22nd International Council on Alcohol, Drugs and Traffic Safety Conference

August 18–21, 2019

Edmonton Convention Centre | Edmonton | Alberta

T2019

CONFERENCE PROCEEDINGS

An initiative of:

ICADTS
THE INTERNATIONAL COUNCIL ON ALCOHOL, DRUGS & TRAFFIC SAFETY

Foundation Sponsor and Host:

VISION ZERO

Edmonton

We are very excited to welcome you to T2019, the 22nd conference of the International Council on Alcohol, Drugs and Traffic Safety (ICADTS) in Edmonton, Canada. ICADTS has been organizing these triannual meetings since 1950, and after Toronto (1953, 1974) and Montreal (2002), this is the 4th time in Canada. The arrival of the T2019 meeting is very timely, as the Canadian legalization of cannabis in October 2018 has had a huge impact on society and raised a range of public health issues including cannabis impaired driving. The ICADTS conferences are the premier international meetings on impaired driving and attract scientists and policy makers from around the world. We are delighted that you can be here to share your expertise.

With our partner, the City of Edmonton, we have put together a rich and stimulating scientific program. The formal goal of our meetings is to collect, disseminate and share information, among professionals in the fields of law, medicine, psychology, forensic toxicology, public health, economics and public policy. But we also hope that you will take this opportunity to meet colleagues old and new, and develop long lasting relationships.

We very much look forward to your contributions and are confident that T2019 will be yet another interesting and exciting ICADTS meeting. We hope that you will enjoy this conference, the hospitality of the City of Edmonton and the beautiful setting.

Kind regards,

Jan Ramaekers
President, ICADTS

It is with great pleasure that we welcome you to T2019, the 22nd International Council on Alcohol, Drugs and Traffic Safety (ICADTS) Conference in Edmonton, Alberta, Canada. Since 1950, ICADTS conferences have served as the foremost international gathering on alcohol and drug impaired road use for researchers, policy makers and practitioners, and all of those striving for a safer world. We are honoured to be hosting this very prestigious conference in our city.

Thanks to the incredible work of our distinguished Scientific Committee we have created a program that we hope you will find both vibrant and comprehensive. The goal of ICADTS is to eliminate alcohol and drug related traffic fatalities and injuries and as such, the Council sponsors conferences to share the most recent research and best practices with delegates from a variety of disciplines ranging from law enforcement to medicine, to public health and education. With this goal as our north star, T2019 features five exceptional keynote speakers, diverse concurrent sessions, specialized workshops, dedicated poster sessions and a wide array of exhibits. More than 100 presenters from around the world will share with you their knowledge, experience and insights.

Our time together provides an opportunity to meet with friends and colleagues and to build new relationships that will span the miles and the years. We are so pleased that you could be with us and we hope that you will enjoy the conference and your leisure time in Edmonton.

With warm regards on behalf of the T2019 Organizing Committee.

Laura Thue
Chair, T2019

PLANNING COMMITTEE

Conference Chair: Laura Thue | City of Edmonton

Dennis Tetreault | City of Edmonton

Bob Hassel | City of Edmonton

Gary Dyck | City of Edmonton

Robyn Robertson | Traffic Injury Research Foundation

Ward Vanlaar | Traffic Injury Research Foundation

Laura Marshall | Laura Marshall Communications

CONFERENCE COORDINATION

City of Edmonton in collaboration with BUKSA Strategic Conference Services

SCIENTIFIC COMMITTEE

Chair: Laura Thue | Senior Research Coordinator, City of Edmonton, Traffic Safety Section

Vice-Chair: Ward Vanlaar | Chief Operating Officer, Traffic Injury Research Foundation (TIRF)

Vice-Chair: Evelyn Vingilis | Professor, Departments of Family Medicine and Epidemiology & Biostatistics, Western University

Kathryn Stewart | Director for the Dissemination and Diffusion of Science-Based Prevention, Prevention Research Center, Oakland, California, USA

Barry Watson | Professor, Centre for Accident Research and Road Safety – Queensland (CARRS-Q), School of Psychology & Counselling, Queensland University of Technology (QUT)

Jim Fell | Principal Research Scientist, Economics, Justice & Society, National Opinion Research Center (NORC) at the University of Chicago

Flavio Pechansky | Professor and Director of the Center for Drug and Alcohol Research, Federal University of Rio Grande do Sul, Porto Alegre, Brazil

Brad Holland | Director of Programs and Research, Canadian Council of Motor Transport Administrators (CCMTA)

Jeff Brubacher | Associate Professor, Department of Emergency Medicine, University of British Columbia

Corporal Brian Sampson | Provincial Impaired Driving Coordinator, British Columbia, Royal Canadian Mounted Police (RCMP)

Scott MacDonald | Scientist, Centre for Addictions Research of British Columbia

Wendy Doyle | Executive Director, Office of Traffic Safety, Alberta Transportation, Government of Alberta

Kathy Belton | Associate Director, Injury Prevention Centre, School of Public Health, University of Alberta

Kwei Quaye | Assistant Vice President, Traffic Safety Services, Saskatchewan Government Insurance

Amy Porath | Director of Research and Policy, Canadian Centre on Substance Use and Addiction (CCSA)

Doug Bierness | Canadian Centre on Substance Use and Addiction (CCSA), Independent Contractor

Thomas G. Brown | Assistant Professor, Department of Psychiatry, McGill University

Louise Nadeau | Professor emeritus, Department of Psychology, University of Montreal

Marie Claude Ouimet | Professeure agrégée, Faculté de médecine et des sciences de la santé, Université de Sherbrooke

Mark Asbridge | Associate Professor, Department of Community Health and Epidemiology, Dalhousie University

Bruna Brands | Professor, Department of Pharmacology and Toxicology, Program Director, Collaborative Program in Addiction Studies, University of Toronto

Dennis Tetreault | Speed Management – Traffic Safety Supervisor, City of Edmonton, Traffic Safety Section

ICADTS EXECUTIVE BOARD

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Mark King | Australia
Maria de Fátima Pereira da Silva | Portugal

Sunday, August 18, 2019

9:00 – 10:00 am | Meeting Level Foyer
Refreshments and Light Breakfast

9:00 am – 4:00 pm | Salons 8, 9, 10
Exhibit Hall

10:00 am – 3:30 pm | Salon 11
YOUNG AND NEW SCIENTISTS SPECIAL SESSION
Promising Minds, ICADTS and the Impaired Driving Field Working Together

- *Introduction, and a brief overview of the education committee concept, and means to be involved* | *Flavio Pechansky*

- *An introduction to ICADTS; who we are, what we have to offer, how they can become involved and benefit from the organization* | *Jan Ramaekers*

- *An overview of the history of the field* | *Kathy Stewart*

- *Research methodology for determining the relationship between alcohol/drug use and driving impairment, including crash risk and opportunities to join* | *Hallvard Gjerde*

- *Practical tools for who is new in the field: How do I find my match? Mentoring, opportunities and navigation on DWI research and practice* | *Juliana Scherer*

12:00 noon – 1:00 pm | Salons 8, 9, 10
Young Scientists Workshop Attendees Grab-n-Go Lunch

- *Determinants of prolonged length of stay at the hospital among victims of road traffic injury: A retrospective cohort study* | *Jinky Leilanie Lu*

- *Cannabidiol and driving: A simulation-based clinical trial* | *Stefan Lakämper*

- *State of Texas ignition interlock laws* | *Jena Prescott*

- *An explorative approach to observing the impairing effects of chronic benzodiazepine use on driving in a clinical population* | *Frederick Vinckenbosch*

- *Psycho-cognitive factors associated with severe injury after crashes of light motorcycles: A multi-center study in Taiwan* | *Carlos Lam*

- *Aggression does not moderate risky driving behaviours among stimulant drug users* | *Amie Hayley*

- *A review of MADD Canada's training program for frontline staff of cannabis retail outlets* | *Eric Dumschat*

12:00 noon – 1:00 pm | Salon 4
SCHOLAR'S LUNCH
(invitation only)

11:30 – 12:00 noon | Salons 8, 9, 10
Drug Driving Workshop Lunch and Networking

12:00 noon – 3:30 pm | Salon 12
DRUG DRIVING AND THE LEGALIZATION OF RECREATIONAL CANNABIS IN CANADA
The Impact on Policing, Challenges for Enforcement and What We Have Learned So Far

A special session sponsored by the City of Edmonton

- *Opening remarks and introductions* | *Inspector Chris Narbonne and Shewkar Ibrahim*

- *Introduction to Vision Zero* | *Shewkar Ibrahim*

- *History and overview of impaired driving In the Canadian context* | *Corporal Richard Nowak*

- *The RCMP experience* | *Corporal Richard Nowak*

- *The Edmonton police service experience* | *Detective Braydon Lawrence*

Coffee Break

- *What can other countries learn from the Canadian experience?* | *All speakers*

- *Closing remarks* | *Inspector Chris Narbonne and Shewkar Ibrahim*

5:00 – 7:00 pm | Chateau Lacombe
WELCOME RECEPTION

Monday, August 19, 2019

7:30 – 8:30 am | Hall D Foyer
Refreshments and Light Breakfast

8:30 – 9:15 am | Hall D
OPENING CEREMONIES

9:15 – 10:00 am
OPENING PLENARY SESSION
Charterland: A Socio–Legal Perspective of Traffic Safety and Canada's Unique Legal Culture
Keynote Speaker: Robert Palser

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10:00 – 2:45 pm | Salons 8, 9, 10
Exhibit Hall

10:00 – 10:30 am | Salons 8, 9, 10
Coffee Break, Exhibits and Posters

10:30 – 11:45 am
CONCURRENT SESSIONS

Salon 4
Roadside Drug Testing — Part I

- *Oral fluid roadside drug testing and deterrence: Australia's second generational national strategic approach* | *Michael Keating*

- *New South Wales police force – roadside drug testing program* | *Robert Toynton*

- *Oral fluid drug screening equipment standards for Canada* | *Amy Peaire*

Salons 5, 6
Alcohol, Drugs and Crashes

- *Involvement of alcohol and drugs in fatal traffic crashes: A report from autopsy and police data 2013–2017 in Chiba, Japan* | *Kazuko Okamura*

- *Alcohol and drug use among road traffic crash victims in Norway* | *Benedicte Joergenrud*

- *In-Person versus distance delivery of the back on track remedial program: A pilot study comparison* | *Jeffrey Brubacher*

- *Alcohol and drug use among fatally injured drivers in Norway during 2005–2015* | *Hallvard Gjerde*

Salon 11
Evaluation of Intervention Programs — Part I

- *Development and initial validation of a measure of within-session change for impaired drivers participating in remedial programs* | *Christine Wickens*

- *Study Protocol: Assisting clinical assessment of fitness to drive following drug or alcohol misuse, using the schuhfried vienna test system fitness to drive (standard) battery* | *Natalie Gastin*

- *Cannabis and motor vehicle crashes: A Canadian culpability study* | *Christine Wickens*

Salon 12
Vias and TIRF Present the E Survey on Road Users' Attitudes — Part I

A special session sponsored and co–chaired by AAAFTS

- *ESRA: Cross-national monitoring of road users' attitudes and performance* | *Uta Meesmann*

- *ESRA thematic report on driving under the influence (DUI) of alcohol and drugs: International comparison of 32 countries* | *Yvonne Achermann Stürmer*

- *Medication and driving: A comparison between Canada, Europe and the United States* | *Heather Woods–Fry*

- *Is BAC per se law related to drivers' perceived attitude, acceptability, and behaviors regarding DUI?* | *Tara Kelley–Baker*

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11:45 am – 1:00 pm | Hall D
Lunch

4

1:00 – 2:15 pm
CONCURRENT SESSIONS

Salon 4

Impaired Driving and Other Risky Behaviours

- *Driver-related risk factors for fatal road traffic crashes associated with alcohol or drug impairment* | *Stig Tore Bogstrand*

- *Risk behaviors of Brazilian drivers according to sociodemographic characteristics* | *Luana Gross*

- *Impaired driving and co-occurring problem behaviours among adolescents: Results from the Ontario student drug and health survey (OSDUHS)* | *Jane Seeley*

- *Association between profiles of cell phone use, driving under the influence, and other risk behaviors in five Brazilian capitals* | *Marcelo Rocha*

Salons 5, 6

Ask the Experts: Legalization of Cannabis and Impaired Road Use In Canada

- *Join our distinguished speakers for an opportunity to ask your questions and have a more in depth and open discussion about the impacts of the legalization of cannabis on impaired road use in Canada* | *Robert Palser, Corporal Richard Nowak and Detective Braydon Lawrence*

Salon 11

Drug Driving Policy — Part I

- *Polish limits for drugs of abuse in whole blood defining driving under the influence and their consequences in expert opinions issuing* | *Wojciech Lechowicz*

- *The harms and costs of impaired driving in Canada* | *Pamela Kent*

- *Cannabis use and THC involvement in fatal crashes in Washington State before and after legalization* | *Lindsay Arnold*

Salon 12

Vias and TIRF Present the E Survey on Road Users' Attitudes — Part II

A special session sponsored and co-chaired by AAAFTS

- *Validation of the theory of planned behaviour in different cultural settings: International comparison of drunk-driving across 5 countries* | *Uta Meesmann*

- *ESRA – Country comparison of drink-driving typologies* | *Gerald Furian*

- *Alcohol related accidents in Europe from the perspective of legislation and road users' attitudes* | *Pavlina Skladana*

- *Analyses of changes in drink driving behavior, attitudes and norms during a period with reduced drink driving enforcement in Sweden: Results based on the ESRA study* | *Anna Vadeby*

2:15 – 2:45 pm | Salons 8, 9, 10
Coffee Break, Exhibits and Posters

2:45 pm
Exhibit Hall closed

2:45 – 3:45 pm
CONCURRENT SESSIONS

Salon 12

Evaluation of DUI Enforcement

- *A comprehensive examination of driving-under-the-influence (DUI) in a large U.S. community* | *James Fell*

- *Intensified drunk driving enforcement in a Swedish region: An evaluation of a pilot study* | *Åsa Forsman*

Salons 5, 6

Perceptions and Behaviour: Preventing Impaired Driving — Part I

- *Perceptions of those who drive after cannabis use: Exploring concepts from the social cognition literature* | *Christine M. Wickens*

- *Associations of perceived harm from regular cannabis use with cannabis-related driving and passenger behaviours among Canadian youth* | *Mark Asbridge*

- *In-vehicle alcohol feedback, low subjective response to alcohol and decision to drive after drinking* | *Marie Claude Ouimet*

Salon 11

Mental Health and Impaired Driving

- *The association between depression, anxiety and stress on self-reported drink- and drug-driving behaviour* | *Sara Liu*

- *Depressed mood and alcohol in risky driving* | *Nevicia Case*

- *The relationship between attention deficit hyperactivity disorder (ADHD) and impaired driving: Results from the Ontario student drug and health survey (OSDUHS)* | *Evelyn Vingilis*

Salons 8, 9, 10

Dedicated Poster Session

- *Come view and hear from poster presenters, check out the list of posters at the end of the program.*

4:00 – 5:00 pm | Hall D
PLENARY SESSION

MADD
Allison Tatham

Vision zero perspectives in a middle-income country: How to move forward on this road
Keynote Speaker: Juliana Scherer

5:15 – 6:15 pm | Salon 12
ICADTS MEMBERS GENERAL MEETING

Tuesday, August 20, 2019

8:30 — 9:00 am | Hall D Foyer
Refreshments and Light Breakfast

9:00 — 9:15 am | Hall D
WELCOMING REMARKS

MADD
Elaine Arnold

9:15 — 10:00 am | Hall D
PLENARY SESSION

**Drink–driving in middle and low income countries:
A huge room of progress to improve road safety**
Keynote Speaker: Benacer Boulaajoul

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10:00 — 2:45 pm | Salons 8, 9, 10
Exhibit Hall

10:00 — 10:30 am | Salons 8, 9, 10
Coffee Break, Exhibits and Posters

10:30 – 11:45 am
CONCURRENT SESSIONS

Salon 5, 6
Prevalence of Alcohol and Drugs in Drivers Around the World

- *Illicit drugs now more common than alcohol among crash involved drivers and riders* | *Matthew Baldock*
- *The prevalence and pattern of drugs detected in injured drivers in four Canadian provinces* | *Jeffrey Brubacher*
- *Estimating the prevalence of psychoactive substances among random drivers in the artic counties of Murmansk (Russia) and Finnmark (Norway)* | *Ragnhild Jamt*
- *Roadside surveys of alcohol and drug use in Canada's North* | *Doug Beirness*

Salons 4
Drug Driving Policy — Part II

- *Innovating the legal system of drugs detection* | *Armin Kaltenegger*
- *Canada's new federal drug–impaired driving provisions: challenges in enforcement and prosecution* | *Erika Chamberlain*
- *Drug driving strategic innovations in policy and practice following the introduction of per se and preliminary drug testing legislation: Ireland and international context* | *Denis Cusack*
- *Association between Uruguay's cannabis law and drivers' fatalities variation: An assessment of two outcomes* | *Marie Claude Ouimet*

Salon 12
Cannabis and Driving Performance

- *A Meta–analytic protocol for determining the effects of cannabis on driving performance* | *Sarah Simmons*
- *Brain activity and cognition of recreational and daily cannabis users that are positive for THC concentrations below and above a per se limit* | *Jan Ramaekers*
- *Effects of cannabidiol (CBD) content in vaporized cannabis on tetrahydrocannabinol (THC)–induced impairment of driving and cognition* | *Thomas Arkell*
- *Synthetic cannabinoid's acute effect on psychomotor, cognitive and subjective experience in intoxicated participants* | *Eef Theunissen*

Salon 11
Evaluation of Intervention Programs — Part II

- *Evaluation of alcohol countermeasure: analysis of recidivism among primary offenders having been referred to the program to assess and reduce the risk of driving while impaired* | *Maxime Brault*
- *Evaluating individual psychological rehabilitation of offenders Part 2: Recidivism rate after intervention and assessment* | *Joachim Seidl*
- *Ethnolinguistic variability among remedial program participants in Ontario* | *Christine Wickens*

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11:45 am — 1:00 pm | Salons 8, 9, 10
Lunch

1:00 — 2:15 pm

CONCURRENT SESSIONS

Salon 12

Drink Driving Policy

- *Evaluating the impacts of Canada's minimum legal drinking age (MLDA) laws on patterns of severe motor vehicle collision injuries in Canada's national trauma registry, 1999–2013* | *Marcos Sanches*

- *Tools for implementing environmental approaches to impaired driving: Helping communities adopt effective strategies* | *Kathryn Stewart*

- *The long-term trend in alcohol-related crashes and associated policy responses in Queensland, Australia* | *Barry Watson*

Salon 11

Innovative Impaired Driving Interventions

- *The role of technology in monitoring impaired driving offenders* | *Tara Casanova Powell*

- *The 'one for the road' group intervention for repeat impaired drivers: Evaluations and development* | *Alex and Kilisitina Dawber*

- *Development of a web-based drugs and alcohol unit as part of the traffic offender intervention program in New South Wales, Australia* | *Ian Faulks*

- *Evaluation of a physician communication tool to educate patients on driving risks when prescribing pain medication* | *Robyn Robertson*

Salons 5, 6

Different Types of Impairment and Driving Performance

- *Analgesic doses of ketamine with dexmedetomidine but not fentanyl produce postoperative driving impairment equivalent to a BAC of 0.05%* | *Amie Hayley*

- *The effects of cannabis and cocaine on driving related tasks of perception, cognition, and action* | *Michelle Tomczak*

- *Eye tracking data assessment: A non-intrusive approach to detect drowsiness in drivers* | *Shahidi Zandi*

Salon 4

Special Session: Impaired Driving in Low and Middle Income Countries — Part I

- *Ergonomic factors in road crash in Metro Manila* | *Jinky Leilanie Lu*

- *Alcohol-impaired driving and speeding in Sao Paulo, Brazil: Findings from the bloomberg initiative for global road safety (BIGRS) 2015-2018* | *Gabriel Andreuccetti*

- *Clusters of driving risk behaviors among Brazilian drivers* | *Juliana Scherer*

- *Road traffic injures in Malawi: The role of alcohol* | *Asbjorg S. Christophersen*

2:15 — 2:45 pm | Salons 8, 9, 10

Coffee Break, Exhibits and Posters

2:45 pm

Exhibit Hall Closed

2:45 — 3:45 pm

CONCURRENT SESSIONS

Salon 5, 6

Perceptions and Behaviour: Preventing Impaired Driving — Part II

- *Alternatives to drunk driving in the United States: Attitudes and behaviors of drivers* | *Carl Wicklund*

- *Community attitudes towards sanction- and therapeutic-based countermeasures to address drug-driving in Victoria, Australia* | *Michael Fitzharris*

- *Investigation of women and engagement in drink driving behaviour* | *Kerry Armstrong*

Salon 11

Ask the Experts: Skating to Where the Puck Will Be

- *The landscape of impaired road use is changing. This session will reflect on shifts in demographic, psychological, social, cultural, political, environmental and scientific factors and consider the Impact on future research. Join our renowned panelists for a stimulating conversation on the next big issues and challenges for researchers in the field. What are the trends that will affect alcohol, drugs and traffic safety in the future and what are the research questions we should be asking now?* | *Evelyn Vingilis, Gabriel Andreuccetti, Richard Maguire and Matthew Baldock*

Salons 8, 9, 10

Dedicated Poster Session

- *Come view and hear from poster presenters, check out the list of posters at the end of the program.*

Salons 4

Special Session: Impaired Driving in Low and Middle Income Countries — Part II

- *The criminal justice system of Pakistan: Deterrent impacts for drug and alcohol use among road drivers* | *Ahsan Ul Haq Kayani*

- *Applying the traffic safety culture concept to drink driving in low and middle income countries: Retrospective case studies and an outline of a prospective approach* | *Mark King*

- *A psychological insight into the driving behaviour of traffic offenders* | *Mark King*

4:00 — 5:00 pm | Hall D

PLENARY SESSION

Driving Baked: Creating a Recipe to Avoid Disaster

Keynote Speaker: Chief Neil Dubord

7:00 — 11:00 pm | Hall D

ICADTS GALA DINNER

Wednesday, August 21, 2019

8:30 – 9:00 am | Meeting Room Foyer
Refreshments and Light Breakfast

9:00 – 10:30 am
CONCURRENT SESSIONS

Salon 5, 6
Toxicology

- *Analytical reliability of four oral fluid–point–of–collection testing devices for drug detection in drivers* | *Juliana Scherer*

- *A toxicological review of DUID case work, prior to, and since the introduction of roadside drug testing and per se drug levels in Ireland* | *Richard Maguire*

- *The value of comprehensive toxicology testing in driving under the influence of drugs (DUID) investigation casework* | *Ayako Chan–Hosokawa*

- *An effort to determine a time–frame on last marijuana use by quantitation of minor blood cannabinoids* | *Ayako Chan–Hosokawa*

- *Kava influence on driving skills: A case study* | *Shuang Fu*

Salons 4
Roadside Drug Testing — Part II

- *Roadside oral fluid drug testing in Queensland Australia: A review of testing and fatality data* | *Jeremy Davey*

- *Enhancing the standardized field sobriety test to detect cannabis impairment* | *Doug Beirness*

- *The effects of recent drug driving legislation in Great Britain* | *Ean Lewin*

- *Appraising the effectiveness of the standardized field sobriety test scoring criteria for discerning blood alcohol concentration limits above and below 0.08* | *Troy Walden*

Salon 11
Young Scientists from Across the Globe

- *Developing provincial and territorial cannabis–impaired driving countermeasures in Canada* | *Eric Dumschat*

- *Reviewing a decade of changes in swiss traffic medicine: Repercussions/ramifications on future challenges* | *Stefan Lakämper*

- *Cortisol, alcohol misuse and impaired driving in male first–time offenders: A 3–year follow–up* | *Hamzah Bakouni*

Salon 12
Special Session: Research on Trends of Alcohol and Other Drug Involvement in Fatally Injured Drivers Working Group

- *Alcohol and other drug involvement in drivers in the United States: 1982–2016* | *James Fell*

- *Prevalence and trends of drugged driving in Canada* | *Steve Brown*

- *An assessment of Δ9–tetrahydrocannabinol concentrations in exhaled breath and plasma in medical cannabis patients* | *Phillip Olla*

- *Drug–involved driving has overtaken alcohol in fatal crashes: The New Zealand experience with a vexed public health and road safety problem* | *Nils vann Lamoen*

10:30 – 11:00 am | Hall D Foyer
Coffee Break

11:00 – 12:30 pm | Hall D
CLOSING PLENARY SESSION AND CLOSING CEREMONIES

MADD
Lynda McCullough

History of ICADTS
Kathy Stewart

Cannabis and Driving: Current issues and Future Perspectives
Johannes Ramaekers

Invitation to T2020 and Closing Remarks

12:30 – 1:30 pm | Hall D Foyer
Lunch: Grab–n–Go

1:30 pm | Edmonton Convention Centre Main Entrance
POST CONFERENCE TOURS DEPART

Presenter	Poster Title
Matt Webster	High–risk behavior among rural female impaired drivers
Bob Voas	Evaluating the effectiveness of an electronic educational intervention for drivers on alcohol ignition interlocks
Tom Nochajski	Impact of a traumatic experience for DWI offenders on substance use, driving behavior, risk, alcohol and mental health problems
Amy Manning	An examination of factors influencing the decision to not install an alcohol ignition interlock
Joris Verster	Efficiency of effort and motivational involvement in task performance during alcohol hangover
Joris Verster	Performance efficiency and motivational involvement when driving under the influence of oxycodone/paracetamol
Leticia Fara	Drug use and different risk behaviors between men and women on Brazilian highways
Don Voaklander	Injuries and restriction in hours of alcohol sales in Wetaskiwin, Alberta: A comparison with the central zone of Alberta
William Pan	The effect of Acetaldehyde in breath alcohol analysis
Henrique Bombana	Psychoactive substances in non–fatal road traffic victims: Preliminary results from an emergency room study in São Paulo, Brazil

YOUNG SCIENTIST STIPEND DESCRIPTION AND WINNERS

These awards were created to encourage young scientists and those embarking on a career in traffic safety to develop their knowledge base and experience in different areas of alcohol, drugs and traffic safety, with financial support for eligible individuals to attend T2019 in Edmonton.

Thank you to City of Edmonton and ICADTS for their generous support in creating these stipends.

Winners

Amie Hayley, Swinburne University of Technology, Australia

Stefan Lakamper, University of Zürich, Switzerland

Natalie Gastin, Swinburne University of Technology, Australia

Marcelo Rocha, Universidade Federal do Rio Grande do Sul, Brazil

Michelle Tomczak, University of Alberta, Canada

Nevicia Case, McGill University, Canada

LMIC STIPEND DESCRIPTION AND WINNERS

These awards were created to encourage researchers from low-or middle-income countries to develop their knowledge base and experience in different areas of alcohol, drugs and traffic safety with support with financial support for eligible individuals to attend T2019 in Edmonton.

Thank you to City of Edmonton and ICADTS for their generous support in creating these stipends.

Winners

Ahsan Ul Haz, Government of Pakistan, Pakistan

Jinky Lu, National Institutes of Health, University of the Philippines Manila, Philippines

Gabriel Andreucceti, University of Sao Paulo Medical School

WORKING PAPER AWARDS

Best Working Paper by a Young Scientist

A $500.00 award will be granted to the author of the best working paper submitted by a Young Scientist based on the quality, relevance and scientific usefulness of the work.

Best Working Paper by a Researcher from a Low-or Middle-Income Country

A $500.00 award will be granted to the author of the best working paper submitted by a Researcher from a Low-or Middle-Income Country based on the quality, relevance and scientific usefulness of the work.

BEST POSTER AWARD

A $500.00 award will be granted for the best poster submission.

ICADTS AWARDS

The Widmark Laureates

The Widmark Award was established in 1965 at Indianna University in honour of Professor Erik M P Widmark, whose comprehensive research during the first half of the twentieth century touched on all aspects of the pharmacology of alcohol.

Widmark Awards honour those who have made an outstanding, sustained and meritorious contribution to the field that has led to international standing and respect. Candidates must have an impressive record of accomplishments that signify pre-eminence in the field.

The Haddon Award

The Haddon Award was established in 1999. It is awarded in recognition of successfully implementing scientific based changes in public policy that reduce the effects of alcohol and drugs on traffic safety.

Borkenstein Award

The Borkenstein Award recognizes individuals who have made an outstanding contribution to international cooperation in alcohol and drug-related traffic safety programs.

A Comprehensive Examination of Driving-Under-The-Influence in a Large Community in the United States

James C. Fell, M.S., NORC at the University of Chicago.

Abstract

Background: Across Miami-Dade County, Florida, driving-under-the-influence (DUI) arrests have decreased substantially.

Aim: The objective of this research was to provide a comprehensive examination of DUI in the county and determine why DUI arrests have declined.

Methods This was accomplished via analysis of (1) existing DUI arrest and crash data; (2) a telephone survey of Miami-Dade drivers (3) roadside surveys of alcohol and drug use conducted in Miami-Dade County; (4) information from focus group discussions with police and prosecutors in Miami-Dade County; and (5) a comprehensive review of the best impaired driving prevention practices.

Results DUI arrests decreased 64% between 2009 and 2016 in Miami-Dade County while the decrease that occurred in the State of Florida as a whole was down 34% and in the United States was down 29% over the same time period. Alcohol-impaired driving related fatal crashes increased from 66 in 2010 to 100 in 2015 (up 52%) and 76 in 2016 (up 15%). The percent of drivers on Miami-Dade County roads on weekend nights with illegal blood alcohol concentrations (BACs >.08 g/dL) increased from 1.5% in 2007 to 3.0% in 2017 (a 100% increase). The percent of drivers on the county roads with marijuana in their systems increased from 2.9% in 2007 to 11.5% in 2017 (a 300% increase).

Discussion Discussions with police and prosecutors in the county revealed police apathy toward DUI enforcement, lack of DUI enforcement training, and a lack of leadership from the police chiefs.

Practical Applications: An action plan with 10 recommendations were made to change the culture in Miami-Dade County and get DUI enforcement back on the public safety agenda.

Key Words: driving-under-the-influence (DUI) arrests; DUI crashes; roadside surveys; focus groups; telephone survey.

Financial Disclosure: This study was funded by the Miami Foundation in partnership with the Miami-Dade County State Attorney's Office.

Conflict of Interest: None.

Introduction

Driving-under-the-influence (DUI) arrests have been declining over the past 30 years in the United States (US). In 1989, there were 1.94 million DUI arrests while in 2017 there were fewer than 1.0 million DUI arrests (FBI, 2017). This decline in DUI arrests has been occurring in many states and US communities.

The current research explored the recent trend reported in Miami Beach, Florida, and across the Miami-Dade County that DUI arrests have decreased over a five year period. In a recent media announcement (Ovalle, 2016) it was noted that County police statistics indicated that 3,609 DUI arrests were made in 2015 (13.4 DUI arrests per 10,000 population), a 57% drop from 2010 when 6,321 DUI arrests were made (25.2 DUI arrests per 10,000 population). Several reasons are cited for this including lack of police staffing and training as well as the introduction of ridesharing programs such as Uber and Lyft. The Miami-Dade County State Attorney's Office wanted to know why DUI arrests have decreased so dramatically. Was it due to commensurate decreases in impaired driving in the county? Or was it due to barriers and issues related to DUI enforcement?

Methods

DUI Arrests and DUI Crashes:

The Miami-Dade State Attorney's Office provided the DUI arrest data from all police agencies in the county for the years 2010-2016. The State of Florida provided the Florida Integrated Report Exchange System (FIRES) Crash Records System for the years 2010-2016. Crashes were characterized by time of day and a ratio of single vehicle nighttime (6:00 pm to 5:59 am) crashes to multiple vehicle daytime (6:00 am to 5:59 pm) crashes was used as a surrogate for alcohol-impaired driving crashes since very few drivers in these

crashes were tested for a BAC. Data from the National Highway Traffic Safety Administration's Fatality Analysis Reporting System (FARS) were analyzed for the years 2010-2016, isolating those fatal crashes that occurred in Miami-Dade County and calculating the fatalities that had a driver with a BAC $\geq$ .08 g/dL. The FARS alcohol imputation file was used for this purpose (Subramanian, 2002) so that BAC data on drivers was estimated when it was missing using an imputation methodology.

Telephone Survey:
The objective of the telephone survey was to gather driver characteristics (those who report DUI and those who do not), and to assess community awareness of DUI prevention and enforcement strategies. A total of 787 interviews were completed with Miami-Dade County residents from May-July 2017. The final response rate was 28.1 percent based on the American Association of Public Opinion Research (AAPOR) Response Rate 3 method. The sample design is best described as a single frame cellular random digit dialing (RDD) survey supplemented with a targeted list of cell phone numbers of residents in Miami-Dade County. The sample size of 787 drivers was sufficient to draw reasonable conclusions. For example, a finding of 40% responding "Yes" to a question had an error of + or – 4% at the 95 percent confidence level so that the true value was somewhere between 36% and 44%. We conducted bivariate analyses to determine significant differences between drivers who self-report DUI and those who self-report not driving under the influence.

Roadside Surveys:
Roadside surveys were conducted on four weekend nights in the Fall of 2017 to meet a minimum goal of 200 drivers. Surveys were conducted on both Friday and Saturday night of each weekend at one location between 10:00 p.m. and 12:00 a.m. and again at a different nearby location from 1:00 a.m. to 3:00 a.m, for a total of four survey locations per weekend. The locations were randomly chosen within the boundaries of cooperating local law enforcement agencies in Miami-Dade County and were the same locations used in the National Roadside Surveys (NRS) of 2007 and 2013/2014. Although there were practical considerations in selecting these locations in 2007 in Miami-Dade County, such as sufficient traffic flow and a safe area to pull vehicles over, the locations were randomly selected from eligible grids on a map of the streets of Miami-Dade County. The objective of this roadside survey was to estimate the alcohol and other drug prevalence of all drivers on the roads in Miami-Dade County during the given time periods.

In this 2017 roadside survey, 339 drivers were directed into the bay for initial screening, 252 drivers were eligible and consented to the survey, and 215 drivers completed the survey. Out of the 215 participating drivers, 197 drivers (91.6%) provided a breath sample for measuring their BrAC and 183 drivers (85.1%) consented to providing a saliva sample for drug testing.

Categories of drugs tested included: marijuana, opioids, sedatives, stimulants, antidepressants, and narcotic analgesics. Oral fluid was used because it can be analyzed to indicate recent cannabis use by identification of the psychoactive substance, delta9-tetrahydrocannabinol (THC). The oral fluid was tested using immunoassay for an initial screening test with a cut-off of 4 nanograms per milliliter (ng/mL) and, if positive, quantitatively confirmed using liquid chromatography with tandem mass spectral detection (LC-MS-MS) at a cutoff level of 2 ng/mL. The results from this roadside survey provided objective biological information on the prevalence of impaired driving on Miami-Dade County roads on weekend nights and the prevalence rates of DUI by alcohol, THC, other drugs, and by a combination of drugs. This information was needed to determine whether DUI on the roads has decreased over the time period in which DUI arrests have decreased. The results of the 2017 survey were compared to the results of the roadside surveys conducted in Miami-Dade County in 2007 and 2013/14 as part of the National Roadside Surveys (NRS) conducted in those years (Kelley-Baker, et al., 2017).

Focus Groups:
Recruitment of law enforcement officers for the focus groups was accomplished via e-mail. Some very proficient DUI arrest officers were selected along with not so proficient officers. The goal of the focus groups was to talk with 5-7 participants at the same time to discuss the problem and to ask general and specific questions about the issue. The common agreed upon focus group remarks were translated into constructive recommendations. In two different sessions, focus group discussions were held with Miami-Dade police officers and Miami-Dade DUI prosecutors.

Results

DUI arrests reported by all police departments in Miami-Dade County, DUI arrests reported by all police departments in the state of Florida, and DUI arrests reported to the Federal Bureau of Investigation (FBI) for the Nation for the years 2009-2016 are shown in Table 1 below:

TABLE 1: DUI ARRESTS FOR 2009-2016

Year	Miami-Dade County	Florida	United States
2009	5,410	53,004	1,440,409
2010	4,339	52,346	1,412,223
2011	3,490	43,784	1,215,077
2012	3,142	44,894	1,282,957
2013	2,656	41,994	1,166,824
2014	2,620	42,745	1,117,852
2015	2,222	31,783	1,089,171
2016	1,974	35,042	1,017,808

DUI arrests declined from 5,410 in the county in 2009 to 1,974 in 2016, a 64% decline. This decline was statistically significant (p<0.001). The coefficient for the trend line was -39.735. The decline in DUI arrests in the State of Florida went from 53,004 in 2009 to 35,042 in 2016, a 34% decline. The difference in differences analyses shows a 4.64% decrease in the overall DUI arrests made in Miami-Dade County relative to the state of Florida, which was statistically significant (p-value=0.002). Nationally, DUI arrests decreased from 1,440,409 in 2009 to 1,017,808 in 2016, a 29% decrease. There was also a 4.04% decrease in the overall DUI arrests made in Miami-Dade County relative to the rest of the United States, which was also statistically significant (p-value=0.001). DUI arrests in Miami-Dade County dropped significantly from the period 2009-2016 for all offenders: males and females, young and older, White and African American.

The ratio of single vehicle nighttime (SVN) crashes (6pm-6am) to multiple vehicle daytime (MVD) crashes (6am-6pm) (serving as a surrogate measure of impaired driving crashes to account for underreporting of impaired drivers by police) decreased significantly in the other counties of Florida but was flat for Miami-Dade County. In the difference in differences analyses, there was a significant difference over time in the ratio of SVN crashes to MVD crashes in Miami-Dade County (flat) relative to the rest of the state of Florida (decreasing trend), which was statistically significant (p-value<0.001).

The FARS data for Miami-Dade County fatal crashes and fatalities for the years 2010-2016 are shown in Table 2. The percent of total traffic fatalities involving an intoxicated driver (BAC$\geq$ .08) has ranged from 28% in 2010 to 35% in 2012 to back down to 27% in 2016. So about one-third of traffic fatalities in Miami-Dade County involve an intoxicated driver over the past 7 years with no significant change in the trend line.

TABLE 2. MIAMI-DADE FARS ANALYSES

	2010	2011	2012	2013	2014	2015	2016
Fatal crashes	227	223	217	212	268	316	279
Fatal crashes BAC >= 0.08	66 (29%)	77 (35%)	73 (34%)	63 (30%)	81 (30%)	100 (32%)	76 (27%)
Traffic fatalities	246	247	235	225	280	340	294
Traffic fatalities BAC >= 0.08	69 (28%)	89 (36%)	82 (35%)	65 (29%)	90 (32%)	111 (33%)	80 (27%)

Telephone Survey of Attitudes and Reported Behaviors:
Of a total of 406 respondents who reported that they drink alcohol, 31% (139) said they had driven a motor vehicle less than 2 hours after drinking within the past 12 months. See Table 3.

Table 3.   Driven motor vehicle <2 hours after drinking alcohol in the past 12 months.

Category	N	Percent (%)
Male	107	39%
Female	32	24%
Latino	78	30%
Non-Latino	55	47%
18-24 years old	15	29%
25-34 years old	42	43%
35 to 39 years old	14	33%
40 to 49 years old	32	38%
50 to 54 years old	4	11%
55 to 64 years old	24	44%
65 years or older	8	22%

Only 54% (422) of the sample thought it was very likely or likely that marijuana impairs a person's ability to drive safely while 14% (107) said it was not likely at all.

Roadside Surveys in 2007, 2013-2014 and 2017:
In the 2017 Miami-Dade roadside survey conducted in this study, 197 nighttime drivers were tested for alcohol. A total of 28 (14.2%) had some alcohol in their systems (BrAC>.01), 15 (7.6%) drivers were impaired by alcohol (BrAC>.05), and 6 (3.0%) drivers had illegal BrACs (>.08). These trends in percentages from 2007 to 2013-2014 to 2017 can be seen in Table 4.

Table 4:   Percent Drivers in Miami-Dade Roadside Surveys with Alcohol by Year

	2007	2013-2014	2017
Some Alcohol (BrAC$\geq$.01)	10.8%	15.5%	14.2%
Impairment (BrAC$\geq$.05)	3.1%	6.2%	7.6%
Illegal (BrAC$\geq$.08)	1.5%	2.3%	3.0%

Other Drugs:
A total 183 respondents voluntarily provided an oral fluid sample in the 2017 survey, which was tested for 52 different drugs. A total of 31 (16.9%) drivers tested positive for at least one drug, 21 drivers tested positive for THC (11.5%).

Figure 1:   Percent of Nighttime Drivers in Miami-Dade Roadside Surveys with Marijuana by Year
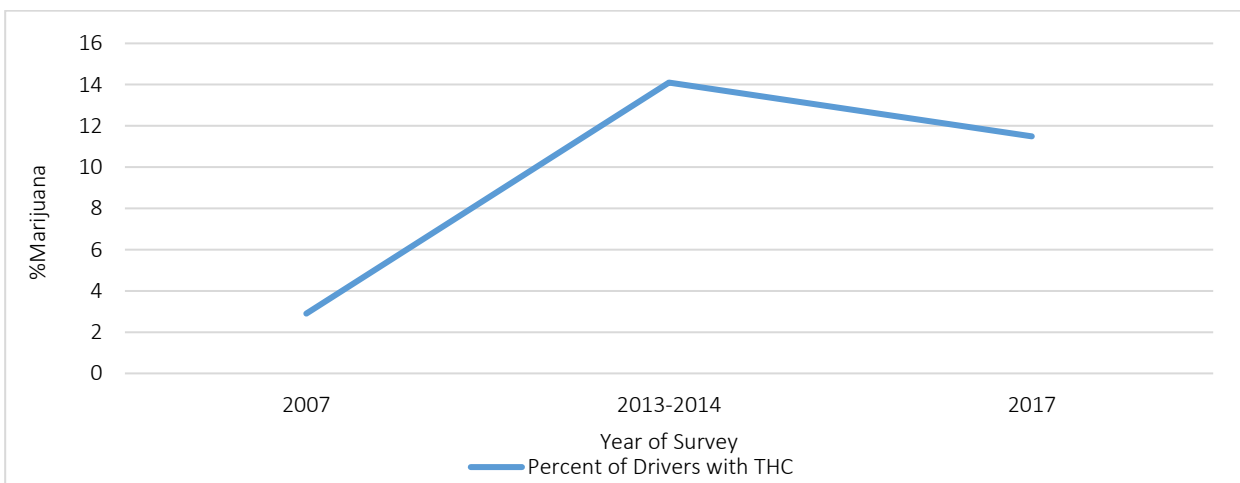
The trends for marijuana are shown in Figure 1. The percent of nighttime drivers from roadside surveys with marijuana in their oral fluid in the 2017 roadside survey has increased from 2007, though there was a slight non-significant decrease from the 2013-2014 survey. Almost four times as many drivers had marijuana in their systems (11.5%) in 2017 than drivers who were intoxicated by alcohol (3.0%).

Focus Groups:
Regarding reasons for the decline in DUI arrests, police officers during focus groups offered the following:
- Law enforcement apathy
- No leadership from the top
- Lack of DUI investigation training
- The "Ferguson" effect (reluctance to make traffic stops which derives from a traffic stop incident where a White law enforcement officer ultimately shot and killed an unarmed African American driver in Ferguson, Missouri)
- Lack of the number of police officers in each agency
- Change in strategy from being "proactive" to "reactive"
- Lack of well-trained and up-to-date drug recognition experts (DREs) who have completed several weeks of intensive training on recognizing drugged drivers
- Lack of federal and state grant funding
- Lack of confidence in the DUI arrest process
- Perception by officers that the "Back on Track" DUI diversion program is a mere "slap on the wrist."

The prosecutors felt more like lack of police training, officer apathy, the dislike of the "Back on Track" program, and the attitudes of jurors played a key role. Jurors reportedly identified with the offenders, had sympathy for them, and tended to vote "not guilty" in less than clear cut cases.

Discussion

This study focused on DUI enforcement in one large community. It is clear that the number of drivers arrested for DUI has declined in Miami-Dade County. The reasons for this are numerous. Focus group discussions with Miami-Dade County police officers indicate that several factors could be contributing to the DUI arrest decline: (1) experienced officers with high DUI arrest rates have retired from several Miami-Dade police departments; (2) young inexperienced officers are not confident in all the procedures that must be followed for a DUI arrest; (3) police chiefs are not emphasizing DUI enforcement; (4) there has been no refresher training given to Miami-Dade police officers on DUI detection and proper arrest procedures; (5) the "Back on Track" diversion program given to many DUI offenders serves as a disincentive to some police officers to make a DUI arrest since the offenders who complete the education program are not officially charged with DUI; (6) the paperwork involved in a DUI arrest is massive and cumbersome for police officers.

The data collected from roadside surveys suggests that driving while impaired by alcohol and marijuana is increasing in Miami-Dade County. Traffic fatalities involving impaired driving have also increased in recent years, indicating that impaired driving is a significant public health problem in Miami-Dade County. Increasing the detection and arrest of impaired drivers has been associated with decreases in impaired drivers on the roads (Fell et al., 2015) and impaired driving crashes (Fell, et al. 2014; Beck, et al., 2017).

Conclusions

From the data analyses and the roadside surveys, there is no evidence that ridesharing has reduced impaired driving in Miami-Dade County. Impaired driving is actually increasing. Therefore, the decrease in DUI arrests is not due to fewer impaired drivers out on Miami-Dade County roads or involved in crashes.

Focus group discussions with law enforcement officers and prosecutors indicated that four factors played a role in the substantial decrease in DUI arrests since 2009: (1) lack of priority and leadership from the police chiefs regarding enforcing DUI; (2) law enforcement apathy toward making DUI arrests; (3) a lack of DUI arrest procedures training; and (4) reluctance of police to make traffic stops (the "Ferguson effect").

