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Impact of Two Shift Schedules on Post-Shift Blood Pressure in Firefighters

Ayeisha H. Haswarey
Portland State University

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Ayeisha H. Haswarey[1], Aanu Ayeni[1], Omar Ordaz-Johnson[1], LaTroy D. Robinson[1], Walaa Abdelmoaty[1], Maya X. Herzig[1], Shelby L. Watkins[1], David Hurtado[1], Andrew W. McHill[1,2], Joshua Gonzalez[1], Todd Bodner[3], Steven A. Shea[1], Nicole P. Bowles[1]

[1]Oregon Institute of Occupational Health Sciences, Oregon Health & Science University
[2]School of Nursing, Oregon Health & Science University, Portland, OR 97239
[3]Department of Psychology, Portland State University, Portland, OR 97207

Background

- Firefighters have an increased risk of cardiometabolic disease[1].
- Blood pressure usually declines during nocturnal sleep (dipping)[2]. Blunted dipping is associated with increased cardiometabolic morbidity and mortality[3].
- Shift work can alter BP dipping[4,5,6]; the extent of alteration by schedule type is debated.
- In this preliminary analysis, we compared post-shift BP and dipping across two firefighting schedules to better understand their implications for disease risk.

Methods

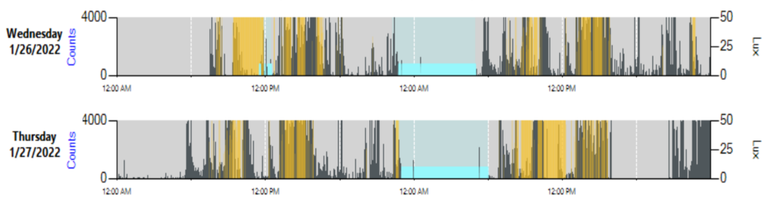
Figure 1. **Study timeline.**

- 20 random participants, a subset of parent study of 122 (Table 1).
- 24-48 hours of at-home ambulatory blood pressure monitoring (ABPM) (Fig. 2a) were completed during off-shift days across study periods 2-3 months apart (Fig. 1).
- Daily sleep diaries for each study period with self-reported time in bed (TIB) and time out of bed (TOB) were merged with actigraphy data (Fig. 2a,b).
- BP readings between a main TIB and TOB = nocturnal "sleep" time. All others (i.e. reported naps) = "wake" time. Number of days on-shift before ABPM and amount of nighttime sleep were noted.
- 48h averages for sleep and wake BP were used to calculate systolic (SBP) and diastolic (DBP) dipping percentages.
- Separate linear mixed model analyses (STATA 16) were run for 24h avg day and night SBP and DBP, and 48h avg SBP and DBP dipping. Study periods (24/48; 1/3/2/3) were included as a fixed effect, subjects were included as a random factor. Statistical significance was set at P <0.05.

Figure 2. ABPM and actigraphy data collection equipment and software.

2a. SpaceLabs Healthcare BP monitor and cuff, ActiGraph Watch (L to R).

2b. ActiGraph ActiLife sleep tracking software.



Results

Table 1. Participant Demographic Characteristics

n=20	(Mean or %)	n=20	(Mean or %)
Gender (female)	10.0%	Body mass index, kg/m^2	28.74 ± 3.51
Age group, y		Avg. weekly call volume	
25-34	20.0%	21-40	10.0%
35-44	50.0%	41-60	45.0%
45-54	30.0%	61-80	10.0%
		80+	35.0%

Figure 3. Representative data, single participant. Avg. sleep SBP was higher on 1/3/2/3. Light grey fill represents avg. sleep duration on 24/48; dark grey overlay represents 1/3/2/3. Avg. sleep duration was slightly longer on 1/3/2/3.

