Personality and Executive Control Characteristics in Younger vs. Older Risky Drivers

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Study Objective

- To unpack the heterogeneity in risky (19-39 yrs. old) male adult drivers from subgroup and developmental perspectives
  1. Multifactorial comparison of different subgroups of convicted risky drivers
  2. Analyses of age effects (19-28 yrs vs. 29-39 yrs)

Clinically meaningful subgroups

- H_E: Risky driving preference is a marker of clinically significant subgroups
  - Common behavioural features
  - Common underlying explanatory pathways to risk taking
  - Selective treatment responsivity
- H_E: Features associated with risky driving preference are influenced by age

Cross-sectional, correlational study design

- Independents variables:

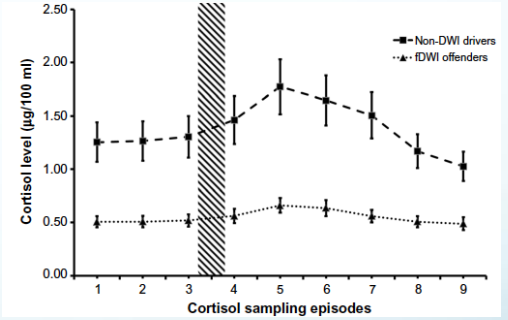
1. Risky driving group
   - 3 age-matched male high-risk driving groups and low-risk controls
     - ‘‘pure’’ DWI offenders: DWI (n = 36)
     - ‘‘pure’’ non-alcohol involved reckless drivers (predominantly speeders): SPEED (n = 28)
     - mixed (DWI+reckless) offenders: MIXED (n =27)
     - Low-risk controls: CTL (n = 47)
2. Age: 19-28; 29-39

Study Design: DVs

- Parametric personality assessment
  - Neo-Pro Inventory Big 5 factors
    - Agreeableness, Conscientiousness, Openess, Extraversion, Neuroticism
  - UPPS-S: Urgency, lack of Premeditation, lack of Perseveration, Sensation seeking
  - Sensitivity to Reward/Punishment Questionnaire (SPSRQ)

Study Design: DVs

- Executive control system (e.g., lateral PFC)
  - Continuous Performance Test (CPT-2)
    - Disinhibition: commission errors; hit reaction time; perseveration errors
- Incentive processing system (e.g., ventral striatum; orbital frontal cortex)
  - Iowa Gambling Task (IGT)
    - Decision making: under ambiguity; under risk
  - Stoplight Task
- Stress response system (SRS)
  - Salivary cortisol: at rest, under stress
    - Amygdala: anxiety/fear response = fearlessness
    - Hippocampus: emotional memory encoding
    - Ambient mesolimbic dopamine release at the nucleus accumbens: dysregulated hedonic homeostasis = ↑arousal/SS/aggression)



Couture et al., 2015.