Practical Applications:

An Action Plan was recommended to officials in Miami-Dade County:

1. Police chiefs need to direct their traffic enforcement officers to be proactive rather than reactive when it comes to impaired driving. If DUI arrest rates can increase 10%, there is evidence that DUI crashes can be decreased 1% (Fell et al., 2014).

2. To help overcome the reluctance of police to make traffic stops, police agencies in Miami-Dade County should join forces to conduct more sobriety checkpoints. Checkpoints are safer for both the police and the drivers going through them. The checkpoints are also better general deterrents to impaired driving than traffic stops or saturation patrols.

3. Since many police officers in Miami-Dade County are not familiar with the DUI detection and arrest process, offer training on DUI enforcement to all traffic enforcement officers in the proper procedures. As officers gain more confidence in their DUI enforcement abilities, more drivers will be detected and arrested who drive impaired. The "Visual Detection of DWI Motorists" pamphlet can help in this regard (NHTSA, 2010).

4. If DUI enforcement is going to increase significantly in Miami-Dade County, then drivers who do drink are going to need better and more convenient alternatives. Support policies and programs that increase the availability, convenience, affordability and safety of transportation alternatives for drinkers who might drive otherwise. This includes transportation ride sharing (e.g., Uber and Lyft), enhancing other public transportation options (especially during nighttime and weekend hours) and boosting or incentivizing transportation alternatives in the densely populated bar districts of the county.

In summary, DUI arrests have decreased 64% in Miami-Dade County since 2009. This is a significantly larger decrease than has occurred in the State of Florida as a whole (34%) and in the United States (29%) over the same time period. This decline is not due to any decline in DUI behavior in the county. In fact, the data indicate an increase in impaired driving on county roads, in crashes, and in fatal crashes. Discussions with police and prosecutors in the county reveal police apathy toward DUI enforcement, lack of DUI enforcement training, and lack of leadership from the top. Police officers need to become proactive rather than reactive toward DUI in the county. The above actions, if implemented, have the potential to change the culture in Miami-Dade County and get DUI enforcement back on the public agenda.

References

Beck, K.H., Fell, J.C. & Kerns, T.J. (2017): Evaluation of Maryland's State Police Impaired Driving Reduction Effort (SPIDRE). *Traffic Injury Prevention*, DOI: 10.1080/15389588.2017.1414948

Federal Bureau of Investigation (FBI). (2017). *Uniform Crime Reports*, 2015. Available at: http://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2011/crime-in-the-u.s.-2011/tables/table-29.

Fell, J.C., Waehrer, G., Voas, R.B., Auld-Owens, A., Carr, K. & Pell, K. (2014). Effects of Enforcement Intensity on alcohol impaired driving crashes. *Accident Analysis and Prevention, 73*, 181-186

Fell, J.C., Waehrer, G., Voas, R.B., Auld-Owens, A., Carr, K. & Pell, K. (2015). Relationship of Impaired-Driving Enforcement Intensity to Drinking and Driving on the Roads. *Alcoholism: Clinical and Experimental Research, 39(1)*, 84-92.

Kelley-Baker, T., Berning, A., Ramirez, A., Lacey, J. H., Carr, K., Waehrer, G., Compton, R. (2017, May). 2013-2014 National Roadside Study of alcohol and drug use by drivers: Drug results (Report No. *DOT HS 812 411)*. Washington, DC: National Highway Traffic Safety Administration.

National Center for Statistics and Analysis. (2004). Fact Sheet. Motor Vehicle Traffic Fatalities and Fatality Rates: 1899-2003. *National Highway Traffic Safety Administration*, Washington, DC.

National Center for Statistics and Analysis. (December 2016). Traffic Safety Facts, 2015 Data: Alcohol-Impaired Driving. National Highway Traffic Safety Administration, *DOT HS 812-350*, Washington, DC.

National Highway Traffic Safety Administration (NHTSA) (March 2010). The Visual Detection of DWI Motorists. *DOT HS 808 677*, Washington, DC.

National Highway Traffic Safety Administration (2017). Fatality Analysis Reporting System data files, 1982-2015. Retrieved January 6, 2017 from http://nhtsa.gov/FARS

Ovalle, D. (2016). DUI arrests plummet in Miami Beach, across Miami-Dade County. *Miami Herald*. http://www.miamiherald.com/news/local/crime/article57603318.html

Subramanian, Rajesh. (2002). Transitioning to multiple imputation - A new method to estimate missing blood alcohol concentration (BAC) values in FARS. (*DOT HS 809 403*). Washington, DC: Mathematical Analysis Division, National Center for Statistics and Analysis, National Highway Traffic Safety Administration, U.S. Department of Transportation.

A Psychological Insight into the Driving Behaviour of Traffic Offenders

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Abstract

There is a dearth of literature from psychological perspective on road safety and this study was first of its kind in Indian context. Given the fact that India holds a dubious distinction for being at the top for road crash victims and fatalities, there is a dire need to address all the possible perspectives that could uncover and provide possible solutions to this growing public health issue. The objective of this study was to look at some of the psychological imperatives like driving anger, vengeance, sensation-seeking, impulsiveness, and dangerous driving that could possibly demarcate and distinguish any pattern amongst both male and female traffic offenders. The research also aimed at identifying predictors of dangerous driving using aforementioned variables. For this study, the respondents were randomly selected from amongst both male and female offenders over a period of six months, at the traffic police station where they would pay the fine and collect driving license of their vehicle. Out of 460 traffic offenders who were administered the questionnaire, a final sample of 100 male and 100 female traffic offenders in the age group of 18-23 years was selected for the study. Using the statistical technique of t-test and step-wise multiple regression equation, the results revealed significant differences among male and female traffic offenders on dangerous driving, sensation-seeking, and impulsiveness parameters. However no significant difference was found on the variables of driving anger and vengeance. Step-wise multiple regression equation found impulsiveness as a top predictor for dangerous driving among both the groups. There is a need for remediation program for the offenders for their sensitization and to be made more responsible about the implications of their actions. Majorly challenges encountered was non-availability of literature in Indian context and retrieving information from the participants. For future research, self-report measures together with the observational data and conducting similar research in bigger context like metros can be done.

Keywords: Traffic offenders, driving behaviour, dangerous driving, India

Introduction

More than a million people die in road crashes globally. Road traffic fatalities are the eighth leading cause of death globally and it is estimated, that it would become the fifth leading cause of death by 2030, with ninety percent of road traffic deaths occur in low-income and middle-income countries (WHO, 2009). Road safety researchers have tried to enlist certain contributory factors to road traffic crashes and have classified them into behavioural, environmental and vehicular failures (Sabey & Taylor, 1980). Looking into the driver behaviour, specifically the driver's personality which has long been recognized as a significant predictor of dangerous driving (Arthur, Barret, & Alexander, 1991; Fine, 1963; Tillman & Hobbs, 1949), this study was designed to have a psychological insight into the driving behaviour of young drivers primarily the young traffic offenders. The variables studied in this research were driving anger, vengeance, sensation-seeking, impulsiveness and their influence on dangerous driving. Driving anger reflects one's propensity to become angry while driving (Deffenbacher et al., 1994). Vengeance on the other hand, is a feeling of retaliation for a perceived injustice or harm. Vengeful drivers have been observed as overreacting to minor infractions and experiencing anger or irrational thoughts (Gibson & Wiesenthal, 1996; Stuckless & Goranson, 1992). As per the research studies done, the most consistent and stable personality traits found in relation to risky driving practices and dangerous driving is sensation-seeking (Iversen & Rundmo, 2002; Sumer, 2003; Roth et al., 2007; Waylen & McKenna, 2008). Impulsiveness has also been associated with dangerous driving due to its relationship with drunk driving, impaired driver behaviour, reduced ability to perceive traffic signs, reduced seatbelt use, and accident rates (Hansen, 1988; Loo, 1978; Stanford et al., 1996) , and therefore, it was considered crucial to include this variable in the study as well.

For the purpose of this study, a sample of drivers in the age group of 18-23 years living in tri-city area in northern India included Chandigarh, Mohali and Panchkula, were selected over a period of two to three years. Only those drivers were included in the sample who were challaned/obtained tickets for a traffic offense (i.e. the moving violations, which refers to any traffic violation when the vehicle is in motion) for at least two times or more by the traffic police, including drivers who were driving without a driving license. Selection of traffic offenders for the study was used, due to the fact that intentional violations are most strongly related to crashes and dangerous driving (Parker, Reason, Manstead, & Stradling, 1995; Reason

et al., 1990). Since the attitude of the driver and other psychological attributes make a great contribution to driving violations (Forward, 2009), it was felt imperative to study the traffic offenders only for the purpose of this study.

Hypothesis

For the present study, following hypothesis were formulated:

1. It is expected that male traffic offenders will be higher than female traffic offenders on: (H1): dangerous driving; (H2): driving anger; (H3): vengeance; (H4): sensation-seeking; (H5): impulsiveness.
2. It is expected that (H6): driving anger; (H7): vengeance; (H8): sensation-seeking; (H9): impulsiveness will emerge as predictors for dangerous driving in male and female traffic offenders

Method

Sample

The research was undertaken at the ticket branch of the traffic police where offenders come to submit their fine for traffic violation. For this study a questionnaire was administered to 460 traffic offenders (both male and female) out of which the final sample of offenders was drawn which included 100 male and 100 female traffic offenders in the age range of 18-23 years with the following inclusion and exclusion criteria.

Inclusion criteria

- Only those drivers were included in the sample who were issued the ticket and challaned for a traffic offense (i.e. the moving violations, which refers to any traffic violation when the vehicle is in motion) for at least two times or more by the traffic police, including drivers who were driving without a driving license.
- The sample included drivers of the age group of 18-23 years and only those drivers who either drove two-wheeled or four-wheeled vehicle.

Exclusion criteria

- Traffic offenders who have received only one challan or ticket for traffic offence.
- Any youngster undergoing any kind of psychological treatment.
- Youngsters who were not financially dependent on their parents, i.e. Individuals who were earning and doing a job.
- Drivers who were using both type of vehicles for commuting, i.e. two-wheeler and fourwheeler.

Further, a flow chart depicts the constitution of the sample

Flow chart on the constitution of the sample
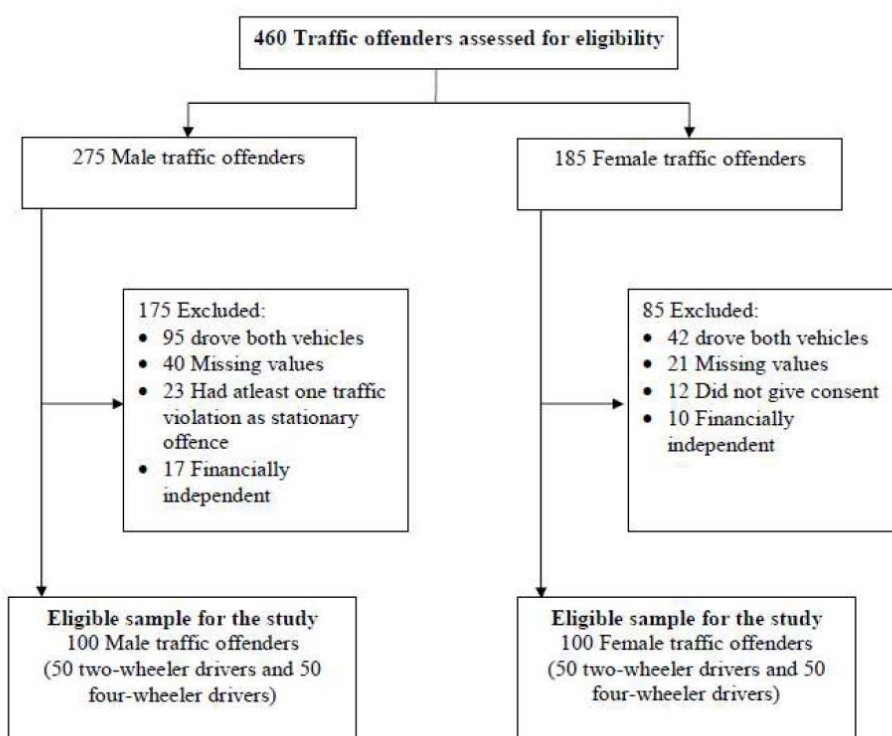
Tools

Following standardized measures to assess the variables were used:

- Driving Anger Scale (Deffenbacher et al., 1994)
- Driving Vengeance Questionnaire (Wiesenthal et al., 2000).
- Sensation-seeking scale (Indian adaptation) (Basu et al., 1993)
- Baratt's Impulsiveness Scale (BIS-11) (Patton et al., 1995)
- Dula Dangerous Driving Index (DDDI) (Dula & Ballard, 2003)

Procedure

The questionnaires were administered to the individuals personally and it took 45 minutes to an hour to record their responses. The participation was voluntary and full confidentiality was assured.

Results

For analysis, t-test and multiple regression equation was applied on the data and results were computed.

The t-test analysis

The t-test analysis found significant difference among male and female traffic offenders on dangerous driving (t =3.47, $p < 0.01$); sensation-seeking (t=3.64, $p < 0.01$) and impulsiveness (t =2.22, $p < 0.01$) (Table 1) while no significant differences among male and female traffic offenders emerged on driving anger and vengeance. The mean scores were found to be higher among group of male traffic offenders (M =70.89), (M =18.36), (M =70.47) as compared to the female traffic offenders (M =61.96), (M =15.54), (M =67.64). on dangerous driving, sensation-seeking and impulsiveness respectively (Table 1).

Table 1: Means, Standard Deviations and t-ratios for Group Differences on all the variables

Variables	Group I Male Traffic Offenders		Group II Female Traffic Offenders		Group I vs Group II
	Mean	SD	Mean	SD	t-ratio
DD	70.89	21.15	61.96	14.73	3.47**
DA	97.27	23.89	100.77	22.19	1.07
V	37.51	8.74	35.43	7.19	1.84
SS	18.36	5.54	15.54	5.41	3.64**
IMP	70.47	9.97	67.64	7.96	2.22**

$* p < 0.05; ** p < 0.01$

VARIABLES- DD = Dangerous driving, DA = Driving Anger, V = Vengeance, BP = Boredom Proneness, SS = Sensation-seeking, IMP = Impulsiveness

Regression Analysis

Among male traffic offenders, four variables turned out to be significant and were retained as predictors, as they explained 48 % ($R^2 = 0.48$) (Table2) of the variance in the criterion variable i.e. dangerous driving. The predictors which emerged significant were impulsiveness ($\beta = 0.30$), driving anger ($\beta = 0.30$), sensation-seeking ($\beta = 0.27$) and vengeance ($\beta = 0.19$). Among female offenders, the results found that two variables turned out to be significant and were retained as predictors, as they explained 12% ($R^2 = 0.12$) (Table2) of the variance in the criterion variable i.e. dangerous driving. The predictors which emerged significant were impulsiveness ($\beta = 0.26$) and sensation-seeking ($\beta = 0.20$).

Groups	Predictor Variables	Standardized Coefficients	T	R Square	R Square Change	F
		Beta				
Male traffic offenders	IMP	0.30	3.71**	.25	.25	21.96**
	DA	0.30	3.77**	.37	.12	
	SS	0.27	3.24**	.45	.08	
	V	0.19	2.27*	.48	.03	
Female traffic offenders	IMP	0.26	2.73**	.09	.09	6.86**
	SS	0.20	2.02*	.12	.04	

Table 2: Step-wise Multiple Regression Equations for dangerous driving among various groups of drivers

$* p < 0.05; ** p < 0.01$

VARIABLES- DD = Dangerous driving, DA = Driving Anger, V = Vengeance, SS = Sensation-seeking, IMP = Impulsiveness

Discussion

The results revealed significant differences among male and female traffic offenders on dangerous driving, sensation-seeking and impulsiveness while no significant difference was found on driving anger and vengeance. Step-wise multiple regression equation found impulsiveness as a top predictor for dangerous driving among both the groups.

The hypothesis (H1) which expected male traffic offenders will be higher than female traffic offenders on dangerous driving was aptly supported. Considering the driving style of both the gender, males are more likely to be involved in road accidents and traffic violations such as speeding, drinking and risk-taking than the females (Storie, 1977) and hence were supported in the present study as well. The hypothesis (H2) and (H3) which expected males to be higher than female traffic offenders on driving anger and vengeance respectively was not supported. Certain research studies also support the findings of the present study. Like, no gender differences were observed on driving anger and aggression by Wickens, Mann, Stoduto, Butters, Ialomiteanu and Smart (2012). Also, a study among Japanese undergraduates did not reveal any gender effect on dispositional vengeance and anger (Sawada & Hayama, 2012). The hypothesis (H4) and (H5) of the present study which expected male traffic offenders will be higher than female traffic offenders on sensation-seeking and impulsiveness respectively was supported. Several studies on gender and sensation-seeking support the current findings (Amirfakhraei et al., 2013; Arnett, 1990; Franken, 1988; Ulleberg & Rundmo, 2002; Zuckerman, 1979) with no gender differences on impulsiveness also being supported (Farnell, 2011).

The hypothesis (H6) and (H7) which expected driving anger and vengeance to be predictors for dangerous driving respectively in male and female traffic offenders were not fully supported as they emerged as predictors only among male and not female traffic offenders. Perhaps, anger or feeling to retaliate might not be a motivating factor behind dangerous driving for female offenders. The hypothesis (H8) and (H9) which expected sensation-seeking and impulsiveness to be a predictor for dangerous driving respectively in male and female traffic offenders was supported among both the groups. Sensation-seeking along with impulsiveness was found to be a good predictor for crash-related conditions, risky driving, driving anger expression and self-reported driving violation (Dahlen et al., 2005; Iversen & Rundmo, 2002; Schwebel et al., 2006).

The present study found male traffic offenders scoring high on dangerous driving, sensation-seeking, and impulsiveness, while driving anger and vengeance were also found significant in predicting dangerous

driving among them. However, impulsiveness and sensation-seeking were common key predictors of dangerous driving among male and female offenders. The fundamental limitation at the moment in India is the need for much larger sample sizes in diverse social and cultural milieu, and need for more extensive observational studies, as also administering a comprehensive questionnaire to study the driving behavior in larger context to obtain a holistic perspective.

References

Amirfakhraei, A., Taghinejad, N., & Sadeghifar, E. (2013). Relationship between risky driving behavior and sensation seeking and sex among students of Islamic Azad University— Bandar Abbas, Iran, in 2012. Journal of Basic and Applied Scientific Research, 3(3), 293- 301.

Arnett, J. (1990). Drunk driving, sensation seeking, and egocentrism among adolescents. Personality & Individual Differences, 11(6), 541–546. doi:10.1016/0191-8869(90)90035- P.

Arthur, W., Barret, G. V., & Alexander, R. A. (1991). Prediction of vehicular accident involvement: A meta-analysis. Human Performance, 4(2), 89-105. doi: 10.1207/s15327043hup0402_1

Basu, D., Verma, V. K., Malhotra, S., & Malhotra, A. (1993). Sensation seeking scale: Indian adaptation. Indian journal of psychiatry, 35(3), 155. Dahlen, E. R., Martin R. C., Ragan, K., & Kuhlman, M. M. (2005). Driving anger, sensation seeking, impulsiveness, and boredom proneness in the prediction of unsafe driving. Accident Analysis and Prevention, 37, 341–348. doi: org/10.1016/j.aap.2004.10.006

Deffenbacher, J. L., Oetting, E. R., & Lynch, R. S. (1994). Development of a driving anger scale. Psychological Reports, 74, 83–91. doi: 10.2466/pr0.1994.74.1.83

Dula, C. S., & Ballard, M. E. (2003). Development and Evaluation of a Measure of Dangerous, Aggressive, Negative Emotional, and Risky Driving. Journal of Applied Social Psychology, 33(2), 263-282. doi: 10.1111/j.1559-1816.2003.tb01896.x.

Farnell, E. (2011). Gender Differences in Impulsivity and Decision Making. (Doctoral Dissertation, The Chicago school of professional psychology). Retrieved from http://gateway.proquest.com/openurl?url_ver=Z39.88-2004&res_dat=xri:pqdiss&rft_val_fmt=info:ofi/fmt:kev:mtx:dissertation&rft_dat=xri:pqdiss:3501766

Fine, B. J. (1963). Introversion-extraversion and motor vehicle driver behavior. Perceptual and Motor Skills, 16(1), 95-100. doi:10.2466/pms.1963.16.1.95

Forward, S. E. (2009). The theory of planned behaviour: The role of descriptive norms and past behaviour in the prediction of drivers' intentions to violate. Transportation Research Part F: Traffic Psychology and Behaviour, 12(3), 198-207. doi: http://dx.doi.org/10.1016/j.trf.2008.12.002

Franken, R. E. (1988). Sensation seeking, decision making styles, and preference for individual responsibility. Personality and Individual Differences, 9(1), 139-146. doi:10.1016/0191-8869(88)90039-6

Gibson, P. M., & David. L. Wiesenthal. (1996). Driving Vengeance Questionnaire (DVQ): The Development of a Scale to Measure Deviant Drivers' Attitudes. York University, the LaMarsh Centre for Research on Violence and Conflict Resolution.

Hansen, C. P. (1988). Personality characteristics of the accident involved employee. Journal of Business and Psychology, 2(4), 346-365. doi: 10.1007/BF01013766

Iversen, H., & Rundmo, T. (2002). Personality, risky driving and accident involvement among Norwegian drivers. Personality and Individual Differences, 33(8), 1251-1263. doi: 10.1016/S0191-8869(02)00010-7

Loo, R. (1978). Individual differences and the perception of traffic signs. Human Factors: The Journal of the Human Factors and Ergonomics Society, 20(1), 65–74. doi:10.1177/001872087802000109

Parker, D., Reason, J. T., Manstead, A. S., & Stradling, S. G. (1995). Driving errors, driving violations and accident involvement. Ergonomics, 38(5), 1036-1048. doi:10.1080/00140139508925170

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt Impulsiveness Scale. Journal of Clinical Psychology, 51, 768-774.

Reason, J. T., Manstead, A. S. R., Stradling, S. G., Baxter, J. S., & Campbell, K. (1990). Errors and violations on the road: A real distinction? Ergonomics, 33, 1315-1332. doi:10.1080/00140139008925335.

Roth, M., Hammelstein, P., & Brähler, E. (2007). Beyond a youthful behavior style–Age and sex differences in sensation seeking based on need theory. Personality and Individual Differences, 43(7), 1839-1850. doi:10.1016/j.paid.2007.06.004

Sabey, B. E., &Taylor, H. (1980). The known risks we run: the highway, 43-70. Springer US. doi: http://dx.doi.org/10.1007/978-1-4899-0445-4_3

Sawada, M., & Hayama, D. (2012). Dispositional vengeance and anger on schadenfreude 1, 2. Psychological reports, 111(1), 322-334. doi: 10.2466/16.07.21.PR0.111.4.322-334

Schwebel, D. C., Severson, J., Ball, K. K., and Rizzo, M. (2006). Individual difference factors in risky driving: The roles of anger/hostility, conscientiousness, and sensationseeking. Accident Analysis and Prevention, 38(4), 801-810. doi: http://dx.doi.org/ 10.1016/j.aap.2006.02.004.

Stanford, M. S., Greve, K. W., Boudreaux, J. K., Mathias, C. W., & Brumbelow, J. (1996). Impulsiveness and risk-taking behavior: Comparison of high-school and college students using the Barratt Impulsiveness Scale. Personality and Individual Differences, 21(6), 1073-1075. doi :10.1016/S0191-8869(96)00151-1.

Storie, V. J. (1977). Male and female car drivers: differences observed in accidents (No. TRRL Lab Rept. 761). http://trid.trb.org/view.aspx?id=55988

Stuckless, N., & Goranson, R. (1992). The vengeance scale: Development of a measure of attitudes toward revenge. Journal of Social Behavior and Personality, 7, 25-42.

Sümer, N. (2003). Personality and behavioral predictors of traffic accidents: testing a contextual mediated model. Accident Analysis & Prevention, 35(6), 949-964. doi:10.1016/S0001- 4575(02)00103-3

Tillmann, W. A., & Hobbs, G. E. (1949). The accident-prone automobile driver A study of the psychiatric and social background. American journal of psychiatry, 106(5), 321-331. Doi :10.1176/ajp.106.5.321.

Ulleberg, P., & Rundmo, T. (2002). Risk–taking attitudes among young drivers: The psychometric qualities and dimensionality of an instrument to measure young drivers' risk–taking attitudes. Scandinavian Journal of Psychology, 43(3), 227-237.

Waylen, A. E., & McKenna, F. P. (2008). Risky attitudes towards road use in predrivers. Accident Analysis & Prevention, 40(3), 905-911.

World Health Organization. (2009). Global status report on road safety: time for action. World Health Organization. Retrieved from http://www.un.org/ar/roadsafety/pdf/roadsafetyreport.pdf

Wickens, C. M., Mann, R. E., Stoduto, G., Butters, J. E., Ialomiteanu, A., & Smart, R. G. (2012). Does gender moderate the relationship between driver aggression and its risk factors?. Accident Analysis & Prevention, 45, 10-18. doi:10.1016/j.aap.2011.11.013

Wiesenthal, D. L., Hennessy, D., & Gibson, P. M. (2000). The Driving Vengeance Questionnaire (DVQ): The development of a scale to measure deviant drivers' attitudes. Violence and Victims, 15(2), 115-136.

Zuckerman, M. (1979). Sensation seeking: Beyond the optimal level of arousal. Sydney: Halsted Press.

A Toxicological Review of DUID Case Work, Prior to, and Since the Introduction of Roadside Drug Testing and *Per Se* Drug Levels in Ireland

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Abstract

Background: The 2016 Road Traffic Act in Ireland enabled An Garda Síochána (AGS) to conduct roadside and station-based drug testing using oral fluid. Per se drug levels were also introduced for Cocaine, Cannabis and Heroin. This review looks at the impact of these measures.

Objective(s): As well as reviewing the toxicological casework prior to the introduction of the new legislative measures this review considered the available data from April 2017 to date including enforcement activity and laboratory findings. Significant trends where identified will be discussed.

Method: Data from the roadside and station-based testing, as well as laboratory screening and confirmation testing was reviewed to evaluate the newly introduced measures. Roadside and station-based testing is conducted using the Drager DT5000 to detect Cannabis, Cocaine, Opiates and Benzodiazepines. Lab screening is by immunoassay/LC-MS-MS. Laboratory confirmation is conducted using GC-MS-MS and LC-MS-MS.

Results: Before the enactment of the new measures the driver had the option to provide either blood or urine. When a specimen of oral fluid is collected and found to be positive for cannabis, cocaine or opiates the driver is compelled to provide a blood specimen. Since the introduction of the new measures there has been a marked increase in the number of blood specimens collected relative to urine. The Drager DT5000 is working well and has performed satisfactorily. There is good agreement between the oral fluid testing system and the laboratory findings. Cannabis and Cocaine are the most prevalent drugs detected using the oral fluid testing system. Opiate and benzodiazepine prevalence are lower. Most cases are in excess of the per se levels stated in legislation for Cannabis and/or Cocaine.

Conclusion: The new measures are effective at detecting drugs in drivers. Ongoing review is required in order to fully evaluate the impact of the legislative changes.

Keywords: Drugs, Oral fluid, *Per se*, LC-MS-MS, GC-MS-MS

Disclosures: None

Background:

Drug driving is a known problem in Ireland (Fitzpatrick, Daly, Leavy, & Cusack, 2006) and the mainstay of the legal measure has been where the presence of an impairing drug is confirmed and impairment is proven the driver has committed an offence (Oireacthas, 2010). In practice this has proven difficult to enforce and so alternative measures which would detect and deter driving under the influence of drugs were necessary. The 2016 Road Traffic Act in Ireland (Oireacthas, 2016) brought in a number of new measures to tackle the problem of driving under the influence of drugs. One important measure was the introduction of *per se* drug levels for Cocaine, Cannabis and Heroin and their metabolites. (see table 1)

Drug/Metabolite	Level in Whole Blood
Δ 9 -Tetrahydrocannabinol (Cannabis)	1ng/ml
11-nor-9-carboxy-Δ 9 -tetrahydrocannabinol (Cannabis)	5ng/ml
Cocaine	10ng/ml
Benzoylecgonine (Cocaine)	50ng/ml
6-Acetylmorphine (Heroin)	5ng/ml

Table 1: 2016 Irish Road Traffic Act, *per se* limits for drugs

Another important measure was the introduction of random roadside drug testing. This new measure would give An Garda Siochana (Irish Police Force) the power to stop, demand an oral fluid specimen and to test a drivers oral fluid for the presence of drugs. While the specific drugs which the police could test for are not specified in legislation, Cannabis, Cocaine, Opiates and Benzodiazepines, were included in the first testing system rolled out in April 2017. The system which was chosen, following competitive tender, was the Draeger Drugtest 5000 (DT5000). In order to be in a position to use the *per se* legislation, the requirement for blood to be provided on foot of a roadside positive drug test, was also included in the new legislation. Previously and in the absence of this particular measure, the driver had the option of providing a urine or blood specimen. At the same time, a new form was also introduced which was called the 'information form' which while not legally required/prescribed, was to be completed by the arresting officer where oral fluid drug testing occurred and returned with the blood specimen to the lab. The main purpose of this form was to enable a review of the performance of the oral fluid drug testing system, a requirement under the Road Safety Authorities strategy (RSA, 2013). These new measures complemented, rather than replaced the existing drug presence and impairment law that had been in place for many years. The laboratory of the Medical Bureau of Road Safety is responsible for the approval supply and testing of the oral fluid testing device. In addition, the laboratory is also responsible for subsequent testing of blood and urine specimens collected following a positive drug test under the Road Traffic Act. These two responsibilities enable the MBRS to comment on the toxicology of DUID case work.

Objective(s):

The main objective of this work was to review the available data to determine whether there were any significant changes or impacts since the introduction of the aforementioned new measures. The DT5000 was initially rolled out to 87 Garda Stations and were fixed and immobile, while an additional 50 were made available for mobile use. Where the police complete the information form indicating the roadside test, the laboratory results can be compared. The main areas of interest arising from the existing and newly introduced measures, and considered here, are:

• Performance of the DT5000 in detecting drugs in oral fluid compared to the results of laboratory tests of specimens of blood taken following a positive oral fluid drug test.

• The frequency of drug positives resulting from police enforcement and if there were any changes since the introduction of the new enforcement measure mentioned above.

• The types of drugs being detected and if there were any changes since the introduction of the new enforcement measure mentioned above.

The new measures came into force on the 13th of April 2017. Data from the 1st of January 2016 up the 12th of April 2017 (pre new measures period) was compared with all available date from 13th of April 2017 to the end of 2018 (post new measures period). Where significant trends were identified these are discussed below.

Method

Data provided by police enforcement activity was provided and reviewed. The laboratory data prior to the change in the legislation was extracted and broken down based on the specimen type and the drugs detected.. The performance of the DT5000 was evaluated by comparing its results as provided with the information form with the labs results. This screening data is compared for the two periods to see in broad terms how the drugs use patterns in drivers changed between the two periods. Lab screening is by immunoassay/LC-MS-MS (since 29/09/18). This was done using sensitivity and specificity calculations (Blencowe et al., 2011) where:

Sensitivity = true positives/true positives + false negatives.

Specificity= true negative/true negative + false positive.

Laboratory confirmation is conducted using GC-MS-MS (Cannabis) and LC-MS-MS (Cocaine, Benzodiazepines, Opiates, Methadone, Amphetamines and Methamphetamines including MDA and MDMA).

Results

Activity information provided by the police for 2018 show that the number of drugs tests carried out at random mandatory intoxicant checkpoints increased steadily over the year. The enforcement activity steadily increased during 2018 and the positivity rate was ca 13%. Additional effort over the Christmas and New Year holiday period is reflected in the graph below. A decrease to pre-Christmas activity is noted for January 2019.
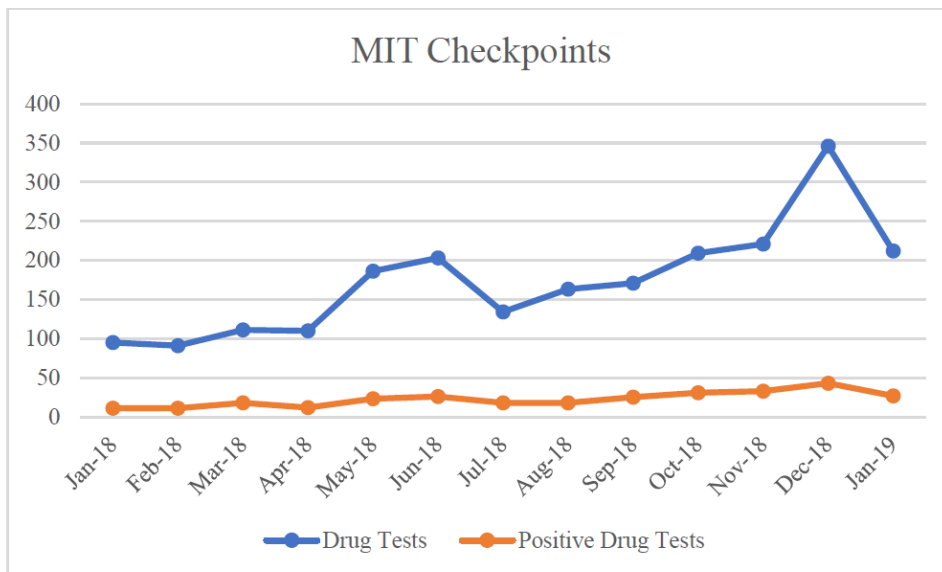
During 2018 608 information forms indicating the results of roadside testing using the DT5000 were received. Of these 49 were not positive for any of the four drugs Cannabis, Cocaine, Opiates and Benzodiazepines in oral fluid. Of the remaining, 559 were positive for at least one drug on roadside screening. Single and polydrug use was indicated based on the DT5000 results. The percentage positives were 72% for Cannabis, 41% for Cocaine, 8% opiates and 7% for Benzodiazepines. Polydrug use indicated the most prevalent combination was Cannabis and Cocaine at 17.2% (n=559, 2018). There were 15 (2.7%) cases where 3 drugs were detected and (0.7%) where all 4 were detected.

The new requirement which compelled a suspected drug driver to provide a blood specimen had a significant impact on the specimen type being provided.

Between the beginning of 2016 and the introduction of the new measures the specimen type was 46% urine and 54% blood. Since the introduction of the new measures up to the end of 2018 the ration has changed to 30% urine and 70% blood. This is an indication that the *per se* legislation has had an impact on the types of specimens being collected.

The number of specimens received for drug testing has also increased significantly. Specimens per day before the introduction of the new measure was 3.5/day however this has increased over the period to 5.1 which is a 46% increase in specimens received for drug testing.

There is good agreement between the oral fluid testing system and the laboratory findings (Drug, Sensitivity, Specificity; Cannabis, 82.5%, 77.2%; Cocaine, 77.3%, 77.8%: Opiates, 85%, 97%; Benzodiazepines, 30.9%, 98.4%, 2018 data). The low sensitivity for the benzodiazepine class can be explained by a combination of differential cross reactivities for the many analytes in this class (Draeger, 2017) and the high protein binding and acidic pKas of the benzodiazepines which reduces the available free benzodiazepine in the oral fluid (Spiehler, 2004).

It is noteworthy that confirmatory analysis of blood is carried out in duplicate and then the lower of to the duplicate results has an uncertainty measurement deduction applied (30%) before reporting. Most cases consist of Cannabis and/or Cocaine, with only 4 cases in 2018 that contained 6-am in excess of the limit.

When the data is considered raw without deduction this shows the relationship between the cut-offs used in the DT5000 and the laboratory.

In the case of Cannabis the cut-off in oral fluid on the DT5000 is 10ng/ml. Where the DT5000 indicates a positive above this cut-off in almost in 83% of cases (n=844, 2018) the lab will confirm that THC is above the *per se* level 1ng/nl. For 11-nor-9-carboxy-Δ 9 -tetrahydrocannabinol 96% of cases (n=844, 2018) will be confirmed above the *per se* limit. The fact that the metabolite is included in Irish law has meant that cannabis user is more likely to be confirmed by the lab. It is worth noting that inclusion of the metabolite does increase the detection time of cannabis use, quantitation of the metabolite also improves the interpretation in the case of a passive smoking defence (Berthet et al., 2016) and finally in almost all cases certified as positive there was a detectable level of THC (99%, n=844, 2018).

Again looking at raw data, in the case of Cocaine the cut-off in oral fluid on the DT5000 is 20ng/ml. Where the DT5000 indicates a positive above this cut-off, Cocaine was confirmed in 74% of cases (n=366, 2018) above the *per se* level 10ng/ml. For Benzoylecgonine 92% of cases (n=366, 2018) will be confirmed above the *per se* limit of 50ng/ml. Again, the inclusion of the metabolite increases the detection of Cocaine use significantly.

Overall drug patterns before and after the introduction of the new measure still show that Cannabis is the most prevalent drug (55% positive before, 57% positive after) after alcohol, however before the new measure Benzodiazepines (29% before, 21% after) were second followed by Cocaine (20% before, 23% after). This has changed and now Cocaine is more prevalent in drivers than Benzodiazepines. This may be a combination of road safety education efforts bearing fruit in the case of Benzodiazepines and in the latter case increased availability of high purity lower cost Cocaine in the EU(EMCDDA, 2019).

Conclusion

Oral fluid drug testing is being used in enforcement of road traffic law and this use has increased throughout 2018. The new *per se* law has had a big impact on the specimen type being collected as evidenced by the significant increase in blood specimens being collected compared to urine and is borne out of the fact that a prosecution can proceed without hard to prove impairment. Cannabis and Cocaine are the most prevalent drugs detected using the oral fluid testing system. Benzodiazepine prevalence is lower and the current system will detect limited number of the benzodiazepine family. There is good correlation between the roadside and the lab results. The new measures are effective at detecting drugs in drivers, however ongoing review is required in order to fully evaluate the impact of the legislative changes.

References

Berthet, A., De Cesare, M., Favrat, B., Sporkert, F., Augsburger, M., Thomas, A., & Giroud, C. (2016). A systematic review of passive exposure to cannabis. *Forensic Science International, 269*, 97-112. doi:https://doi.org/10.1016/j.forsciint.2016.11.017

Blencowe, T., Pehrsson, A., Lillsunde, P., Vimpari, K., Houwing, S., Smink, B., . . . Verstraete, A. (2011). An analytical evaluation of eight on-site oral fluid drug screening devices using laboratory confirmation results from oral fluid. *Forensic Science International, 208*(1), 173-179. doi:https://doi.org/10.1016/j.forsciint.2010.11.026

Draeger (2017). [Draeger DrugTest 5000 Specificity/Cross Reactivity Chart].

EMCDDA. (2019). *European Drug Report: Trends and Developments*. Retrieved from http://www.emcdda.europa.eu/system/files/publications/8585/20181816_TDAT18001ENN_PDF.pdf

Fitzpatrick, P., Daly, L., Leavy, C. P., & Cusack, D. A. (2006). Drinking, drugs and driving in Ireland: more evidence for action. *Injury Prevention, 12*(6), 404-408. doi:10.1136/ip.2006.013177

Road Traffic Act 2010, (2010).

Road Traffic Act 2016, (2016).

RSA. (2013). *RSA Strategy 2103-2020*. Ireland Retrieved from http://www.rsa.ie/Documents/About%20Us/RSA_STRATEGY_2013-2020%20.pdf.

Spiehler, V. (2004). Clarkes Analysis of Drugs and Posions. In M. O. AC Moffat, B Widdop (Ed.), (Vol. 1): Pharmaceutical Press.

Alcohol and Other Drug Involvement in Drivers in the United States: 1982-2016

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Abstract

Since 1982, the United States has been tracking the blood alcohol concentrations (BACs) of drivers fatally injured in traffic crashes.

Aim: Using the U.S. Fatality Analysis Reporting System (FARS) and five National Roadside Surveys of U.S. drivers, we (a) examined the trends from 1982 to 2016 for BACs in fatally injured drivers and (b) examined the trends of alcohol and other drugs in drivers on U.S. roads on week-end nights. Method In 2016, 61% of driver fatalities were tested for BAC with a known result. When BAC data are unavailable, the estimated BAC is statistically imputed using crash, driver and other characteristics to obtain more complete and accurate alcohol data.

Results In 2016, 30% of fatally injured drivers had impairing BACs ($\geq$ .05 grams per decilitre [g/dL]); 28% were at or above the illegal BAC limit in the United States (BAC $\geq$ .08g/dL); and 12% had very high BACs ($\geq$ .20g/dL). These percentages are a vast improvement over 1982 when the percentages were, respectively, 52% ($\geq$ .05g/dL), 49% ($\geq$ .08g/dL), and 22% ($\geq$ .20g/dL). However, the 2016 percentages of fatally injured drivers with the above BACs have been similar to the percentages found since 1997. While the number of drivers killed in crashes has decreased 4% between 1997 and 2016, the proportion with impairing BAC levels ($\geq$ .05 g/dL) has ranged from 36% in 2008 and 2009 to 30% in 2016. In contrast, according to National Roadside Surveys (NRS) in the U.S., 13.7%, 8.4%, 7.7%, 4.5% and 3.1% of drivers out on the roads on week-end nights had BACs$\geq$ .05g/dL in 1973, 1986, 1996, 2007 and 2013-2014, respectively. The 2007 NRS and 2013-2014 NRS indicated 16% and 22% of drivers on the roads had drugs in their system with 9% and 13% showing marijuana, respectively. Therefore, the prevalence of drugs among week-end night time drivers on US roads was much higher than drivers with BACs$\geq$.05 g/dL. Drugs other than alcohol are not consistently tested for in FARS so we did not include that data in our analyses.

Conclusions Evidence-based strategies have been credited for the substantial decline in alcohol-impaired driving between 1982 and 1997 and include: (1) the adoption of stronger impaired driving laws in the states; (2) increased enforcement of impaired driving laws; (3) raising the minimum legal drinking age to 21 in all states; (4) a reduction in per capita alcohol consumption; and (5) specific socioeconomic factors (e.g., recessions, unemployment rates, fewer young drivers). A Committee from the National Academies of Science, Engineering and Medicine (NASEM) assessed the alcohol-impaired driving status in the United States in 2018 and made a number of recommendations for getting to zero alcohol-impaired driving fatalities.

Key Words: alcohol-impaired drivers; blood alcohol concentrations (BAC); fatally injured drivers; Fatality Analysis Reporting System (FARS); United States.

Background:

In 2015, over 35,000 people were killed in traffic crashes in the United States (US) (NHTSA, June 2017). That accounted for 1.3% of all deaths from all causes in the US that year (Sivak & Schoettle, 2017). That may seem like a small percentage, but European countries and Australia had much lower percentages as a comparison (e.g. United Kingdom - 0.3%; Germany – 0.4%; Switzerland – 0.5%; France – 0.6%; Australia – 0.8%). About a third of the US traffic crash fatalities are due to speeding (NHTSA, July 2017), another third are due to alcohol-impaired driving (NHTSA, June 2017), while almost half of the drivers and passengers in cars who were killed were not wearing their seat belt (NHTSA, February 2017). Many countries around the world are committed to the vision of eliminating fatalities on their Nation's roads. The Zero Deaths vision is

a way of describing how a combination of strategies is going to affect safety: Toward Zero Deaths. The goal was first adopted by Sweden in 1997 and "Vision Zero" has evolved across the world and in many US states. The approach uses a data-driven multidisciplinary approach involving highway design, vehicle safety features and the integration of education, enforcement, engineering and emergency medical services (www.TowardZeroDeaths.org).

Since 1899, 3.5 million people have died in traffic crashes in the United States, with an estimated 1.6 million killed in crashes involving alcohol-impaired driving (National Center for Statistics and Analysis/NCSA, 2004). Of the 37,461 people killed in traffic crashes across the United States in 2016, almost one third (10,497) were killed in crashes involving an alcohol-impaired driver (BAC $\geq$ .08 g/dL)(NCSA, 2017 October). In addition, between 1994 and 2010, approximately 1.4 million drivers have been arrested annually for driving while intoxicated (DWI) or driving under the influence (DUI). This has decreased in between 2010 and 2016 to 1.0 million DWI arrests (-28%) (Federal Bureau of Investigation, 2016). DUI arrests between 1983 and 2016 have decreased 47%. See Figure 1.
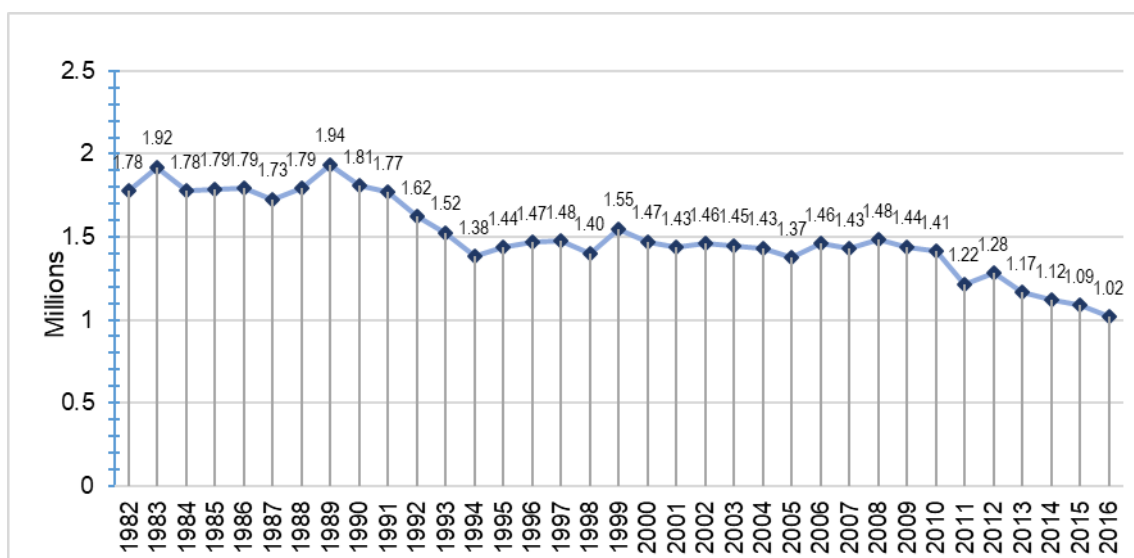

Figure 1: DUI Arrests in the U.S. 1982-2016

Aims:

The aims for this study were: (1) examine the trends from 1982 through 2016 (the latest year for which we have fatality data at the time the study was conducted) for the BACs in fatally injured drivers; and (2) examine the trends of alcohol and other drugs in drivers on U.S. roads on week-end nights from National Roadside Surveys (NRS).

