Experiences from large-scale, non-incentivized, fatigue data collections in aviation

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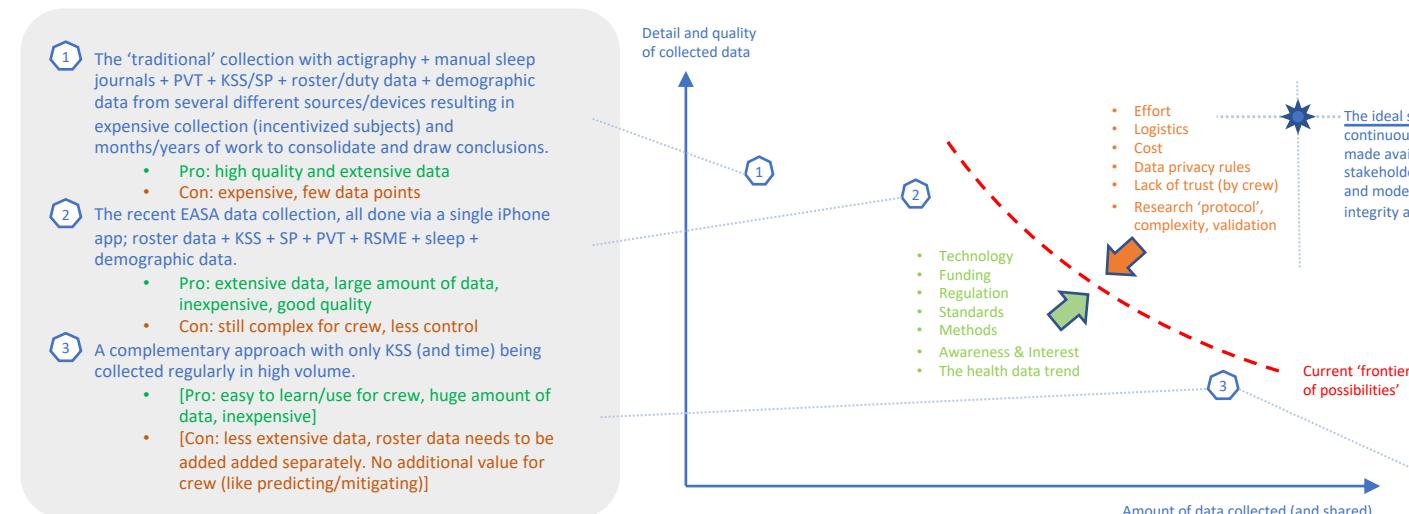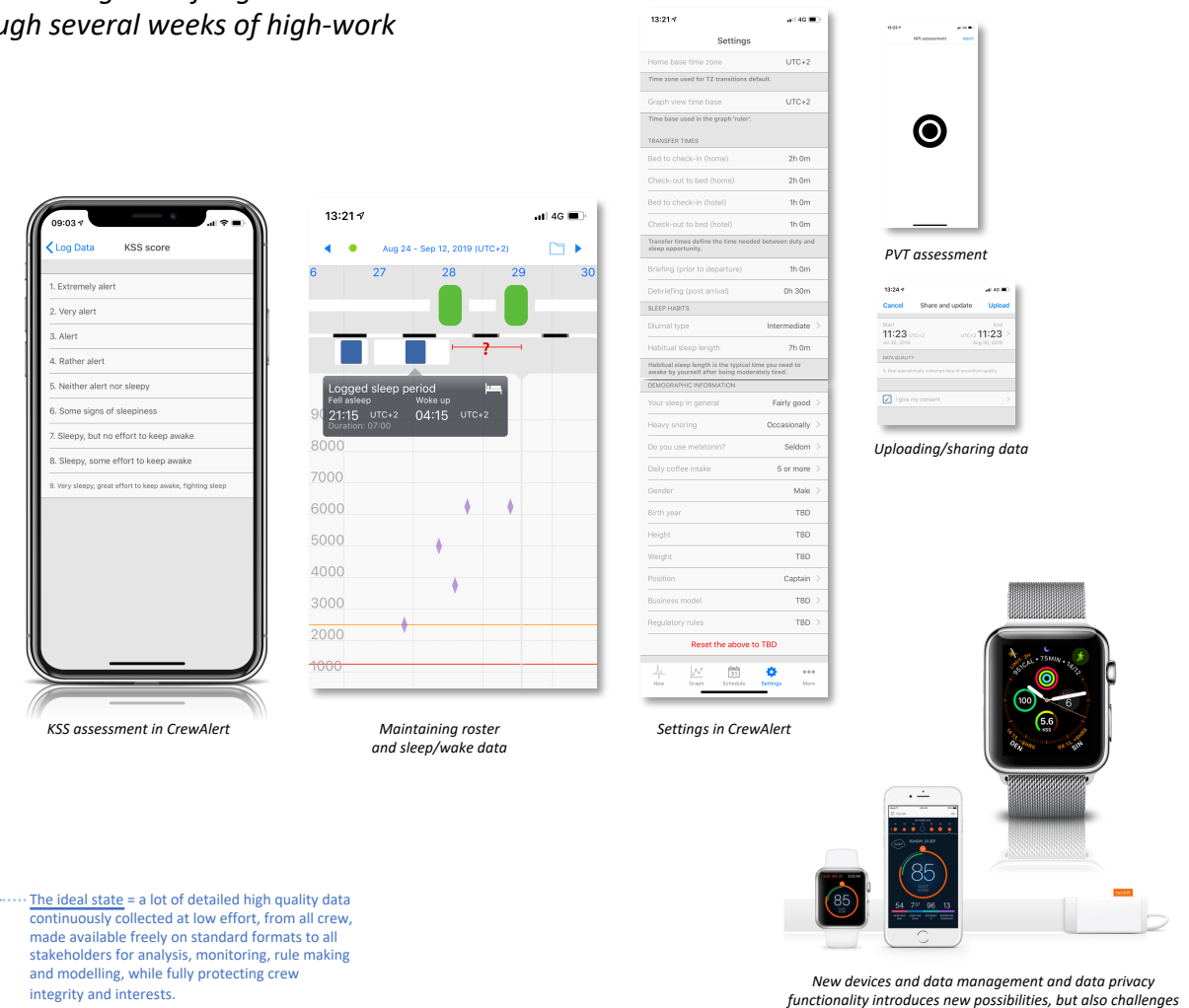
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Background: Fatigue data collections today are often cumbersome, expensive and result in relatively small data sets kept 'tight to the chest' by the collecting organisations/entities. There is a shortage of data for effectively moving knowledge and fatigue risk modelling forward within aviation – for example regarding long-term effects to pilots operating through several weeks of high-work load conditions, versus lower workload.

