Sleep Disorder/Intolerance -1

- Review article: 60 studies reviewed
- Risk factors:
 - Age
 - 13 studies – young age more tolerant
 - 7 studies – young age less tolerant
 - 6 studies – no association with age
 - Gender
 - 8 studies – women less tolerant than men
 - 4 studies – women more tolerate than men
 - 4 studies – no association with gender
 - Chronotype
 - 9 studies – morning types less tolerant
 - 3 studies – morning types more tolerant
 - 4 studies – no association with chronotype

Saksvik et al Sleep Med Rev, 2011; 15, 221-235



Shift Work Sleep Disorder/Intolerance -2

- Risk factors (cont.)
 - Genetics: variants in Period 3 gene
 - Internal desynchronization: <24 hr rhythm = less tolerant
 - Anxious personality (neuroticism) = less tolerant
 - Internal locus of control = more tolerant
- Occupations at risk
 - Health care industry (nurses)
 - Travel industry (train conductors, air traffic controllers, pilots and airline attendants)
 - Night security guards
 - Bakers
 - New parents

Saksvik et al, *Sleep Med Rev*, 2011; 15, 221-235



Astronauts are desynchronized, too...





Astronauts are desynchronized, too...





Shift Work Sleep Disorder

- Effects of type of shift schedule
 - Longer shift periods? 8-hr vs. 12-hr shifts?
 - Less off time between shifts?
 - Earlier start times?
 - **OR and surgical units**
 - **Commuting distances**



Summary Points

- Most younger adults can tolerate night shift better than most older adults.
- Shorter night shifts may be tolerated better than longer night shifts.
- A night-shift worker can cope with changes in sleep-wake patterns by sleeping during the day.
- Excessive sleepiness is a risk for auto accidents.
- A night-shift worker with SWSD/intolerance is more likely to have irritable bowel symptoms or other GI problems.



Health Consequences and Comorbidities of SWSD

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Role of the Nurse: Integrating SWSD Interventions for You and Your Patient

Overview

- Risky health habits of shift workers
- Diseases associated with shift work



Important Caveats

- Shift work may cause some health problems
- Shift work sleep disorder may cause some health problems
- Correlation does not imply causation
- 3rd variable problem, spurious correlation
 - Circadian misalignment vs. sleep loss vs. other



Breast Cancer

- Elevated risk of breast cancer
 - >20 years rotating night shift work: multivariate RR 1.79; 95% CI 1.06 to 3.01¹
 - At least 0.5yrs of night work: OR 1.5; 95% CI 1.3 to 1.7²
 - Higher prevalence in flight attendants, but confound of radiation³
 - 30+ years nursing nights OR 2.21; CI 1.10 to 4.45⁴

1. Schernhammer et al., *Epidemiology*, 2006; 2. Hansen, *Epidemiology*, 2001; 3. Rafnsson et al., *Cancer Causes Control*, 2001; 4. Lie et al., *Cancer Causes Control*, 2006



Breast Cancer

Odds ratios for breast cancer associated with duration, frequency and type of night work among women of the CECILE study

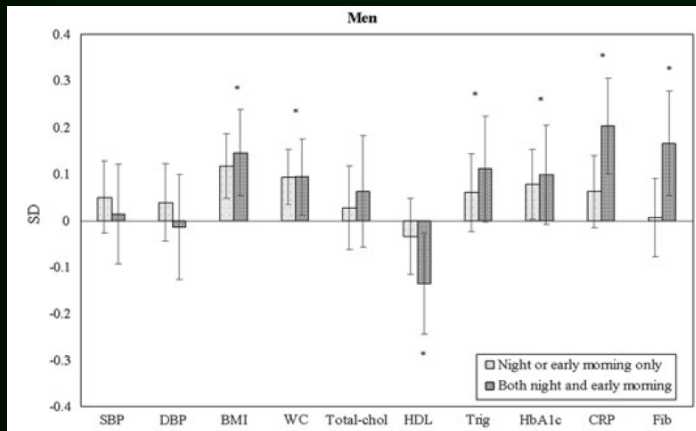
	Cases; n = 1,232 (%)	Controls; n = 1,317 (%)	OR ¹	95% CI ²
Never worked at night	1,068 (86.7)	1,170 (88.8)	1.00	reference
Ever worked at night	164 (13.3)	147 (11.2)	1.27	(0.99–1.64)
Type of night work				
Late evening ³	42 (3.4)	38 (2.9)	1.25	(0.79–1.98)
Early morning ⁴	9 (0.7)	12 (0.9)	0.90	(0.36–2.21)
Overnight ⁵	120 (9.7)	102 (7.7)	1.35	(1.01–1.80)
Total duration of night work periods (years)				
<4.5	66 (5.4)	69 (5.2)	1.12	(0.78–1.60)
≥4.5	98 (7.9)	78 (5.9)	1.40	(1.01–1.92)

- Even higher risk if > 4 years of night work prior to 1st pregnancy: OR 1.95 [1.13–3.35]¹
 - 1,232 cases, 1,317 population controls
- Men: rotating shifts, higher rate of prostate CA²

1. Menegaux, *Int J Cancer*, 2012; 2. Conlon et al., *Epidemiology*, 2007



Risks For Cardiovascular Disease



* P<0.05

- Mediation of socioeconomic, health behaviors, job-related factors
- Women: only significant for triglycerides, MUCH higher.

Thomas & Power, *Eur J Epidemiol*, 2010



Table 2 Mean systolic and diastolic blood pressure according to age, health behaviors and work characteristics.

Characteristic	n	Mean (SD) systolic BP (mmHg)	P ^a	Mean (SD) diastolic BP (mmHg)	P ^a
Age (years)			< 0.001		< 0.001
< 30	1053	108.4 (10.1)		71.8 (8.0)	
30–45	1633	109.9 (11.3)		74.1 (8.7)	
≥ 45	1130	116.7 (14.9)		78.1 (9.9)	
Health behaviors					
Body mass index (kg/m ²)			< 0.001		< 0.001
< 25	2921	110.1 (11.7)		73.6 (8.7)	
≥ 25	869	116.6 (14.2)		78.4 (9.9)	
Smoking status			0.38		0.92
Non-smoker	2715	111.4 (12.6)		74.7 (9.1)	
Smoker	1087	111.7 (12.7)		74.6 (9.4)	
Alcohol consumption			0.16		0.23
0–1 glass/day	3756	111.5 (12.7)		74.7 (9.2)	
≥ 2 glasses/day	60	114.3 (12.3)		76.3 (10.7)	
Sporting activities			0.11		0.26
< 1 hour/week	1749	111.9 (13.2)		74.9 (9.4)	
≥ 1 hour/week	2067	111.3 (12.2)		74.5 (9.1)	
Work characteristics					
Specialty area			0.088		0.056
Medicine	1292	112.2 (12.7)		75.3 (9.4)	
Emergency/intensive care	1362	110.9 (12.7)		74.2 (9.1)	
Surgery	1162	111.6 (12.5)		74.5 (9.2)	
Type of employment			0.47		0.018
Part-time	908	111.8 (13.0)		75.4 (9.4)	
Full-time	2005	111.5 (12.5)		74.4 (9.1)	
Work schedule			< 0.001		0.023
Fixed day shifts	1863	112.3 (12.9)		75.3 (9.4)	
Rotation shifts	1802	111.4 (21.4)		74.7 (9.1)	
Fixed night shifts	149	114.8 (13.1)		76.6 (9.2)	

Gaudemaris et al., *Arch Cardiovasc Dis*, 2010 (nurses and nurse assistants in France)



Menstrual Cycle

- Longer duration of shift work = higher risk of irregular menstrual cycle

Association of Rotating Shift Work and Other Characteristics With Irregular Menstrual Pattern^a (n = 6930) Among 71, 077 Participants of the Nurses' Health Study II (1993)

	Age-adjusted RR (95% CI)	Full Model RR (95% CI)
Rotating shift work (months)		
0 ^b	1.00	1.00
1–9	1.20 (1.11–1.30)	1.13 (1.05–1.22)
10–19	1.24 (1.12–1.39)	1.18 (1.06–1.31)
20+	1.34 (1.24–1.45)	1.23 (1.14–1.33)

Lawsen et al., *Epidemiology*, 2011



Childbirth Problems

- Small for gestational age (<5th percentile)¹
 - Shift work, work-related hazard exposure, insufficient sleep duration, ETOH exposure, less walking
- Lower birth weight (LBW), preterm, or small for gestational age (SGA)²
 - Statistical effects of trends in:
 - <2500g (3.2%): >40hrs/wk, more active job
 - <3000g (15.4%): >40hrs/wk, more active job, SW (trend)
 - Preterm (4.1%): >40hrs/wk, temp job
 - SGA (6.5%): more active job
 - Shift work may add to cumulative risk
- RR of: preterm 1.16, LBW 1.27, SGA 1.12³

1. Abeyseena et al., *Aust NZ J Obstet Gynaecol*, 2009. 2. Niedhammer et al., *BJOG*, 2009.
3. Bonzini et al., *BJOG*, 2011



Mental Health Problems

- Female nurses in Taiwan, rotating shift vs. day shift worker comparisons¹
- Mental health complaints
 - OR 1.91; 95% CI 1.39–2.63
- Sleep complaints
 - OR 2.26; 95% CI 1.57–3.28
- Both symptoms improved if at least 2 days off, after night shift schedule
- Higher rates of anxiety and depression symptoms in shift working Norwegian ICU nurses vs. population²