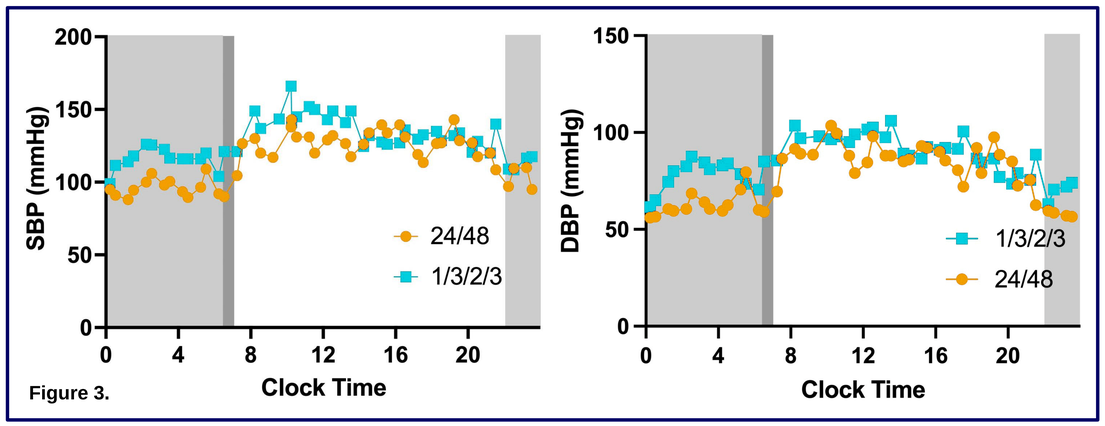


Figure 4. Average systolic blood pressure during sleep increased by 3.46 ± 1.18 mmHg (p<0.01) on 1/3/2/3 schedule. Wake SBP decreased by -1.87 ± 1.19 mmHg but was not significant (p=0.115). Changes in DBP during sleep and wake were also insignificant (1.29 ± 0.906; -1.36 ± 0.955 mmHg p≤0.153).

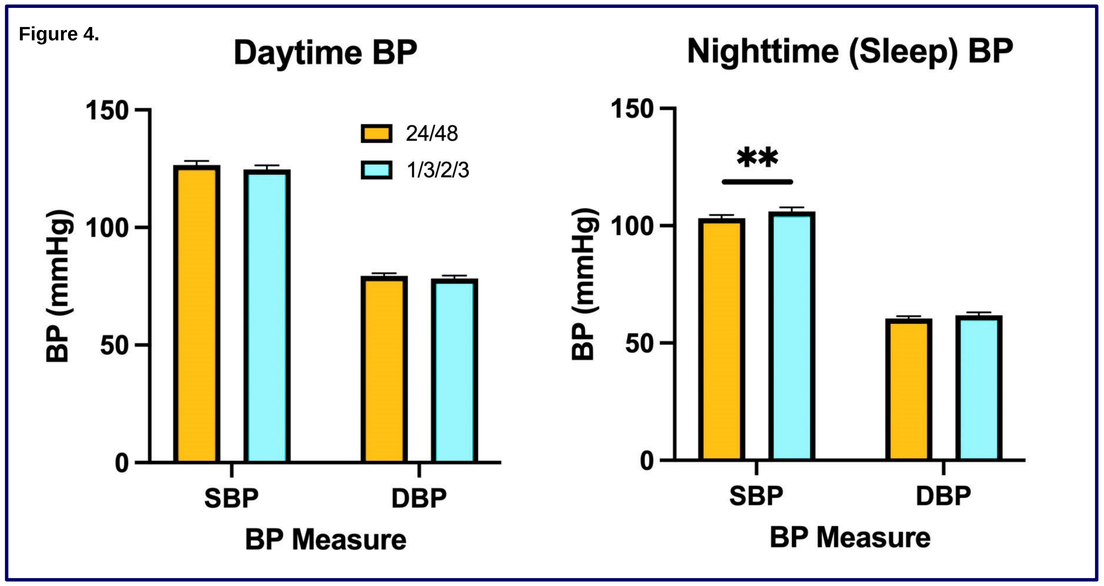
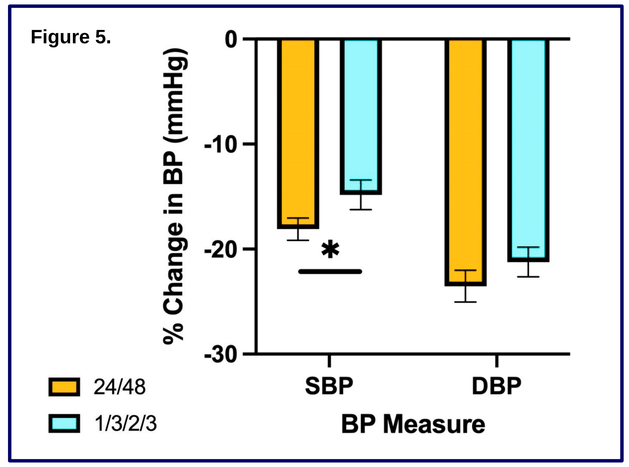


Figure 5. Overall SBP dipping decreased by 2.85 ±1.26 mmHg (p<0.05) on the 1/3/2/3 schedule in 15 participants with 48 hours of ABPM data. No other dipping changes were significant.



Conclusions

- The 1/3/2/3 schedule increased SBP and blunted systolic dipping during sleep post-shift relative to the 24/48 schedule.
- SBP during wake, DBP during wake/sleep and DBP dipping were not significant. Amount of nocturnal sleep and prior days on-shift were not significantly related to BP.
- We speculate that 1/3/2/3 might alter feature(s) of sleep (i.e. efficiency, accumulated sleep, etc.) which may mediate this association between schedule and sleep SBP[7,8].
- The remaining sample from the parent study will be analyzed to replicate these findings and to examine the mediating role of accumulated sleep on- and off-shift prior to recordings.

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