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Measuring Fatigue and Sleepiness in Collegiate Aviation Pilots

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MEASURING FATIGUE AND SLEEPINESS IN COLLEGIATE AVIATION PILOTS

2020 NTAS CONFERENCE
DAYTONA BEACH, FLORIDA

AUTHORS

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WHAT TO EXPECT

- **Introduction**
- **Methodology**
- **Preliminary Results**
- **Next Steps**

INTRODUCTION

- A query using the National Transportation Safety Board (NTSB) database yielded 36 accidents involving Code of Federal Regulation Part 91, general aviation operators, from January 2000 through December of 2017, in which pilot fatigue was a contributing factor.
- Most research studies have focused on fatigue identification and management within the commercial and/or military aviation environments (Caldwell et al., 2009; Gawron, 2016; Sieberichs & Kluge, 2016).
- However, collegiate aviation may be the most challenging in terms of fatigue mitigation. Flight instructors and students often have schedules which may increase the risks for fatigue.

TOP CAUSES FOR FATIGUE FOR COLLEGIATE AVIATION PILOTS

MCDALE & MA (2008)

- **Intensive workload and/or long workday**
- **Reduced rest**
- **Boredom**
- **Scheduling**
- **Poor quality of sleep**

MENDONCA, F., KELLER, &LU. C. (2019)

- **Intensive workload and/or long workday**
- **Not enough sleep**
- **Poor quality of sleep**
- **Academic activities**
- **Poor scheduling of flight lessons**

METHODOLOGY FOR UNDERSTANDING CIRCADIAN RHYTHMS

- What is the self reported fatigue and sleepiness patterns of our sample population?
- Is there a significant difference between sleepiness/fatigue levels and time of day as well as by day?
- Thirty-two participants
- Collected demographic data
- Four weeks of data collection (3 weeks reported)
- Asked participants to record their responses (8a, 12p, 4p, and 9p) M-SU
- KSS and Samn-Parelli Scales
- Compensated

SCALES USED

Karolinska Sleepiness Scale (KSS)

1= Extremely alert

2 = Very alert

3 = Alert

4 = Rather alert

5 = Neither alert nor sleepy

6 = Some sign of sleepiness

7 = Sleepy, but no effort to keep awake

8 = Sleepy, but some effort to keep awake

9 = Very sleepy, great effort to keep awake, fighting sleep

10 = Extremely sleepy, can't keep awake

Samn-Perelli Scale (SPS)

