

Uses and Limitations of Biomathematical Fatigue Models White Paper

This white paper and attachment are provided by the IATA Human Factors Task Force (HFTF) as a guideline for the use and limitations of the biomathematical models.

1. The potential use of the models

Biomathematical models (BMM) are an optional tool for fatigue hazard identification.

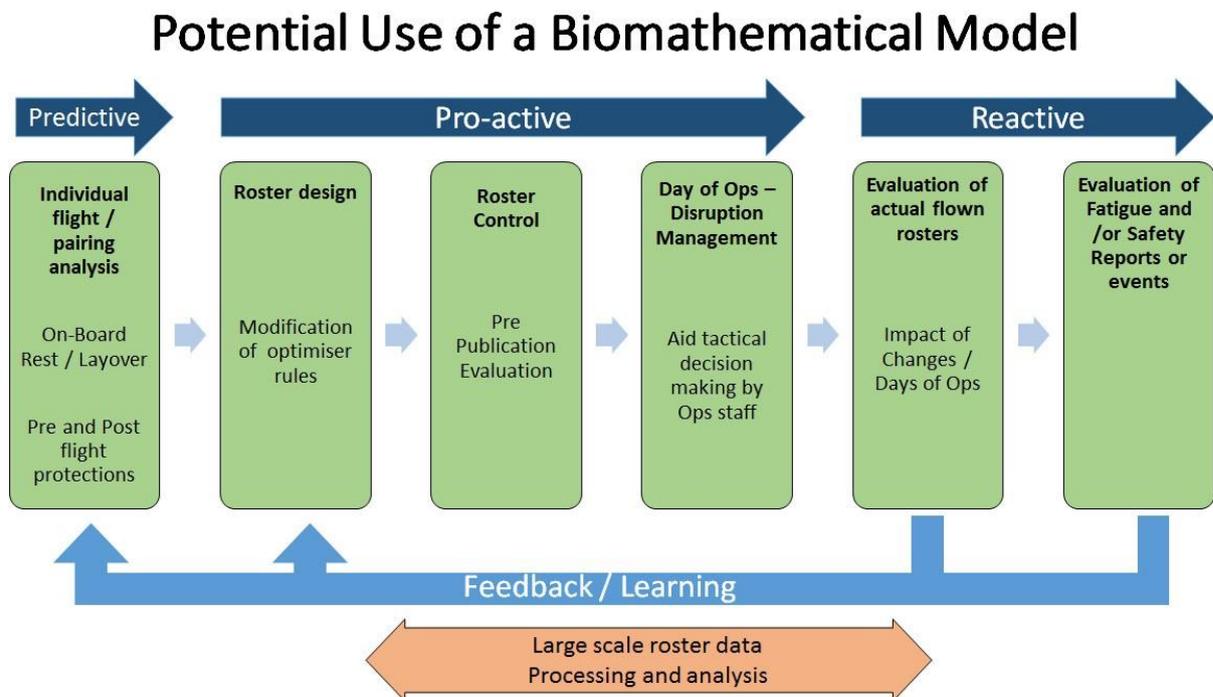


Figure 1: Potential usage of Biomathematical Model

- The output of the model provides metrics which can be used for relative comparisons of fatigue risks.
- This information can then be used to develop schedules and optimize pairings that promote alertness and mitigate fatigue-related risks.
- Certain models can also be used for analysis of "as flown" schedules and rosters, as well as tracking and analysis of operational and safety KPIs/SPIs.



- The model can be a useful tool to analyze the potential fatigue exposure and identify fatigue drivers in a safety event, if combined with crew member's perceptions and sleep history.

2. Limitations of the models

- A model is not a Fatigue Risk Management System (FRMS).
- An optimizer used in conjunction with a model does not constitute an FRMS.
- A model should not be used by individuals, operators or regulators as the sole go/no-go decision-making tool.
- The output of a model does not necessarily correlate to a safety risk.
- Model outputs represent the population average and may not be accurate for specific individuals.
- Model sleep predictions may not reflect actual sleep duration and quality which are fundamental to the validity of a model's output.
- Models may not consider the operational context and mitigations.
- Models may be better at detecting fatigue risk related to sleep restriction, instead of the fatigue risk in operations related to workload and long duties.
- Models might identify different risk levels if used to evaluate individual pairings verses an entire roster due to the challenges created by combining individual pairings into a roster.

See Attachment 1 to this document for an expanded discussion on uses and limitations of biomathematical fatigue models.

3. Conclusion

There are many factors that affect fatigue; modelling is one part of the equation and should be used in combination with other operational data and available information to assess fatigue risks.

Prior to selecting a model, the HFTF recommends that an operator discuss fatigue risk management requirements with their Regulator and read the additional reference



documents listed below. The operator should also ask the vendor for a trial period to allow the operator to apply it to their specific operation.

The algorithm underlying BMMs, which is based on sleep science, is undoubtedly undergoing daily research to improve its accuracy. However, the accuracy of the variables input by users into the BMM is also an important factor. Applying sleep science to operational situations is difficult due to the large number of variables involved. If the variables inserted into the BMM are inaccurate, they will affect the output of BMM.

It is important for BMM not to be used alone, but to establish a system for validation based on sleep science and operational experience.

4. References

IATA's Fatigue Safety Performance Indicators (SPIs): A Key Component of Proactive Fatigue Hazard Identification

IATA/ICAO/IFALPA Fatigue Management Guide for Airline Operators, 2015