Managing Fatigue in safety-critical workforces: Primary risk factors and practical approaches

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CEO & Principal Consultant
A brief intro to Integrated Safety Support (ISS)

• A diverse team with expertise in data analytics, sleep disorders, scientific & workplace research, safety regulation, change management & safety/risk engineering

• Completing projects in 10+ countries per year
What do we do?

• We provide cost-effective Fatigue Management via:

<table>
<thead>
<tr>
<th>Fatigue training courses</th>
<th>Roster analysis</th>
<th>Fatigue Risk Assessment</th>
<th>Data Analytics</th>
<th>Sleep &amp; Fatigue studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• online and classroom-based</td>
<td>• to assess fatigue ‘hot spots’ in hours of work</td>
<td>• to identify risks and improvements</td>
<td>• to find links between safety, costs &amp; other data</td>
<td>• to assess real-world effects of work</td>
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Session Overview

• What is fatigue and what are its effects?
• A (very) brief history of fatigue research
• An overview of primary risk factors
• Fatigue Risk Management (FRM) overview
• Practical examples of effective solutions
• Questions & Discussion
What is ‘fatigue’ in an industry/work context?

1. Fatigue is a *state of impairment* that can negatively impact on safety, productivity, quality, morale, compliance, profits, and more.

2. It *occurs naturally* due to factors like:
   a) Poor sleep quality and/or quantity
   b) Workload that is too low (i.e. boring) or too high (i.e. overwhelming)
   c) Poor nutrition, lack of hydration, etc.
Fatigue is often a protective mechanism

• When we are feeling fatigued our brain and body are telling us to rest/recover

• This makes perfect sense from an evolutionary point of view since fatigue can negatively impact on risk taking, safety, immune/health states, etc.

• Depending on the source(s) of fatigue we might need sleep, rest, food, specific vitamins and/or minerals, and/or hydration, etc.
Most businesses aim to manage the risk of falling asleep but the real benefits come from effort much earlier.

If people were more mentally alert and engaged what would happen to error rates, efficiency, morale, etc?

The Fatigue Spectrum is © Integrated Safety Support and available for use with permission.
Who does fatigue effect?

• All of us, usually due to a combination of work and non-work factors

• Groups whose roles make them especially prone to fatigue include:
  - Workers in 24h settings
  - Those in boring and/or high tempo work roles
  - DIDO/FIFO/commuters
  - On-call/call-out workers (and those with children!)
The experience of fatigue is very personal

- Research clearly indicates a range of inter-related factors
- These impact different people very differently
- Other factors (e.g. desire to work or avoid overtime) are different
The effects of fatigue can be catastrophic

- The role of fatigue has been noted in a wide range of well-publicized catastrophes

  Chernobyl 1986

  Exxon Valdez 1989

  Challenger Space Shuttle 1986
A (very) brief history of fatigue research

- Scientific studies about work-related fatigue have existed since 1893 in Britain, 1901 in Germany and 1905 in Belgium.
- The Harvard Fatigue Laboratory opened in 1927, and its Mission required the group "...to work with industry to explain the physiology of fatigue".
- Their areas of interest included work hours, work environments, sleep, nutrition and hydration.
- Clarity existed then that work hours impacted outcomes including productivity, absenteeism & equipment damage.

Primary risk factor clusters

- Staffing levels
- Work patterns
- Work-load
- Sleep & Health
- Stress
- Monitoring & Management
- Staff selection, training, etc.

Integrated Safety Support
ENHANCING FUTURE WORKFORCES TODAY
Fatigue Risk Management: Basics/Essentials

1. Visible fatigue-related leadership at all levels

2. Sufficient personnel to cover all operational requirements including mandatory training and predicted leave, staff turnover, future changes (e.g. seasonal peaks), etc.

3. Awareness raising through communication & training

4. A reporting system aligned with ‘just culture’, a formal review process & team, plus de-identified feedback reporting that is visible, to support future reporting
Fatigue Risk Management: Intermediate

5. Formalised shared responsibility in Policy & Procedures, training, documented risk assessment, monitoring & reporting, ongoing reviews and improvements, etc.

6. Routine use of a bio-mathematical model to predict fatigue in scheduled & actual work hours (noting that on-call/stand-by are still not well addressed by models)

7. Routine analysis of available data to identify valid patterns (e.g. between fatigue model scores, incident data, workload metrics, costs like staff sick leave, etc.)
Fatigue Risk Management: Advanced

8. Engagement of personnel to report on hazards related to fatigue, to allow more proactive visibility/management

9. Formal provision of support to manage sleep disorders in people who volunteer for screening & diagnosis (uptake likely to be higher through EAPs)

10. Investment in IT automation & integration: e.g. fatigue bio-mathematical modelling built into the rostering system, data analytics for regular reporting automated
Comprehensive Fatigue Risk Management (FRM) focusses on eliminating and/or reducing risk factors in multiple layers.

What if I want to read more of the science?

