Occupational Demands on Fatigue and Driving Safety in Surgical Residents

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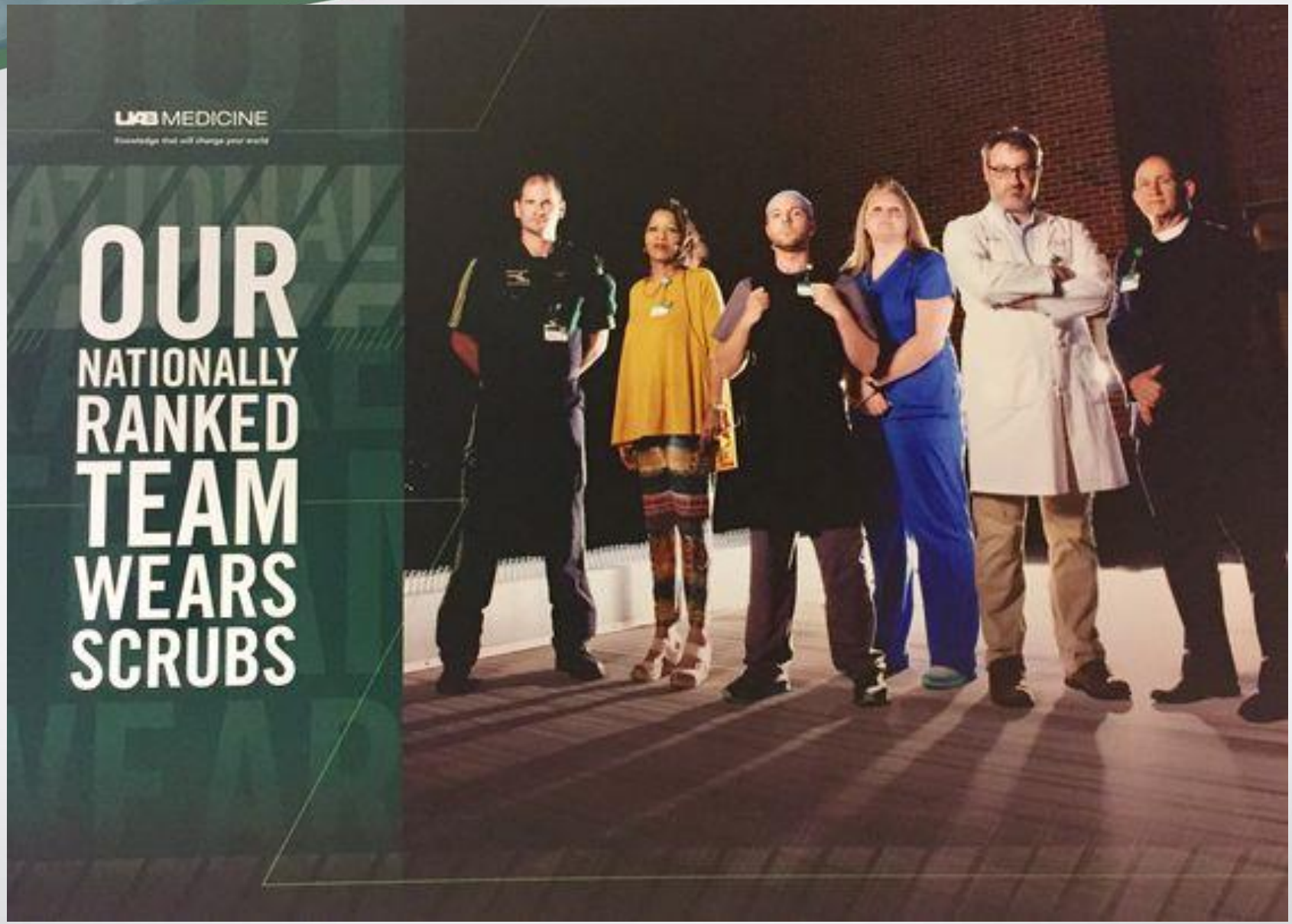
Knowledge that will change your world


UAB MEDICINE
OUR
NATIONALLY
RANKED
TEAM
WEARS
SCRUBS

Medical Residents

- Sleep and fatigue commonly reported (Parshuram et al 2015; Veasey et al, 2002)
- May work duty periods as long as 28 hours (ACGME, 2011)
- Short sleep durations and night shift hours common (Lockley et al., 2007)

Flexible hours vs. ACGME standard – New England Journal of Medicine

- No difference in rate of death or serious complications in patients
- No difference in self-reported frequency at which resident fatigue affected patient or personal safety

