**Short sleep duration, late sleep timing, and late eating timing:**

**A trilogy of behavioral risk factors for high morning blood pressure?**

Elissa K. Hoopes,1 Melissa A. Witman,1 Michele N. D’Agata,1 Talia Brookstein-Burke,1

David G. Edwards,1 Shannon M. Robson,1 Susan K. Malone, and 2 Namni Goel.3

*1University of Delaware, Newark, DE*

*2New York University, New York, NY*

*3Rush University Medical Center, Chicago, IL*

**INTRODUCTION:** Short sleep (<7h/night) increases cardiovascular disease (CVD) risk. Not clear is if delayed timing of sleep or eating amplifies this risk. We tested whether adults with short sleep + late behavior timing would have the highest blood pressure (BP) vs. those with one (short sleep-OR-late timing) or no risk behaviors (adequate sleep + early timing).

**METHODS:** Over 14 days, N=30 adults (28±7y, 43% male, BP 114±10/70±7 mmHg) wore wrist accelerometers to assess sleep (duration, onset timing). Concurrently, timing of eating onset (first caloric intake after awakening) and offset (last caloric intake before sleep) were determined using image-assisted diet records. Morning systolic (SBP) and diastolic BP (DBP) were obtained. Regression models of SBP and DBP tested associations with sleep onset, eating onset, and eating offset. Sleep duration (<7 vs. ≥7h) and behavior timing metrics (median split) were dichotomized, and ANOVAs compared BP between sleep duration + behavior timing groups.

**RESULTS:** In adjusted models, later sleep onset associated with higher SBP (B=3.0±1.3 mmHg/h, *p*=0.03) and DBP (B=2.5±0.9 mmHg/h, *p*=0.01). Later eating onset associated with higher DBP (B=2.1±0.9 mmHg/h, *p*=0.03), and later offset with higher SBP (B=4.1±1.4 mmHg/h, *p*<0.01) and DBP (B=3.3±1.0 mmHg/h, *p*<0.01). Participants with short sleep + late eating offset exhibited higher DBP vs. adequate sleep + early eating (75±7 vs. 67±7*, p*=0.03), and tended to exhibit higher SBP and DBP vs. short sleep-OR-late eating (both *p*=0.07).

**CONCLUSION:** These data indicate later sleep and eating timing, especially in the setting of short sleep, exemplifies a chrono-behavioral phenotype of CVD risk.

Word Count: 250/250 words