

Joint Session

Fatigue Risk Management Systems: Measurement and Evaluation of Effectiveness

Evaluation of Fatigue Management Programs

Ann Williamson, Ph.D.
University of New South Wales

10:20 - 10:45

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Ann Williamson, Ph.D.
Biography

Ann Williamson (BSc Honours, PhD) is currently Professor of Aviation Safety and NHMRC Senior Research Fellow at the University of New South Wales. She was, until recently, Acting Director of the NSW Injury Risk Management Research Centre at the University of New South Wales. Before returning to the University, she was Head of the Human Factors and Ergonomics Unit at the National Institute for Occupational Health and Safety. Ann has worked in the area of injury prevention on occupational and public safety issues in both state and federal government and universities. Ann's research has focused on human factors and safety, particularly on fatigue and its effects on performance. Her research in the area has ranged from field to laboratory work and included industries like road transport, aviation and mining.

Evaluation of Fatigue Management Programs

Ann Williamson

Department of Aviation
University of New South Wales
Sydney, Australia



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What are we actually evaluating?

- Operator fatigue management
- Company level fatigue management
- System level fatigue management
 - Relationships between individual operators, company, other parties in the system
- ▶▶ Measures differ depending on what is being evaluated

What are we actually evaluating?

Inputs?

- ★ Is the design of the FMP acceptable?
e.g., Hours of rest,
Hours of work
- ★ Can the company support it?
 - ★ Should it be allowed?

OR

Outputs?

- ★ What is the effect of the FMP?
- ★ Does it need to be modified?

FMP Implementation process 

What do we want to know?

INPUTS

- Does the proposed FMP comply with current regulations
- Does the proposed FMP really manage fatigue?

OUTPUTS:

- Does it make operators more fatigued?
- Does it affect performance
- Does it affect the business?

Measuring the INPUTS: Should the FMP be implemented?

- **Operator:**
 - Will the FMP really manage fatigue?
 - Is it an improvement on current practice?
- **Company:**
 - Who wants to implement it: Management?
Employees?
 - Can the business sustain it?
- **System:**
 - Does it comply with current (and foreseen) working hours regulations?
 - Does it set a precedent for the industry?

Measurement of Outputs

The effects of the FMP

- Does it make operators less (or more) fatigued?
- Does it affect performance
 - less safe?
 - poorer quality?
- Does it affect the business?
 - Human resources outcomes
 - OHS outcomes
 - Quality or efficiency outcomes
 - Financial outcomes

What do you measure - INPUTS

- Operator:
 - Modeling of the fatigue in work-rest schedules;
 - wide range of modeling tools(FAID, XIMES, HSE fatigue tool.... etc)
 - Workforce sufficiently aware of fatigue management and their role in its management.
 - Workforce accepting of change to FMP

What do you measure - INPUTS

- **Company:**
 - Audit of systems for managing work-rest, eg.,
 - Management with sufficient knowledge of fatigue effects and effective countermeasures
 - Scheduling approaches to cope with operational demands, staff absences, other realities...
 - Effective systems for monitoring employee work-rest
 - Education/training program for employees of fatigue management.

What do you measure - OUTPUTS

- Operators:
 - Compliance with work-rest scheduling:
 - diaries, log books, Actigraphy
 - Operator fatigue:
 - Subjective ratings: (many techniques, but problems)
 - On-road drowsiness measures (Optalert, Perclos, etc)
 - Physiological changes: (eye activity, (Tsai, et al, 2007; LeDuc, 2005), voice analysis (Greeley et al., 2007), others....)

What do you measure - OUTPUTS

Operators:

- Performance affects:
 - External to work task: wide range of tests used, sensitivity to fatigue not always well-known
 - PVT, reaction time, vigilance, dual task, various complex cognitive tasks??
- Part of work task: depends on task, has benefits of high validity for the purpose of fatigue management, eg.,
 - Driving – lane tracking, headway, reaction speed etc
 - Flying – checking instruments, order of actions etc
- Employee satisfaction with the FMP, including effects on sleep opportunities, work-life balance etc...
- Family satisfaction with the FMP

What do you measure - OUTPUTS

- Management of work-rest scheduling by companies
 - Audit of management of schedules
 - How often schedules slip? When? Why?
 - Audit of management tracking of violations by operators and other symptoms of non-compliance
 - Does the company know when operators don't comply? Do they know when? Why?
 - Audit of other FMP-related outcomes:
 - Changes in workload, including need to do other tasks, remuneration

What do you measure - OUTPUTS

- Affects on business?
 - Audit of human resources records – absences, lost time
 - Audit of OHS outcomes – near misses, injuries
 - Audit of quality or efficiency outcomes – delays, poor service

When do you measure?

- Input evaluation = before the decision to start the FMP.
- Output evaluation =
 - After the FMP has been in place...But...
 - Balance between maximising time for the FMP to 'bed-down' and ceasing a trial FMP that is not working well.

Some of the issues in evaluating FMP's



Inputs:

- 'Limitations' of biomathematical models
- Current state of the art on 'good' fatigue management
- Limitations of current regulation
- Balancing of operational needs with fatigue management

Outputs:

- Relationship between subjective fatigue and performance is not clear.
- Labile nature of subjective fatigue – difficult to measure reliably.