Bilimoria et al., 2016

Residents – ACGME Policy

Category	Policies
Maximum Shift Length	28 hours (24 hours + 4 hours for transition)
Minimum Time Between Shifts	8 hours
	14 hours if following 24 hours of continuous duty
Maximum Hours per Week	80 hours (averaged over 4 weeks)
Days off	1 in every 7 days (averaged over 4 weeks)
On-call Duty Frequency	No more than 1 every 3 nights

Medical Residents

- Fatigued during nearly half of their time awake
  - Post-shift task effectiveness and error risk on cognitive tasks comparable to functioning with BAC of 0.08 (McCormick et al., 2012)
- Surgical residents' response times to simple reaction time task significantly slower post-duty (Talusan et al., 2014)
- Risk of falling asleep while driving or stopped in traffic significantly higher in 1st year residents (PGY-1) working 5 extended shifts in a month (Barger et al., 2005)

Sleep and Crash Rates

- Crash Rates (compared to 7 hours of sleep)
  - 6-7 hrs = 30% crash rate increase
  - 5-6 hrs = 90% crash rate increase
  - 4-5 hrs = 130% crash rate increase
  - < 4 hrs = 11.5 times crash rate increase

AAA Foundation for Traffic Safety, 2016

Sleepiness and Fatigue

- Reduces activation states and availability of attentional resources (Recarte & Nunes, 2009)
- Lowered endogenous attention (Trick & Enns, 2009)
  - Selective attention
- Deteriorated performance (Gharagozlou et al., 2015)

Method

- 42 residents from surgical programs
  - Data collection in progress
- 3 visits
  - Off Day
  - On Day
    - Before Shift
    - After Shift

Measures

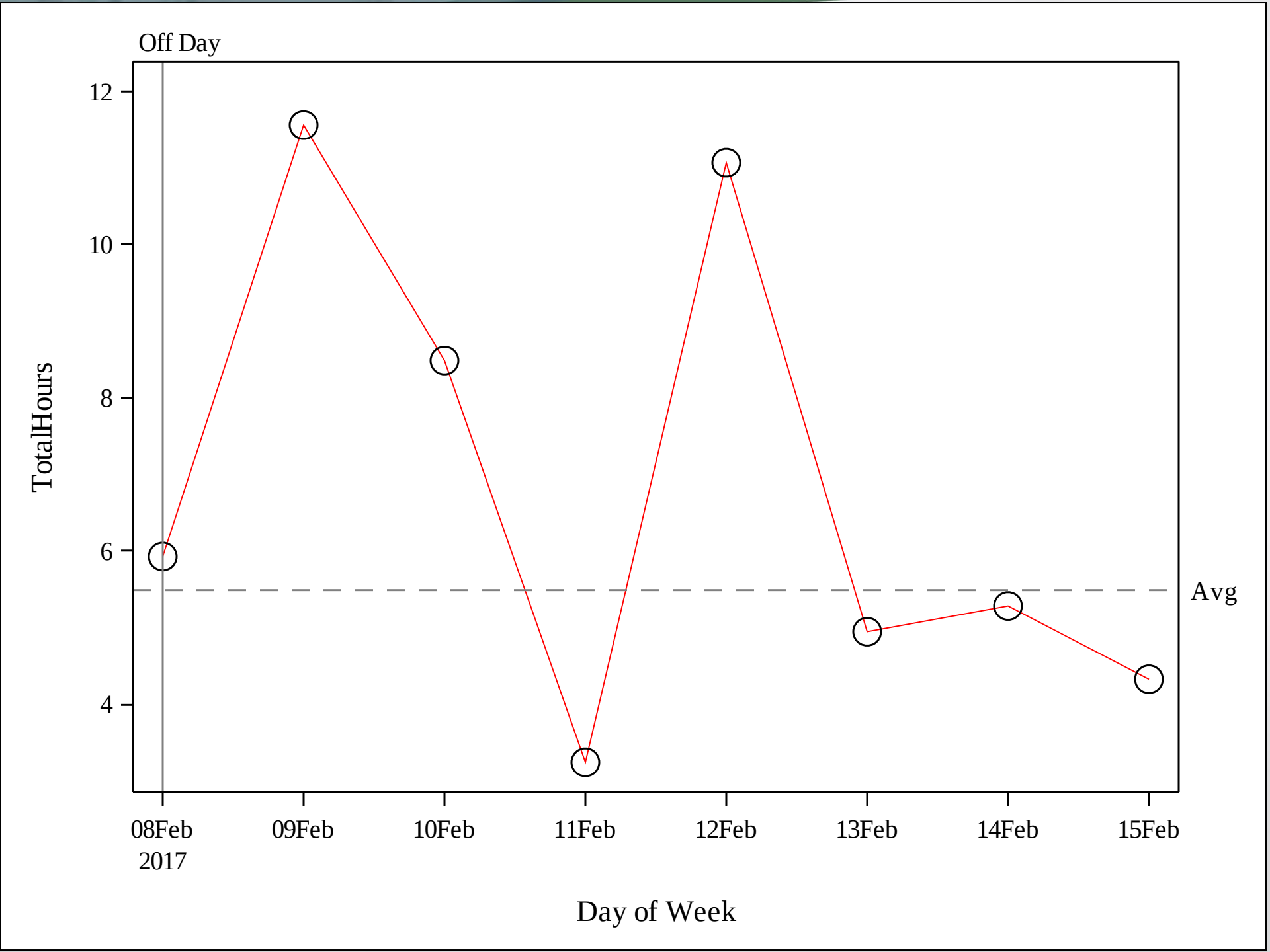
- **Epworth Sleepiness Scale**
- **Actigraphy watch**
- Driving History Questionnaire
- Driver Behavior Questionnaire (DBQ)
- Occupational Fatigue Exhaustion Recovery
- Workplace Stress Scale
- Holmes-Rae Life Stress Inventory
- Cortisol (via saliva)
- Heartrate Variability (HRV)