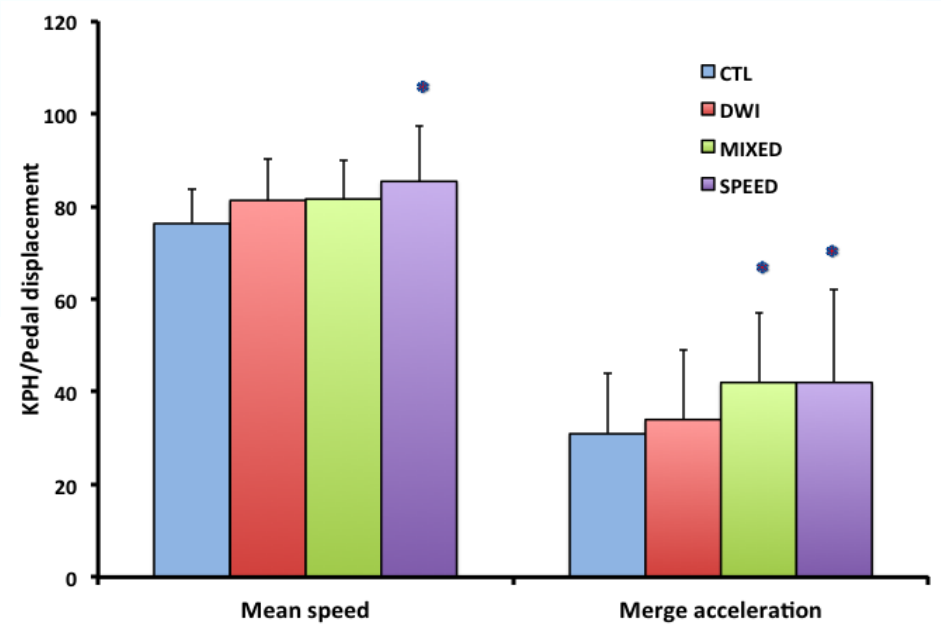
Study Design: DVs

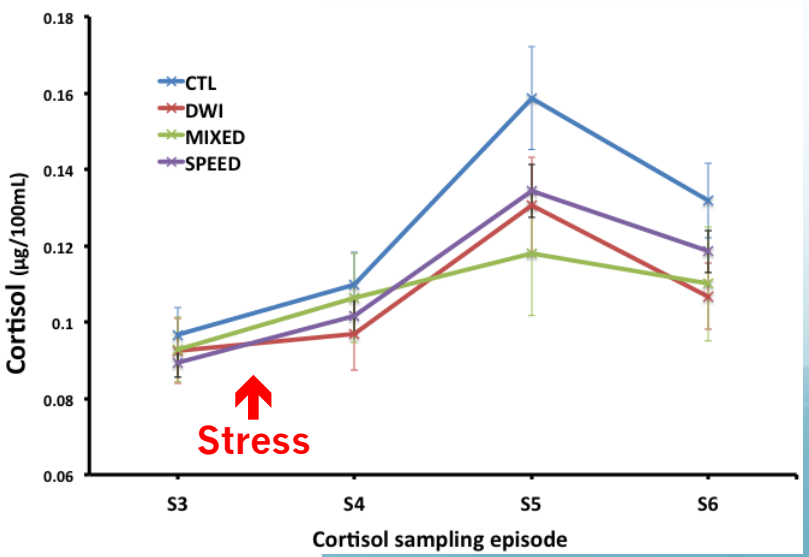
- Three distinct risk-taking driving behaviours measured in simulation
  - Mean speed
  - Waiting time before passing
  - Acceleration to merging traffic

Results: Group effects (Brown et al. 2016; PLoS)

Personality
Executive control
Incentive process
Stress response system

	DWI	MIXED	SPEED
NEO-FFI			
Neuroticism			
Extraversion			
Openness			
Agreeableness		[-11.8, -1.7]	
Conscientiousness			
UPPS-P			
Lack of premeditation			
Urgency			
Sensation seeking		[0.3, 1.1]	[0.1, 8.0]
Lack of perseverance			
SPSRQ			
Sensitivity to Punishment			
Sensitivity to Reward		[1.0, 4.3]	
CPT-2			
Commission errors			[2.7,13.1]
Hit reaction time	[-10.3, -0.02]		
Perseveration errors			
Iowa Gambling Task			
Under ambiguity			[-10.4, -0.8]
Under risk			
Stoplight Task			[0.01, 0.2]
Cortisol			
Mean baseline			
Stress response	[-.077, -.010]	[-.090, -.017]	[-.086, -.002]





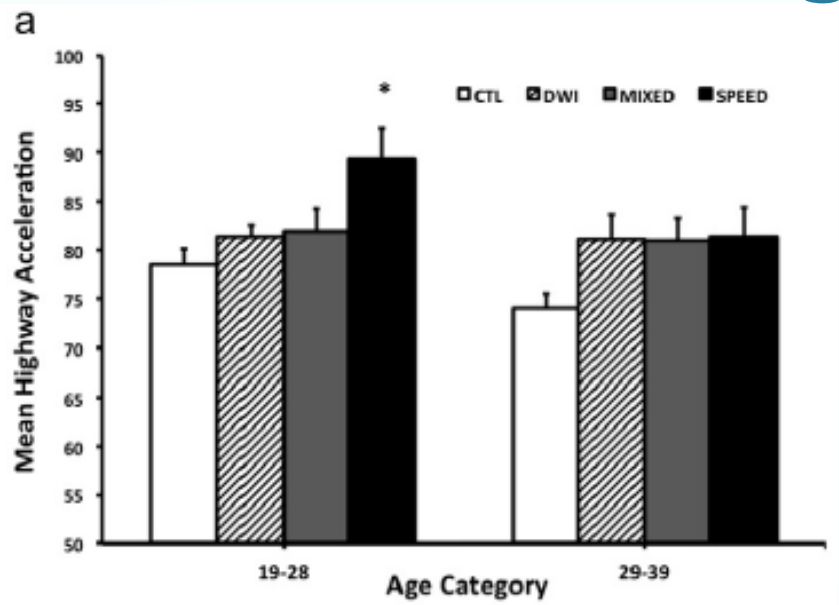
Summary

- All 3 risky driver groups showed distinct differences compared to low-risk drivers
  - MIXED: Dysregulation of EC system and fearlessness (no brakes!)
  - SPEED: Dysregulation of incentive/reward process system (full gas!)
  - DWI: Sensitivity of inhibitory system to effect of alcohol

