



**Fatigue Kills
Take a Break**

Methodology of Evaluating Truck Driver Fatigue Interventions: Results from a Pilot Study

Bronson Du, Univ Waterloo,
School of Public Health & Health
Systems

Hugh Davies, UBC

Pete Johnson, Univ Washington

Phil Bigelow, Univ Waterloo

Driver Fatigue is an important cause of road crashes.

Driver fatigue is very dangerous condition created when a person is suffering symptoms of fatigue while driving, often resulting from the hypnotic (Inducing sleep; soporific or hypnosis) effect especially during nighttime (peak levels at night can be 10 times daytime levels) driving either falling asleep at the wheel or so exhausted they made serious - and fatal - driving errors.



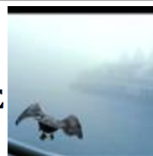
THE AGE
Victoria

Truck driver 'fatigued' before fatal crash

May 28, 2013

A truck driver was fatigued at the time he crashed into the back of a car and killed its occupant because he had been doing extra driving work outside his usual job, a court has heard.

FEATURED VIDEO
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Driver fatigue potential cause of Coquihalla Highway tour bus crash: transportation minister

THE CANADIAN PRESS SEPTEMBER 18, 2014

thestar.com
ONTARIO

News / Ontario

Driver sleepy in 18% of fatal crashes, study finds

Driver fatigue could be the cause of almost one in five fatal crashes and motorists need to wake up to the fact that feeling a little drowsy behind the wheel can be deadly, a report released today suggests.



DRIVER FATIGUE – AN ACCIDENT WAITING TO HAPPEN

This topic is sponsored by [NRMA – ACT Road Safety Trust](#).

Although we often associate driver fatigue with long-haul truck drivers, it can affect all of us.

Strange things happen in the dead of night. A car leaves a dark and lonely highway, apparently at full speed, and slams into an unforgiving tree. Nobody sees it happen and the driver is dead. On another country road, a car drifts from its lane for no obvious reason and smashes into an oncoming truck, killing all the car's occupants.

More than likely, these crashes were caused by fatigue: drivers either falling asleep at the wheel or so exhausted they made serious – and fatal – driving errors.



Truck Crashes



Police-Reported Commercial Motor Vehicle Traffic Crashes (US Department of Transportation, 2013)

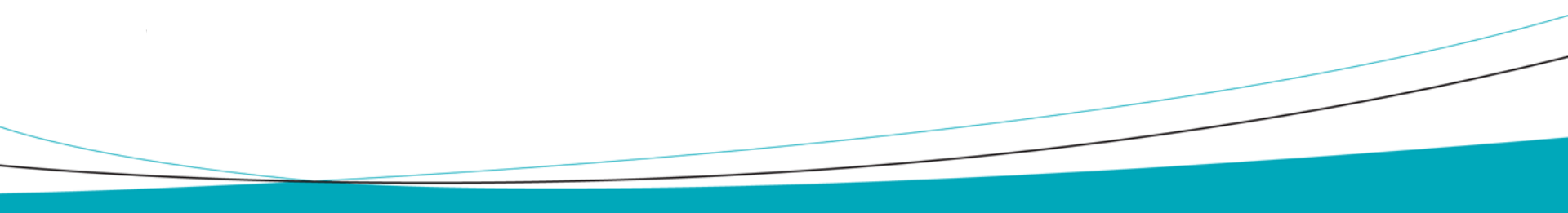
	Fatal	Injury	Property Damage only	Total
2011	3,341	60,000	210,000	273,000
Cost / Crash	\$7, 200, 000	\$331, 000	\$18, 000	n/a
Total Cost	\$39 Billion	\$32 Billion	\$16 Billion	\$ 87 Billion

Prevalence of Truck Driver Drowsiness

MaCartt et al. 2000 (n=593)

