

MOTORCOACH DRIVERS' DUTY START TIME AFFECTS PRE-DUTY SLEEP AND FATIGUE

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Motorcoach Operations

- Scheduled
 - Regular route
 - Commuter express
- On-Demand
 - Tour
 - Charter



US Hours-of-Service Regulations

- 10-15 hours on-duty
- Maximum of 10 hours driving
- Minimum of 8 hours off-duty

Measures

- Sleep (diary and actigraphy)
- Diary
 - Work and off-duty periods
 - Self report
 - Karolinska Sleepiness Scale
 - Samn-Perelli Fatigue
- Performance on the PVT

Analyses

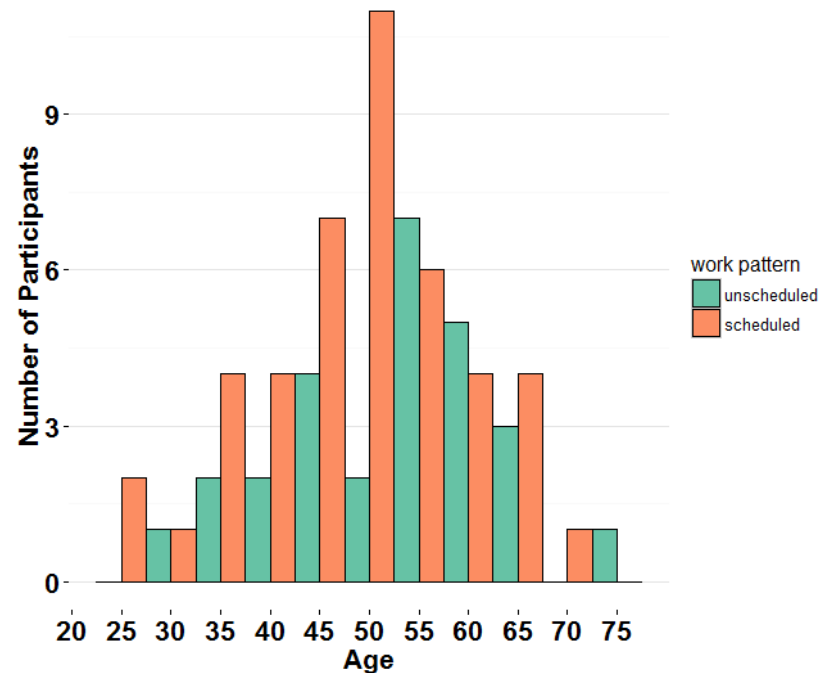
- Shift start time (binned)
- Pre-duty sleep duration summed over 24 hours
- Time awake calculated as duration since last actigraphy wake time

- Descriptive analyses
- Linear mixed-effects models for pre-work measures
 - 3x separate models
 - Random intercept for participant
 - Predictive variables
 - Shift start time (binned)
 - Pre-duty sleep duration
 - Time awake