• There are now numerous portals for searching the scientific and medical literature
• Increasingly, these includes links to open source and otherwise free content
  • http://www.ncbi.nlm.nih.gov/pubmed
Resources for researchers and practitioners

• Fatigue risk management: Organizational factors at the regulatory and industry/company level

• Fatigue Risk Management in the Workplace

• Countermeasures for use in fatigue risk management
Resources for researchers and practitioners

- ICAO - Fatigue Management Guide for Operators
  www.icao.int/safety/fatiguemanagement/FRMS%20Tools/FMG%20for%20Airline%20Operators%202nd%20Ed%20(Final)%20EN.pdf

- OGP IPIECA – Performance indicators for fatigue risk management systems

  https://www.iso.org/standard/65694.html
### Examples of practical & effective tools

**Fatigue risk exposures & controls software (GRAID)**

#### One-minute self-assessment tool for fatigue

<table>
<thead>
<tr>
<th>GRAID Elements</th>
<th>24 Exposures</th>
<th>11 Controls</th>
<th>13</th>
<th>As Is</th>
<th>To Be</th>
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</thead>
<tbody>
<tr>
<td>E1 Exposure</td>
<td>Potential consequences of a fatigue-related occurrence</td>
<td>VH</td>
<td>C</td>
<td>A</td>
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<tr>
<td>E2 Exposure</td>
<td>Commuting</td>
<td>M</td>
<td>B</td>
<td>A</td>
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<tr>
<td>E3 Exposure</td>
<td>Quality of employer provided sleeping environment</td>
<td>M</td>
<td>B</td>
<td>A</td>
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<tr>
<td>E4 Exposure</td>
<td>Operating hours</td>
<td>VH</td>
<td>C</td>
<td>B</td>
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<tr>
<td>E5 Exposure</td>
<td>Predictability of planned hours of work</td>
<td>L</td>
<td>C</td>
<td>B</td>
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<tr>
<td>E6 Exposure</td>
<td>Variability in operational demand</td>
<td>L</td>
<td>A</td>
<td>B</td>
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<td>E7 Exposure</td>
<td>Employee engagement</td>
<td>M</td>
<td>A</td>
<td>C</td>
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<td>E8 Exposure</td>
<td>Opportunities and incentives which may increase personal fatigue</td>
<td>H</td>
<td>C</td>
<td>A</td>
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<tr>
<td>E9 Exposure</td>
<td>Secondary activities</td>
<td>H</td>
<td>B</td>
<td>B</td>
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<tr>
<td>E10 Exposure</td>
<td>Workforce turnover</td>
<td>H</td>
<td>A</td>
<td>A</td>
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<tr>
<td>E11 Exposure</td>
<td>Working fatigue level</td>
<td>L</td>
<td>B</td>
<td>A</td>
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<tr>
<td>C1 Control</td>
<td>Workforce replacement planning processes</td>
<td>M</td>
<td>A</td>
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<tr>
<td>C2 Control</td>
<td>Hours of work (HOP) - fatigue assessment</td>
<td>L</td>
<td>B</td>
<td>A</td>
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<tr>
<td>C3 Control</td>
<td>Fatigue hazard analysis</td>
<td>M</td>
<td>C</td>
<td>B</td>
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<tr>
<td>C4 Control</td>
<td>Fatigue Tolerance Level (FTL)</td>
<td>M</td>
<td>A</td>
<td>A</td>
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<tr>
<td>C5 Control</td>
<td>Workforce profile and capacity planning</td>
<td>M</td>
<td>C</td>
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<tr>
<td>C6 Control</td>
<td>Fatigue risk management policies and procedures</td>
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<td>B</td>
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<td>C7 Control</td>
<td>Communication and consultation frameworks</td>
<td>L</td>
<td>C</td>
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<td>C8 Control</td>
<td>Fatigue-related training</td>
<td>H</td>
<td>B</td>
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<td>C9 Control</td>
<td>Compliance</td>
<td>M</td>
<td>C</td>
<td>B</td>
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<tr>
<td>C10 Control</td>
<td>Contingency and emergency procedures</td>
<td>M</td>
<td>B</td>
<td>C</td>
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<tr>
<td>C11 Control</td>
<td>Incidents and accidents</td>
<td>M</td>
<td>B</td>
<td>A</td>
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<td>C12 Control</td>
<td>FRMS continuous improvement</td>
<td>M</td>
<td>C</td>
<td>B</td>
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<tr>
<td>C13 Control</td>
<td>Diagnosis and treatment of sleep disorders</td>
<td>M</td>
<td>C</td>
<td>B</td>
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<table>
<thead>
<tr>
<th>Current Fatigue State</th>
<th>How do you feel right now?</th>
<th>Did you sleep in the last 24 hours?</th>
<th>How would you rate the quality of that sleep?</th>
<th>Have you experienced any significant physical signs of fatigue immediately prior to or during this shift?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A bit tired, some effort required to stay alert</td>
<td>Very fatigued, having difficulty staying alert</td>
<td>Yes</td>
<td>Very alert – wide awake</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Very alert – wide awake</td>
<td>Average</td>
<td>Good</td>
<td></td>
</tr>
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</table>

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<tr>
<th>Signs of Fatigue</th>
<th>Have you experienced any significant mental signs of fatigue immediately prior to or during this shift?</th>
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<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
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<tr>
<th>Do you believe you are fit for duty?</th>
<th>Fitness for Work</th>
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<tr>
<td>No</td>
<td>Yes, with additional risk controls</td>
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</table>
Examples of practical & effective tools

Use of planned and actual hours of work to predict fatigue ‘hot spots’ (FAID)
Examples of practical & effective tools

Objective performance testing using an iPad

Objective sleep tracking

Image © Joggle Research
Examples of practical & effective tools

Fatigue safety surveys & semi-structured interviews

Online and classroom training on personal Fatigue Management
Fatigue is an unavoidable experience anywhere that shift work, on-call work and/or long work hours exist.

However, fatigue can be managed successfully at the individual, team, system and organizational levels.

Cost-effective tools and approaches are available, as is guidance/support.

Solutions should be respectful of our human limitations (and strengths) as well as supported by data/technology.
Closing comments

• If developing Fatigue Management for your workplace, start small and achieve success in basics before adding complexity (distraction)

• Changing behavior takes time: so treat Fatigue Management as an evolution not a revolution

• We can all be role models & advocates for good sleep & Fatigue Management in our workplaces, families & communities
For more information please contact me on:

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To learn more about what we do, or connect with us to keep up-to-date, find us using the links below: