The Impact of New Technology on Sleep Data Collection and Model Validation

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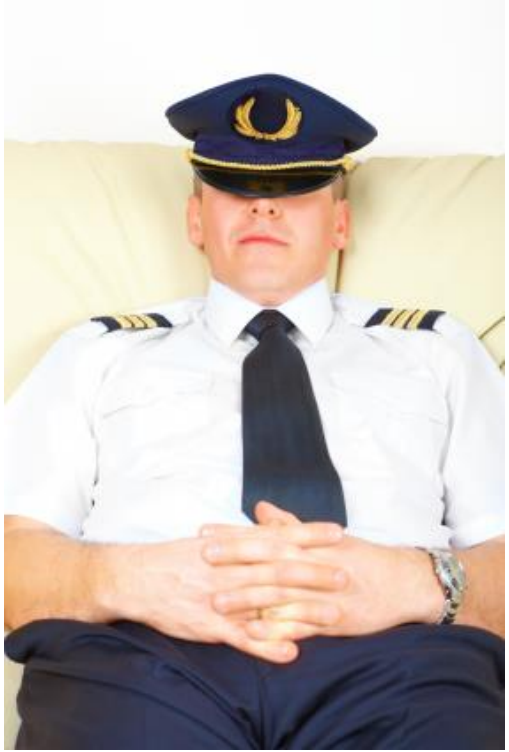
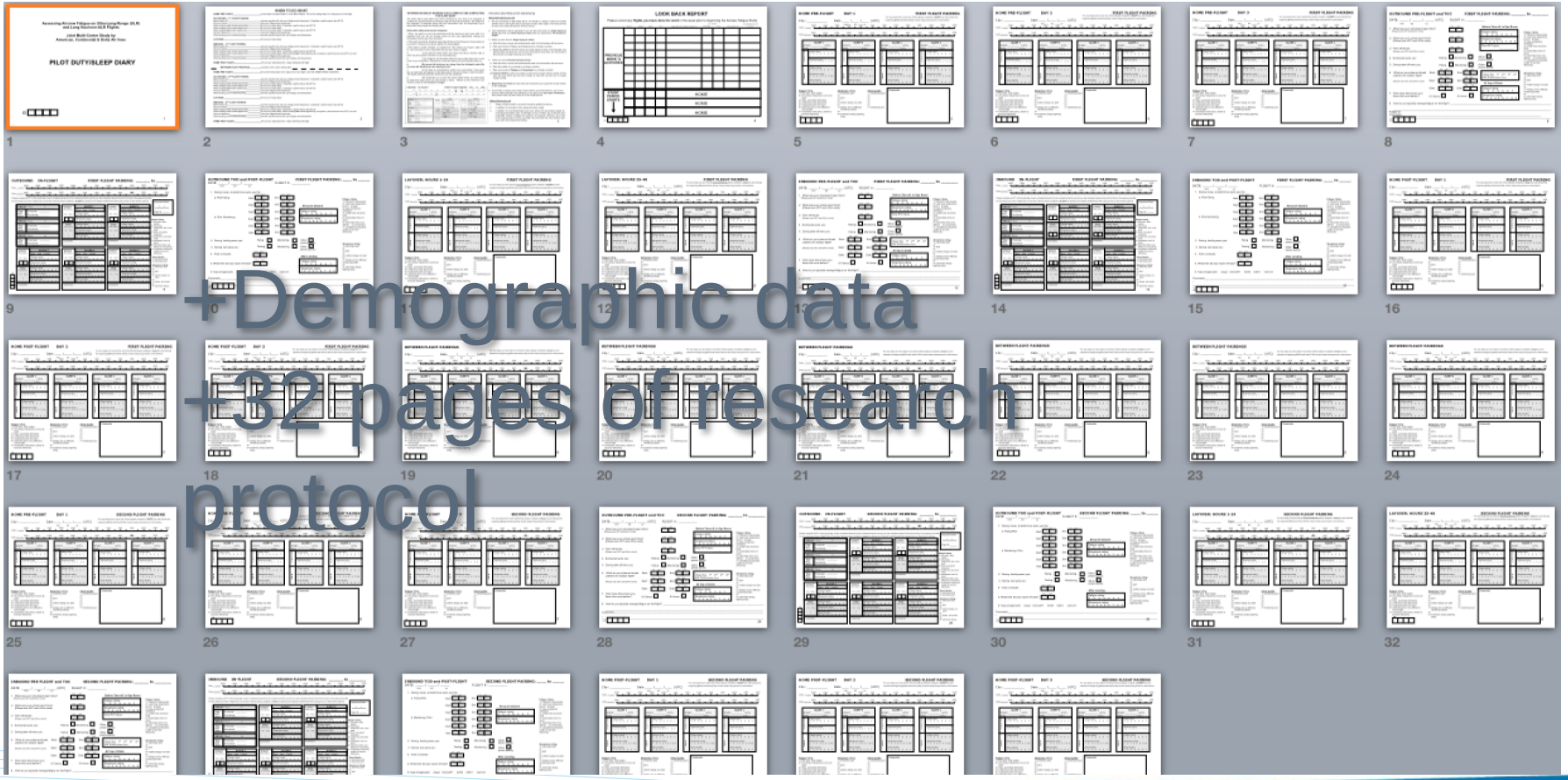
David Karlsson