1. Lin et al., *Int Arch Occup Environ Health*, 2011; 2. Bjorvatn et al., *Nurs Crit Care*, 2012



Gastrointestinal Disorders

- GI complaints are very common in shift work
- Variety of theories
- Upper/lower GI symptoms higher in evening vs. day¹
- More GI symptoms, irregular meal timing, and GI medications in rotating vs. day shift nurses²
- Irritable bowel syndrome (OR 2.14) and abdominal pain (OR 2.8) higher in rotating vs. day shift nurses
IBS-D higher in night vs. day³
- Mixed results for gastric ulcers⁴

1. Caruso et al., *Am J Ind Med*, 2004; 2. Saberi & Moravveji, *J Circadian Rhythms*, 2010;
3. Nojkov et al., *Am J Gastroenterol*, 2010; 4. van Mark et al., *Int Arch Occup Environ Health*, 2010



Obesity

- Nurses and midwives changing from day to shift, or shift to day¹:
 - Shift to day: 3.02 kg/m² decrease in BMI
 - Day to shift: 0.56 kg/m² increase in BMI
- Nurses and midwives²:
 - Shift workers 15% more likely to be overweight (BMI >25 and <30) or obese (BMI >30)
 - Suggest need for longitudinal research

1. Zhao et al., *J Occup Environ Med*, 2012; 2. Zhao et al., *J Occup Environ Med*, 2011



Weaker Response to Bariatric Surgery

- Roux-en-Y procedure
- Retrospective chart review
- Relatively small sample of shift workers
- % excess body weight lost, shift workers vs. non-shift workers (all $P < 0.01$)
 - 3 months: 29.9% vs. 43.8%
 - 6 months: 46.4% vs. 61.3%
 - 12 months: 56.5% vs. 76.8%

Ketchum & Morton, *Obesity Surgery*, 2007



Type-2 Diabetes

- Nurses' Health Study I (n=69,269) and II (n=107,915)
- No DM, CAD, or CA at baseline
- Followed at 2-4 year intervals, 18-20 year of f/u
- Vs. women without shift work Hx hazard ratios of
 - 1-2yrs of shiftwork: 1.05(1.00-1.11)
 - 3-9yrs: 1.20 (1.14-1.26)
 - 10-19 years: 1.40 (1.30-1.51)
 - 20+ years: 1.58 (1.43-1.74)
 - Only partial mediation by BMI

1. Pan et al., *PLoS Med*, 2011



Metabolic Syndrome

- Various risk factors for other diseases:
 - Central obesity
 - Insulin resistance
 - Hypertension
 - Low LDL and/or high triglyceride levels
- 877 day vs. 474 rotating shift workers¹
 - BMI: 27.1 vs. 26.3 kg/m²
 - Fasting insulin: 65.5 vs. 55.9 pmol/L
 - Diastolic BP: 78 vs. 76 mmHg
 - Triglycerides: 1.71 vs. 1.5 mmol/L
 - Metabolic syndrome OR 1.51; 95% CI 1.01–2.25
- Other examples, such as higher resistin levels in shift working men²

1. Sookoian et al., *J Intern Med*, 2007; 2. Burgueno et al., *Atherosclerosis*, 2010



Cerebrovascular Disease

- Nurses' Health Study (n = 80,108)
- Stroke is 3rd leading cause of death in women
- 4 percent increase in risk per 5 years of rotating shift work
- Data adjusted for obvious contributors to CVA
- May be "threshold effect" at 15+ years of shift work

Brown et al., *Am J Epidemiol*, 2009



Comorbid Sleep Problems

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

Walia et al., *Sleep Breath*, 2011



Restless Legs Syndrome

- More prevalent in rotating shift workers (2 types of schedules) vs. non-rotating day shift workers
 - 14.7% and 15.2% vs. 8% (day workers; $P<0.05$)
 - RLS was not more severe in shift workers
- RLS associated with (all $P<0.001$):
 - Slightly older age (35.2 vs. 32.7)
 - Longer years of working (11.8 vs. 8.9)
 - More antihistamine use (16.3% vs. 4.3%)

Sharifian et al., *Journal of Circadian Rhythms*, 2009.