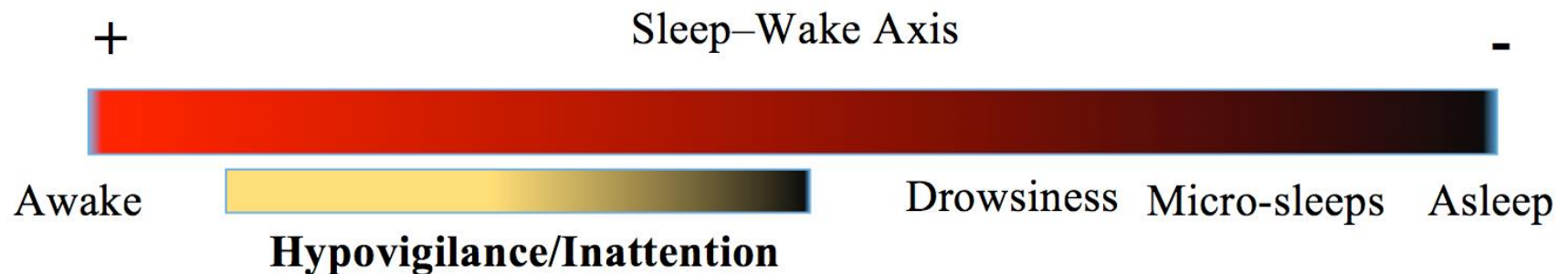
- 47% have fallen asleep at the wheel of their truck
- 25% have done so in the past year

Castro et al. 2004 (n=238)

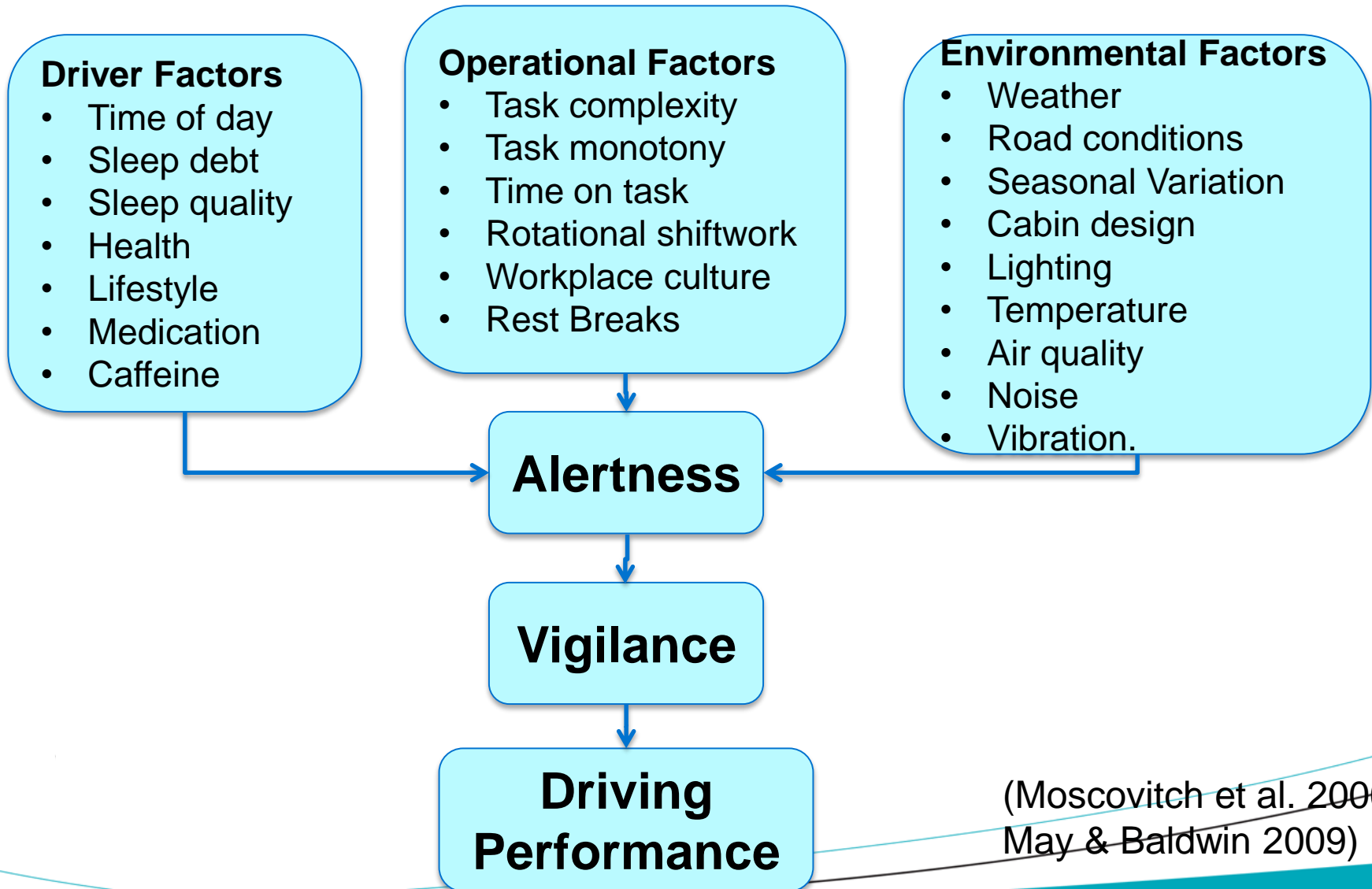
- 56% are tired at least some of the time while driving
 - 32% have driven with their eyes closed
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Vigilance

