Can we convince tired drivers to take a break from driving?

Ann Williamson¹, Rena Friswell¹, Jake Olivier², Raphael Grzebieta¹ and Rainer Zeller¹

1 Transport and Road Safety (TARS) Research Centre
2 School of Mathematics and Statistics
Relationship: fatigue and crashing

Driver fatigue:
- accounts for a significant proportion of fatal crashes
- Current countermeasures involve guidance to drivers
Guidance-based fatigue countermeasures focus on:

• Advice to drivers on the fatigue experience and when to rest when they experience fatigue

But do drivers have insight into their fatigue to be able to stop and rest prior to crashing?
Study 1: Can drivers tell when too tired to drive?

Short sleep period last Night (< 5 hrs)

2 hr monotonous, afternoon drive (simulator)
Driver (n=60) ratings of sleepiness, risk of falling asleep, risk of crashing every 200 secs.

Relationship ratings and subsequent driving performance (Cox’s regression)

* Williamson, Friswell, Grzebieta, Olivier and Zeller (2014)
Results: Drivers are aware of increasing fatigue while driving

Driver predictions of:

<table>
<thead>
<tr>
<th>Falling asleep in next few minutes</th>
<th>≥ 4 times more likely to crash, 9 times more likely to cross centreline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleepiness</td>
<td>10 times more likely to cross centrelines</td>
</tr>
<tr>
<td>Crash likelihood</td>
<td>Not so accurate</td>
</tr>
</tbody>
</table>
Conclusion

• Drivers are aware of sleepiness, and likelihood of falling asleep before safety-related outcomes occur.
• Drivers can make an informed decision about the safety of their driving when fatigued.

So:

Why do fatigue-related crashes continue to occur?
If drivers know they are tired, why don’t they do something about it?
Current Study Aim

• To investigate whether drivers can be motivated to increase break-taking in response to fatigue

Study design:

• In a simulator, three groups of drivers:
  – Incentive for safe performance, or
  – Incentive for trip completion, or
  – No incentives.
### Study design

Fatigue induction (all groups) = short prior sleep (5hrs), test - afternoon, monotonous country drive scenario

<table>
<thead>
<tr>
<th></th>
<th>Safety incentive</th>
<th>Time incentive</th>
<th>No incentive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reimbursement at completion of two hour drive</td>
<td>$100</td>
<td>$100</td>
<td>$100</td>
</tr>
<tr>
<td>BUT…</td>
<td>Lose $20 for any crash, drive off-road, centreline crossings</td>
<td>Lose $20 for each minute over two hours to complete the drive</td>
<td>-</td>
</tr>
<tr>
<td>No. participants</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>
Study measures

- **Driving performance:**
  - Crashes,
  - Centreline crossings, lane departures, lane edge touches, variability of lane position

- **Subjective ratings (made every 200 secs):**
  - Sleepiness
  - Likelihood of falling asleep
  - Likelihood of crashing

- **Drowsiness**
  - Optalert (JDS)
Participants

n = 30 participants per group
63.7% male
Mean age = 26.4yrs
(range 20-60yrs)

Procedure

• Practice drive
• Validation of sleep reduction by actigraph
• Drive commenced 14:30hr
• Duration = 1:59hr at posted speed limits (80, 100, 110kph)
• Ratings prompted by tone every 200 secs
• = 35 across drive
### Results: sleepiness manipulation

<table>
<thead>
<tr>
<th></th>
<th>Mean (sd)</th>
<th>Diff between groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual sleep hours</td>
<td>4.49h (0:56)</td>
<td>ns</td>
</tr>
<tr>
<td>Sleep quality rating (/100)</td>
<td>57.8 (23.9)</td>
<td>ns</td>
</tr>
<tr>
<td>Hrs since waking at start of drive</td>
<td>7:25 (1:21)</td>
<td>ns</td>
</tr>
<tr>
<td>Mean highest KSS rating</td>
<td>7.56 (1.69)</td>
<td>ns</td>
</tr>
<tr>
<td>Highest Optalert score</td>
<td>3.10 (1.70)</td>
<td>ns</td>
</tr>
<tr>
<td>Participants reporting falling sleep</td>
<td>35.6%</td>
<td>ns</td>
</tr>
</tbody>
</table>
The Drive

Time to complete drive:
- Time group faster than no motivation group

% drivers who stopped
- Fewer Time group stopped than either other group

Mean total time stopped
- Both motivation groups stopped for shorter period than no motivation group
Driving Performance

Lane edge touches
- Fewer edge touches for Safety Motivation than No motivation

Variability of lane position
- Safety Motivation less variable than No motivation
**Time**
- Completed trip faster
- No or few short breaks
- Driving performance poor

**Safety**
- Trip longer (but by small margin)
- More/longer breaks
- Best driving performance

**No Incentive**
- Highest trip duration
- Stopped most/longest
- Poorest performance
Summary of results

• All groups reached same levels of fatigue during the drive
• Safety incentives group significantly improved driving performance
  – due to drivers taking strategic rest breaks (?)
  – (without significant cost to time in the trip)
Can drivers be motivated to take more breaks when fatigued?

**YES, if we provided incentives to do it.**
So what?....... We need to.....

1. **Change** the message to road users about fatigue
   – Emphasise the **need to avoid the consequences of feeling fatigue** and make safe decisions (similar to decision to not speeding or drink-driving)

2. Vigorously enforce penalties for crashes and incidents shown to involve fatigue
   – Increase motivation to comply

3. Explore the strategic use of technology in enhancing enforcement
People can be motivated to respond to the signs of fatigue and driving performance improves…

So why don’t we do it?
“Unfortunately, there’s no law against driving after doing triple shifts.”