Consecutive 12-HR Shifts Influence Stress and Fatigue in Nurses

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Abstract

High acuity, long hours, and complexity of patient care are significant contributors to nurses' stress, increasing the risk to patient safety. Working multiple consecutive days of 12-hour shifts in an acute care hospital setting make nurses highly vulnerable to stress and fatigue potentially compromising patient safety. Studies evaluating consecutive workdays using biobehavioral methods are limited in the US.

Purpose: The aim of this study was to assess changes in and relationship between stress, biological responses, and fatigue over three consecutive 12-hr workdays.

Methods: A repeated measure design measured at baseline: perceived personal stress and work-related stress. A visual analog scale of stress and fatigue and saliva samples were used at repeated time points pre- and post-shift for cortisol and alpha amylase assays. Social resources were evaluated to determine if these buffered the effects between stress and fatigue.

Results: 81 nurses, 43 day nurses and 38 night nurses, included 22% male nurses. Ages of the nurses were mostly in two group ranges: 30-39 (25%), and 40-49 (43%); Race was Asians (38%), and Caucasians (32%), and followed by Hispanics (26%), and African-American (16%). BSN grads (85%) with approximately 15 years experience groups evenly distributed from 0-5 years (24%), 6-10 years (25%), and 11-15 years (30%). Nurses reported working an average of 12.5 hours per shift (SD±0.5). Stress did not significantly change from shift 1 to 3. Fatigue increased in both day and night shift nurses for each shift worked, but statistically significant in night shift nurses (p=0.05).

Methods

Design: A non-experimental, observational study with a within - subject repeated measures design. Convenience samples of acute care nurses who met inclusion criteria, complete a consent to enroll in the study. Data is collected before and after a 12-hour shift for three consecutive shifts.

Sample and Setting:

Nurses recruited from 350-bed acute care hospital (emergency, critical care, & medical/surgical) units in Houston, Texas.

To collect data consistently specimens were collected between 6-7 am and 6-7 pm. Dayshift nurses start there shift at 6;45am (pre-shift) end 7:15 pm (post-shift) Night shift nurses start shift 6:45pm (pre-shift) and end 7:15 am (post-shift)

	Baseline	Day 1 Pre-shift	Day 1 Post-shift	Day 2	Day 3 Pre-shift	Day 3 Post-shift
Demographics	X					
Personal stress (PSS)	X					
Work Stress (NSS)	X					
General Stress (VAS-S)	X	X	X		X	X
Fatigue (MFI)						
Fatigue (VAS-F)	X	X	X		X	X
Social Resources (MSPSS)	X					
Saliva Cortisol/Alpha Amylase		X	X		X	X

RECRUITMENT FLYER

Research Study for Medical/Surgical Nurses

"ROLE OF STRESS AND SOCIAL RESOURCES ON CORTISOL AND FATIGUE IN STAFF NURSES IN AN ACUTE CARE SETTING

Who: DAY OR NIGHT SHIFT NURSES ON MEDICAL/SURGICAL OR FLOAT POOL

- ✓ Working at least 36 hours per week
- ✓ Able to supply saliva samples x 4
- ✓ Work 3 consecutive days for at least 12 hours
- ✓ Not receiving treatment for infection, taking corticosteroids, antibiotics or antidepressants

When: Before your shift starts and after your shift on the 3rd consecutive days

Where: Break room/conference room on your unit

What to expect:

- ✓ Complete questionnaires
- ✓ Provide Demographic information
- ✓ Provide saliva samples at beginning and end of shift Day 1 and Day 3.

Total time required: 1 hour

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Demographics & Descriptive Statistics

Table 1.

Descriptive and Reliability Analysis for Baseline Stress, Social Resources, and Fatigue Instruments (N=81)

	Ranges Possible	Ranges Actual	Mean	SD	Cronbach α
Personal Stress	0 - 49	6 – 30	18.7	5.2	.81
Work-Related Stress	0 - 165	45 - 165	112.8	28.3	.91
Stress VAS	0 - 10	0 - 10	3.51	2.8	
Cortisol AM	ND - 1.515	.029 - .706	0.275	0.172	
Cortisol PM		.005 - .789	0.135	0.174	
Alpha Amylase AM	3.1 – 423	5.2 - 259.9	97.1	68.4	
Alpha Amylase PM	4.19 - 415.5	57.1	94.0		
Multidimensional Fat.	20 - 100	20 - 82	45.1	14.1	.92
Fatigue VAS	0 - 10	0 - 10	3.54	3.1	
Social Resources	0 - 84	0 - 84	68.4	7.2	.95

Note. PSS=Perceived Stress Scale for Perceived Personal Stress; NSS=Nurse Stress Scale for work-related stress; VAS-S=Visual Analog Scale for Overall Stress Baseline; VAS-F= Visual Analog Scale Fatigue for General Fatigue Baselines; MFI=Multidimensional Fatigue Inventory for baseline general fatigue; MSPSS=Multidimensional Scale of Perceived Social Support for social resources.
Raw cortisol values reported in ug/dL and alpha amylase in u/mL
ND= not detected.

