Targeting Drowsy Driving for Safer Drivers, Safer Roads:

Technology to Culture and Back Again

Clare Anderson, PhD.
Professor of Sleep and Circadian Science
Centre for Human Brain Health, School of Psychological Sciences
University of Birmingham

Adjunct Professor (Research)
Monash University Accident Research Centre (MUARC)

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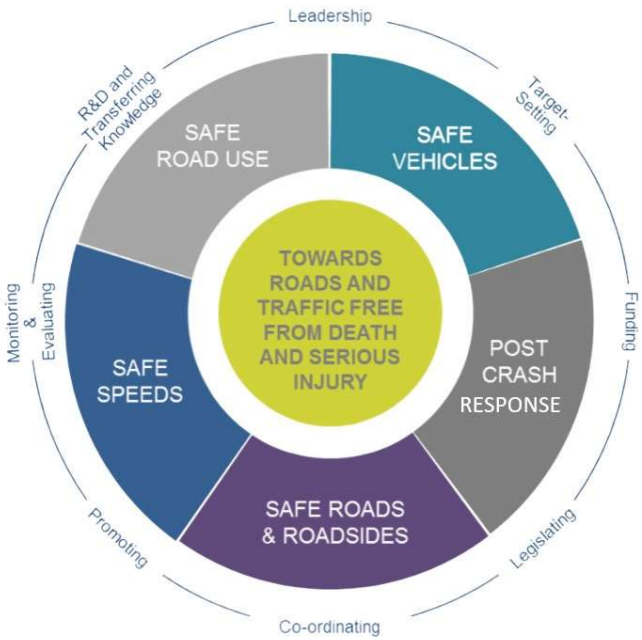
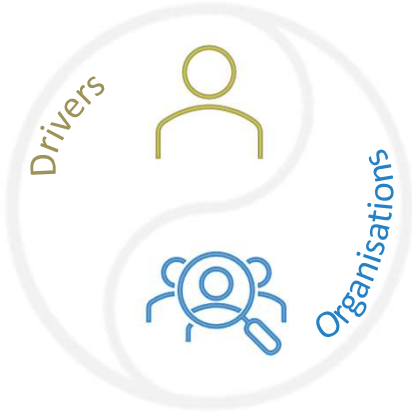
Road Safety as a Safe System



Source: https://www.pacts.org.uk/safe-system/

Shared Responsibility



Principle to Practice?

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Targeting Drowsy Driving

Principle to Practice

Fatigue Risk Management Solutions

Overview

- DROWSY DRIVING
  - **Causes and Consequences of Drowsy Driving**
  - **Countermeasures to Drowsy Driving**
- ROAD SAFETY AS A SHARED RESPONSIBILITY
  - **Key Driver Factors**
  - **Key Organisational Factors**
- SUMMARY

