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What you need to know about FAID®

enquire@interdynamics.com

www.interdynamics.com

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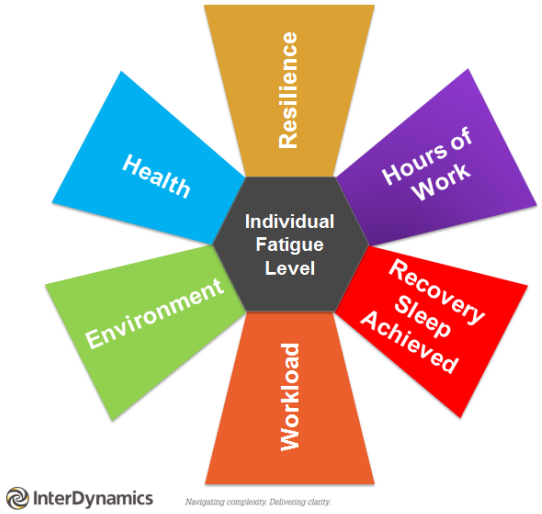
1. FAID Fatigue Assessment Software Introductory Notes

1.1. Introduction to FAID and Fatigue Risk Management

Fatigue levels for individuals can be the result of a number of factors including recovery sleep achieved (quality and quantity), hours of work impacts, workload, environment, health issues, and individual susceptibility/resilience to fatigue. Both work and non-work related fatigue factors contribute to safety risks at work, and as a result require proactive management by individuals and the organisation to ensure the risks associated with fatigue are controlled to a tolerable level.



FAID is a powerful analytical tool based on scientific knowledge which can support the management of hours of work within an organisation's fatigue risk management guidelines. Managing hours of work taking into account fatigue is one of the major elements of a proactive and effective Fatigue Risk Management System (FRMS). Please refer to InterDynamics' InterDynamics' website for a discussion on other key elements of an FRMS.

1.2. What you need to know about FAID

Developed using scientific research and knowledge gained over several decades on circadian factors, the effects of shift lengths, and the timing of shifts and the importance of previous work periods on fatigue and performance, FAID is a biomathematical model of human alertness response to work and rest patterns.

Many regulators and industry bodies recognise that within an FRMS adequate management of fatigue-related risks associated with working hours includes more than simply working hours. Circadian influencers and biological limits to recovery are also important. Consideration of these factors can most effectively and efficiently be supported by the strategic use of a biomathematical model such as FAID.

FAID has been designed to be a powerful decision support tool based on what can be known with confidence: working hours or duty periods. FAID uses work hours as its input to predict the effect on fatigue and performance of different duty periods or work schedules. It is a model of human biology and is best used as a statistically significant indicator of general human

response, but not as a predictor of an individual's condition. This is true of all models given that variations in sleep requirements and tolerances do exist within the human population.

FAID considers the influence of work periods (time of day, length and how recent) and human biological limits associated with sleep and recovery, to determine an hours of work-related fatigue score (FAID Score). FAID does not consider other personal factors that contribute to an individual's fatigue (i.e. sleep disorders, health, sleeping conditions etc.). Like any biomathematical model, which (by definition) uses general population level data to provide a view of relative fatigue exposures, neither FAID nor any other model in the market can provide an accurate prediction of an individual's level of fatigue. To try to do so with FAID or any other fatigue model would be inappropriate. Individuals will always need to be considered and managed as individuals, within any fatigue risk management regime.

1.3. The FAID Standard Bio-mathematical Model

No bio-mathematical model (BMM) can predict work-related fatigue completely, however the likelihood of fatigue impairment associated with different work hours can be reviewed using FAID which includes the FAID Standard BMM.

The FAID Standard BMM was first released by InterDynamics in 1999 and has been a reliable contributor to assessing and managing fatigue risk since then.

A FAID Score is provided, indicating different levels of fatigue exposure for different work hours. The higher the FAID Score the higher the fatigue exposure.

Using formulae and factors developed and validated by Dr Adam Fletcher and Professor Drew Dawson at the Centre for Sleep Research, University of South Australia, the FAID Standard BMM provides a representative score of the hours of work related fatigue exposure of a worker, based on the following biological determinants of fatigue:

a. Time of day of work and breaks
b. Duration of work and breaks
c. Work history in the preceding seven days
d. Biological limits on recovery sleep

This model is structured upon a probabilistic scoring method with weighting scores for each hour of a day for both work and rest. This model is most sensitive to the cumulative effects of consecutive work periods, particularly those at night.