Methods

The *Fatality Analysis Reporting System (FARS)* is a census of all fatal crashes (defined as a death of a participant within 30 days of the crash event) occurring on U.S. public roadways and reported to the police. FARS analysts are stationed in each of the 50 States, the District of Columbia, and Puerto Rico. They collect data in more than 100 categories from several state data sources (including state crash report records, driver records, death certificates, vehicle registration files, and other sources), which they enter into a local computer database. Alcohol involvement is documented through BAC test results collected by police or coroners. Where such data are not available, the BACs of drivers, pedestrians, and cyclists are statistically imputed using crash characteristics (such as a police report of driver impairment) to obtain more complete and accurate alcohol data [Subramanian, 2002]. This imputation is available in FARS for each year from 1982 through the current year. It provides a BAC value for every driver, pedalcyclist, and pedestrian in the FARS file (NHTSA, 2018). Drugs other than alcohol are not consistently tested for in FARS so we did not include that data in our analyses. *National Roadside Surveys (NRS)* of alcohol prevalence in drivers on U.S. roads on week-end nights have been conducted in the U.S. in 1973, 1986, 1996, 2007 and 2013-14. Beginning in 2007, in addition to breath tests for alcohol, oral fluid and blood samples were collected for drug analyses. These surveys involved randomly stopping drivers at 300 locations across the 48 contiguous

states in the U.S. Data were collected during 2-hour Friday daytime sessions (9:30 a.m. to 11:30 a.m. or 1:30 p.m. to 3:30 p.m.) at 60 locations and during four 2-hour nighttime periods (10 p.m. to midnight and 1 a.m. to 3 a.m. on Fridays and Saturdays) at 240 locations. Both self-report and biological measures were taken. Biological measures included breath-alcohol measurements on about 9,000 drivers, oral fluid samples from about 7,000 drivers, and blood samples from about 3,000 drivers (Berning, Compton and Wochinger, 2015).
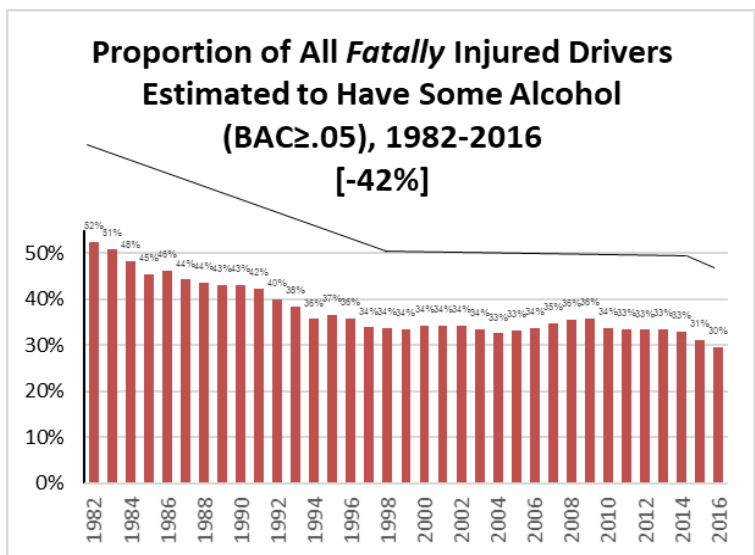
Results

For fatally injured drivers, Figure 2 shows the proportion of drivers who had any alcohol in their system at the time of the crash (BAC≥.01 g/dL) for each year from 1982-2016. Those proportions decreased from 55% in 1982 to 36% in 1997, a 36% decrease in those proportions. But since 1997, the proportions have ranged from 33-38% with slight yearly variations.
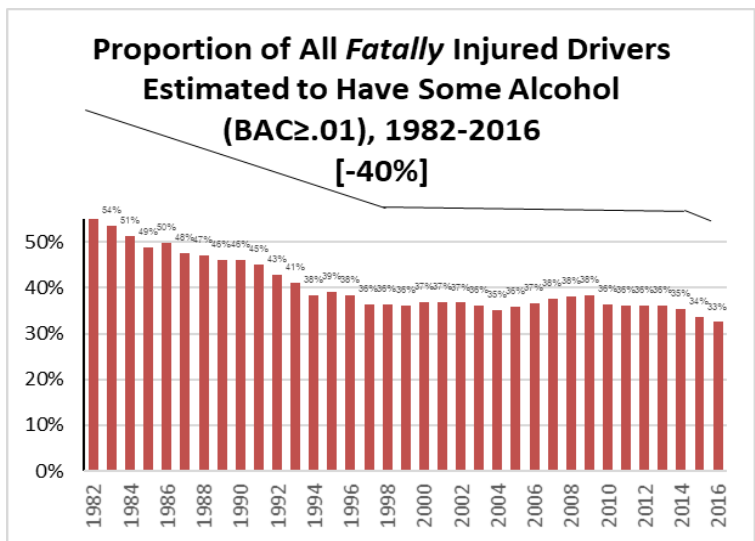
Figure 2: Proportion of Fatally Injured Drivers with BACs≥.01 g/dL, 1982-2016, United States

Figure 3 shows the proportion of fatally injured drivers who were impaired (BAC≥.05 g/dL) from 1982-2016. Once again, those proportions decreased from 52% in 1982 to 34% in 1997 (35% decrease) and then remained relatively level from 1998-2016 at 30-36%. Figure 4 shows the proportions of fatally injured drivers who were intoxicated (BAC≥.08 g/dL). Those proportions decreased from 49% in 1982 to 32% in 1997, a 35% decrease, then showed little progress from 1998-2016, ranging from 28-33%. Finally, Figure 5 shows the proportions who had very high BACs (≥.20 g/dL). In similar fashion, the proportions decreased from 22% in 1982 to 14% in 1997 (36% decrease) and then remained fairly stable ranging from 12-15% for the years 1998-2014.

Figure 3: Proportion of Fatally Injured Drivers with BACs≥.05 g/dL

Proportion of All *Fatally* Injured Drivers Estimated to Have Been Legally Intoxicated (BAC≥.08), 1982-2016 [-43%]
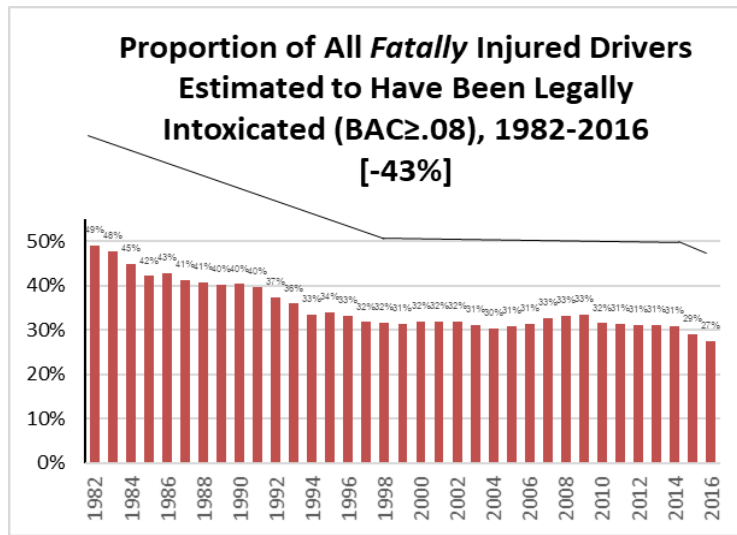
Figure 4: Proportion of Fatally Injured Drivers with BACs≥.08 g/dL

Proportion of All *Fatally* Injured Drivers with Very High BAC (BAC≥.20) 1982-2016 [-45%]
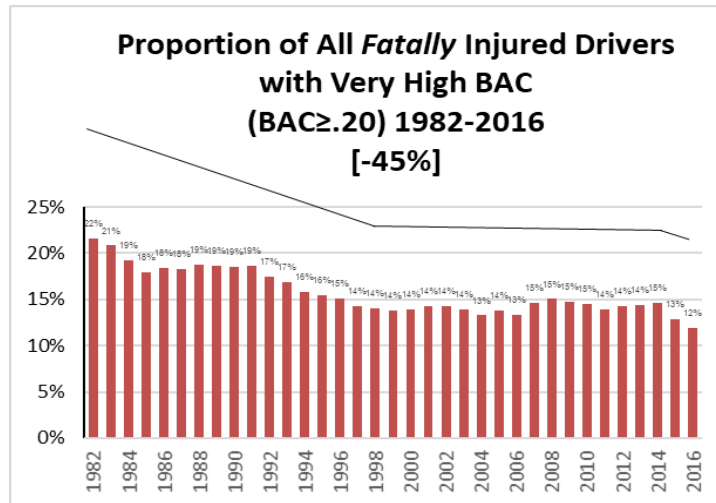
Figure 5: Proportion of Fatally Injured Drivers with BACs≥.20 g/dL

Contrary to the driver fatalities, the NRS data of drivers on U.S. roads paints quite a different picture, with a continual decrease in the proportion of drivers on the roads with positive BACs. In 1973, more than one out of three drivers (36%) on the roads on week-end nights had been drinking (BAC≥ .01 g/dL) according to the breath test data. That proportion dropped to one out of four (26%) drivers with alcohol in their system in 1986, one out of six (17%) in 1996, one out of eight (12%) in 2007, and even further to one out of twelve drivers (8%) in 2013-2014. The proportions of drivers with impairing BACs (≥ .05 g/dL) showed a similar pattern: 1973 – 13.7%; 1986 – 8.4%; 1996 – 7.7%; 2007 – 4.5% and 2013-14 – 3.1%.

Percent Drivers with BACs ≥ .05 g/dL

	1986	1996	2007	2014	1986-2014 Change
National Roadside Survey Drivers	8.4%	7.7%	4.5%	3.1%	-63%
Fatally Injured Drivers	46.3%	35.7%	34.9%	32.9%	-29%

Table 1: Percent Drivers with BACs ≥ .05: Roadside Drivers vs. Fatally Injured Drivers

The pattern for drivers with BACs≥ .08 g/dL: 1973 – 7.5%; 1986 – 5.4%; 1996 – 4.3%; 2007 – 2.2% and 2013-14 – 1.5% was similar. However, regarding drugs other than alcohol, the 2007 NRS indicated 16.3% while the 2013-14 NRS showed an increase to 20.0%. Regarding the proportion of drivers with marijuana (THC) in their systems, that also increased from 8.6% in the 2007 NRS to 12.6% in the 2013-14 NRS.

Discussion

In the United States, proven effective strategies have been substantially underutilized. The reasons for this vary, but public complacency is a major factor. For example, the following strategies could substantially reduce traffic fatalities:

1. *Sobriety Checkpoints*

Checkpoints are highly effective in deterring drinking and driving (Shults et al., 2001; Elder et al., 2002; Fell et al., 2004; Voas et al., 2005). Checkpoints are safer for both police and the public than individual traffic stops. Widespread use of checkpoints could reduce fatalities by at least 8%. Only 38 states use sobriety checkpoints. Only 12 states conduct them on a weekly basis. Using passive alcohol sensors at the checkpoints to detect drinking drivers would increase detection of drinking drivers by 50% (Ferguson et al., 1995).

2. *Lowering the BAC limit for driving to .05 g/dL*

Studies in Australia and Europe show that lowering the BAC to .05 could reduce traffic fatalities by 11% (Fell & Scherer, 2017). Administrative sanctions (license suspension, fine) could be used for drivers with BACs=.05-.07 (highly effective in Canada) (Fell et al., 2016).

3. *Alcohol Ignition Interlock Installations*

All states have alcohol ignition interlock device (IID) laws. Studies show that all offender laws are associated with a 16% reduction in drinking driver fatal crashes (Teoh et al., 2017). Yet in the best states, only 50% of eligible offenders actually install the device on their car. Loopholes in the laws must be closed.

4. *Oral Fluid Screening for Drugged Driving*

Roadside surveys on week-end nights indicate that about 16-20% of drivers have impairing drugs in their systems (Kelley-Baker et al., May 2017). Australia uses an oral fluid drug screening device that can detect drug presence in about 3 minutes (Pathtech Drugwipe 2). These need to be approved for use in the states in order to detect and reduce drugged driving.

Conclusion

While substantial progress has been made in reducing alcohol-impaired driving in the United States, progress has levelled off since 1997. There has been a slight decrease in alcohol-impaired driving between 2009 and 2016, however, much more can be done to accelerate progress. It is possible that the recent decrease in DUI arrests nationwide (Figure 1) is making impaired driving less risky.

In January 2018, the National Academies of Sciences, Engineering, and Medicine released the most comprehensive report on accelerating progress to reduce alcohol-impaired driving fatalities in the United States to date (National Academies of Sciences, Engineering and Medicine (2018); see also Teutsch and Naimi, 2018). The report (written by a prestigious committee assembled to review the impaired driving problem) provides a blueprint to solving the problem by identifying evidence-based and promising policies, programs, strategies and system changes to increase nation progress in reducing alcohol-impaired driving traffic fatalities.

Among many other recommended strategies, those pertinent to this study include:

■ Local governments should adopt and/or strengthen laws and dedicate enforcement resources to stop illegal alcohol sales (i.e., sales to already intoxicated adults and sales to underage persons).

■ Local law enforcement agencies should conduct sobriety checkpoints in conjunction with widespread publicity to promote awareness of these enforcement initiatives.

■ Municipalities should support policies and programs that increase the availability, convenience, affordability and safety of transportation alternatives for drinkers who might drive otherwise. This includes

permitting transportation network company ride sharing, enhancing public transportation options (especially during night time and weekend hours) and boosting or incentivizing transportation alternatives in rural areas.

■   Every state should implement DWI courts and these courts should include available consultation or referral for evaluation by an addiction trained clinician.

■   All states should enact all offender alcohol ignition interlock laws. To increase effectiveness, states should consider increased monitoring periods based upon the offender's BAC at the time of arrest and past recidivism.

■   States should enact per se laws for alcohol-impaired driving at 0.05 BAC and accompany enactment with media campaigns and robust and visible enforcement efforts.

References

Berning A., Compton R., Wochinger K. (2015) Results of the 2013–2014 National Roadside Survey of Alcohol and Drug Use by Drivers. National Highway Traffic Safety Administration; *DOT HS 812-118*.

Elder RW, Shults RA, Sleet DA, Nichols JL, Zaza S, Thompson RS.(2002) Effectiveness of sobriety checkpoints for reducing alcohol-involved crashes. Traffic Inj Prev. 2002;3:266-274.

Federal Bureau of Investigation. (2016) *Uniform Crime Reports*. Federal Bureau of Investigation: West Virginia. Available at: http://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2011/crime-in-the-u.s.-2011/tables/table-29.

Fell, J.C., Lacey, J.H., & Voas, R.B. (2004). Sobriety checkpoints: Evidence of effectiveness is strong, but use is limited. *Traffic Injury Prevention*, 5(3), 220-227.

Fell, James C., Beirness, Douglas J., Voas, Robert B., Smith, Gordon S., Jonah, Brian, Maxwell, Jane C., Price, Jana, Hedlund, James. (2016). Can Progress in Reducing Alcohol-Impaired Driving Fatalities be Resumed? Results of a Workshop sponsored by the Transportation Research Board, Alcohol, Other Drugs, and Transportation Committee (ANB50). Traffic Injury Prevention, 17(8), 771-781. http://dx.doi.org/10.1080/15389588.2016.1157592

Fell, JC & Scherer, M (2017). Estimation of the Potential Effectiveness of Lowering the Blood Alcohol Concentration (BAC) Limit for Driving from .08 to .05 grams per deciliter in the United States, Alcoholism: Clinical & Experimental Research, December 2017.

Ferguson SA, Wells JK, Lund AK. The role of passive alcohol sensors in detecting alcohol-impaired drivers at sobriety checkpoints.(1995) Alcohol, Drugs, and Driving. 1995;11:23-30.

Kelley-Baker, T., Berning, A., Ramirez, A., Lacey, J. H., Carr, K., Waehrer, G., Compton, R. (2017, May). 2013-2014 National Roadside Study of alcohol and drug use by drivers: Drug results (Report No. DOT HS 812 411). Washington, DC: National Highway Traffic Safety Administration.

National Academies of Sciences, Engineering and Medicine (2018). Getting to zero alcohol-impaired driving fatalities: A comprehensive approach to a persistent problem. Washington, DC: The National Academies Press. Doi: http://doi.org/10.17226/24951

National Center for Statistics and Analysis. (2004) *Fact Sheet*. Motor vehicle traffic fatalities and fatality rate: 1899-2003, National Highway Traffic Safety Administration; Washington, DC.

National Center for Statistics and Analysis. (2018) *Traffic Safety Facts*, 2016 Data: State Alcohol-impaired driving estimates. U.S. Department of Transportation, National Highway Traffic Safety Administration, Washington, DC.DOT HS 812 483.

NHTSA (February 2017). Traffic Safety Facts: 2015 Data: Occupant Protection in Passenger Vehicles. National Highway Traffic Safety Administration, Washington, DC, DOT HS 812 374.

NHTSA (June 2017). Traffic Safety Facts: 2015 Data: State Traffic Data. National Highway Traffic Safety Administration, Washington, DC, DOT HS 812 412.

NHTSA (July 2017). Traffic Safety Facts: 2015 Data: Speeding. National Highway Traffic Safety Administration, Washington, DC, DOT HS 812 409.

National Highway Traffic Safety Administration (2018). Fatality Analysis Reporting System data files, 1982-2016. Retrieved January 6, 2018 from http://nhtsa.gov/FARS

Shults RA, Elder RW, Sleet DA, et al. (2001) Reviews of evidence regarding interventions to reduce alcohol-impaired driving. Am J Prev Med. 2001;21:66-88.

Sivak, M & Schoettle, B (September 2017). Mortality from Road Crashes in 183 Countries: A Comparison with Leading Causes of Death. University of Michigan. SWT-2017-14.

Subramanian, Rajesh. (2002). Transitioning to multiple imputation - A new method to estimate missing blood alcohol concentration (BAC) values in FARS. (DOT HS 809 403). Washington, DC: Mathematical Analysis Division, National Center for Statistics and Analysis, National Highway Traffic Safety Administration, U.S. Department of Transportation.

Teoh, ER, Fell, JC, Scherer, M, Wolfe, DE, (March 2018). State alcohol ignition interlock laws and fatal crashes. Published by the Insurance Institute for Highway Safety, Arlington, VA.

Teutsch, SM, and Naimi, TS (2018). Eliminating Alcohol-Impaired Driving Fatalities: What Can Be Done? Annals of Internal Medicine, Ideas and Opinions. Doi:10.7326/M18-0069

Voas RB, Lacey JH, Fell JC. The PASpoint system - passive sensors at mini-checkpoints: Bringing Australia's random breath-test system to the United States.(2005) Transportation Research Circular. 2005;E-C072:45-53.

Alcohol Related Accidents in Europe from the Perspective of Legislation and Road Users' Attitudes

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Abstract

Background: In many countries, alcohol is one of the main factors contributing to road accidents. Alcohol has adverse effects on driving performance, such as longer reaction time, reduced alertness or visual impairment. In some countries, the share of alcohol-related fatal road accidents exceeds a quarter or even a third of the total.

Objectives: The objective of this presentation is to describe the relationship between the proportion of alcohol related accidents in selected European countries and background aspects such as legal BAC limits, enforcement approaches, drinking habits and patterns, and attitudes of drivers and other road users to drink driving issues.

Methods: The data to be analysed will derive primarily from the second E-Survey of Road users' Attitudes (ESRA2) and the European Commission CARE database (alcohol-related road accidents). European countries meeting the following conditions are selected: carrying out of alcohol tests in all road crashes the police attend or at least in road crashes with (serious) injuries or fatalities, and participation in ESRA2.

Results: Results based on the first edition of ESRA (ESRA1; N=38,738) show a link between the proportion of alcohol-related road deaths and drivers' attitudes and reported behaviour, such as driving after drinking alcohol, acceptability of drunk driving, support to zero tolerance for alcohol, or the perception of alcohol as a risk factor. The setting of legal BAC limits also seems to play an important role.

Discussion, Conclusions and Implications: One limitation of the study is under-reporting of the presence of alcohol in accidents. Moreover, the extent of under-reporting differs by country. Suggestions for road safety policy will be given taking this limitation into account.

Keywords: Alcohol; road accidents; attitudes

Disclosure: No relevant affiliations or conflicts of interest exist.

Introduction

Background
Alcohol has adverse effects on driving performance, such as longer reaction time, reduced alertness or visual impairment. In many countries, alcohol is one of the main factors contributing to road accidents. In some countries, the share of alcohol-related fatal road accidents exceeds a quarter or even a third of the total.

The extent of drink-driving, the perception of danger of alcohol in traffic or the support for policy measures are associated with the general drinking culture in a given country (frequency and amount of drinking, alcohol beverages preferred, occasions and purpose of drinking – i.e. intoxication or social and gastronomic complement). They are also related to economic regulations (taxes, prices, availability and marketing of alcoholic beverages) and, last but not least, to political and legislative regulations such as the blood alcohol concentration (BAC) limits for driving.

Objectives
The objective of the paper is to describe the relationship between various aspects of drink-driving such as legal BAC limits, enforcement approaches, drinking habits, and attitudes of drivers to drink-driving issues. These aspects are examined in relation to the proportion of alcohol-related accidents in a limited number of countries, In addition, the association between a "zero tolerance" approach and attitudes and behaviours are analysed.

Methods

In this working paper, we describe the background factors supposed to be associated with alcohol-related road deaths. The data regarding attitudes, behaviours and enforcement experiences of drivers derive from the E-Survey of Road users' Attitudes (ESRA), the data regarding legal BAC limits as well as drinking habits and patterns derive mostly from WHO publications.

In the presentation at the ICADTS conference, we will also show the results regarding the association between the factors mentioned above and alcohol-related road accidents for the countries with sufficient data available. The source for the accident data is the European Commission CARE database.

Drinking data sources
The data used for the purpose of this paper are extracted from the "Global status report on alcohol and health 2018" and from the "European Report on Alcohol Policy 2016" which is based mostly on WHO data plus some other sources. (WHO, 2018; European Alcohol Policy Alliance, 2016).We extracted yearly per capita consumption (including unreported) of alcohol, financial and marketing regulation, sale restrictions and legal BAC limits for driving.

The ESRA survey

The ESRA project (E-Survey of Road users' Attitudes) is a joint initiative of road safety institutes, research organisations, public services and private sponsors. The aim is to collect comparable data on road users' opinions, attitudes and behaviours with respect to road traffic risks.

The first edition of the ESRA survey (ESRA1) was carried out in 2015-2017. Data was gathered from almost 40,000 road users in 38 countries across five continents. (Meesmann, Torfs, Nguyen, & Van den Berghe, 2018). In the second edition (ESRA2), which was conducted in 2018, data from more than 35,000 road users were collected across 32 countries. In each country, an online survey was conducted using access panels of the national adult populations (≥18 years old). More detailed information about the ESRA2 results on drink-driving can be found in the ESRA thematic report 'Driving under the influence of alcohol and drugs' will be released shortly before ICADTS conference (Achermann Stürmer, Meesmann & Berbatovci, 2019).

Data analysis
The European countries participating in ESRA2 that carry out alcohol tests in at least those crashes with (serious) injuries or fatalities were selected (OECD/ITF, 2017).

Descriptive analyses based on ESRA2 data were conducted for car drivers regarding self-reported alcohol-related behaviours, the perception of alcohol as a cause of a road traffic accidents, acceptance of legal measures and the experience with enforcement. SPSS 24.0 was used for all analyses (IMB corp, 2016).

Results

The following 13 countries met inclusion criteria and were included for analyses: Austria (AT), Belgium (BE), Czech Republic (CZ), Finland (FI), France (FR), Greece (GR), Hungary (HU), Ireland (IE), Poland (PL), Portugal (PT), Serbia (RS), Sweden (SE), and Switzerland (CH).

Drinking characteristics
Approximately half of the selected countries apply excise duties on all types of alcoholic beverages (CZ, FI, FR, IE, PL, SE), in other countries (AT, BE, GR, HU, PT, CH), wine is not included. All employ some sale restrictions, at least age limitations. In most countries, alcohol is not sold to intoxicated persons. In some countries (BE, FI, FR, IE, PT, SE) alcoholic beverages cannot be sold at petrol stations. Another important indicator that differs substantially between countries is yearly alcohol per capita (15+) consumption (see table

Table 1: Overall alcohol consumption in 2016 including unrecorded alcohol

Up to 11 litres	Finland, Greece, Sweden
11,1 – 13 litres	Austria, Belgium, France, Hungary, Ireland, Poland, Portugal, Serbia, Switzerland
More than 13 litres	Czech Republic

In the selected countries, four different levels of legal BAC limits are in force (see table 2); in addition, most countries apply specific limits for novice drivers and/or professional drivers. Although generally we can expect more restrictive measures in societies with negative value given to alcohol, typically northern and Baltic countries (Allamani, 2008), in traffic it seems to be true only partially, as absolute ban of alcohol is applied in two countries with rather Mediterranean patterns of drinking (Popova et al. 2007).

Table 2: General legal BAC limits

Zero tolerance	Czech Republic, Hungary
0,2 g/l	Poland, Sweden
0,3 g/l	Serbia
0,5 g/l	Austria, Belgium, Finland, France, Greece, Ireland, Portugal, Switzerland

Opinions, attitudes and behaviours of car drivers (ESRA2-analyses)

As mentioned above, the results regarding self-declared behaviours of car drivers, their attitudes towards alcohol-related issues, their acceptance of legal measures and experience with enforcement are obtained thanks to ESRA2. The selected 13 countries include 15'000 respondents.

Overall, the proportion of car drivers reporting that they have driven after drinking alcohol at least once over the last 30 days was 21% (table 3). The analysis shows that the proportion of self-reported drink-driving varies considerably from country to country. The highest proportions were found in Switzerland and Portugal (34%), the lowest in Hungary (5%), the Czech Republic and Poland (both 7%). 15% of car drivers reported that they had been driving at least once over the last 30 days when they may have exceeded the legal BAC limit. The highest proportions were found in Belgium (24%), Switzerland and France (both 22%), the lowest in Finland and Hungary (both 4%).

Overall, 7% of the car drivers believe that most of their friends would drive after having drunk alcohol. In both Greece and Serbia, a considerably higher proportion of car drivers agreed with this statement (both 15%) A large proportion of car drivers think that alcohol is a relevant cause of a road crash involving a car. 82% attributed the scores 4, 5 or 6 on a 6-point scale from 1 "never" to 6 "(almost) always" to the question "How often do you think alcohol is the cause of a road crash involving a car?" The countries with the highest percentages are Finland (91%) and Czech Republic (89%) and the ones with the lowest, Ireland (70%) and Greece (76%).

The three legal measures related to drinking and driving included in the survey have high support among the car drivers: between 60% and 79% were (rather) in favour of these three measures (table 3). The degree of support for these legal measures differs widely between countries. The measure "Install an alcohol "interlock" for drivers who have been caught drunk driving on more than one occasion" is much less well accepted in Switzerland (65%) and Austria (68%) than in Finland (89%), Sweden or Serbia (both 88%). The measure "Zero tolerance for alcohol (0,0 ‰) for novice drivers" is least supported in Finland (68%) and France (74%). This measure is particularly well accepted by car drivers in Serbia (91%) and Hungary (88%).

Table 3: Answers of car drivers to various questions about drink-driving in ESRA2, by country, 2018

	AT	BE	CH	EL	FI	FR	IE	PL	PT	SE	CZ	HU	RS	Total
Self-declared behaviour as a car driver, by country (% at least once over the last 30 days)														
Having driven after drinking alcohol	31%	33%	34%	28%	9%	29%	12%	7%	34%	8%	7%	5%	19%	21%
Having driven when you may have been over the legal BAC limits	15%	24%	22%	19%	4%	22%	11%	6%	14%	7%	12%	4%	11%	15%
Level of agreement for different statements, by country (% of agreement: scores 4 and 5 on a 5-point scale from 1 (disagree) to 5 (agree))														
Most of my friends would drive after having drunk alcohol	6%	13%	8%	15%	1%	6%	7%	6%	13%	2%	4%	3%	15%	7%
Alcohol as a cause of car accidents (% of frequencies : scores 4, 5 and 6 on a 6-point scale from 1 (never) to 6 ((almost) always))														
How often do you think alcohol is the cause of a road crash involving a car?	80%	82%	80%	76%	91%	80%	70%	83%	85%	82%	89%	85%	84%	82%
Acceptance of legal measures, by country (% of acceptance: scores 4 and 5 on a 5-point scale from 1 (oppose) to 5 (support))														
Install an alcohol "interlock" for drivers who have been caught drunk driving on more than one occasion	68%	76%	65%	85%	89%	74%	83%	86%	83%	88%	78%	81%	88%	79%
Zero tolerance for alcohol (0,0 ‰) for novice drivers	82%	78%	75%	84%	68%	74%	83%	79%	79%	82%	85%	88%	91%	79%
Zero tolerance for alcohol (0,0 ‰) for all drivers	49%	56%	48%	66%	58%	51%	74%	64%	65%	71%	69%	83%	73%	60%

The proportion of car drivers in favour of the measure "Zero tolerance for alcohol (0,0 ‰) for all drivers" is considerably lower. In Switzerland and Austria, the majority of car drivers are against it (48% and 49% in favour). In Hungary and Ireland the support for this measure is the highest (74% and 83%).

Overall, more than a quarter of the car drivers in the 13 European countries considered it (rather) likely that they would be subject to an alcohol test. In Poland, Serbia, the Czech Republic and Hungary, this proportion is markedly higher than in the other countries (figure 1). There is a strong association between the perceived likelihood of being checked for drink- driving and the level of enforcement. Finland is an exception, as the proportion of car drivers expecting an alcohol control is low (15%), while 42% have been checked for alcohol in the last 12 months.

Alcohol related accidents

Analyses of alcohol-related road accidents are based on the CARE database (common EU database on road accidents). Only the number of active participants involved in an accident (drivers and pedestrians) who were killed and tested for alcohol was taken into account (in the years 2015 - 2017). France, Portugal, Poland, Hungary and the Czech Republic are included in this analysis. Unfortunately, the quality of data for other countries is insufficient: for a large proportion of active road users killed, there is no information on BAC test results.

In the first step (A) fatality numbers for BAC level 0, 0.01-0.5 and more than 0.5 g/l were compared, in the second step only the results (negative/positive) were compared.

The analyses show that most of the victims have a BAC = 0 (50 - 90 %), 1-5% a BAC below 0.5 and 8-40%, a BAC above 0.5 In France, 60% have a BAC=0, 4% a BAC below 0.5 and 27% a BAC above 0.5. (for 9 %, the alcohol level was not unknown).
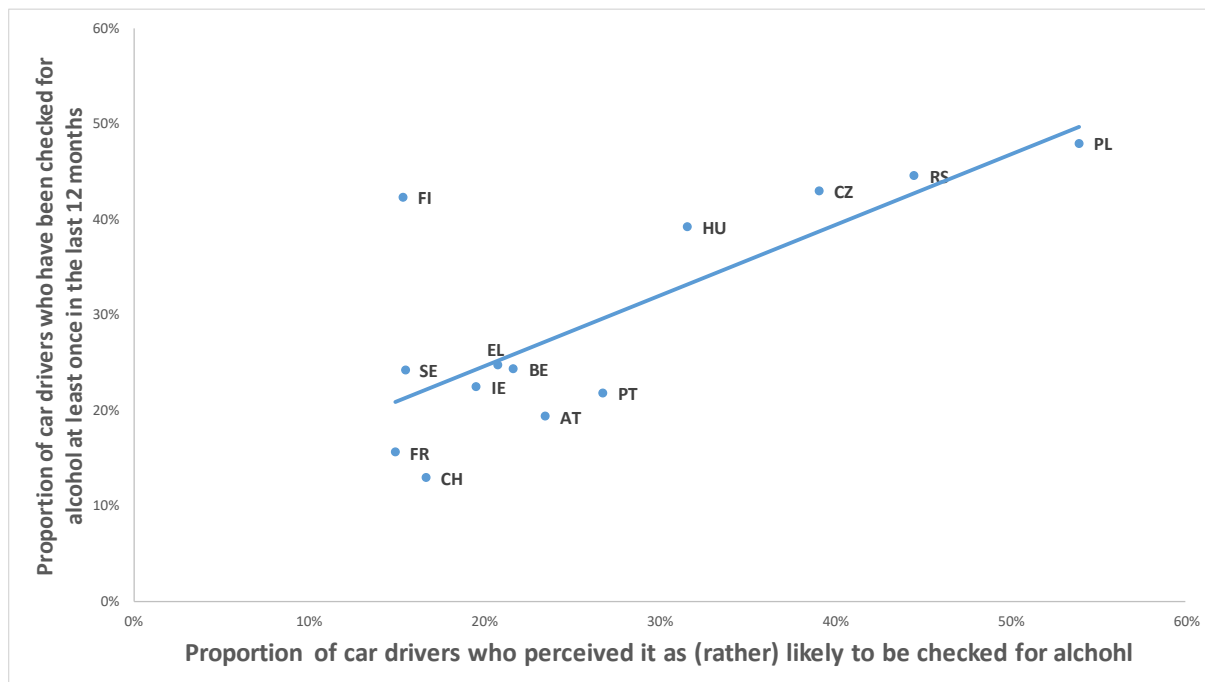
Figure 1 Relationship between the perceived likelihood to be checked for alcohol and the alcohol checks in the 13 European countries

Conclusions

The study describes the complex relationship between drinking habits, legal measures and users' attitudes to drink-driving issues. Though the drinking habits of given country seems to play an important role, two factors seems to rectify both attitudes and behaviours of drivers relatively successfully – BAC limits and intensity of enforcement.

The lowest proportion of self-reported driving after consumption of alcohol was recorded in Hungary, the Czech Republic and Poland, while Hungary appears among countries with the lowest percentage of driving with BAC above limit. Respondents from Finland and Sweden, but also from Hungary, the Czech Republic and Poland seldom believe that their friends would drive after having drunk alcohol. While Finland and Sweden belong to countries with the lowest consumption of alcohol, the results of Poland, Hungary and namely the Czech Republic (the highest per capita consumption among selected countries) can be rather explained by strict legal BAC limit (zero tolerance in HU and CZ) and relatively high level of enforcement.

This assumption is also supported by a percentage above average of drivers perceiving alcohol as risky factor in road traffic in Finland and again in the Czech Republic, where the approach to alcohol is otherwise tolerant.

The results of analysis of alcohol-related accidents, though limited regarding the number of countries with data of sufficient quality, seem to speak for zero tolerance of alcohol in road traffic. Although the limit 0.0 g/l is problematic and even the abstainer might have BAC up to 0.2 g/l, the strenght of such limit seems to lie in clarity of complete ban.

References

Achermann Stürmer, Y., Meesmann, U. & Berbatovci, H. (2019) Driving under the influence of alcohol and drugs. ESRA2 Thematic report Nr. 2. ESRA project (E-Survey of Road users' Attitudes). Bern, Switzerland: Swiss Council for Accident Prevention.

Meesmann, U., Torfs, K., Nguyen, H., & Van den Berghe, W. (2018). Do we care about road safety? Key findings from the ESRA1 project in 38 countries. ESRA project (European Survey of Road users' safety Attitudes). Brussels, Belgium: Vias institute.

OECD/ITF (2017). Alcohol-related road casualties in official crash statistics.

Global status report on alcohol and health 2018. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO.

European Report on Alcohol Policy. A Review 2016. European Alcohol Policy Alliance, 2016

Allamani, A. (2008), Alcoholic Beverages, Gender and European Cultures. Substance Use & Misuse, 43: 1088–1097

Popova, S., Rehm, J., Patra, J., Zatonski, W. (2007), Comparing alcohol consumption in central and eastern Europe to other European countries. ALCOHOL AND ALCOHOLISM, 42/5, p. 465-473, DOI: 10.1093/alcalc/agl124

Alternatives to Drunk Driving in the United States: Attitudes and Behaviors of Drivers

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Abstract

Background: Declines in alcohol-impaired driving in the United States seemed to have plateaued since 2010.

Objectives: To help characterize the current state of alcohol-impaired driving and alternatives.

Methods: Data from the Road Safety Monitor (RSMs 2015-2018), an annual public opinion survey maintained by the Traffic Injury Research Foundation USA, Inc. (TIRF USA), were used (N=16,586 U.S. drivers). Data were analyzed using two sample tests of proportions and logistic regression analysis.

Results: There has been little change from 2015 to 2018 when it comes to alcohol-impaired driving behavior and attitudes, even though a clear majority of drivers are concerned about alcohol-impaired driving and view it as a serious problem. In 2018, approximately 12% of drivers reported driving when they thought they were over the legal limit and 3.4% indicated they drove impaired often or very often. While the overall level of familiarity with, and access to, alternative options to alcohol-impaired driving remains high, actual use of the substitutes have not significantly changed, and some alternatives remain under-utilized. Results showed varying characteristics with respect to gender and age among self-reported drunk driving and users of alternatives.

Discussion, Conclusions and Implications: Given the high levels of familiarity with campaigns and alternatives to alcohol-impaired driving but the limited use of these alternatives, there is great potential to increase the reliance on, and the usage of, these alternative solutions.

Keywords: alcohol-impaired driving, alcohol-impaired driving campaigns, alcohol-impaired driving alternatives.

Introduction

Progress was made in reducing the alcohol-impaired driving problem in the past decade in the United states. To illustrate, the number of fatalities per 100 million vehicle miles traveled (VMT) has been reduced by 26.7% from 0.45 in 2005 to 0.33 in 2011 (NCSA 2016). The number of alcohol-impaired driving fatalities decreased by 27.4% from 13,582 in 2005 to 9,865 in 2011. However, after years of progress, declines in alcohol-impaired driving in the United States seemed to have plateaued in recent years. Fatality rates in alcohol-impaired driving crashes per 100 million VMT have been oscillating between 0.33 and 0.35 since 2011 to 2017 (NHTSA 2018) and the number of fatalities in these crashes is not decreasing (10,874 in 2017). These recent data demonstrate that continued action is needed.

One solution to help address the problem is to encourage more people to use alternatives to alcohol-impaired driving such as safe ride home programs, public transportation, and designated drivers. Safe ride home programs provide alternative transportation options such as taking taxi services or public transportation to get home (Sarkar et al. 2005); they include both for-profit (e.g., Uber and Lyft) and non-profit safe ride home programs (for a review of the literature on safe ride home programs, see: Barrett, Vanlaar and Robertson 2017). Safe ride home programs have evolved from the concept of a "designated driver" which is defined as one person within a group who refrains from the consumption of alcohol so that they can transport passengers home safely.

Methods

Data Sources

Data on alcohol-impaired driving behaviours and attitudes have been collected as part of the Traffic Injury Research Foundation USA, Inc. (TIRF USA) series of Road Safety Monitors (USA RSM) since 2015. The survey is administered annually to a sample of U.S. drivers aged 21 years or older. A total of 1,500 participants completed the poll in 2018; 5,027 in 2017; 5,050 in 2016 and 5,009 in 2015.

Data Analysis

All analyses were conducted using Stata 14.2 (StataCorp., 2015). The data from the RSM were analyzed, considering the stratified and weighted sampling design to avoid bias. Two-sample tests of proportion, linear regressions and logistic regression analyses were conducted to evaluate statistical significance of results and possible trends.

Results

3.1 Alcohol-impaired driving behaviors as reported by U.S. drivers

Self-reported alcohol-impaired driving behavior by U.S. drivers is shown in Figure 1. Respondents were asked two questions. First, they were asked how many times in the past 12 months they had driven when they thought they were probably over the legal limit. Results on the left-hand side show the percent of drivers who reported doing this one, or more times. Second, respondents were asked how often they drive impaired on a scale from 1 (never) to 6 (very often). The results on the right-hand side show the percent of those who chose 5 or 6 on this scale.

The percent of respondents that reported driving when they thought they were over the legal limit increased to 11.6% in 2018 up from 9.2% in 2017. This percent was highest in 2016 with 11.7% and lowest in 2015 with 8.0%. The percent of respondents that indicated they drive impaired often or very often also increased in 2018 to 3.4% up from 2.7% in 2017 (but this increase was not statistically significant, $p > 0.05$). Although this 3.4% in 2018 represents a significant decrease with respect to the 5.5% in 2016, it is not significantly different from the 4.0% in 2015.

Figure 1: Percent of U.S. drivers self-reporting alcohol-impaired driving in 2015-2018
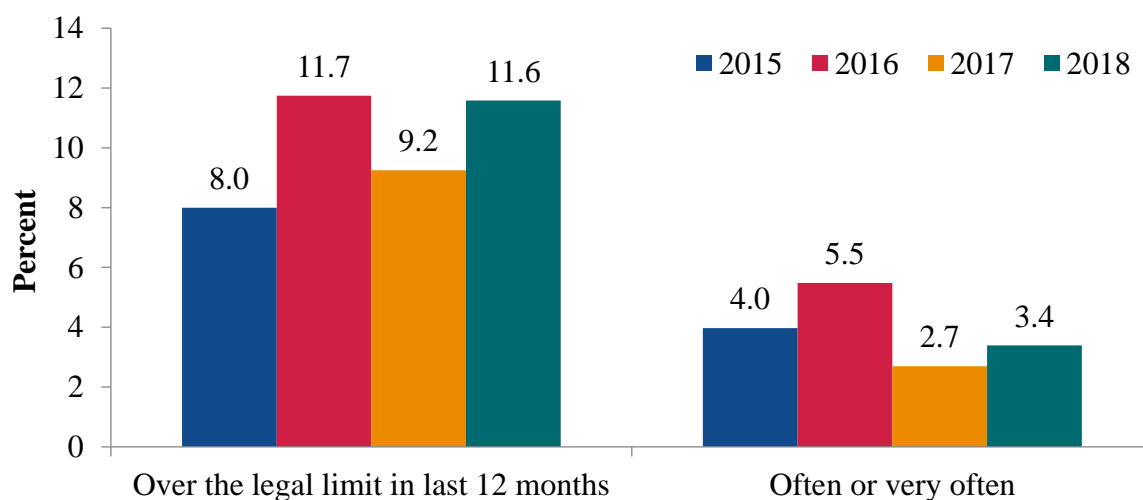
Data were analyzed to determine if there were any relationships between drivers' behaviours and their age, sex, the distance they drive, the number of tickets issued, whether they had previously been injured in a collision, and their marital status (see Table 1).

Table 1: Percentage and odds ratios (OR) for drivers reporting alcohol-impaired driving in the past 12 months: 2015-2018 by sex and age. *p-value<0.05

	Sex		Age					
	Female	Male	21-29	30-39	40-49	50-59	60-69	70+
Over the legal limit	6.3* (1.0)	13.7* (1.9*)	18.0* (1.0)	16.6* (0.8)	7.9* (0.5*)	6.5* (0.4*)	4.5* (0.3*)	3.4* (0.2*)
Often or very often	2.0* (1.0)	6.1* (1.7*)	7.7* (1.0)	8.4* (1.2)	2.9* (0.7*)	1.5* (0.4*)	1.3* (0.4*)	1.2* (0.3*)

Overall, 13.7% of male drivers versus 6.3% of female drivers reported driving when probably over the legal limit at least once in the previous 12 months. Regarding driving impaired often or very often, 6.1% of male drivers versus 2.0% of female drivers reported this behaviour.

Drivers aged 21 to 29 years, were more likely to report driving when probably over the legal limit at least once in the previous 12 months in comparison to older age groups. Furthermore, the prevalence of this behaviour decreased with age. Similarly, drivers aged 21 to 39 years were more likely than older drivers to report driving impaired often or very often.

Logistic regression models controlling for sex and age confirmed the above results.

3.2 Alternatives to Alcohol-Impaired Driving

Drivers in the U.S. were polled about alternative solutions to alcohol-impaired driving. Figure 2 provides an overview of the different questions about designated drivers and responses.

Respondents were informed that a designated driver is the person who agrees to do the driving and won't be drinking alcoholic beverages when going out with others who will be drinking alcoholic beverages. Each year a majority of respondents reported that they have ever used or have been a designated driver; 74.7% in 2015, 77.4% in 2016, 78.0% in 2017 and 75.7% in 2018. The increase from 2015 to 2016 was significant (3.6% change, p=0.02) but then this percentage remained nearly unchanged and the changes were not significant.

