

Background

- Southeast Florida's subtropical climate exposes workers to extreme heat, which can cause various symptoms of heat related illness (HRI).
- HRI include heat rashes, heat cramps, heat exhaustion, and heat stroke
- Work productivity is a casualty of heat stress but not much research is available on how heat exposure can affect a worker's after-work productivity.
- Occupational heat exposure can commonly result in HRI symptoms, which workers may have to recover from at home.
- Extreme occupational heat exposure may be affecting a worker's personal life

Purpose of the Study

- The purpose of this study is to look at the relationship between heat exposure on environmental service workers in South Florida and their productivity, social interactions, and emotional well-being after work.
 - Determine daily heat (WBGT) index, workload, and HRI symptoms of participants
 - Assess participant's after-work productivity, mood, and social capacity
 - Determine if there is a correlation
- Hypothesis: Environmental service workers who are exposed to high heat stress, as indicative of high WBGT index and heavy workload, will not accomplish their daily personal after-work tasks, and will exhibit low social interactions, and poor emotional well-being.

Significance of the Study

- 2023 was the hottest summer ever recorded in history.
- Implications of extreme heat exposure on a worker's personal life is not well understood.
 - Current research is limited to countries outside of the US.
- Data can shed light on whether the effects of heat stress and HRI can extend well into a worker's personal life.
 - After-work productivity includes tasks such as house chores, exercise, social gatherings, and child obligations
 - A worker's mood and social capacity can help determine their emotional and social well-being

Materials and Methods

- 11 participants were recruited from a South Florida environmental services company (Triumvirate Environmental).
- Survey administration occurred over a period of 30 days and collected self-reported data on:
 - Symptoms of HRI, quantity of planned after-work goals/tasks, quantity of completed after-work goals, rating of mood before and after each shift.
 - Rating of social capacity after work, rating of sleep quality, level of perceived workload, and quantity of hours worked.
- Kestrel 5400 Heat Stress Tracker logged the WBGT index every 20 minutes
 - The hourly WBGT mean was compared to the ACGIH TLVs of 31°C for light workload, 29°C for moderate workload and 27.5°C for heavy workload, with the assumption of a work-rest regimen of 50 to 75% (ACGIH, 2022)
- Correlation was determined using Pearson correlation test.

Results

- The highest WBGT reading occurred on February 12th reaching an average hourly high of 33° C ± 1.2 °C at noon.
- There were four days during the study (01/31, 02/12, 02/14, and 02/16) where most participants had to deal with a heavy workload.
- On 02/12 participant's were exposed to a high hourly WBGT reading of 33 ± 0.8 °C and heavy workload.
 - 36.4% (n=4) of the participants reported symptoms of HRI on this day
- Week 6 (March 4-8) contained the most hourly WBGT exceedances of the ACGIH TLV of 29°C.
 - Participants reported HRI symptoms including thirst, heavy sweating, muscle cramps, and headache
- Most days during this study consisted of a low WBGT index
- All-time high daily WBGT average occurred on 02/12, reaching 30.4 ± 3.1 °C/ heavy workload
 - 5 instances of HRI symptoms including nausea, muscle cramps/ pain, weakness, and elevated body temperature
 - The after-work productivity was 71%, average mood rating was 2.8 ± 0.8, average social capacity rating was 2.7 ± 0.7, average sleep quality rating was 3.4 ± 1.1.
- 2nd highest daily WBGT average occurred on 03/08, reaching 30.6 ± 2.7°C/ moderate workload
 - 3 instances of HRI symptoms including thirst and muscle cramps/ pain
 - The after-work productivity was 73%, average mood rating was 3.9 ± 0.7, average social capacity rating was 3.7 ± 0.5, average sleep quality rating was 3.6 ± 1.3
- The correlation between the daily average WBGT and after-work productivity (r= -0.34, n=29) was not statistically significant (P=0.07)

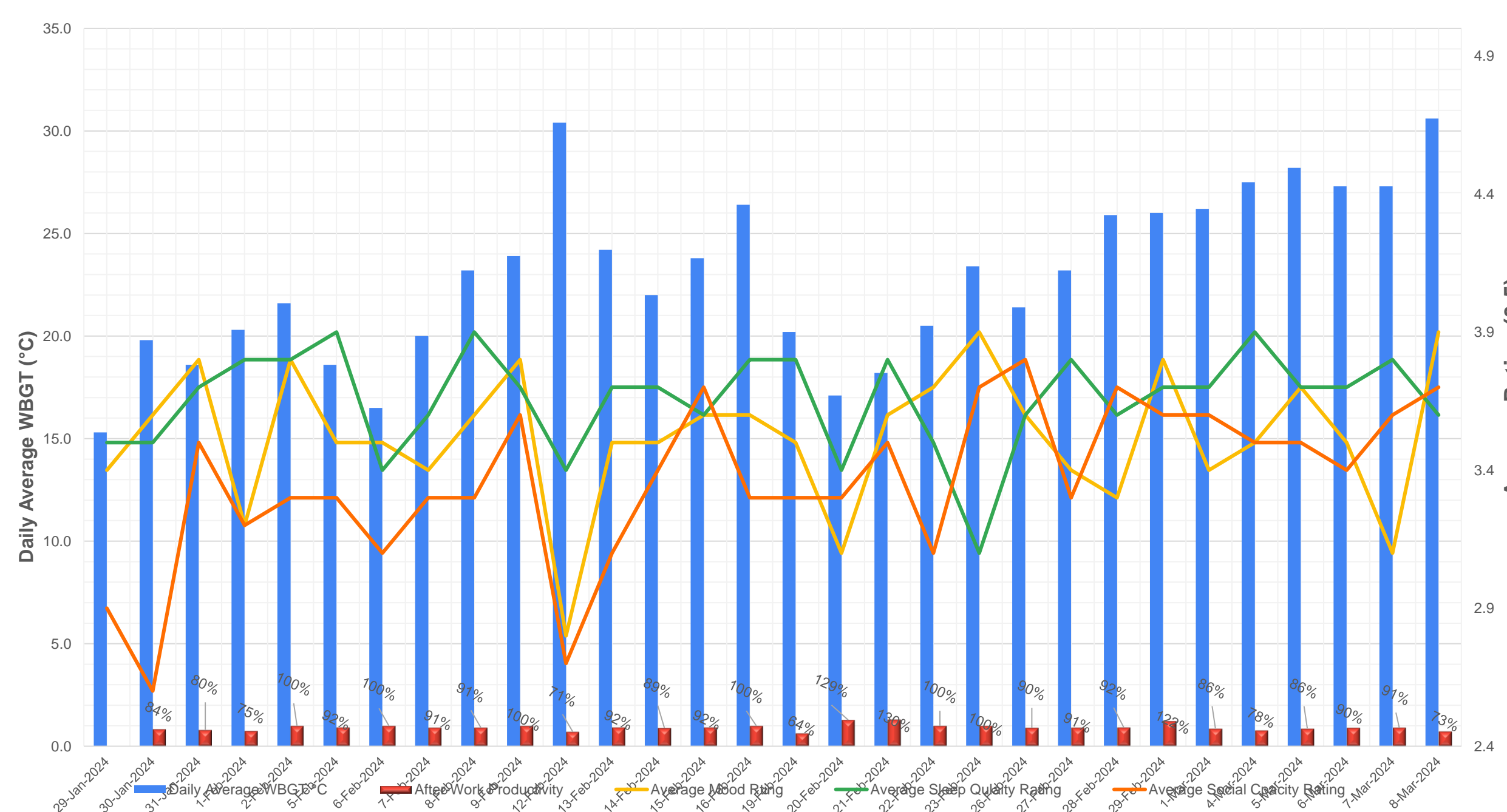


Figure 1. Daily Averages for WBGT, Percentage of After-work Productivity and Ratings for Mood, Quality of Sleep, & Social Capacity by Monitoring Day (Mohansingh, 2024, p.46)