Levels of stress, fatigue, and social resources were compared between day and night shift nurses at baseline. Social resources (MSPSS) were significantly lower in night shift nurses than day shift nurses (p =.05). The Cronbach's alphas for the study instruments ranged from .81 to .95 (see Table 3). There were no significant differences in demographics and questionnaires except for social resources between the groups of nurses (Table 2).

Table 2

Comparison of Baseline Descriptive Data for Stress, Fatigue, and Social Support between Day and Night Shift Nurses

	All Nurses (N=81) (SD) Mean	Day Shift Nurses (N=41) (SD) Mean	Night Shift Nurses (n=38) (SD) Mean	Comparison p
Personal Stress (PSS)	18.7 (5.2)	18.0 (5.6)	19.5 (4.6)	.21
Work-related Stress (NSS)	112.8 (28.3)	113.1 (29.4)	113.0 (27.4)	.94
Overall Stress (VAS)	3.51 (2.8)	3.5 (2.8)	3.4 (3.0)	.92
Multidimensional Fatigue (MFI)	45.1 (14.1)	45.5 (13.6)	45.5 (13.7)	.80
Overall Fatigue VAS	3.54 (3.1)	3.7 (3.3)	3.4 (3.0)	.74
Social Resources (MSPSS)	68.36 (17.26	72.1 (11.9)	64.2 (21.2)	.05

Comparison of Stress, Fatigue, and Cortisol between Day 1 and Day 3

Hypothesis 1: Stress, biological responses, and fatigue will be significantly higher on day 3 than day 1. There was not a significant increase in overall stress as measured by the VAS-S scale for either day or night shift nurses. For biological responses, changes were compared between pre-shift of day 1 and pre-shift of day 3, as well as between post-shifts of day 1 and day 3 for day and night shift nurses separately to control for circadian variability. The only significant findings was a significant decrease in cortisol from pre-shift day 1 to pre-shift day 3 for day shift nurses, (p=.007). Alpha amylase levels were not significantly different for pre-shift or post-shift changes for either shift nurses. Fatigue measured by VAS-F was increased in both groups of nurses but the increase was significant only for night shift nurses, p = .001 (see Table 2).

Results

Table 3

Changes in Stress, Fatigue, Cortisol and Alpha Amylase over Three Consecutive 12- hour Workdays

Day Nurses Variables	Mean (SD)	Comparison Mean Diff	P	Night Nurses Variables	Mean (SD)	Comparison Mean diff	p
Stress VAS							
Day 3 Post-shift	4.2 (2.5)	0.2	.68	Day 3 Post-shift	3.1 (2.5)	0.1	.87
Day 1 Pre-shift	4.0 (2.8)			Day 1 Pre-shift	3.2 (2.1)		
Cortisol							
Day 3 Pre-shift	-1.65 (.93)	- 0.45	.007	Day 3 Pre-shift	-1.79 (.81)	0.18	.19
Day 1 Pre-shift	-1.20 (.79)			Day 1 Pre-shift	-1.97(1.02)		
Day 3 Post-shift	-2.95 (1.01)	0.16	.30	Day 3 Post-shift	-2.31(1.37)	-0.33	.12
Day 1 Post-shift	-3.11 (0.96)			Day 1 Post-shift	-1.96 (.83)		
Alpha Amylase							
Day 3 Pre-shift	4.22 (.93)	0.06	.59	Day 3 Pre-shift	4.76 (.79)	-.06	.54
Day 1 Pre-shift	4.16 (.90)			Day 1 Pre-shift	4.82 (.92)		
Day 3 Post-shift	4.61 (.80)	-0.10	.43	Day 3 Post-shift	4.43 (.89)	0.19	.17
Day 1 Post-shift	4.71 (.81)			Day 1 Post-shift	4.24 (.90)		
Fatigue VAS							
Day 3 Post-shift	4.8 (2.8)	1.2	.06	Day 3 Post-shift	4.5 (2.5)	2.0	.001
Day 1 Pre-shift	3.6 (3.2)			Day 1 Pre-shift	2.5 (2.2)		

Table 4

Changes in stress, Cortisol, Alpha Amylase, and fatigue within each work Day 1 and Day 3

Variables	Night Shift Nurses (n = 38) Mean/(SD) Log Trans	p	Mean (SD) Log Trans	p
Visual Analog Scale Stress				
Pre-shift Day 1	4.0 (2.8)	.14	3.3 (2.5)	.90
Post-shift Day 1	4.8 (2.5)		3.4 (2.3)	
Pre-shift Day 3	4.0 (2.7)	.66	2.7 (2.4)	.28
Post-shift Day 3	4.2 (2.5)		3.2 (2.5)	
Cortisol				
Pre-shift Day 1	-1.33(0.85)	.005	-2.14 (1.1)	.71
Post-shift Day 1	-3.04 (1.0)		-2.03 (0.77)	
Pre-shift Day 3	-1.69(0.94)	.005	-1.88 (0.86)	.15
Post-shift Day 3	-2.97 (1.0)		-2.33 (1.43)	
Alpha Amylase				
Pre-shift Day 1	4.24 (0.92)	.005	4.83 (0.91)	.001
Post-shift Day 1	4.75 (0.85)		4.29 (0.89)	
Pre-shift Day 3	4.24 (0.91)	.003	4.78 (0.81)	.007
Post-shift Day 3	4.58 (0.78)		4.43 (1.02)	
Fatigue VAS				
Pre-shift Day 1	3.5 (3.2)	.39	2.4 (2.1)	.005
Post-shift Day 1	4.1 (2.9)		4.2 (2.6)	
Pre-shift Day 3	4.1 (2.8)	.18	3.9 (2.3)	.18
Post-shift Day 3	4.8 (2.8)		4.6 (2.5)	