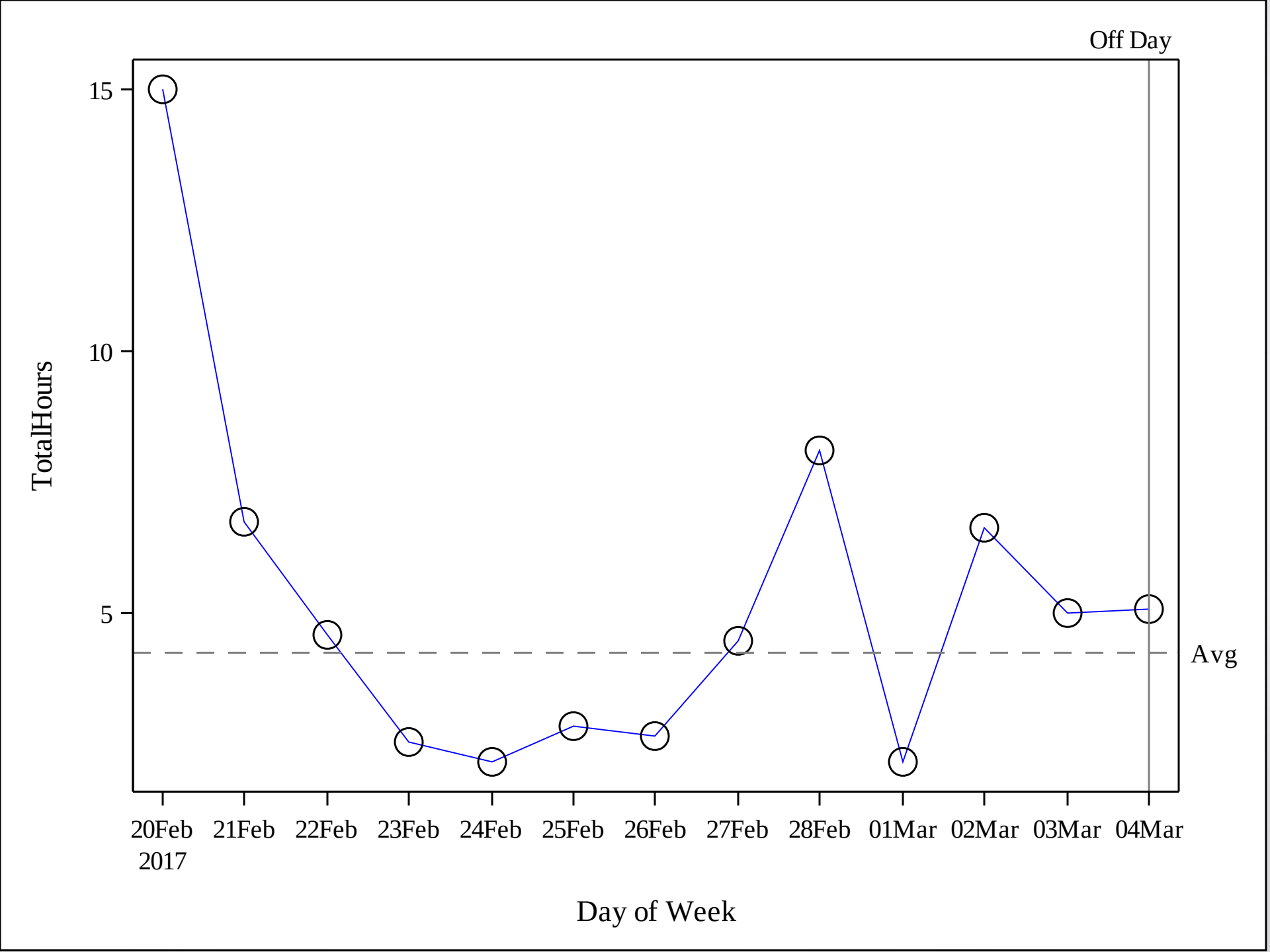
Simulated Drive

- 3 sections
  - Urban
  - Residential
  - Freeway
- ~ 16 minute drive
- Night
- Ambient traffic

Provisional Results (*n* = 9)

Variable	Mean (SD)	n (%)	Range
Age (years)	29.72 (2.82)		27 - 34
Gender (male)		7 (78%)	
Year in Residency	2.67 (1.27)		1 - 5
Total Sleep Time (hours)	6.42 (1.41)		4.50 – 8.44
Sleep Efficiency (%)	92.39 (5.13)		81.30 – 97.42
Wake After Sleep Onset (minutes)	24.95 (13.25)		9.80 – 51.85