RESULTS

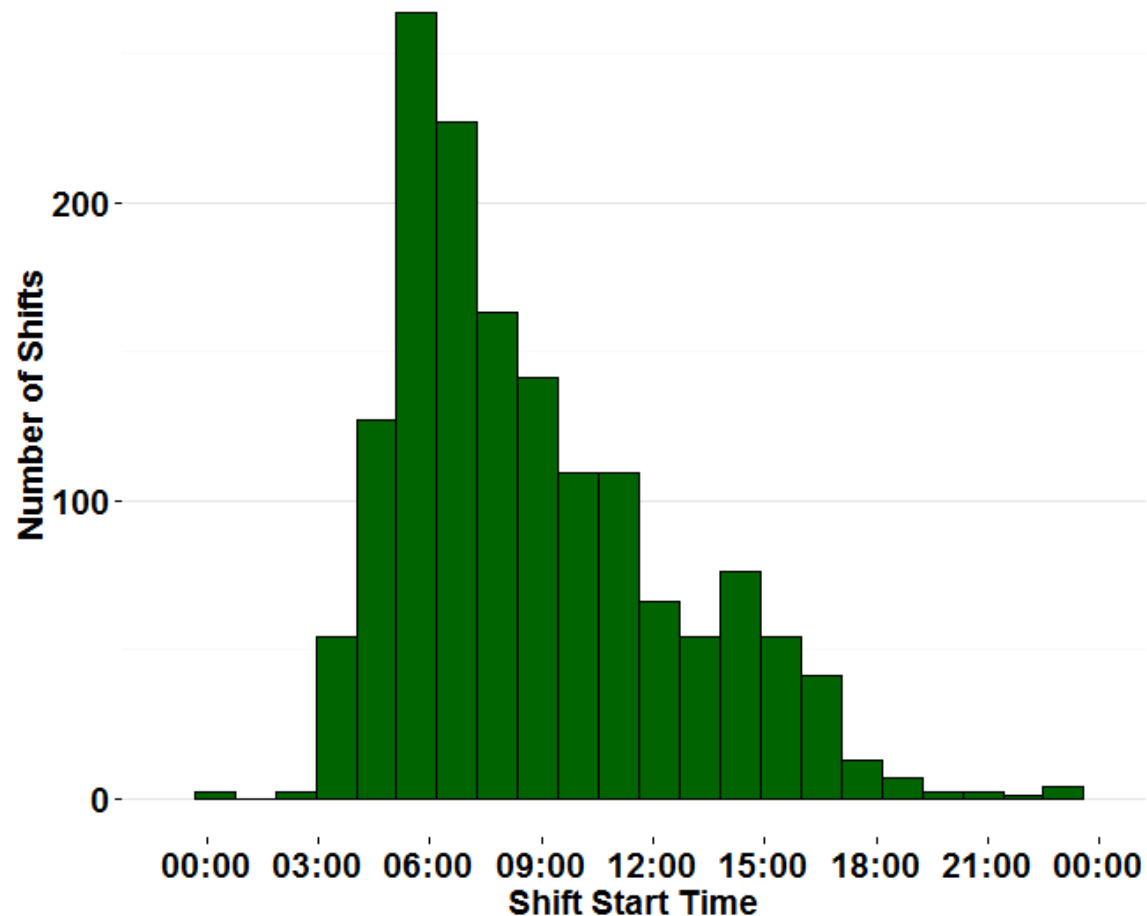
Participants

- N = 78 drivers included
- Studied for an average of 30 days each (range 9-30 days)
- Age $\bar{x} = 50$ (± 10) years
- 75% male
- 62% scheduled route drivers



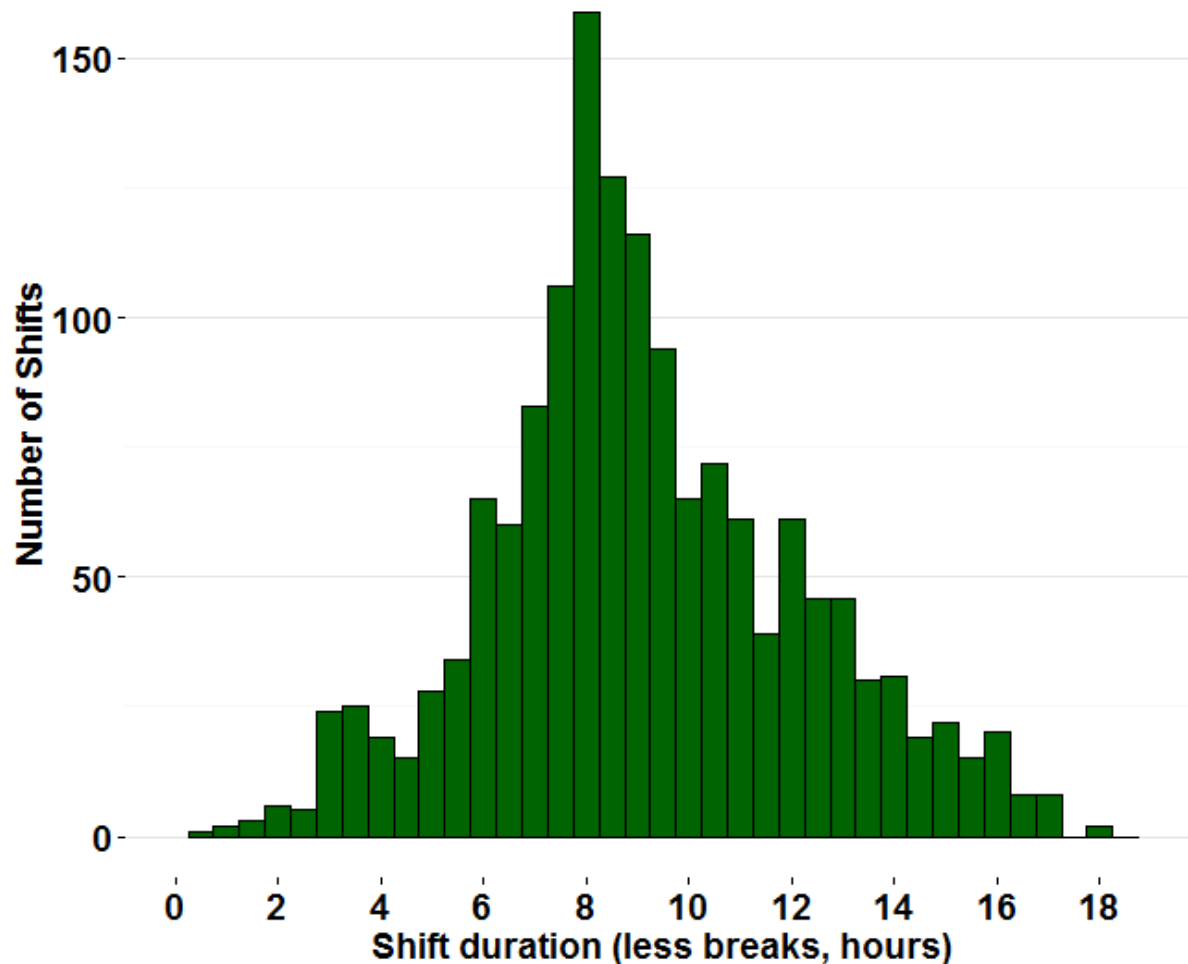
Duty Start Times

- Shifts tended to start in the morning (average start time = 08:15 ± 00:56)