Hypothesis 2. Stress, biological responses, and fatigue will be significantly higher at post-shift than pre-shift on day 1 and day 3. This hypothesis tests acute changes within a 12-hour shift work. There were no significant changes in stress (VAS) from pre- to post-shift in both groups of nurses (Table 3). For biological responses, cortisol increased significantly within the shift (p=.005) both days for day shift nurses, though not for night shift. Alpha amylase significantly increased within shift day 1 (p =.005), and day 3 (p =.003) in day shift nurses, and within day 1 (p=.001), and day 3 (p=.007) for night shift nurses. Fatigue levels were not significantly higher within the shift for day shift nurses but there was a significant increase in fatigue from day1 pre-shift to day 1 post-shift, (p=.005) for night shift nurses (see Table 4).

Table 5

Hierarchical Multiple Regression Predicting Cortisol and Alpha Amylase from Baseline Personal and Work-related Stress

	Post-Shift Cortisol Day 1		Post-Shift Cortisol Day 3		Post-Shift Alpha Amylase Day 1		Post-Shift Alpha Amylase Day 3	
	Day Shift	Night Shift	Day Shift	Night Shift	Day Shift	Night Shift	Day Shift	Night Shift
Predictor	ΔR^2 β	ΔR^2 B	ΔR^2 β	ΔR^2 β	ΔR^2 β	ΔR^2 β	ΔR^2 β	ΔR^2 β
Step 1 Covariates	.03	.05	.01	.12	.20*	.01	.06	.02
Step 2	.04	.14	.06	.004	.07	.02	.02	.02
Personal stress	-.06	.06	-.25	-.06	.17	.04	-.08	- .05
Work stress	-.17	-.36	-.01	-.07	-.29	-.13	.17	.11
Total R^2	.07	.19	.07	.12	.27	.03	.08	.04

Note: Covariates were race, and, hours' sleep between shifts, and number of children in the home.
Personal stress=PSS; Work Stress=NSS; General stress=VAS-S.
Cortisol and alpha amylase are log-transformed.
*p<.05; **p<.01, however none of the models were significant.
Standardized beta used.
Tolerance levels for all regression models were checked for collinearity.

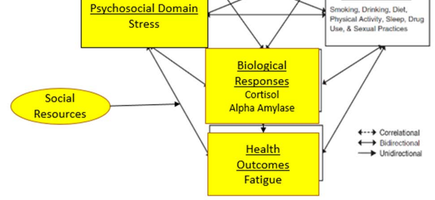
Moderation Between Stress and Fatigue

Hypothesis 3: Social resources will moderate the effect of stress on fatigue. The effect of moderation was evaluated by the significance of interactions between stress and social resources on fatigue, after accounting for covariates. Social resource (MSPSS) and stress variables were centered to reduce potential collinearity problems. Social resources total score results showed a negative skew (skewness = 1.77 and Kurtosis = 3.33) with the majority of nurses reporting very high social resources.

Association between Biological Responses and Fatigue at Salivary Collection

Hypothesis 4: Salivary cortisol and alpha amylase will be positively correlated with fatigue. A Pearson correlation was used to evaluate the relationships between biological responses and fatigue (VAS-F) corresponding for each salivary collection time over 4 time points. In day and night shift nurses, the correlations between cortisol and alpha amylase and fatigue have limited statistically significant correlations. Therefore, cortisol and alpha amylase are not correlated with overall fatigue (VAS-F).

Modified Kang's Biological Interactions Model



- Personal and work-related stress (psychosocial domains).
- Social resources (psychosocial domain) moderate the relationship between stress and fatigue in this study.
- Salivary cortisol and alpha amylase (biological domain)
- Fatigue (health outcome).

Recommendations

- ❑ Nurses are aware of practice attitudes and practices to maintain a healthy work environment but fail at self-care.
- ❑ Make healthy choices.
- ❑ Stay hydrated, keep water close at hand.
- ❑ Eat healthy foods, high in protein, low in fat and sugar.
- ❑ Take a lunch break.
- ❑ Use coffee and other caffeinated beverages wisely.
- ❑ Sleep at least 6 hours between shifts.
- ❑ Reduce consecutive shifts and overtime when possible.
- ❑ Nursing leaders support work breaks and meal breaks, and reduce overtime.
- ❑ Be knowledgeable of fatigue and its effect on patient care and recognize the signs of fatigue.
- ❑ Recognize ineffective coping, passive behavior, and negative communication as a possible result of fatigue.
- ❑ Be familiar with hospital employee assistance programs.

Contact Information

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