Figure 2: Percent of U.S. drivers who self-report using alternatives to alcohol-impaired driving in 2015-2018
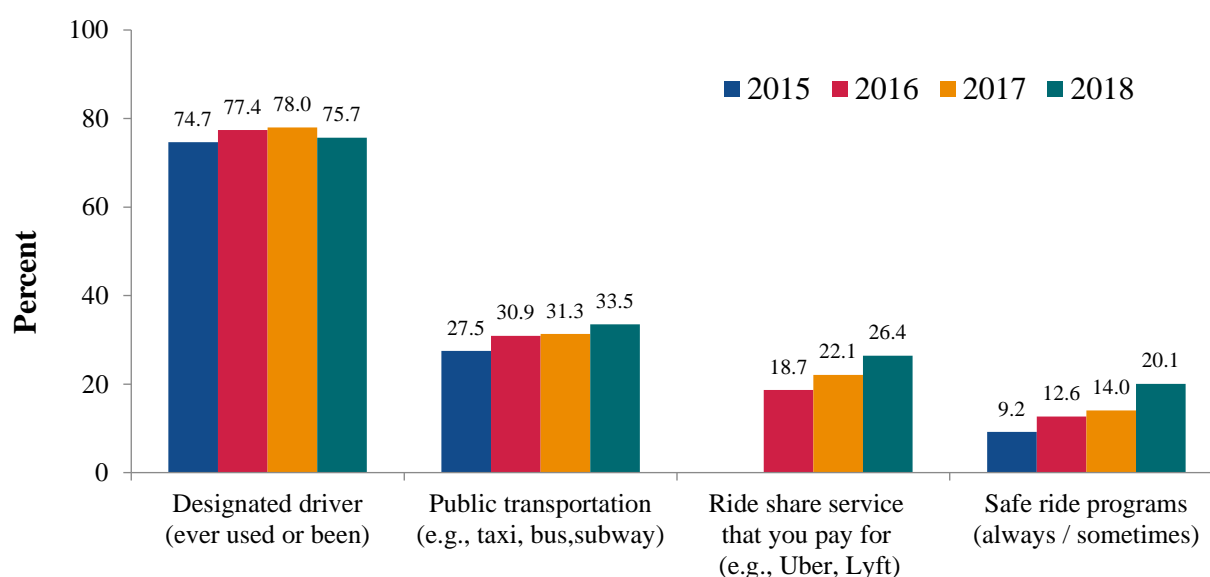
Another alternative to alcohol-impaired driving is the use of a taxi or any type of public transportation, such as a subway or bus that provide a safe ride home. A minority of respondents reported ever having obtained a ride home after drinking alcohol beverages by any of these public transportation options. The increase from 27.5% in 2015 to 30.9% in 2016 was significant (12.4% change, p=0.01) but the subsequent changes were

not: 31.3% in 2017 and 33.5% in 2018. Overall there is a significantly increasing trend for this percent from 2015 to 2018 (coef.=1.9, p=0.04).

In 2016, respondents were asked for the first time if they had ever used a ride share service (i.e., private transportation) that you pay for, such as Uber or Lyft, after drinking alcohol beverages. The percent of drivers using this alternative has significantly increased from 18.7% in 2016, to 22.1% in 2017 and 26.4% in 2018 (trend: coef.=3.9, p=0.04).

Safe ride home programs were defined as "offering to drive impaired drivers home or drive both the impaired driver and the driver's vehicle home, such as businesses, bus or taxi agencies, or volunteer groups". The percent of respondents who answered they always or sometimes used these programs when available increased from 9.2% in 2015 to 12.6% in 2016, 14.0% in 2017 and 20.1% in 2018 (trend: coef.=3.4, p=0.03).

Analyses of RSM data from 2015 to 2018 revealed significant sex and age differences in the use of different alternatives to DWI (see Table 2).

Table 2: Percentage and odds ratios (OR) for drivers reporting use of alternatives to DWI, 2015-2018 by sex and age. *p-value<0.05

	Sex		Age					
	Female	Male	21-29	30-39	40-49	50-59	60-69	70+
Designated driver (ever used or been)	77.3 (1.0)	75.8 (0.9*)	85.2* (1.0)	86.7* (0.9)	82.0* (0.6*)	77.2* (0.5*)	66.9* (0.3*)	52.9* (0.2*)
Public transportation (e.g., taxi, bus, subway)	25.3* (1.0)	35.7* (1.5*)	49.2* (1.0)	48.7* (1.04)	33.5* (0.6*)	22.8* (0.4*)	12.1* (0.2*)	7.2* (0.1*)
Ride share service that you pay for (e.g., Uber, Lyft)	16.9* (1.0)	25.7* (1.3*)	45.9* (1.0)	37.9* (0.7*)	17.7* (0.3*)	11.1* (0.2*)	5.3* (0.1*)	3.0* (0.04*)
Safe ride programs (always / sometimes)	11.5* (1.0)	27.5* (2.1*)	38.1* (1.0)	43.9* (0.9)	11.9* (0.3*)	9.0* (0.2*)	2.6* (0.1*)	2.5* (0.1*)

Overall, older and female drivers were less likely to report using any of the different alternatives to impaired driving. The only exception was that female drivers were more likely than males to report using or being a designated driver.

Conclusions

The analysis revealed increases in both measures of self-reported alcohol-impaired driving in 2018. The increase in one indicator related to frequency of this dangerous behavior was not statistically significant, but the increase in the other indicator related to driving when probably over the legal alcohol limit, was significant. The most common reason that drivers reported for this behavior was that they believed they were okay to drive (approximately 50% of drivers reported this belief; see Wicklund et al. 2018 for more detail). This suggests they may not recognize the impairing effects of alcohol after they have been drinking or understand how their driving abilities may be affected. Encouraging people to use alternative solutions can help alleviate this behavior.

The use of a designated driver seems to be the most commonly used alternative to alcohol-impaired driving, with approximately 76.6% of drivers reporting ever using or being one. However, this percent remained nearly unchanged in the four years of data. The results related to the use of public transportation, revealed a slight, ongoing increase from 27.5% in 2015 to 33.5% in 2018. Still, a significant majority of respondents indicated they do not use public transportation as an alternative to operation of a vehicle after consuming alcoholic beverages. There were also increases in the use of safe ride programs and ride share services, but these remain the less common of the alternatives with approximately only one in five of the respondents using these options.

Overall, there have been increases in the use of these alternatives from 2015 to 2018. Furthermore, when combining all alternatives, safe ride home programs or rideshare, using public transportation, or being/using a designated driver, an overwhelming majority of respondents reported using them in occasions when drinking occurred; 77.0% in 2015, 80.1% in 2016, 80.1% in 2017 and 81.2% in 2018. In terms of licensed drivers, this represents 183 million drivers using alternatives to alcohol-impaired driving in 2018, compared to 168 million in 2015 (based on an estimated 225 million drivers holding a valid license in the U.S in 2017 and 218 million in 2015[*]).

The survey also gleaned respondent profiles of those who used alternative solutions and compared them to those who did not use them. These profiles help provide insight into possible strategies to encourage increased utilization of alternatives. For example, younger (21-39 years-old) respondents were much more likely to utilize safe ride home programs and public transportation than older drivers (40-70+ years-old). Additionally, males were more likely to use these alternatives than females. Yet, females were more likely to use a designated driver than males.

In conclusion, this study indicates that there is significant opportunity for growth in the utilization of alternatives to alcohol-impaired driving, particularly because many U.S. drivers are aware of alternatives, and have used them at least once in their life. Where most gains can be made is probably in terms of encouraging U.S. drivers to use these alternatives more often, in addition to also convincing non-users to rely on them.

References

Barrett, H., Vanlaar, W.G.M., Robertson, R.D. (2017). Safe rides as an alternative to alcohol-impaired driving and their effects: A literature review. Ottawa, ON: Traffic Injury Research Foundation.

National Center for Statistics and Analysis (NCSA) (2016). 2015 motor vehicle crashes: Overview. (Traffic Safety Facts Research Note. Report No. DOT HS 812 318). Washington, DC: National Highway Traffic Safety Administration

National Highway Traffic Safety Administration (NHTSA) (2018). Traffic Safety Facts. Research Note. 2017 Fatal Motor Vehicle Crashes: Overview. DOT HS 812 603. Washington, D.C.: U.S. Department of Transportation.

Sarkar, S., Andreas, M., & De Faria, F. (2005). Who uses safe ride programs: an examination of the dynamics of individuals who use a safe ride program instead of driving home while drunk. The American Journal of Drug and Alcohol Abuse, 31(2): 305-325.

StataCorp. (2015). Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.

Wicklund, C., Mainegra Hing, M., Robertson, R.D., & Vanlaar, W.G.M. (2018). Alcohol-Impaired Driving in the United States: Results from the 2018 TIRF USA Road Safety Monitor. Washington, DC: Traffic Injury Research Foundation USA (TIRF USA), Inc.

[*]U.S. Department of Transportation, Federal Highway Administration, Highway Statistics, available at https://www.fhwa.dot.gov/policyinformation/statistics/2016/dl201.cfm, and https://www.fhwa.dot.gov/policyinformation/statistics/2017/pdf/dl20.pdf, accessed February 2019.

An Assessment of the Δ9-Tetrahydrocannabinol Concentrations in Exhaled Breath and Plasma

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Abstract

Cannabis research is important for establishing legislation, policies, and determining effective benchmarks for law enforcement in order to preserve public health and safety. The legalization of cannabis brings many challenges to Canadian healthcare and judicial landscapes. Due to the variability in the effects of cannabis on different populations and demographics, our research aims to explore the impact of Tetrahydrocannabinol (THC) on frequent users such as medical cannabis patients, and determine how this population would be impacted by the Canadian drug impaired driving law (formally Bill 46). Our objective is to explore the immediate and short-term impacts of THC concentration in blood plasma, breath levels, and neurocognition over a 5-hour period. We captured the subjective-effects of Cannabis using a visual analog scales (VAS), a series of 100-mm-long lines labeled with either a mood or a physical symptom. The blood and breath samples were captured over a 5-hour period and measured using liquid chromatography-tandem mass spectrometry techniques. For neurocognitive testing, we used a battery of teststhat comprised of executive functioning, visuomotor processing, visual scanning, visualsequencing, cognitive flexibility, and other cognitive tests. Afterwards, we developed models using artificial neural networks for data analysis to determine the length of time a participant's blood / breath levels returned to baseline and became lower than the legal per se limits. Our findings indicate that breath THC concentrations rise much more rapidly than blood levels. The blood THC concentrations were higher for males compared to females, however the breath THC levels did not differ by gender. The peak blood and breath THC levels showed a decreasing trend as the age of the subjects increased. We are in the process of utilizing our research data and findings to develop an artificial intelligence-based framework for detecting cannabis impairment.

Keywords: Medical Cannabis, Pragmatic Clinical Trial, THC, Blood, Breathalyzer

Introduction

The use of medical cannabis has been widespread following decriminalization around many parts of the world (Lucas & Walsh, 2017). The effectiveness of cannabis use to relief pain for patients with various types of maladies has been established, while the physiological effects and its variances in terms of impairment caused by THC across different populations have not been fully explored (Schwope, Bosker, Ramaekers, Gorelick & Huestis, 2012; Sznitman & Room, 2018). This has severe implications for legislative and policy development purposes, where presently, blanket zero-tolerance policies in conjunction with alcohol impairment are the norm regards to the operation of vehicles and road safety. Studies of the long-term effects of cannabis use on impairment have been limited in their study design and sample size due to a variety of factors including the legal status of cannabis. Furthermore, studies of long term cannabis use conducted between 2004 to 2015 show a large degree of variability in their results (Curran, Freeman, Mokrysz, Lewis, Morgan & Parsons, 2016). Reviews of the long-term effects of cannabis on cognition performed during this time indicate that long term heavy cannabis use leads to deficits in motor function, executive function, and memory (Ganzer, Broning, Kraft, Sack & Thomasius, 2016; Solowij & Battisti, 2008; Wrege, Schmidt, Walter, Smieskova, Bendfeldt & Radue, 2014). Some of the most compelling recent evidence among these include impairment in episodic memory (Crane, Schuster, Fusar-Poli & Gonzalez, 2013). In fact, abstinence time, age of onset, compensatory mechanisms, sex differences, and other confounding factors may alter the measured effects of long term cannabis use on cognition. Therefore, additional well designed and higher powered studies would be necessary to determine the correlation between long term cannabis use and cognition. (Curran, Freeman, Mokrysz, Lewis, Morgan & Parsons, 2016; Ganzer, Broning, Kraft, Sack & Thomasius, 2016; Crane, Schuster, Fusar-Poli & Gonzalez, 2013). Peak drug levels and peak levels of subjective intoxication are experienced approximately 2 hours after administration (Chesher, Bird, Jackson, Perrignon & Starmer, 1990; Curran, Brignell, Fletcher, Midddleton & Henry, 2002).

Breath analysis has the potential to foster the development of new non-invasive diagnostic devices, an interest for both, forensic and medical science. Techniques to detect drugs cannabis and exhaled breath, similar to

breath alcohol tests, are highly desirable as an alternative to blood, urine and saliva urine analysis in situations such as police controls for drugged driving.

Previous research has investigated exhaled breath and drugs of abuse and successfully detected 28 nonvolatile drugs of abuse in the breath (Ullah, Sandqvist, Beck, 2018).

Human breath may contain approximately up to 3000 compounds, which comprise of volatile and nonvolatile compounds. The non-volatile compounds carry in the aerosol particles could be collected as exhaled breath collection device, which typically takes about 2 to 3 minutes to perform. The detection window of cannabis in breath after smoking one cannabis cigarette in occasional and chronic smokers was at least 3h. Only THC was detected, and not the metabolite. The THC concentration in exhaled breath was related to the physiological changes that occur over time. (Coucke, Massarinin, Ostijin, Beck & Verstraete, 2014).

Compounds from exogenous origin are also detected in exhaled breath, especially with regard to THC since it was administered through inhalation (Beck, Sanqvist, Dubbelboer & Franck 2011). The possibility to detect drug use by using exhaled breath is intriguing when considering that alcohol testing technology has been developed to the point that on-site breath testing with legally defensible results using infrared spectroscopy can be performed and also used for vehicle alcolocks (Beck, Sanqvist, Dubbelboer & Franck 2011). Identification of recent cannabis smoking and intoxication or impairment is critical to drug testing in the workplace, drug treatment facilities, and in driving under the influence of drugs (DUID)[3] programs. SensAbues breath collection devices and a validated liquid chromatography–tandem mass spectrometry (LC-MS/MS) method has been used to quantify breath cannabinoids in chronic and occasional cannabis smokers following controlled smoked THC administration. Detection of recent cannabis smoking is important for documenting accompanying impairment. Here we describe cannabinoid concentrations in exhaled breath following controlled smoked cannabis administration; these data characterize breath cannabinoids, the duration of detection, and peak concentrations. Breath collection is noninvasive and easily observed, and samples can be collected roadside. Breath alcohol tests are widely employed by law enforcement to provide evidence of recent alcohol consumption during roadside stops. Exhaled breath analysis also is evolving as a new frontier in lung and cardiovascular disease testing (Himes, Scheidweiler, Beck, Gorelick, Desrosiers & Huestis, 2013).

THC in oral fluid can be detected for 48 h in chronic smokers during sustained abstinence; therefore, exhaled breath may offer a cannabinoid detection alternative and better coincide with impairment 1–2 h after smoking (Himes, Scheidweiler, Beck, Gorelick, Desrosiers & Huestis, 2013).Oral fluid (OF) is an accepted alternative biological matrix for drug treatment, workplace, and DUID (driving under the influence of drugs) investigations, but establishing the cannabinoid OF detection window and concentration cutoff criteria are important.

Δ^9-Tetrahydrocannabinol (THC) was the most commonly detected drug in oral fluid (OF) among drivers testing positive for potentially impairing drugs. Research has also established that THC can be detected in the breath and blood levels cannabinoid concentrations following controlled cannabinoid smoking detectable from 1 – 4 hours (Himes, Scheidweiler, Beck, Gorelick, Desrosiers & Huestis, 2013). Governments and law enforcement agencies are interested in finding alternatives to urine and blood for identifying recent drug use Huestis (2013) . In Canada, the current approved matrix for DUID programs is saliva. THC is still detectable in oral fluid for 48 hour after consumption. Exhaled breath testing may be an alternative to oral fluid testing as cannabinoid detection in this matrix may correspond with impairment (Himes, Scheidweiler, Beck, Gorelick, Desrosiers & Huestis, 2013).

 The purpose of this research is to provide further insight to aid legislators in establishing policies and laws that take medical cannabis users into greater account, as their characteristics and outcomes with regards to cannabis use greatly differ from recreational users. For our pragmatic clinical trial, we recruited 23 medical cannabis patients out of a pool of 300 verified research subjects through a random selection process. Our main goal was to evaluate any potential relationship between exhaled breath and blood plasma concentrations, along with any changes in neurocognition. In the sections to follow, we will outline our experimental methodology, followed by our results, and finally a brief discussion on the significance of our findings.

Materials and Methods

The criteria we used to screen participants were: 24 years of age or older, native speakers of English, medical marijuana license issued for a chronic health condition, medically stable, and peripheral veins suitable for repeated venipuncture. Exclusion criteria include pregnancy, and allergy to any cannabinoid or marijuana smoke. At the time of this study, cannabis consumption was illegal in Canada, the ethics approval stated that only medical cannabis patients could be used in the study, and conduct a medical intake interview with a medical practitioners. The most common reason for the medical marijuana prescription was a psychiatric disorder (n = 15 or 68.2%), followed by musculo-skeletal (n = 4 or 18.2%), (auto)immune (n = 2 or 9.1%) and respiratory (n = 1 or 4.5%) illnesses. The majority of the sample (n = 12 or 54.5%) identified pain management as one of the reasons for which medical marijuana was prescribed. One patient withdrew from the study early due to experiencing adverse effects after exposure. Average self-reported cannabis consumption was 3.2 grams/day (SD = 1.5, range: 1-14). The study was conducted on a single day, from 8:30 AM to 3:00 PM. Patients' breath collection was achieved using the SensAbues exhaled breath collection device, which is a plastic tube consisting of a filter that traps the aerosols containing the drug particles for effective for rapid collection according to previous research [4]. The subjects were asked to breath into the device for a count of 25 breaths. The devices are then stored at -25C until processing. Participants were asked to provide a baseline neural assessment and provide blood and breath samples. They consume 20% THC via vapes, dabs or by smoking a joint for 10 minutes, asked to report their subjective sense of intoxication on a visual analogue scale. After a 30-minute wait period, they provided biological samples and performed cognitive testing. The biological samples were then collected every hour for the following 3 hours. Neurocognition tests were administered at baseline, after consumption, and prior to the conclusion of the experiment. The tests included executive function, language and processing speed, visuomotor processing speed, Object naming, and executive function tests.

To each breath collection device, 1 ng of internal standard (THC-d3) was added. A standard curve (0.001 – 5,000 ng) was prepared by pipetting the appropriate amount of standard on blank breath pods. Standards and samples were treated to the same extraction conditions. Each device was placed on a conical glass tube and 2 mL of methanol was gently added to each pod and allowed to saturate the pod for 5 min. After 5 min, 5 mL of methanol was added to each pod and an empty syringe was used to apply pressure to elute residual methanol. The tubes were then centrifuged for 2 min at 500 x g. The supernatant was removed to a 1.5 mL Eppendorf tube and centrifuged at 20,000 x g for 45 min at 4°C. The supernatant was transferred to an autosampler vial with a glass insert and analyzed by Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS), following previous research methodologies [5].

To a series of 1.5 mL Eppendorf tubes 1 ng of internal standard (THC-d3) was added to each. A standard curve (0.001 – 5,000 ng) was prepared by pipetting the appropriate amount of standard into the Eppendorf tube along with 100 µL of matrix. Samples had 100 µL of patient plasma added. Standards and samples were treated to the same extraction conditions. Each tube was extracted as follows: 1 mL of 0.1% formic acid in methanol was added, vortex for 1 min, centrifuge at 20,000 x g for 10 min at 4°C, and the supernatant was removed to a conical glass tube which was then evaporated to dryness under a gentle flow of nitrogen at 35°C. The supernatant was transferred to an autosampler vial with a glass insert and analyzed by LC-S/MS. THC was measured by liquid chromatography-tandem mass spectrometry using a QTRAP 5500 triple-quadruple mass spectrometer (Sciex, Framingham, MA) in positive electrospray ionization mode by MRM data acquisition with an Agilent 1200 HPLC (Agilent Technologies: Santa Clara, California, USA). Chromatography was performed by automated injection on a Kinetex Biphenyl column, 50 x 2.1 mm, 2.6 µm particle size) (Phenomenex, Torrance, CA). The HPLC flow was maintained at 400 µL/minute with mobile phases consisting of: A= 0.1% formic acid in water, and B = 0.1% formic acid in acetonitrile. Initial conditions were 50% A and the gradient was ramped to 5% A by 2.5 min and then returned to 50% A. Total run time was 7 minutes. Data acquisition and quantification was performed with Analyst 1.6.2 software (Sciex, Framingham, MA).

Data Analysis

For data analysis of the breath – blood correlation, we used artificial intelligence-based deep neural network analysis to develop models for identifying patterns between the breath and blood plasma THC concentrations. Table 1 provides a summary of the biosamples data. The clinical trial data variables used to develop the deep learning models included the following:

- Time Elapsed since cannabis consumption
- Breath THC concentration
- Gender of the participant
- Age of the participant
- Dosage consumed
- Body Mass Index (BMI) of the participant

In the future, statistical analysis will be conducted on the full data set to explore the relationship between the subjective data collected and the bio samples.

Results

Our analysis revealed that THC blood concentrations increased less rapidly relative to breath concentrations in medical cannabis patients. For majority of participants, the blood concentration levels did not exceed 5ng/ml, even as breath levels reached their peak values. Breath THC concentrations reached a peak value after 0.5 hours of consumption on average. Breath concentration levels reached baseline levels after up to 2 hours. It was also observed that the peak breath concentrations showed a decreasing trend as the participants' BMI increased, with the peak breath concentrations exceeding 100ng for the participants with a BMI less than 30. When comparing both the breath and the blood THC concentration levels between our participants, we found that males generally had higher concentrations relative to females. The blood plasma and breath concentration peak levels exhibited a decreasing trend as the age of the participants increased. When conducting the baseline THC concentration tests at the beginning of the study, Figure 1 reveals that less that 20% of the participants had equivalent blood concentration levels below the lower legal limit of 2 ng/ml at baseline, which is the minimum concentration required to be considered impaired according to the Canadian Federal Impaired Driving Act legislation. We used a plasma – blood conversion model used in the literature (Heustis, Barnes & Smith, 2005; Desrosiers, Himes, Scheidweiler, Concheiro-Guisan, Gorelick & Huestis, 2014) to estimate blood levels for per se limits comparison. 29% of participants exceeded the estimated blood concentration level of 5 ng/ml legal limit at baseline, which is the higher per se limit under the Canadian legislation. While 38% exceeded 10 ng/ml. When tested 30 minutes after consumption, 100% of the study participants had estimated blood THC concentrations above the 5 ng/ml maximum Canadian legal per se limit. At 150 minutes after consumption 100% of the participants were still over the 2ng level, with 85% over the 5 ng limit. The subjective data illustrated in Figure 2 was collected as baseline prior to consumption. The mid point was survey was collected 30 minutes after consumption, and the final survey was collected prior to discharge which would have been 210 minutes after consumption. This data revealed that the subjects reported only being moderately high an average of 5/10, pain levels reduced from an 3.7 to 2.8 after consumption. There was an increase in alertness being reported after consumption from 5.4 to 9.2. More analysis is required to statistically analyze the subjective data and explore the relationship with the neurocognitive data.
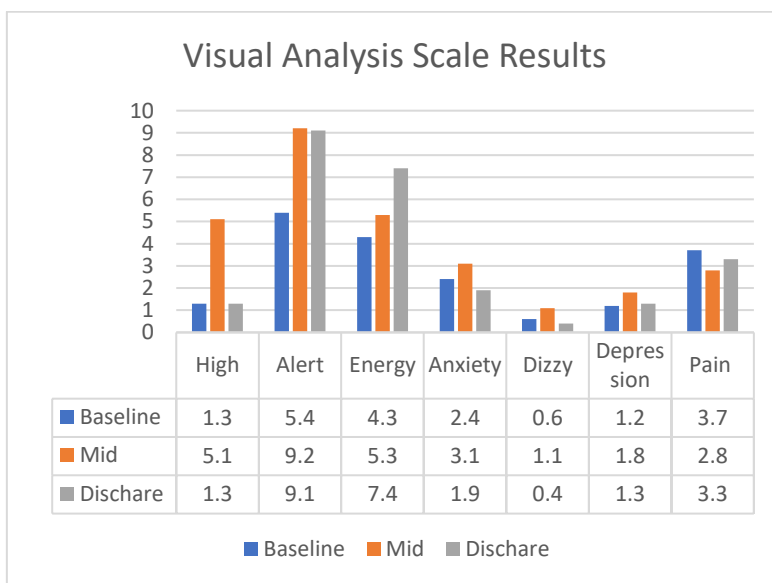
Future Research

The research conducted with medical patients will be replicated with a larger sample size using recreational cannabis users. At the time of this study, it was illegal to consume cannabis and we were restricted by our ethics protocol to only use medical patients and they were only allowed to consume for 10 minutes, future research will allow longer consumption times and include non-medical patients. The results from the recreational cannabis study will be used to train and improve the AI neural network to determine patterns of how the breath and blood are related to research subjects
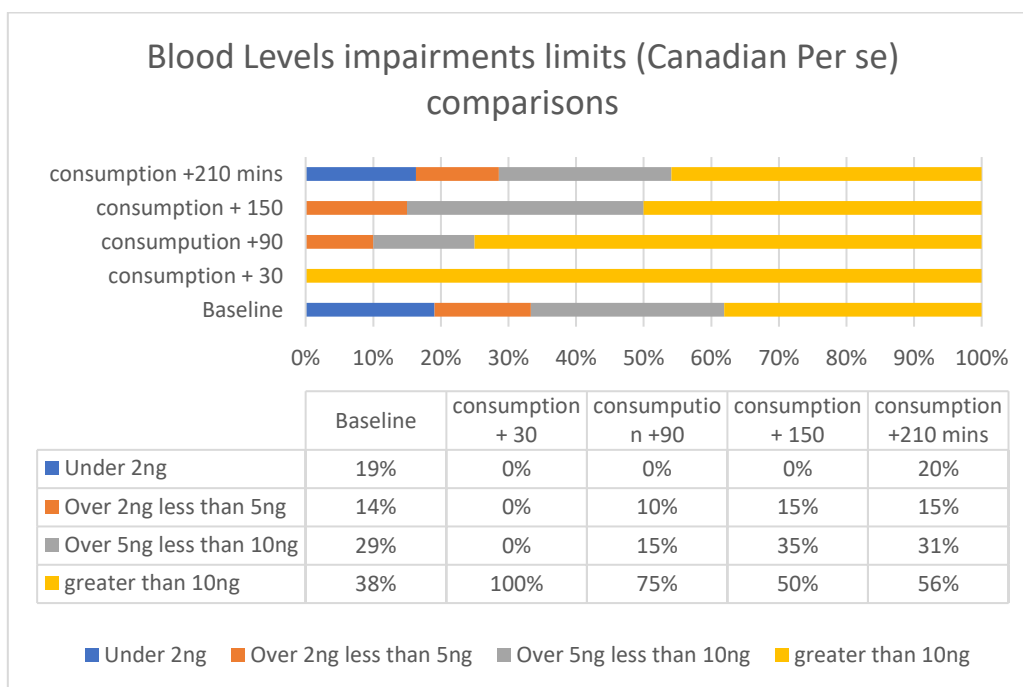
Conclusion

The pilot study observed that certain patients had a persistent blood THC concentration level above the legal limit even at baseline when the plasma results are converted to blood equivalence. Other research subjects had a blood concentration level well below legal limits, even though their THC breath levels was high as illustrated in Figure 2. Given this small sample size, there appears to be no direct correlation between blood and breath tests. There are no guidelines in the literature regarding THC breath levels. The sample of patients in our study self reported as being only moderately high (average 5 of 10) following their exposure to THC. More analysis is required to statistically correlate the neurocognitive tests with the blood levels to determine if blood levels above the legal limits correlate to impairment. There could be implications for law enforcement in regard to generating false positive and false negative impairment tests as tolerance is more likely to develop in chronic users (Hartman & Heustis, 2013). When considering the implications, the limitations of our research needs to be considered. Some major limitations of our study are the sample size and the scope, which

is a challenge present in many clinical trials due to resource constraints. For future studies, it will be necessary to increase the sample of the study and increase the number of variables to account for additional factors. In summary, our findings validate existing research, and provide additional evidence for using exhaled breath testing as an effective means of THC impairment and field sobriety detection (Beck, Sandqvist, Dubbelboer & Franck, 2011; Beck, Stephanson, Sandqvist & Franck (2012).

Appendix

Visual Analysis Scale Results

	High	Alert	Energy	Anxiety	Dizzy	Depression	Pain
Baseline	1.3	5.4	4.3	2.4	0.6	1.2	3.7
Mid	5.1	9.2	5.3	3.1	1.1	1.8	2.8
Dischare	1.3	9.1	7.4	1.9	0.4	1.3	3.3

Figure 1 : Visual Analysis Scale results for research subjects.

Blood Levels impairments limits (Canadian Per se) comparisons

	Baseline	consumption + 30	consumption +90	consumption + 150	consumption +210 mins
Under 2ng	19%	0%	0%	0%	20%
Over 2ng less than 5ng	14%	0%	10%	15%	15%
Over 5ng less than 10ng	29%	0%	15%	35%	31%
greater than 10ng	38%	100%	75%	50%	56%

Figure 2: Research subjects Blood levels compared to Canadian Per Se limits

References

Beck, O., Sandqvist, S., Dubbelboer, I., Franck, J. (2011). Detection of Δ9- tetrahydrocannabinol in exhaled breath collected from cannabis users. *Journal of Analytical Toxicology*, 35(8), 541-544.
 Beck, O., Stephanson, N., Sandqvist, S., Franck, J. (2012). Detection of drugs of abuse in exhaled breath from users following recovery from intoxication. *Journal of Analytical Toxicology*, 36(9), 638-646.

Beck, O., Stephanson, N., Sandqvist, S., Franck, J. (2013). Detection of drugs of abuse in exhaled breath using a device for rapid collection: comparison with plasma, urine and self- reporting in 47 drug users. *Journal of Breath Research*, 7(2), 026006.

Chesher, G.B., Bird, K.D., Jackson, D.M., Perrignon, A., Starmer, G.A. (1990). The effects of orally administered Δ^9-tetrahydrocannabinol in man on mood and performance measures: a dose-response study. *Pharmacology Biochemistry & Behavior,* 35, 861-864.

Coucke L., Massarini E., Ostijn Z., Beck O., Verstraete A. (2014). Δ9-Tetrahydrocannabinol concentrations in exhaled breath related to physiological effects following cannabis smoking. *Clinical Biochemistry*, 49(13-14), 1072-7.

Crane, N. A., Schuster, R. M., Fusar-Poli, P. & Gonzalez, R. (2013). Effects of cannabis on neurocognitive functioning: recent advances, neurodevelopmental influences, and sex differences. *Neuropsychol. Rev.* 23, 117–137.

Curran, H. V., Brignell, C., Fletcher, S., Middleton, P., Henry, J. (2002). Cognitive and subjective dose–response effects of acute oral Δ9-tetrahydrocannabinol (THC) in infrequent cannabis users. *Psychopharmacology,* 164, 61–70.

Curran, H.V., Freeman, T.P., Mokrysz, C., Lewis, D.A., Morgan, C.J.A., Parsons, L.H. (2016) Keep off the grass? Cannabis, cognition, and addiction. *Nature Reviews Neuroscience,*17, 293-306.

Desrosiers N.A., Himes S.K., Scheidweiler K.B., Concheiro-Guisan M., Gorelick D.A., Huestis, M.A. (2014). Phase I and II cannabinoid disposition in blood and plasma of occasional and frequent smokers following controlled smoked cannabis. *Clinical Chemistry* 60:4, 631-43.

Ganzer, F., Broning, S., Kraft, S., Sack, P., Thomasius, R. (2016). Weighing the evidence: A systematic review on long-term neurocognitive effects of cannabis use in abstinent adolescents and adults. *Neuropsychol Rev,* 26, 186-222.

Hartman, R. L., Huestis, M. A. (2013). Cannabis effects on driving skills. *Clinical chemistry*, 59(3), 478-492.

Himes, S.K., Scheidweiler, K.B., Beck, O., Gorelick, D.A., Desrosiers, N.A., Huestis, M.A. (2013). Cannabinoids in Exhaled Breath following Controlled Administration of Smoked Cannabis. *Clinical Chemistry* 59:12, 1780-1789.

Huestis M.A., Barnes A., Smith M.L. (2005). Estimating the time of last cannabis use from plasma delta9-tetrahydrocannabinol and 11-nor-9-carboxy-delta9-tetrahydrocannabinol concentrations. *Clinical Chemistry* 51:12, 2289-95.

Lee D., Milman G., Barnes A., Goodwin R.S., Hirvonen J., Heustis M.A. (2011). Oral fluid cannabinoids in chronic, daily Cannabis smokers during sustained, monitored abstinence. *Clinical Chemistry* 57(8), 1127-36.

Lucas P., Walsh Z. (2017). Medical cannabis access, use, and substitution for prescription opioids and other substances: a survey of authorized medical cannabis patients. *International Journal of Drug Policy*, 42, 30-35.

Kintz P., Mura P., Jamey C., Raul J-S. (2016). Detection of Δ^9-tetrahydrocannabinol in exhaled breath after cannabis smoking and comparison with oral fluid. *Forensic Toxicology*, 35, 173-178

Schwope D.M. Bosker W.M. Ramaekers J.G. Gorelick D.A. Huestis M.A. (2012) Psychomotor Performance, Subjective and Physiological Effects and Whole Blood Δ9-Tetrahydrocannabinol Concentrations in Heavy, Chronic Cannabis Smokers Following Acute Smoked Cannabis. *Journal of Analytical Toxicology*, 36, 405–412.

Solowij, N., & Battisti, R. (2008). The chronic effects of cannabis on memory in humans: a review. *Current Drug Abuse Reviews*, 1(1), 81–98.

Sznitman, S. R., & Room, R. (2018). Rethinking indicators of problematic cannabis use in the era of medical cannabis legalization. *Addictive Behaviors*, 77, 100-101.

Ullah S., Sandqvist S., Beck O. (2018). A liquid chromatography and tandem mass spectrometry method to determine 28 non-volatile drugs of abuse in exhaled breath. *Journal of Pharmaceutical and Biomedical Analysis*, 148:251-258.

Wrege, J., Schmidt, A., Walter, A., Smieskova, R., Bendfeldt, K., Radue, E. W., et al. (2014). Effects of cannabis on impulsivity: a systematic review of neuroimaging findings. *Current Pharmaceutical Design*, 20(13), 2126–2137.

Analytical Reliability of Four Oral Fluid Point-Of-Collection Testing Devices for Drug Detection in Drivers

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Abstract

Background: Point-of-collection testing (POCT) devices for psychoactive substance detection through oral fluid samples are used in several countries for traffic enforcement. However, the reported reliability of such devices is quite heterogeneous among studies - and evaluating and comparing their analytical performance is paramount in order to guide enforcement policies focused on local needs.

Aim: To evaluate the analytical reliability of four POCT devices for the detection of cocaine and cannabinoids using oral fluid samples of Brazilian drivers.

Method: 168 drivers were recruited during standard roadblock procedures in Southern Brazil. Subjects were screened using one of the following POCT devices: the DDS2™, the DOA MultiScreen™, the Dräger DrugTest 5000™ and the Multi-Drug Multi-Line Twist Screen Device™ (MDML). Split oral fluid samples for confirmatory analysis were also collected, and stored in a -80°C freezer. Results of the screening tests were compared with chromatographic assays in order to obtain the reliability parameters.

Results: The prevalence of confirmed positive samples for cocaine and cannabinoids were 9% and 4.4%, respectively. Sensitivity, specificity, and accuracy for cocaine detection were, respectively: DDS2™ = 100%, 100%, and 100%; MDML™ = 86%, 100% and 98%; Dräger™ = 100%, 100% and 100%; and DOA™ = 83%, 100% and 97%. Sensitivity, specificity and accuracy for the detection of cannabinoids were, respectively: DDS2™ = 75%, 100% and 78%; MDML™ = 29%, 100% and 89%; Dräger™ = 100%, 100% and 100%; and DOA™ = 0%, 94% and 100%,

Conclusion: We observed a high prevalence of drivers testing positive for cocaine and cannabinoids. The evaluated POCT devices achieved reliability measures greater than 80% for cocaine detection, which is considered appropriate by international guidelines. However, the reliability for cannabinoid detections did not achieve the desired parameters in three of the four devices tested. Difficulties in detecting cannabinoids at the roadside should be better evaluated before the implementation of such tests.

Introduction

The impact of illicit psychoactive substance use in driving performance is being broadly studied in the last years. Although there is still no clear evidence on the dose-effect relationship for other substances as there is for alcohol, the literature highlights that drug use can impact driving skills in different ways and intensities (Busardo et al., 2017; Strand et al., 2016). Besides that, a high prevalence of drug-positive drivers at the roadside and involved in traffic collisions are reported worldwide (Christophersen et al., 2016; Lipari et al., 2013; Penning et al., 2010). In this sense, there is an international effort in applying public policies and new technologies aiming the detection and the deterrence of drug use by drivers.

The use of point-of-collection testing (POCT) devices for psychoactive substance detection was first implemented in Australia, and now they are being used for traffic enforcement in several countries (Verstraete, 2005). The main advantages of POCT devices are the ease of use, the possibility of quick results at the roadside, and the screening for multiple substances at the same time using an alternative and non-invasive biological matrix, such as oral fluid (Drummer, 2005). On the other hand, the reported reliability of these devices seems to vary in different studies, especially for cannabinoids and opioid detection, as shown in a recent meta-analysis of our research group (Scherer et al., 2017a).

In Brazil, despite the fact that drugged driving is prohibited, there is no approved device to test drivers at the roadside. Therefore, it is important to evaluate and compare the analytical performance of different POCT

devices according to local needs in order to guide public policies. Knowing that cannabinoid and cocaine are the most prevalent illicit substances consumed in Brazil (Laranjeira, 2014), this study aimed to evaluate the analytical reliability of four POCT devices for the detection of these substances using oral fluid samples from Brazilian drivers stopped in roadblocks.

Method

A total of 168 drivers were recruited during 37 standard roadblock procedures in Southern Brazil. Data collection occurred between 11 PM to 5 AM on different days of the week, according to the traffic patrols availability. This study was performed in collaboration with the Department of Transportation of the state of Rio Grande do Sul (DETRAN-RS) and the Federal Highway Police (PRF-RS). All data was collected in the metropolitan area of Porto Alegre, Brazil, in days and locations chosen by convenience for the police department as part of standard operating procedures. Inclusion criteria included being 18 years old or above and presenting any condition that would prevent the driver from returning driving to the road (e.g.: positive breathalyzer test, no driving license, etc). In this sense, only drivers who were not allowed to return to the road were included in this study. Moreover, the last criterion was used to ensure the ethical responsibility to avoid a potential positive subject in the drug screening test. All subjects participated voluntarily in the research, and sign the informed consent.

Subjects were screened by trained traffic agents, and saliva samples were tested using a single device. The following POCT devices were tested: the DDS2™ (n=50), the DOA MultiScreen™ (n=42), the Dräger DrugTest 5000™ (n=23) and the Multi-Drug Multi-Line Twist Screen Device™ (MDML, n=49). The main characteristics of each device are presented in **Table 1**. All screening procedures were performed according with the manufactures. Split oral fluid samples for confirmatory analysis were also collected using microtubes free of additives and stored in a -80°C freezer.

The confirmatory analyzes were carried out by the Immunalysis Corporation (California, USA), using the standard protocols established by that company, which are based on international recommendations for toxicological analysis. Initially, all samples were analyzed by ELISA (Enzyme-Linked Immunosorbent Assay). After this step, all samples that tested positive in the ELISA assay - as well as the samples with discordant results between the ELISA test and the device screening test - were analyzed again by chromatographic methods. 5% of the negative samples (7 for cocaine and 7 for cannabis) were randomly chosen to be analyzed by the chromatographic assays as well. The cutoff used for cannabinoids detection (THC) was 4ng / mL in the ELISA and 2ng/ mL in the gas chromatography-mass spectrometry (GC-MS) analysis. For cocaine, the cutoff was 20 ng/mL in the ELISA and 8ng/ mL in the liquid chromatography tandem mass spectrometry (LC-MS/MS). Samples that presented THC and cocaine/benzoylecgonine concentrations equal to or greater than 2 ng /mL and 10 ng /mL, respectively, in the chromatographic analyzes were considered positive samples, as recommended in the Walsh´s International Guideline.

Table 1. POCT devices used in the study and their main characteristics.

Device	DDS2 Mobile Test System	DOA MultiScreen	Draeger DrugTest 5000	Multi-Drug Multi-Line Twist Screen Device
Manufacture (country)	Alere Inc (United Kingdom)	Ulti Med Products (Germany)	Drägerwerk AG & Co. (Germany)	Alere Inc (USA)
Drug panel (cutoff ng/mL)	Amphetamines (50), benzodiazepines (20), cannabinoids (25), cocaine (30), opioids (40), Methamphetamines (50)	Amphetamines (50), benzodiazepines (10), cannabinoids (12), cocaine (20), opioids (40), Methamphetamines (50), Ecstasy (50), Oxycodone (40)	Amphetamines (50), benzodiazepines (15), cannabinoids (5-25), cocaine (20), opioids (20), Methamphetamines (35)	Amphetamines (50), benzodiazepines (20), cannabinoids (100), cocaine (20), opioids (40), Methamphetamines (50), Phencyclidine (10)

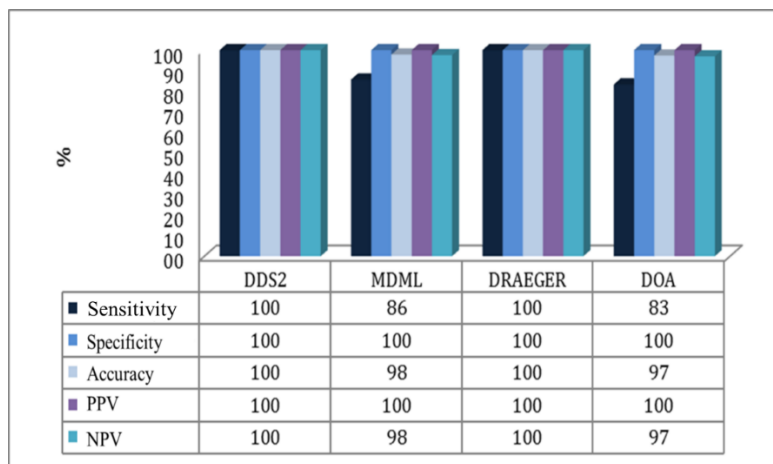| Interpretation of results	Automatized (reader)	Automatized (reader)	Automatized (reader)	Visual

Legend: the cutoff values for each substance are within parenthesis and are presented as ng/mL.

Results

Cocaine

From the 168 subjects that were screening for cocaine during data collection, a total of 160 obtained a valid screening result. Of those, 156 were tested in the confirmatory analysis (4 samples were lost due to the small volume collected). A total of 14 samples (9% of the 156) were confirmed positive for cocaine. The reliability measures of the devices showed a general sensitivity of 87.5%, specificity of 100.0% and accuracy of 98.7%. All the evaluated devices obtained reliability measurements for cocaine detection greater than 80% [*] (**Figure 1**).
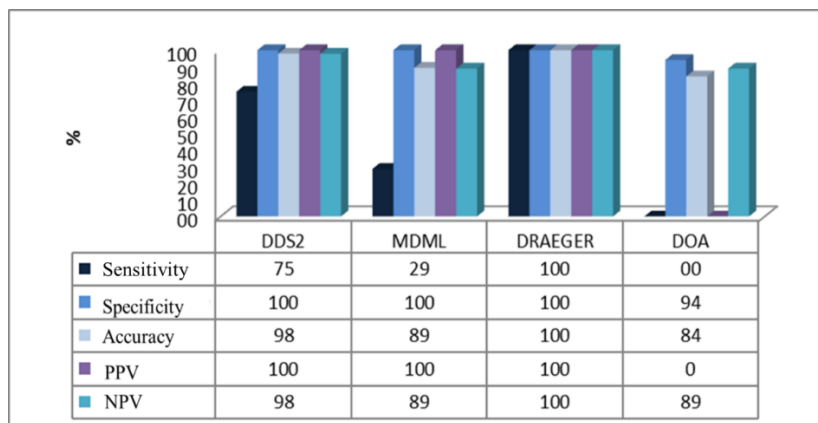
[*] International recommendation from the DRUID project.

	DDS2	MDML	DRAEGER	DOA
Sensitivity	100	86	100	83
Specificity	100	100	100	100
Accuracy	100	98	100	97
PPV	100	100	100	100
NPV	100	98	100	97

Figure 1. Reliability measures for cocaine detection among the four tested POCT devices. PPV = positive predictive value; NPV = negative predictive value.

Cannabinoids

From the 160 subjects that obtained valid results in the cannabinoids screening tests, 158 were tested in the confirmatory analysis (2 samples were lost due to the small volume collected). A total of 7 samples (4.4% of the 158) were confirmed positive for cannabis. The reliability measures of the devices showed a general sensitivity of 41.2%, specificity of 98.6% and accuracy of 92.4% for the detection of cocaine. Just one device devices obtained reliability measurements for cannabinoids detection greater than 80% (**Figure 2**).

	DDS2	MDML	DRAEGER	DOA
Sensitivity	75	29	100	00
Specificity	100	100	100	94
Accuracy	98	89	100	84
PPV	100	100	100	0
NPV	98	89	100	89

Figure 2. Reliability measures for cocaine detection among the four tested POCT devices. PPV = positive predictive value; NPV = negative predictive value.

