Driver behaviour: What's behind the numbers?

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Drivers' choices are an important part of the road transport system

but they are only one part (and drivers shouldn't bear all of the blame when they choose wrong)

The principles of the Safe System approach

Safer Journeys

TRG Transport Research Group

Drivers do choose

Their speed
(moment to moment)

When/whether to drive
(after drinking, tired, etc.)

To use their seat belt

Not to use their phone

When to merge or overtake

Their vehicle/travel mode

Drivers don't choose

The design of the road

The speed limits

The road rules

The location of roadside hazards

The rigour of licence testing

The skills & safety of other road users

Speed and Alcohol by the numbers

Speed is the single biggest road safety issue in New Zealand

average 750 Death/Serious injury crashes per year (NZTA, 2018)

In 2017 speeding was a contributing factor in 95 fatal crashes, 526 serious injury crashes and 1,362 minor injury crashes

Alcohol is the second biggest road safety issue in NZ

average 500 Death/Serious injury crashes per year (NZTA, 2018)

In 2017, alcohol or drugs were a contributing factor in 123 fatal crashes, and 448 serious injury crashes and 973 minor injury crashes.

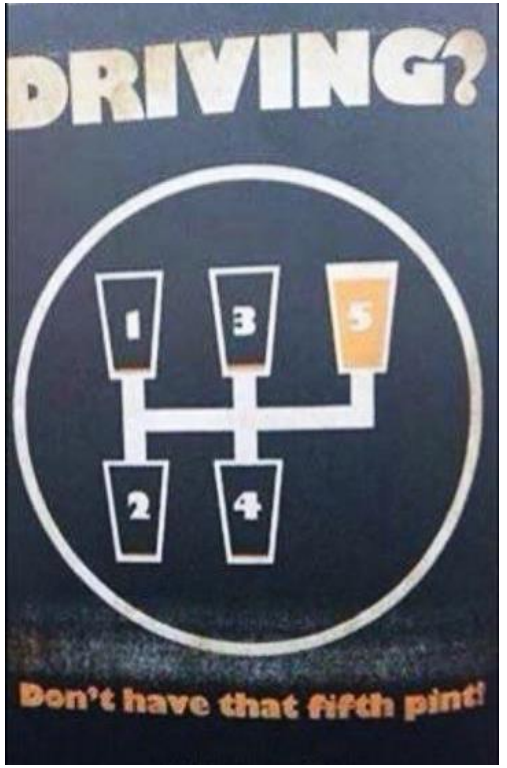
Speed and Alcohol perceived to be greatest causes of crashes by both the general public and Police (Rolison, et al, 2018)

Speed and Alcohol by the numbers

Continue to be major contributors to crashes

But do these numbers tell the whole story?
Do they tell us how to address these perennial problems?
(other than “getting tough”)

We've been trying to solve these problems for over 50 years,



And the numbers show that we still have a significant problem…

Crash fatalities have increased 52% since 2013
Currently highest since 2009

Crash serious injuries have increased 44% since 2013
Currently highest since 2008

Population growth +8% since 2013

GDP growth +15% since 2013

Why are these issues so difficult to solve?

What's behind the numbers?

Over many years researchers have conducted experimental studies to examine the processes underlying driver behaviour

What have we learned?
First, let's consider speed

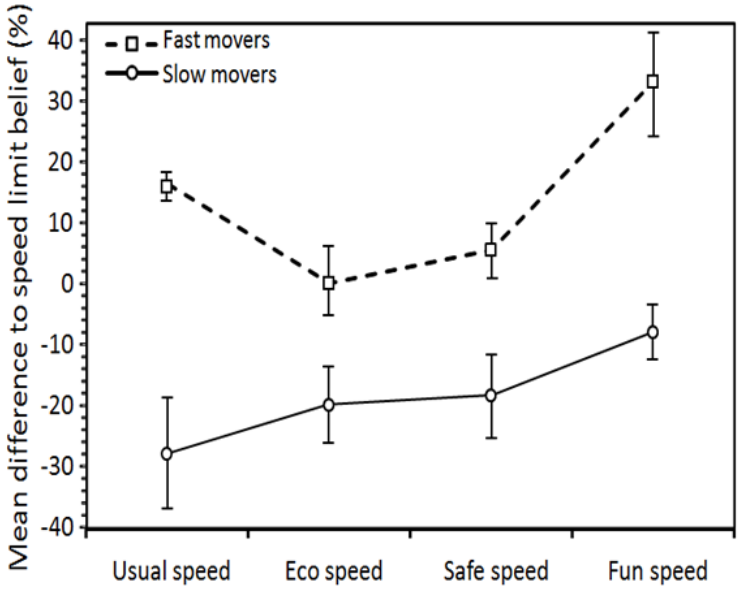
In 2016 the total social cost of crashes involving drivers speeding was about $879 million, 22% of the social cost associated with all injury crashes

Why do drivers drive the speeds they do?

We routinely find significant heterogeneity of speeds, and large differences in individual preferences

Fast movers: prefer to travel 10% faster than the speed limit

Slow movers: prefer to travel 10% slower than the speed limit



(Ahie, Charlton, & Starkey, 2015)

"I like to drive 60 no matter what the speed limit is. It is the speed where I am most alert and drive the best"

Generally, I drive anywhere from 10 to 20 mph over the speed limit, with a few exceptions depending on driving conditions, traffic density, visibility, etc. I'm simply more comfortable driving at that speed. It makes me nervous to drive any slower because you inevitably end up in someone's blind spot and they nearly run you off the road while changing lanes. I think that driving fast forces my brain to pay attention to road, whereas driving the speed limit bores me to death. Being bored while driving can lead to anything from highway hypnosis to being inadequately prepared to react to a dangerous situation that may suddenly arise. Sure, the faster you go, the more likely it is you will hurt yourself or others in the event of an accident, but it will also be a lot less likely that'll get in that accident in the first place… since I'm paying attention I always anticipate hazards before anyone else.

(Anon, NZ Fast & Safe website)

Unfortunately, exceeding speed limits is common; across all road types 40–50% of drivers speed to some degree (OECD/ECMT, 2006)

Is 5 km/h over the speed limit really speeding?