Off Day
12
10
8
6
4
TotalHours
Avg
08Feb
2017
09Feb
10Feb
11Feb
12Feb
13Feb
14Feb
15Feb
Day of Week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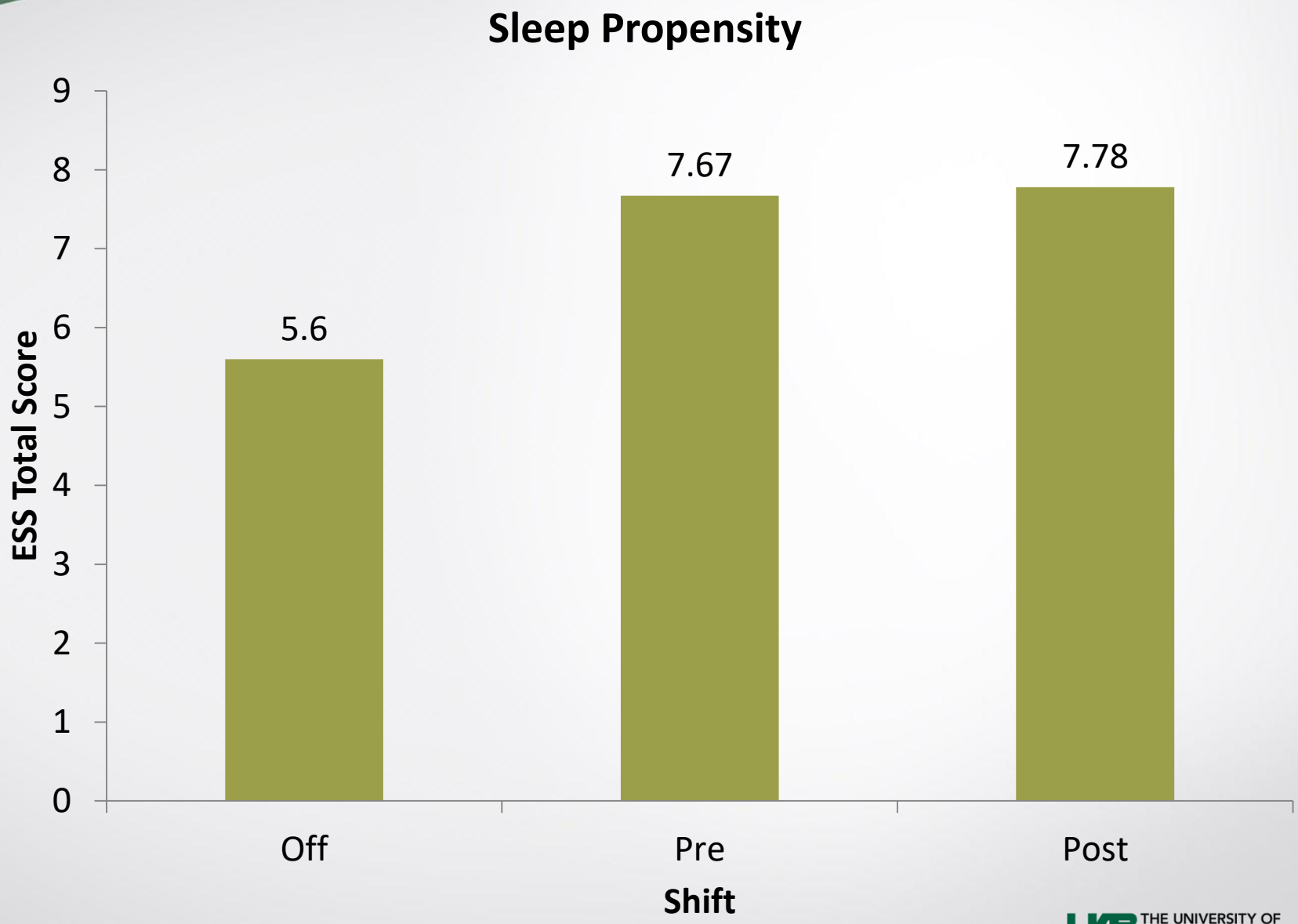
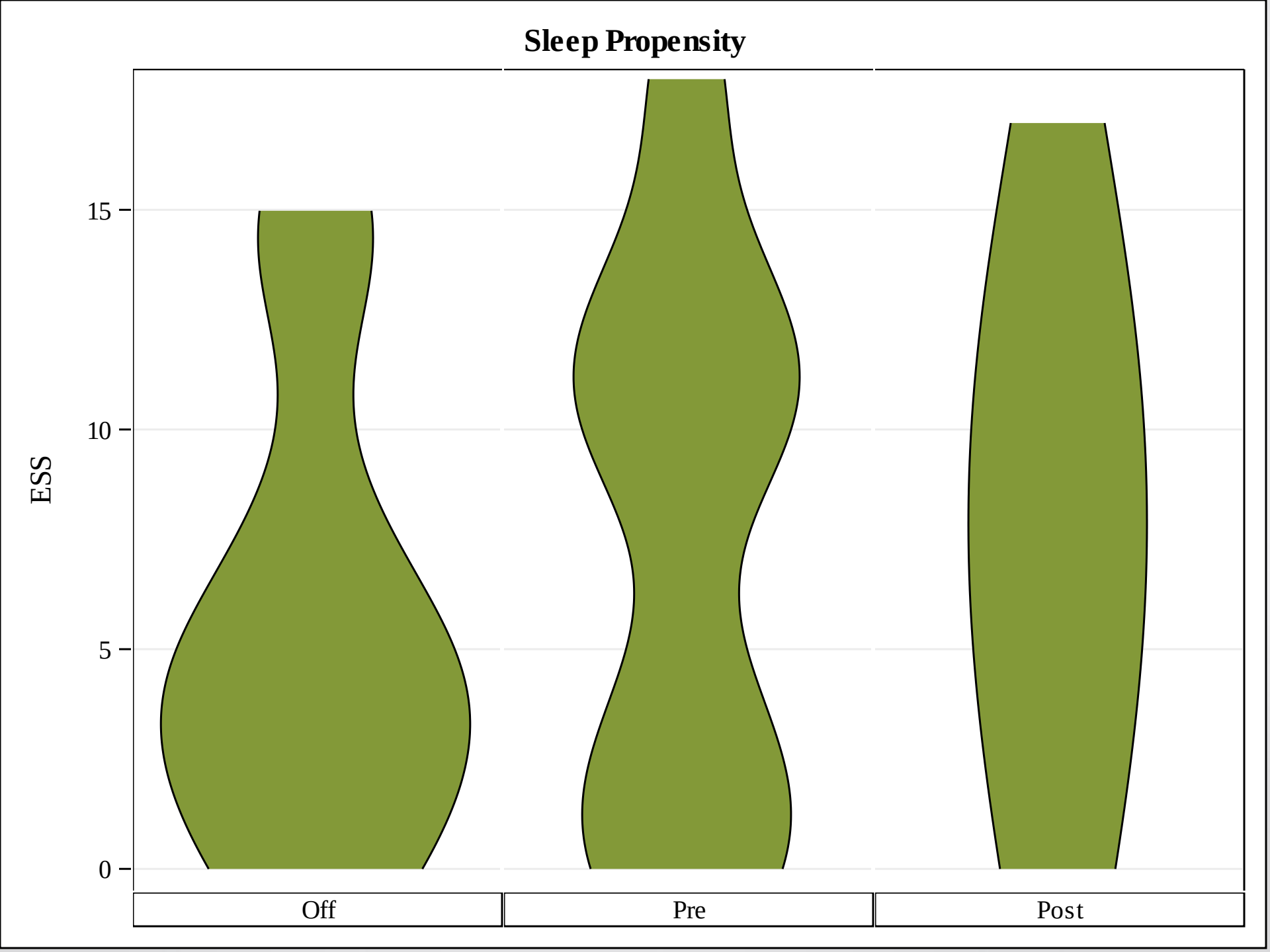