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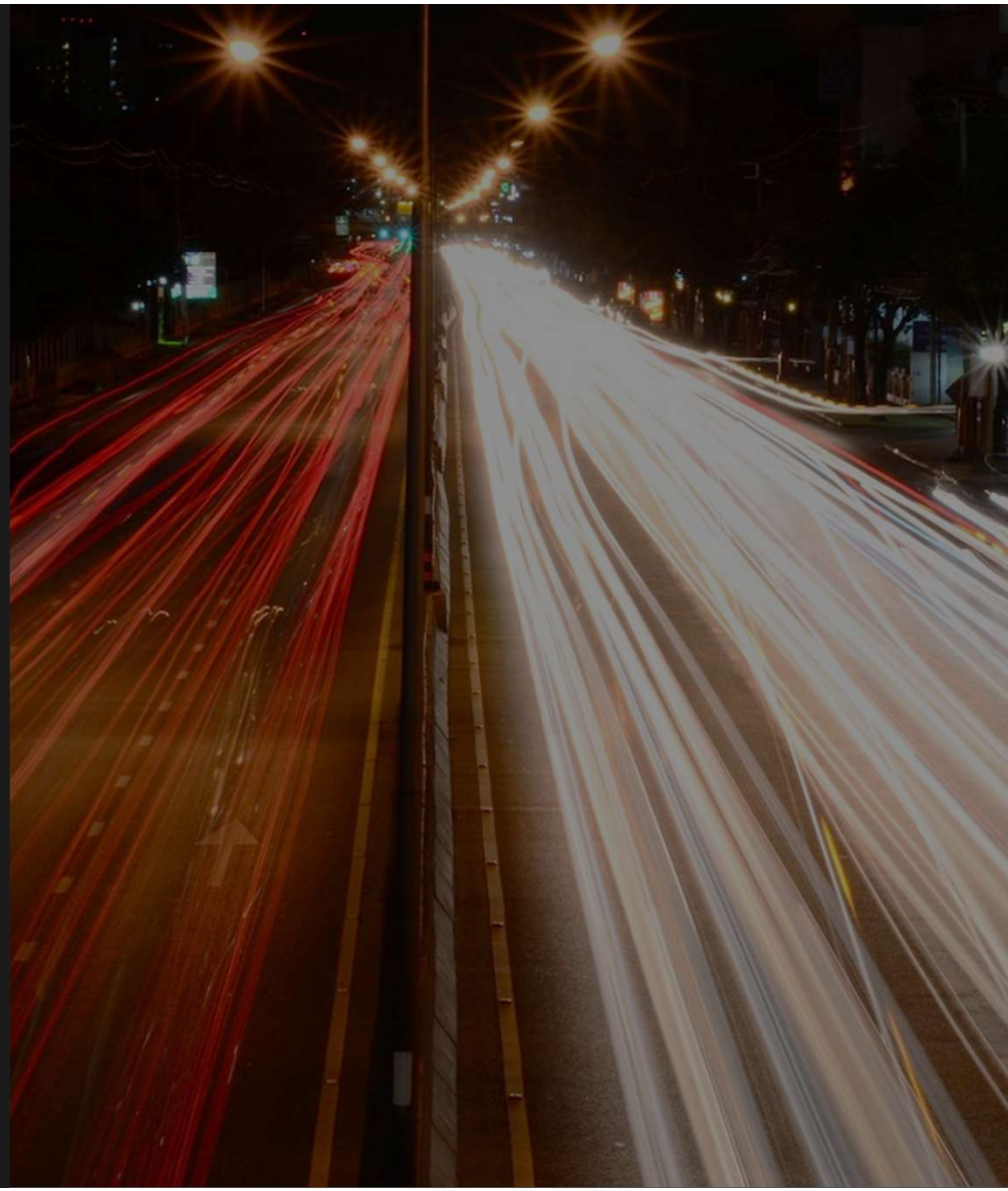
Causes Consequences Countermeasures

Drowsy Driving

Targeting drowsiness for safer drivers, safer roads



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What causes drowsiness & fatigue?

DROWSINESS

1. Total sleep loss
2. Sleep debt
3. Time of day
4. Sleep inertia
5. Sleep disorders

FATIGUE

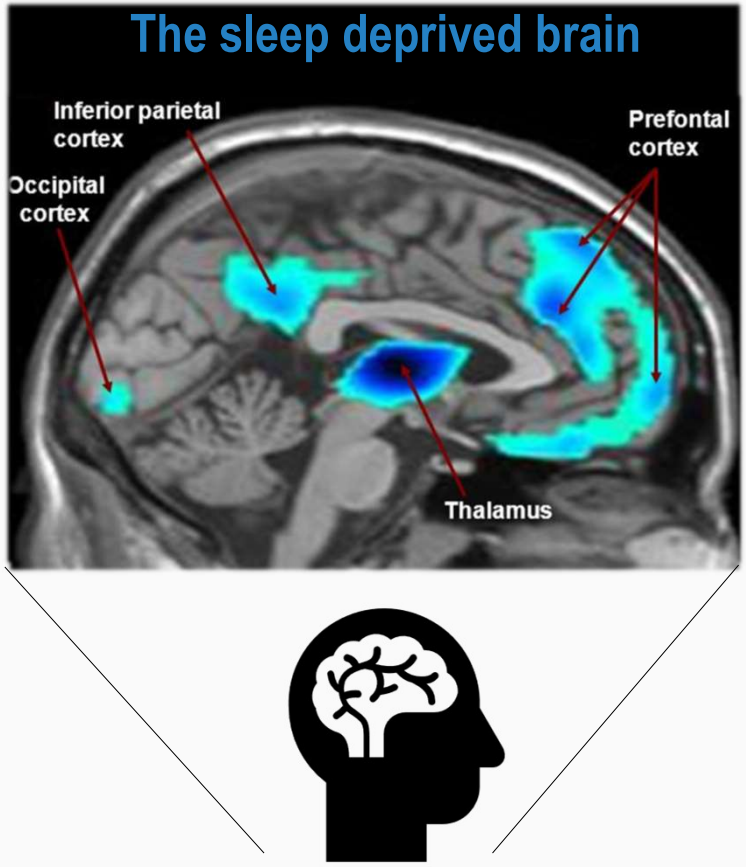
Time on Task

Cognitive Load

Stress

Physical Exertion

Medical Conditions



Sleep Deprivation: Consequences

Alertness & Attention

- Likelihood Falling Asleep
- Reduced Concentration
- Delayed Response Time
- Lapses in Attention
- Distractibility
- Task switching

Cognitive Function

- Logical Reasoning
- Memory Problems
- Poor Decision Making
- Impulsivity and Lack of Inhibitory control
- Poor Communication
- Flexible thinking or goal directed behaviours

Emotional Regulation

- Frustration
- Irritability
- Emotionally Reactivity
- Poor Social Interactions

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Sleep Deprivation: Consequences

A Driving Perspective

Poor concentration

Boredom

Stiffness, aches, cramps

Feeling restless

Speed inconsistent

Blinking more than normal

Daydream, distraction

Sore, tired eyes

Resting eyes at a stop light

Feeling drowsy or tired

Mood changes

Making errors

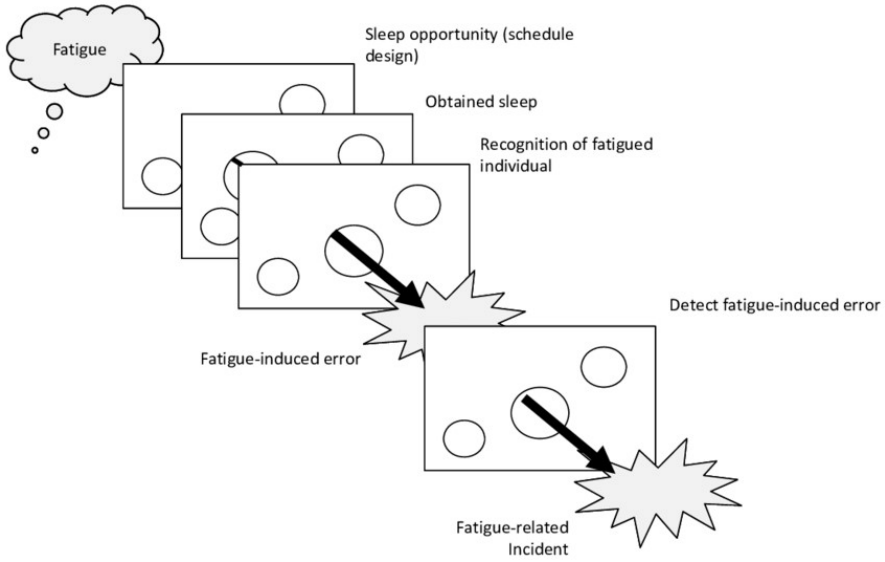
Difficulty keeping control

Falling asleep (microsleep)

Countermeasures for Drowsy Driving

Hours of work and rest
Education and awareness
Technological solutions
- Biomathematical modelling
- Predictive technology
- Monitoring technology

Incidence Reporting
Countermeasures
- Light
- Caffeine
- Napping
- Task load/duration



Jackson, P.G. (2015) Managing Fatigue using a Fatigue Risk Management Plan.

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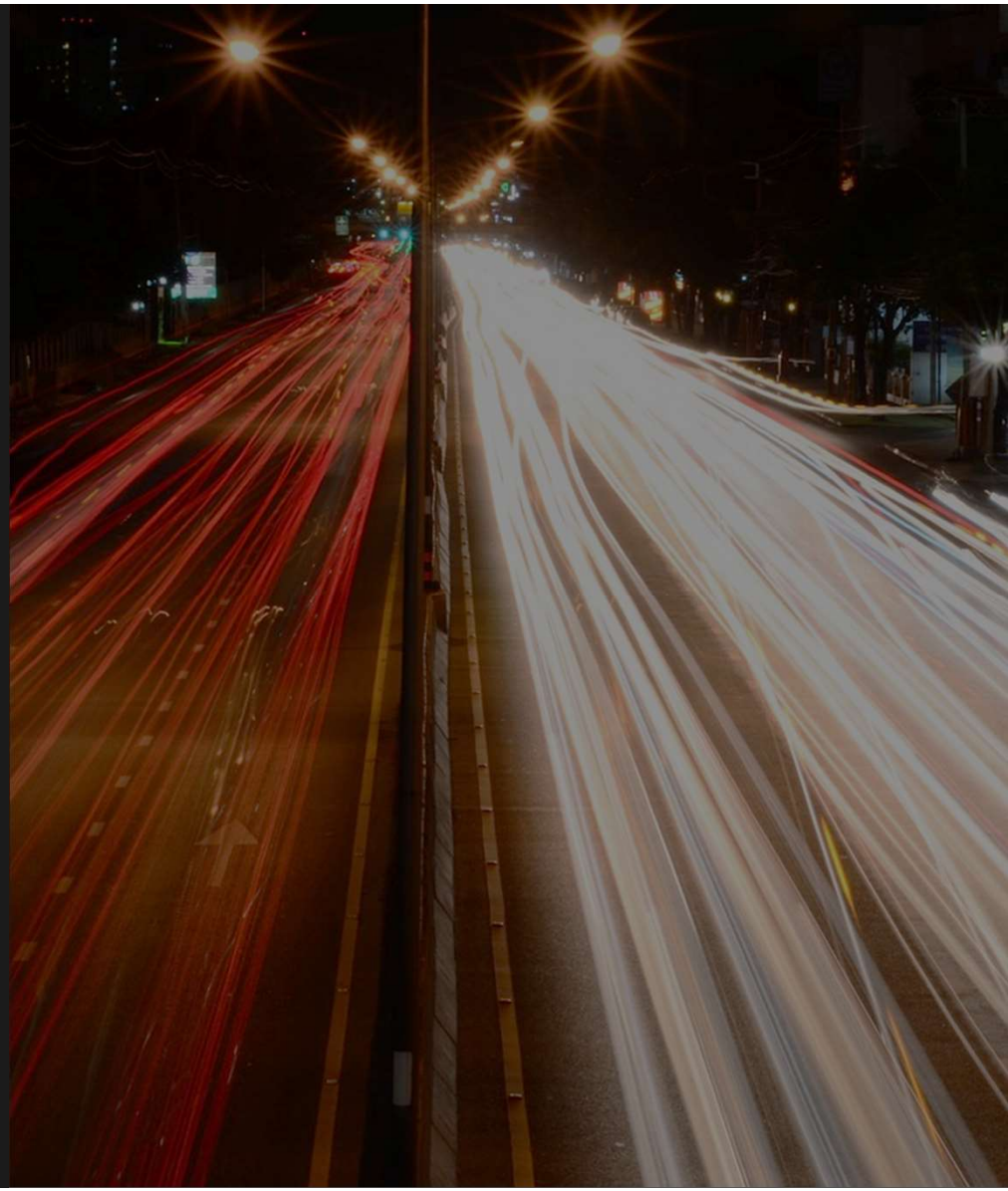
Road Safety: A Shared Responsibility

Driver and Organisational Factors Involved in Promoting Alertness, Health and Safety.



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Driver Factors

1. **Prioritise sleep to promote fitness to drive?**

Sleep guidelines?

Historically, researchers used 5 hours of sleep as 2.9 increase odds in risk of crash where car occupant was injured (Connor et al., 2002)

Across 6845 drivers involved in a RTC, risk of culpability increased as a function of sleep loss. Relative to those sleeping 7 – 9hours…

Drivers who had 5 hours prior sleep were 2.9 times more likely to be culpable

Drivers who had <4 hours prior sleep were 15.1 times more likely to be culpable
(Tefft et al., 2018)

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Driver Factors

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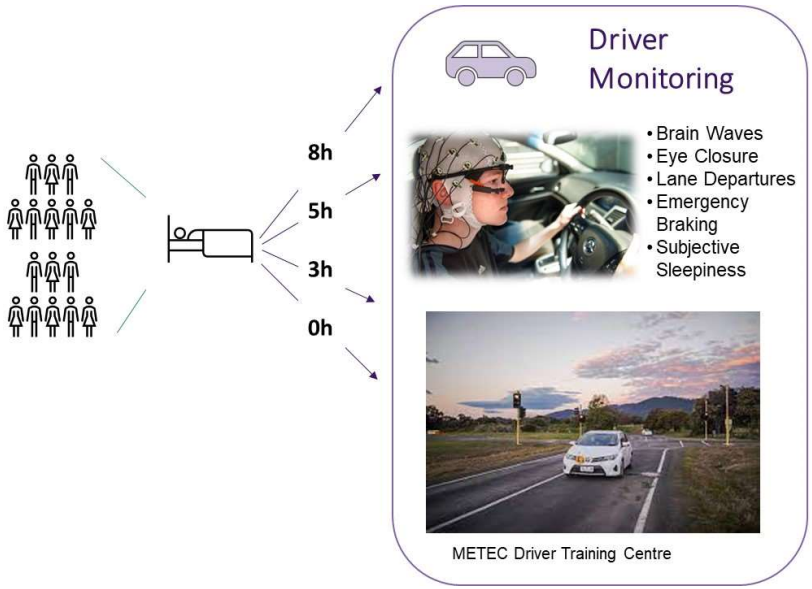

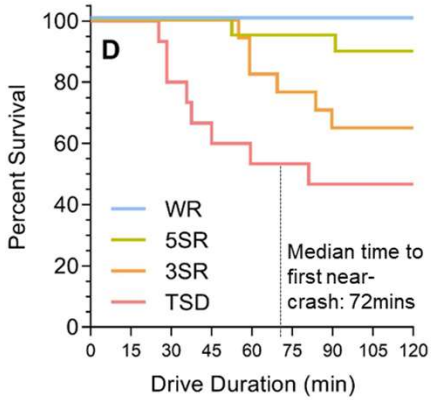

<5h sleep = more than 4x crash risk

Manousakis & Anderson (2024). Unpublished

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Driver Factors

1. Prioritise sleep to ensure fitness to drive – ideally at least 6 hours prior to driving
2. **Stop, take a break**

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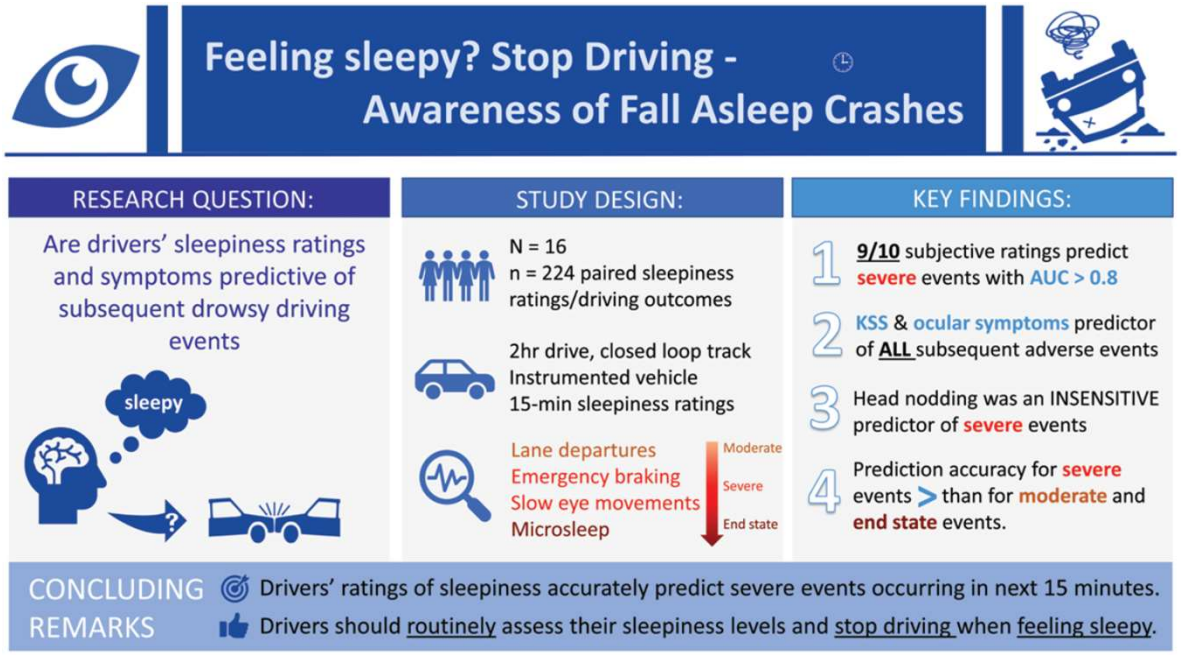
Original Article

Feeling sleepy? stop driving—awareness of fall asleep crashes

Clare Anderson[1,2,3,*], Anna W.T. Cai[1], Michael L. Lee[2,3], William J. Horrey[4,5], Yulan Liang[4], Conor S. O'Brien[2,6], Charles A. Czeisler[2,3] and Mark E. Howard[1,2,3,7].



Anderson et al. (2023). Sleep, **8, zsad136**

Driver Factors ⇌ Organisation Factor

1. Prioritise sleep to ensure fitness to drive – ideally at least 6 hours prior to driving
2. Stop, take a break – every 2 hours OR when feeling any sign of sleepiness
3. **Report sleepiness, adverse events, sleep problems, other sleep factors**

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Organisational Factors

1. **In-Vehicle Technology**

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Organisational Factors

1. In-Vehicle Technology

Active safety systems are an important part of safe systems approach

Optalert®

Seeing Machines ™

SmartCap™

Geobox©

Cardiowheel©

AmTech PST©

PVT Workfit ©

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Organisational Factors

1. In-Vehicle Technology

Active safety systems are an important part of safe systems approach

1. Carefully evaluate technology *(validation)*
2. Accepted by workers/drivers
3. Effective utilisation of data

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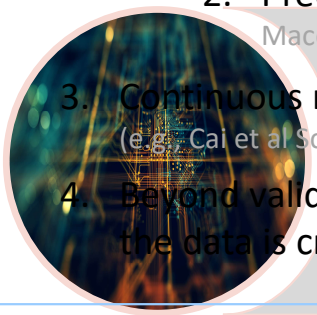
An evaluation and comparison of commercial driver sleepiness detection technology: a rapid review

Jennifer M Cori[1,2,3,6,7], Jessica E Manousakis[1], Sjaan Koppel[4], Sally A Ferguson[5], Charli Sargent[5], Mark E Howard[1,2,3,6,7] and Clare Anderson[1]

Key findings

1. Ocular-based systems are highly effective for detecting drowsiness (e.g. Anderson et al. 2013, 2018. Cori et al., 2020)
2. Prediction technologies have good utility (e.g., Maccora et al. 2018)
3. Continuous monitoring technology can be effective. (e.g. Cai et al Sci Rep. 2020)
4. Beyond validity, effective implementation and utility of the data is critical



Continuous Monitoring

Prediction Technologies

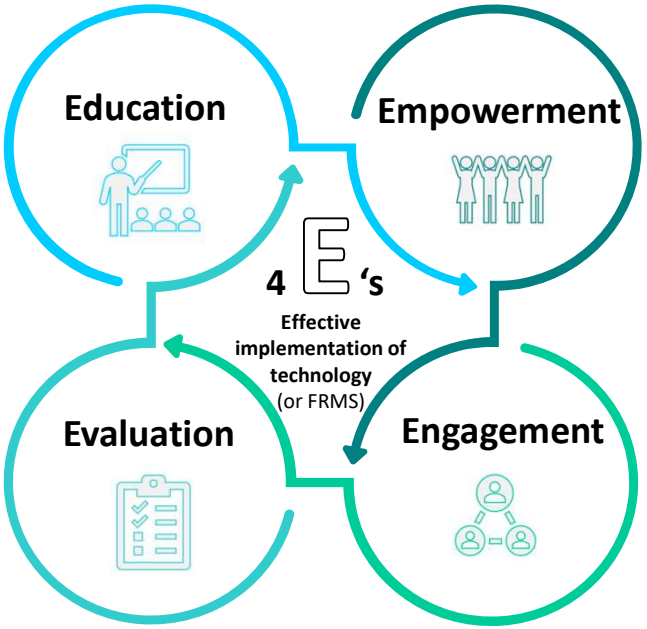
Scheduling Technologies

Native Systems

Organisational Factors

1. In-Vehicle Technology

2. **Implementation**



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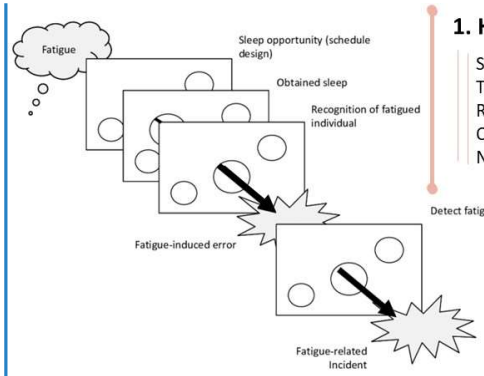
Organisational Factors

1. In-Vehicle Technology

2. Implementation

3. **Culture**



1. Hours of Work & Rest

- Shift Duration
- Time between shifts
- Rest breaks
- On-Call
- Night work

2. Biomathematical modelling

- Identify 'problem' schedule
- Compare schedules

3. Prediction Tech

- Identify fatigued individuals

4. Awareness

- Drivers to stop when drowsy

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Organisational Factors

1. In-Vehicle Technology

2. Implementation

3. **Culture**

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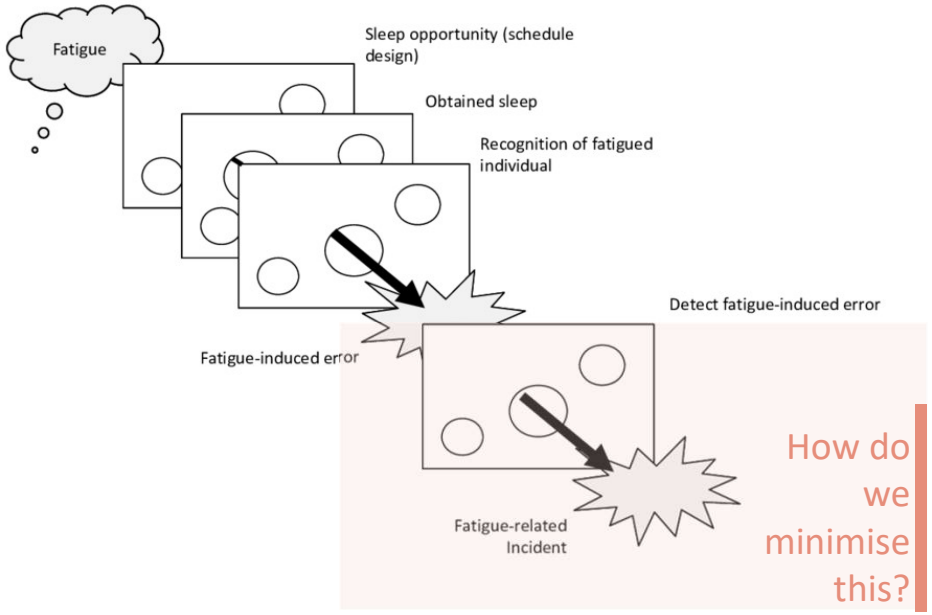
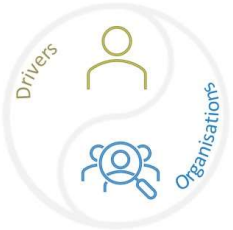


Detect/ Report

Solution

Jackson, P.G. (2015) Managing Fatigue using a Fatigue Risk Management Plan.

Organisational Factors ⇌ Driver Factors



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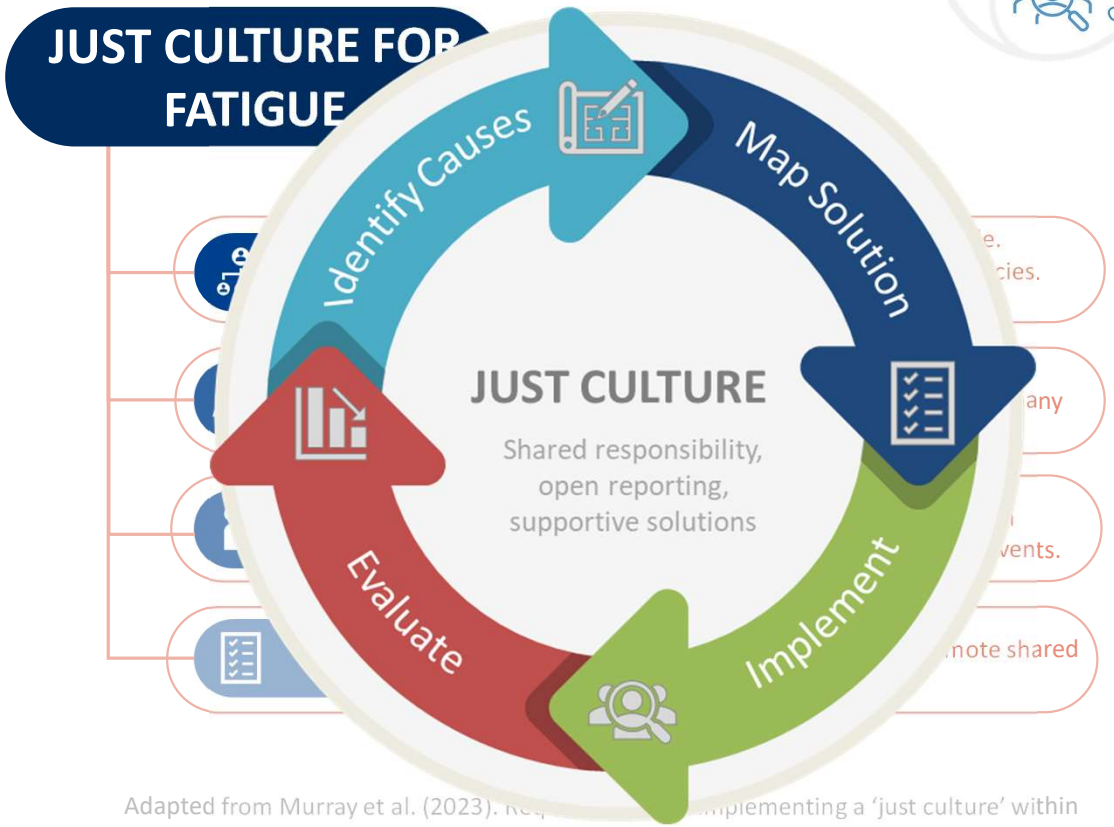

Adapted from Murray et al. (2023). Re… implementing a 'just culture' within healthcare organisations: an integrative review. BMJ Open Quality. **12:**e002237

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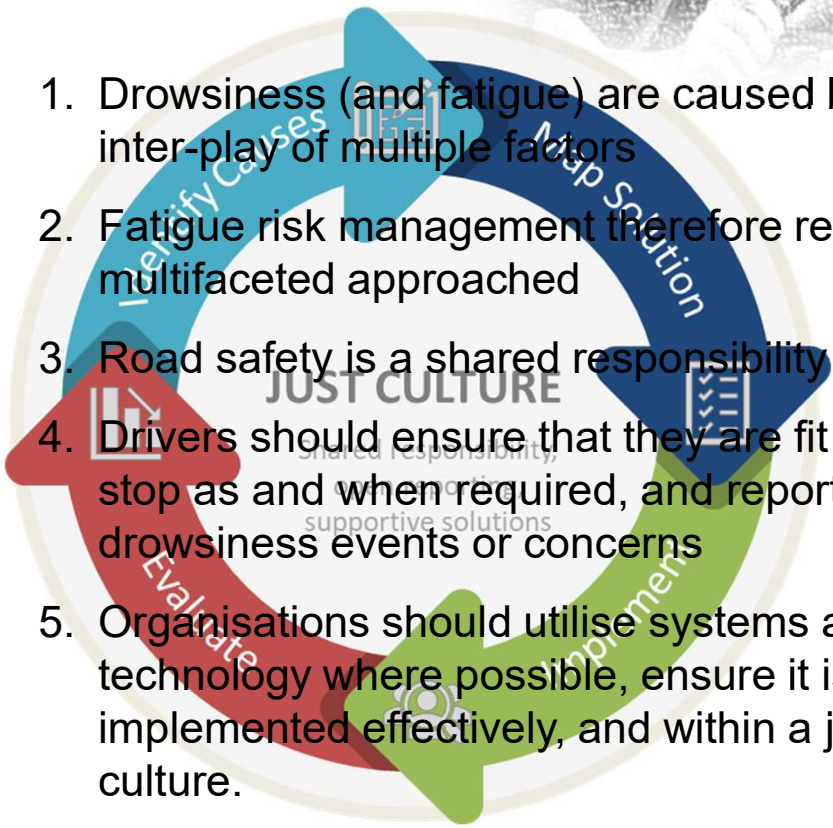
Summary Remarks



1. Drowsiness (and fatigue) are caused by an inter-play of multiple factors
2. Fatigue risk management therefore requires a multifaceted approached
3. Road safety is a shared responsibility
4. Drivers should ensure that they are fit to drive, stop as and when required, and report drowsiness events or concerns
5. Organisations should utilise systems and technology where possible, ensure it is implemented effectively, and within a just culture.
6. Any questions?

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UNIVERSITY OF BIRMINGHAM

c.anderson.4@bham.ac.uk
@sleepyclare
https://www.birmingham.ac.uk/staff/profiles/psychology/anderson-clare