Over 60 km/h and the risk of an injury crash doubles every 5km/h (Kloeden et al 2002)

Reducing the speeds of vehicles in urban areas by 5km/h would result in a 30% reduction in pedestrian fatalities (McLean et al 1994)

The greatest reduction in injury crashes could be achieved from reducing the speeds of vehicles travelling just above (1 to 5km/h) over the speed limit (Kloeden et al 2011)

Speed Limit & Enforcement credibility

Enforcement can be very unpopular if the speed limits don't match the perceived safe speed

King: Police have no speeding quota policy

Monday, 3 July 2006, 11:19 am

Press Release: New Zealand Government

3 July 2006

King: Police have no speeding quota policy

Police Minister Annette King says she has been assured by Police Comm
Howard Broad that there is no policy requiring police staff to issue a set c
tickets for speeding.

"The controversy over the weekend has arisen from what has been descr
police themselves as a 'daft' memo issued in the Central police district. I a
that that memo had nothing to do with police policy, and that it represent
misguided road policing at a local level," she says.

Simply reducing the speed limit is not credible

Drivers choose (and remember) speeds and speed limits they think the roads ought to have

(Charlton & Starkey, 2017)

Speed choice is often habitual and unconscious

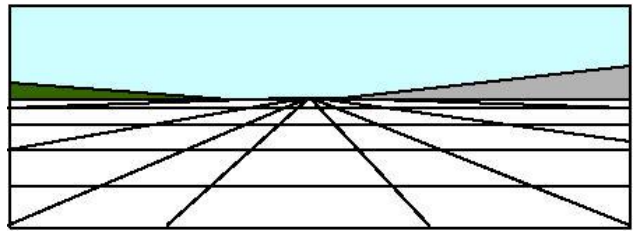
Much of our driving behaviour is automatic

esp. lane keeping & speed maintenance

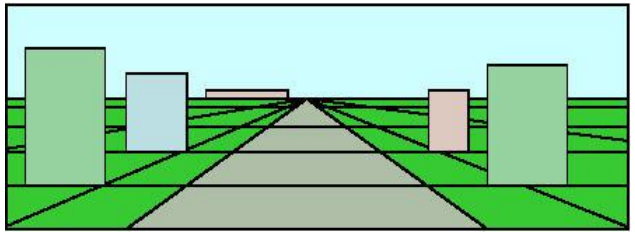
(Charlton & Starkey, 2011, 2013)

Perceptual features of the road and road environment can function as natural accelerators or decelerators

Wide lanes
Straight alignment
Empty roadside
Long forward view
Smooth surface



Narrow lanes
Horizontal & vertical curves
Irregular vertical elements
Short forward view
Rough, noisy surface



Development of Self-Explaining Roads

Using natural accelerators and decelerators to achieve:

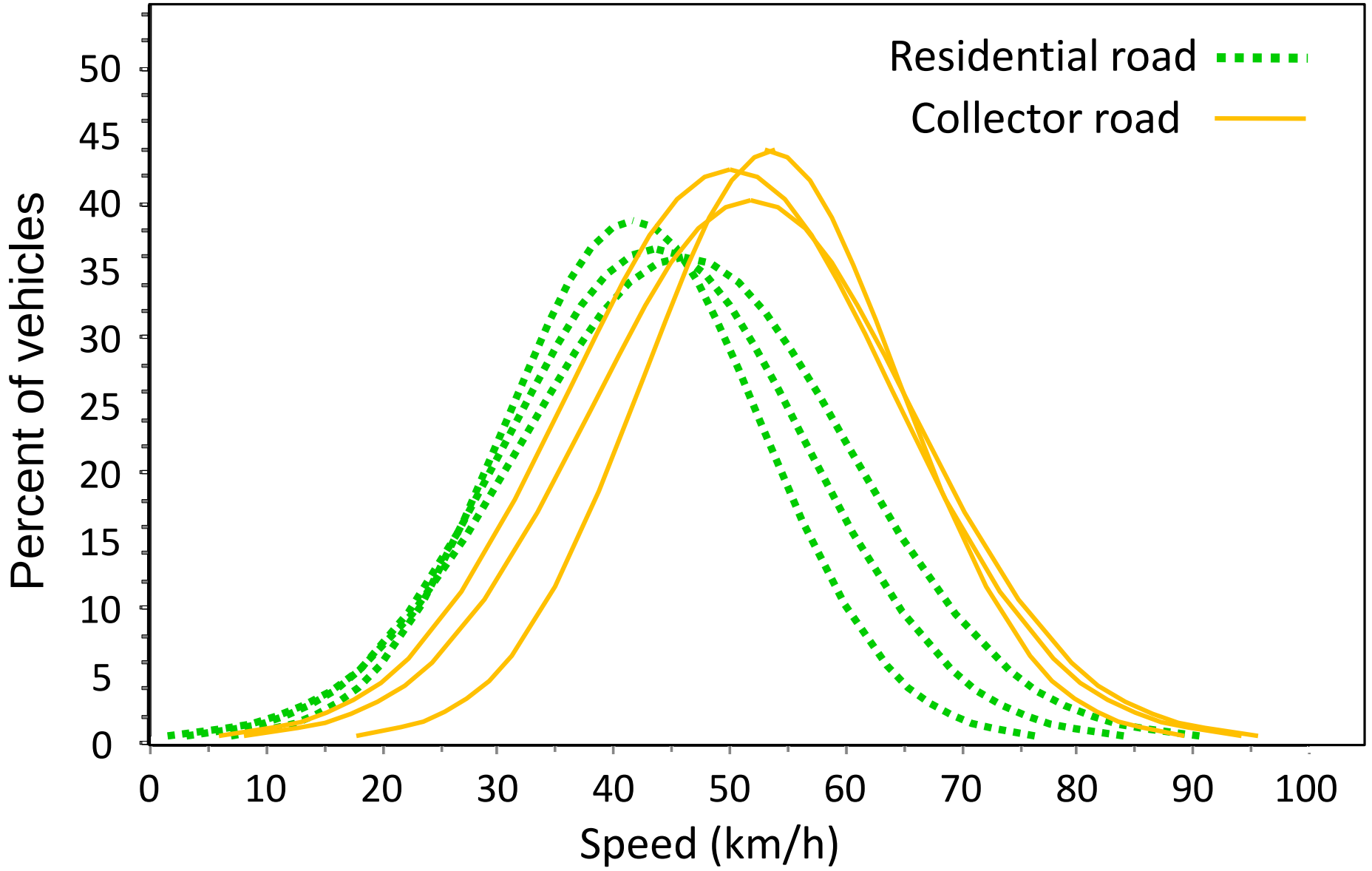
- Better differentiation of speed between road types
  (e.g., slower for residential roads, faster for collector roads)
- Increased homogeneity of speed across drivers