Introduction

- **Increasing need for data collection**
  - Airline Industry (part of new regulations)
  - Scientific Community
- **Airline crew data**
  - Airline crew are shift workers (but different)
  - Pilots are generally early adopters
- **New technology can be used to:**
  - Improve the quality of collected data
  - Decrease cost of each collected record
  - Facilitate larger data collections

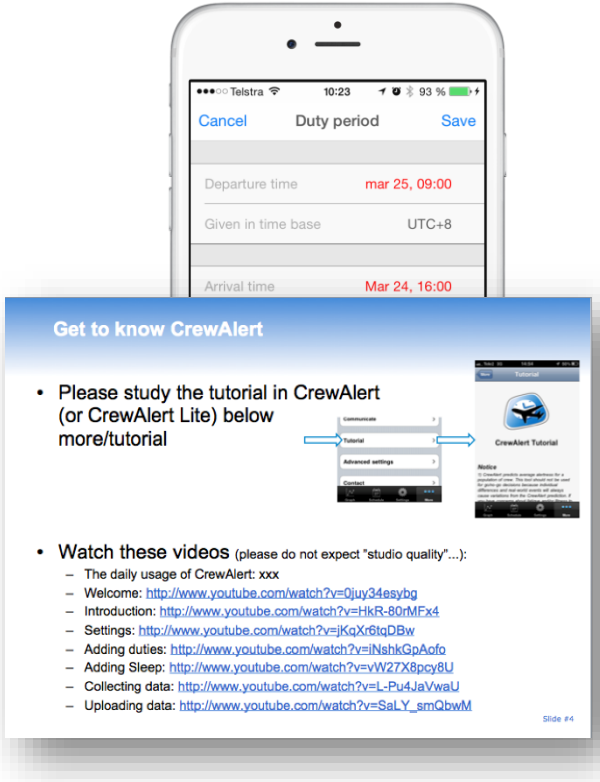


Traditional Data Collection Protocol



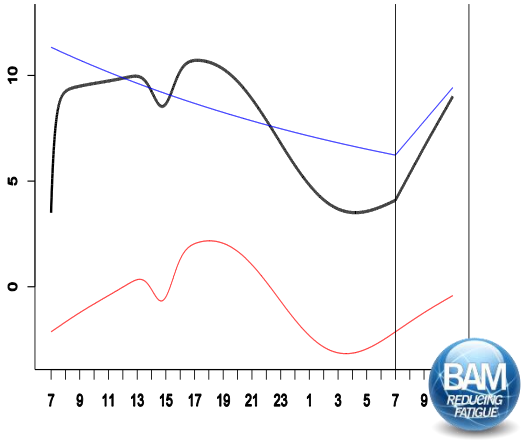
Potential for Improvement

- **Improved data quality**
  - Automated validation on data input
  - Graphical representation allows user to catch errors in input
  - Problems can be fixed by user before upload
- **Improved scalability**
  - Decreased need for logistics
  - E-training instead of classroom training
- **All data gathered in one place**