Summary

- Working rotating or nights shifts increases risk for:
 - Cardio- and cerebrovascular disease
 - Several types of cancer
 - Obesity and obesity-related disease (OSA, DM)
 - GI, reproductive, metabolic, and other diseases
- Increase in bad health behaviors and decrease in good health behaviors



Possible Confounds

- Not always well controlled in studies
- Smoking status
 - Alcohol use
 - Abuse of medications or illicit drugs
 - Exercise
 - Diet
 - Stress



Other Confounding Variables

- Duration of shift work (years)
- Duration of shift itself (8hr, 12hr, other)
- Gender
- Age
- Selection bias for shift work
- Survival effect
- Job-specific risks (e.g., chemical exposure)
- Inadequate or missing control group



Sample Countermeasures

- Improve diet and increase exercise
 - Increase HDL, lower LDL
 - Decrease triglycerides
 - Lower risk for OSA, DM, metabolic syndrome
 - Improve blood pressure
- Address sleep complaints
 - Sleep restriction clearly linked to health risk
- Consider avoiding nights or rotating shifts if already at increased risk for certain diseases



SWSD in Safety, Performance, Productivity

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Role of the Nurse: Integrating SWSD Interventions for You and Your Patient

In This Segment We Will Describe

- Alertness and the cognitive process under conditions of reduced sleep
- Sleep loss–related patient-care errors
- Sleep loss–related nurse accidents and injuries
- Sleep loss–related public safety events: traffic accidents, injuries



Sleep Deprivation

- Neurocognitive impairment and sleepiness are often unrecognized by the affected person
- Sleep deprivation causes episodes of involuntary microsleep



Four Areas of Neurocognitive Change

- Performance deficits
- Impaired information processing
- Cognitive flexibility
- Impaired mood



Performance Deficits

- Performance is unstable when intense concentration is needed
 - Omission: fail to respond to stimulus
 - Commission: respond when stimulus is not present
- False reassurance because it doesn't happen every time you are sleep deprived
- Accuracy is preserved at the expense of speed
- Increased effort is needed to remain "on task"—performance deteriorates with increased time on task
- Response time slows

IOM, Sleep disorders and sleep deprivation, an unmet public health problem, 2006; Durmer and Dinges, 2007)



Memory and Information Processing

- Short-term recall and working memory decline
 - Remembering a drug dose from chart to med room
 - Looking up a phone number and walking to phone to dial
 - Remembering next task when interrupted
- Reduced learning of new information
 - Patient handovers
 - In-service on new equipment

IOM, Sleep disorders and sleep deprivation, an unmet public health problem, 2006; Durmer and Dinges, 2007)



Cognitive Flexibility

- Divergent thinking deteriorates
 - No “thinking out of the box”
 - Perseverate on ineffective solutions
 - Cannot recognize better alternatives even if clearly available
- Risk assessment is faulty, risk-taking behavior increases
 - Less able to learn from negative consequences of behavior
- Loss of situational awareness

IOM, Sleep disorders and sleep deprivation, an unmet public health problem, 2006; Durmer and Dinges, 2007



Impaired Mood

- Irritability, anxiety, depression
- Loss of vigor
- Inappropriate behavior
 - Giggling
- Communication skills decrease
 - Misinterpret others
 - Word-finding problems
- Avoid communicating when in difficult situations

IOM, Sleep disorders and sleep deprivation, an unmet public health problem, 2006; Durmer and Dinges, 2007



Sleep Loss–Related Patient-Care Errors



washingtonpost.com > Health

A Case That Shook Medicine

By *Barron H. Lerner*
Special to The Washington Post
Tuesday, November 28, 2006

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May 4, 2010



Dear Program Directors, Members of the Faculty, Designated Institutional Officials,
Residents and Fellows of the United States,

It has been about five months since I last shared an update on the progress of the task force charged with drafting standards relating to professional responsibility, transitions in care, supervision and resident duty hours for the profession. I am pleased to relate that the work of the group is nearly complete, and that their recommendations will soon begin to traverse the path that all program requirement revisions must follow on their way to approval by the ACGME Board of Directors .

The ACGME Task Force: A Uniquely Qualified Team

Photo: Libby Zion, http://libbyzion.com/Libby_s_Story.html



EXHIBIT 3
Association Of Errors Or Near Errors With Nurses' Scheduled Work Duration And Overtime, 2002

Scheduled work duration (hours)	Number of shifts	Shifts with one or more errors			Shifts with one or more near errors		
		Number	Percent	OR (p value)	Number	Percent	OR (p value)
Up to 8.5							
No OT	377	8	2.1	1.00	15	4.0	1.00
OT	2,075	65	3.1	1.34 (.42)	76	3.7	0.90 (.74)
8.5-12.5							
No OT	246	6	2.4	1.00	3	1.2	1.00
OT	937	36	3.8	1.53 (.36)	42	4.5	2.32 (.08)
≥12.5 or more							
No OT	360	6	1.7	1.00	8	2.2	1.00
OT	1,263	70	5.5	3.26 (.005)	67	5.3	2.34 (.03)
Total	5,258	191	3.6		211	4.0	

> near errors cannot be classified because of missing scheduled work durations.