(Charlton et al, 2010; Mackie et al, 2013)

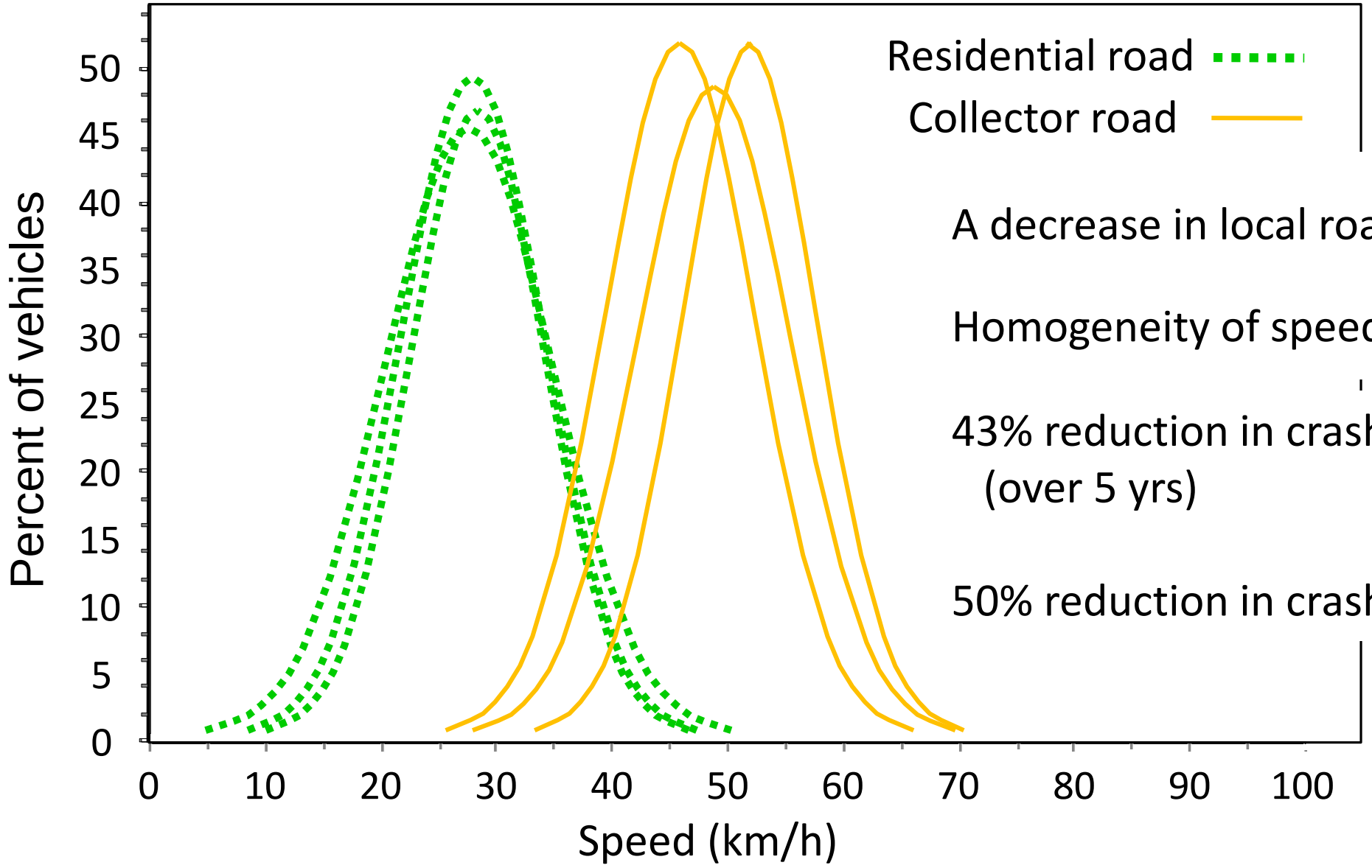
Local roads

Collector roads

Pre-treatment speeds



Post-treatment speeds



A decrease in local road speeds

Homogeneity of speeds

43% reduction in crashes (over 5 yrs)

50% reduction in crash costs

Drivers sometimes don’t notice or miss signs

(Charlton & Starkey, 2011, 2013)

Drivers do usually notice changes in lane markings

Using road markings as a continuous cue for speed

Funded by AARF

We wanted to see if speed markings would be helpful in assisting compliance self-explaining and “self-enforcing”

We developed road markings to indicate speed in consultation with Steering Group and NZTA

(not to scale)

Markings for 80 km/h used as “reference standard”

Produced better speed limit compliance

Produced better speed differentiation

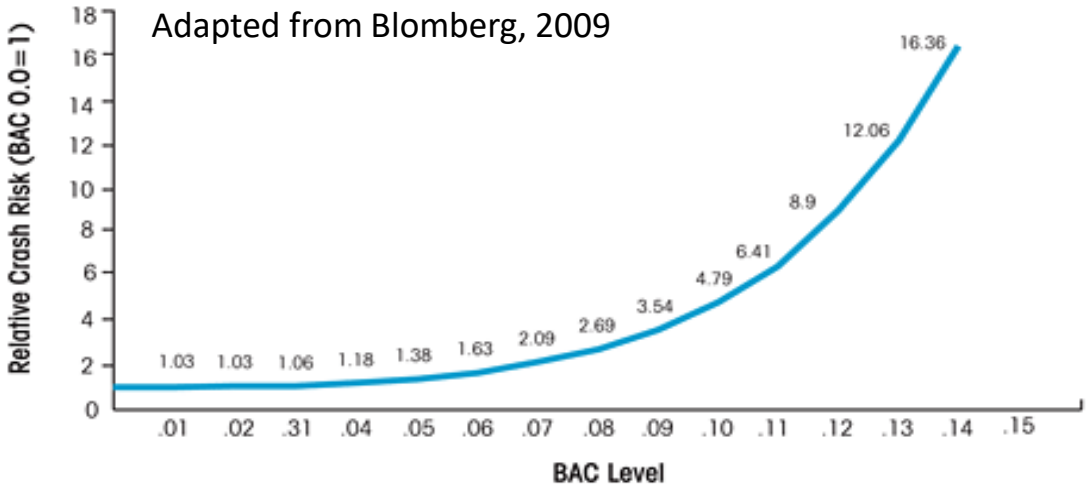
Rapid speed change

Markings improved homogeneity

More drivers chose the same speed for the same section of road

Alcohol and Driving

It has been a problem for a long time; drunk driving recognised as a crime from the early 1900s