1 = fully alert, wide awake

2 = very lively, responsive, but not at peak

3 = okay, somewhat fresh

4 = a little tired, less than fresh

5 = moderately tired, let down

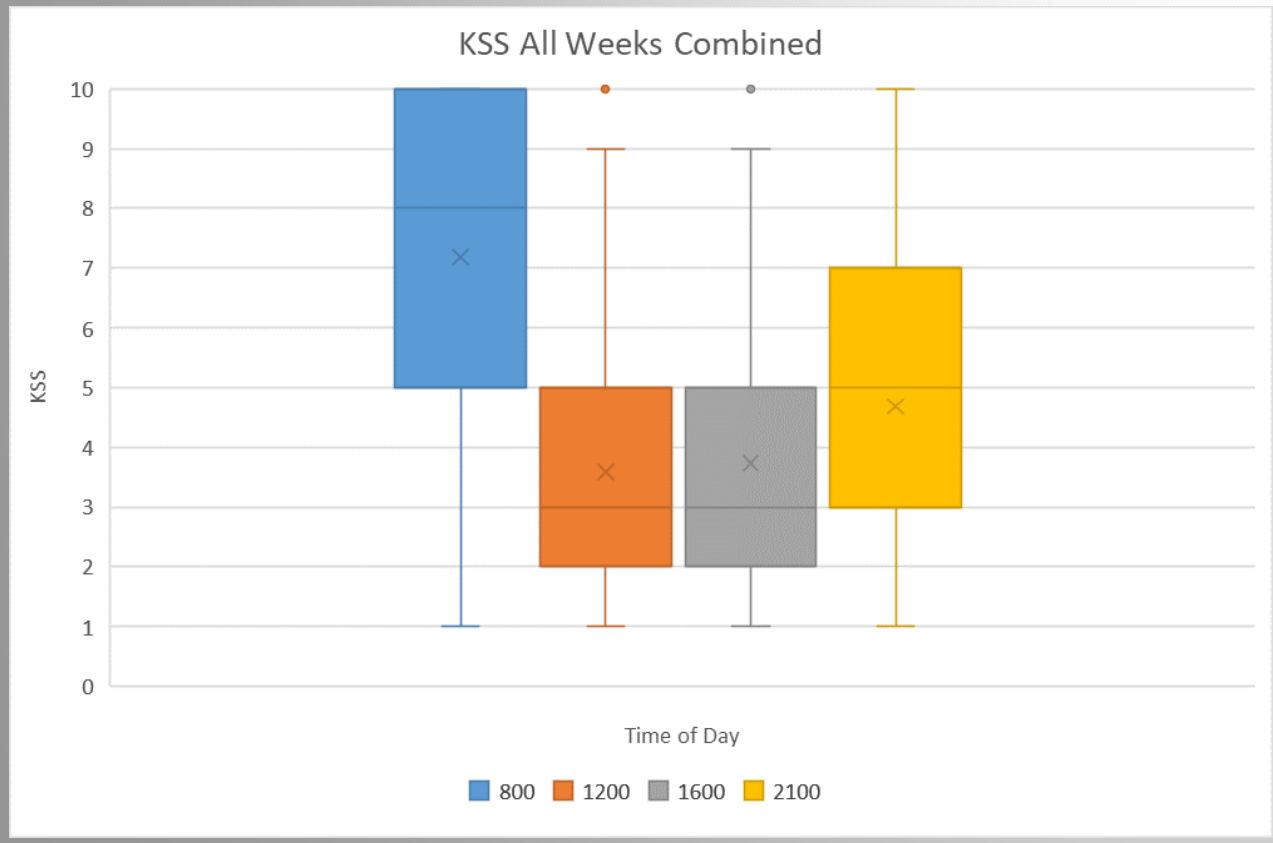
6 = extremely tired, very difficult to concentrate

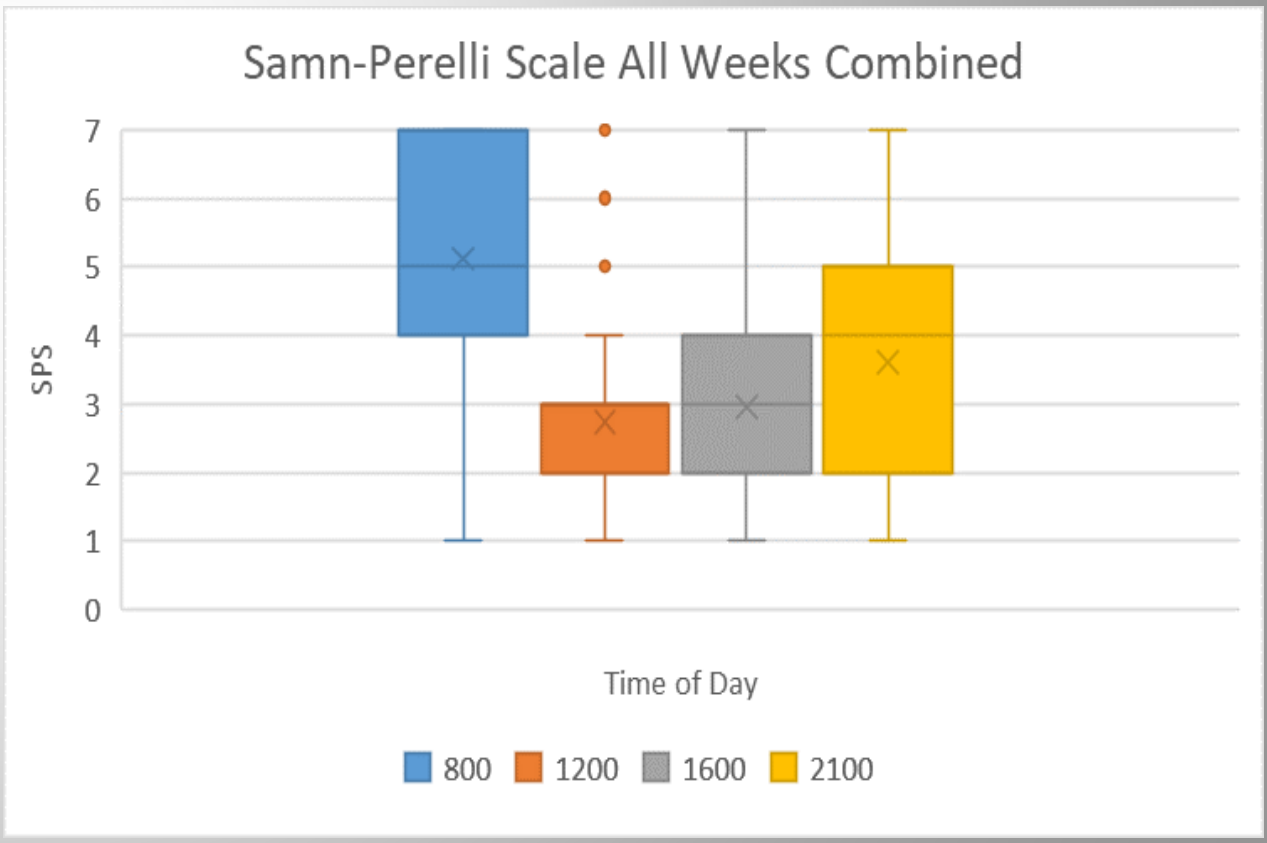
7 = completely exhausted, unable to function effectively