Age main effects:

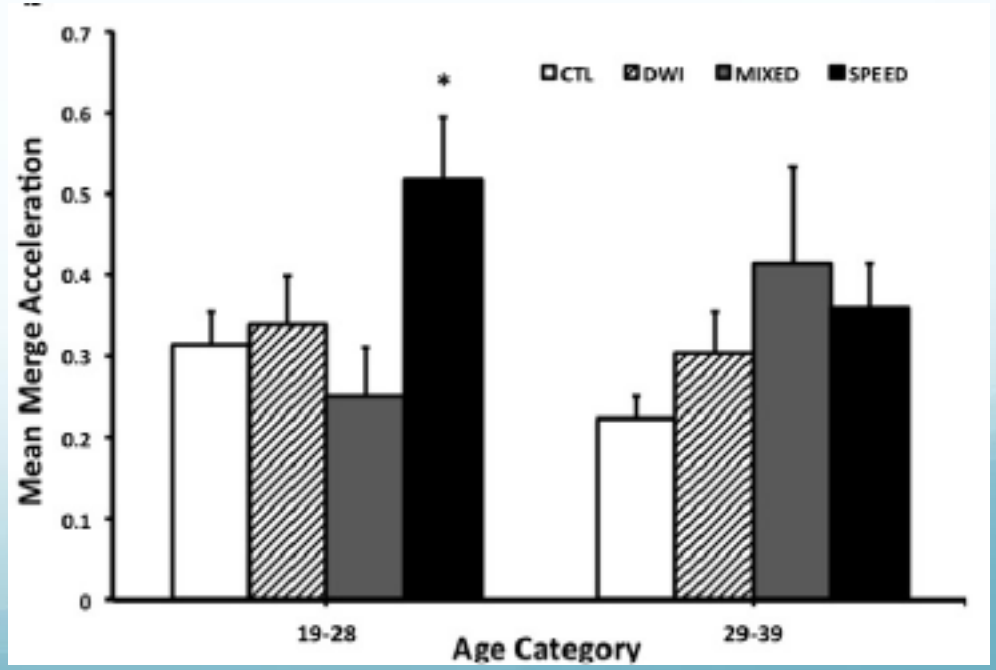
- As expected
  - Younger drivers vs. older drivers:
    - ↑ Sensation seeking
    - ↑ Mean speed in simulation

Results: Age x Group effects

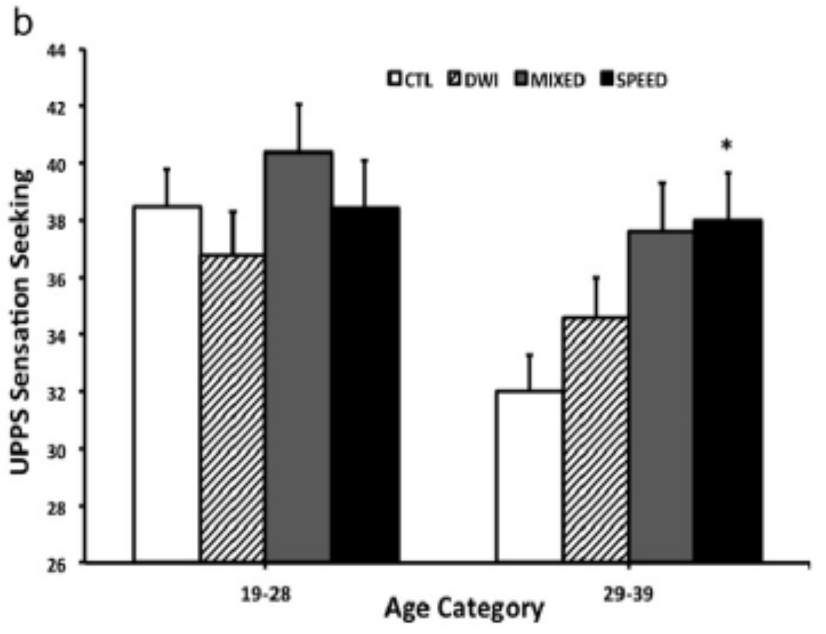


Brown et al, 2017 Personality & Ind. Diff

- As expected
  - Young SPEED drivers showed ↑ speeding and reckless driving behaviour in simulation

