Low Cortisol Reactivity and Risky Driving Behaviors Under the Influence of Alcohol in Young Drivers

24th Canadian Road Safety Conference, Vancouver, BC

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Presentation plan

* Introduction
* Relevance
* Hypothesis
* Methods
* Results
* Discussion
Goal

* The goal of the current study is to measure the relationship between cortisol reactivity and the presence of risky driving behaviors under the influence of alcohol, in young male drivers, using a driving simulator.
Introduction

Road Traffic Crashes

<table>
<thead>
<tr>
<th>Road Traffic Crashes</th>
<th>Injuries/ year</th>
<th>Deaths/ year</th>
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<tbody>
<tr>
<td>Worldwide (2009)</td>
<td>50 million</td>
<td>1.2 million</td>
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<tr>
<td>Canada (2009)</td>
<td>173 000</td>
<td>2 200</td>
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</table>

* Young male drivers are at high risk of being involved in fatal crashes

Drivers Fatalities in Canada by Age Group (2009)

Drivers Fatalities in Canada by Gender (2006)

Organisation mondiale de la santé, 2009; Transport Canada, 2011
Studies observed that road traffic crashes are often preceded by the presence of risky driving behaviors (RDB)

* Driving under the influence of alcohol = 30% of fatal crashes
* Speeding = 27% of fatal crashes
* Traffic sign violations = 12% of fatal crashes

### Highway Safety Code Infractions by Type

- Speeding: 73%
- Traffic sign violations: 17%
- Others: 6%
- Seatbelt offences: 4%

### Driving Related Criminal Code Infractions by Type

- Alcohol related: 92%
- Others: 8%
Introduction

Factors Associated with Risky Driving Behaviors

Demographic, psychological and substance use factors
* ♂
* < 25
* Sensation seeking
* Impulsivity
* Antisocial personality traits
* Alcohol, cigarette and drug use

Cortisol reactivity and risky driving behaviors: An objective psychobiological risk factor
Definition: Physiological response to stress, variable between individuals, measurable using cortisol, one of the stress axis hormones.

* Low cortisol reactivity was strongly associated with frequency of past DUI convictions
* Cortisol reactivity was more strongly associated with passed DUI convictions than other factors
* Cortisol reactivity was significantly lower in DUI-recidivists compared with non-DUI control group
* Low cortisol reactivity was associated with higher crash and near-crash rates during the first 18 months of licensure
The current study aims to expand our knowledge regarding cortisol reactivity and RDB, by observing driving behaviors of young male drivers, under the influence of alcohol, using a driving simulator.

1st study to combine cortisol reactivity, driving behaviors and alcohol consumption.

Driving behaviors observed in the current study are:
- Decision to DUI
- Speed
- Traffic-sign violations
This study examines the relationship between stress response and RDB under the influence of alcohol in young male drivers. It was hypothesized that low cortisol reactivity is associated with increased RDB under the influence of alcohol in young male drivers.
Methods

Participants and Dependent Variable

Participants
N = 40 healthy male drivers aged 20 - 24 years old and living in greater Montreal

Dependent variable: Risky driving behaviors under the influence of alcohol
(the data for the dependent variable was obtained from a larger study)

1) Alcohol consumption
   2 doses randomly assigned to the participants (45 g/kg or 65 g/kg)*

2) Baseline driving simulation under the influence of alcohol
   - Score for speed
   - Score for traffic sign-violations

3) Self-assessment of the blood alcohol concentration (BAC)
   Participants randomly assigned to use or not a feedback device, programmed to indicate that their BAC was above the legal limit*

4) Decision to drive or not a 2nd simulation under the influence of alcohol
   - Score for decision to DUI

* Alcohol dose and use of feedback device are variables from the larger study that we controlled in the analysis
Methods

Dependent Variable Measurement

**Risky Driving Behavior Under the Influence of Alcohol**

**Speed**
Average speed during the first simulation
+
**Traffic sign violation**
3 points by infraction for stop signs and traffic light violations during the first simulation
+
**Decision to DUI:**
15 mins wait and 15 mins ride as a passenger = 0 points
Drive 2 minutes and 15 mins ride as a passenger = 4 points
Drive the entire 2nd simulation (approx. 15 mins) = 15 points

* Higher scores = riskier driving behaviors
Independent variable: Cortisol Reactivity

Cortisol reactivity was measured during a 2nd visit at the lab.

A stress induction task, the *Trier Social Stress Test* was used to measure salivary cortisol reactivity:

1) 30 minutes of rest
2) 10 minute task in front of evaluators combining oral communication and arithmetic task with time constraint
3) 60 minutes of rest

8 salivary cortisol samples were obtained at 15 minute intervals before and after the task.
Cortisol Reactivity Measure

Area under the curve between t3 and t8

$$AUC_g = \frac{(c4+c3)}{2}t3 + \frac{(c5+c4)}{2}t4 + \frac{(c6+c5)}{2}t5 + \frac{(c7+c6)}{2}t6 + \frac{(c8+c7)}{2}t7$$

C = cortisol; T = time interval between 2 samples

Methods

Independent Variable Measurement

CORTISOL

Arrival and rest (t1) rest (t2) stress task (t3) rest (t4) rest (t5) rest (t6) rest (t7) departure (t8)
Partial Correlation Analysis
To measure the correlation between cortisol reactivity and the presence of risky driving behaviors after alcohol consumption, while controlling two variables from the larger study that were randomly assigned.

Controlled variables
1) Alcohol dose
2) Use of feedback device
After controlling for 1) alcohol dose and 2) use of feedback device, we found a significant inverse correlation between cortisol reactivity and presence of risky driving behaviors under the influence of alcohol.
**Discussion**

* Low cortisol reactivity is associated with increased risky driving behaviors under the influence of alcohol
* Results are congruent with previous studies
  * Low cortisol associated with frequency of past DUI convictions
  * Low cortisol associated with higher crash and near-crash rates
* Cortisol reactivity = Objective psychobiological risk factor associated with different RDB
* Drivers with low cortisol reactivity (low stress response) may not perceive dangers the same way than other drivers
* A better understanding of high-risk drivers could enable the development of more personalized intervention tools
  * E.g., Monitoring risky driving behaviors using in-vehicle feedback technologies
    * Effective at reducing RDB with young drivers
    * Future studies could test this intervention with young drivers with low cortisol reactivity
Special Thanks

* Research directors: Marie Claude Ouimet and Élise Roy
* Lab research assistants
* Research project funding agencies
  * Programme de recherche universitaire en sécurité routière FQRSC, SAAQ, FRSQ
  * CIHR team in transdisciplinary studies on driving while intoxicated
* Scholarship funding agencies
  * CIHR team in transdisciplinary studies on driving while intoxicated
  * Centre de recherche - Hôpital Charles-LeMoyne
  * Réseau de recherche en sécurité routière
  * Chaire de recherche en toxicomanie de l’Université de Sherbrooke
  * Centre de réadaptation en dépendance de Montréal – Institut Universitaire
  * Auto 21


Thank you for your attention!

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