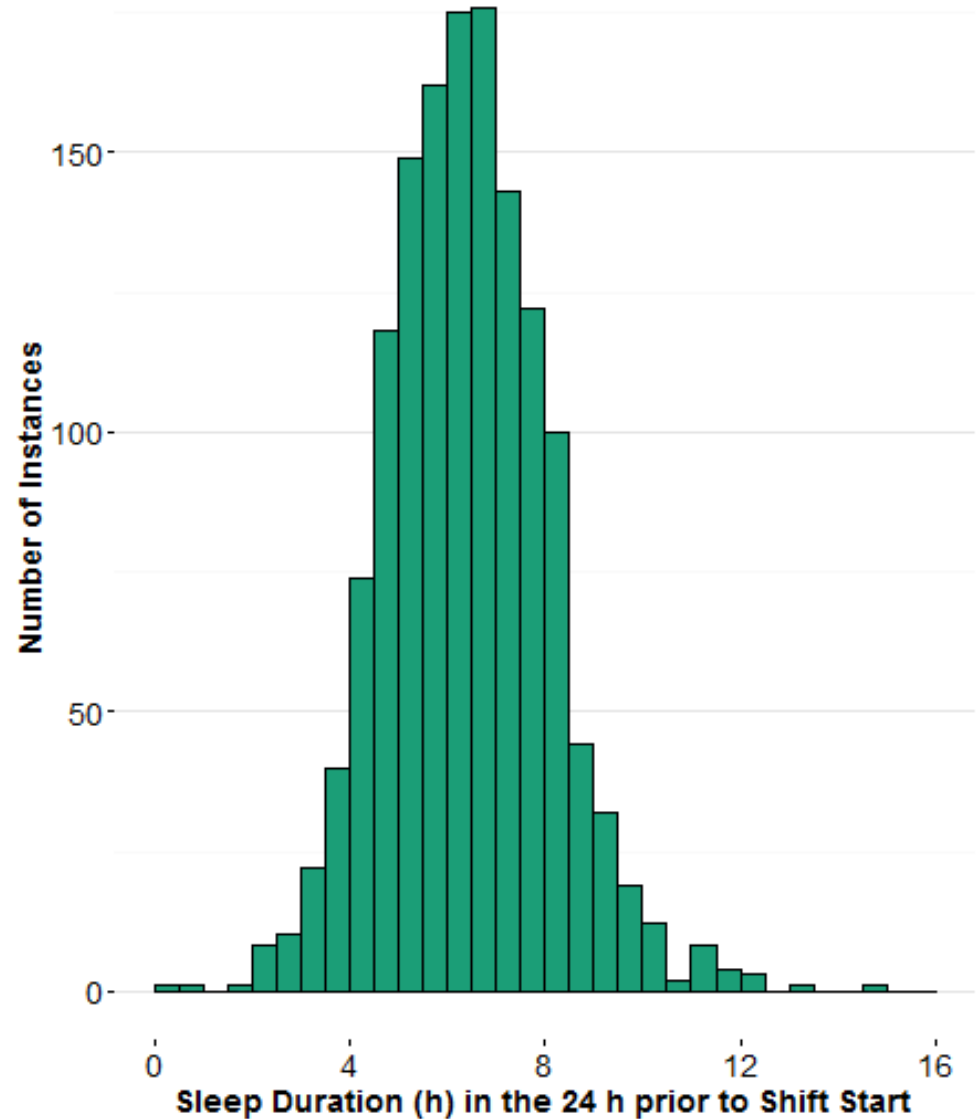
Duty Duration

- Work shifts were on average 9.2 (± 3.0) hours long



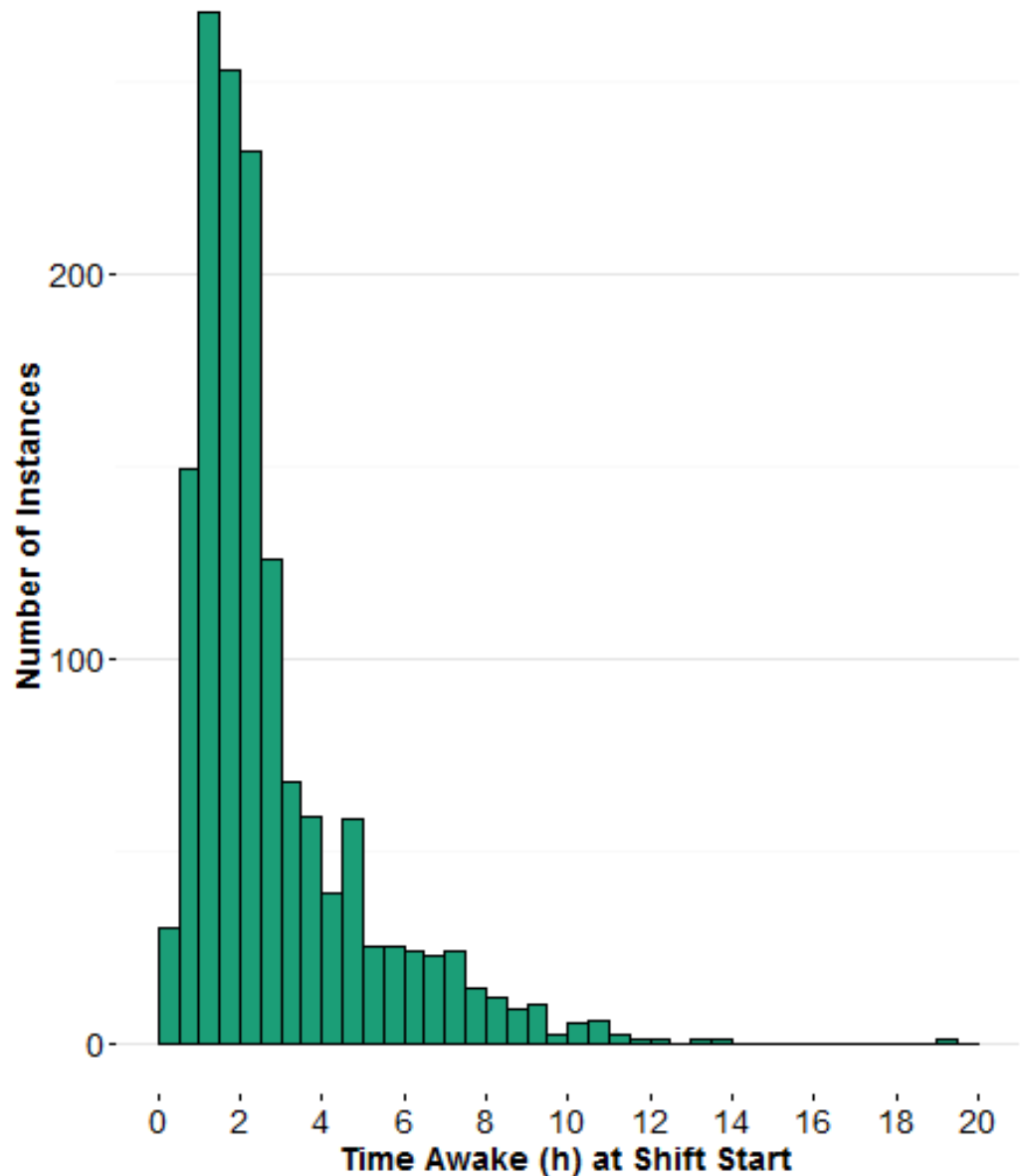