Discussion

The present study allowed the initial analytical evaluation and comparison of four POCT devices for cocaine and cannabinoid detection using samples from Brazilian drivers. Our findings corroborate previous studies that suggest a significant prevalence of Brazilians drivers with positive results for the detection of drugs other than alcohol. Besides that, the reliability analysis of the devices for cocaine detection showed values of sensitivity, specificity and accuracy within the internationally recommended parameters (>80% according to DRUID project) for all evaluated devices. On the other hand, just one device achieved acceptable reliability measures for cannabinoids detection. However, it is important to point out that this same device had a lower number of evaluations when compared to the others, which may influence the presented results.

Studies that evaluated cocaine detection in roadside studies usually show good analytical reliability, with accuracy ranging from 63 to 100% (Scherer et al., 2017a). Due to its basic properties, cocaine and their metabolites are likely to be found in oral fluid, especially after the first hours of administration (Cone and Huestis, 2007; Ellefsen et al., 2016a). Recently, two studies evaluating DDS2™ using oral fluid sample of drivers found an accuracy of 99% (Edwards et al., 2017) and 85.7% (Veitenheimer and Wagner, 2017). Other devices, although less evaluated in the literature, also presented acceptable reliability measures in recent studies (Ellefsen et al., 2016b; Scherer et al., 2017b). By the other hand, the reliability measures of POCT devices for cannabinoids detection are very heterogeneous among studies, especially because of its hydrophobic properties and its complex pharmacokinetics (Bosker and Huestis, 2009; Choo and Huestis, 2004; Cone and Huestis, 2007). In our meta-analysis, we found accuracies ranging from 41 to 100%, with a summarized AUC of 85% (Scherer et al., 2017a). According to Newmeyer et al. (2017), the analytical accuracy of the DT5000 ranged between and 84.0%–92.0% in studies using oral fluid samples with low confirmatory cutoff. For DDS2™, similar results were obtained (Moore et al., 2013; Newmeyer et al., 2017; Veitenheimer and Wagner, 2017).

It is important to note that the great variability among different studies could be due to several methodological approaches, involving aspects from oral fluid collection until confirmatory analysis protocols. This highlight the need for evaluating each device according to local polices and local needs. In our study, the reliability for cannabinoid detections did not achieve the desired parameters in three of the four devices tested. Therefore, difficulties in detecting cannabinoids in the Brazilian context should be better evaluated before the implementation of these tests. Moreover, further studies should be performed in order to evaluate the reliability of the detection of other drugs, expanding the sample size and including other Brazilian locations.

References

Bosker, W.M., Huestis, M.A., 2009. Oral fluid testing for drugs of abuse. Clin. Chem. 55 11 , 1910–31. doi:10.1373/clinchem.2008.108670

Busardo, F.P., Pichini, S., Pellegrini, M., Montana, A., Lo Faro, A.F., Zaami, S., Graziano, S., 2017. Correlation between Blood and Oral Fluid Psychoactive Drug Concentrations and Cognitive Impairment in Driving under the Influence of Drugs. Curr. Neuropharmacol. 16 1 , 84–96. doi:10.2174/1570159X15666170828162057

Choo, R.E., Huestis, M.A., 2004. Oral fluid as a diagnostic tool. Clin. Chem. Lab. Med. 42 11 , 1273–87. doi:10.1515/CCLM.2004.248

Christophersen, A.S., Mørland, J., Stewart, K., Gjerde, H., 2016. International trends in alcohol and drug use among vehicle drivers. Forensic Sci. Rev. 28 1 , 37–66.

Cone, E.J., Huestis, M.A., 2007. Interpretation of oral fluid tests for drugs of abuse, in: Annals of the New York Academy of Sciences. pp. 51–103. doi:10.1196/annals.1384.037

Drummer, O.H., 2005. On-site drug testing. Bull. Narc. 57 1–2 , 205–11.

Edwards, L.D., Smith, K.L., Savage, T., 2017. Drugged Driving in Wisconsin: Oral Fluid Versus Blood. J. Anal. Toxicol. 41 6 , 523–529. doi:10.1093/jat/bkx051

Ellefsen, K.N., Concheiro, M., Pirard, S., Gorelick, D.A., Huestis, M.A., 2016a. Pharmacodynamic effects and relationships to plasma and oral fluid pharmacokinetics after intravenous cocaine administration. Drug Alcohol Depend. 163, 116–25. doi:10.1016/j.drugalcdep.2016.04.004

Ellefsen, K.N., Concheiro, M., Pirard, S., Gorelick, D.A., Huestis, M.A., 2016b. Cocaine and benzoylecgonine oral fluid on-site screening and confirmation. Drug Test. Anal. 8 3–4 , 296–303. doi:10.1002/dta.1966

Laranjeira, R., 2014. II Levantamento Nacional de Álcool e Drogas (LENAD) - 2012. São Paulo.

Lipari, R.N., Hughes, A., Bose, J., 2013. Driving Under the Influence of Alcohol and Illicit Drugs, The CBHSQ Report.

Moore, C., Kelley-Baker, T., Lacey, J., 2013. Field testing of the Alere DDS2 Mobile Test System for drugs in oral fluid. J. Anal. Toxicol. 37 5 , 305–7. doi:10.1093/jat/bkt022

Newmeyer, M.N., Swortwood, M.J., Andersson, M., Abulseoud, O.A., Scheidweiler, K.B., Huestis, M.A., 2017. Cannabis Edibles: Blood and Oral Fluid Cannabinoid Pharmacokinetics and Evaluation of Oral Fluid Screening Devices for Predicting Δ^9-Tetrahydrocannabinol in Blood and Oral Fluid following Cannabis Brownie Administration. Clin. Chem. 63 3 , 647–662. doi:10.1373/clinchem.2016.265371

Penning, R., Veldstra, J.L., Daamen, A.P., Olivier, B., Verster, J.C., 2010. Drugs of abuse, driving and traffic safety. Curr. Drug Abuse Rev. 3 1 , 23–32.

Scherer, J.N., Fiorentin, T.R., Borille, B.T., Pasa, G., Sousa, T.R.V., von Diemen, L., Limberger, R.P., Pechansky, F., 2017a. Reliability of point-of-collection testing devices for drugs of abuse in oral fluid: A systematic review and meta-analysis. J. Pharm. Biomed. Anal. 143, 77–85. doi:10.1016/j.jpba.2017.05.021

Scherer, J.N., Fiorentin, T.R., Sousa, T.R.V., Limberger, R.P., Pechansky, F., 2017b. Oral Fluid Testing for Cocaine: Analytical Evaluation of Two Point-of-Collection Drug Screening Devices. J. Anal. Toxicol. 41 5 , 392–398. doi:10.1093/jat/bkx018

Strand, M.C., Gjerde, H., Mørland, J., 2016. Driving under the influence of non-alcohol drugs--An update. Part II: Experimental studies. Forensic Sci. Rev. 28 2 , 79–101.

Veitenheimer, A.M., Wagner, J.R., 2017. Evaluation of Oral Fluid as a Specimen for DUID. J. Anal. Toxicol. 41 6 , 517–522. doi:10.1093/jat/bkx036

Verstraete, A.G., 2005. Oral fluid testing for driving under the influence of drugs: history, recent progress and remaining challenges. Forensic Sci. Int. 150 2–3 , 143–150. doi:10.1016/j.forsciint.2004.11.023

Canada's New Federal Drug-Impaired Driving Provisions: Challenges in Enforcement and Prosecution

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Abstract

Context: Although drug-impaired driving has been prohibited in Canada since 1925, there were no drug-specific enforcement provisions until the Criminal Code was amended in 2008 to authorize standardized field sobriety testing and Drug Recognition Evaluation (DRE). While these provisions improved enforcement somewhat, they had little, if any, deterrent effect. DRE evidence was routinely challenged, and courts were sceptical about the link between the presence of a drug and impairment of driving-related skills. With the de-criminalization of cannabis in 2018, there will be even greater need to identify and prosecute drug-impaired drivers.

Objectives: This paper examines key drug-impaired driving provisions of Bill C-46, which received Royal Assent in June 2018. Among other things, it authorized Parliament to create per se drug-impaired driving offences, and authorized police to demand bodily samples (most likely oral fluid) if they reasonably suspect that a driver has drugs in his body. These are important provisions, but will still pose challenges for the enforcement and prosection of drug-impaired driving.

Key Outcomes: The challenges posed by the legislation are: (1) it will be difficult for police to prove that they had the requisite reasonable suspicion that a driver had drugs in his body; (2) due to limitations in the technology, the THC threshold of screening devices will be set much higher (25ngs) than the per se limits (2-5ngs and 5+ngs); (3) the cost and time delay associated with the devices will limit the feasibility of roadside screening tests for cannabis.

Discussion and Implications: Without a quick, simple, inexpensive, and accurate means of screening for drugs at roadside, this new legislation is unlikely to have a deterrent effect, and the incidence of driving after cannabis use is likely to increase, particularly among youth.

Disclosure: Chamberlain is on the MADD Canada Board of Directors; Solomon is Director of Legal Policy for MADD Canada.

Introduction

Although drug-impaired driving has been prohibited in Canada since 1925, there were no drug-specific enforcement provisions until the *Criminal Code* was amended in 2008 to authorize standardized field sobriety testing (SFST) and Drug Recognition Evaluation (DRE). While these provisions improved enforcement somewhat, they had little, if any deterrent effect (Solomon & Chamberlain, 2014). Recent survey and roadside screening data indicate that driving after cannabis use continues to increase (Robertson *et al*., 2017; Beirness & Porath, 2017), and that the percentage of drivers testing positive for drugs exceeds the percentage testing positive for alcohol, particularly among young people (Beasley & Beirness, 2014; Beirness & Beasley, 2018). Further, while the percentage of fatally-injured drivers testing positive for alcohol has been decreasing, the percentage testing positive for drugs has been increasing (Solomon, Ellis & Zheng, 2018, p. 1). The number of cannabis-positive, fatally-injured drivers increased more than 230% from 2000 to 2014 (Traffic Injury Research Foundation, 2017, p. 1).

With the de-criminalization of cannabis in Canada in 2018, there will be even greater need to identify and prosecute drug-impaired drivers. Unfortunately, the enforcement measures introduced in Bill C-46 (2018) are likely to prove challenging in their implementation, and will not allow enforcement to keep pace with the inevitable increase in cannabis use in Canada (Solomon, Chamberlain & Vandenberghe, 2018).

The Pre-Existing Law

Prior to 2008, police in Canada had no specific authority to gather evidence related to drug-impaired driving. The relevant criminal offence was simply driving while one's ability was impaired by alcohol or any drug (*Criminal Code*, s. 253(1)(a), now s. 320.14(1)(a)). This meant that the prosecution of drug-impaired driving was typically based on an officer's testimony about the accused's driving and other behaviour (*e.g.* erratic driving, lack of coordination, slurred speech, admission of drug consumption). However, even when a driver

had consumed drugs and was obviously impaired, the Crown usually needed to introduce expert evidence to prove that the drug was the cause of the impairment. Obtaining a conviction based on the testimony of a non-expert patrol officer was described by the Department of Justice as "nearly impossible" (Department of Justice, 2003, p. 4).

In light of these challenges, the *Criminal Code* was amended in 2008 to add two drug-impaired driving enforcement tools. First, police were authorized to demand that a driver participate in SFST if they had reasonable grounds to suspect that the driver had any alcohol or drugs in his or her body (*Criminal Code*, s. 254(2)(a), now s. 320.27(1)(a)). This low threshold test is based on the same grounds as demanding breath tests on approved screening devices (ASDs). As with ASD tests, the results of SFST can only be used to screen drivers and provide grounds for demanding an evidentiary breath test or DRE.

Second, police were given authority to demand DRE from a driver who they had reasonable grounds to believe had, within the preceding three hours, committed the offence of driving while impaired by drugs or by a drug in combination with alcohol (*Criminal Code*, s. 254(3.1), now s. 320.27(2)(a)). The results of the DRE were admissible in evidence at trial, if the DRE was conducted in accordance with the stringent regulatory requirements and the driver was afforded the right to counsel. Refusal to participate in either SFST or DRE, without a reasonable excuse, is a criminal offence.

While these amendments were an improvement, they raised challenges of their own. With respect to SFST, research suggests that police may fail to detect many drug-positive drivers, and may never even demand a screening test (Brubacher *et al.*, 2018). Research also suggests that SFSTs are not an especially valuable screening tool when it comes to assessing impairment caused by cannabis or other drugs (Stough *et al.*, 2006). DRE tests, in turn, are time-consuming and cumbersome, and the training of evaluating officers is expensive (Solomon & Chamberlain, 2014). This means that the number of qualified DRE officers in Canada is relatively low, and their distribution across the country is uneven. For instance, it may be difficult to secure an evaluating officer in a rural community late at night within the prescribed three-hour time limit. Further, DRE is primarily an indication that the driver has a specified drug in his or her system; it does not focus on driver impairment. As a result, DRE evidence was routinely challenged by accused, and judges were sceptical about the link between the presence of a drug and impairment of driving-related skills (Solomon & Chamberlain, 2014; *R. v. Abbasi-Rad*, 2016). Moreover, it was not until 2017 that the Supreme Court of Canada ruled that DRE evidence was admissible in court without having to independently qualify the evaluating officer as an expert through a special *voir dire* hearing (*R. v. Bingley*).

These difficulties help to explain why, in spite of the increase in driving after drug use, drug-impaired driving charges accounted for only 3.9% of total impaired driving charges in 2016 (Statistics Canada, 2018). Even when drivers are charged, the conviction rate for drug-impaired driving is significantly lower (61%) than for alcohol-impaired driving (81%) (Perreault, 2015). In short, enforcement methods were not keeping up with the increasing rates of driving after drug use.

The 2018 Legislative Amendments

Bill C-46 was a major revision of the *Criminal Code*'s impaired driving provisions, including the introduction of mandatory (*i.e.* random) alcohol screening and a restriction on several problematic defences. It also confirmed that DRE evidence is admissible without having to independently qualify the evaluating officer as an expert. In terms of new drug-impaired driving provisions, two changes were critical: Parliament was given authority to establish *per se* drug-related driving offences (*Criminal Code*, s. 320.14(1)(c)); and police were authorized to demand roadside drug screening tests (s. 320.27(1)(c)) and evidentiary blood tests (s. 320.28(2)(b)) in specified circumstances.

The Per Se Offences

Pursuant to Bill C-46, Parliament has enacted three new cannabis-related *per se* driving offences:
  i.   having 2 but less than 5 nanograms of THC per ml of whole blood (a summary conviction offence punishable by a fine of up to $1000);
  ii. having 5 or more nanograms of THC per ml of whole blood (a hybrid offence, with the same penalties as the alcohol-impaired driving offences);

iii.   having 2.5 or more nanograms of THC per ml of whole blood *and* a BAC of 0.05% or higher (a hybrid offence with the same penalties as the alcohol-impaired driving offences).

Testing of Bodily Fluids

Bill C-46 maintained the police power to demand SFST and DRE in specified circumstances, and added two other powers to collect evidence of drug-impaired driving. First, police are authorized to demand "a sample of a bodily substance" for testing on "approved drug screening equipment" from a person if they have reasonable grounds to suspect that the person has a drug in his or her body and has driven within the preceding three hours. For the foreseeable future, this power will be limited to requiring oral fluid samples on a roadside oral fluid test kit.

Second, Bill C-46 authorizes police to demand that a person provide a blood sample (*Criminal Code*, s. 320.28(2)(b)) or submit to DRE (s. 320.28(2)(a)) if they have reasonable grounds to believe that the person has driven while his or her ability to do so was impaired to any degree by a drug, or a drug in combination with alcohol, or has committed the offence of driving with a blood-drug concentration equal to or greater than the proscribed limit.

The Challenges Raised by the 2018 Enforcement Provisions

While the new *per se* offences and police powers will strengthen drug-impaired driving enforcement, there are significant limits on their effectiveness, particularly in regard to THC. There are three obvious challenges.

First, it may be difficult for officers to meet the threshold requirement for demanding an oral fluid sample, namely, that they had reasonable grounds to suspect that the driver had drugs in his or her body. This test has already proved to be a significant hurdle in alcohol-impaired driving cases: a national survey indicated that defence counsel often successfully challenged the basis for the officer's belief that the driver had alcohol in his or her body and, thus, the legality of the demand for a breath screening test or SFST (Robertson, Vanlaar & Simpson, 2009, pp. 68-70). This would, in turn, result in the evidentiary breath tests being excluded from evidence and, ultimately, in the accused's acquittal. We can expect that officers will have even more difficulty establishing the requisite grounds in drug-related cases, since the signs and symptoms of drug use are not as widely recognized.

Next, based on the Canadian Society of Forensic Science's recommendation, the THC threshold for testing positive on the roadside oral fluid screening devices was set at 25 nanograms per millilitre of oral fluid (Canadian Centre of Forensic Science, 2017, p. 4). This threshold is obviously under-inclusive, in that drivers with 2 to 24 nanograms/millilitre of oral fluid will evade detection and will not be required to submit to DRE or evidentiary blood testing, even though many of them may be above the *Criminal Code per se* limit at roadside. (This high threshold was adopted because THC levels in blood peak during or immediately after use, and fall an estimated 80% to 90% within 30 minutes. A lower threshold could result in some drivers failing the roadside test, only to be cleared on an evidentiary test after having been brought to the police station, given the opportunity to contact counsel, etc.)

Finally, the current cost of oral fluid drug testing is substantial, ranging anywhere from $12-$45 per test kit, depending on the manufacturer (Hildrebrand *et al.*, 2008; Asbridge & Ogilvie, 2015). The time it takes to obtain the test result also varies depending on the manufacturer, ranging from 3 to 12 minutes. Moreover, the cost of an evidentiary blood-drug test kit appears to be in the range of several hundred dollars, and it can take months to obtain the results. This is troubling, since drug-impaired driving cases already require more court appearances and take about twice as long to complete as alcohol-impaired driving cases (median length 227 days vs 121 days) (Perreault, 2016, pp. 15-16). By comparison, a roadside or evidentiary alcohol breath test costs pennies and the results are available in a minute.

Unfortunately, there is no inexpensive, quick, simple, and accurate means of screening large numbers of drivers for cannabis at roadside. Given the costs and wait times, it is not feasible to conduct the large number of roadside drug screening and evidentiary blood tests necessary to substantially decrease the prevalence of drug-impaired driving.

Conclusion

Like the 2008 amendments, the 2018 amendments should be viewed as a positive development, in that they will moderately strengthen enforcement and increase detection, charge and conviction rates for cannabis-impaired driving. The deterrent impact of these new provisions will depend in part on whether the provinces and territories enact complementary drug-related roadside administrative licence suspension provisions, and whether federal and provincial governments are willing to make the very substantial financial commitments necessary to maintain relatively high rates of roadside oral fluid drug screening. However, it remains to be seen whether the new cannabis-related driving provisions will halt, let alone reverse, the increasing incidence of driving after cannabis use.

References

Asbridge, A., & Ogilvie, R. (2015). *A Feasibility Study of Roadside Oral Fluid Testing*. Oakville, ON: MADD Canada.

Beasley, E., & Beirness, D. (2014). *Alcohol and Drug Use Among Drivers Following the Introduction of Immediate Roadside Prohibitions in British Columbia: Findings from the 2012 Roadside Survey*. Victoria, BC: Office of the Superintendent of Motor Vehicles.

Beirness, D., & Beasley, E. (2018). *Alcohol and Drug Use by Drivers in Ontario: Findings from the 2017 Roadside Survey*. Ottawa, ON: Beirness & Associates, Inc.

Beirness, D., & Porath, A. (2017). *Clearing the Smoke on Cannabis – An Update*. Ottawa, ON: Canadian Centre on Substance Abuse.

Bill C-46, *An Act to amend the Criminal Code (offences relating to conveyances) and to make consequential amendments to other Acts*, S.C. 2018, c. 21.

Brubacher, J.R., Chan, H., Erdelyi, S., Asbridge, M., Mann, R.E., Purssell, R.A., & Solomon, R. (2018). Police documentation of drug use in injured drivers: Implications for monitoring and preventing drug-impaired driving. *Accident Analysis and Prevention*, *118*, 200-206.

Canadian Society of Forensic Science, Drugs and Driving Committee. (2017). *Drug-Screening Equipment – Oral Fluid Standards and Evaluation Procedures*. Ottawa, ON: Author.

Criminal Code, R.S.C. 1985, c. C-46.

Department of Justice Canada. (2003). *Drug-Impaired Driving: Consultation Document*. Ottawa, ON: Author.

Hildebrand, D., Kellosalmi, M., Moore, J., Chan, E., & Hasman, D. (2008). *Oral Fluid Testing Devices – Validation of Selected Commercial Products for Future Roadside Screening for Drugs.* Ottawa, ON: Canadian Police Research Centre.

Perreault, S. (2016). *Impaired Driving in Canada, 2015*. Ottawa, ON: Statistics Canada.

R. v. Abbasi-Rad, 2016 ONCJ 542.

R. v. Bingley, 2017 SCC 12.

Robertson, R.D., Mainegra Hing, M., Pashley, C.R., Brown, S.W., & Vanlaar, W.G.M. (2017). Prevalence and Trends of drugged driving in Canada. *Accident Analysis and Prevention, 99,* 236-241.

Robertson, R., Vanlaar, W., & Simpson, H. (2009). *National Survey of Crown Prosecutors and Defence Counsel on Impaired Driving*. Ottawa, ON: Traffic Injury Research Foundation. Solomon, R., & Chamberlain, E. (2014). Canada's New Drug-Impaired Driving Law: The Need to Consider Other Approaches. *Traffic Injury Prevention, 15*(7), 685-693.

Solomon, R., Chamberlain, E., & Vandenberghe, M. (2018). Canada's New Cannabis-Related Driving Legislation: The Elusive Quest for an Effective Deterrent. *Canadian Criminal Law Review, 23*, 265-290.

Solomon, R., Ellis, C., & Zheng, C. (2018). *Cannabis and Other Drugs Among Drivers of Highway Vehicles Dying Within 30 Days of a Crash on a Public Road: Canada, 2014*. Oakville, ON: MADD Canada.

Statistics Canada. (2018). *CANSIM Table 35-10-0177-01: Incident-based crime statistics, by detailed violations*. Ottawa, ON: Author.

Stough, C., Boorman, M., Ogden, E., & Papafotiou, K. (2006). *An Evaluation of the Standardised Field Sobriety Tests for the detection of impairment associated with cannabis with and without alcohol*. Payneham, SA: National Drug Law Enforcement Research Fund.

Traffic Injury Research Foundation. (2017). *Marijuana Use Among Drivers in Canada, 2000- 2014*. Ottawa, ON: Author.

Clusters of Driving Risk Behaviors Among Brazilian Drivers

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Abstract

Background: Risky drivers present heterogeneous profiles and personality traits. No data regarding the identification of these clusters exist in Brazil; therefore, deterrence efforts will be less focused and effective. **Objective:** To identify driving risk behavior (DRB) clusters in Brazilian drivers and examine differences in drug use.

Methods: A total of 6,392 drivers were recruited by convenience in public spaces (e.g. supermarkets, gas stations, shopping malls) of five Brazilian cities. A Knowledge, Attitudes, and Practices survey was conducted via face-to-face interviews between 4:00 and 10:00 PM in order to collect information regarding driving behaviors. All recruited drivers were 18 years old or above, and were residents of the interventions cities. An optimal number of clusters for DRB was determined by average silhouette width. A Partition Around Medoids (PAM) algorithm was used to identify groups of car drivers in relation to the following DRB: driving without a seat belt (SB), exceeding the speed limit (SPD), using a cell phone while driving (CELL), and driving after drinking alcohol (DUI). After these clusters were identified, we conducted a descriptive analysis of sociodemographic and drug use profile of each group.

Results: The sample comprised mostly men (63,4%), with a mean age of 43 years, and a mean of 13 years of education. More than 22% of the sample presented episodes of binge drinking in the previous year, and 7,6% reported drug use other than alcohol. Five clusters of DRB were identified. In cluster 1 (20.1%), subjects presented history of CELL; in cluster 2 (41.4%) drivers presented no DRB; in cluster 3 (9.3%), all drivers presented SPD; in cluster 4 (12.5%) drivers presented high percentage of all DRB, and in cluster 5 (16.6%) all drivers presented DUI, with low prevalence of the other DRB. Clusters with DUI (4 and 5) comprised more men (82 and 79%, respectively), with binge drinking (51 and 46%) and drug use in the previous year (13.5 and 8.6%). Cluster 1 had more education years (mean=14.4) and the highest personal income (mean=US$1,335). Cluster 2 had older drivers (mean=46.6 years), and fewer bingers (11%). Cluster 4 had the youngest drivers (mean=34.4 years).

Conclusions: We could classify drivers with different DRB. Overall, alcohol-related clusters are associated with young who frequently binge. This supports behavior heterogeneity among drivers, calling for targeted interventions for these clusters.

Introduction

It is well established that most road traffic injuries (RTI) are consequences of human factors, in particular driving behaviors. According to the World Health Organization, the human behaviors that lead to most RTI are: driving above the speed limit; using cellphone while driving; not using safety devices such as child restraint, helmet and seat belt; and driving under the influence of alcohol and other psychoactive substances (PAS) (WHO, 2019). In this sense, recent evidence suggests that there is a high heterogeneity among risky drivers, and the different combination of these risky behaviors may imply very different profiles of drivers (Brown et al., 2016). Thus, interventions aimed at risky drivers would benefit from a better understanding of the particularities of these individuals - especially in low- and middle-income countries, where evidence is scarce and mortality due to RTI are among the highest.

Due to the fact that traffic behavior is a multifactorial component with non-linear relationships between different variables, the use of complex methods of analysis, such as Machine Learning (ML), could be useful to identify patterns of risks that are difficult to recognize when using traditional methods. Among ML methods, cluster analysis (Xu & WunschII, 2005) is a clinically relevant method because it detects inter-individual differences and the existence of multiple groups, breaking a unidimensional classification (Bora, Veznedaroğlu, & Vahip, 2016; Lee et al., 2017). Thus, the use of this kind of analysis could favor the identification of the clusters of drivers who present different and overlapping patterns of risky behaviors, facilitating the development of more specific and effective interventions. Therefore, we aimed at identifying clusters of driving risk behavior (DRB) in a sample of Brazilian drivers using ML algorithms, and at verifying their differences concerning sociodemographic characteristics and drug use profile.

Method

Data collection, sampling, and procedures

Data presented in this study were collected as part of the Global Road Safety Program Brazil/"Vida no Trânsito" project. In the present analysis, we used secondary data from the interview of Brazilian drivers at public places to understand their knowledge, attitudes, and practices (KAP survey) concerning alcohol/drug use and other behavioral risk factors. The KAP survey was conducted in five Brazilian capitals once between March and May 2014, and again between August and November 2014. While the survey was explicitly designed to better understand drink driving, questions regarding other risk behaviors were also embedded.

The sampling occurred in two stages:

1. Intervention cities were divided into regions along existing municipal divisions. The regions were selected with the assumption that the distribution of drivers therein was equal to that of the general (city-wide) driving population. The number of regions that were sampled varied according to the size of the intervention city.

2. In each of the regions, the data collection teams identified sites in which they could safely approach drivers. Consistent with methods employed in other Global Road Safety Program countries, these sites included: supermarkets, gas stations, shopping malls, fairs, plazas, and public parks. Where needed, the team requested authorization from business owners to conduct the surveys in parking lots or near the entrances/exits of a given establishment. The same data collection sites were maintained for all rounds.

The target population for the KAP survey was drivers registered in each intervention city. Anyone reporting not having driven in the last 12 months, or being a tourist, i.e. from another city, was excluded. Individuals under 18 years were also excluded. The KAP surveys were conducted via face-to-face interviews and all data were entered into an ODK-based structured questionnaire, which was accessed via tablet. Data were collected during five consecutive days, by two different teams, between 4:00 and 10:00 PM - although adjustments were made due to the specificities of each city (i.e. climatic conditions). Data collection teams were comprised of four interviewers and a manager, who in addition to overseeing the data collection process also provided a brief intervention to drivers who reported drinking immediately prior to the interview, and especially if they reported intending to drive after the interview. This intervention consisted of explaining the risks associated with drink driving and offering to the participant the possibility of a safe ride home via a friend or family member, or a taxi voucher.

A total of 12,231 persons were approached during the KAP survey data collection. Of those, 1,308 reported not having driven in the previous 12 months and 1,199 did not accept to participate in the study, ending in a final sample of 9,724 participants.

This study was approved by the Institutional Review Board at the Hospital de Clínicas de Porto Alegre (under N. GPPG 10-0477 - CAAE/CONEP-Brazil:22108813.6.0000.5327). All subjects included in the study signed informed consent.

Data pre-processing

For the present analysis, we selected just the participants who referred to being cars or truck drivers (n=7,439). From those, we excluded 1,045 participants who have not finished the interview and, for that reason presented missing information. Therefore, the final number of participants included in the present analysis was 6,392 drivers. The following variables were used to perform the cluster analysis: a) Driving without seat belt; b) Exceeding the speed limit; c) Using the phone while driving; and d) Driving after drinking alcohol.

Data analysis

We used the algorithm Partition Around Medoids (PAM) (Kaufman & Rousseeuw, 2005) to identify groups of car drivers in relation to behavior risk, using as input the variables presented in the previous section. PAM is a realization of a k-medoids clustering algorithm that groups a set objects into a given number k of clusters. This machine learning technique attempts to minimize the sum of dissimilarities between data points labeled to be in a cluster and its medoid. PAM starts randomly selecting k of the n data points as the medoids. Then, the algorithm repeats the following steps: assigning each data point to the cluster with the closest medoid; for each medoid, randomly select a point, compute the cost of swapping it with the medoid; if the cost decreased, select this new configuration of medoids. PAM ends the computation when there is no change in the assignments.

We have used the Gower's distance to perform the dissimilarities (Gower, 1971). The best number of clusters was determined by analyzing the average silhouette width and the practical interpretation of the clusters. Another internal validation measures were performed to verify the quality of clustering as Dunn and Person-Gamma Indexes (Hassani & Seidl, 2017).

Results

The PAM algorithm returned five clusters of drivers. In Cluster 1 (n=1282, 20.1% - "unsafe cellphone users") all subjects presented a history of cell phone use while driving. Cluster 2 (n=2649, 41.4% - "safe drivers") was comprised of subjects who do not exhibit driving risk behaviors. In Cluster 3 (n=595, 9.3% - "speeders") all drivers presented a history of exceeding the speed limit. In Cluster 4 (n=802, 12.5% - "high-risk drivers"), drivers presented a high percentage of all driving risky behaviors analyzed. Cluster 5 (n=1064, 16.6% - "drunk drivers") was comprised of drivers with history of driving after drinking alcohol, with a low prevalence of other driving risk behaviors. The socio-demographic characteristics, drug use profile and other traffic infractions of each cluster are shown in **Table 1**.

Table 1. Sociodemographic characteristics, drug use profile and traffic infractions among the five clusters of DRB.

	Cluster 1 *Unsafe cellphone users* n=1282 (20.1%)	Cluster 2 *Safe Drivers* n=2649 (41.4%)	Cluster 3 *Speeders* n=595 (9.3%)	Cluster 4 *Risky drivers* n=802 (12.5%)	Cluster 5 *Drunk drivers* n=1064 (16.6%)
Sex [1]					
..Male	714 (55.7)	1446 (54.6)	398 (66.9)	657 (81.9)	838 (78.8)
..Female	568 (44.3)	1203 (45.4)	197 (33.1)	145 (18.1)	226 (21.2)
Age (years) [2]	39.8 ± 12.5	46.6 ± 15	43 ± 15.4	34.4 ± 11.4	40.5 ± 12.7
Years of Education [2]	14.4 ± 3.4	12.8 ± 3.9	12.7 ± 3.9	13.7 ± 3.2	13.8 ± 3.4

Monthly income (R$) [3]	3000 [2000-5000]	2450 [1400-4000]	2500 [1500-4000]	3000 [1700-5000]	3000 [2000-5500]
Proportion of driving years in life (%) [2]	43.2 ± 19	41.6 ± 21.9	41.9 ± 21.2	41.1 ± 18.1	43.8 ± 18.6
Binge drink [1]					
..Binge drinker	177 (13.8)	288 (10.9)	79 (13.3)	408 (50.9)	486 (45.7)
..Don't binge drink	397 (31)	823 (31.1)	154 (25.9)	326 (40.6)	578 (54.3)
..Don't drink	708 (55.2)	1538 (58.1)	362 (60.8)	68 (8.5)	0 (0)
Believes alcohol impair driving [1]	1132 (88.3)	2405 (90.8)	534 (89.7)	530 (66.1)	677 (63.6)
Lifetime accident involvement after dinking	60 (4.7)	66 (2.5)	20 (3.4)	112 (14.0)	89 (8.4)
Drug use[1]*	98 (7.6)	153 (5.8)	35 (5.9)	108 (13.5)	91 (8.6)
Drugged driving[1]*	51 (4.0)	59 (2.2)	11 (1.8)	71 (8.8)	57 (5.3)
Fined for cellphone use while driving [1]*	152 (11.9)	23 (0.9)	15 (2.5)	99 (12.3)	62 (5.8)
Fined for not using seat belt while driving [1]*	61 (4.8)	54 (2)	23 (3.9)	84 (10.5)	47 (4.4)
Fined for speeding [1]*	278 (21.7)	282 (10.6)	142 (23.9)	284 (35.4)	219 (20.6)

[1]Frequency (%); [2]Mean ± standard deviation; [3]Median [Q1-Q3]. *In last year.

Conclusion

The cluster analysis identified five subgroups of drivers with different profiles of DRB engagement. These subgroups differed both on sociodemographic characteristics and drug use profile. In line with international evidence (Brown et al., 2012; Dotta-Panichi, Wagner, & Sarriera, 2013; Flowers et al., 2008; Sanna et al., 2015; Stephens, Bishop, Liu, & Fitzharris, 2017), our study showed that drunken driving-related clusters are associated with male young drivers who frequently binge. They also presented the highest prevalence of PAS use, history of drugged driving in the previous year, and lifetime history of road traffic crashes when compared with the other clusters.

Despite the fact of some limitations, including the reliance on self-report data and the use of a convenience sample, this study offers for the first time an evaluation of multiple DRB in a big sample of Brazilian drivers. Even though cluster results are usually difficult to replicate, this method is being consistently used to identify clusters of drivers with different profiles in order to provide a foundation for public policies. In addition, our results endorse the hypothesis that lower awareness of impairment is correlated with the higher frequency of drunken driving behavior and that in Brazil there is still a lack of traffic enforcement – which can be affirmed by the low prevalence of fines among the clusters with different risky behaviors. In conclusion, the heterogeneity of DRB among our sample highlights the need to develop and evaluate different strategies in order to deter drivers according to cluster profiles.

References

Bora, E., Veznedaroğlu, B., & Vahip, S. (2016). Theory of mind and executive functions in schizophrenia and bipolar disorder: A cross-diagnostic latent class analysis for identification of neuropsychological subtypes. Schizophrenia research, 176(2–3), 500–505. Retrieved February 13, 2019, from https://linkinghub.elsevier.com/retrieve/pii/S0920996416302742

Brown, T. G., Dongier, M., Ouimet, M. C., Tremblay, J., Chanut, F., Legault, L., & Kin, N. M. K. N. Y. (2012). The role of demographic characteristics and readiness to change in 12-month outcome from two distinct brief interventions for impaired drivers. Journal of Substance Abuse Treatment, 42(4), 383–391. Retrieved February 13, 2019, from http://www.ncbi.nlm.nih.gov/pubmed/22119179

Brown, T. G., Ouimet, M. C., Eldeb, M., Tremblay, J., Vingilis, E., Nadeau, L., Pruessner, J., et al. (2016). Personality, Executive Control, and Neurobiological Characteristics Associated with Different Forms of Risky Driving. (E. Yechiam, Ed.)PLOS ONE, 11(2), e0150227. Retrieved January 29, 2017, from http://www.ncbi.nlm.nih.gov/pubmed/26910345

Dotta-Panichi, R. M., Wagner, A., & Sarriera, J. C. (2013). Discriminant Profile of Young Adulthood Driving Behavior among Brazilian Drivers. The Spanish Journal of Psychology, 16, E8. Retrieved February 13, 2019, from http://www.ncbi.nlm.nih.gov/pubmed/23866255

Flowers, N. T., Naimi, T. S., Brewer, R. D., Elder, R. W., Shults, R. A., & Jiles, R. (2008). Patterns of Alcohol Consumption and Alcohol-Impaired Driving in the United States. Alcoholism: Clinical and Experimental Research, 32(4), 639–644. Retrieved February 13, 2019, from http://www.ncbi.nlm.nih.gov/pubmed/18341648

Gower, J. C. (1971). A General Coefficient of Similarity and Some of Its Properties. Biometrics (Vol. 27). Retrieved February 13, 2019, from http://members.cbio.mines-paristech.fr/~jvert/svn/bibli/local/Gower1971general.pdf

Hassani, M., & Seidl, T. (2017). Using internal evaluation measures to validate the quality of diverse stream clustering algorithms. Vietnam Journal of Computer Science, 4(3), 171–183. Springer Berlin Heidelberg. Retrieved February 13, 2019, from http://link.springer.com/10.1007/s40595-016-0086-9

Kaufman, L., & Rousseeuw, P. J. (2005). Finding groups in data : an introduction to cluster analysis. Wiley. Retrieved February 13, 2019, from https://www.wiley.com/en-br/Finding+Groups+in+Data:+An+Introduction+to+Cluster+Analysis-p-9780471735786

Lee, J., Rizzo, S., Altshuler, L., Glahn, D. C., Miklowitz, D. J., Sugar, C. A., Wynn, J. K., et al. (2017). Deconstructing Bipolar Disorder and Schizophrenia: A cross-diagnostic cluster analysis of cognitive phenotypes. Journal of affective disorders, 209, 71–79. Retrieved February 13, 2019, from https://linkinghub.elsevier.com/retrieve/pii/S0165032716320924

Sanna, M. B., Tuqan, A. T., Goldsmith, J. S., Law, M. S., Ramirez, K. D., Liao, D. H., & Moore, A. A. (2015). Characteristics of Older At-Risk Drinkers Who Drive After Drinking and Those Who Do Not Drive After Drinking. Traffic Injury Prevention, 16(2), 104–108. Retrieved February 13, 2019, from http://www.ncbi.nlm.nih.gov/pubmed/24874549

Stephens, A. N., Bishop, C. A., Liu, S., & Fitzharris, M. (2017). Alcohol consumption patterns and attitudes toward drink-drive behaviours and road safety enforcement strategies. Accident Analysis & Prevention, 98, 241–251. Retrieved February 13, 2019, from http://www.ncbi.nlm.nih.gov/pubmed/27770690

World Health Organization - WHO. (2019). Global status report on road safety 2018. WHO. World Health Organization. Retrieved February 13, 2019, from https://www.who.int/violence_injury_prevention/road_safety_status/2018/en/

Xu, R., & WunschII, D. (2005). Survey of Clustering Algorithms. IEEE Transactions on Neural Networks, 16(3), 645–678. Retrieved February 18, 2019, from http://ieeexplore.ieee.org/document/1427769/

Development and Initial Validation of a Measure of Within-Session Change for Impaired Drivers Participating in Remedial Programs

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Abstract

Background: Remedial programs have shown value on several measures, including reduced recidivism and substance use. These findings have involved lengthy, complex studies that are typically not feasible for monitoring effectiveness on an ongoing basis, or for quality assurance purposes. We describe here development and preliminary validation of a brief, within-session measure of change to monitor program impact on an ongoing basis.

Objectives: We constructed a 13-item instrument reflecting content areas shown in previous research or suggested by theory to be related to program outcomes: drinking-driving knowledge, attitudes, negative affect, behavioural intentions, and perceived self-efficacy in avoiding future drink-driving. We conducted preliminary validation studies to determine if these measures capture within-session change, and if that change predicts substance use at 6-month follow-up.

Methods: A sample of 1,647 participants in Ontario's Back on Track (BOT) program completed the 13–item scale immediately before and immediately following participating in their assigned 8-hour Education or 16-hour Treatment program. Another sample of 394 Warn Range offenders completed the scale immediately before and after completing their Education (n=363) or Treatment program (n=31). Using probabilistic matching procedures, pre and post data are being matched to 6-month follow-up data to assess the relationship of within-session change to longer-term behaviour change.

Results: The scale appears sensitive to change immediately following program completion, with beneficial changes for nearly all measures across both Education and Treatment programs. Preliminary results from the probabilistic matching data suggest that some measures of within-session change are predicting change in substance use at 6-month follow-up, with changes in negative affect and self-efficacy being most consistently related. Confirmation with a larger sample is ongoing.

Discussion: The scale can identify positive change immediately following participation in a brief remedial measures program. Preliminary results suggest that this within-session change predicts change in self-reported substance use at 6-month follow-up.

Introduction

The strongest evidence for the beneficial effects of remedial program participation among impaired driving offenders comes from large scale studies assessing the medium to long-term impact of remedial program participation on substance use, recidivism and health outcomes (e.g., Brown et al, 2010; Ma et al, 2015; Mann et al, 1988, 1994; Stoduto et al, 2014; Wells-Parker & Williams, 2002; Wickens et al, 2013). Early evaluations also reported short-term effects of remedial program participation on attitudes and related measures but these measures were criticized for not being related to longer-term outcome measures (Mann et al, 1983). A validated measure of within-session change that is predictive of long-term outcomes would be useful for clinical and evaluation purposes in cases where longer-term follow-ups are not feasible.

However, no validated or standardized measures of within-session change have been reported in the literature.

We report here the development and preliminary validation of a within-session measure of change in remedial programs for drink-driving offenders guided by previous research and theoretical considerations. Items were developed reflecting five general areas: (1) knowledge related to drink-driving; (2) attitudes towards driving after drinking and traffic safety in general; (3) behavioural intentions; (4) self-efficacy, and; (5) negative affect. Measures of *knowledge and attitudes* have long been used as measures of the immediate impact of programs for drinking drivers, and more generally to assess impact of psychoeducational program participation (Mann et al, 1983, 1988). Previous studies have shown that knowledge and attitude measures will change with remedial program participation (Mann et al, 1983). *Behavioural intentions* are an individual's plans or expectations of performing a behaviour at some time in the future, and these are important components of Ajzen and Fishbein's influential theory of behaviour change (Ajzen & Fishbein, 2000). Behavioural intentions have also been shown to be useful predictors of future behaviour, and change in behavioural intentions are related to behavioural change (Webb & Sheeran, 2006). *Self-efficacy* is the belief that one can successfully complete tasks or achieve goals, and is a central construct in Bandura's prominent model of behavioural change (Bandura, 1977). Self-efficacy measures have been identified as important predictors of future behaviour in drink-driving and related programs (Wells-Parker et al, 2000). *Negative affect* consists of negative feelings or emotional states such as depression and anxiety and has been linked theoretically to the impact of remedial measures programs for convicted drinking drivers (Wells-Parker et al, 2009). Research confirms that negative affect is significantly related to program outcomes (Mann et al, 2009; Wells-Parker & Williams, 2002).

The measures of within-session change used in early evaluations of remedial measures programs typically included measures of knowledge and attitudes, which had only modest theoretical justification for linking to longer-term change. Our inclusion of measures of change in behavioural intentions, self-efficacy and negative affect have stronger theoretical justifications for being linked to measures of longer-term change.

We describe here change in these measures over the course of participating in an 8-hour or 16-hour remedial intervention. We also present a preliminary assessment of how change over the course of participating in the remedial intervention is associated with change in the number of drinking days reported between assessment and 6-month follow-up. The number of drinking days has been found previously to be an important indicator of successful remedial program outcome (e.g., Flam-Zalcman et al, 2013; Wickens et al, 2018).

Method

Setting and Samples

This work was conducted as part of the ongoing evaluation of Back on Track (BOT), Ontario's remedial measures program for impaired driving offenders. Individuals who attend BOT as a result of a Criminal Code conviction must complete an assessment, then either an 8-hour Education or 16-hour Treatment workshop depending on their risk category as determined by the assessment, followed six months later by a follow-up interview. Individuals who attend BOT as a result of a roadside Warn Range offence must either complete the Education program (second-time offenders) or the Treatment program (third-time offenders).

The BOT participants included in the first analysis were the 1,647 individuals (Criminal Code and Warn Range offenders) from whom matched pre- and post-workshop questionnaires were collected between September 2011 and October 2012. Of these respondents, 853 completed the Education workshop and 794 completed the Treatment workshop. Ethical concerns regarding anonymity of respondents led to the use of probabilistic matching procedures for linking pre- and post-workshop forms, that involved use of a restricted identifier code for each participant that included only first initial and initial of birth month. As well, it is made clear to all participants that completion of the questionnaires is not mandatory. During this time period, approximately 11,317 individuals completed the BOT program, suggesting that 15 percent of participants completed both pre- and post-workshop forms and their forms were successfully matched. The

participants included in the second analysis were a subsequent sample of 8,300 Criminal Code offenders who participated between 2012 and 2017, for whom matched pre- and post-workshop questionnaire data were available, and whose data were also able to be matched to their assessment and 6-month follow-up data using probabilistic matching procedures.

Pre- and Post-Workshop Questionnaires

Administration of the brief evaluation instrument at the beginning and at the end of each Education and Treatment workshop was incorporated as standard procedure into BOT. Pre- and post-workshop questionnaires were identical and presented participants with a total of 13 items, as summarized in Table 1. All participants were informed that these questionnaires were not part of the official BOT program, and that completion of the questionnaires was completely voluntary.