- an ability to sustain attention to a task for a period of time (Parasuraman, 1998)
- Cannot reliably detect the first signs of transitioning to a low level of wakefulness (Thiffault, 2011)



Factors affecting Driver Drowsiness



(Moscovitch et al. 2006;
May & Baldwin 2009)

Measuring Driver drowsiness

- Many tools
 - Perclos, AveClos, Blink frequency/duration
 - Steering wheel variability
 - Standard deviation of lane departure
 - Many of these assessment tools are validated using the **Psychomotor Vigilance Task**

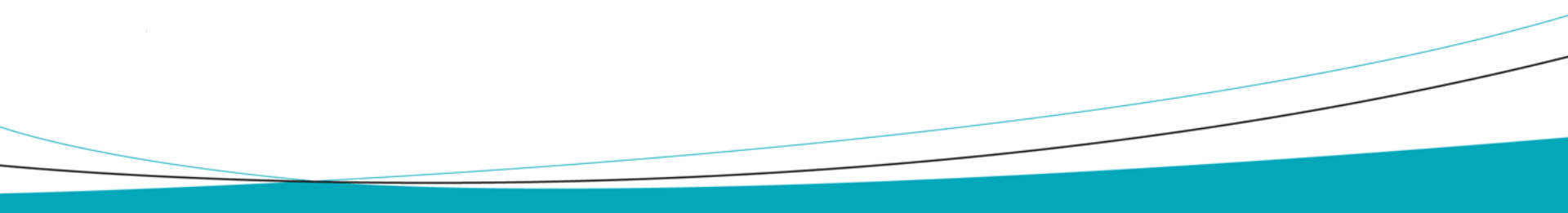
Psychomotor Vigilance Task (PVT)

- 10-minute sustained attention reaction time task
- Stimulus appears randomly between 2-10 seconds
- Performed on a computer, tablet or smartphone
- Often used to measure changes in alertness during sleep deprivation



Dependent variables

Changes in Vigilance

1. Mean Reaction Time
 2. Inverse Mean Reaction Time
 3. Fastest 10% reaction time
 4. Slowest 10 % reaction time
 5. Variability
 6. Performance Errors (< 100 ms)
 7. Vigilance Lapse (>500 ms)
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Purpose