1.3.1. Validation and Assumptions

The formula and factors used by the FAID Standard BMM have been validated within simulated work environments and field-based situations by the Centre for Sleep Research, University of South Australia.

Provided below are the major assumptions used to develop the FAID Standard BMM.

1. **Recovery** from work-related fatigue by sleeping can be obtained at any time an individual is not working. The amount of recovery sleep assumed at any point in time is a subset of the opportunity available, dictated by time of day and competition from factors such as social pressures (Dean, Fletcher, Hursh, & Klerman, 2007). FAID is a statistical model and considers the changing likelihood and quality of recovery sleep at different times of the day.

2. The FAID Standard BMM takes into account a rolling 7-day history in its analysis, giving consideration to the accumulating impact of fatigue over the past 7 days. There is no weighting given to time further back than 7 days or 168 hours.
3. Individuals can only recover from fatigue that has been accumulated and cannot store recovery to offset against potential future fatigue (Dawson & Fletcher, 2001).

The development and validation of the FAID Standard BMM is well substantiated and has been published in numerous international peer-reviewed journals and books.

1.3.2. FAID Score

A standard workweek of 40 hours, Monday to Friday, 9 a.m. to 5 p.m., when analysed, results in a peak FAID Score of 41. By comparison, a 40-hour week of 11 p.m. to 7 a.m. night shifts results in a peak FAID Score of 97. A study by Dawson and Reid indicates that scores between 80 and 100 (high fatigue likelihood) are comparable to the level of fatigue-related impairment after 21-24 hours of continuous sleep deprivation (Dawson & Reid, 1997). This result was observed when the sleep deprivation started at 8 a.m. on a Monday, following a standard working week and weekend break. Multiple studies have shown that performance impairment at such a level of sleep deprivation is comparable to that experienced at blood alcohol concentrations of over 0.05% (Fletcher, Lamond, van den Heuvel & Dawson, 2003).

A FAID Score can provide an indication of the likelihood of performance impairment associated with fatigue. Validation studies suggest that work-related FAID Scores correlate very highly with sleep-onset latency, neurobehavioural impairment and subjective sleepiness (Fletcher, 1999).

This score is used by the FAID Standard BMM.

1.4. Setting Tolerance Levels

Bio-mathematical models do not make decisions on which work schedules are most appropriate in specific workplaces. What the models do, however, is provide information that can be useful when decisions about fatigue management need to be made. Tracking FAID results in relation to incident frequency, absenteeism levels, employee sick days or other organisationally meaningful data would allow a clearer illustration of the relationship between hours of work and its related costs.

Hours of work-related fatigue exposure can be limited by allocating work hours within a FAID Score benchmark figure (Tolerance Level / FTL).

Different Tolerance Levels may be set for specific tasks or roles. A lower Tolerance Level may be set for a higher risk task or role, and a higher Tolerance Level may be set for a lower risk task or role. For a specific task or role, one Tolerance Level may be used for planned hours of work, with the option of reviewing actual hours against a higher Tolerance Level, acknowledging that variances to the plan may occur on day of operations.

The list below represents an example of a combination of hours of work rules that could fit within an organisation's FRMS guidelines, utilising FAID software as a key component in the development and audit of fatigue risks associated with hours of work:

- A Tolerance Level of ***x*** (or multiple Tolerance Levels for tasks of various risks)

- Monthly, or roster cycle period compliance to Tolerance Level of all shifts for each individual to be no less than ***y***%
- Individual shifts should not exceed ***z*** points above the Tolerance Level
- Varying levels of actions/controls to be applied as exposures approach/exceed Tolerance Level
- Potential for differing values of ***x***, ***y***, and ***z*** for planned and actual hours.

Tolerance Levels and target compliance percentages are usually determined by an organisation after carrying out a Fatigue Hazard Analysis (**FHA**) risk assessment for a specific role[1]. That is, a risk assessment which reviews the hazards of a role when fatigue is present. The risk assessment would take into account (among other things) the current hours of work fatigue exposure analysed using FAID including, importantly, the Apparent Tolerance Level (the overall hours of work fatigue exposure currently being tolerated by the organisation).