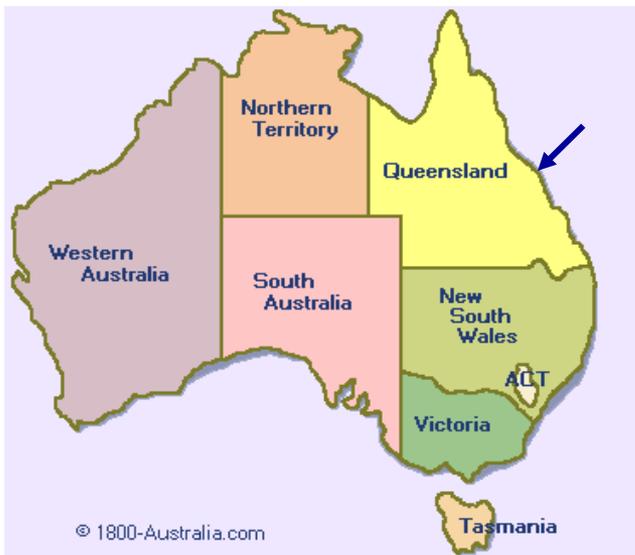
Examples of FMP evaluation

- FMP's appearing in many industries
- Much written, but few attempts at evaluation
- In Australia, started with long distance road transport, aviation, mining etc



Long distance road transport

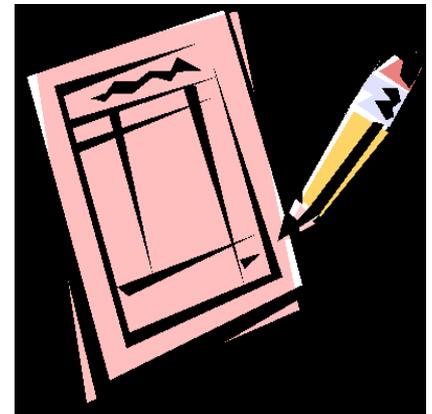
- Early 1990's:
Queensland
Department of
Transport established
FMP pilot project
- Trucking companies
put forward proposals
to Technical Expert
group for assessment
- If approved,
companies allowed to
vary aspects of work-
rest schedules to
make compatible
operational (business
efficiency) and fatigue
management needs.



Evaluation of pilot FMP project

(Burgess-Limbrick, Bowen-Rotsaert, 2002)

- Independent evaluation of fatigue and business efficiency outcomes – five years after pilot started
- Evaluated wholistic effects of FMP not the effects of specific changes
 - Pre FMP Vs Post FMP Vs non-FMP industry group



FMP pilot evaluation – Driver results

- FMP drivers more likely to report:
 - involvement in scheduling
 - schedule allows enough time for non-driving work, time for breaks, needing to speed to meet deadlines
- FMP drivers less likely to report:
 - tired while driving, driving while impaired, already tired at start of trip
 - Noticing indicators of fatigue in their driving performance
 - Needing to use ‘temporary’ strategies to manage fatigue (eating, caffeine, opening window, showering, etc)
 - Not knowing enough about fatigue management

FMP pilot evaluation – Business Results

Six companies surveyed

- Positives

- More proactive role in managing driver fatigue, liked greater flexibility in scheduling, more driver involvement
- Perceived that FMP was effective in ↓ fatigue
- Two-thirds found FMP more efficient in practice (truck utilisation, customer complaints, not operating illegally, more organised scheduling of drivers)
- ? Increase in operating profit (2% to 6% in one company)

FMP pilot evaluation – Business Results

- Negatives

- Initial driver resistance (new approach, lack of knowledge), lack of union support
- Administrative effort required
- Enforcement officers lack of knowledge of pilot program
- Drivers wanting to do extra shifts (contrary to FMP requirements)
- Costs – implementation (\$681 per driver; \$43,100 total), operating (admin, training, travel, auditing = \$659 per driver pa;)

Current approach

- National; Heavy Vehicle Driver Fatigue reform – to be introduced in September, 2008
- FMP with standard, basic and advanced FMP
- Self-audit checklists for Drivers and Operators (with resources for further information)



Current approach

- Implementation with independent auditors using certified auditors and formal audit matrix
- Audit will include, management and operational:
 - scheduling and rostering,
 - fitness for duty,
 - fatigue knowledge and awareness,
 - responsibilities,
 - internal review,
 - records and documentation/
 - health,
 - workplace conditions
 - management practices,
 - operating limits

Aviation

- Part of move to Safety Management System approach
- Previously emphasis on prescribed hours (CAO 48) with exemptions
- CASA Discussion paper on suggested FMP in 2004
- CASA Current Working Group on Fatigue Risk Management Systems



Conclusions

Pre-implementation of FMP (Inputs)

Evaluate

- the system (company) to determine whether it can manage an FMP
- the proposed work-rest schedule for *predicted* effects on safe performance
- understanding of operators and managers of fatigue management principles

Conclusions

Post implementation (Outputs)

Evaluate

- safe work performance and outcomes
- Whether system (company) is maintaining appropriate support systems to back up the FMP

Good Luck!

Think twice about evaluating

- subjective fatigue
- Physiological changes related to drowsiness or sleep onset