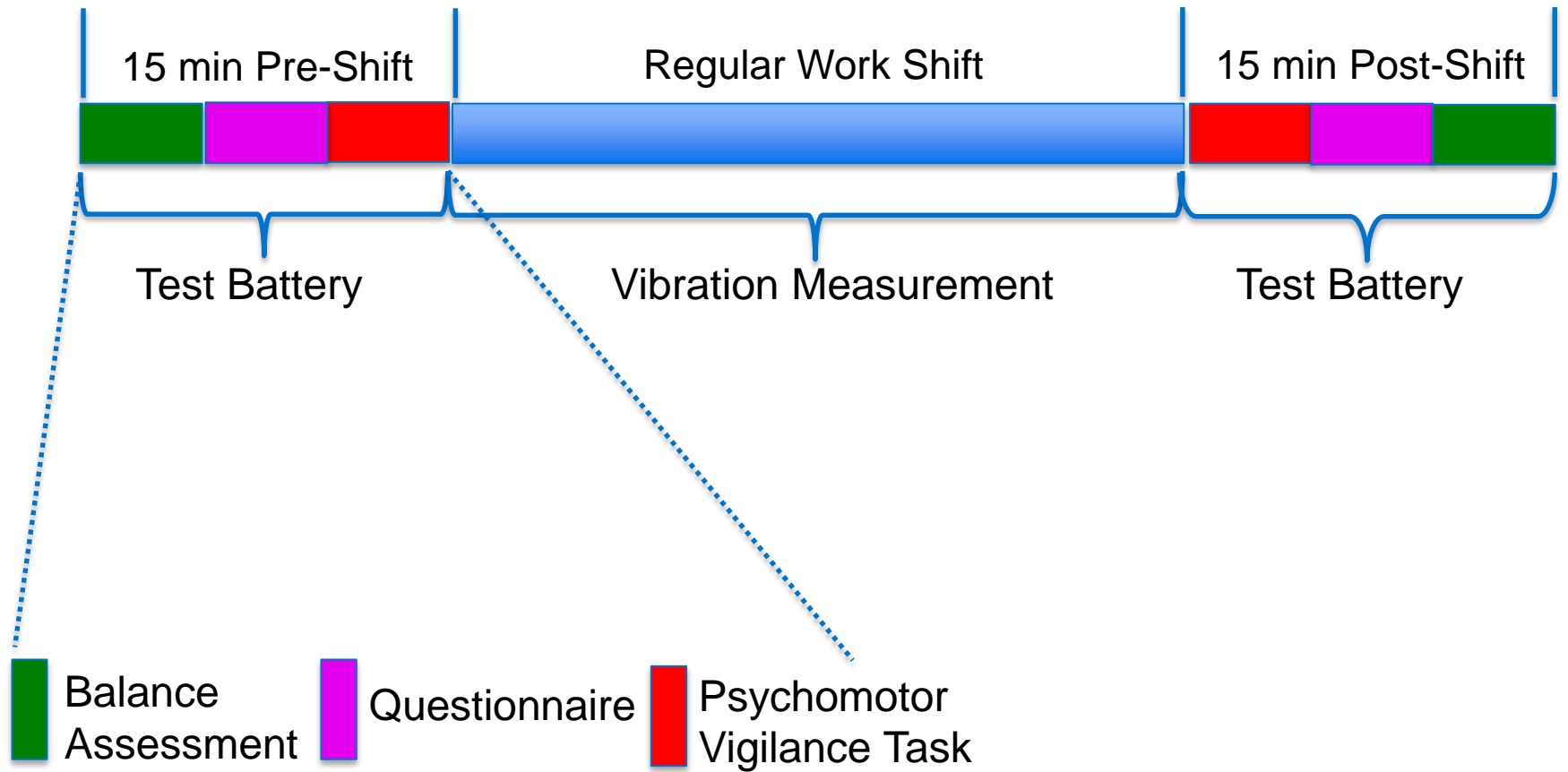
- To develop sensitive and feasible method to detect changes in vigilance over a truck driver's work-shift in the field setting

Protocol and Participants

N=5

	Conventional Seat					Seat Installation		EMVC Seat				
Day	1	2	3	4	5	6	7	8	9	10	11	12
Pre-Shift	Questionnaire PVT					Seat Installation	Questionnaire PVT					
Work Shift												
Post Shift	PVT Questionnaire						PVT Questionnaire					

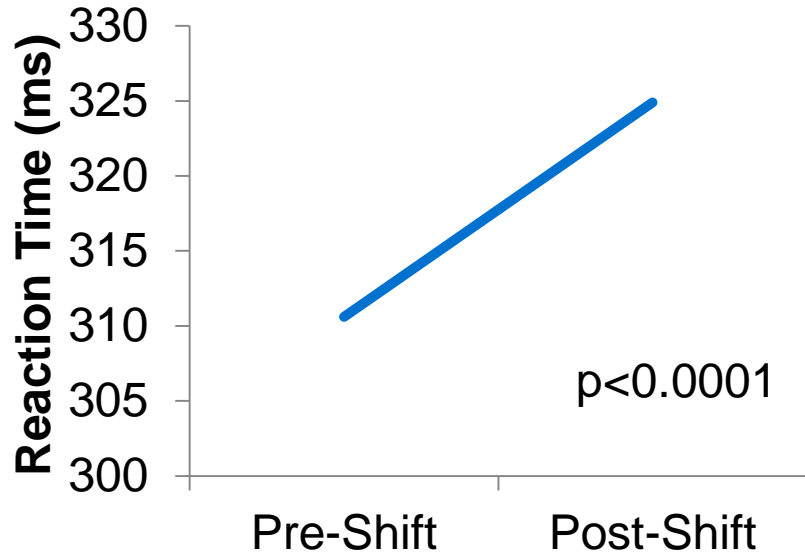
Procedures



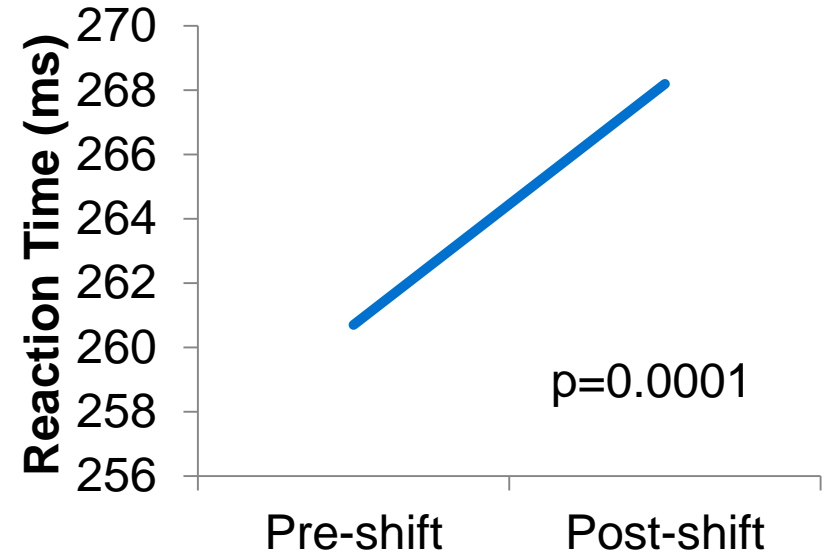
Summary of Results

- 5/6 measured variables showed significant decrements in performances over the entire shift regardless of seating condition