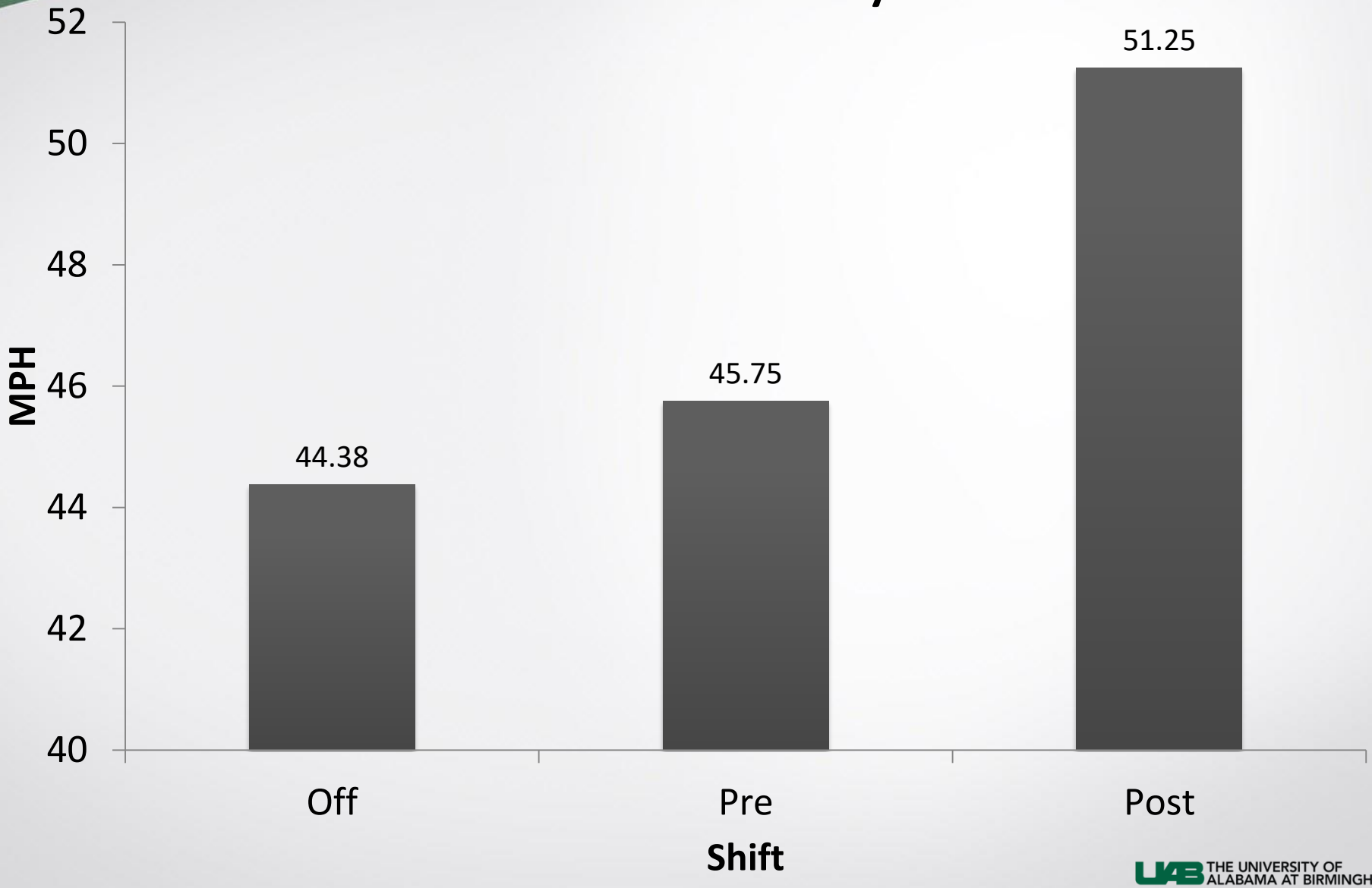
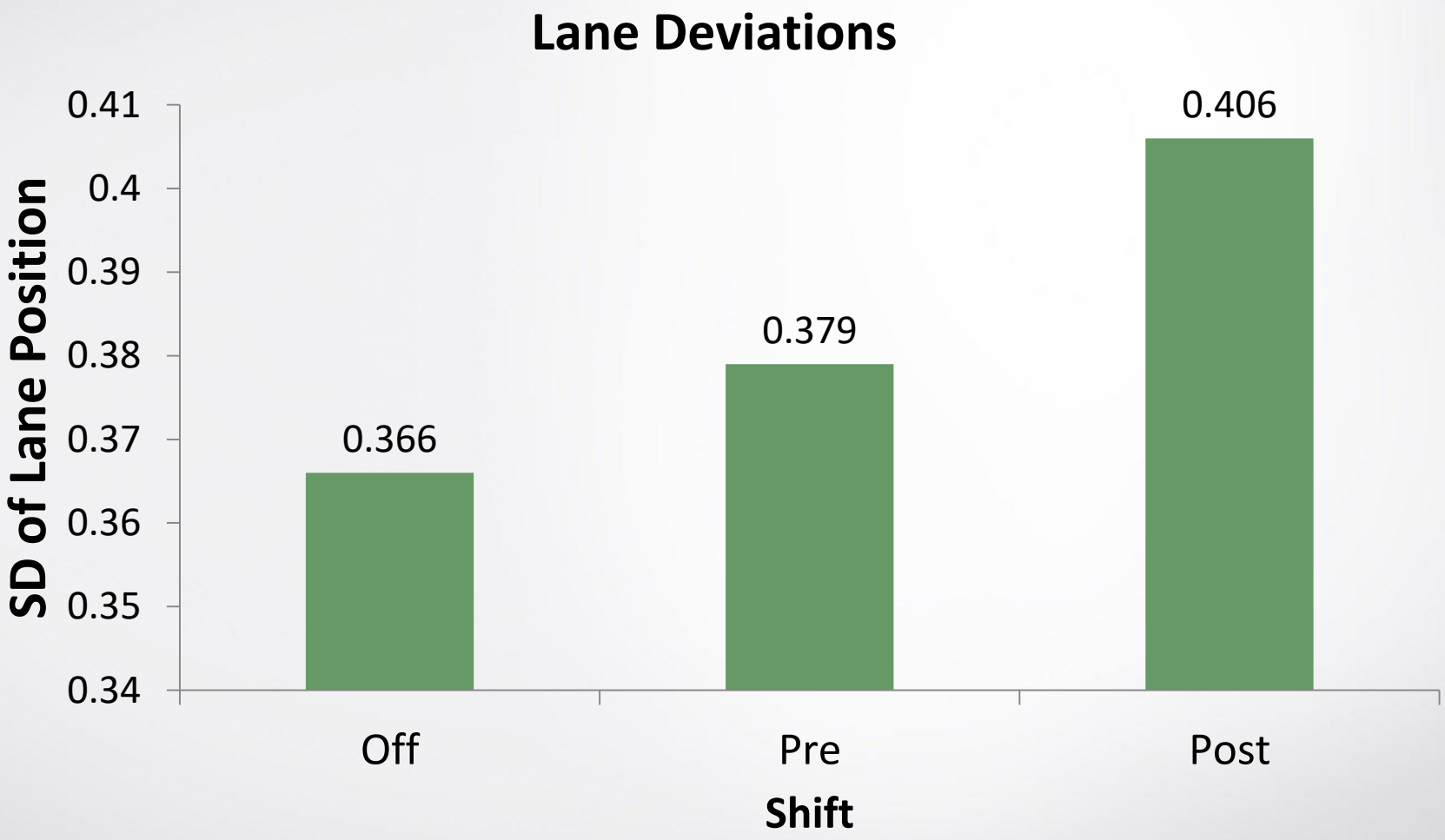
Day of Week