DATA WATCH

The Working Hours Of Hospital Staff Nurses Ar Patient Safety

Both errors and near errors are more likely to occur w staff nurses work twelve or more hours at a stretch.

by Ann E. Rogers, Wei-Ting Hwang, Linda D. Scott, Linda H. Aiken, and David F. Dinges

HealthAffairs

At the Intersection of Health, Health Care and Policy

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doi: 10.1377/hlthaff.23.4.202



Table 3 Association between work hours, errors, and near errors

Work duration, hours*	Shifts, No. (%)	Shifts with at least 1 error, No. (%)	Odds ratio (P)	Shifts with at least 1 near error, No. (%)	Odds ratio (P)
≤8.5	543 (9)	11 (2)	1.00	27 (5)	1.00
>8.5 to <12.5	1720 (29)	46 (3)	1.42 (.30)	72 (4)	1.13 (.59)
≥12.5	3748 (62)	146 (4)	1.94 (.03)	247 (7)	1.64 (.05)
Total	6011	203	NA	346	NA

*The duration of 6 work shifts could not be classified because of missing data. Abbreviation: NA, not applicable.

Findings similar to Rogers, extended work days increased the risk for patient-care errors and near errors

Effects of Critical Care Nurses' Work Hours on Vigilance and Patients' Safety

Linda D. Scott, PhD, RN, Ann E. Rogers, PhD, RN, Wei-Ting Hwang, PhD and Yawei Zhang, MS, MD

Am J Crit Care January 2006
vol. 15 no. 1 30-37





Sleep Loss–Related Nurse Accidents, Injuries



TABLE II. Age-Adjusted Odds Ratios (OR) for Reported Incident Cases of Musculoskeletal Disorders by Work-Schedule Characteristic, for Nurses with ≥ 1 Year Worked in Nursing at Baseline, 2003–2004

Work-schedule variable	Musculoskeletal disorder					
	Neck* (N = 226)		Shoulder** (N = 281)		Back*** (N = 308)	
	OR	95% CI	OR	95% CI	OR	95% CI
Hours/day	1.07	0.99–1.16	1.08*	1.01–1.16	1.08*	1.01–1.16

Work 13+ hrs	Neck*		Shoulder**		Back***	
	OR	95% CI	OR	95% CI	OR	95% CI
No	1.00	—	1.00	—	1.00	—
Yes	1.94 ^c	1.38–2.74	1.87 ^c	1.35–2.58	1.87 ^c	1.37–2.55

Cumulative 15-month incidence of injuries ranged from 14%–21% by body part, and risk increased substantially when nurses worked extended hours per day

AMERICAN JOURNAL OF INDUSTRIAL MEDICINE 49:964–971 (2006)

Longitudinal Relationship of Work Hours, Mandatory Overtime, and On-call to Musculoskeletal Problems in Nurses

Alison M. Trinkoff, ScD, RN, FAAN,¹ Rong Le, PhD, RN, Jeanne Geiger-Brown, PhD, RN, Jane Lipscomb, PhD, RN, FAAN, and Gary Lang, MSH, RN



Age-Adjusted Odds Ratios (OR) for Needlestick Injury in the Past Year and Relative Risk (RR) for Incident Needlestick Injury Among Nurses Who Had Worked ≥ 1 Year at Baseline, According to Work Schedule at Baseline, 2002-2004

Work-schedule variable*	OR (95% CI) for needlestick injury in the past year ^a	RR (95% CI) for incident needlestick injury ^b
Status		
Part-time	1.00	1.00
Full-time	1.13 (0.86-1.48)	0.77 (0.56-1.04)
No. of jobs		
1	1.00	1.00
>1	1.07 (0.81-1.43)	0.88 (0.62-1.26)
Hours worked per day		
≤ 8	1.00	1.00
9-11	1.19 (0.88-1.61)	0.92 (0.64-1.32)
≥ 12	1.68* (1.27-2.24)	1.63* (1.17-2.26)
Continuous	1.10* (1.05-1.16)	1.09* (1.02-1.17)
Hours worked per week		
≤ 40	1.00	1.00
41-49	0.85 (0.62-1.17)	1.10 (0.77-1.56)
≥ 50	1.12 (0.80-1.57)	0.70 (0.44-1.12)
Continuous	1.01 (1.00-1.02)	0.99 (0.98-1.01)
Days worked per week		
1-5	1.00	1.00
6-7	0.89 (0.50-1.58)	0.95 (0.49-1.83)
Continuous	0.92 (0.83-1.01)	0.86 (0.77-0.97)
Weekends worked per month		
0-1	1.00	1.00
2-4	2.03* (1.60-2.58)	1.70* (1.28-2.26)
Continuous	1.30* (1.18-1.43)	1.25* (1.11-1.39)
Shift		
Days only	1.00	1.00
Other than days	1.68* (1.32-2.12)	1.59* (1.20-2.11)