Understanding and managing your organisational risk profile with relation to fatigue is an important process within FRMS that involves looking at multiple areas of exposure. For example, a view of the organisation's fatigue risk profile can be gained by determining the:

- Fatigue risk profile of the workforce through an employee Managing Fatigue Survey;
- Hours of work risk profile through a FAID Hours of Work Diagnostic of planned and actual hours worked;
- Workplace hazards in the context of fatigue, associated with specific roles and environmental factors through a Fatigue Hazard Analysis risk assessment; and
- Drawing it all together with a fatigue risk grading will provide contextual data on the specific fatigue-related risks for your organisation, and how to manage them effectively within a true risk-management framework.

As can be seen, the use of FAID in determining the hours of work risk profile is one component of many.

1.5. FAID Inputs and Assumptions

FAID uses duty period start and finish times as inputs, in determining the work and non-work period to be analysed. In performing its analysis of the work period and non-work periods, FAID does not take into account the following considerations:

- A reduction in opportunity for sleep when **commute times are greater than 45 minutes between home and work**. Hence, FAID will overestimate the recovery value of non-work periods in these circumstances. An organisation may wish to extend the shift start and finish time by the amount travelled longer than an hour to account for the longer commute scenario.
- **Short breaks within a duty period as non-work periods**. For breaks within a duty period to be included as non-work time they need to be at least 4 hours or greater in duration, and quality sleeping facilities must be available (Dean, Fletcher, Hursh & Kleman, 2007). This means that breaks, such as lunch or crib breaks, are not included

[1] *InterDynamics' risk assessment methodology founded on Zurich's Hazard Analysis methodology aligned with AS/NZS ISO 31000:2009.*

as non-work time, as short breaks are unlikely to be long enough for recovery sleep to be obtained.

- **Trans-meridian travel**, unless FAID Time Zone is used. If individuals travel 3 or more time zones from their home base, then it is recommended that a specialty version of FAID, FAID Time Zone or FAID Quantum be used, which takes trans-meridian travel into account.
- What an individual has actually achieved with regards to **recovery sleep during a non-work period**. FAID formula and factors provide an estimate of the fatigue exposure typical of the average person based upon statistics gathered from a large sample group. It is not a pure measure of fatigue, and cannot by itself give an indication of whether an individual is fit for work. In the instance where individuals do not use a non-work period to obtain the recovery sleep FAID is predicting would be statistically likely during the non-work period, then the fatigue exposure indicated by FAID might be quite different from that actually experienced by the individual.

Circadian time is defined in a fixed phase relationship to clock-time. Mean phase shift between circadian and clock time has been said to be in the order of up to 1 to 2 hours without individuals having crossed time zones (Dawson & Fletcher, 2001). Variations of this magnitude would have little effect on FAID Score values. Also, the average phase shift in response to a broad range of shift schedules is typically in the order of 2 to 4 hours for night shift and less for afternoon shift (Rutenfranz, Colqhuhoun, Knauth & Gartner, 1977; Dawson, Encel & Lushington, 1995). Phase shifts, even in this range are unlikely to result in a significant error (Dawson & Fletcher, 2001).

1.5.1. Prior History or Initial State of an Individual

At the point of time at which the input data starts there is no information about the prior activity of the individual. The individual may have worked many hours or none.

While the software can commence to calculate scores from the time of the first work period this is only valid if there was no work performed in the previous seven days.

If the person may have performed work in the week prior to the start of the data, it is prudent to consider as valid only the results beyond seven days after the start of the data. This is to rule out any influence the undocumented work periods might have on the scores in the first week.

FAID is an easy product to use when appropriate training is undertaken. The above points need to be considered when using FAID, to ensure its most effective and appropriate use in the organisation's operational context. Please contact us (faidtraining@interdynamics.com) if you would like **training in the context of use and functionality of FAID**.

We hope that this information assists you as you become familiar with the use of FAID as one element of a Risk-Based Approach to managing fatigue in your workplace.

The InterDynamics FRMS team.

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