Sleep Duration

- mean 6.4 (± 1.6) hours sleep in the 24-hours prior to duty start

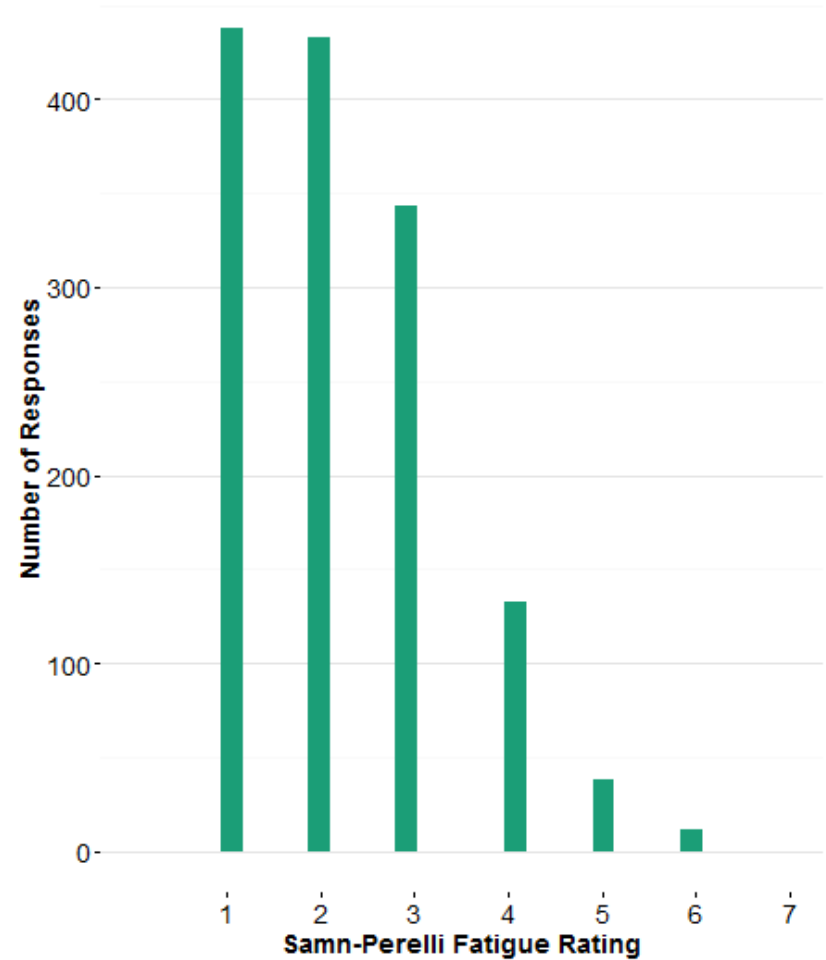
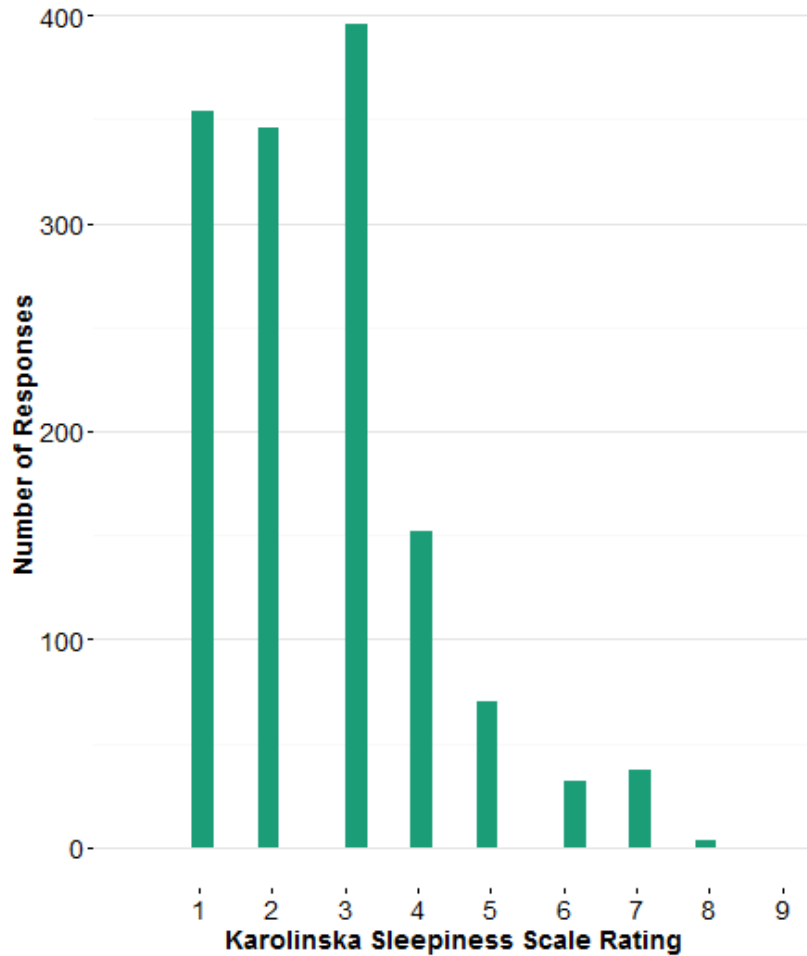