Statistical Analysis

Data were analyzed using SAS. To assess within-session change, paired-sample t-tests were conducted on all 13 items, contrasting pre- and post-workshop scores. Analyses were conducted for the total sample, as well as for Education and Treatment workshop participants separately. To assess how within-session change related to change in drinking days between assessment and 6-month follow-up, simple regression analyses were conducted for each of the 13 items. The outcome measure was the difference in the number of drinking days between assessment and six months follow-up and the independent measure was the difference between pre- and post-workshop questionnaire scores. Table 2 shows the regression parameter estimates (*beta*), *t* and *p*-values of the model for each item.

Results

Within-Session Change - All Workshop Participants

Table 1 presents the pre- and post-workshop scores for each item for all respondents, Education and Treatment workshops combined. Separate analyses were conducted for participants in the Education Workshop and the Treatment Workshop, with very similar results. In terms of participants' drink-driving knowledge, significant improvement was demonstrated. Participants' mean estimate of the number of drinks an average person can have in two hours and still drive safely went from 1.06 before BOT workshop completion to 0.71 following BOT workshop completion.

Improved affect was also demonstrated by the full sample of participants following program completion. Participants reported feeling less sad or blue and less nervous after BOT completion. Participants also expressed changes in attitudes toward drink-driving, acknowledging the behaviour as dangerous and as representing a major safety problem. Results for the full sample showed improved behavioural intentions to avoid driving after consuming three drinks at a party, as well as just one drink at a party. Interestingly, there was no change in participants' intentions to reduce how much they drink to avoid driving after drinking. The full sample's ratings of both self-efficacy items increased following BOT workshop completion, demonstrating increased confidence in their ability to avoid driving after drinking.

Within Session Change Predicting 6-Month Change in Drinking Days

Table 2 presents preliminary analyses relating within-session change to change in the number of drinking days in the preceeding 90 days between assessment and 6-month follow-up. As can be seen, five of the 13 measures of change between the beginning and the end of the 8 or 16-hour programs showed significant associations with measures of change in the number of drinking days between assessment and 6-month follow-up. Interestingly, no significant relationships between change in knowledge and change in attitudes and change in drinking days were observed. Change in one of the behavioural intention measures, and in one of the self-efficacy measures was significantly associated with change in drinking days. Changes in three of the four measures of negative affect were significantly associated with change in number of drinking days between assessment and follow-up.

Table 1 – **Means, standard deviations, and *t*-tests of pre- and post-workshop questionnaire scores (*n*=1,647)**

Items	Pre-Workshop Mean (SD)	Post-Workshop Mean (SD)	t	p
Knowledge				
The number of drinks an average person can have in two hours and still drive safely is[1]:	1.06 (0.85)	0.71 (0.63)	14.44	<.001
Affect[2]				
I often feel sad or blue	1.54 (0.80)	1.46 (0.75)	4.54	<.001
I am feeling sad or blue now	1.43 (0.78)	1.24 (0.62)	9.58	<.001
I often have feelings of nervousness	1.62 (0.85)	1.52 (0.79)	5.42	<.001
I am feeling nervous now	1.51 (0.81)	1.21 (0.58)	15.34	<.001
Attitude[2]				
Driving after drinking is a dangerous behaviour	3.83 (0.56)	3.95 (0.35)	-7.77	<.001
Driving after drinking is a major safety problem	3.83 (0.57)	3.92 (0.42)	-6.22	<.001
Road safety is a major problem in Ontario	3.35 (0.79)	3.58 (0.73)	-11.96	<.001
Behavioural Intention[2]				
Once I get my license back, I would probably drive if I had only three drinks at a party	1.21 (0.63)	1.14 (0.53)	3.96	<.001
Once I get my license back, I would probably drive if I had only one drink at a party	1.82 (1.06)	1.65 (1.01)	6.34	<.001
I plan to reduce how much I drink to avoid driving after drinking	3.53 (0.88)	3.56 (0.87)	-1.12	0.26
Self-Efficacy[2]				
I am confident that I can avoid driving after any drinking in the future	3.82 (0.60)	3.91 (0.43)	-5.28	<.001
I will be successful in my efforts to avoid driving after drinking in the future	3.88 (0.52)	3.91 (0.45)	-2.49	0.01

[1] Response options ranged from 0-8+

[2] Responses rated on a 4-point Likert-type scale with the labels "1-Strongly Disagree", "2-Somewhat Disagree", "3-Somewhat Agree", and "4-Strongly Agree"

Table 2 – Regression of within-session change measures on change in number of days of alcohol use between assessment and follow-up: Regression parameter (*beta*) estimates

Pre-post session items	Beta (Std. Error)	t	p
1. The number of drinks an average person can have in two hours and still drive safely is:	0.25 (0.23)	1.09	0.27
2. Driving after drinking is a dangerous behaviour.	0.06 (0.30)	0.21	0.83
3. Driving after drinking is a major safety problem.	-0.10 (0.29)	-0.35	0.73
4. Once I get my license back, I would probably drive if I had only three drinks at a party.	0.47 (0.24)	1.92	0.05
5. Once I get my license back, I would probably drive if I had only one drink at a party.	0.15 (0.17)	0.86	0.39
6. I plan to reduce how much I drink to avoid driving after drinking.	-0.09 (0.16)	-0.54	0.59
7. Road safety is a major problem in Ontario.	0.06 (0.22)	0.25	0.80
8. I often feel sad or blue.	0.01 (0.29)	0.05	0.96
9. I am feeling sad or blue now.	0.52 (0.25)	2.08	0.04
10. I often have feelings of nervousness.	0.74 (0.26)	2.83	<0.01
11. I am feeling nervous now.	0.67 (0.23)	2.95	<0.01
12. I am confident that I can avoid driving after any drinking in the future.	0.07 (0.25)	0.26	0.80
13. I will be successful in my efforts to avoid driving after drinking too much in the future.	0.75 (0.30)	2.47	0.01

Discussion

The results of this preliminary evaluation provide support for the use of these pre- and post-workshop questionnaires in assessing the impact of participation in remedial programs for impaired driving offenders, and are consistent with the expectation that the BOT program would exert a beneficial impact on participants. The pre-post results for all 1,647 respondents combined showed that responses to 12 of the 13 items included in pre- and post-workshop questionnaires showed statistically significant change in a positive direction. Only for one question (i.e., "I plan to reduce how much I drink to avoid driving after drinking") was there no significant change. Overall, participants improved in their knowledge of drink-driving, their assessment of how dangerous drink-driving is in Ontario, in how well they expected to be able to avoid driving after drinking, and whether they felt sad or blue or nervous. Very similar results were found for respondents who took the Treatment and Education workshops when viewed separately. These data provide convergent evidence that BOT program participation can exert a beneficial impact on participants, which is consistent with evidence obtained from evaluations that have evaluated change in Criminal Code participants from baseline assessment to 6-month follow-up (Flam-Zalcman et al, 2013; Sharpley et al, 2007; Stoduto et al, 2014; Wickens et al, 2018), as well as evidence from a province-wide assessment of the impact of the introduction of the program on recidivism rates (Ma et al, 2015).

Our preliminary results provide no indication that changes in knowledge and attitude measures are related to longer-term change in drinking days. However, change in measures of negative affect, self-efficacy and behavioural intentions showed relationships with 6-month change in drinking days.

Negative affect measures have been theorized to reflect a dissonance-related state in participants that can motivate behavioural change (Wells-Parker et al, 2009). Negative affect states may also motivate continued drinking and thus relief of these states may be an important goal of interventions (Dill et al, 2007). Previous research suggests that negative affect may signal receptiveness to interventions, can predict 6-month follow-up substance use measures, as well as post-program recidivism rates (Mann et al, 2009; Wells-Parker et al, 2009). The present results provide further support for the significance of negative affect in understanding participants' responses to remedial program participation.

The significance of self-efficacy in behavioural change processes has long been recognized (Bandura, 1977). Wells-Parker et al (2000) observed that drink-drivers participating in a remedial program with higher levels of self-efficacy showed lower recidivism rates over a follow-up interval. Behavioural intentions are considered to be the pathway between attitudes and behaviour change (Ajzen & Fishbein, 2000; Webb & Sheeran, 2006). In a recent meta-analysis of intention-behaviour investigations, Webb and Sheeran (2006) observed that a medium to large change in reported intentions was associated with a small to medium change in behaviour.

While the results of this study provide evidence of program success and validity of the pre- and post-workshop assessment measures, several limitations need to be kept in mind in interpreting these findings. Data are based on self-report, and thus may be subject to associated forms of bias. The number of successful matches of pre- and post-workshop forms was around 15 percent, similar to that observed in other studies involving drink-driving offenders (e.g., Sheehan et al, 2012). Since the match between pre-and post-workshop forms was based on a key provided by the clients, inconsistent use of a key would also have resulted in lower observed participation rates. Other important limitations include the lack of a comparison group, and the use of only one measure of long-term outcome (drinking days).

References

Ajzen, I., & Fishbein, M. (2000). Attitudes and the attitude-behavior relation: Reasoned and automatic processes. *European review of social psychology*, *11*(1), 1-33.

Brown, T. G., Dongier, M., Ouimet, M. C., Tremblay, J., Chanut, F., Legault, L., & Ng Ying Kin, N. M. K. (2010). Brief motivational interviewing for DWI recidivists who abuse alcohol and are not participating in DWI intervention: a randomized controlled trial. *Alcoholism: Clinical and Experimental Research*, *34*(2), 292-301.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84,* 191-215.

Dill, P. L., Wells-Parker, E., Cross, G. W., Williams, M., Mann, R. E., Stoduto, G., & Shuggi, R. (2007). The relationship between depressed mood, self-efficacy and affective states during the drinking driving sequence. *Addictive Behaviors*, *32*(8), 1714-1718.

Flam-Zalcman, R., Mann, R. E., Stoduto, G., Nochajski, T., Rush, B. R., Wickens, C. M., Thomas, R. K., & Rehm, J. (2013). Does an increase in amount of alcohol treatment improve results? A regression-discontinuity analysis. *International Journal of Methods in Psychiatric Research, 22,* 59-70.

Ma, T., Byrne, P. A., Haya, M., & Elzohairy, Y. (2015). Working in tandem: The contribution of remedial programs and roadside licence suspensions to drinking and driving deterrence in Ontario. *Accident Analysis & Prevention*, *85*, 248-256.

Mann, R. E., Anglin, L., Wilkins, K., Vingilis, E. R., MacDonald, S., & Sheu, W.-J. (1994). Rehabilitation for convicted drinking drivers (second offenders): Effects on mortality. *Journal of Studies on Alcohol, 55*, 372-374.

Mann, R. E., Leigh, G., Vingilis, E. R., & De Genova, K. (1983). A critical review on the effectiveness of drinking-driving rehabilitation programmes. *Accident Analysis & Prevention*, *15*(6), 441-461.

Mann, R. E., Stoduto, G., Flam Zalcman, R., Nochajski, T. H., Hall, L., Dill, P., & Wells-Parker, E. (2009). Examining factors in the Research Institute on Addictions Self-Inventory (RIASI): associations with alcohol use and problems at assessment and follow-up. *International journal of environmental research and public health*, *6*(11), 2898-2918.

Mann, R. E., Vingilis, E. R., & Stewart, K. (1988). Programmes to change individual behaviour: Education and rehabilitation in the prevention of drinking and driving. In M. D. Laurence, J. R. Snortum, and F. E. Zimring (Eds.), *The social control of drinking and driving* (pp. 248-269), Chicago: University of Chicago Press.

Sharpley, J., Flam Zalcman, R., Mann, R. E., Brands, B., & Stoduto, G. (2007). *Outcome evaluation of the Back on Track program: Program impact in alcohol and drug use and related problems. Report 7.* Toronto: Centre for Addiction and Mental Health.

Sheehan, M., Fitts, M., Wilson, H., & Schramm, A. (2012). *A process and outcome evaluation of the Under the Limit (UTL) therapeutic drink driving program for recidivist and high range offenders.* Queensland, Australia: Centre for Accident Research and Road Safety.

Stoduto, G., Mann, R. E., Flam-Zalcman, R., Sharpley, J., Brands, B., Butters, J., Smart, R. G., Wickens, C. M., Ilie, G., & Thomas, R. K. (2014). Impact of Ontario's remedial program for drivers convicted of drinking and driving on substance use and problems. *Canadian Journal of Criminology and Criminal Justice/La Revue canadienne de criminologie et de justice pénale*, *56*(2), 201-217.

Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin*, *132*(2), 249-268.

Wells-Parker, E., Kenne, D. R., Spratke, K. L., & Williams, M. T. (2000). Self-efficacy and motivation for controlling drinking and drinking/driving: An investigation of changes across a driving under the influence (DUI) intervention program and of recidivism prediction. *Addictive behaviors*, *25*(2), 229-238.

Wells-Parker, E., Mann, R. E., Dill, P. L., Stoduto, G., Shuggi, R., & Cross, G. W. (2009). Negative affect and drinking drivers: a review and conceptual model linking dissonance, efficacy and negative affect to risk and motivation for change. *Current drug abuse reviews*, *2*(2), 115-126.

Wells-Parker, E., & Williams, M. (2002). Enhancing the effectiveness of traditional interventions with drinking drivers by adding brief individual intervention components. *Journal of Studies on Alcohol and Drugs*, *63*(6), 655-664.

Wickens, C. M., Butters, J., Flam Zalcman, R., Stoduto, G. & Mann, R. E. (2013). Alcohol control measures and traffic safety. In P. Boyle, P. Boffetta, W. Zatonski, A. Lowenfels, O. Brawley, H. Burns, & J. Rehm (Eds.), *Alcohol: Science, policy and public health* (pp. 378-388), Oxford, England: Oxford University Press.

Wickens, C. M., Flam-Zalcman, R., Stoduto, G., Docherty, C., Watson, T. M., van der Maas, M., Brands, B., Ilie, G., Matheson, J., Mann, R. E., & Thomas, R. K. (2018). The impact of remedial program participation on convicted drinking drivers' alcohol and other drug use six months following program completion. *International Journal of Mental Health and Addiction, 16,* 598–616.

Development of a Web-Based Drugs and Alcohol Unit as Part of the Traffic Offender Intervention Program in New South Wales, Australia

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Abstract

Background: The NSW Traffic Offender Intervention Program (TOIP) is a pre-sentencing intervention for driver offenders, offered in face-to-face classes only.

Objective: TOP ONLINE is a web-based traffic offender intervention developed in desktop, tablet and smartphone applications. TOP ONLINE overcomes some of the obstacles to high fidelity program implementation concerning content, accessibility, and self-paced learning. This paper details the development and pilot testing of the TOP ONLINE: Drugs and Alcohol Unit.

Method: An existing accredited Drugs & Alcohol session was adapted into the Moodle open-source educational platform (https://moodle.org/). The online unit was field tested with offenders, and was also critiqued by independent assessors with relevant experience. A usability survey and interviews were conducted with offenders and the independent assessors. Usage data captured by the Moodle platform was also reviewed.

Results: Pilot testing of the TOP ONLINE: Drugs & Alcohol Unit was conducted over January 2017-January 2018: 351 offenders were offered the program, 217 (62%) registered, and 158 (45%) commenced the program. Most (148, 94%) offenders who started, completed. Offenders enjoyed the control of when and how they accessed the Unit. The independent assessors approved the content and presentation of the online unit. The Moodle platform logs enabled usage by offenders to be reviewed. Unless unit segments were mandated by the program logic some offenders would skip sections, and focus on assessment items only.

Discussion, Conclusions and Implications: The TOP ONLINE: Drugs & Alcohol Unit shows that web-based learning can be integrated into a traffic offender intervention program successfully. It does not suit all offenders. There can be intervening reasons why even those offenders who express an interest do not access the resource. It is noted that online learning for TOIP, as discussed here, was offered in the context of blended learning opportunities integrating face-to-face, group discussion, home study and online learning.

Background

The NSW Traffic Offender Intervention Program (TOIP) is a major pre-sentencing intervention for drivers who have been caught for driving offences (Faulks, Siskind & Sheehan, 2018). Until recently, the pogram has been offered in face-to-face classes only, and is a fixed program of study regardless of the offences committed. The curriculum is the same for young speeding offenders, for drink drivers, for drug drivers, or for offenders who have driven while suspended or disqualified. As well, up to 1 in 5 offenders attending the program will miss a class, resulting in delays in sentencing and increased costs associated with further adjournments, or else sentencing without prior completion.

Objective

TOP ONLINE is a web-based traffic offender intervention developed to augment and extend TOIP, in desktop, tablet and smartphone applications. The aims of TOP ONLINE are: first, the need to better target traffic offender rehabilitation measures to engage offenders; and, second to address inefficiencies in program delivery and the operation of the Local Court-based Traffic Offender Intervention Program in NSW. TOP ONLINE has been designed to overcome some of the obstacles to high fidelity program implementation concerning content, accessibility, and self-paced learning. This working paper summarises the development and pilot testing of the TOP ONLINE: Drugs and Alcohol Unit.

Method

An existing accredited Drugs & Alcohol face-to-face session was adapted into the Moodle opensource educational platform (https://moodle.org/). The adaptation incorporated the accredited lecture-based curriculum and assessment. The lectures were organised into eleven segments, typically between 4-8 minutes. The accredited curriculum was extended to include additional material, including: an introductory video lecture that described the learning platform and key features; an AUDIT assessment (Allen, Litten, Fertig & Barbor, 1997); an interview with a drugs and alcohol counsellor; examples of public service advertising targeting drink driving and drug driving; a PDF file of the Powerpoint presentation slides used in the Drugs

& Alcohol Unit; and links to resources and relevant information. The online unit was field tested with offenders who were offered the unit as an alternative to attending a face-to-face class. Offenders registered in-class in the week prior to the scheduled drugs and alcohol presentation. They were asked to complete the online unit prior to the face-to-face class, otherwise they had to attend the class as scheduled.

The online unit was also critiqued by independent assessors with relevant road safety, drug and alcohol, legal, or educational experience. A usability survey and interviews were conducted with both offenders and with the independent assessors. Usage data routinely captured by the Moodle platform was also reviewed.

Results

Lesson content

Table 4 shows the lesson content of the Drugs and Alcohol Unit that is offered online. The content differs from many alcohol and other drug interventions, as it is accepted that the offenders attending the program are adults and have experience (or at the least exposure) to alcohol and other drug use. The focus is not on drug and alcohol use prevention, but rather on harm minimisation (cf, e.g., Vogl, Teesson, Newton & Andrews, 2012, for a description of a school-based alcohol use prevention intervention).

Table 1. The lesson content of the TOP ONLINE Drugs and Alcohol Unit

Slides.	Content description
1-19	Drugs other than alcohol Who uses drugs? What is a drug? Availability of drugs - prescription drugs, over-the-counter medications, and common drugs in foods and drinks Off-label drug use Drug effects - tolerance, dependence and withdrawal; Dose-relationships (purity and potency)
20-29	Misuse and abuse of drugs, illicit drug use Drug harms A medical emergency . . . if you're worried about a mate who has taken a drug
30-48	Types of psychoactive drugs Stimulants – Nicotine; Cocaine, amphetamines; Ecstasy (MDMA); Methamphetamine; Caffeine Hallucinogens – LSD, Cannabis (at high doses); Ketamine Depressants – Opiates; Benzodiazepams; Cannabis (at low doses); Anti-histamines; Anti-depressants
49-56	Police enforcement of drug driving NSW Drug driving laws - Driving under the influence of a drug (DUI Drug); Driving with an illicit drug present Police roadside drug testing (MDT)
57-65	Alcohol Depressants – Alcohol; What does alcohol do; Risk and alcohol; Grand Rapids and Fort Lauderdale drink driving studies
66-73	NSW Drink driving laws Driving under the influence of alcohol (DUI Alcohol) Driving with a Prescribed Concentration of Alcohol Random Breath Testing (RBT) NSW Drink driving offences, blood alcohol concentration levels and driver licensing classes Alcohol ignition interlocks
74-88	Managing alcohol use and driving Just don't do it –If you're drinking, don't drive; If you're driving, don't drink Alcohol and standard drinks Alcohol absorption and elimination A case study of alcohol absorption and elimination Statistics on drink driving in NSW Steps to avoid drug driving and drink driving Drug and alcohol awareness – further information

Pilot testing

Pilot testing of the TOP ONLINE: Drugs & Alcohol Unit was conducted over January 2017- January 2019. A total pool of 416 offenders were offered the online program, 255 (61%) registered to participate, and 193 (46%) actually commenced the program. For those offenders who logged in and started, the trial was highly successful: almost all offenders completed (181, 94%), and those who did not complete attended the face-to-face session subsequently.

Table 2. Results from the usability study of offenders who completed the TOP ONLINE Drugs and Alcohol Unit

	Yes	No
Have you taken an online course before	48 %	52 %
Would you take a TOP ONLINE module again	97 %	3 %
What device(s) did you use to access TOP ONLINE		
Desktop	48%	
Tablet /Laptop	10%	
Smartphone	42 %	
(If you used a smartphone, did you download the Moodle app)	(38%)	(63%)
When you logged in, and you saw your dashboard, was it easy to work out what to do	95%	5%
Were the videos appropriate		
They were an appropriate length to watch	100%	0%
The information was clearly presented	98%	2%
The videos were informative and relevant	100%	0%
I enjoyed watching the videos	98%	2%
Did you watch the extra media resources	77%	23%
Did you attempt the self-test quiz about alcohol	100%	0%
Did you download the Drugs & Alcohol presentation	67%	33%

	Poor	Good
Ease of access to TOP ONLINE		
Access to the website	0%	100%
Using your allocated username	0%	100%
Using the password set for you	0%	100%

	Straight away	Within 1-2 days	The next week
You were asked to do the online Drugs & Alcohol Module within a one-week period . . . When did you start the module	4%	47%	49%

	About the same	Shorter	Longer
Compared to the face-to-face classes, did you find that it seemed to take longer or shorter to watch the video lectures and do the assignments and other activities online	41%	54%	4%

Table 2 shows some results from the usability study. While about half of the offenders had not undertaken online study before, almost all indicated that they would take further online study if available. The Moodle platform was seen as being easy to understand and use, and the material presented within the Drugs & Alcohol Unit was well regarded.

Offenders reported that they enjoyed the control of when and how they accessed the Unit, including options such as re-running lecture segments regarding material they did not at first understand fully, being able to assess the unit anytime and anywhere, and the use of smartphones, tablets and desktops as available. The material presented in the online unit was more extensive than that presented in a face-to-face session, but many offenders perceived the time to complete the unit to be shorter.

The offenders' reasons for not accessing the online unit were practical: work, family or social activities intervened or there were problems with accessing the internet. The alternative availability of the face-to-face class as scheduled also influenced the offenders' decision to access the online unit.

The independent assessors approved the content and presentation of the online unit, although one assessor felt that editing was required for the interview with the drug and alcohol counsellor. The logs created by the Moodle platform enabled patterns of use by offenders to be reviewed. The logs showed that unless unit segments were mandated by the program logic some offenders would skip both required lecture sections and other optional sections (the drug and alcohol counsellor interview, examples of public service advertisements), and focus on the assessment items only.

Discussion, Conclusions and Implications

Online interventions to address alcohol and/or other drug use are now common (White, Kavanagh, Stallman, et al., 2010). The development and implementation of the TOP ONLINE: Drugs & Alcohol Unit has demonstrated that web-based learning can be integrated into a broader traffic offender intervention program successfully (see also Wilson, 2015, for a demonstration of a standalone drink driving intervention). However, while TOP ONLINE provides an innovative new platform for the delivery of drug and alcohol education, it does not suit all offenders, and there can be intervening reasons why even those offenders who express an interest do not access the resource.

The development of TOP ONLINE enabled several opportunities to be identified. For example, it may be more appropriate to reorganise the online intervention into separate a Alcohol (Drinkdriving) Unit and a Drugs Other Than Alcohol (Drug driving) Unit to better target the specific offence category of offenders attending TOIP, as no offenders had been charged with both a drink driving and drug driving offence. Another challenge is to ensure that the curriculum is fully delivered to offenders, and thus the settings for the online intervention must require all segments to be viewed (i.e., no 'extension' or discretionary segments). The AUDIT assessment was conducted as a research tool only and the results were not communicated to the offenders. It could be appropriate to provide the AUDIT assessment results to offenders, as this is an oportunity for intervention with those who report their drinking to be at risky or harmful levels (Wilson, 2015).

It is concluded that online learning is a feasible option for traffic offender interventions. It is noted that online learning for TOIP, as discussed here, was offered in the context of blended learning opportunities integrating face-to-face, group discussion, home study and online learning. Importantly, there is an additive effect to the online Drugs & Alcohol Unit, as offenders are required to attend a series of seven face-to-face lecture sessions and group discussions. Drug and alcohol issues are addressed in many other sessions, including sessions addressing policing, managing risks on the road, insurance, and legal aspects.

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References

Allen, J. P., Litten, R. Z., Fertig, J. B., & Babor, T. (1997). A review of research on the Alcohol Use Disorders Identification Test (AUDIT). Alcoholism: Clinical and Experimental Research, 21(4), 613-619.

Faulks, I.J., Siskind, V. & Sheehan, M. (2018). Characteristics of offenders attending a Traffic Offender Intervention Program in New South Wales, Australia. In: 2018 Australasian Road Safety Conference, 3-5 October 2018, Sydney, Australia.

Vogl, L. E., Teesson, M., Newton, N. C., & Andrews, G. (2012). Developing a school-based drug prevention program to overcome barriers to effective program implementation: The CLIMATE schools: Alcohol module. Open Journal of Preventive Medicine, 2(3), 410-422.

White, A., Kavanagh, D., Stallman, H., Klein, B., Kay-Lambkin, F., Proudfoot, J., Drennan, J., Connor, J., Baker, A., Hines, E. and Young, R. (2010). Online alcohol interventions: A systematic review. Journal of Medical Internet Research, 12(5).

Wilson, H. (2015). An innovative online intervention: The Steering Clear First Offender Drink Driving Program. In: 2015 Australasian Road Safety Conference, 14-16 October 2015, Gold Coast, Qld.

Drug Driving in Ireland Following the Introduction of *Per Se* Legislation: Lessons Learned in an International Context

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Abstract

Context: The Road Traffic Act 2016 legislated for per se blood levels for drugs driving and police preliminary drug testing in oral fluid.

Objectives: To assess the results of an integrated approach to driving under the influence of drugs (DUID) from medical, scientific, legislative, enforcement and prosecutorial perspectives to harmonise closely these areas of activity and expertise for successful road safety strategy in DUID and to review measurables over a two-year period.

Key Outcomes: Evidence on review of data since April 2017 shows that the level of detection of DUID has increased. The number of specimens for laboratory confirmation for cannabis and cocaine has risen significantly. Collaboration with the regulatory authority for medicines and with pharmacy and medical practice remains essential. Medical exemption provisions for medicinal cannabis have not been availed of by drivers to any significant extent. Prosecutions under the new measures have been successful but have generated new questions. The uptake of testing of oral fluid while significant is lower than anticipated. This information has fed back into police operational practice; medical and pharmacy practice; medicines regulations; medical fitness to drive assessment criteria; and to the parliament to improve the road safety strategy on DUID.

Discussion: DUID remains an international evidence-based road safety measure. Initiatives against DUID are considered in the holistic context of enforcement and medical fitness to drive. The responsibilities of the driver are part of safe driving initiatives. Recent court judgements have so confirmed. Education of healthcare professionals remains essential. Strategic integrated intoxicant testing includes preliminary alcohol and drug testing; standardised impairment testing; and evidential and forensic laboratory confirmatory testing. Scientific methodology innovations and outcomes are reviewed in parallel. There are strengths and weaknesses in the impact of the legislative measures on road safety particularly in police enforcement arising from this outcome review with policy makers, strategists, police service and the forensic laboratory.

Keywords: DUID, preliminary testing, legislative changes, road safety strategy

Disclosures: None

Introduction: The Road Traffic Act 2016 in Ireland includes *per se* legislation for Cannabis, Cocaine and Heroin in whole blood. This new measure and the roadside and an Garda Siochana (the Irish national police force) station-based preliminary drug testing of oral fluid were introduced in April 2017. This was as a direct result of the actions set out in the national strategy for Ireland, Road Safety Strategy 2013-2020. Action 78 was to "Legislate for the implementation of chemical roadside testing for drugs". Action 124 required the National DUI Forensic Laboratory (the Medical Bureau of Road Safety/"MBRS") to "Evaluate on an ongoing basis the use of roadside drug screening devices".

Objective: To assess, with international comparisons, the results of an integrated approach to DUID from medical, scientific, legislative, enforcement and prosecutorial perspectives in recognition of the necessity to have these areas of activity and expertise in a close harmony as is achievable for successful road safety strategy in DUID. Recent developments in various jurisdictions in the decriminalisation of cannabis for medicinal purposes and for personal use has brought this debate into focus with the overlap between road safety strategy and law, criminal law, forensic science and public health considerations.

Methods: DUID Data for Ireland of the National DUI Forensic Laboratory (the MBRS) from the newly introduced roadside and Police station-based preliminary drug testing devices together with the confirmatory

laboratory (GC-MS-MS /LC-MS-MS) testing results and the national Garda data returns since April 2017 are analysed to assess the outcome and efficacy of these wide-ranging measures.

Results: There has been a significant increase in the number of blood specimens collected since the introduction of the new legislation. The number of specimens requiring laboratory confirmation for cannabis and cocaine has risen significantly. The uptake of testing of oral fluid while significant is lower than anticipated.

The number of Mandatory Intoxicant Testing (MIT) roadside checkpoints (provided for in the update from Mandatory Alcohol Testing checkpoints in the road traffic legislation of 2016 to now include drug testing) in 2018 is presented in Figure 1. The figures for Garda activity in those MIT checkpoints for 2018 are presented in Table 1.

Figure 1.

Month	Total Checkpoints Conducted	Total Breath Tests	Positive Breath Tests	Negative Breath Tests	Total Drug Tests	Positive Drug Tests	Negative Drug Tests
January	4,767	20,287	85	20,202	95	11	84
February	4,811	19,742	95	19,647	91	11	80
March	4,848	22,099	92	22,007	111	18	93
April	5,714	25,755	138	25,617	110	12	98
May	5,913	30,119	193	29,926	186	23	163
June	5,419	26,123	194	25,929	203	26	177
July	5,572	25,842	169	25,673	134	18	116
August	5,273	26,165	135	26,030	163	18	145
September	5,329	25,440	142	25,298	171	25	146
October	5,811	31,336	178	31,158	209	31	178
November	5,440	25,540	101	25,439	221	33	188
December	6,068	34,223	136	34,087	346	43	303
Total	**64,965**	**312,671**	**1,658**	**311,013**	**2,040**	**269**	**1,771**

Mandatory Intoxication Testing Return 2018

Table 1.

A total of 1,417 blood and urine samples were screened for DUID drugs in 2018 as presented in Table 2. These samples were then subject to confirmatory analysis. A total of 1,388 results were confirmed positive in blood (by GC-MS-MS /LC-MS-MS) for cannabis, cocaine and benzodiazepines (to November 2018) as set out in Table 3. A number of drivers were positive for more than one drug and the figures must be interpreted in this context.

	Cannabis	Benzo	Cocaine	Opiate	Amphetamine	Methamphetamine
No.	1052	417	473	310	50	38
%	74%	29%	33%	22%	4%	3%

Table 2. Drug Screening Results 2018

Confirmatory 2018	Cannabis Blood	Cocaine Blood	Benzodiazepines
Total Positive	719	369	300
% Positive	51%	26%	21%
% Male	93%	92%	88%
% Female	7%	8%	12%
Average Age	29	31	33

Table 3. Drug Confirmatory Blood Results 2018 (provisional to end November 2018)

Whilst there have been convictions, consolidated and tabulated information and statistics on prosecutions of DUID before the criminal courts since the implementation of the legislative changes in April 2017 are not yet available from the Garda, prosecution and Court authorities.

Discussion

Driving under the influence of drugs (DUID) must continue to be an evidence-based road safety measure internationally. This paper considers by comparative review recent developments internationally and nationally. In Ireland, preliminary drug testing in oral fluid for cannabis, benzodiazepines, cocaine and opiates and *per se* levels for cannabis, cocaine and heroin were introduced in significant legislative, scientific and enforcement reforms in 2017. The *per se* levels introduced are set out in Table 4.

Drug/Metabolite	Level in Whole Blood
Δ 9 -Tetrahydrocannabinol (Cannabis)	1ng/ml
11-nor-9-carboxy-Δ 9 -tetrahydrocannabinol (Cannabis)	5ng/ml
Cocaine	10ng/ml
Benzoylecgonine (Cocaine)	50ng/ml
6-Acetylmorphine (Heroin)	5ng/ml

Table 4: *per se* levels, section 8 Road Traffic Act 2016 amending sections 4(1)(A) and 5(1)(A) of the Road Traffic Act 2010

Different jurisdictions in Europe have opted for a variety of cut-off concentrations for blood levels of THC (Table 5).

THC ng/ml	Country
1	Belgium Denmark Ireland Luxembourg Netherlands (if other drugs are present)
1.3	Norway (*)
2	Czech Republic United Kingdom
3	Netherlands (if THC only is detected) Norway (*)
9	Norway (*)

Table 5: Legal Cut-off concentrations for blood levels of THC in Europe (EMCDDA & CCSUA May 2018)
(*) In Norway, the severity of the penalty is increased according to the level of THC detected.
Source: Hughes, 2017

As an example of recent DUID changes outside of Europe, the Federal Government of Canada legalised cannabis for sale and personal use in October 2018 under Bill C-45. The Manitoba Justice Minister had called on the Government not to proclaim the legislation until roadside screening was in place. The Transportation Provisions of the Criminal Code (Bill C- 46) in Canada set then introduced reform to set different *per se* levels for cannabis and driving with offences at 2 but less than 5ng THC per ml blood and greater than 5 ng THC per ml blood. It also introduced a hybrid offence for combined THC and alcohol. The legislation came into effect on December 18 2018.

The road safety strategy in Ireland has as an aim a nationwide distribution of Preliminary Drug Testing (PDT) devices for both roadside use and for use in Garda stations. This is achieved by co-operation as between the MBRS and the national Garda force. A diagrammatic representation of the locations of PDT devices and Evidential Breath Testing (EBT) and PDT Garda stations is given in Figure 2. A total of 157 PDT devices are available nationwide to the police which compares with 1,400 Preliminary Breath Testing devices. The number of roadside drug tests and of positive drug tests indicate an increase in the number of MIT checkpoints and in roadside drug testing but the latter remain much smaller in number and together with the very small number of PDT tests carried out in the Garda stations in 2018 show the potential for significant expansion of such testing as envisaged in the road safety strategy and by the facilitating legislative changes.

Figure 2: EBT / PDT Locations in Ireland 2018 with population of 4.9 million

The results from the PDT, screening and confirmatory results indicate that cannabis, cocaine and benzodiazepines are the three most prevalent drugs detected in DUID and that the population is predominantly young, male drivers.

The road safety strategy in tackling the problem and dangers of DUID are linked to the medical fitness to drive requirements. These are now set out in the publicly available document: *Sláinte agus Tiomáint* on Alcohol and Drugs Misuse and Dependence; and also in the *Information Leaflets:* Medicines and Driving & Driving Under the Influence of Illicit Drugs and/or the Abuse of Prescription Drugs. This information is available to physicians, the driver patient and the general public.

The Road Traffic Act 2016 included a novel medical exemption for medicinal cannabinoids, but only if the driver is not impaired (Figure 3). To date, there is no recorded case of the exemption being pleaded by any driver where the *per se* blood level for cannabis has been exceeded. Other jurisdictions are currently looking at similar issues around the legalisation of cannabis for medical and personal use.

Figure 3.

Different jurisdictions have approached the setting *per se* DUID levels in a number of ways. England and Wales opted for levels based on a crash risk formula following a review in 2013 and in legal regulations introduced in 2015. Ireland opted for a zero-tolerance approach based on its 2012 report. It remains critical to safe driving that drivers continue to take their prescribed and over the counter medications in accordance with healthcare advice. Measures
against DUID must be considered in the holistic context of medical fitness to drive over a spectrum of medical conditions. The role and responsibilities of the driver are a part of safe driving initiatives and recent court judgements, including the Supreme Court case of McGarvey v Barr (2009), have confirmed this responsibility. Education of healthcare professionals, particularly doctors and pharmacists, must form part of both undergraduate and postgraduate training. For Garda officers and doctors, impairment evidence remains an intrinsic part of enforcement and practical training of both doctors and police is a core requirement as the existing presence and impairment legislation runs in parallel with the newer *per se* prosecutable offence in all jurisdictions. Integrated intoxicant testing includes preliminary breath alcohol testing; preliminary drug testing; standardised impairment testing; evidential alcohol testing; and forensic laboratory confirmatory testing. This has now been achieved in Ireland with a stringent review of its impact and success or otherwise now underway.

The Drager DrugTest 5000 Analyser was selected following a review of such devices in an MBRS report in 2012 and a subsequent competitive tender within the European Union in 2014. The performance of the devices since their introduction in Ireland cannabis, cocaine, opiates and benzodiazepines (sensitivity and specificity) has been compared to laboratory screening and confirmatory data in the MBRS, the national DUID forensic laboratory, in
2018. Figures show good agreement between the oral fluid testing system and the laboratory findings and these are presented in a Working Paper in the ICADTS T2019 toxicology session. Improvements have also been made in confirmatory analytical techniques (GC-MSMS /LC-MS-MS).

Conclusions

The level of detection of drug driving in Ireland has increased since the legislative changes of 2016 introducing preliminary roadside and police station drug testing, per se levels for certain drugs in whole blood and expanded mandatory intoxicant checkpoint provisions. This has also increased the awareness in the driving population of the availability of detection and enforcement methods at the roadside. There is

potential to increase greatly the number of PDT tests at the roadside and police stations. The analysis of the DUID drug results allows for more targeted awareness road safety campaign strategies to the relevant driver populations. The linkage to medical fitness to drive fits into a more holistic approach to addressing the issues in DUID and road safety.

References

Cusack D, Leavy P and Maguire R. Report on Roadside Drug Testing and Equipment and Related Matters 2012. Retrieved from www.ucd.ie/mbrs/t4media/MBRS%20Roadside%20Drug%20Testing%20Report.pdf

Cusack, Maguire and Kearns. Driving under the influence of drugs: epidemiology, clinical impairment and latest legislative *per se* approach in Ireland and Europe. Presented to International Academy of Legal Medicine Congress, June 2016.

Department of Justice, Canada. Criminal Code Bill C-46. Retrieved from www.justice.gc.ca. Dunlop S, Hayes K, Leavy P, Cusack D, Maguire R (2017). An atmospheric pressure chemical ionisation liquid chromatographic–tandem mass spectrometry method for the analysis of benzodiazepines in urine. *Journal of Chromatography B: Analytical Technologies in the Biomedical and Life Sciences* 1064, 22-27.

Fitzpatrick P, Daly L, Leavy P and Cusack D (2003). Driving Under the Influence of Drugs in Ireland; Results of a Nationwide Survey 2000 – 2001. Retrieved from www.ucd.ie/mbrs/t4media/Drug%20Driving%20Survey%202000-01.pdf

Fitzpatrick P, Dal L, Leavy P and Cusack D (2006). Drinking, Drugs and Driving in Ireland: more evidence for action. *Injury Prevention* 12, 404-408.

Hughes B (2017). Contemporary challenges for regulatory models. European Monitoring Centre for Drugs and Drug Addiction Third International Symposium, Lisbon.

Maguire R, Kennedy A, Gogarty O, Cusack D and Kear H. Driving under the influence of drugs: scientific and technical evaluation and selection of a preliminary drug testing system devices available in the European Union. Presented to International Academy of Legal Medicine Congress, June 2016.

Maguire R et al. (2019). A toxicological review of DUID case work, prior to, and since the introduction of roadside drug testing and per se drug levels in Ireland. Working Paper for ICADTS T2019.

McGarvey v Barr and Delap (2009). Supreme Court of Ireland [2009 No. 144P].

Road Safety Authority (2013). Road Safety Strategy 2013-2020. Retrieved from www.rsa.ie/Documents/About%20Us/RSA_STRATEGY_2013-2020%20.pdf

Road Safety Authority (2018). Slainte agus Tiomaint: Medical Fitness to Drive Guidelines; Chapter 6.1 and 6.2: Alcohol and Drugs Misuse and Dependence. www.rsa.ie/Documents/Licensed%20Drivers/Slainte%20agus%20%20Tiomaint%202018.pdf

Road Traffic Act (Ireland) 2016. Retrieved from www.irishstatutebook.ie

Road Traffic Act (England and Wales) 2014 and The Drug Driving (Specified Limits) (England and Wales) Regulations 2014. Retrieved from legislation.gov.uk.

Wolff K et al (2013). Driving under the influence of drugs: Report from the expert panel on drug driving. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/167971/drug-driving-expert-panel-report.pdf

Drug Use and Different Risk Behaviors Between Men and Women on Brazilian Highways

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Abstract

Background: The literature suggests that men and women have different risk behaviors in traffic. Despite that, there are few studies in Brazil that differentiate these behaviors, especially on the use of psychoactive substances.

Objective: To compare psychoactive substance use and risk behaviors in Brazilian traffic between men and women.

Methods: This is a secondary data analysis of a roadside cross-sectional study about driving behavior that consecutively recruited 2,262 drivers, from two Brazilian capitals. Binary regression analysis was performed for outcome prediction.

Results: The sample consisted mostly of male (84.2%), young adults (33±10 years), who studied until higher education (40.1%). Binary logistic regression analysis showed that men were 1.7 greater chance to have speeding fines (CI: 1.027-2.979, p<0.001), 1.9 greater chance to binge drink (CI: 1.341-2.694, p<0.001), and 1.8 times greater chance to drink and drive (CI: 1.302- 2.566, p<0.001) – having reported 4.5 times more history of accidentally under this condition (CI: 2.201-9.2580, p<0.001), with no difference in perceived risk between groups. In addition, men had a 2.5 greater chance of not wearing a seat belt (CI: 1.387-4.522, p<0.002). On the other hand, women were 1.7 greater chance to use psychoactive substances (CI: 1.009-3.189, p<0.004), of the type Prescription Drugs 15 (80.0). Also, women had 1.2 greater chance of being a passenger of a drunk driver (CI: 1.020-1.644, p<0.003).

Conclusion: Our study shows that men and women provide different types of risk behavior. The greater chance of substance use by women is an alert for traffic safety, since the main focus is usually on male offenders. This evidence may contribute to the construction of more effective strategies in Brazil, as the detection of these substances on highways.

Keywords: risk behavior, traffic, Brazil

Introduction

Traffic collisions (CTs) are among the main external causes of death in Brazil, affecting mainly young men (Malta et al., 2017). In the last decade, studies on traffic have reported risk behaviors responsible for fatal traffic collisions, such as driving under the influence, which enables more personalized interventions, especially amongst the male population (Korn and Bonny-Noach, 2017; Verstraete and Legrand, 2014).

The male role in risky behavior in traffic is not new. It is known that the male population is more likely to engage in risk behaviors, and their representation on risky driving is well proven - not only in developed countries but also in low and middle countries (Brown, Ouimet, Nadeau, Tremblay, & Pruessner, 2015; Pechansky et al., 2012). Despite this, literature suggests that men and women are involved in different risk behaviors, which are important to differentiate. Studies have shown sex differences in driving behavior - women wear seatbelts more often and tend not to drive without a license. On the other hand, men tend to drink and drive and are more aggressive in traffic (Brown et al., 2015; Hennessy & Wiesenthal, 2001; Tsai et al, 2008; McKnight & McKnight, 2003). However, women are increasingly engaging in risky behaviors such as binge drinking and psychoactive

substances use in the last years (Wilsnack et al., 2018; UNODOC, 2016; Bertoni, et al., 2014; Fernandez-Montalvo et al., 2014). In the same way, there has been a growth in women's involvement in fatal collisions, showing that women may also be risking more in traffic than before (Kostyniuk et al., 1998; Mayhew et al., 2003; Tsai et al, 2008), but little is known how this is being expressed in women driving behavior and how women differentiate themselves from men in this aspect.

Because of the emerging evidence on female risk behaviors in traffic, and the notion that males express more risk when driving, enforcement becomes extremely skewed for the approach in males. There are no studies in Brazil that differentiate behaviors among sex, especially on the use of psychoactive substances. Studies exploring sex differences may contribute for the construction of effective and personalized intervention, especially in developing countries. In this study, we aimed at evaluating the use of psychoactive substances and other risk behaviors between men and women in a sample of Brazilian drivers.

Methods

Sample selection and procedures

This is a secondary data analysis of a roadside cross-sectional study about driving behavior that consecutively recruited 2,650 drivers, from two Brazilian capitals – Teresina and Palmas. 338 drivers refused to participate in the study, totaling 2,262 subjects. From August 2011 to July 2013, our team conducted, with technical assistance from the Johns Hopkins International Injury Research Unit (JH-IIRU), five rounds of roadside interviews among drivers stopped at night between 10pm-4am, in sobriety checkpoints, organized by local transit authorities. The subjects were recruited, and individuals who had reported not driving in the past 12 months and under the age of 18 were excluded from the study. The roadside interview covered socio-demographic information from participants such as sex, age, highest level of educational and contextual information from the vehicle as well as a range of items related to risky driving behavior as drug use, drinking and driving, no sit belt use, speeding, among others behaviors. Subjects were interviewed by trained and supervised data collectors and researches.

Data analysis

The variables of this study were purposely selected because they were risk factors for male drivers. The odds ratio of each variable was estimated by a Binary Logistic Regression analysis, for outcome prediction. The variables were analyzed separately as outcomes. Age was used as a quantitative measure. The categorical variables are presented in absolute and relative frequencies. All statistical analyses were completed using Statistical Package for the Social Sciences (SPSS) software version 18.0 (Chicago:SPSS Inc; 2009.).