Study / Collected Data

- **Data collected using an iPhone app**
  - One part Crowd-sourcing
  - One part in collaboration with airline
- **Study objectives**
  - Validate individual components of TPM/BAM
  - Assess the feasibility of using predicted sleep
  - Quantify the accuracy of the model



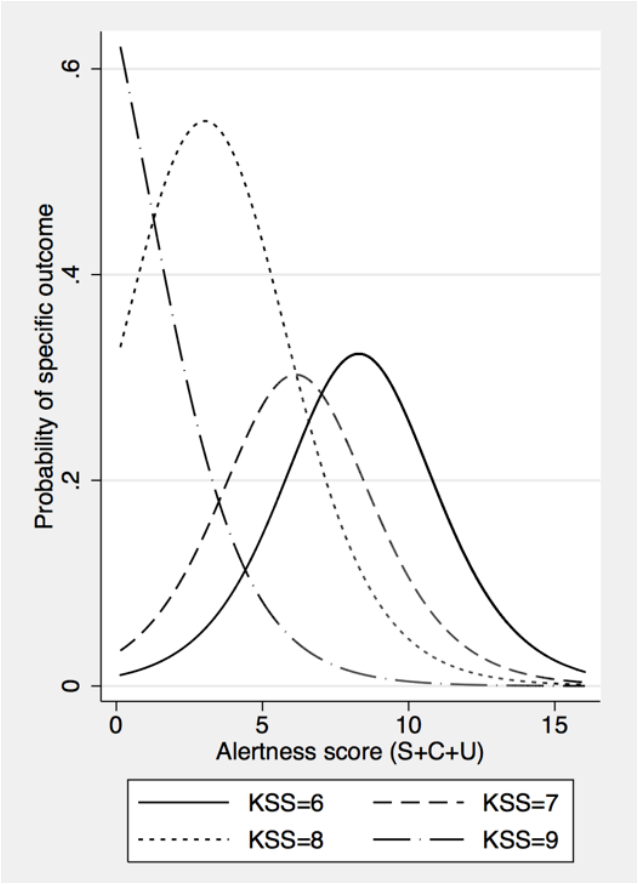
Data Analysis

- **More than 150 crew uploaded data**
  - Less than 3% of uploads discarded
  - Main analysis contains only assessments in home-base time-zone
  - Other assessments used only to estimate time-zone adjustment
- **About the data**
  - Collection executed at minimal cost
  - Mainly volunteer participants

	Home base time zone
Subjects (n)	130
Age (mean years)	42
Age (sd years)	8
Gender (% males)	92%
Position	
Captain	50%
First Officer	42%
Cabin crew	4%
Other	5%
Diurnal type	
Extreme evening	2%
Evening	26%
Intermediate	44%
Morning	28%

Results

- **Data analysis made at SRI**
- **Model components were validated**
  - Slightly new formulations
  - Best fit reduces number of components
- **Model extensions**
  - Probabilities of sleepiness by model prediction
- **Predicting sleep reduces accuracy**
  - Still useful when observed sleep is missing



Future Work

- **Tool improvements**
  - Still a steep learning curve
  - Extend data validation
- **New data collections**
  - Analysis of crew behavior during long layovers
  - Create a regular flow of collected data
- **Keep improving the model with more data**

Conclusions

- **Using new technologies for data collection**
  - Reduce amount of discarded data
  - Improve quality of collected data
  - 100% scalable

- **Model validation**
  - Validation of individual components
  - Predict risk of sleepiness

For more information read the full paper at:
journals.plos.org/plosone/article?id=10.1371/journal.pone.0108679