Time Awake

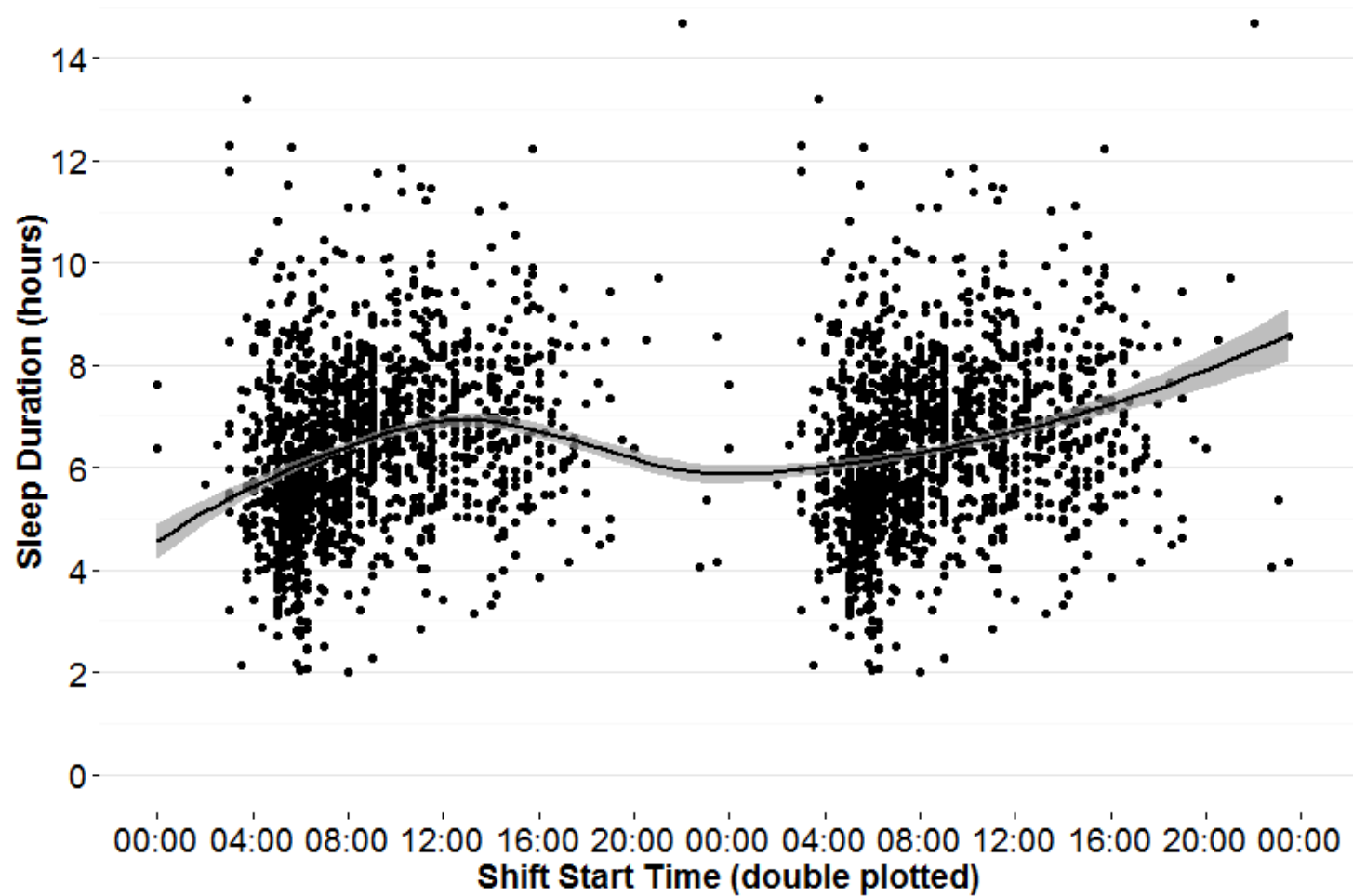
- 2.7 ± 2.1
hours prior to
duty start



Subjective Ratings



Sleep Duration by Duty Start Time



Subjective Rating Models

- KSS and SP were predicted by shift start time and total sleep time in the 24 hours prior to shift start.
- Neither KSS or SP was predicted by time awake at shift start.