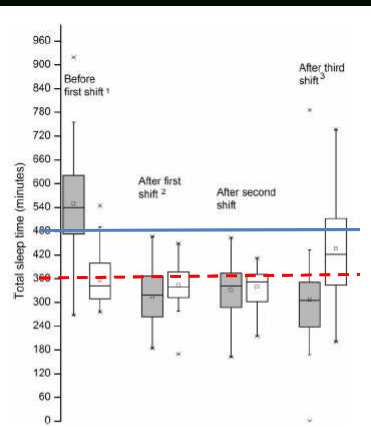


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ORIGINAL ARTICLE

Work Schedule, Needle Use, and Needlestick Injuries Among Registered Nurses

Allison M. Trinkoff, ScD, RN, FAAN; Rong Le, MS, RN; Jeanne Geiger-Brown, PhD, RN; Jane Lipscomb, PhD, RN



8 hr
6 hr

Total sleep time (minutes) for day- and night-shift nurses working three successive 12-h shifts. Shaded box plots for nurses working night shift, nonshaded boxes for day shift. Box plot contains 25th to 75th percentiles, with central line as median and small box as mean, whiskers are to 95th percentile, and crosses are outliers. Differences between day-shift versus night-shift sleep. ¹t = 8.8, p < .0012; ²t = -2.1, p = .04; ³t = -4.3, p < .001.

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Sleep, Sleepiness, Fatigue, and Performance of 12-Hour-Shift Nurses

Jeanne Geiger-Brown,¹ Valerie E. Rogers,² Allison M. Trinkoff,¹ Robert L. Kane,³ R. Barker Bausell,¹ and Steven M Scharf,⁴



Sleep Loss–Related Public Safety Events

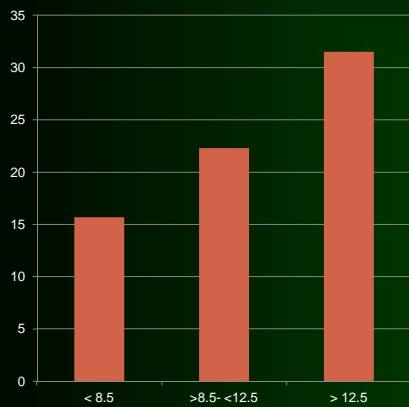


SLEEP AND DRIVING

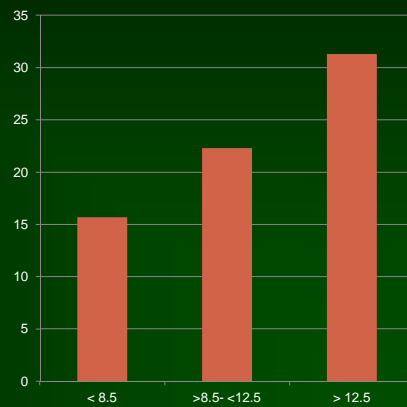
The Relationship between Nurse Work Schedules, Sleep Duration, and Drowsy Driving

Linda D. Scott, PhD, RN¹; Wei-Ting Hwang, PhD²; Ann E. Rogers, PhD, RN, FAAN³; Tami Nyssen, MSN, RN⁴; Grace E. Dean, PhD, RN⁵; David F. Dinges, PhD⁶

Shifts with drowsy driving
(2,919 shifts)



Shifts with MVC or near miss
(282 shifts)





Role of the Nurse: Integrating SWSD Interventions for You and Your Patient

Michael Decker PhD, RN, RRT, D.ABSM
Diplomate, American Board of Sleep Medicine
Byrdine F. Lewis Chair in Nursing
Georgia State University



Role of the Nurse: Integrating SWSD Interventions for You and Your Patient

Unique Vulnerability and Role of Nurse



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Rotating Shifts Impact Nursing

- Fatigue and recovery problems attributable to shift work are well recognized and independent of partnership or family status¹
- Optimal standards for patient care may be difficult to achieve for nurses, who may suffer from sleep deprivation and health problems associated with rotational night work and disrupted physiological rhythms^{2,3}
- Night-shift workers are reportedly most susceptible to SWD, with an estimated 32.1% of this group experiencing symptoms that meet the minimum diagnostic criteria for SWD compared with 26.1% of rotating-shift workers⁴

1. Winwood PC, et al. *J Adv Nurs*. 2006;56(4):439-449, 2.Muecke S. *J Adv Nurs*. 2005;56(4):439-449, 3.Gold DR, et al. *Am J Public Health*. 1992;82(7):1011-1014., 4.Drake CL, et al. *Sleep*. 2004;27:1453-1462.



Self-awareness and Self-assessment of Sleepiness

“Sleep loss is at least as potent as ethanol in its performance-impairing and amnestic effects and is significantly more potent in its sedative effects^{1”}

- **Myth**

“I can tell how tired I am and I know when I’m not functioning up to par.”

- **Facts**

Studies show that sleepy people *underestimate* their level of sleepiness and *overestimate* their alertness

The sleepier you are, the *less accurate* your perception of degree of impairment.