Dose related increase in crash risk from BACs over 0.04%; exponential increase at BACs over 0.10% (Blomberg et al, 2005, 2009)

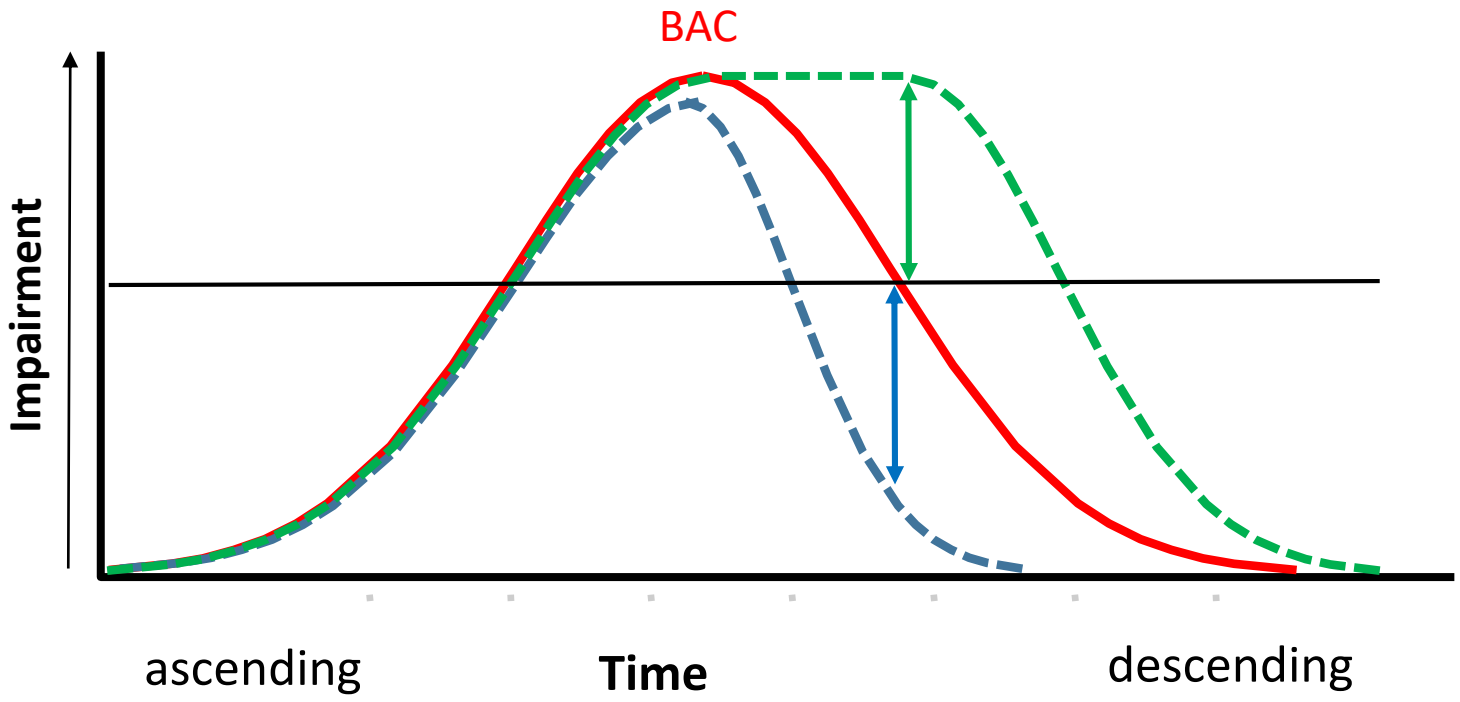
Solution: Legal limit for blood/breath alcohol for drivers

BUT: Different skills are impaired at different BACs **AND** the effect of alcohol differs over time

BAC = blood alcohol concentration

Is driving with a 0.05 BAC any safer than driving at 0.08?

1. Evaluate the biphasic effects of .05 and .08 alcohol levels on psychomotor, cognitive, and driving performance
2. Identify the relationship between drivers' self-perception of intoxication and the actual level of performance impairment produced

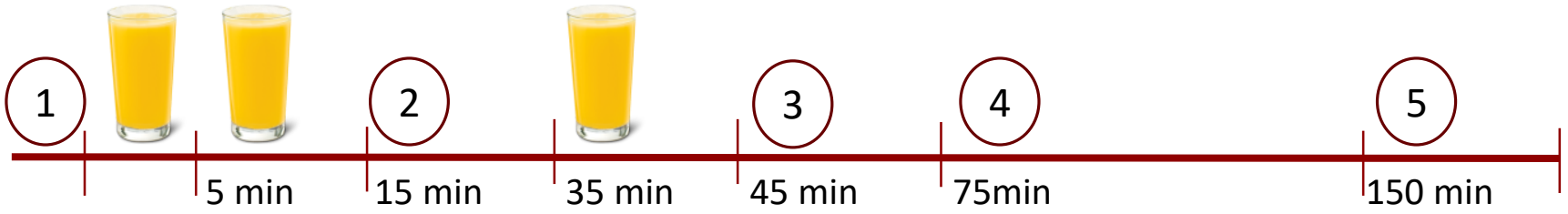


Acute tolerance: better performance on descending limb at given BAC (less impairment when BAC is decreasing)

Acute protracted error: worse performance on descending limb at given BAC (greater impairment when BAC is descending)