Limitations

- Most shifts began in the morning and ended in the early evening
 - limiting observation of shifts around the clock
- Unable to discern whether HOS regulations were complied with
 - driving was not logged separately from other work duties

Conclusions

- Drivers' average 24-hour sleep duration consistent with truck drivers, below recommendations
- Sleep duration influenced by shift start time (circadian factor)
- Participants did not generally report excessive levels of sleepiness or fatigue at the start of duty
- Subjective ratings worse with less sleep, night work

- **Timing of off-duty periods influences sleep and subjective ratings**
- **Off-duty duration is not the only important factor in hours-of-service regulations**

Acknowledgments

- Thanks to the driver participants
- RAs Jack Hodges and Jennifer Zaslona (Surrey)
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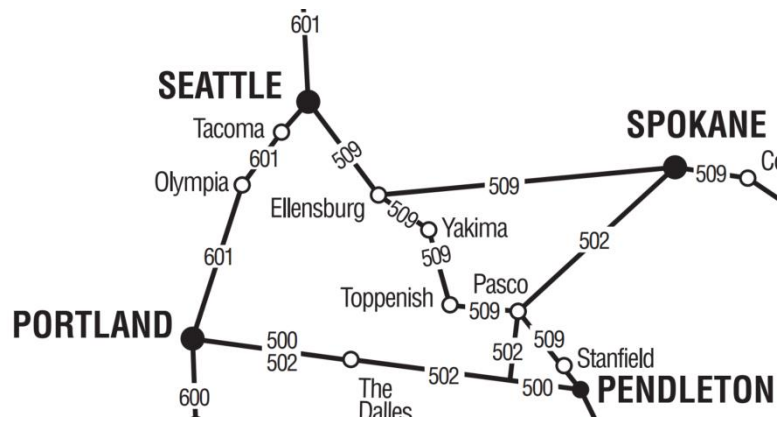
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Scheduled Routes