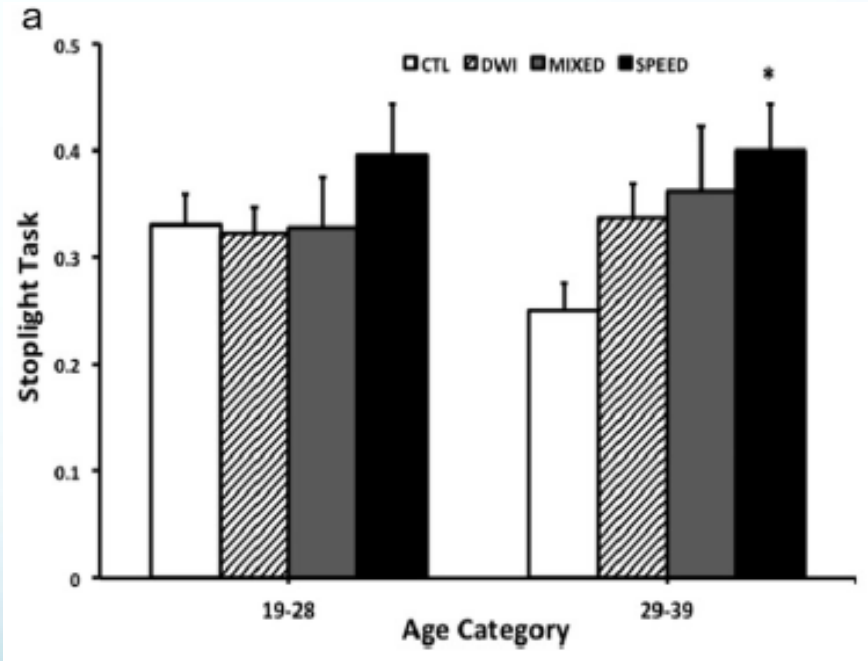


Results: Age x Group effects



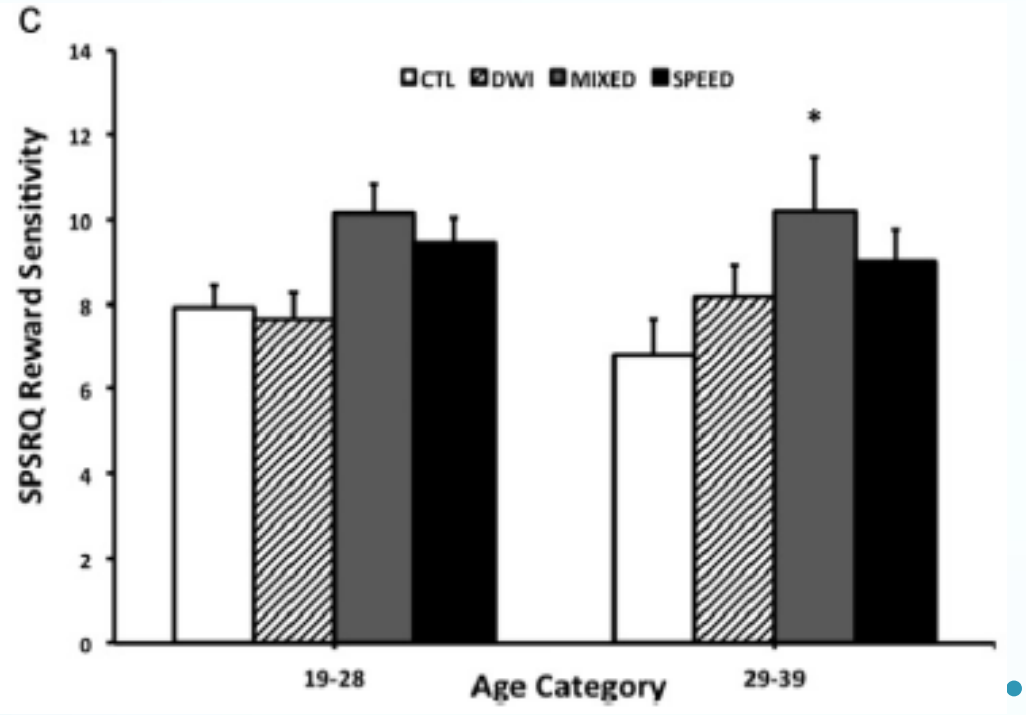
Brown et al, 2017 Personality & Ind. Diff