PRELIMINARY RESULTS

Age: (**18-20 = 81%),** (21-25 = 13%), and (26-35 = 6%)
Sex: (**M = 91%),** (F = 9%)
Enrollment Status: (Freshman = 28%), (**Sophomore = 34%),** (Junior = 22%), (Senior = 13%), (Graduate = 3%)
Certificates/Ratings: (Student = 25%), (**Private = 47%),** (Commercial = 3%), (Instrument = 13%), (Multi = 3%), (CFI = 3%), (CFII = 6%)
Total Hours: (<100 = 25%), (**101-200 = 43%),** (201-400 = 25%), (401-1000 = 7%)

n=32





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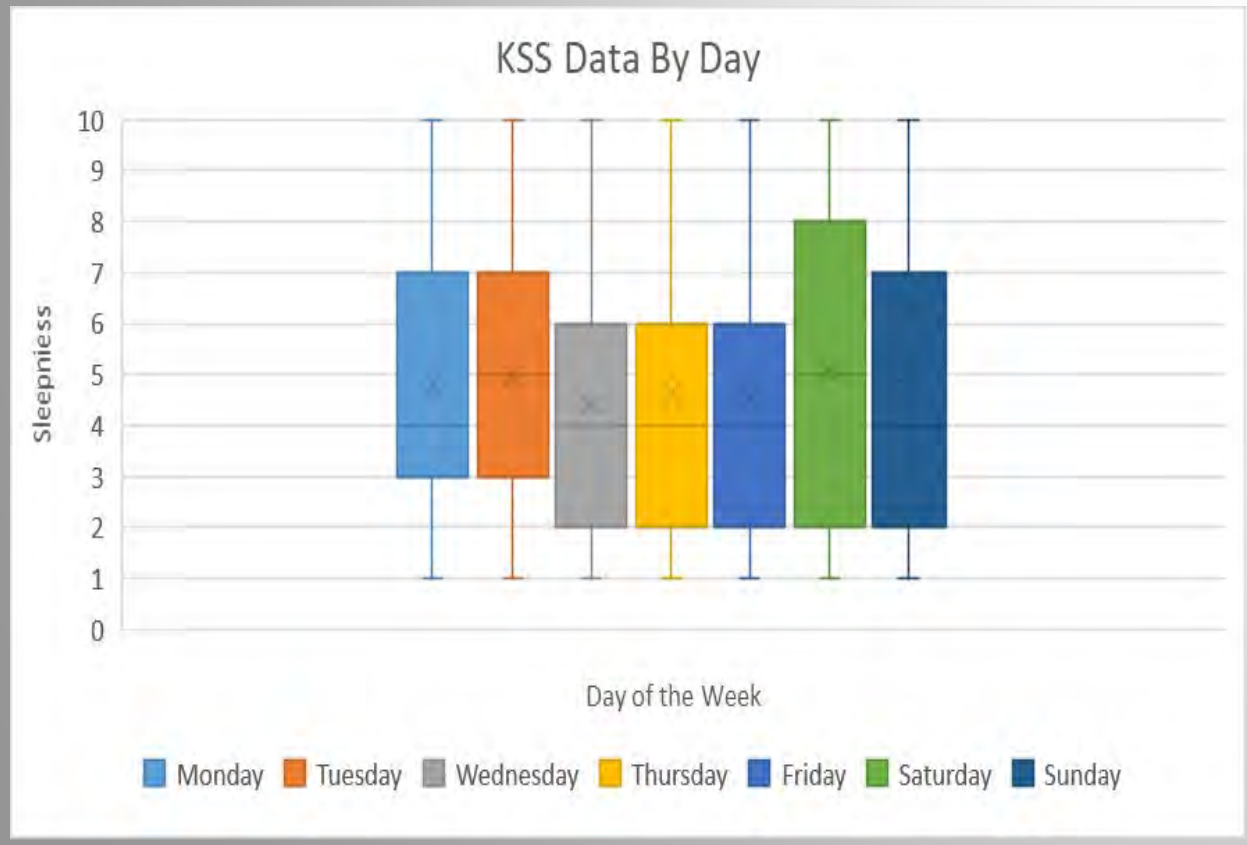
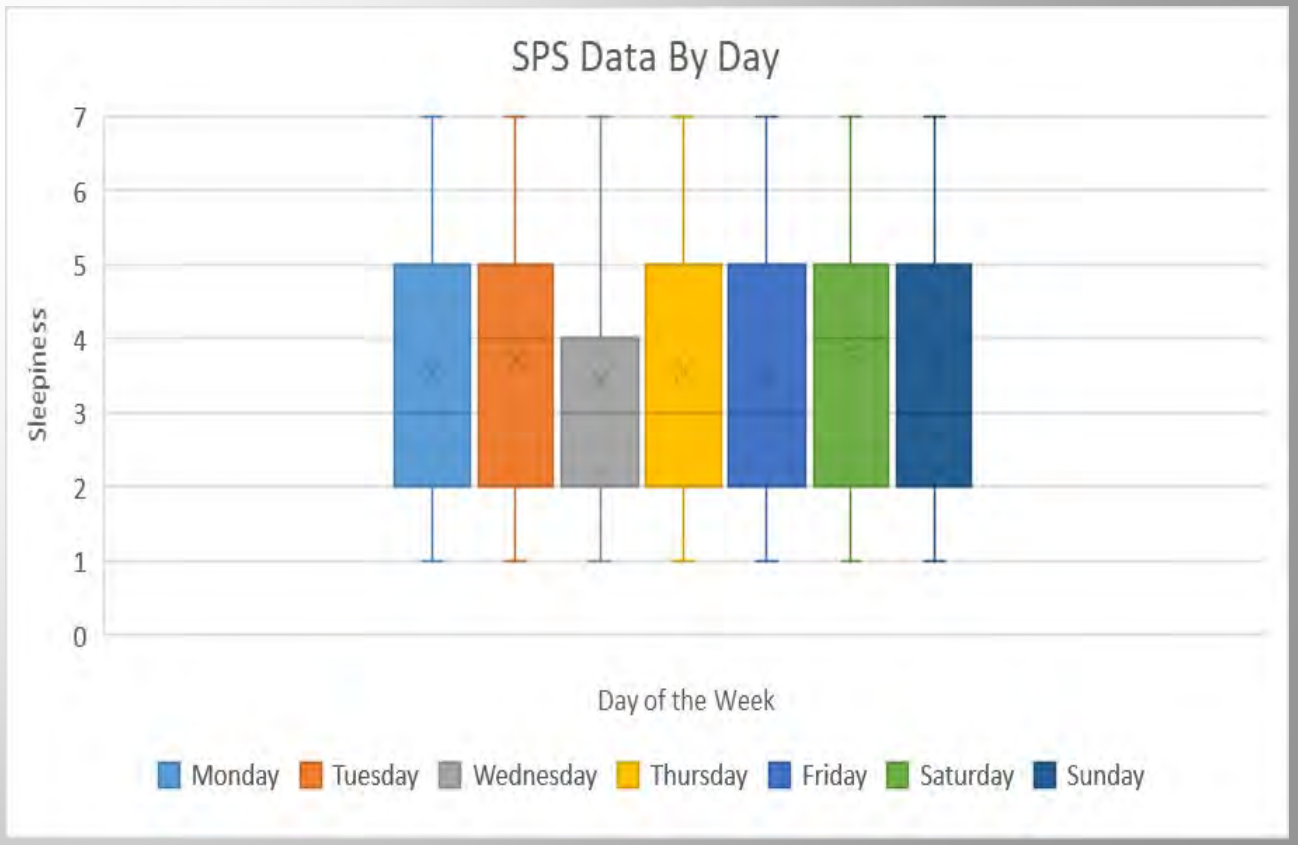