Results

Sociodemographic characteristics

Table 1 summarizes the sociodemographic characteristics of males (n=1,904) and females (n=358). The sample consisted mostly of male (84.2%), young adults (33±10 years), who studied until higher education (40.1%).

Table 1 - Sociodemographic characteristics in a sample of drivers from Brazil

Variables	Total (n=2,262)	Male (n=1,904)	Female (n=358)	p-value
Age[1]	33 ± 10	33 ± 11	32 ± 9	**<0.002**
Education: years[2]	**12**+907 (40.1)	671 (29.7)	235 (10.4)	**<0.001**

[1] Means ± Standard Deviation.

[2] Values expressed by absolute frequency (%).

Table 2 summarizes the drug use and others risky behaviors among male and female drivers. Binary logistic regression analysis showed that men were 1.7 greater chance to have speeding fines (CI: 1.027-2.979,

p<0.001), 1.9 greater chance to binge drink (CI: 1.341-2.694, p<0.001), and 1.8 times greater chance to drink and drive (CI: 1.302- 2.566, p<0.001) – having reported 4.5 times more history of accidentally under this condition (CI: 2.201-9.2580, p<0.001), with no difference in perceived risk between groups. In addition, men had a 2.5 greater chance of not wearing a seat belt (CI: 1.387-4.522, p<0.002). On the other hand, women were 1.7 greater chance to use psychoactive substances (CI: 1.009-3.189, p<0.004), of the type Prescription Drugs 15 (80.0). Also, women had 1.2 greater chance of being a passenger of a drunk driver (CI: 1.020-1.644, p<0.003).

Table 2 – Drug use and risky behaviors among male and female in a sample drivers from Brazil

Variables	Total (n=2,262)	Male (n=1,904)	Female (n=358)	OddsRatio (CI: 95%)	p- value
Lack of Self Belt Use	1,346 (59.5)	1,186 (62.3)	160 (44.8)	1.387-4.522	**<0.002**
Speeding Fines	220(9.7)	198 (10.4)	22 (6.2)	1.027-2.979	**<0.001**
Being a passenger of a drunk driver	893(39.4)	733 (38.5)	160 (44.8)	1.644-1.020	**<0.002**
Binge Drinking	1,051(47.4)	932 (49.0)	119 (33.5)	1.341-2.694	**<0.001**
Drink and Drive	1,233 (47.0)	1.083 (56.9)	150 (41.9)	1.302-2.566	**<0.001**
Traffic collision for drinking and driving	204(7.7)	196 (10.3)	8 (2.5)	2.201-9.2580	**<0.001**
Psychoactive Substances Use and Driving	69(2.6)	47 (2.5)	22 (6.2)	3.189-1.009	**<0.004**

Values expressed by ¹absolute frequency (%). Odds Ratio= Odds Ratio by Binary Logistic Regression

Discussion and Conclusion

This is the first Brazilian study to evaluate different risk behaviors in traffic between men and women, especially regarding substance use. Although men are currently the largest focus in national and international studies on traffic risk due to their prevalence of involvement in traffic collisions, our study shows that men and women provide different types of risk behavior, with female subjects presenting important attitudes to be evaluated. In our study, behaviors such as drinking and driving, seat belt use, speed fines, binge drinking and traffic collisions for drinking and driving remained predictive of males. However, regarding the use of substances and hitchhiking with drivers who had drunk, being a woman seems to predict these behaviors in Brazil.

Increasingly, women are engaging in more types of risky behaviors, which may also be reflecting on their behavior in traffic. The literature corroborates our findings, showing that women are more exposed to traffic risks in recent years (Tsai, Anderson, & Vaca, 2008). The literature shows that substance use may be associated with practicing other risky behaviors (Korn & Bonny-Noach, 2013), suggesting that drug involvement may exacerbate involvement in risk taking, such as driving under the influence and being a passenger of a drunk driver, found in this study. The Involvement in different types of risk behavior in traffic may be explained by a combination of cognitive and personality factors such as impaired decision making, impulsivity and sensation seeking (Brown et al., 2016; Sloan, Eldred, & Xu, 2014). Despite the diversity of risk behavior in men, women's behaviors are highly impacted in terms of fatality in traffic collisions, given the high mortality in these circumstances.

The greater chance of substance use by women compared to men is an alert for traffic safety, since the main focus is usually on male offenders. Future research focusing on personality traits and cognition in female drivers may assist in preventive measures for these behaviors in traffic. Thus this evidence may contribute to the construction of more effective strategies in Brazil, such as the implementation of detection of psychoactive substance usage amongst drivers on Brazilian highways.

References

Bertoni N, Burnett C, Cruz MS, Andrade T, Bastos FI, Leal E, et al. Exploring sex differences in drug use, health and service use characteristics among young urban crack users in Brazil. Int J Equity Health. 2014;13(1):70. DOI: 10.1186/s12939-014-0070-x

Brown, T. G., Ouimet, M. C., Eldeb, M., Tremblay, J., Vingilis, E., Nadeau, L., … Bechara, A. (2016). Personality, Executive Control, and Neurobiological Characteristics Associated with Different Forms of Risky Driving. *PloS One*, *11*(2), e0150227. https://doi.org/10.1371/journal.pone.0150227

Brown, T. G., Ouimet, M. C., Nadeau, L., Tremblay, J., & Pruessner, J. (2015). Sex Differences in the Personality and Cognitive Characteristics of First-Time DWI Offenders. *Journal of Studies on Alcohol and Drugs*, *76*(6), 928–934. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/26562601

Fernandez-Montalvo J, Lopez-Goñi JJ, Azanza P, Cacho R. Gender differences in drug-addicted patients in a clinical treatment center of Spain. Am J Addict. 2014;23(4):399-406. DOI: 10.1111/j.1521-0391.2013.12117.x

Hennessy, D. A., & Wiesenthal, D. L. (2001). Gender, Driver Aggression, and Driver Violence: An Applied Evaluation. *Sex Roles*, *44*(11/12), 661–676. https://doi.org/10.1023/A:1012246213617

Jessor, R., Turbin, M. S., & Costa, F. M. (1997). Predicting developmental change in risky driving: The transition to young adulthood. Applied Developmental Science, 1, 4–16. Reprinted in Lerner, R. M. (Ed.). Adolescence: Development, diversity, and context. Hamden, Connecticut: Garland

Korn, L., & Bonny-Noach, H. (2013). Health risk and deviant behaviors among students in an academic institution in Israel. International Journal of Child & Adolescent Health, 6(2), 191–201.

Kostyniuk L, Molnar LJ, Eby DW. (1998) Are women taking more risks while driving? A look at Michigan dirvers. In: Proceedings of the Second National Conference in Women's Travel Issues. US Department of Transportation, Washington, DC, pp. 502– 516.

Malta, D. C., Minayo, M. C. de S., Soares Filho, A. M., Silva, M. M. A. da, Montenegro,

M. de M. S., Ladeira, R. M., … Naghavi, M. (2017). Mortalidade e anos de vida perdidos por violências interpessoais e autoprovocadas no Brasil e Estados: análise das estimativas do Estudo Carga Global de Doença, 1990 e 2015. *Revista Brasileira de Epidemiologia*, *20*(suppl 1), 142–156. https://doi.org/10.1590/1980-5497201700050012

McKnight, A. J., & McKnight, A. S. (2003). Young novice drivers: careless or clueless? *Accident; Analysis and Prevention*, *35*(6), 921–925. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12971927

Pechansky, F., Duarte, P. do C. A. V., De Boni, R., Leukefeld, C. G., von Diemen, L., Bumaguin, D. B., … Fuchs, D. F. P. (2012). Predictors of positive Blood Alcohol Concentration (BAC) in a sample of Brazilian drivers. *Revista Brasileira de Psiquiatria (Sao Paulo, Brazil : 1999)*, *34*(3), 277–285.

Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/23429773 Sloan, F. A., Eldred, L. M., & Xu, Y. (2014). The behavioral economics of drunk

driving. *Journal of Health Economics*, *35*, 64–81. https://doi.org/10.1016/j.jhealeco.2014.01.005

Tsai, V. W., Anderson, C. L., & Vaca, F. E. (2008). Young Female Drivers in Fatal Crashes: Recent Trends, 1995–2004. *Traffic Injury Prevention*, *9*(1), 65–69. https://doi.org/10.1080/15389580701729881

United Nations Office on Drugs and Crime. World Drug Report 2016 [Internet]. Viena; UNODOC; 2016. Available from: https://www.unodc.org/wdr2016

Wilsnack, R., Wilsnack, S., Gmel, G., Wolfgang, K. (2018). Gender Differences in Binge Drinking. Alcohol Research, Jan; 39(1): 57–76. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6104960/

ESRA Thematic Report on Driving Under the Influence of Alcohol and Drugs – International Comparison of 32 Countries

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Abstract

Background: Driving under the influence (DUI) of alcohol and drugs constitutes a main cause of road casualties. Public attitudes, legislation, and enforcement measures influence the number of road accidents attributed to DUI. ESRA (E-Survey of Road users' Attitudes) provides recent data on DUI for 32 countries.

Objectives: The objective of this presentation is to give an overview of the ESRA thematic report 'Driving under the influence of alcohol and drugs', which will be released during this ICADTS conference. The report is based on the second edition of the survey (ESRA2), which is currently being conducted; the data and first round of analyses will be available in early 2019.

Methods: Self-declared impaired driving, related attitudes and opinions as well as enforcement experiences, and support for policy measures - all variables collected in ESRA - are compared between countries, genders, and age groups. Logistic regression models explore underlying factors predicting self-declared DUI.

Results: Results from the first ESRA edition (ESRA1; N=38,738) showed that drink-driving was reported by 30% of the drivers and 14% for drug-driving; driving after taking medication that carries a warning concerning the driving ability, by 25%. The national results differ substantially, ranging from 11-43% for alcohol, 3-24% for drugs, and 7-34% for medication. Different factors have been found to be associated with impaired driving, among others 'gender', 'personal acceptability' and 'perceived likelihood of being checked for alcohol and drugs'.

Conclusion: There are notable disparities in the behaviour and attitudes towards impaired driving between the countries and socio-demographic groups. The ESRA project aims at monitoring these differences.

Keywords: driving under the influence; alcohol; drugs; attitude

Disclosure: No relevant affiliations or conflicts of interest exist.

Introduction

Driving under the influence (DUI) of alcohol and drugs constitutes one of the main causes of road casualties. The consumption of impairing substances leads to increased reaction time, lower vigilance, poor judgement and can impair visual functions. Public attitudes, legislation, and enforcement measures influence the number of road accidents attributed to DUI. The ESRA2_2018 survey (E-Survey of Road users' Attitudes) provides recent comparable data on opinions, attitudes, behaviours and enforcement experiences regarding DUI of alcohol and drugs across 32 countries.

The objective of the associated ICADTS presentation is to give an overview of the ESRA thematic report 'Driving under the influence of alcohol and drugs', which will be released shortly before the ICADTS conference (Achermann Stürmer, Meesmann & Berbatovci, 2019). The report is based on the second edition of the survey, which was conducted in 2018. The current paper focusses on the topics 'self-declared DUI of alcohol, drugs and medicines' and 'support for policy measures related to DUI'.

Methods

ESRA2 survey

The ESRA project (E-Survey of Road users' Attitudes) is a joint initiative of road safety institutes, research organisations, public services, and private sponsors, aiming at collecting comparable international and

national data on road users' opinions, attitudes and behaviour with respect to road traffic risks. The project is funded by the partners' own resources and covers countries all over the world.

ESRA is an extensive online panel survey, using a representative sample (at least N=1,000) of the national adult populations in each participating country. A common questionnaire was developed and translated into national language versions. The themes covered are e.g. 'selfdeclared behaviour', 'attitudes and opinions on unsafe traffic behaviour', 'enforcement experiences', and 'support for policy measures'. The survey addresses different road safety topics (e.g. DUI of alcohol, drugs and medicines, speeding, distraction) and targets all types of road users. The first edition of the ESRA survey (ESRA1) took place in 2015-2017. Data were gathered from almost 40,000 road users in 38 countries and reports giving an overview on the results, including on DUI were published (Meesmann, Torfs, Nguyen, Van den Berghe, 2018; Achermann Stürmer, 2016). As mentioned, the present paper is based on the second edition of the global survey (ESRA2_2018), which was carried out in 32 countries, and collected data from more than 35,000 road users (Meesmann, U., & Torfs. K., (2019).

Data analysis

For the purpose of this paper, descriptive analyses were conducted to compare 'self-declared DUI' and 'support for policy measures' across countries, regions, gender and age. Proportions were compared across four regions ('Europe20', 'AsiaOceania5', 'NorthAmerica2', 'Africa5') to determine if there were significant differences between them. The same was done for the gender and age group[*] differences within each region. Note that a weighting of the data was applied to calculate national and regional means. This weighting took into account small corrections with respect to gender and six age groups, as mentioned in footnote 1. In addition, the regional weights took into account the population size of each country in the total set of countries in the given region (United Nations Statistics Division, 2019). SPSS 25.0 was used for all analyses (IMB corp, 2017).

[*]6 age groups: 18-24y, 25-34y, 35-44y, 45-54y, 55-64y, 65y+

Results

The results presented in this paper focus on self-declared DUI of alcohol, drugs and medicines as well as support for policy measures related to drink-driving. The presentation during the ICADTS conference will, furthermore, show results on other themes related to DUI (e.g. acceptability, attitudes, enforcement) as well as explorative analyses on predictors of selfdeclared DUI of alcohol and drugs, based on logistic regression models.

Self-reported driving under influence of alcohol, drugs and medicines

Within the ESRA2 questionnaire, respondents were asked to answer four questions on selfdeclared DUI (see Table 1). Car drivers had to answer on a five-point scale ranging from never to (almost) always. For the purpose of the analysis, the value of 1 was coded as never, and values 2 to 5 were coded as at least once. Table 1 shows the proportion of car drivers who reported DUI at least once in the last 30 days. The three lowest values are highlighted in green, and the three highest values in red.

Table 1: Self-declared driving under the influence of alcohol, drugs and medicines in the last 30 days, by country and region

Over the last 30 days. how often did you as a CAR DRIVER…	drive when you may have been over the legal limit for drinking and driving	drive after drinking alcohol	drive 1 hour after using drugs (other than medication)	drive after taking medication that carries a warning that it may influence your driving ability
	at least once (2-5)	at least once (2-5)	at least once (2-5)	at least once (2-5)
National weighted means				
Australia	8.9%	23.7%	5.9%	13.4%
Austria	14.8%	30.5%	7.3%	22.0%
Belgium	24.2%	33.1%	7.1%	18.1%
Canada	14.5%	25.9%	12.8%	16.7%
Czech Republic	11.9%	7.2%	2.7%	11.5%
Denmark	11.6%	26.7%	4.2%	12.2%
Egypt	13.1%	13.6%	20.3%	20.8%
Finland	4.1%	9.3%	1.7%	13.2%
France	22.3%	28.9%	6.3%	23.2%
Germany	9.0%	18.2%	3.7%	13.0%
Greece	19.3%	27.7%	7.2%	8.4%
Hungary	3.9%	5.4%	2.2%	10.3%
India	19.9%	15.7%	20.4%	26.2%
Ireland	10.7%	12.2%	6.9%	13.8%
Israel	7.6%	11.0%	3.4%	6.1%
Italy	13.6%	20.2%	4.3%	12.6%
Japan	5.0%	3.7%	12.5%	10.9%
Kenya	16.8%	22.7%	16.7%	21.9%
Morocco	14.2%	13.5%	18.0%	20.3%
Netherlands	9.0%	21.1%	5.1%	14.8%
Nigeria	11.9%	17.9%	24.1%	16.1%
Poland	6.4%	6.8%	2.9%	12.8%
Portugal	14.1%	33.9%	4.4%	13.2%
Republic of Korea	8.0%	8.9%	3.5%	19.2%
Serbia	11.0%	19.4%	3.8%	10.4%
Slovenia	16.6%	27.4%	3.5%	6.8%
South Africa	21.4%	32.5%	12.6%	23.4%
Spain	17.1%	24.7%	5.9%	19.6%
Sweden	6.9%	7.7%	4.7%	10.2%
Switzerland	21.5%	33.6%	4.3%	16.2%
United Kingdom	8.8%	17.9%	7.4%	12.9%
United States	11.1%	21.2%	12.1%	15.0%
Regional weighted means				
Europe20	13.1%	20.6%	5.0%	15.0%
AsiaOceania5	17.4%	14.3%	18.3%	23.8%
NorthAmerica2	11.4%	21.7%	12.2%	15.2%
Africa5	15.5%	18.7%	18.0%	20.9%

Note. (1) Reference population: car drivers, at least a few days a month. (2) Weighted means were applied. (3) Three lowest values highlighted in green and three highest values in red.

The results indicate that the proportion of car drivers who report DUI of alcohol, drugs and medication varies across countries and regions. In Europe and North America, the psychoactive substance most frequently reported by car drivers was alcohol (more than 20% in both regions), followed by medication that carries a warning that it may influence driving ability (15% in both regions). Driving under the influence of drugs is clearly lower in these two regions, particularly in Europe (5% vs. 12% in North America). In Asian and African countries, DUI of medication seems to play a bigger role than alcohol and drugs (more than

20% regarding medication and between 14% and 19% regarding alcohol and drugs in both regions). Overall at country level, the highest prevalence rates are found for drink-driving, namely in Portugal (34%), Switzerland (34%) and Belgium (33%)[*], and the lowest for drugdriving (without medication), in Finland (1.7%), Hungary (2.2%) and the Czech Republic (2.7%).

In all regions, men report more often DUI of alcohol and of drugs (other than medication) than women. Only in Asia and Oceania, no significant gender difference was observed. The gender difference was particularly strong in Europe. The greatest difference was found for driving after drinking alcohol in the last 30 days, which was reported by 27% of all male drivers in Europe, compared to 13% of all female drivers (chi-square = 461.45; df = 1; pvalue < 0.001; Cramer's V: 0.174). The association with age differs per substance and per region and is described in more detail in the ESRA2 thematic report on DUI (Achermann Stürmer, Meesmann & Berbatovci, 2019).

Support for policy measures related to drink-driving

Within the ESRA2 questionnaire, respondents were asked to answer three questions on policy measures related to drink-driving (see Table 2). They had to answer on a five-point scale ranging from oppose to support. For the purpose of the analysis, the values 4 to 5 were coded as support, and values 1 to 3, as oppose and neutral.

Table 2 shows the proportions of the respondents who support a certain policy measure. The three lowest values are highlighted in green and the three highest values in red. In all regions, the three alcohol-related policy measures have high support among the respondents, particularly in Africa, as well as in Asia and Oceania. The highest support in all regions can be found for an obligation to install an alcohol 'interlock' for drivers who have been caught drink-driving on more than one occasion (between 79% and 85%). The least supported measure is 'zero tolerance for alcohol (0.0‰) for all drivers', particularly in Europe and North America (below 68% vs. slightly above 80% in the two other regions).

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[*]Note that in all three countries the general legal blood alcohol concentration (BAC) alcohol limit is 0.5 g/l. Thus, driving after drinking a small amount of alcohol is legally allowed (except for certain driver groups e.g. young/novice drivers).

Table 2: Support for policy measures related to drink-driving by country and region

Do you support or oppose a legal obligation to ...	install an alcohol 'interlock' for drivers who have been caught drunk driving on more than one occasion?	have zero tolerance for alcohol (0.0‰) for novice drivers (licence obtained less than 2 years)?	have zero tolerance for alcohol (0.0‰) for all drivers?
	support (4-5)	support (4-5)	support (4-5)
National weighted means			
Australia	84.7%	85.4%	50.6%
Austria	71.6%	83.2%	51.2%
Belgium	76.1%	78.1%	57.6%
Canada	85.0%	85.6%	59.1%
Czech Republic	78.3%	86.1%	73.7%
Denmark	84.5%	69.1%	52.4%
Egypt	85.4%	83.9%	87.8%
Finland	88.6%	69.4%	60.1%
France	73.1%	74.2%	53.3%
Germany	69.0%	84.1%	62.3%
Greece	85.1%	83.9%	67.4%
Hungary	82.5%	87.5%	83.2%
India	83.8%	80.5%	82.0%
Ireland	83.8%	82.6%	74.0%
Israel	82.7%	88.5%	77.3%
Italy	79.7%	53.7%	77.7%
Japan	82.2%	78.9%	78.3%
Kenya	93.9%	88.4%	88.8%
Morocco	80.3%	77.6%	77.1%
Netherlands	79.7%	82.4%	64.9%
Nigeria	91.7%	90.7%	90.8%
Poland	87.2%	79.4%	67.2%
Portugal	82.8%	79.0%	66.1%
Republic of Korea	86.3%	75.4%	72.5%
Serbia	88.4%	91.9%	75.7%
Slovenia	85.8%	92.2%	72.2%
South Africa	86.3%	79.1%	75.1%
Spain	87.2%	89.4%	80.8%
Sweden	86.1%	80.4%	71.5%
Switzerland	65.6%	73.9%	48.8%
United Kingdom	80.5%	80.8%	70.7%
United States	79.8%	79.2%	62.3%
Regional weighted means			
Europe20	78.7%	77.9%	67.3%
AsiaOceania5	83.7%	80.2%	80.5%
NorthAmerica2	80.4%	79.9%	62.0%
Africa5	84.9%	81.7%	82.2%

Note. (1) Reference population: all road users. (2) Weighted means were applied. (3) Three lowest values highlighted in green and three highest values in red.

Gender is significantly associated with the support for measures in most regions. No significant gender difference was observed only for the 'interlock' measure in Asia and Oceania and for a 'zero tolerance for alcohol (0.0‰) for all drivers' in Asia and Oceania as well as in Africa. The gender difference was particularly strong in Europe and North America. The biggest difference was found in North America, where 84% of all female drivers supported a 'zero tolerance for alcohol (0.0‰) for novice drivers (licence obtained less than 2 years)', compared to 76% of all male drivers (chi-square = 18.21; df = 1; p-value < 0.001; Cramer's V: 0.096). In all regions and for all proposed policy measures the results show significant associations with higher age, except for the highest age group (65+) in Africa.

Conclusion

There are notable disparities in self-declared DUI and support for policy measures between the countries and regions, as well as between socio-demographic groups. The national results of self-declared DUI, for example, range from 4-34% for alcohol, 2-24% for drugs, and 7- 26% for medication. In all regions, women tend to report less often DUI of alcohol and of drugs (other than medication) and are more strongly supportive of alcohol-related policy measures than men. Moreover, the results show that in regions with higher proportions of self-declared drink-driving (Europe and North America), support for alcohol-related policy measures tends to be lower. At the country level, this association can also be observed.

References

Achermann Stürmer, Y. (2016). Driving under the influence of alcohol and drugs. ESRA thematic report no. 2. ESRA project (European Survey of Road users' safety Attitude). Bern, Switzerland: Swiss Council for Accident Prevention.

Achermann Stürmer, Y., Meesmann, U. & Berbatovci, H. (2019). Driving under the influence of alcohol and drugs. ESRA2 Thematic report Nr. 2. ESRA project (E-Survey of Road users' Attitudes). Bern, Switzerland: Swiss Council for Accident Prevention.

IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

Meesmann, U., & Torfs. K., (2019). ESRA2 methodology report. ESRA project (E-Survey of Road users' Attitudes). Brussels, Belgium: Vias institute.

Meesmann, U., Torfs, K., Nguyen, H., & Van den Berghe, W. (2018). Do we care about road safety? Key findings from the ESRA1 project in 38 countries. ESRA project (European Survey of Road users' safety Attitudes). Brussels, Belgium: Vias institute.

UNdata, United Nations Statistics Division, 2019.

ESRA: Cross-National Monitoring of Road Users' Attitudes and Performance

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Abstract

Background. Trends in road safety performance and the success of policy measures can be monitored using road safety performance indicators based on accident statistics, road side surveys, or questionnaire surveys. However, results are seldom comparable across countries because of differences in aims, scope, or methodology.

Objectives. ESRA (E-Survey of Road users' Attitudes) is a global cross-national initiative in 46 countries, coordinated by Vias institute. Aim of this initiative is to provide scientific support to road safety policy by generating comparable national data on the current road safety situation. The use of a uniform sampling method and identical questionnaire allows comparisons across countries.

Methods. ESRA is an online panel survey, using a representative sample (N=1,000) of the national adult populations in each participating country. A common questionnaire was developed and translated into national language versions. The themes covered are e.g. self-declared behaviour, attitudes and opinions on unsafe traffic behaviour, enforcement experiences and support for policy measures. The survey addresses different road safety topics (e.g. driving under the influence of alcohol, drugs and medicines, speeding, distraction) and targets all types of road users.

Results. The first edition of the survey (ESRA1) was conducted in three waves (2015,2016,2017) in 38 countries (N=38,738) and in December 2018 the second edition (ESRA2_wave1) will be launched in 32 countries (expected N=32,000). This presentation is intended as an introduction for the special session on ESRA. Main outlines of the project, methodology and some key results will be described.

Conclusions. The fast growth of the ESRA initiative shows the feasibility and added value of a joint data collection by a network of road safety organisations. The intention is to repeat the measurements on a triennial basis and to develop time series. Disclosure. No relevant affiliations or conflicts of interest exist.

Keywords: international survey; road safety; safety culture; attitude

Background

Trends in road safety performance and the success of policy measures can be monitored using road safety performance indicators based on accident statistics, road side surveys, or questionnaire surveys. However, results are seldom comparable across countries because of differences in aims, scope, or methodology. Hence, in 2015, Vias institute (formerly the Belgian Road Safety Institute) launched the ESRA (E-Survey of Road users' Attitudes) initiative to fill this knowledge gap. The current paper as well as the corresponding ICADTS presentation is intended to serve as an introduction for the special session on ESRA. Main outlines of the initiative, the survey methodology and some key results will be described.

The ESRA Initiative

The ESRA Network

ESRA (E-Survey of Road users' Attitudes) is a joint initiative of road safety institutes, research organisations, public services, and private sponsors, aiming at collecting comparable international and national data on road users' opinions, attitudes and behaviour with respect to road traffic risks. ESRA is funded by the partners' own resources and covers countries all over the world. Vias institute in Brussels (Belgium) initiated and coordinates ESRA, in cooperation with a core group of partner organisations from eleven countries (BASt, BFU, CTL, IATSS, IFSTTAR, ITS, KFV, NTUA, PRP, SWOV, TIRF). A first edition of the ESRA survey (ESRA1) was conducted in three waves between 2015-2017[*] (ESRA1; Meesmann, Torfs, Nguyen, & Van den Berghe, 2018). The current paper focusses on the second edition of the ESRA survey, which was conducted in 32 countries in 2018 (ESRA2_2018). 2 almost 40,000 road users in 38 countries across 5 continents

Objectives

The objectives of the ESRA initiative are:

- to provide scientific support for road safety policy at national and international levels; • to make internationally comparable data available on the current road safety situation in countries all over the world;
- to develop a series of reliable, cost-effective and comparable road safety performance indicators;
- to develop time series on road safety performance.

The intention is to repeat this survey every three years and extend it to an increasing number of countries.

*2 almost 40,000 road users in 38 countries across 5 continents

Survey Methodology

Data collection

Online panel survey

ESRA is an extensive online panel survey, using a representative sample (at least N=1,000) of the national adult populations in each participating country. More specifically, ESRA2 is based on a web survey using access panels. This approach has some advantages compared to other survey modes, especially given the international context of the study. These advantages are: (1) self-administered web surveys are less prone to social desirability in responses compared to interviewer-administered surveys, and (2) they also have some practical advantages such as the length of the survey, timing, and costs (De Leeuw, Hox, & Dillman, 2008; Baker, Blumberg, Brick, Couper, Courtright, Dennis, et al. 2010; Goldenbeld, & de Craen, 2013).

Scope and questionnaire

A common questionnaire was developed and translated into 42 national language versions. The survey was programmed in six different characters: Greek, Hebrew, Hindi, Japanese, Korean, and Latin. The main themes covered in the ESRA2 questionnaire are: 'socio-demographic information', 'mobility and exposure', 'self-declared unsafe behaviour in traffic', 'acceptability of safe and unsafe traffic behaviour', 'attitudes towards safe and unsafe traffic behaviour', 'subjective safety and risk perception', 'support for policy measures', 'enforcement', 'road crash involvement', 'vehicle automation', and two bonus questions which were filled in by each national partner. The survey addresses different road safety topics: 'driving under the influence of alcohol, drugs and medicines', 'speeding', 'protective systems (e.g. seat belt use, helmet use)', 'distraction' and 'fatigue'.

Sample and fieldwork

The survey targets all types of road users. The aim is to cover a representative sample of the national adult population of at least 1000 respondents in each country. Hard quotas were used for gender and age distribution during the sampling procedure (United Nations Statistics Division, 2019). The geographical spread of the sample across the country was monitored (soft quota). Four market research agencies (INFAS, Ipsos (formerly GfK), Punto de Fuga, and SSI) organised the fieldwork under the supervision of the Vias institute. The fieldwork was conducted simultaneously in all countries in December 2018.

Figure 1: Geographical coverage of the ESRA2_2018 survey

In total the ESRA2_2018 survey collected data from more than 35,000 road users across 32 countries. Table 1 shows the distribution of the sample by region, gender, and age group. Figure 1 shows the geographical coverage of the survey.

Table 1: Specifications of the sample by region

Region	Sample size	Gender			Age group					
		male	female	other	18-24	25-34	35-44	45-54	55-64	65+
Europe20	23027	48%	52%	0%	10%	16%	17%	18%	16%	24%
AsiaOceania5	5010	50%	49%	1%	19%	23%	20%	15%	11%	12%
NorthAmerica2	1943	49%	51%	1%	12%	18%	16%	18%	16%	19%
Africa5	5056	49%	51%	0%	25%	28%	20%	13%	8%	7%
TOTAL	35036									

Note. (1) Reference population: all road users. (2) Unweighted sample.

Data processing and reporting

The cleaned data files of the market research companies were merged together into one, including the answers of all respondents in 32 countries. The statistical packages used were SPSS 25.0 (IMB corp, 2017) and R (R core team, 2018).

Dichotomisation of the data

The original data were dichotomized in order to minimize the number of answer categories in view of the analyses and dissemination. The dichotomization was done centrally by Vias institute and used in all descriptive analyses of the ESRA2 reports. The dichotomizations and reference categories for each question are indicated in the ESRA2 questionnaire in Meesmann & Torfs (2019).

Regional groups

Four groups were defined in order to compare the results on regional level:

- Europe20: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Serbia, Slovenia, Spain, Sweden, Switzerland, United Kingdom
- NorthAmerica2: Canada, USA
- AsiaOceania5: Australia, India, Israel, Japan, Korea
- Africa5: Egypt, Kenya, Morocco, Nigeria, South Africa

Weighting of the data

Weighting of the data was applied to calculate national and regional means. This weighting took into account small corrections with respect to gender and six age groups: 18-24y, 25-34y, 35- 44y, 45-54y, 55-64y, 65y+. Furthermore, the regional weights took into account the population size of each country in the total set of countries in this region (United Nations Statistics Division, 2019).

Costs and external funding

The costs for the ESRA initiative are kept as low as possible. The main principles to achieve this are: (1) using online panel services; and (2) sharing the analysis work amongst the ESRA partner organisations. The financial resources for the survey costs and the staffing resources for the analyses were secured by the ESRA2 partners own sources.

In most countries, the cost for gathering the data was in the range between 5,000 and 10,000 € (for 1000 respondents). Overall, the out-of-pocket costs for creating the ESRA2_2018 database (32 countries) amounted to around 160,000 €.

The ESRA2 questionnaire was developed by Vias institute in collaboration with the ESRA2 core group partners. National partners were responsible for the translations of the master version into their national language version(s). Furthermore, they were responsible for the validations of the national results and provided contextual information necessary for the interpretation of the results. The analyses of the common data were a joint effort of ESRA2 core group in (BASt, bfu, CTL, IATSS, IFSTTAR, ITS, KFV, NTUA, PRP, SWOV, TIRF, Vias institute), who spent over 60 person months on analysing and producing the common ESRA2 output.

Results and Discussion

ESRA2 output

The results of the ESRA2_2018 survey will be published in a main report (Meesmann et al. 2019), a methodology report (Meesmann & Torfs, 2019), 15 thematic reports on different topics (speeding, distraction (mobile phone use), fatigue, seat belt, child restraint systems, unsafety feeling & risk perception, enforcement, vehicle automation, pedestrians, cyclists, moped drivers and motorcyclists, young road users, elderly road users, and gender aspects), and 32 country fact sheets. Furthermore, ESRA2 partners plan to publish national reports, scientific articles, and conference contributions. A final conference of the ESRA2 project will be held in March 2020 (Paris, France). For more information see: www.esranet.eu .

Example of ESRA2 results – self-declared unsafe traffic behaviour

As an example of ESRA2 results, this paper will present self-declared unsafe traffic behaviour as a car driver. Within the ESRA2 questionnaire respondents were asked to answer 14 questions on self-declared behaviour as a car driver (see Table 2). Car drivers were asked to answer on a fivepoint rating scale ranging from never to (almost) always. For the purpose of the analysis, the value of 1 was coded as never, and values 2 to 5 were coded as at least once. Table 2 shows the proportion of car drivers who reported a certain behaviour at least once in the last 30 days. The three lowest values are highlighted in green and the three highest values in red.

The results show that in Europe and in North America, speeding offences were clearly the most frequently reported unsafe traffic behaviour (between 56% and 72%), while in Africa, Asia and Oceania, the use of a hands-free mobile phone was the most often reported unsafe driving behaviour (67% vs. 55% in Asia and Oceania) in this comparison. In all regions, the results show low percentages of drivers who reported driving under the influence of drugs or alcohol (above the legal limit). The percentage on self-declared driving after drinking alcohol are clearly higher. Note, that in most countries driving after drinking a small amount of alcohol is legally allowed.

Furthermore, the results show big regional difference with respect to not using seat belts or child restraint systems (North America and Europa between 10-18%; Asia, Oceania and Africa between 35% and 48%). Note, that the Asian and Oceanian region is strongly dominated by the Indian sample.

Table 2: Self-declared driving behaviour, drugs and medicines in the last 30 days by country and region

Over the last 30 days, how often did you as a CAR DRIVER …	Regional weighted means			
	Europe20	AsiaOceania5	NorthAmerica2	Africa5
	at least once (2-5)			
drive when you may have been over legal limit for drink-driving?	13%	17%	11%	16%
drive after drinking alcohol?	21%	14%	22%	19%
drive 1 hour after using drugs (other than medication)?	5%	18%	12%	18%
drive after taking medication with warning that it may influence your driving ability?	15%	24%	15%	21%
drive faster than the speed limit inside built-up areas?	56%	43%	59%	43%
drive faster than the speed limit outside built-up areas (but not on motorways/freeways)?	68%	45%	66%	50%
drive faster than the speed limit on motorways/freeways?	62%	46%	72%	51%
drive without wearing your seatbelt?	17%	35%	18%	44%
transport children under 150cm without using CRS (e.g. child safety seat cushion)?	15%	44%	11%	47%
transport children over 150cm without wearing their seatbelts?	13%	47%	10%	48%
talk on hand-held mobile phone while driving?	29%	38%	38%	54%
talk on hands-free mobile phone while driving?	48%	55%	51%	67%
read text message/email or check social media (e.g. Facebook, twitter, etc.) while driving?	24%	37%	36%	47%
drive when you were so sleepy that you had trouble keeping your eyes open?	20%	23%	22%	25%

Note. (1) Reference population: car drivers, at least a few days a month. (2) Weighted means were applied. (3) Three lowest values highlighted in green and three highest values in red. (3) CRS = child restraint systems.

For more results on driving under the influence, see other ICADTS presentation on ESRA and Achermann Stürmer, Y., Meesmann, U. & Berbatovci, H. (2019).

Conclusion

The fast growth of the ESRA initiative shows the feasibility and added value of a joint data collection by a network of road safety organisations. ESRA has become a global initiative which already conducted surveys in 46 countries across 6 continents (ESRA1, ESRA2). The intention is to repeat the measurements on a triennial basis and to develop time series of road safety performance indicators.

References

Achermann Stürmer, Y., Meesmann, U. & Berbatovci, H. (2019) Driving under the influence of alcohol and drugs. ESRA2 Thematic report Nr. 2. ESRA project (E-Survey of Road users' Attitudes). Bern, Switzerland: Swiss Council for Accident Prevention.

Baker, R., Blumberg, S. J., Brick, J. M., Couper, M. P., Courtright, M., Dennis, J. M., et al. (2010). AAPOR Report on online panels. Public Opinion quarterly, 74(4), 711-781

De Leeuw, E. D., Hox, J. J., & Dillman, D. A. (2008). International handbook of survey methodology. New York, NY: Taylor & Francis.

Goldenbeld, C., & de Craen, S. (2013). The comparison of road safety survey answers between web-panel and face-to-face; Dutch results of SARTRE-4 survey. Journal of Safety Research, 46, 13-20.

IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

Meesmann, U., & Torfs. K. (2019). ESRA2 methodology report. ESRA project (E-Survey of Road users' Attitudes). Brussels, Belgium: Vias institute.

Meesmann, U., Torfs, K., Nguyen, H., & Van den Berghe, W. (2018). Do we care about road safety? Key findings from the ESRA1 project in 38 countries. ESRA project (European Survey of Road users' safety Attitudes). Brussels, Belgium: Vias institute.

R Core Team (2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Torfs. K., Meesmann, U., Van den Berghe, W., & Trotta, M. (2016). ESRA 2015 – The results. Synthesis of the main findings from the ESRA survey in 17 countries. ESRA project (European Survey of Road users' safety Attitudes). Brussels, Belgium: Belgian Road Safety Institute.

UNdata, United Nations Statistics Division, 2019.

Ethnolinguistic Variability Among Remedial Program Participants in Ontario

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Abstract

Background: In Ontario, Canada, impaired driving offenders are required to participate in the Back on Track (BOT) remedial program before they are eligible for licence reinstatement. Ontario is one of the most ethnically diverse areas in the world; to effectively respond to the needs of BOT clients it is important to understand ethnic diversity and any language issues that might affect program success.

Objectives: This exploratory work assessed the ethnolinguistic background of BOT participants, including their perceived comfort with participating in the program in English, and whether these factors differed for Criminal Code versus Warn Range participants, or by provider location.

Methods: We present descriptive information on ethnolinguistic characteristics of a sample of 11,779 BOT participants who voluntarily completed an anonymous questionnaire at registration.

Results: The BOT population reflects the ethnic diversity of Ontario. The largest proportion of participants overall are White-North American (62.4%), but substantial numbers of other ethnoracial groups are observed. While most participants report being born in Canada, 24% were born outside of the country. After White-North American, the two largest ethnoracial groups are White-European (12.4%) and South Asian (7.0%). Each provider location appears to represent a community with a relatively unique ethnolinguistic make-up. The large majority of respondents identify English as their primary language, and 98.9% report being completely, very, or moderately comfortable with English. Relative to Warn Range offenders, Criminal Code offenders are more likely to be White-North American, born in Canada, and report English as their primary language.

Discussion: BOT participants are representative of Ontario's ethnolinguistic variability. While it appears that the large majority of BOT clients are comfortable with English, an important minority are not. In response to these findings, BOT client workbooks have recently been translated into Punjabi and Tamil. Further monitoring of the ethnolinguistic characteristics of BOT clients is warranted.

Introduction

Back On Track (BOT) is Ontario's remedial measures program for impaired drivers. The structure of the program is determined by Provincial guidelines. Drinking drivers with a Criminal Code conviction are required to first complete an assessment that measures the severity of their substance-related problems. Individuals whose problems are determined to be less severe, as determined by the assessment, are assigned to an 8-hour Education workshop. Those whose problems are determined to be more severe are assigned to a 16-hour Treatment workshop. Finally, six months following completion of the 8-hour or 16-hour workshop, program participants must complete a 30-minute follow-up interview, typically by telephone. This structure is modified for those entering the program because of Warn Range offenses to exclude the assessment and follow-up interview requirements.

Canada has over 200 ethnic groups and is one of the most ethnically diverse jurisdictions in the world (Chui et al, 2008). Participants in the BOT program thus may represent a number of different ethnocultural groups. As well, 28.5% of the province's population was not born in Canada, and 26.6% of Ontarians are Allophones (people with a mother tongue other than English or French (Statistics Canada, 2013). From its inception, BOT has followed other Provincial government programs in allowing program participants to bring their own interpreters with them when they attend programs. This practice has proven successful in

allowing those with limited understanding of English to participate successfully in the program. Nevertheless, there is a need for more information about the ethnic background of BOT participants and their familiarity with the English language.

New Canadians bring their cultural norms, beliefs and attitudes to Canada, including drinking practices and habits (Agic et al, 2011). There is increasing recognition of the importance of language and culture in government services, including road safety programs (Mental Health Commission of Canada, 2012; Wray, Agic, Bennett-AbuAyyash, et al. 2013; Zeitoun and Al-Masri, 2010), and it is important to understand the cultural and language needs of populations served, including BOT participants. This report presents data from an initial investigation of language and ethnocultural identity among respondents participating in the BOT program. The work is exploratory in nature, and was undertaken to provide insight into ethnocultural diversity among participants of the program, potential language barriers some program participants may be facing, and differences among program providers in the ethnocultural diversity of participants.

Methods

Beginning in November, 2010, all BOT participants were asked to voluntarily complete a brief questionnaire containing questions about language and ethnocultural identity. The ethnicity and language questions were derived from similar questions employed by Statistics Canada and by CAMH in other contexts (e.g., CAMH Monitor telephone survey of the adult population, socio-demographic questions asked of treatment clients). The questions were designed to elicit information about language most comfortable speaking, a comfort level with speaking English, self-identified ethnocultural identity, and country of birth.

Two methods were used to invite BOT participants to complete the ethnolinguistic survey. First, as part of the online registration process, participants were asked if they would be willing to complete the questionnaire voluntarily and anonymously. Those willing to do so could click a link that took them to the form. Second, for those who received a mailed registration package, the ethnolinguistic questionnaire was included, along with an invitation to complete the forms voluntarily and anonymously. These individuals were able to mail the forms back to the BOT office, or could hand in the forms at one of their contacts with program staff.

This report is based on data provided by 10,652 Criminal Code participants and 1,127 Warn Range participants, who completed forms between November, 2010 and October, 2012. While we cannot be certain of the exact total of individuals who had the opportunity to complete the questionnaire, we can estimate it based on the total number of individuals who completed the BOT program (about 22,000). Based on this estimate, the proportion of BOT participants who volunteered to complete the questionnaire was about 50%. This figure should be treated with caution because the exact number of individuals eligible to complete the form during this period was not available, but it nevertheless compares reasonably well with other estimates of participation rates in voluntary surveys (e.g., Mann et al, 2010).

Data collected through participants completing online forms (n=10,682) were imported to a Microsoft Excel dataset. These data were also able to be linked to basic demographic information (i.e., age, sex, program location). This information was not available for data collected by returned paper forms (n=930). Paper forms were scanned using Remark scanning software and imported to a Microsoft Excel dataset. The two datasets were merged for analysis purposes.

The large majority of participants were males (84.2% vs. 15.8% females). Interestingly, in comparison to male respondents, a higher proportion of female respondents were more likely to be Criminal Code participants (16.5%) than Warn Range participants (9.4%). The largest proportion of respondents fell into the 30-44 year-old age group (36.5%). The next largest proportion was found in the under 30 year-old age group (34.4%), followed by those aged 45-59 years (23.6%). Much smaller proportions were found in the 60-74 year-old age group (5.4%) and the 75 years of age and over group (0.2%). In general, Warn Range participants were younger than Criminal Code participants.

Ethnocultural identity and country of birth

Table 1 presents self-reported ethnocultural identity for Criminal Code and Warn Range participants. Overall, the largest proportion of participants identified themselves as White-North American (62.4%), followed by White-European (12.4%) and South Asian (7.0%). Aboriginal (2.8%), Indian-Caribbean (2.5%), and Latin Americans (2.2%) each constituted more than 2% of the sample, with the remaining groups (Black-Caribbean, East Asian, South East Asian, Mixed Background, Middle Eastern, Black-African, Black-North American, and Other) each constituting less than 2% of the sample. Some differences in ethnocultural identity between Criminal Code and Warn Range participants were also seen. White-North American, Aboriginal, Latin American, and those who fell into the Other category appeared more likely to be Criminal Code than Warn Range participants, while those from all other groups appeared more likely to be Warn Range than Criminal Code participants.

Table 1: *Ethnocultural identity by type of participant (data from online and paper forms) ***

Ethnocultural Identity	Criminal Code Participants (N=10652)	Warn Range Participants (N=1127)	TOTAL (N=11779)
White - North American	6600 (64.0%)	517 (47.4%)	7117 (62.4%)
White – European	1277 (12.4%)	141 (12.9%)	1418 (12.4%)
Asian – South	665 (6.5%)	132 (12.1%)	797 (7.0%)
Aboriginal	307 (3.0%)	15 (1.4%)	322 (2.8%)
Indian – Caribbean	242 (2.3%)	41 (3.8%)	283 (2.5%)
Latin American	225 (2.2%)	22 (2.0%)	247 (2.2%)
Black – Caribbean	176 (1.7%)	33 (3.0%)	209 (1.8%)
Asian – East	131 (1.3%)	55 (5.0%)	186 (1.6%)
Asian - South East	134 (1.3%)	37 (3.4%)	171 (1.5%)
Mixed Background	147 (1.4%)	20 (1.8%)	167 (1.5%)
Middle Eastern	108 (1.0%)	29 (2.7%)	137 (1.2%)
Black – African	106 (1.0%)	22 (2.0%)	128 (1.1%)
Other	113 (1.1%)	11 (1.0%)	124 (1.1%)
Black - North American	79 (0.8%)	16 (1.5%)	95 (0.8%)
Total	10310 (100.0%)	1091 (100.0%)	11401 (100.0%)

* - Pearson's chi-square test indicates significant differences among groups, p<.0001

Table 2 summarizes information on country of birth in the sample. Overall, the majority of participants were born in Canada (76.0%), but nevertheless a substantial proportion (24.0%) was born outside of the country. Differences between Criminal Code and Warn Range participants in country of birth were also seen. Criminal Code participants appeared more likely to be born in Canada than Warn Range participants (76.8% vs. 68.3%), while Warn Range participants appeared more likely to be born outside of Canada than Criminal Code participants (31.7% vs. 23.2%).

