Fatigue Management: Technological advances and Fatigue Risk Management Systems

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Emergence / adoption of fatigue detection technologies

Foundations in transportation industry to address road safety
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- Foundations in transportation industry to address road safety
- Increasing interest from other industries and occupational health and safety groups
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Global market on Driver Monitoring Systems projected to grow from $1.6 bn (2019) to $2.4 bn (2027)
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Concerns include:
• Keeping up with the technology
• “What is the right technology for me/our organization?”
Ranking fatigue detection technologies
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Ease of use

Accuracy / Effectiveness

Biomathematical models
Ranking fatigue detection technologies

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Fitness for Duty Tests
Ranking fatigue detection technologies

Ease of use

- Biomathematical models
- Fitness for Duty Tests
- Task Performance

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Worker monitoring

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Accuracy / Effectiveness
Worker monitoring fatigue technologies (passive)

- Brain activity (EEG)

Data Source: Muse
Worker monitoring fatigue technologies (passive)

- Brain activity (EEG)
- Posture/head nod

Data Source: Alertme Lifesaver Alert
Worker monitoring fatigue technologies (passive)

- Brain activity (EEG)
- Posture/head nod
- Ocular measures
  - Duration/rate of blinks
  - Eyelid closure

Data Source: OptAlert
Worker monitoring fatigue technologies (passive)

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- Posture/head nod
- Ocular measures
  - Duration/rate of blinks
  - Eyelid closure
- Galvanic skin response

Data Source: BodyBugg
Worker monitoring fatigue technologies (passive)

- Brain activity (EEG)
- Posture/head nod
- Ocular measures
  - Duration/rate of blinks
  - Eyelid closure
- Galvanic skin response
- Heart rate variability

Data Source: Harvard Health
Ranking fatigue detection technologies

Ease of use

- Biomathematical models
- Fitness for Duty Tests
- Task Performance
- Worker monitoring
- Hybrid Solutions

Accuracy / Effectiveness
Defining a fatigue “threshold”

- Fatigue is on a continuum, not a cut point
- Fatigue “threshold” depends on task
- Risk = likelihood + consequence
- Fatigue mitigation strategies should consider this
Fatigue Risk Management Systems (FRMS)

- Risk-based approach vs. hours of service
Fatigue Risk Management Systems (FRMS)

- Risk-based approach vs. hours of service; hybrid models emerging
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- Reflects the need for multiple layers of defensive strategies: predictive, proactive, reactive
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- Risk-based approach vs. hours of service; hybrid models emerging
- Reflects the need for multiple layers of defensive strategies: predictive, proactive, reactive
- Shared responsibility of employers and employees
FATIGUE RISK MANAGEMENT SYSTEM

Policies & Procedures
- Outline of organizational management
- Required procedures

Responsibilities
- Roles and responsibilities


**FATIGUE RISK MANAGEMENT SYSTEM**

- Policies & Procedures
  - Outline of organizational management
  - Required procedures

- Responsibilities
  - Roles and responsibilities

- Risk Assessment / Management
  - Hours of work
  - Sleep patterns
  - Symptoms checklist
  - Error/Incident reporting

- Controls & Action Plans
  - Fatigue management “Tools” and decision trees

- Training
  - Promote knowledge about fatigue
  - Fatigue management strategies for employees
Implementation and Effectiveness of Fatigue Risk Management Systems (FRMS)
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- Potential challenges: cost, complexity, culture
NIOSH activities in fatigue detection and FRMS

- Collaboration between Center for Work and Fatigue Research, Center for Motor Vehicle Safety and Center for Direct Reading and Sensor Technologies: Interviews, literature review, science blogs
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- Miners: Project MANIFEST
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- Miners: Project MANIFEST
- Commercial vehicle operators: evaluation of the North American Fatigue Management Program

https://www.cdc.gov/niosh/topics/fatigue/default.html
Considerations for the future role of technologies
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- Criteria for validation of device
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- Criteria for validation of device
- Combined with other data sources
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- Criteria for validation of device
- Combined with other data sources
- Caution of overreliance on technology
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- Integration into FRMS and SMS
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- Combined with other data sources
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- Integration into FRMS and SMS
- Real world application of devices
Questions for the Board

- With the influx of new fatigue detection technologies available on the commercial market, what can NIOSH do to promote their effective use within a holistic approach to fatigue risk management?

- Given the limited company resources and the complex, integrated efforts needed for FRMS, how can we help employers/workers develop this comprehensive approach?
Thank you!

For more information, contact CDC
1-800-CDC-INFO (232-4636)

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.