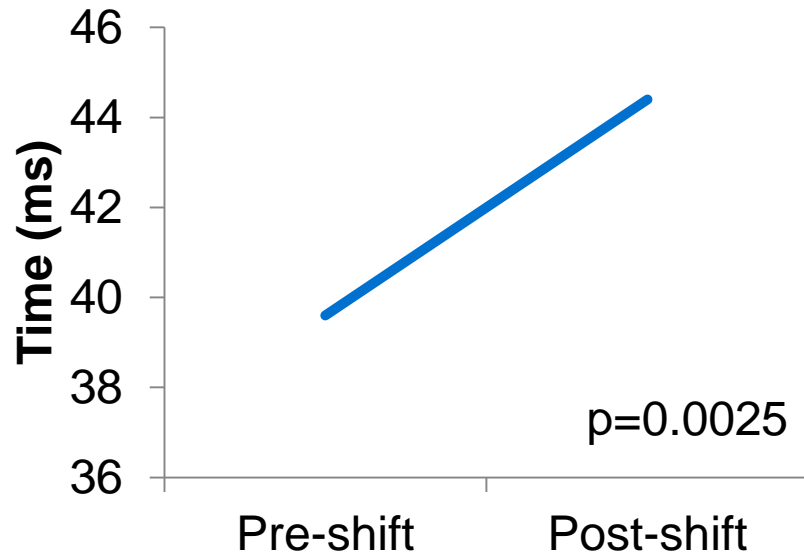
Mean Response Times



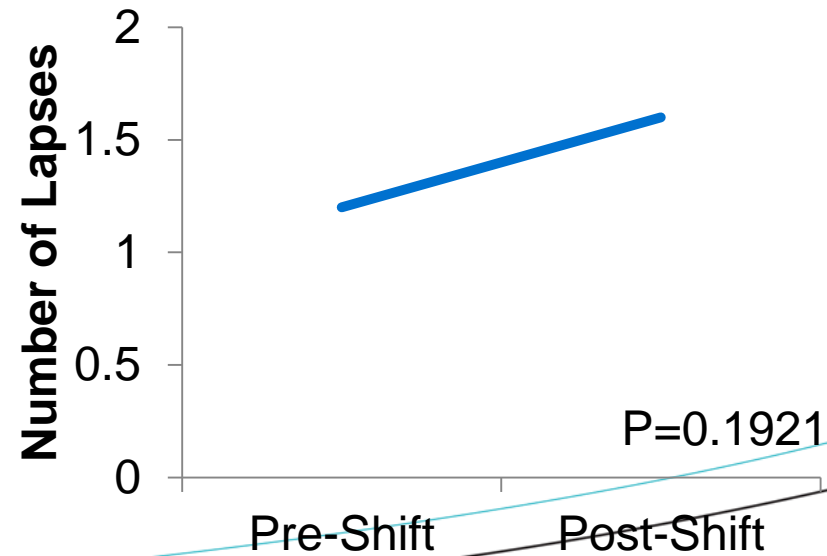
Fastest 10%



Variability



Lapses >500ms



WBV and Vigilance

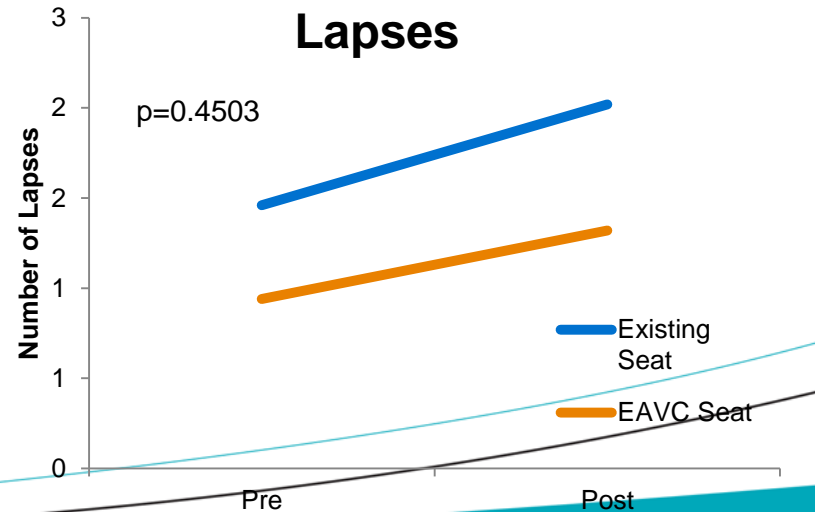
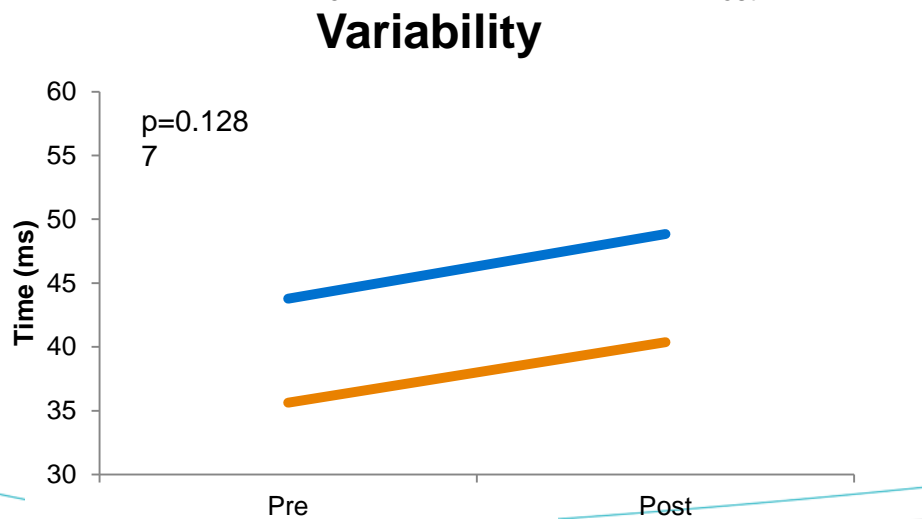
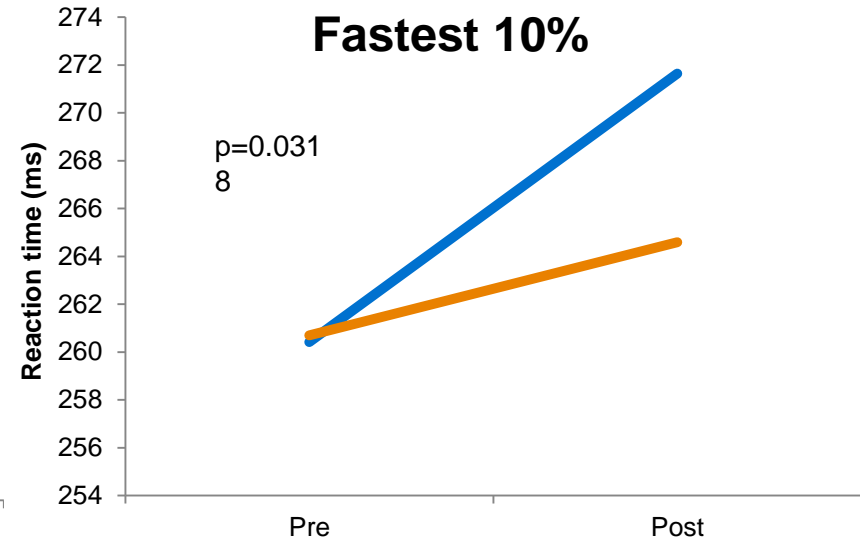