- Older Speed group show ↑ SS
- Older Speed group show riskier performance on Stoplight Task



- Consistent with "arrested development" of the reward system in older SPEED drivers

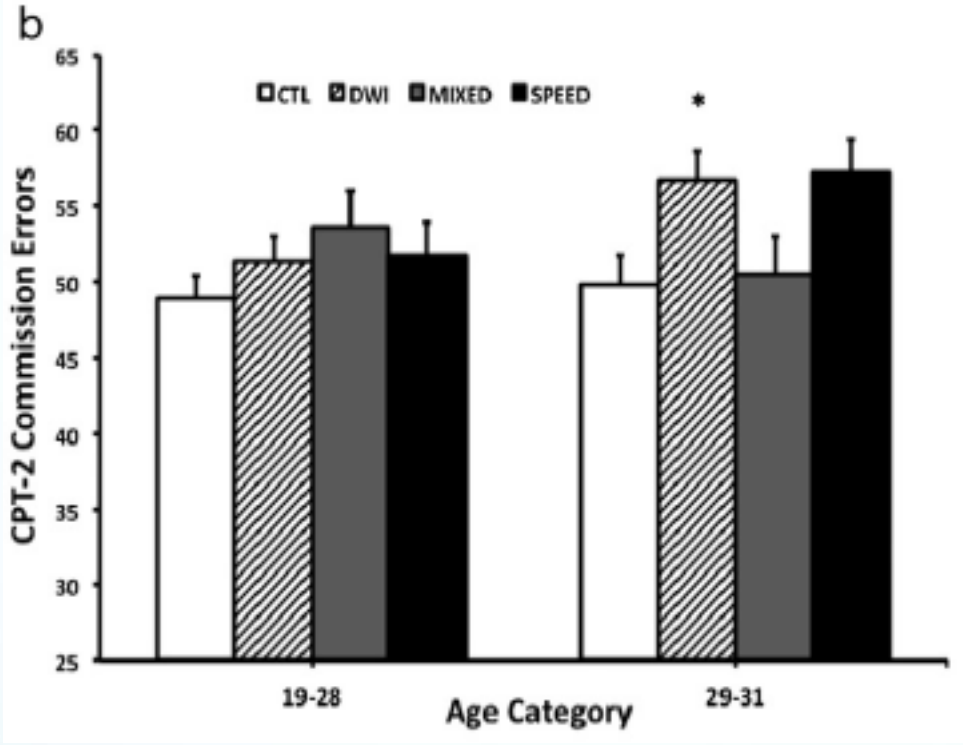
Results: Age x Group effects



Brown et al, 2017 Personality & Ind. Diff

- Older MIXED group show ↑ Reward Sensitivity
  - Reward sensitivity typically declines with age
  - Hyper-sensitivity to reward elevated despite increased age in MIXED group

Results: Age x Risky Driver Group



Brown et al, 2017 Personality & Ind. Diff

- Older DWI group show ↑ commission errors (i.e., disinhibition)
  - disrupted maturation of EC system
  - Younger drivers may engage in DWI via another pathway

Conclusions

- ✓ Risky driving preference (i.e., group effects) were accompanied by distinct personality and neuropsychological characteristics that may contribute to risk taking
- ✓ Young drivers showed characteristics consistent with the ''young driver problem''
- ✓ Age effects were unique depending on risky driving preference
  - ✓ In older drivers:
    i. disrupted maturation of reward-related systems in older SPEED and MIXED drivers
    ii. disrupted development or alcohol-related dysfunction of executive control in DWI

Implications

- ✓ Preliminary analyses require replication and enhancement in study design (e.g., sex effects; larger N)
- ✓ Results suggest that unpacking heterogeneity in the risky driving population should account for both risky driving preference and driver age
- ✓ Interventions accounting for both risky driving preference and age seem warranted for enhanced effectiveness
- ✓ We are now conducting analyses to detect selective treatment responsivity based upon subgroup characteristics