Study 1: Drinking individually – tested individually

Three alcohol dose groups: placebo, medium (.05) or high (.08)

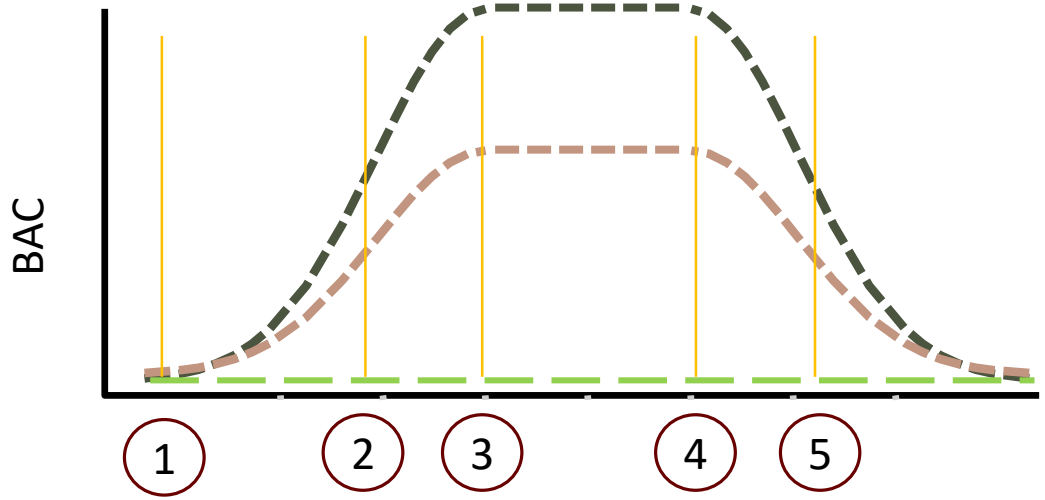


Time since first drink

(approx 3.5 hrs)

Study 2: Social drinking – drinking in groups of 3, tested individually

Drinks provided and BACs recorded every 15 mins until desired BAC reached



Block 1 baseline

Block 2 ascending (.03 or .05)

Block 3 peak 1 (.05 or .08)

Block 4 peak 2 (.05 or .08)

Block 5 descending (.03 or .05)

Performance Measures

CogState test battery

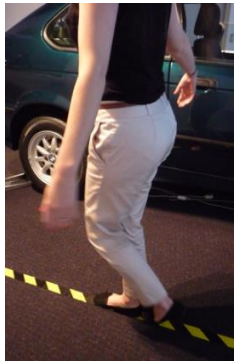
Timed Chase Test
Groton Maze Learning Task (GMLT)
Card identification Task (RT)
GMLT Recall Task

Driver Attention Inhibition & Reaction (DAIR) test

Speed, lane position, hazard reactions

Walk & turn test

NZ Police Compulsory Impairment Test



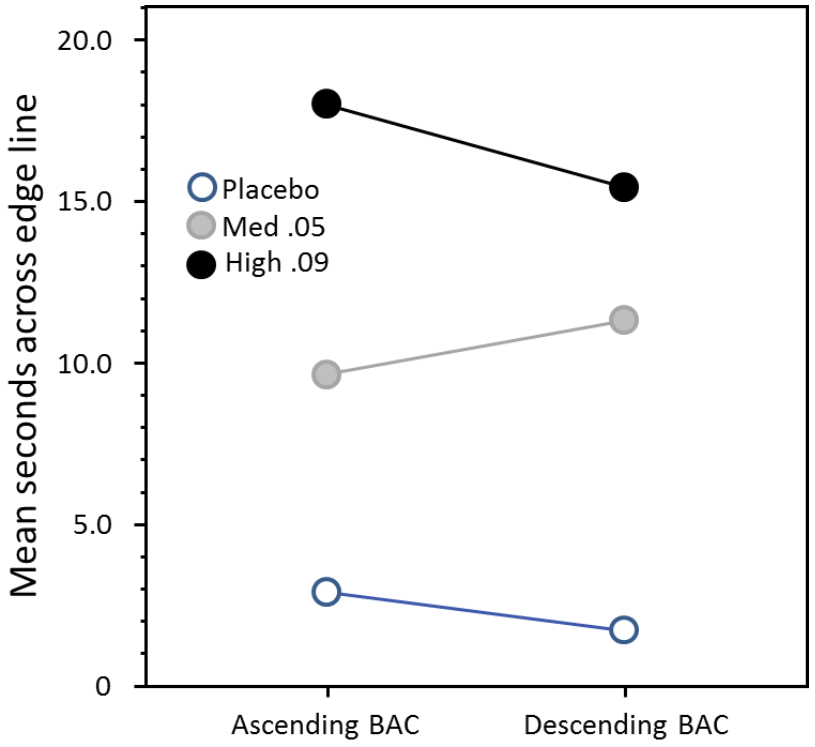
Self-ratings of intoxication & willingness to drive

Symmetric Alcohol Effects

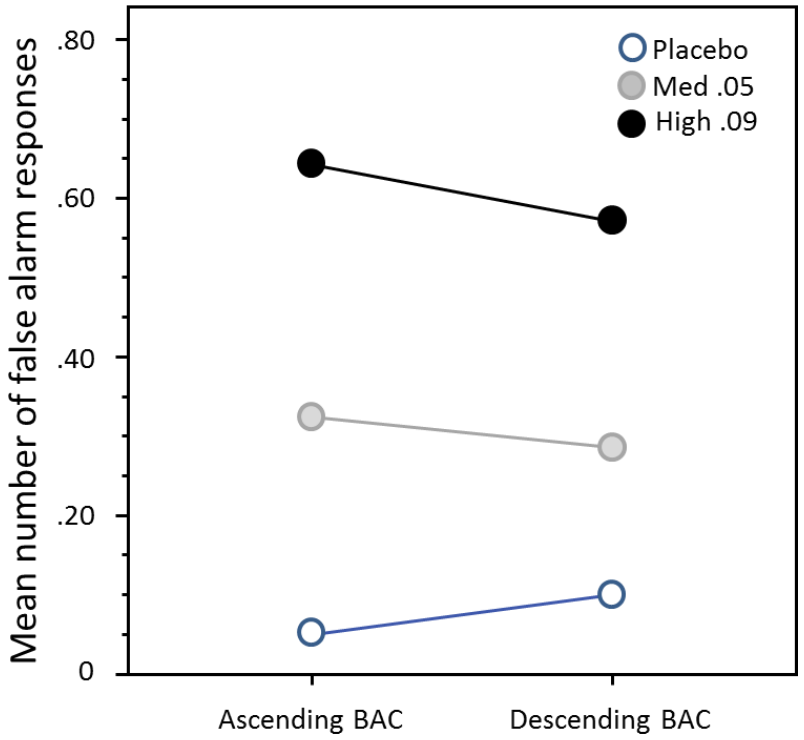
More alcohol = more impairment; No difference due to time