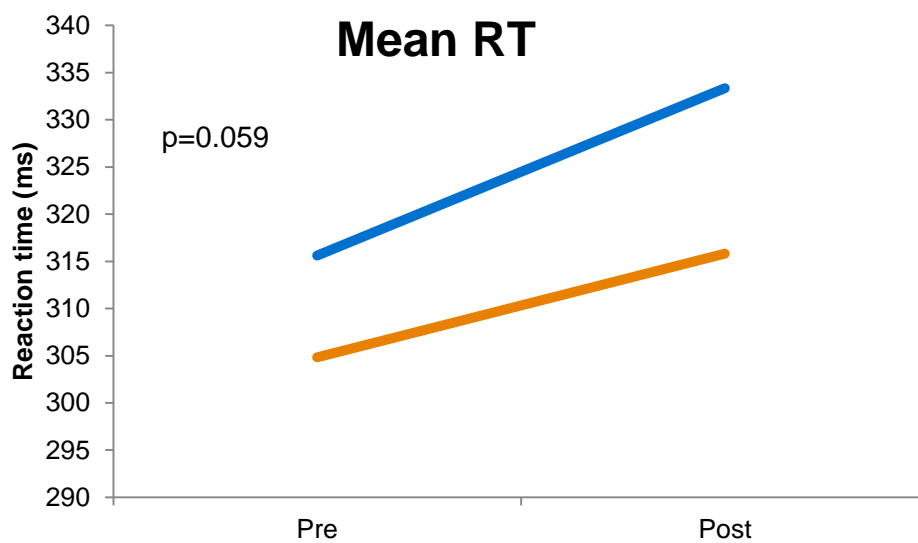
Lab Studies using Objective measures

- Decrease in wakefulness after acute exposure to WBV using EEG (Satou et al. 2006; Satou et al. 2007)
- Increased reaction times and vigilance lapses after acute exposure to WBV. (Wang & Johnson 2014)