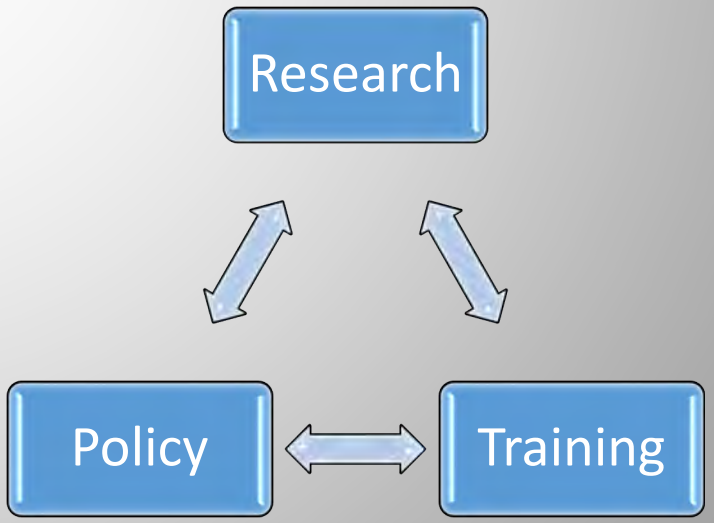


NEXT STEPS

- Continue analyses along with various safety data
- Incorporate from previous studies
- Make policy recommendations
- Training and education

BEST PRACTICES

- “No one is immune from fatigue. Yet, in our society, establishing widespread preventive measures to combat fatigue is often a very difficult goal to achieve” (Salazar, n.d.)
- Fatigue prevention is one of the most useful ways to combat fatigue.
- Needs to be addressed from multiple angles.



FATIGUE MANAGEMENT AS A PART OF SMS

- Implementation of SMS is highly encouraged in collegiate aviation. Many aviation schools have implemented a SMS program.
- Fatigue risk could be managed to an acceptable level using existing SMS processes by identifying and mitigating the fatigue risks.
- Inclusion of fatigue management-related topics within the training programs

QUESTIONS AND DISCUSSION

- Are there any issues with fatigue in your program?
- How can we improve fatigue mitigation among our students?
- How can we collaborate to revive, improve, and expand collegiate aviation fatigue research?

REFERENCES

- Caldwell, J. A., Mallis, M. M., Caldwell, J. L., Miller, J., Paul, M., & Neri, D. (2009). Fatigue countermeasures in aviation. *Aviation, Space, and Environmental Medicine 80*(1), 28-59.
- Gawron, V. J. , J. A. (2016). Overview of self-reported measures of fatigue. *The International Journal of Aviation Psychology, 26*(3), 120-131.
- McDale, S., & Ma, J. (2008). Effects of fatigue on flight training: A survey of U.S. Part 141 flight schools. *International Journal of Applied Aviation Studies, 8*(2), 311-336.
- Mendonca, F., Keller, J., & Lu, C.T. (2019). Fatigue identification and management: An analysis of collegiate aviation pilots in the United States. *International Journal of Aerospace, Aeronautics, and Aviation.*
- National Transportation Safety Board (NTSB). (2014). *NTSB 2017-2018 most wanted list of transportation safety improvements.* Retrieved from https://www.ntsb.gov/safety/mwl/Documents/2017-18/MWL-Brochure2017-18.pdf
- Sieberichs, S., & Kluge, A. (2016). Good sleep quality and ways to control fatigue risks in aviation—An empirical study with commercial airline pilots. In: Goonetilleke R.,