Significant BAC effects

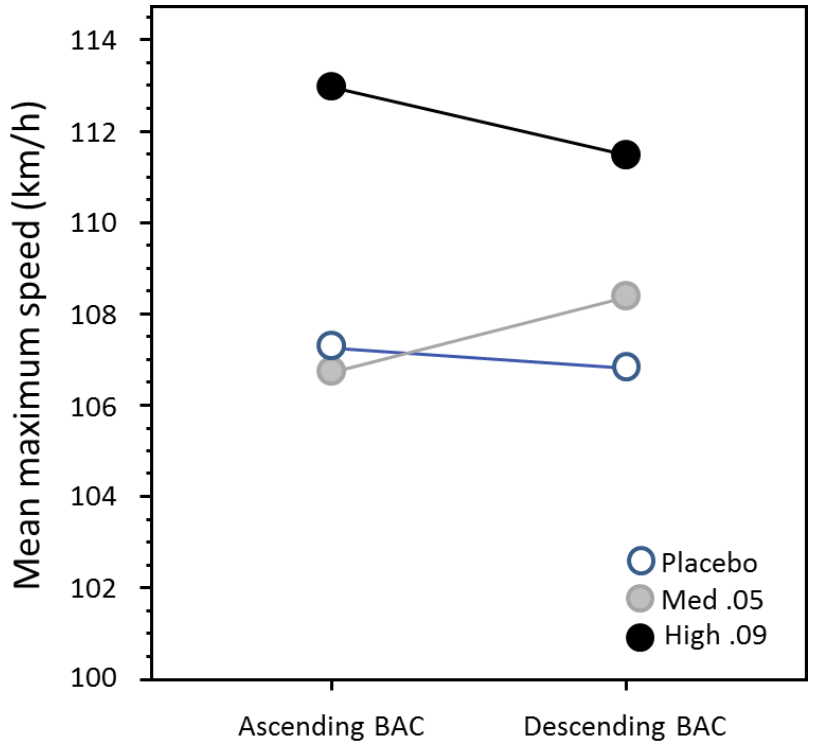
Sec over the edge line



False alarm responses



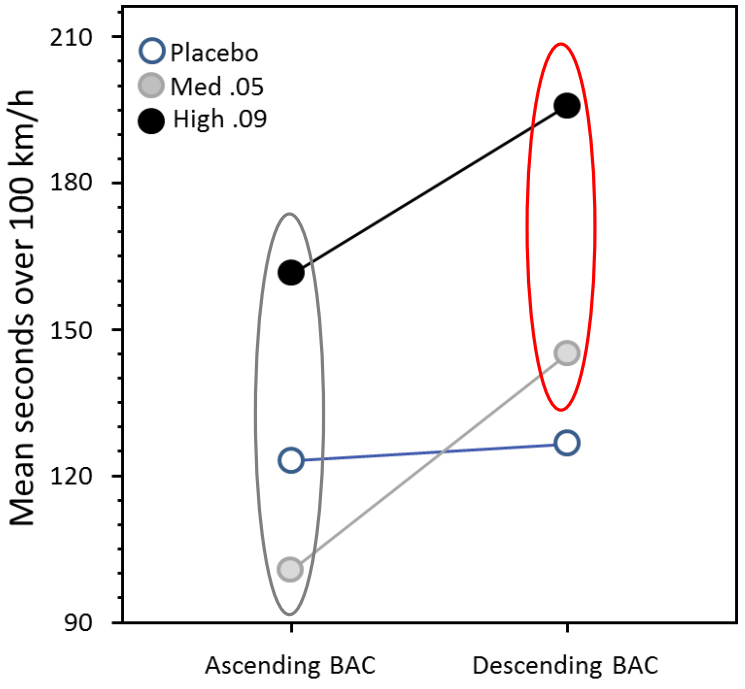
Mean maximum speed



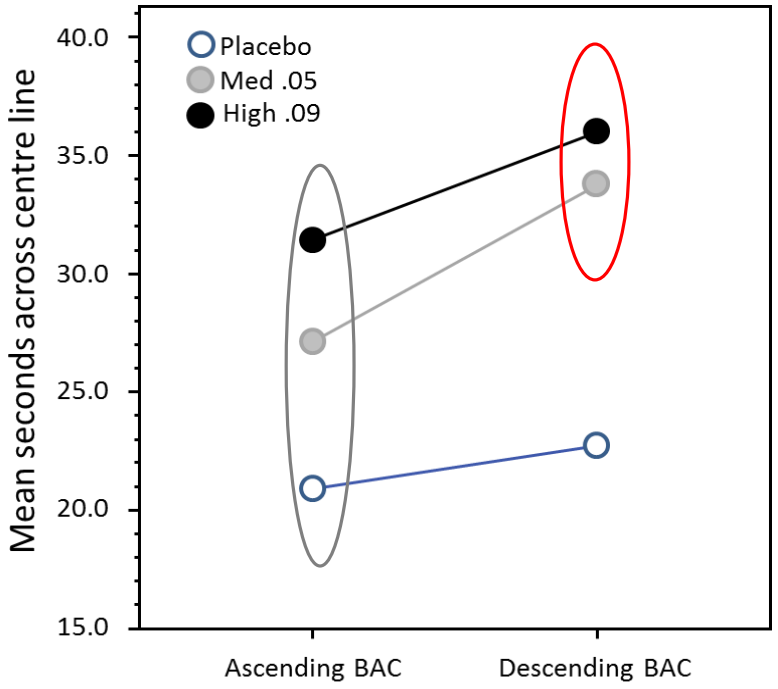
Acute Protracted Error

More alcohol = more impairment AND impairment increases with time
(even though BAC hasn't changed)