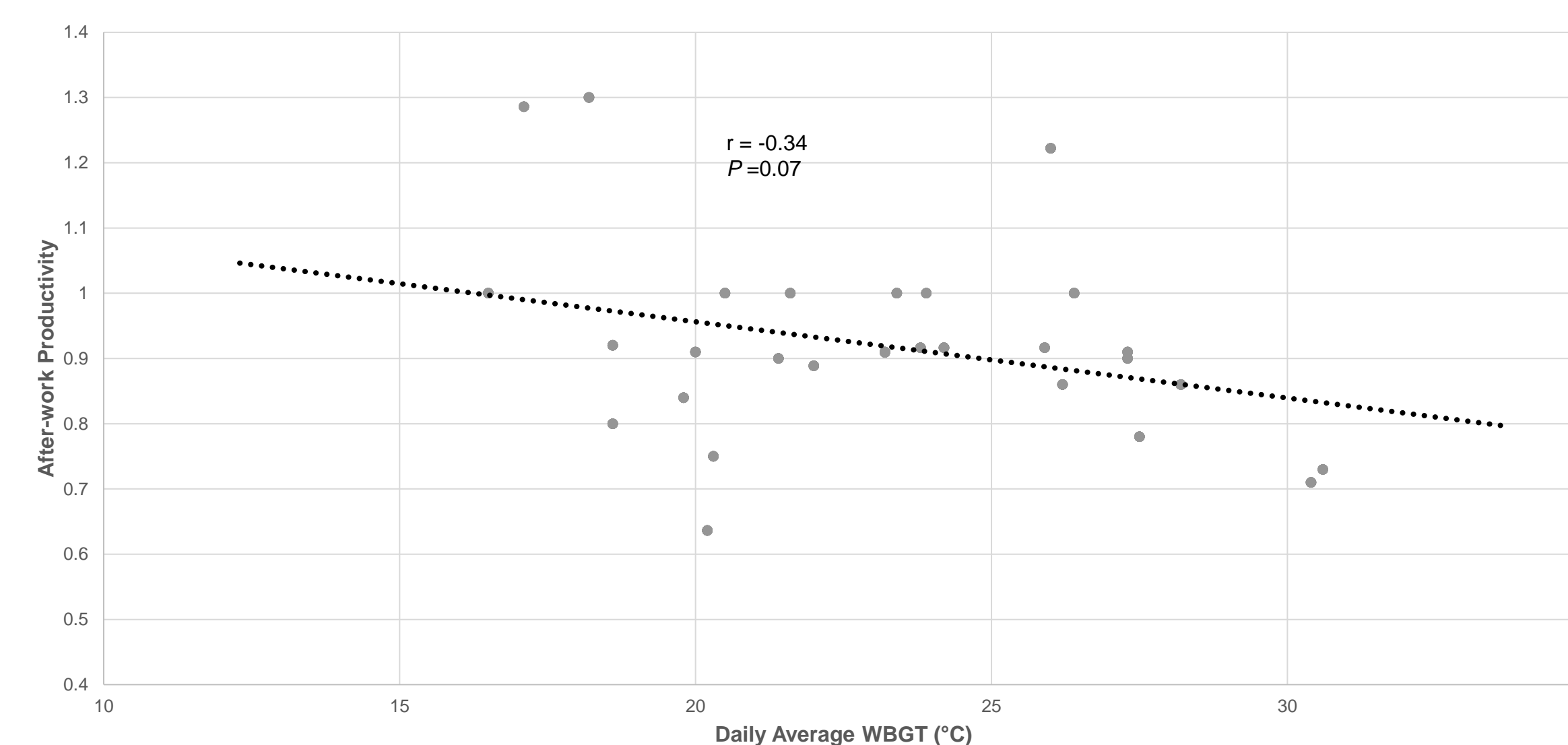


Figure 2. Correlation between Daily Average WBGT Index and Percentage of After-work Productivity (Mohansingh, 2024, p.47)

Results (cont'd)

- All-time low daily WBGT average occurred on 01/29, reaching 15.3 ± 0.7 °C
 - 6 instances of HRI symptoms including muscle cramps/ pain, thirst, and irritability
 - The average mood rating was 3.4 ± 0.7, the average quality of sleep rating was 3.5 ± 1.0, and the average social capacity rating was 2.9 ± 1.1
- 2nd lowest daily WBGT average occurred on 02/06, reaching 16.5 ± 2.4 °C/ moderate workload
 - The after-work productivity was 100%, average mood rating was 3.5 ± 0.8, average social capacity rating was 3.1 ± 0.9, average sleep quality rating was 3.4 ± 0.7

Discussion Highlights

- There are many other factors that can affect a worker's social/ emotional well-being and after-work productivity
- Only 2 out of the 30 days had a daily average WBGT index where participants were exposed to heat levels that exceed the ACGIH TLV
 - 2 days of extreme heat exposure cannot provide sufficient information about after-work productivity and social/ emotional well-being
- 02/12 had the 2nd lowest after-work productivity and the all-time lowest average social capacity rating
- 03/08 had the 3rd lowest after-work productivity
- Week 6 is the only week where participants did not complete 100% of their after-work goals/ tasks
- Study is limited by the lack of high WBGT data collected (study occurred in winter)

Conclusion

- A worker's emotional and social well-being can be very situational
- No consistent data to show a correlation between exposure to a high heat stress and a worker's low mood/ social capacity, or sleep quality
 - A heavy workload may play a bigger factor in this
- More consistent data collection during the summer season in Florida is needed to draw a conclusion between after-work productivity and occupational heat exposure
- It is recommended that this study be conducted during the summer season in Florida
- Heat-related illness prevention plan is the best way to minimize occupational heat stress

References

- American Conference of Governmental Industrial Hygienists (ACGIH). (2022). Heat stress and strain. In: 2022 TLVs® and BEIs®. Cincinnati, OH: ACGIH Signature Publications; p. 229-246.
- Mohansingh, R. (2024) *Assessing the Effects of Occupational Heat Stress on the After-Work Productivity, Social Interactions and Emotional Well-Being of Environmental Service Workers* [Professional Paper, East Carolina University].