Regular Route

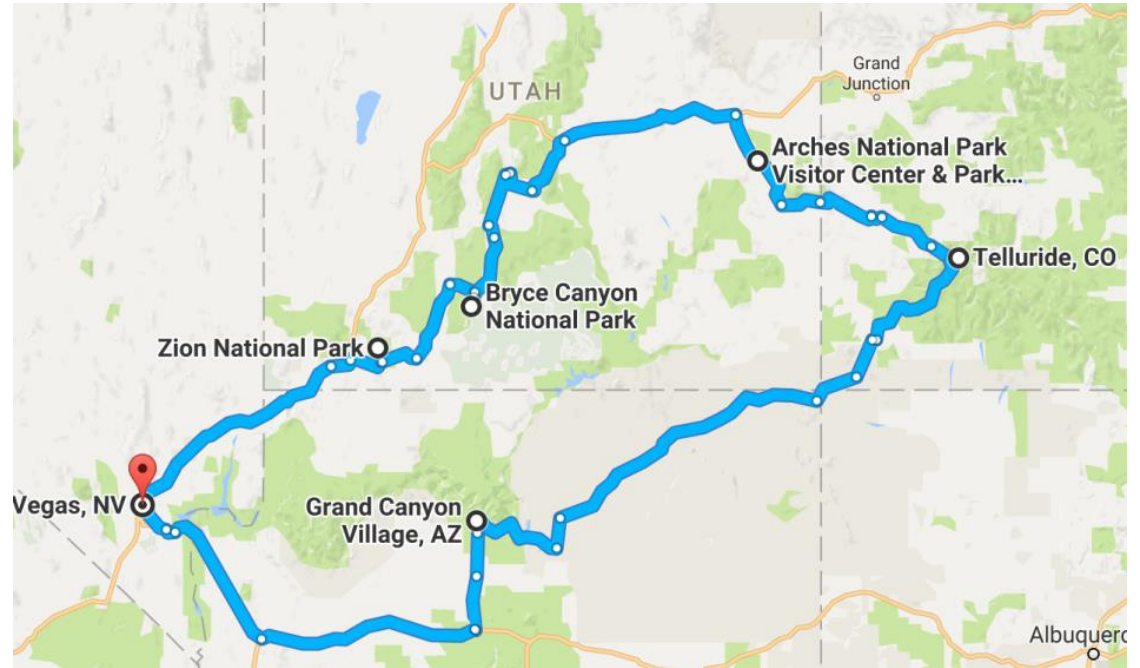


Commuter Express

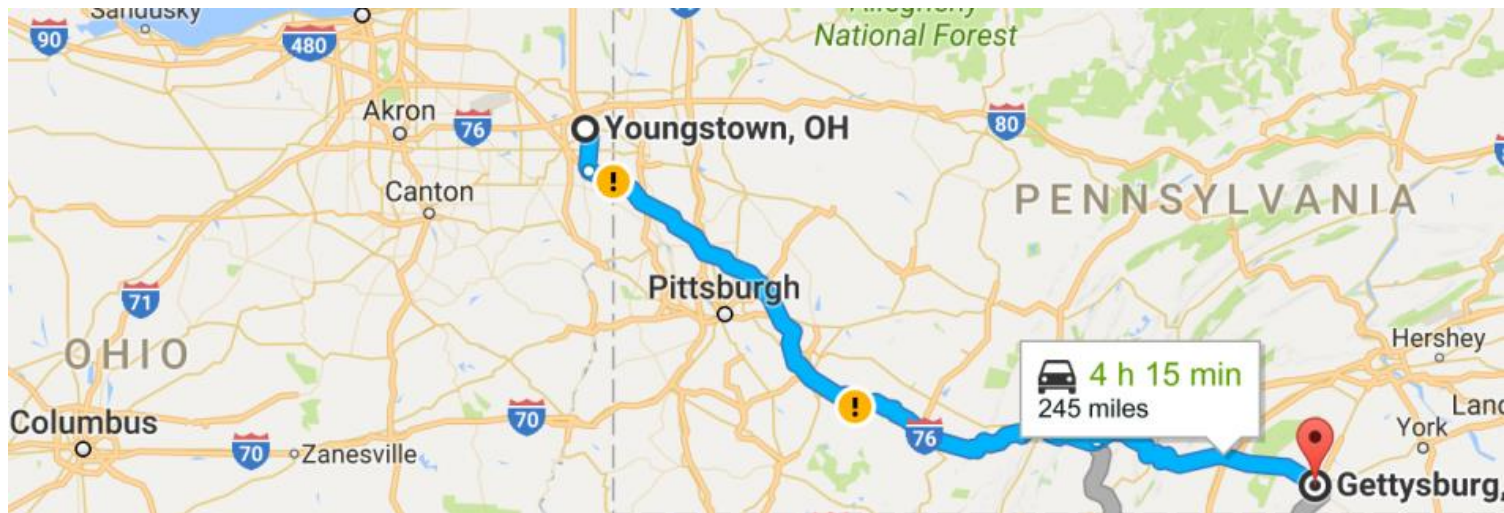
SYLMAR/LAKE VIEW TERRACE/SUNLAND/TUJUNGA/MONTROSE/E. GLENDALE



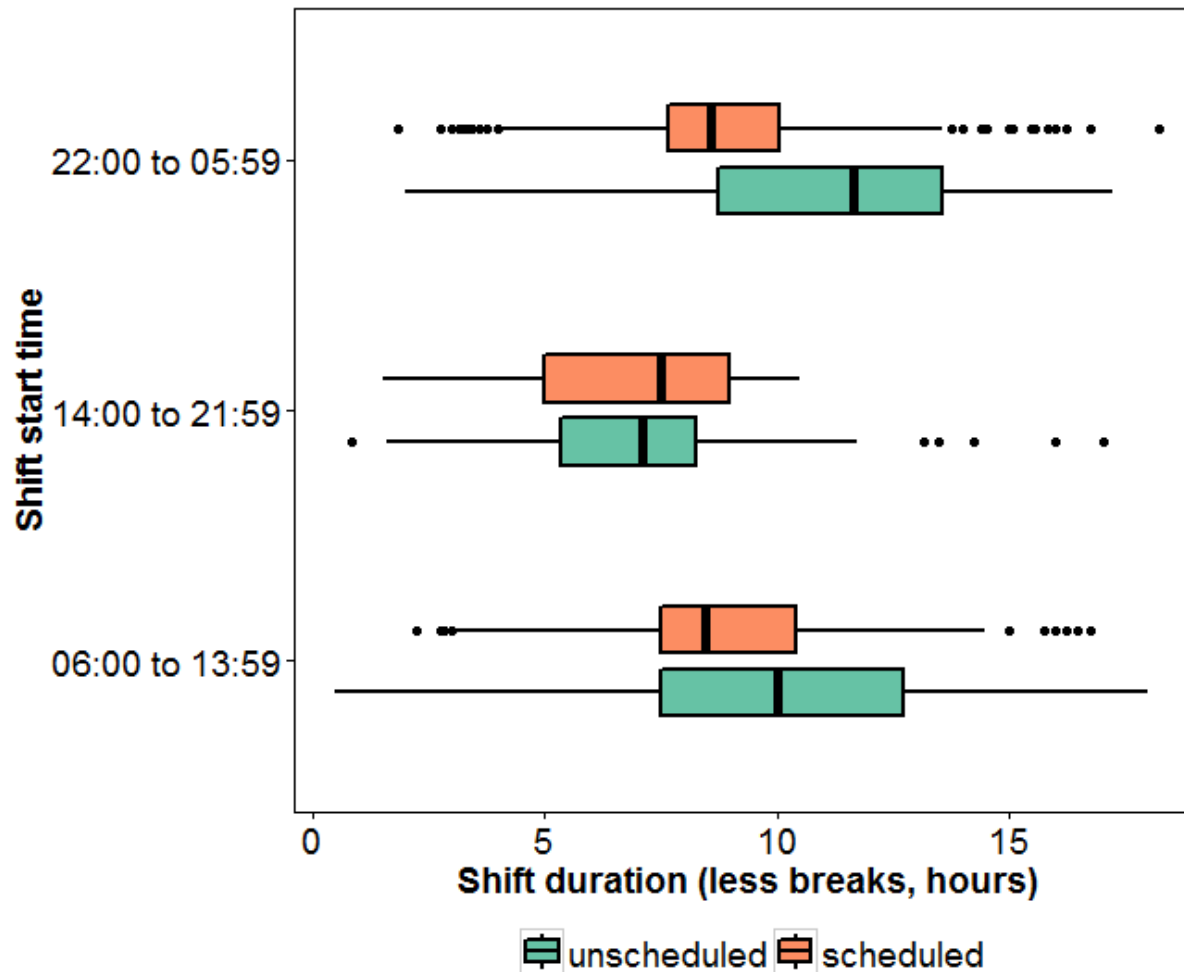
Tour



Charter

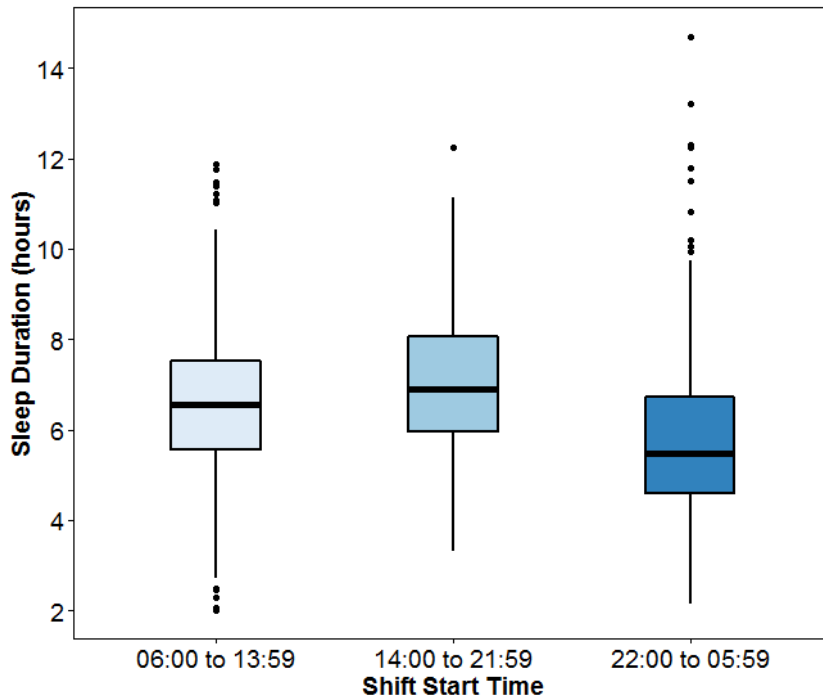


Duty Duration



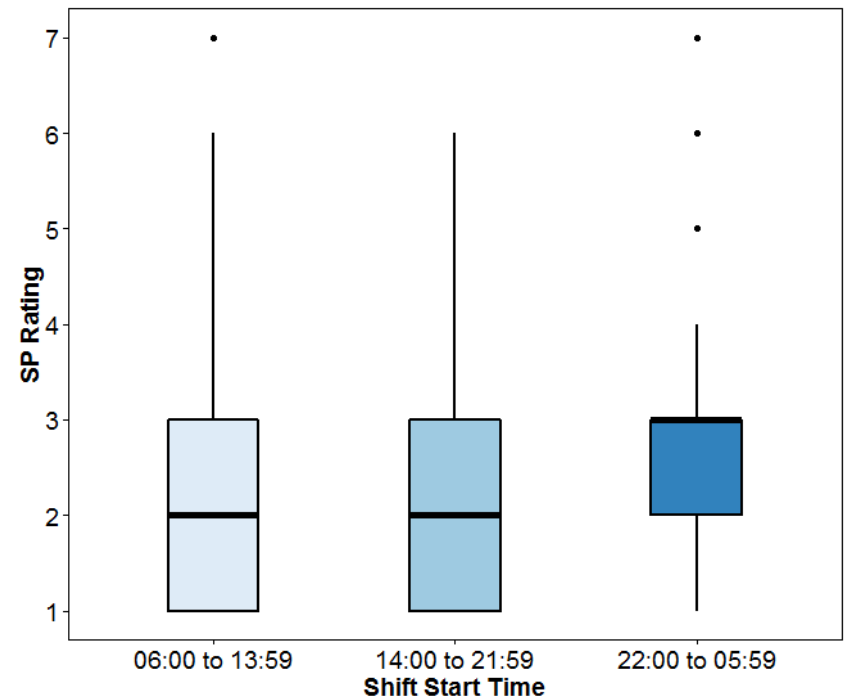
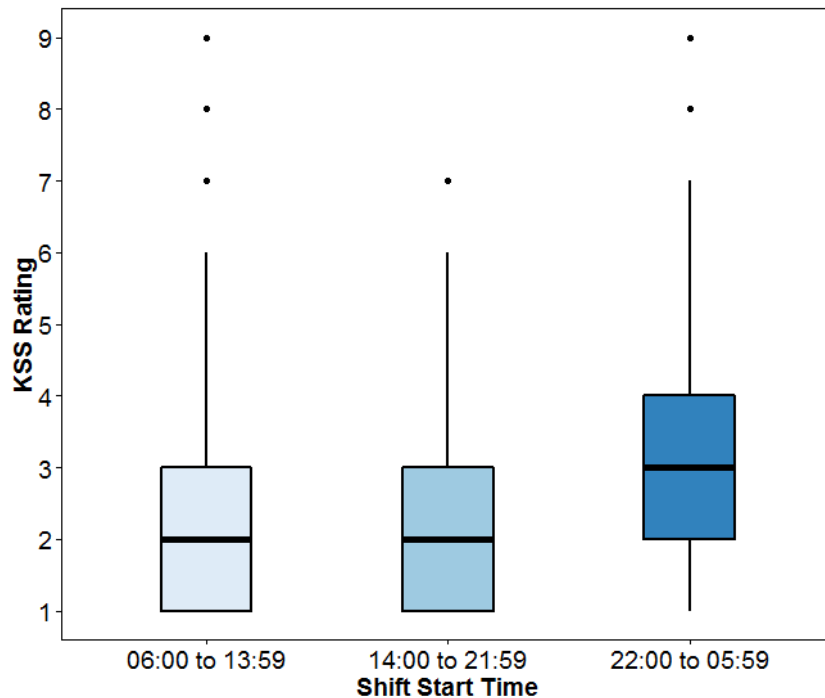
Sleep Duration by Duty Start Time

Participants slept less prior to shifts that started in the night/early morning relative to those that started in the morning or afternoon



Shift Start Time	Estimate (hours)	SE
06:00 to 13:59	6.43	0.11
14:00 to 21:59	6.66	0.15
22:00 to 05:59	6.09	0.14

Subjective Ratings by Duty Start Time



Off-Duty Periods