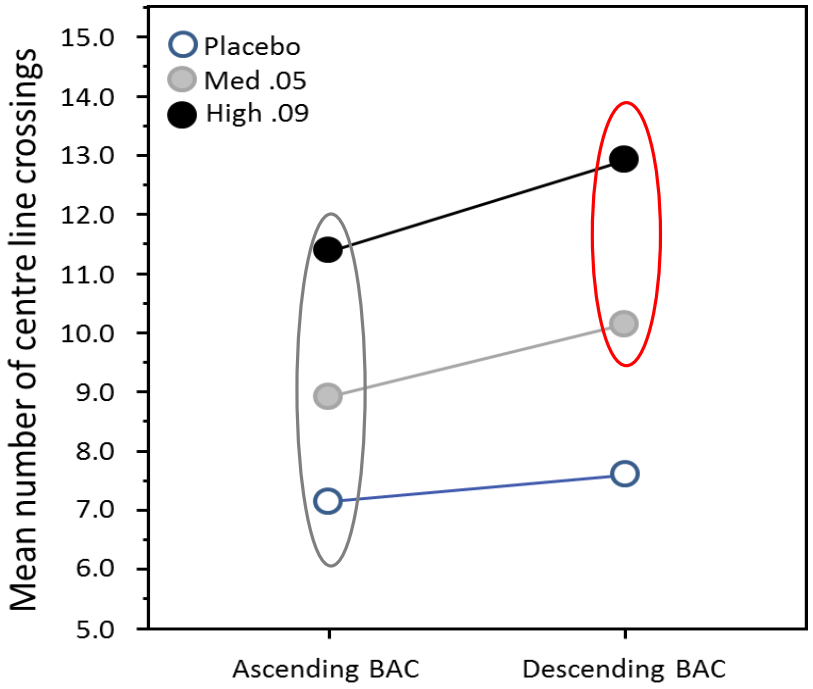
Time speeding



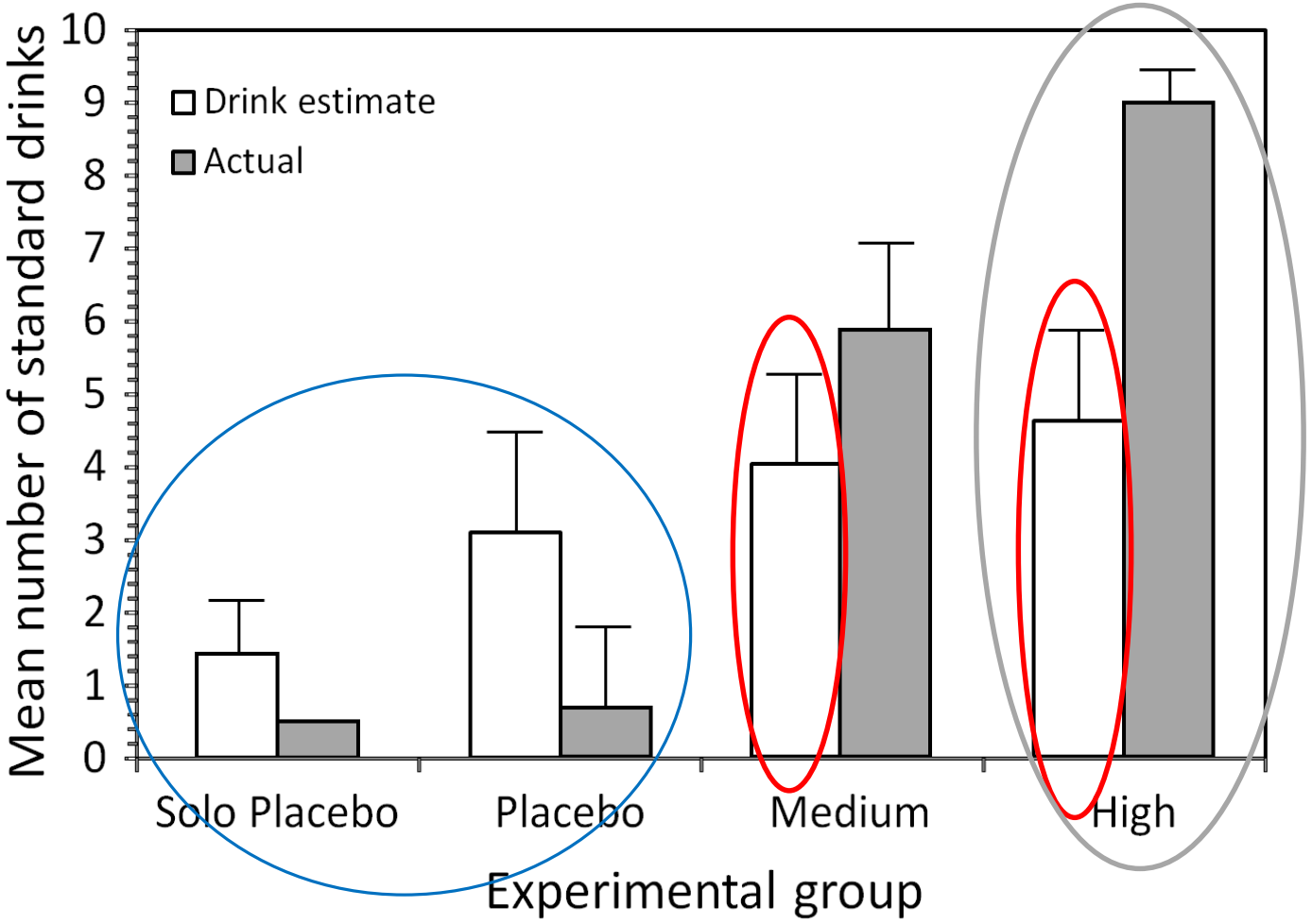
Time over the centre line



Centre line crossings



Participants were unable to judge how much alcohol they had consumed



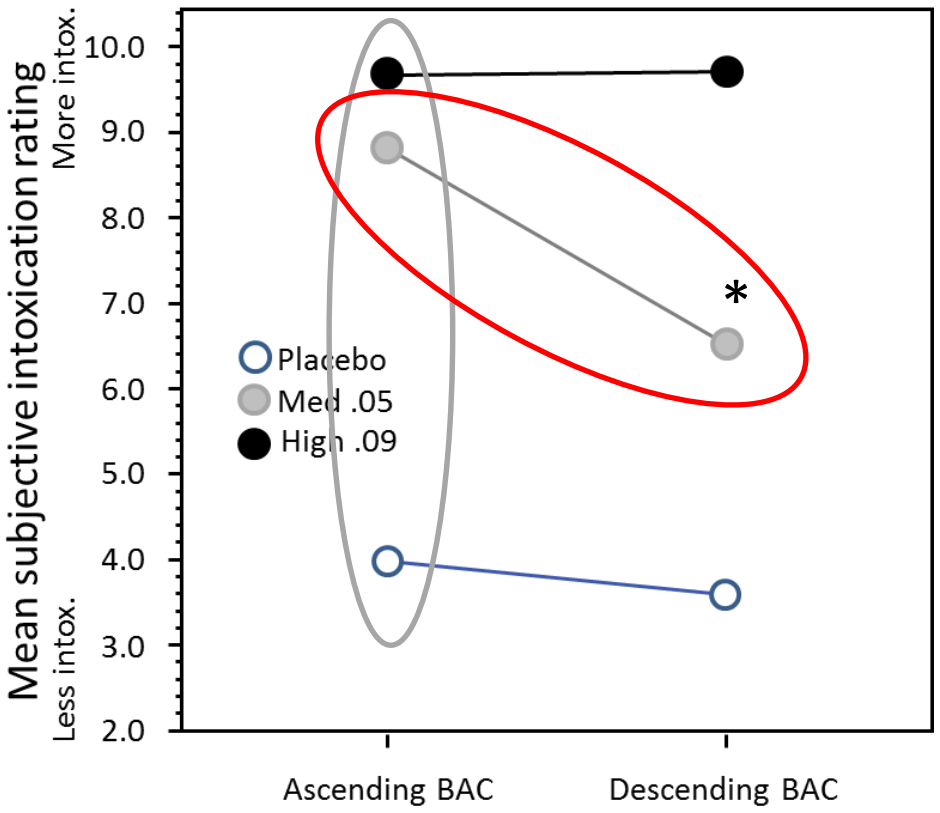
.08 BAC participants' estimates were about *½ as much* a they had consumed

Not significantly different than .05 participants

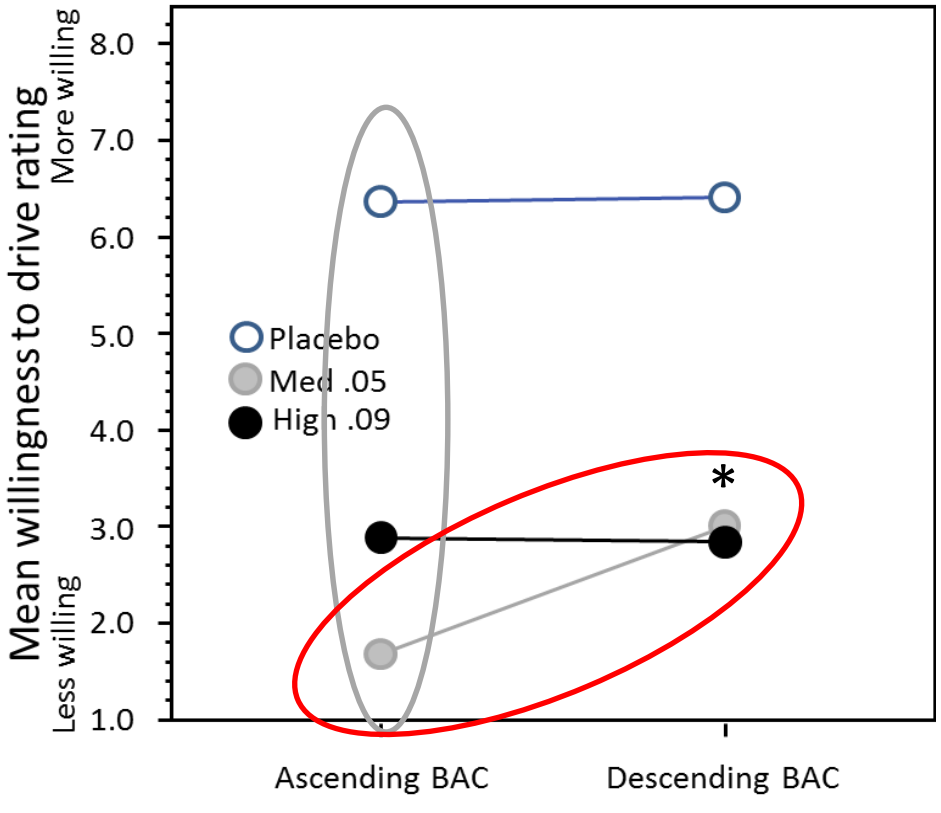
Even those in the placebo group thought they had been drinking – this effect was greater when drinking (or not) in small groups

Subjective ratings of intoxication and willingness to drive

Subjective intoxication rating



Willingness to drive rating



More alcohol = higher intoxication rating and lower willingness to drive

BUT with moderate alcohol (.05) perceived intoxication lower when BAC is descending and more willing to drive (you feel less drunk than you are)

Significant BAC & phase effects * Pairwise comparisons $p < .05$

So, what *is* behind the numbers?

Speed

Simply reducing the speed limit (by changing signs) is ineffective

Speed limits compliance and speed homogeneity can be improved by providing better cues to drivers

- The 'look and feel' of the road should match the speed limit
- Use of natural accelerators and decelerators
- Continuous information about the speed limit

Alcohol

Legal BAC limit for driving only addresses part of the problem

Improve awareness of how alcohol affects the decision to drive, in addition to the effects on driving performance

- Have a designated driver (zero alcohol)
- Plan transport before you go out (and don't take the car)
- Friends who have been drinking are poor judges of intoxication
- A lower legal BAC (0.02) would be a safer option – removes subjective judgement

Acknowledgements

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Questions?

If you would like to contact us about our research please email TRG@waikato.ac.nz