You can fall asleep briefly (“microsleeps”) without knowing it

© American Academy of Sleep Medicine

1. Roehrs T, et al. *Sleep*. 2003;26(8):981-5.



How is Sleepiness Measured?

- Questionnaires and scales (subjective)
- Behavioral and performance (objective)
- Physiological (objective)



Subjective Rating Scales

- Consist of “subjective measures” of sleepy behavior assessed by single item questions and/or scales consisting of multiple items
 - Epworth Sleepiness Scale¹
 - Stanford Sleepiness Scale²
 - Karolinska Sleepiness Scale³
 - Pittsburgh Sleep Quality Index Questionnaire⁴
 - Athens Insomnia Scale⁵
- The sensitivity and specificity of such tests are influenced by:
 - Terms, such as fatigue, tiredness and sleepiness may contribute to misclassification
 - Clinical experiences show that patients who have lived with severe sleepiness for many years may underreport their sleepiness due to habituation

1. Johns MW. *Sleep*. 1992 Aug;15(4):376-81. 2. Glenville M, Broughton R. *Adv Biosci*. 1978 Jul 24-25;21:235-44.
3. Gillberg M, et al. *Sleep*. 1994 Apr;17(3):236-41. 4. Buysse DJ, et al. *Psychiatry Res*. 1989 May;28(2):193-213.
5. Soldatos CR, et al. *J Psychosom Res*. 2000 Jun;48(6):555-60.



Epworth Sleepiness Scale (ESS)

Use this scale to choose the most appropriate number for each situation:

- 0 = Would never doze
- 1 = Slight chance of dozing
- 2 = Moderate chance of dozing
- 3 = High chance of dozing

Situation	Chance of dozing
Sitting and Reading	_____
Watching TV	_____
Sitting inactive in a public place (e.g., theatre)	_____
As a passenger in car for an hour without break	_____
Lying down to rest in the afternoon	_____
Sitting and talking to someone	_____
Sitting quietly after lunch without alcohol	_____
In a car, while stopping for a few minutes in traffic	_____

A score of greater than 10 is interpreted as daytime sleepiness

* the ESS is not validated in night- or rotating-shift workers. Nonetheless, it is useful "screen" for excessive sleepiness.



Behavioral and Performance - Psychomotor Vigilance Test (Assessing reaction time)

- Requires responses to a small, bright-red-light stimulus (LED-digital counter) by pressing a response button as soon as the stimulus appears
- Designed to be sensitive to sleep deprivation (experimental, occupational, and clinical) induced in many different ways (i.e., through sleep fragmentation, acute prolonged waking, chronic partial sleep restriction, etc.)



Basner M, Dinges DF. *Sleep*. 2011 May 1;34(5):581-91.



Physiological - Multiple Sleep Latency Testing

- Objective assessments reduce potential error associated with subjective assessments of sleepiness or alertness
- Most common: multiple sleep latency test (**MSLT**)
 - a well-validated test of the physiologic tendency to fall asleep during usual waking hours
 - performed under very controlled conditions
 - five 20-minute nap opportunities are given at two-hour intervals, beginning 2 hours after morning awakening
 - an all night in-laboratory sleep study must precede the MSLT to “rule-out” conditions that could impact
 - **Patient is asked to fall asleep!**
 - Parameters measured are:
 - average number of minutes to sleep onset
 - appearance of REM sleep during the nap



Carskadon MA, et al *Sleep*. 1986 Dec;9(4):519-24.



Summary of Subjective / Objective Assessments of Sleepiness

- A person cannot necessarily gauge how sleepy he/she may be
- A person’s performance may be impaired by sleepiness without being aware of it
- Hospital-based nursing practice can implement subjective questionnaire assessments
- Behavioral and performance measures (such as psychomotor vigilance testing) may be better suited for primary care settings
- MSLT with its prerequisite sleep study are reserved for specialty diagnostic sleep laboratories



Non-Pharmacologic Management Strategies of Sleepiness

- Improve sleep hygiene¹
 - darkened room, sound attenuation, cool temperature,
 - allow for extra sleep time for “recovery sleep” after 1st couple of nights to counter overall reduction in total sleep time
- Consider light therapy²
 - bright light therapy to help resynchronize circadian rhythms
- Exercise³
 - develop “practical” exercise regime (fast walking) and maintain daily schedule
- If possible, do not work several back-to-back nightshifts^{4,5}
 - cumulative sleep loss, with corollary performance decrements and increased propensity for accidents occur following multiple concurrent night-shifts
- AVOID OTC stimulant drinks
 - rebound sleepiness
 - high sugar content

1. Zee PC, Goldstein CA. *Curr Treat Options Neurol.* 2010 Sep;12(5):396-411. 2. Simon RD. *J Clin Psychiatry.* 2012 Jun; 73(6):e20.
3. Thorpy MJ. *J Fam Pract.* 2010 Jan;59(1 Suppl):S24-31. 4. Folkard S, et al. *Industrial Health.* 2005;43(1):20-23. 5. Costa G, et al. *Chronobiol Int.* 2006;23(6):1125–1137.