Method and findings: With more versatile mobile devices, custom-made mobile applications (apps) and wearables, it is increasingly possible to streamline data collections from crew. A number of attempts have been made over the past 6-7 years to run large-scale data collections using a single device, already in the possession of crew, to reduce the involved logistics - enabling a fully scalable approach.

EASA recently commissioned a study to review the European flight and duty time limitations which came into effect in February 2016. The study, concluded in late 2018, relied in part on a large number of European airlines contributing with fatigue survey data. This data was collected by crew on a voluntary basis using an iPhone app for data entry and upload. Jeppesen has used the same appliction over several years and the main usability concerns in these data collections, hard to overcome, are:

- A steep learning curve for crew
- Difficult for crew to maintain their roster information correctly
- Easy to misunderstand the concepts for a manually kept sleep/wake log
- Quickly becoming a non-insignificant workload, for an uncertain return

KSS assessment in CrewAlert

Maintaining roster and sleep/wake data

Settings in CrewAlert

PVT assessment

Uploading/sharing data

New devices and data management and data privacy functionality introduces new possibilities, but also challenges

① The 'traditional' collection with actigraphy + manual sleep journals + PVT + KSS/SP + roster/duty data + demographic data from several different sources/devices resulting in expensive collection (incentivized subjects) and months/years of work to consolidate and draw conclusions.
- Pro: high quality and extensive data
- Con: expensive, few data points

② The recent EASA data collection, all done via a single iPhone app; roster data + KSS + SP + PVT + RSME + sleep + demographic data.
- Pro: extensive data, large amount of data, inexpensive, good quality
- Con: still complex for crew, less control

③ A complementary approach with only KSS (and time) being collected regularly in high volume.
- [Pro: easy to learn/use for crew, huge amount of data, inexpensive]
- [Con: less extensive data, roster data needs to be added added separately. No additional value for crew (like predicting/mitigating)]

Detail and quality of collected data

- Effort
- Logistics
- Cost
- Data privacy rules
- Lack of trust (by crew)
- Research 'protocol', complexity, validation

The ideal state = a lot of detailed high quality data continuously collected at low effort, from all crew, made available freely on standard formats to all stakeholders for analysis, monitoring, rule making and modelling, while fully protecting crew integrity and interests.

- Technology
- Funding
- Regulation
- Standards
- Methods
- Awareness & Interest
- The health data trend

Current 'frontier of possibilities'

Amount of data collected (and shared)

Discussion: Mobile apps and wearable technologies are promising enablers for efficient large-scale fatigue data collections, but the market has yet to see applications that simultaneuously a) preserve data subject integrity, b) fulfill scientific requirements for validation and completeness, c) provide better balance between ease of use and amount and quality of collected data, and d) ideally also integrate smoothly into airline FRMSs to provide a continuous data flow complementing (often flawed) processes for crew feedback, today mainly consisting of fatigue reports.

CrewAlert TOD: a new more streamlined approach only collecting KSS (and time) plus optional data on controlled rest, sleep in past 24h and RSME. Roster data is automatically brought in separately.

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