Sleep Propensity
ESS
15
10
5
0
Off
Pre
Post

Residential Velocity





Work Activity

Variable	Mean (SD)	Range
Surgeries Performed	1.67 (1.22)	0 - 4
Hours in Surgery	5.33 (2.66)	2 - 8
kcals	883.26 (423.15)	263.01 – 1695.95
Step Counts	7983.06 (2520.14)	2818.50 – 11992.00

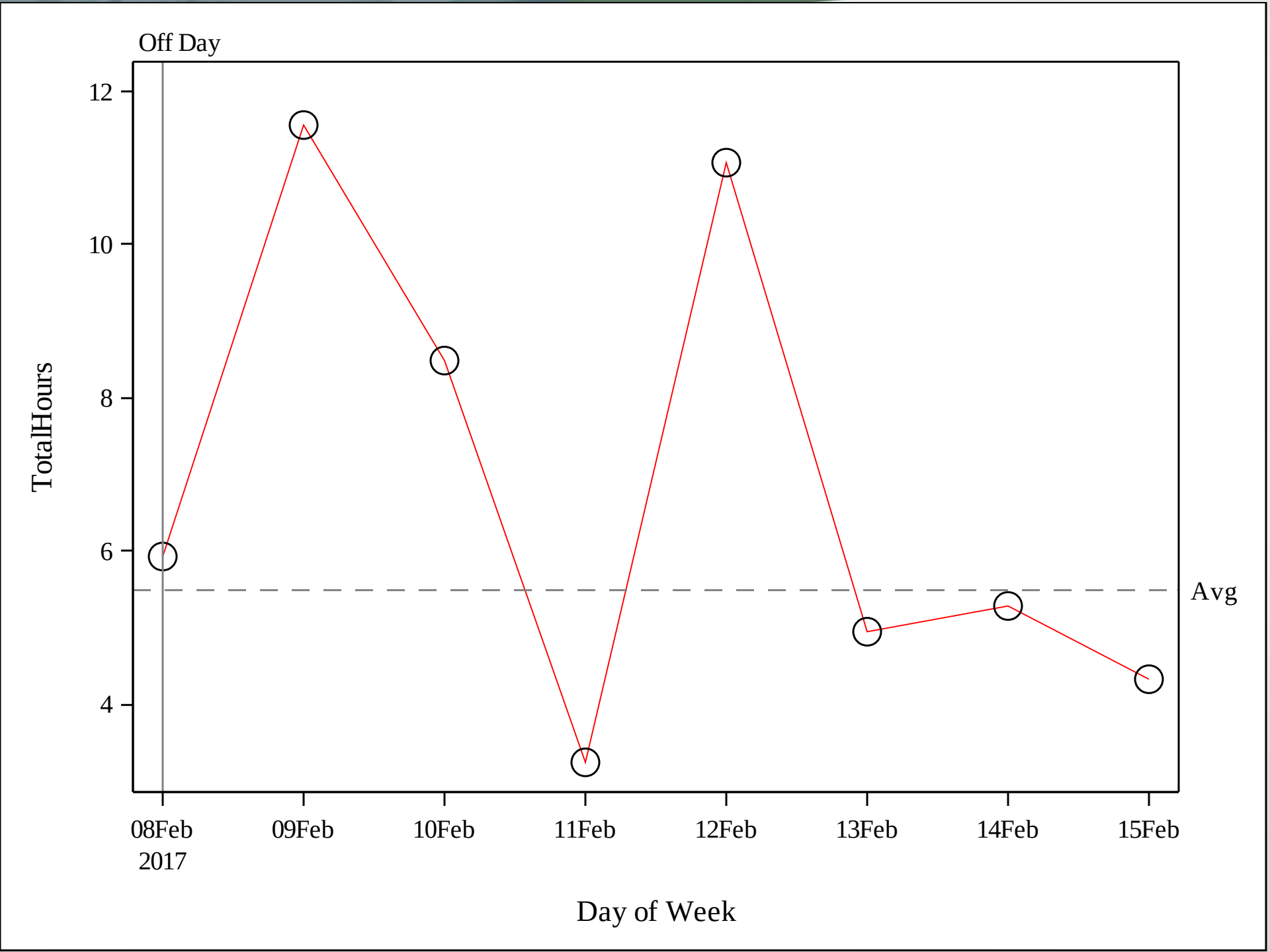
Intercorrelations

	Surgery Time	kcals	Steps	WASO	Efficiency
Total Sleep	0.89**	-0.85**	-0.67	-0.48	-.45
Efficiency	0.42	-0.12	-0.60	-0.99**	
WASO	-0.46	0.13	0.59		
Steps	-0.38	0.75*			
kcals	-0.59				
Surgery Time	-				

** $p < .05$
* $p < .10$

Discussion

- Surgical residents are getting less sleep (~ 6 hours) than the amount associated with safe driving
  - 7+ hours (Neri et al., 1997)
  - At nearly 30% increased risk (AAA, 2016)
- Inconsistent sleep, inconsistent schedules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“Fast and Sloppy”

- Sleep deprived individuals often increase speed in decision making at the expense of committing more errors (Horowitz et al., 2003; Killgore et al., 2012; McKenna et al., 2007)
  - Greater risk taking

- Residents may display “fast and sloppy” approach to driving post-shift
  - Greater velocity, poorer lane maintanence
- Performance high post-shift ?

Limitations

- Data collection in progress – small sample size
- Driving simulation
  - Relatively valid replication of real world driving behaviors (Morgan et al., 2011; Underwood et al., 2011)
- Actigraphy estimates
  - Good agreement with polysomnography (Morgenthaler et al., 2007; Signal et al., 2005)

Acknowledgments

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