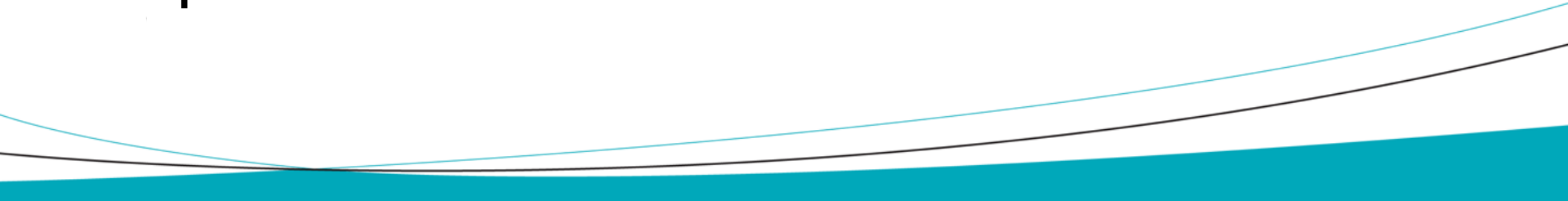
Lab Studies using Self-reports

- Conflicted results with self reported alertness after acute exposures to WBV (Ljungberg 2010)

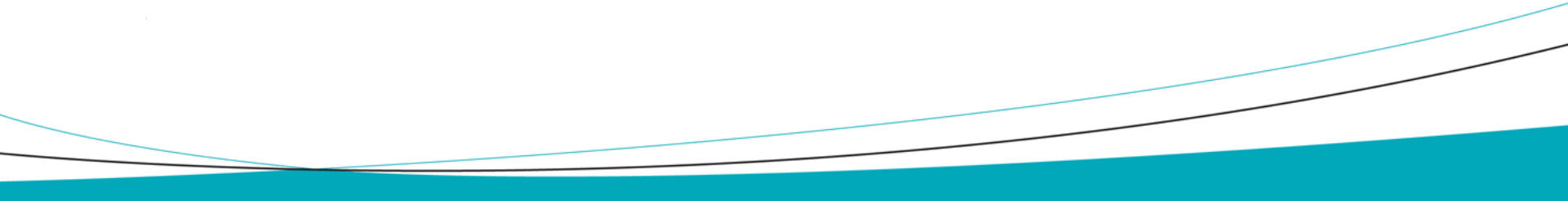
Active vs. Passive Seat Suspension



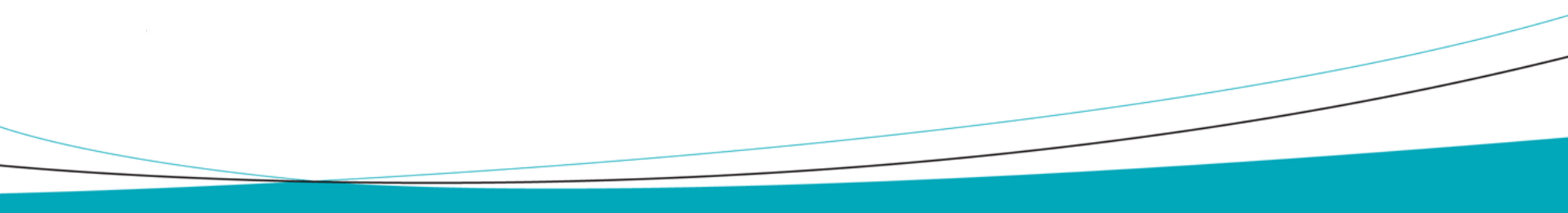
Summary

- PVT was sensitive to detect changes between pre- and post- shifts in the field setting
 - The Fastest 10% of the reaction times was the most sensitive parameter to detect changes with an intervention
 - Drivers very accepting of PVT and questionnaire administration
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Limitations

- PVT cannot be assessed while driving
 - No real time fluctuations of alertness
 - Small sample size
 - Potential Confounding
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Acknowledgements

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THANK YOU

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APPLIED HEALTH
SCIENCES

www.ahs.uwaterloo.ca