Pharmacologic Management Strategies-1

Goal #1: Facilitate sleep onset and maintenance during time of day that circadian drive is promoting wake

- **Melatonin agonists**¹
 - Ramelteon (Rozerem) is a melatonin receptor agonist
 - stimulates those receptors responsive to melatonin, a hormone secreted by the pineal gland of all animals and humans. Release of melatonin, which stimulates melatonin receptors, is associated with an increase of sleep propensity.
- **Non-benzodiazepines**
 - Zolpidem (Ambien, Ambien CR, Stilnox, and Sublinox)²
 - short-acting (15 minute onset with 2-3 hour duration that potentiates gamma-aminobutyric acid (GABA), an inhibitory neurotransmitter, by binding to GABA_A receptors
 - does not adequately maintaining sleep, unless used in the CR formulation
 - may be associated with morning “hangover” effect
 - Eszopiclone (Lunesta)³
 - mechanism of action is via the benzodiazepine receptor-GABA complex, similar to zolpidem

1. Harelend R, et al *Arzneimittelforschung.* 2008;58(1):1-10. Review. 2. Depoortere H, et al *J. Pharmacol. Exp. Ther.* 237 (2): 649–58
3. Najib J. *Clin Ther.* 2006 Apr;28(4):491-516.



Pharmacologic Management Strategies -2

Goal #2: Facilitate maintenance of wakefulness.

- **Non-prescription - Wake promoting**
 - Caffeine is often used as the initial treatment for excessive sleepiness associated with reduced sleep
 - It achieves its wake-promoting effects by antagonizing adenosinergic neurons located in the hypothalamus and projecting into cells in the cortex, basal forebrain, and reticular activating system¹
 - Through its inhibition of adenosine receptors, caffeine prevents sleep onset and maintenance¹
- **Prescription - Wake promoting**
 - Armodafinil (Nuvigil®)²
 - used to improve wakefulness in adults who experience excessive sleepiness due to shift work disorder (SWD), obstructive sleep apnea, or narcolepsy
 - mechanism of action remains unclear
 - may be related to increased release of monoamines

1. Schwartz JR., Roth T. *Curr Neuropharmacol*. 2008;6(4): 367–378. 2. Czeisler C.A. et al *Mayo Clin Proc*. 2009;84(11):958-972.



Summary of Dr. Lee's Key Points

- **SWSD – Definition**
 - Insomnia *or* excessive sleepiness, temporally associated with work period during habitual sleep phase. Shiftwork is an essential component
 - Shorter shifts and less frequent night shift is tolerated better than longer more frequent night shifts
 - A night shift worker can cope with changes in sleep-wake patterns by sleeping during the day



Summary of Dr. Geiger-Brown's Key Points

- Consequences of shiftwork sleep disorder
 - Performance is unstable when intense concentration is needed
 - Short term recall and working memory decline
 - Reduced learning of new information
 - Divergent thinking deteriorates
 - Risk assessment is faulty, risk taking behavior increases
 - Loss of situational awareness
 - Irritability, anxiety, depression
 - Loss of vigor
 - Inappropriate behavior
 - Communication skills decrease



Summary of Dr. Wyatt's Key Points

- Working rotating or night shifts increases risk for:
 - Cardio- and cerebrovascular disease
 - Several types of cancer
 - Obesity and obesity-related disease (OSA, DM)
 - GI, reproductive, metabolic, and other disease

Sample Countermeasures

- Improve diet and increase exercise
 - Increase HDL, lower LDL
 - Decrease triglycerides
 - Lower risk for OSA, DM, metabolic syndrome
 - Improve BP
- Address sleep complaints
 - Sleep restriction clearly linked to health risk
- Consider avoiding nights or rotating shifts if already at increased risk for certain diseases



Summary of Dr. Decker's Key Points

- Rotating shifts impact Nursing
 - Optimal patient care may be difficult to achieve for nurses who may suffer from sleep deprivation and health problems associated with rotational night work
 - Night-shift workers are reportedly most susceptible to SWSD, with an estimated 32.1% of this group experiencing symptoms that meet the minimum diagnostic criteria.
 - Sleep loss is at least as potent as ethanol in its performance-impairing and amnesic effects and is significantly more potent in its sedative effects.
 - A person cannot necessarily gauge how sleepy he/she may be.
 - A person's performance may be impaired by sleepiness without being aware of it.
 - Both pharmacologic and nonpharmacologic interventions exist

See a Board Certified Sleep Physician if you believe that you may have a sleep-related disorder