Table 2: *Birthplace by type of participant (data from online and paper forms) ***

Birthplace	Criminal Code Participants (N=10652)	Warn Range Participants (N=1127)	TOTAL (N=11779)
Canada	8076 (76.8%)	753 (68.3%)	8829 (76.0%)
Elsewhere	2434 (23.2%)	349 (31.7%)	2783 (24.0%)
Total	10510 (100.0%)	1102 (100.0%)	11612 (100.0%)

* - Pearson's chi-square test indicates significant differences among groups, p<.0001

Language and comfort with English

Data on the language that participants reported being most comfortable speaking (referred to herein as primary language) is presented in Table 3. The large majority of respondents reported English as their primary language (90.3%). Primary languages identified by between 1 and 2% of participants were Punjabi (1.1%) and Other (1.7%; the footnote in Table 5 identifies the main ethnocultural identities of participants who responded Other on this question). While some participants responded that each of the other 21 languages represented in the question were their primary language, the proportions were all less than 1%. No significant differences between Criminal Code and Warn Range participants were seen in their self-identified primary language.

Table 4 presents data on the comfort level with English for Criminal Code and Warn Range participants. The large majority of respondents reported that they were completely comfortable with English (93.5%), and most of the rest reported being very comfortable (2.2%) or moderately comfortable (3.1%) with English. Only a very small proportion reported being only a little comfortable (0.7%) or not at all comfortable (0.4%) with English. Differences in comfort level with English were observed between Criminal Code and Warn Range participants. Criminal Code respondents appeared more likely than Warn Range respondents to report being completely comfortable (93.7% vs. 91.4%) with English, while Warn Range respondents appeared more likely than Criminal Code respondents to fall into the remaining categories.

Table 3: Primary language by type of participant (data from online and paper forms)

Primary Language	Criminal Code Participants (N=10652)	Warn Range Participants (N=1127)	TOTAL (N=11779)
English	9288 (90.6%)	954 (87.7%)	10242 (90.3%)
Other [a]	182 (1.8%)	10 (0.9%)	192 (1.7%)
Punjabi	123 (1.2%)	7 (0.6%)	130 (1.1%)
Tamil	90 (0.9%)	17 (1.6%)	107 (0.9%)
French	89 (0.9%)	10 (0.9%)	99 (0.9%)
Spanish	85 (0.8%)	6 (0.6%)	91 (0.8%)
Portuguese	67 (0.7%)	7 (0.6%)	74 (0.7%)
Chinese	49 (0.5%)	21 (1.9%)	70 (0.6%)
Russian	54 (0.5%)	5 (0.5%)	59 (0.5%)
Vietnamese	37 (0.4%)	14 (1.3%)	51 (0.4%)
Serbian	43 (0.4%)	2 (0.2%)	45 (0.4%)
Arabic	22 (0.2%)	5 (0.5%)	27 (0.2%)
Hindi	21 (0.2%)	5 (0.5%)	26 (0.2%)
Korean	20 (0.2%)	4 (0.4%)	24 (0.2%)
Persian/Farsi	17 (0.2%)	4 (0.4%)	21 (0.2%)
Urdu	12 (0.1%)	7 (0.6%)	19 (0.2%)
Gujarati	15 (0.1%)	0 (0.0%)	15 (0.1%)
Tagalog	9 (0.1%)	3 (0.3%)	12 (0.1%)
Albanian	7 (0.1%)	3 (0.3%)	10 (0.1%)
Ojibwa	8 (0.1%)	2 (0.2%)	10 (0.1%)
Greek	5 (0.0%)	1 (0.1%)	6 (0.1%)
Bengali	4 (0.0%)	1 (0.1%)	5 (0.0%)
Dari	5 (0.0%)	0 (0.0%)	5 (0.0%)
Somali	4 (0.0%)	0 (0.0%)	4 (0.0%)
Total	10256 (100.0%)	1088 (100.0%)	11344 (100.0%)

Table 3: *Primary language by type of participant (data from online and paper forms)*

Primary Language	Criminal Code Participants (N=10652)	Warn Range Participants (N=1127)	TOTAL (N=11779)

[a] 'Other' primary language corresponds to participants with the following ethnocultural identities: White-European languages (58.3%), White-North-American(8.6%), Black-African (5.4%), Asian-South East(4.3%), and Middle Eastern (3.2%).

Table 4: *Comfort with English by type of participant (data from online and paper forms)**

Comfort with English	Criminal Code Participants (N=10652)	Warn Range Participants (N=1127)	TOTAL (N=11779)
Completely	9743 (93.7%)	1004 (91.4%)	10747 (93.5%)
Very	225 (2.2%)	33 (3.0%)	258 (2.2%)
Moderately	316 (3.0%)	42 (3.8%)	358 (3.1%)
A little	73 (0.7%)	9 (0.8%)	82 (0.7%)
Not at all	36 (0.3%)	10 (0.9%)	46 (0.4%)
Total	10393 (100.0%)	1098 (100.0%)	11491 (100.0%)

* - Pearson's chi-square test indicates significant differences among groups, p=.0082

Discussion

BOT participants reflect the ethnic diversity of the Ontario population. While the largest proportion of participants overall are White-North American (62.4%), substantial numbers of participants from other ethnocultural groups were observed. As well, while most participants report being born in Canada, nearly a quarter (24%) was born outside of the country. After White-North American, the two largest ethnocultural groups are White-European (12.4%) and South- Asian (7.0%). Smaller proportions of respondents endorse other groups, most notably Aboriginal (2.8%), Indian-Caribbean (2.5%), and Latin American (2.2%). While the number of individuals from specific ethnic groups are small, nevertheless they represent cultures with very different practices and attitudes, including those related to alcohol and driving (e.g., Agic et al, 2011). It is also the case that some of the broad categories used here, such as South-Asian, themselves represent several very distinct cultures and linguistic groups (Agic et al, in press).

The large majority of respondents noted their primary language as English (90.3%). While many other primary languages were also seen, the proportion of respondents endorsing these other languages was small. The most common primary language noted after English was 'Other' (1.7%) followed by Punjabi (1.1%), Tamil (0.9%), French (0.9%), and Spanish (0.8%). This observation suggests that a large majority of program participants appear to be English speakers. This is confirmed by the data on the comfort level with English, with 98.9% of respondents reporting being completely, very, or moderately comfortable with English. Nevertheless, it is important to recognize that 1.1% of participants are only a little or not at all comfortable with English. While this small percentage would seem to suggest that language accessibility is not a significant problem at present, nevertheless it does justify the continuation of the policy of allowing participants to bring personal interpreters. Efforts to improve participants' access to the program may consider identifying some of the major languages where translation of program information may be justified. As with ethnocultural group, there does not appear to be a consistent pattern of primary language group across service providers, other than English being the primary language of the large majority of participants.

We also examined whether there were any differences in ethnocultural group or primary language between Criminal Code and Warn Range offenders. In general, Criminal Code offenders were more likely to be

White-North American, to be born in Canada, to report English as their primary language, and to report higher levels of comfort with English than Warn Range participants. Since Criminal Code offenses involve higher BACs and presumably involve more drinking on the occasion when the offense occurred, these findings are generally consistent with other studies that suggest that those born in Canada or who endorse 'Canadian' as their ethnicity report heavier drinking and higher levels of risky drinking, on average, than those born in other countries or who report belonging to other cultures (Agic et al, 2016).

While these results are of substantial interest, it is important to recognize important limitations in the way that the data were collected and thus in the strength of the conclusions that can be drawn. The constraints that collection of the data could not be construed as program requirements, and also that collection of the data not intrude on time needed to fulfill program requirements, meant that the total number of individuals who were eligible to complete the questionnaire could not be specifically identified but only estimated. Also, the questionnaire was available only in English. Because of this, individuals who are less familiar with English may be less likely to complete it. This could result in an underestimate of the number of individuals who are not familiar with English, or who are from cultural backgrounds with less familiarity with the language.

References

Agic, B., Mann, R. E., & Kobus-Matthews, M. (2011). Alcohol and impaired driving in ethnoracial communities in Ontario: A qualitative investigation. *Drugs: Education, Prevention and Policy, 18*, 116-123.

Agic, B., Mann, R. E., Tuck, A., Bondy, S., Simich, L. & Ilie, G. (2016). Alcohol use among immigrants in Ontario, Canada. *Drug and Alcohol Review, 35*, 196-205.

Chui, T., Tran, K., & Maheux, H. (2008). *Canada's Ethnoracial Mosaic, 2006 Census: Census Year 2006*. Statistics Canada.

Mann, R. E., Stoduto, G., Vingilis, E., Asbridge, M., Wickens, C. M., Ialomiteanu, A., Sharpley, J., & Smart, R. G. (2010). Alcohol and driving factors in collision risk. *Accident Analysis and Prevention, 42*, 1538-1544.

Mental Health Commission of Canada. (2012). *Changing directions, changing lives: The mental health strategy for Canada*. Calgary, AB: Author

Statistics Canada. (2013). *Immigration and ethnocultural diversity in Canada*. National Household Survey, 2011. Catalogue no. 99-010-X2011001

Wray, R., Agic, B., Bennett-AbuAyyash, C., Kanee, M., Lam, R., Mohamed, A., & Tuck, A. (2013). *We ask because we care: The Tri-Hospital + TPH health equity data collection research project*. Toronto: Toronto Public Health/St. Michael's Hospital/Centre for Addiction and Mental Health/Mount Sinai Hospital. http://knowledgex.camh.net/health_equity/Documents/Final%20Complendium%20September%202013.pdf

Zeitoun, N., & Al-Masri, H. (2010). *Culture counts: Meeting the road safety needs of newcomers.* Paper presented at 2010 Canadian Multidisciplinary Road Safety Conference, Niagara Falls, Ontario, June 2010.

Evaluating Individual Psychological Rehabilitation of Offenders.
Part 2: Recidivism Rate After Intervention and Assessment.

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Abstract

Background: At the T2016 congress in Gramado (Brazil) we discussed the rehabilitation program and the follow-up assessment of clients attending our traffic-psychological therapy in the period of 2013 to 2015. Results regarding the rate of recidivism are available now.

Aim: After the withdrawal of the driver's license due to alcohol, drug or significant traffic offenses, the clients must prove their fitness to drive. Seeking counseling from a traffic psychologist is conducive to that end. Before driving privileges are reinstated, German offenders need to pass a medical psychological assessment (MPA) ("Medizinisch-Psychologische Untersuchung MPU"). If a client passes that assessment successfully, he is classified fit to operate a vehicle again and get back their unrestricted driver's license. We would like to introduce the rehabilitation briefly and the result of the evaluation on the basis of MPA results between 2013 and 2017. We were able to evaluate the effectiveness of the rehabilitation program by examining the recidivism rate over a period of 3 years.

Method: The AFN (Association for Education, Advanced Training and Further Education) developed a "traffic psychological therapy" based on Alfred Adler's individual psychology. The AFN's traffic psychological therapy comprises at least 10 hours over a period of at least 6 months. The therapy takes place in individual sessions or in small groups with a maximum of 4 participants and a duration of 18 hours. With the support of the Driving License Agency we were able to monitor former participants regarding any relevant recidivism within 3 years after completing the rehabilitation program.

Results: In total, 384 clients completed the rehabilitation program between 2013 and 2017. Of all the therapy participants, 86 % obtained a positive result in the MPA, 8 % were recommended additional courses and 6 % obtained a negative result. Out of the 219 clients between 2013 and 2015, only 5 persons relapsed. 4 persons, caught drunk-driving and 1 person that was caught under the influence of drugs, committed another alcohol offense. Clients, who were caught under the influence of drugs or clients with significant traffic offenses did not have a relapse within the 3-year period.

Discussion and Conclusions: It became apparent that the overwhelming majority of offenders could restore their fitness to operate vehicles by means of traffic psychological therapy.
After completing the rehabilitation program successfully, the rate of recidivism is 2,3 % within 3 years.

Keywords: Rehabilitation program, recidivism, evaluation, assessment

Background

Germany has a long tradition of rehabilitating habitual traffic offenders. Penalties alone are inadequate protection against reoffending. Attitude and conduct must inevitably be changed permanently.

The driver license will be revoked for
(1) crimes committed under the influence of alcohol (from BAC 0.16 %),
(2) multiple traffic offenses under the influence of alcohol,
(3) consumption of controlled substances,
(4) 8 points or more on the driver license (registered at the Driver Fitness Assessment System) and the driver will be classified as unfit for operating motor vehicles.

The offenders shall restore their fitness to drive during the retention period. Seeking counseling from a traffic psychologist is conducive to that end. Before driving privileges are reinstated, German offenders need to pass a medical psychological assessment (MPA) ("Medizinisch-Psychologische Untersuchung MPU").

A medical psychological assessment is an interdisciplinary examination of a person´s driving fitness that renders of the current state of scientific knowledge relating to a specific situation which is completed by answering a given question.

Every year about 100,000 medical psychological assessments are conducted in Germany, whereby with a total of about 50 million motorists only 0.2 % of the motorists are affected by this measure.

The purpose of the MPA is to assess whether the offender is fit to operate vehicles again.

Aim

In this process, the offenders willing to restore their fitness can be expertly guided by a traffic psychologist. They have to realize the scope of their problems (alcohol, drugs, speeding, etc.) and implement changes in their attitude and behavior.

A traffic psychological rehabilitation method has been developed and evaluated on the basis of MPA results. We would like to introduce the rehabilitation and the result of the evaluation between 2013 and 2017 and the recidivism rate over a period of 3 years.

Method

The AFN (Association for Education, Advanced Training and Further Education) developed a "traffic psychological therapy" based on Alfred Adler's individual psychology. Using the focal lifestyle analysis, each participant is working on the background of their own individual problem. The goal is to eliminate the breeding ground for the symptoms, thereby facilitating safe road use in the future.
Essential parts of the "traffic psychological therapy" are the acquisition and extension of the participant's knowledge, regarding the effect and risks of alcohol and drug consumption, legal regulations like the legal alcohol limit, different point systems or other information. The participants are given homework as well, to ensure that they keep on working on their own, too.

The focal lifestyle analysis is based on the method of individual psychology (IP) founded by the Austrian psychotherapist Alfred Adler. The term "lifestyle" refers to the typical pattern of dealing with difficult tasks and life periods that individuals develop over the course of their lives. However, some persons are not capable of dealing successfully and healthily with disadvantages they experience in their life. They feel inferior and start to "over-compensate" for their problems by seeking power and dominance, losing their flexibility in thinking and coping in the process. Their problems will often increase instead of getting solved and they will experience exhaustion, dissatisfaction, low self-esteem and general a lack of success. The consumption of drugs and alcohol promises – and temporarily provides – a "solution" and relief.

An Intervention can help the affected person address the problem and make their lifestyle clear to them as well as point out that change is possible. The Seminar leader, the individual and the other participants compile the typical lifestyle strategies of each individual and develop new objectives and effective strategies together that make previous consumption behavior redundant.
The main aim is to help the participants of the traffic psychological therapy realize that their "sober behavior" was just as problematic as their "consumptive behavior" and that their offences are directly related to the whole person and their life story.

The AFN's traffic psychological therapy comprises at least 10 hours over a period of at least 6 months. It is implemented in individual or small group (4 participants, 18 hours) therapy.
We were able to evaluate the effectiveness of the rehabilitation program by MPA results and the recidivism rate.

We decided to choose a three-year period after the end of the measure. We define a relevant relapse in the criterion of legal currency:
☐ in the case of an alcohol question: another alcohol offense
☐ in the case of a drug question: a new drug offence or alcohol offense
☐ for questions relating to traffic law: renewed driving disqualification due to general traffic offenses.

Results

384 subjects took part in the evaluation. They completed the traffic psychological therapy between 2013 and 2017. Distribution among the problematic groups: 72 % alcohol, 13 % drugs, 15 % traffic offenses. Of all the therapy participants, 86 % obtained a positive result in the MPA, 8 % were recommended additional courses and 6 % obtained a negative result.
Of the 219 clients between 2013 and 2015, only 5 persons relapsed. 4 persons, caught drunk-driving and 1 person that was caught under the influence of drugs, committed another alcohol offense. Clients, who were caught under the influence of drugs or clients with significant traffic offenses did not relapse within the 3-year period.

Discussion and Conclusions

It has become apparent that the overwhelming majority of offenders could restore their fitness to operate vehicles by means of the traffic psychological therapy.

After completing the rehabilitation program successfully, the rate of recidivism is 2,3 % within 3 years. The next step will be to verify the results of the clients between 2016 and 2018 by relapses within the 3-year period (T2022).

References

Brenner-Hartmann, J., Wagner, T., Mußhoff, F., Hoffmann-Born, H., Löhr-Schwab, S., & Seidl, J. (2014). Assessment of personal resources for safe driving: The principals of medical psychological assessment in Germany. Bonn: Kirschbaum.
http://traffic-psychology-international.eu/wp-content/uploads/2017/05/1923_Assessment-of-personal_E_Book_web.pdf

Spoerer, E., Ruby, M. M., & Jensch, M. (1997). Back to the wheel: Theory and practical experience in the rehabilitation of traffic offenders. Faktor Mensch im Verkehr: Vol. 40. Braunschweig: Rot-Gelb-Grün.

Evaluating the Effectiveness of an Electronic Educational Intervention for Drivers on Alcohol Ignition Interlocks

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Abstract

Background: Alcohol ignition interlock devices (IID) have been effective in reducing alcohol-impaired driving. As drivers with IIDs maintain routine contact with installers, there is a prime opportunity to evaluate provider interventions designed to reduce rates of alcohol-impaired driving. Unfortunately, few studies to date have attempted to evaluate such interventions with this high-risk population.

Objectives: In the current study, we evaluated the effectiveness of the Learn Your Limit (LYL) program for drivers with IIDs. The LYL is an educational intervention is delivered by provider texts and email to IID users to encourage the separation of drinking from driving. This study sought to contrast the performance of participants who received the supplemental LYL program with those in a treatment-as-usual condition.

Methods: Participants (N = 313) were recruited via fliers and were randomly assigned to a treatment-as-usual or LYL conditions. Demographics and measures of performance while on IID were collected and analyzed using a series of multivariate linear regression analyses.

Results: Group assignment was non-significant when predicting total IID lockouts (β)= - .089, p = .251 indicating that LYL participation did not significantly reduce total lockouts. However, when examining multiple high BAC lockouts, group assignment significantly predicted high lockout rates (β)= - .216, p = .005 indicating that those who participated in the LYL program were over 20% less likely to have multiple high BAC lockouts.

Discussion and Implications: Although it did not achieve full success, the LYL program has shown enormous potential. To realize its full potential efforts to improve the delivery of the program, to isolate the program from changes in IID legislation and IID market need to be developed. A partnership with manufacturing companies to ensure consistency of interlocks with use of blue tooth and Wi-Fi for real-time educational lessons and videos would provide a next step opportunity.

Introduction

Drivers convicted of Driving Under the Influence (DUI) are four times more likely to be involved in a fatal crash while impaired by alcohol than an average licensed driver [1]. Alcohol ignition interlock devices (IIDs) are tools that prevent a vehicle from starting when the drivers' Blood Alcohol Content (BAC) is about a specified level. Research has consistently shown that while on the vehicle of a DUI offender, IIDs are more effective than license suspension for controlling recidivism [2, 3] and reducing DUI rates [4-8]. As a result, all 50 U.S. states and Washington D.C. have enacted laws providing for IIDs as a sanction for DUI. Unfortunately, the efficiency of IIDs to prevent alcohol-related crashes is limited at least in part by the failure of the benefits of IIDs while on the offenders vehicles to persist after device removal [9].

While installed on the vehicle, IIDs have been found to reduce recidivism by up to 65% [10]. The reduction in the incidence of recidivism while the IID is in place may indicate that drivers adapted their drinking behaviors to accommodate the IID. This suggests that such adaptive behavior could be potentiated through an integration of treatment with IID programs to minimize relapse after IID removal [9]. Recent developments in IID technology have the potential to provide targeted interventions to IID users, and therefore, to improve participants' IID experiences as well as after the device is removed [11]. New technologies have potential for delivering information to interlock users that can help them in avoiding lockouts and violations and encourage adaptive behaviors while in the interlock program [12]. Despite this potential, however, to our knowledge, there has been no use of automated electronic technology to intervene with active interlock users.

Funded by NIAAA through a Small Business Innovation Research (SBIR) program, an Arizona interlock services provider, Axxess Unlimited, LLC, proposed to produce an intervention designed to expand their communication capability with their clients to transmit prevention and educational messages directly to interlock users via text messages and/or emails with imbedded short video links; these messages were designed to also be easily accessible via the existing client "Dashboard" account as well. The existing system was augmented to include more detailed structured feedback to clients on their behavior and provide educational information covering the technical aspects of using the interlock device, tools and resources to help prevent impaired driving, and behavioral strategies to separate drinking from driving. PIRE independently evaluated the efficaciousness of the intervention to promote adaptive behaviors while on IID. This report presents the outcome of that evaluation.

The electronic intervention.

Typically, interlock companies offer a brief training to their clients on the operational use of the interlock device via vendors at area installation centers. Prior to grant funding, Axxess Unlimited implemented an "onboarding" (enrollment) system that used three short introductory video presentations for all new clients at the time of registration focusing on how the interlock works and how to avoid violations, as well as information on their various service plans.

With funding from the SBIR, this system was extended to allow clients to receive regular detailed *prevention information* and *extended feedback* on specific lockouts and violations. There were specific tailored messages for common violations while on IID.

Study Design and Analyses

Phase I:

Phase I of the SBIR program assessed the feasibility of the educational intervention. Quantitative interlock data were collected and used to compare the experiences of the previous year (2014) interlock clients ($N = 971$, our reference/comparison group) to the 538 enrolled in 2015. Participants in the reference group were exposed to the pre-intervention, basic interlock plan with limited information provided upon enrollment. Comparisons were made on Arizona Motor Vehicle Department (MVD) defined violations (two .08 BAC lockouts) as well as on IID violations (lockouts > .02 BAC and missed retests).

Web Survey to Determine Interest in an Electronic Intervention

A 30-item, confidential web survey of clients was also employed to determine customer assessment of the value of the current Dashboard system and their views on the potential value of the hypothetical addition of educational text messages and emails with video links. Two hundred participants were invited via an email to complete a 10-minute web survey using Survey Monkey for an incentive of $20; 157 clients ultimately completed the survey. The web survey collected information in two key areas: (a) client-centered characteristics (demographics, priors, time in program, lockouts and other violations, fees paid, and reasons for choosing the interlock company); and (b) the extent to which clients used the current program features and Axxess Unlimited's existing Dashboard system (and their reactions to these services—favorable, indifferent, unfavorable). The existing Dashboard system not only allowed clients to access information about appointments and invoices, but to view their interlock log data and contemporaneously record explanations related to any lockouts and violations

Phase II:

Phase II of the SBIR program was set to evaluate the intervention by conducting a random assignment study of clients receiving the electronic intervention with clients receiving basic interlock services. In Phase II, in addition to four introductory educational videos, a series of 12 short prevention and motivational messages, with most including video links (<1 to 3 minutes in length), were developed focusing on a variety of topics including information on how the interlock works, tools to help the customer while on the interlock program, educational pieces on preventing violations, and motivational pieces on separating drinking from driving. These messages were automated and programmed to be delivered via text and/or email at specific times after interlock

installation (e.g., Day 1 after interlock installment, Day 10, Day 25, etc.) over the first 6 months on the interlock. All interlock users in the intervention group were set to receive at least two prevention messages per month (for a total of 12).

The electronic system also delivered targeted *prevention information* and *extended feedback* when individual clients had lockouts and violations. There were specific messages for an early morning positive BAC test; an obvious mouth alcohol failure (a high positive test followed by a low or zero BAC test); and failure to take a running retest.

The Phase II evaluation also included web-based entry and exit surveys to determine the level of participation and perception of the degree to which the intervention might elicit behavioral changes following its removal. Subjects received $30 (which was later increased to $50) for completing the entry survey and $70 for the exit survey. Participants (N = 313) were recruited via fliers and were randomly assigned to a treatment-as-usual or to the electronic intervention. Demographics and measures of interlock performance (MVD defined violations and IID violations) and program satisfaction while on IID were collected and analyzed using a series of multivariate linear regression analyses.

Problems and Barriers

A series of unexpected problems and barriers arose during Phase II, in particular the occurrence of market changes in Arizona which resulted in an increase in the number of interlock providers and subsequently, an increase in competition for the participating interlock company. These developments delayed recruitment and resulted in a lower number of subjects for the study. Between Phases 1 and 2, changes in the state required interlock specifications required a change in interlock devices for the study continuity. Further, the logistics of randomly assigning clients to the intervention or to the comparison group were complicated when judges required that some DUI offenders have access to their Dashboard interlock log information. In addition, despite having been trained, relying on interlock installation personnel to assist with the random assignment plan proved to be problematic. Finally, participants who filled out the Phase II Exit surveys skipped many of the questions related to the intervention.

Results

Phase I:

Table 1 shows that the interlock users in the experimental group had significantly fewer IID-defined (lockouts) and MVD -defined violations than did the interlock users in the comparison group. Using the guidelines proposed by Cohen [13], the corresponding effect size was moderate ($\eta^2 = .0598$) for IID violations and small for MVD violations ($\eta^2 = .0118$). This difference is logical as the requirements to meet an MVD violation are notably more stringent (i.e., BAC levels have to be much higher to count as an MVD violation) than they are to meet an IID violation.

Table 1. Mean number of IID-violations and MVD violations

	Experimental Group (N=538)		Reference Group (N=971)		P value
	Mean	SD	Mean	SD	
IID Violations	1.19	2.85	3.32	4.60	<.001
MVD Violations	0.30	0.84	0.67	1.29	<.001

Experimental and reference group indicate IID clients who in participated of the enhanced program (in 2015), and those who did not (in 2014). IID-violations and MVD-violations refer to violations as established by the settings of the interlock device (IID-violations; BAC ≥ .03) or by the Motor Vehicle Department (MVD-violations; BAC ≥ .08). SD denotes standard deviation.

The web surveys revealed that there was significant potential for several of the electronic intervention features. Participants reported that information placed on the Dashboard, or received via email or text would be useful.

Almost 50% of participants indicated they accessed the Dashboard via their cellphone. Performance incentives were viewed favorably including reduced monthly fees for potentially completing a brief education/treatment session with counselors. Though the treatment sessions were not implemented in the current study, these Phase I results indicated that drivers with IIDs would be receptive to such an intervention with a financial incentive like reduced interlock fees.

Phase II:

MVD-violations and IID-violations.

Group assignment was non-significant when predicting total IID lockouts (β)= - .089, *p* = .251 indicating that intervention participation did not significantly reduce total lockouts. However, when examining incidents of high BAC lockouts (>.08), the intervention group reported about 14% fewer high BAC lockouts than the comparison group. Similarly, group assignment significantly predicted high BAC lockout rates (β)= - .216, *p* = .005 with those who participated in the intervention program were over 20% less likely to have multiple high BAC lockouts.

Web-based process evaluation.

We found no differences between the comparison and intervention conditions on the number of issues clients reported with the device, or the amount of the perceived financial burden. Nevertheless, there was a trend of those in the comparison condition reporting more issues related to having the IID than those in the intervention condition (p = 0.086).

We also assessed indicators of self-reported future behavioral modifications in association with the intervention program. Participants were asked a series of questions assessing whether they felt they needed to change their drinking behaviors, and how they might do so. Interestingly, though neither group was more likely to report problems with their drinking behaviors or express need to change their behaviors when the device was installed on their car, upon removal of the interlock, those in the intervention condition were significantly more likely to endorse items suggesting behavioral adaptations following removal of the device including: "Change where and when you drink?" and "Change who you drink with?" (*t*(-2.01), *p*<.05 and *t*(-2.20), *p*<.05, respectively). This may indicate that those in the intervention condition could be more likely to make meaningful changes following device removal.

Discussion

Despite facing multiple problems , the evaluation suggests that some elements of the electronic intervention implemented while the interlock units were on the offender's vehicles were effective for reducing the most serious violations. We found that regular text and email messages with video links are viable methods for disseminating information to DUI offenders on IIDs – both in terms of getting information to drivers and potentially receiving information from them. The web surveys revealed that the electronic intervention was generally well received, and there was notable interest in several of the program features.

When taken together, results seem to indicate that though the intervention did not decrease the frequency of lockouts relative to the basic program, when participants in the intervention did lock out, fewer of their lockouts were above a legal BAC limit of .08 when compared to the basic condition.

Thus, although it did not achieve full success partially due to the implementation problems and barriers described above, the electronic intervention has shown good potential. To realize the full potential to improve the delivery of such a program, adding targeted electronic educational messages to improve interlock performance will have to be cost effective for interlock companies. A partnership with manufacturing companies to ensure consistency of interlocks with use of blue tooth and Wi-Fi for real-time educational lessons and videos could provide a next step opportunity. Finally, developing brief therapeutic interventions designed to be delivered electronically to IID users may allow for the development of additional adaptive behaviors.

References

Hedlund, J. and J. Fell, *Persistent drinking drivers in the U.S.* Annals of Advances in Automotive Medicine, 1995. 39: p. 1-12.

Willis, C., S. Lybrand, and N. Bellamy, *Alcohol ignition interlock programmes for reducing drink driving recidivism.* Cochran Database of Systematic Reviews, 2004. 18(4): p. CD004168.

Elder, R.W., et al., *Effectiveness of ignition interlocks for preventing alcohol-related crashes: A Community Guide systematic review.* American Journal of Preventive Medicine, 2011. 40(3): p. 362-376.

Marques, P.R., R.B. Voas, and A.S. Tippetts, *Behavioral measures of drinking: patterns from the Alcohol Interlock Record.* Addiction (Abingdon, England), 2003. 98(Suppl 2): p. 13-9.

Voas, R.B., et al., *Evaluation of a program to motivate impaired driving offenders to install ignition interlocks.* Accident Analysis and Prevention, 2002. 34(4): p. 449-455.

Voas, R.B., et al., *Mandating Treatment Based on Interlock Performance: Evidence for Effectiveness.* Alcoholism: Clinical and Experimental Research, 2016. 40(9): p. 1953-1960.

Voas, R.B., et al., *The Alberta Interlock Program: the evaluation of a province-wide program on DUI recidivism.* Addiction (Abingdon, England), 1999. 94(12): p. 1849-59.

Roth, R., R. Voas, and P. Marques, *Mandating interlocks for fully revoked offenders: the New Mexico experience.* Traffic Inj Prev, 2007. 8(1): p. 20-5.

Elder, R.W., et al., *Effectiveness of ignition interlocks for preventing alcohol-impaired driving and alcohol-related crashes: a Community Guide systematic review.* Am J Prev Med, 2011. 40(3): p. 362-76.

Beirness, D. and P. Marques, *Alcohol Ignition Interlock Programs.* Traffic Injury Prevention, 2004. 5(3): p. 299-308.

Zador, P.L., et al., *The effects of closer monitoring on driver compliance with interlock restrictions.* Accident; analysis and prevention, 2011. 43(6): p. 1960-7.

Voas, R.B., *Enhancing the Use of Vehicle Alcohol Interlocks With Emerging Technology.* Alcohol research : current reviews, 2014. 36(1): p. 81-9.

Cohen, J., *Statistical power analysis for the behavioral sciences*. 2nd ed. 1988, Hillsdale, N.J.: L. Erlbaum Associates.

Evaluating the Impacts of Canada's Minimum Legal Drinking Age (MLDA) Laws on Patterns of Severe Motor Vehicle Collision Injuries in Canada's National Trauma Registry, 1999-2013.

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Abstract

Context. In Canada, the minimum legal drinking age (MLDA) is 18 years in Alberta, Manitoba, and Québec, and 19 years in the rest of the country. Recently, a Canadian expert panel has recommended raising the MLDA across all provinces to at least 19 years of age or—ideally—to 21 years of age.

Objective. To assess the impacts of current MLDA laws on severe motor vehicle collision (MVC) injuries seen in hospital-based trauma centres in Canada.

Data source. Canada's National Trauma Registry-Comprehensive Data Set (NTR-CDS, 1999-2013).

Sample. NTR-CDS admissions of patients aged 14-23 years (total admissions, $n = 7946$; males = 5357) including major trauma (Injury Severity Score > 12) due to MVCs.

Primary outcome. ICD-9/10-defined MVC injuries.

Analytic plan. Regression-discontinuity analyses.

Key findings. Males accounted for approximately 67.4% of all severe traffic-related MVC admissions to trauma centres during the study span. In comparison to young males slightly younger than the drinking age, those young men just older than the MLDA had significant and immediate increases of 26% (95% CI = 3%-49%, $p = 0.029$) in trauma-centre admissions for injuries due to MVCs. There was no evidence of change across the MLDA for females 7.6% (95% CI = -14.5%-30%, $p = 0.497$).

Discussion. Given that the MLDA appears to attenuate severe MVC-related injuries among young males still under MLDA constraints, it is reasonable to expect that raising the MLDA may reduce the overall societal burden of alcohol-related severe MVC trauma among newly restricted young adults.

Keywords. Minimum legal drinking age laws; youth; alcohol consumption; motor vehicle collisions; hospital records.

Disclosure. None of the authors report any conflicts of interests related to financial or ethical issues in the conduct of this research.

Introduction

Alcohol use is the largest contributor to the global burden of morbidity and mortality among adolescents and young adults aged 10-24 years old (Institute for Health Metrics and Evaluation, 2013; Gore et al., 2011; Lim et al., 2012), and road traffic crashes represent the second leading cause of disability-adjusted life years lost (DALYs) in this age group(Gore et al., 2011). Given the prominence of alcohol-related injuries among young people worldwide (The Management of Substance Abuse Team (MSB) in the Department of Mental Health and Substance Abuse (MSD) of the World Health Organization, 2011), especially those due to motor vehicle collisions (MVCs) (World Health Organization (WHO), 2015), many countries have established minimum legal drinking age (MLDA) restrictions regarding the purchase, use, and possession of alcohol products. The MLDA aims to reduce the burden that alcohol-related harms hold among young people.

Canadian MLDAs are under provincial jurisdiction, and almost all provinces set their current legislated drinking ages in the mid-to-late 1970s. The MLDA is 18 years of age in Alberta, Manitoba and Québec, and 19 years of age in the rest of Canada. Recently, the Canadian Public Health Association (Canadian Public

Health Association, 2011) and Canadian alcohol-policy experts have recommended raising the MLDA across all provinces to 19 years of age, with the expert panel also identifying 21 years as the ideal (Stockwell et al., 2019).

A large majority of studies assessing the impacts of the MLDA on MVCs were conducted 20-40 years ago [for reviews, see (McCartt, Hellinga, & Kirley, 2010; Wagenaar & Toomey, 2002)], as most research relied on natural experiments involving legislative changes in the United States in the 1980s (Wagenaar & Toomey, 2002). It is reasonable to argue that the impacts of MLDA laws observed two to four decades ago might be substantially attenuated in the contemporary context due, in large part, to advances in both road and vehicle safety (Kahane, 2004; Waller, 2002), introduction of provincial graduated driver licensing (GDL) legislation (Dee, Grabowski, & Morrisey, 2005; Masten, Foss, & Marshall, 2011; Mayhew, Simpson, & Singhal, 2005; McCartt, Teoh, Fields, Braitman, & Hellinga, 2010), declining prevalence of past year drinking and past month binge drinking among adolescents and young adults (1999-2013) (Boak, Hamilton, Adlaf, & Mann, 2013), and increases in the severity of penalties for drinking and driving (Asbridge et al., 2009; Mann et al., 2001; Vingilis, Blefgen, Lei, Sykora, & Mann, 1988).

Over the last seven years, our research team has demonstrated that Canadian drinking age legislation has a significant impact on driving-related harms. For example, in comparison to youth slightly younger than the MLDA, those young people just older than the MLDA have significant and immediate increases in: motor vehicle collision fatalities [among males (Callaghan, Sanches, Gatley, & Stockwell, 2014)]; police-reported motor vehicle collisions [among males and females (Callaghan, Gatley, Sanches, & Asbridge, 2014)]; and alcohol-impaired driving crimes [among males and females (Callaghan et al., 2016)]. However, our program of research has shown some inconsistencies in relation to the impact of the MLDA on MVC injuries seen in hospital-based settings in Canada (Callaghan et al., 2013; Callaghan, Sanches, & Gatley, 2013). In a large, national study, we found that young men (but not young women) gaining the MLDA incur significant and immediate increases in severe motor vehicle collision injuries requiring inpatient hospital-based services (Callaghan, Sanches, & Gatley, 2013). However, in another study, we found that the MLDA was not associated with evidence of increases in inpatient or emergency department utilization for MVC injuries (Callaghan et al., 2013).

The primary aim of the current study is to clarify the impacts of the MLDA on hospital-based service utilization due to motor vehicle collision injury among young people in Canada. Using Canada's National Trauma Registry (NTR), we expected that there would be significant and immediate increases in severe MVC trauma episodes among young men and women who were just released from MLDA restrictions.

Methods

Data Sources.
National Trauma Registry – Comprehensive Dataset (NTR-CDS)
The NTR-CDS dataset includes only individuals who presented to a participating trauma centre with an injury severity score of (ISS) > 12 (Canadian Institute for Health Information, 2014). The ISS is an international system developed to allow comparisons of injury severity patterns across countries (Palmer, 2007). This dataset captures demographic information, details of pre-hospital and hospital care, and patient outcomes at discharge and post-hospitalization. The NTR-CDS only contains information from designated trauma hospitals in provinces/territories with established trauma registries, or other participating trauma facilities. The NTR-CDS was decommissioned on March 31, 2014.

The NTR currently uses the ICD-10-CA/CCI classification system, introduced in 2004-2005. Older NTR records used ICD-9-CCP and ICD-9-PM (Canadian Institute for Health Information, 2016).

Data span.

The NTR-CDS includes the following data spans, by province/territory: 1999/2000-2012/2013 in Alberta, British Columbia, Manitoba, Ontario, and Nova Scotia; New Brunswick (2000/2001-2012/2013); Newfoundland and Labrador (2003/2004-2012/2013); Nova Scotia (1999/2000-2012/2013); Québec (2000/2001-2012/2013); and Saskatchewan (2009/2010-2012/2013). During the study span, there was variation in the number of facilities reporting to the NTR-CDS, ranging from 25 in 1999/2000 to 112 in 2012/2013.

Sample.

The number of admissions of patients aged 14-23 years (total admissions, n = 7946; males = 5357) hospitalized with major trauma (Injury Severity Score > 12) due to motor vehicle collision injuries in participating trauma centre hospitals across Canada (excluding Quebec). Patients from Newfoundland and Labrador and Manitoba were excluded from analyses due to missing key information in the dataset (i.e., date of birth or date of admission) required for calculating the age-in-month variable.

Construction of MVC outcomes.

We used ICD-9 and ICD-10 codes for traffic-related collision injuries (Centers for Disease Control and Prevention, n.d.)– see Table 1.

MVC injuries: count data.

We defined the primary outcome in terms of monthly counts of NTR admissions for motor vehicle collision-related injuries.

Driver's age.

We calculated the age of the driver at the time of NTR admission in terms of age in months.

Analytic plan.

Regression-discontinuity.

We employed a regression-discontinuity (RD) design(Shadish, Cook, & Campbell, 2002; Thistlethwaite & Campbell, 1960)—a quasi-experimental approach which can provide credible estimates of the causal effect of an intervention on a specified outcome (Lee & Lemieux, 2009). A detailed description of RD can be found in our prior publications (Callaghan et al., 2016; Callaghan, Sanches, Gatley, & Stockwell, 2014; Callaghan et al. 2013; Callaghan, Sanches, & Gatley, 2013).

Primary RD analyses: Non-parametric local regression.

In our primary nonparametric local regression analyses, we used a recent approach (Calonico, Cattaneo, & Titiunik, 2014b) implemented in the R package—rdrobust (Calonico, Cattaneo, & Titiunik, 2014a; R Development Core Team, 2014)—to fit the robust RD models with bias correction. We also used the triangular kernel weighting approach and a recently proposed strategy for identifying the optimum bandwidth in the local regression series (Calonico et al., 2014b). Local regression fits a piecewise weighted regression model to each data point by using a set of points in its neighborhood. To estimate the MLDA effect, two local regression models are adjusted, one on each side of the discontinuity, and the difference in their estimates at the discontinuity point is the estimated MLDA effect. An important strength of local regression is that the approach is relatively robust to non-linearities and allows for data modeling without making assumptions about the functional form of the model. This is a key advantage of local regression as compared to traditional parametric regression, where one usually needs to test higher order polynomial terms, a practice which recently has been criticized (Gelman & Imbens, 2014).

Results

Males accounted for approximately 67.4% of all severe traffic-related MVC admissions in the study. The RD analyses found that in comparison to young males slightly younger than the drinking age, those young men just older than the MLDA had significant and immediate increases of 26% (95% CI = 3%-49%, p = 0.029) in trauma-centre admissions for injuries due to motor vehicle collisions (Figure 1). There was no evidence of change across the MLDA for females 7.6% (95% CI = -14.5%-30%, p = 0.497) (Figure 1).

Discussion

The current study found that young men gaining the legal drinking age incurred a significant and immediate 26% increase in national trauma centre admissions for severe motor vehicle collision trauma. There was no evidence of significant changes in patterns of MVC admissions across the MLDA for females. This finding dovetails with our prior work showing that release from MLDA restrictions is associated with significant increases in male (but not female) inpatient hospitalization admissions due to MVC injuries (Callaghan, Sanches, & Gatley, 2013, 2013).

Recent work in the field also has shown that in comparison to their female counterparts, young men experience a substantially higher absolute number of driving-related harms appearing immediately after the MLDA, such as mortality due to MVCs (Callaghan et al., 2014; Carpenter & Dobkin, 2009, 2017), police-reported alcohol-impaired driving crimes (Callaghan et al., 2016), hospitalizations for injuries due to MVCs (Callaghan et al., 2013; Kypri et al., 2006), and population-based, police-reported MVCs (Callaghan et al., 2014). This disproportionate burden of traffic-related harms among young men might be due to a number of factors, such as their relatively greater levels of binge drinking, driving after drinking, drinking while driving, and engaging in riskier driving behavior than females (Adlaf, Demers, & Gliksman, 2005; Harré, Brandt, & Dawe, 2000; Health Canada, 2014; Rhodes & Pivik, 2011).

Study results should be interpreted in light of a number of potential limitations. The primary analytic strategy used a regression-discontinuity approach, which assumes that potentially confounding variables are smoothly distributed across the MLDA cutoff. If a factor differentially affected individuals on either side of the MLDA, then this might undermine the validity of the estimates. Even though a number of traffic-related policies changed during the study spans [e.g., reduced BAC limits and *per se* laws (Mann et al., 2001); more severe alcohol-impaired driving penalties (Asbridge et al., 2009; Vingilis et al., 1988)], it is unlikely that broad population-based policy changes would affect our results, as these policies would be unlikely to impact differently collisions for those slightly younger versus those just older than the MLDA. However, the implementation of GDL programs (which included 0% BAC restrictions) in some provinces may have affected the MLDA results (see Supplementary Table 1). For example, in British Columbia and Alberta, the minimum age of release from the GDL 0% BAC restrictions can occur at the same time as the provincial MLDA, although it is likely that the lifting of these restrictions (which occur after the successful completion of a final roadside exam at the end of the GDL program) would occur later than the MLDA for the bulk of young drivers because the final roadside exam pass rate in these two provinces is approximately 60%, and not all young drivers take the exam at the minimum age (Personal communication. 16th September 2015; Peters T. Office of Traffic Safety, Alberta Transportation. Personal communication. 21st September 2015; Fang M. Insurance Corporation of British Columbia (ICBC). Personal communication). Thus, the post-MLDA effect in British Columbia and Alberta may be confounded by release from the 0% BAC restrictions in these two provinces. In some provinces, release from 0% BAC restrictions (as a result of GDL completion) can occur prior to the provincial MLDA, and this may have attenuated the MLDA effect by increasing the number of MVCs just prior to the MLDA.

 Despite these limitations, the current study makes an important contribution to the ongoing Canadian and international debates by demonstrating that release from current Canadian drinking-age restrictions is associated with significant and immediate increases in severe motor vehicle collision trauma among male drivers. Raising MLDAs nationally to the recommended 19 or 21 years of age would likely result in a substantial reduction in alcohol-related MVCs in the newly alcohol-restricted age groups—particularly among young males. Study results also show that transition across the MLDA is an important phase of driving-related risk for young men, and it may be helpful for public health strategies to target this period with tailored, event-specific interventions.

References

Adlaf, E. M., Demers, A., & Gliksman, L. (2005). *Canadian campus survey, 2004*. Toronto, ON: Centre for Addiction and Mental Health.

Asbridge, M., Mann, R. E., Smart, R. G., Stoduto, G., Beirness, D., Lamble, R., & Vingilis, E. (2009). The effects of Ontario's administrative driver's licence suspension law on total driver fatalities: A multiple time series analysis. *Drugs: Education, Prevention, and Policy*, *16*(2), 140–151.

Boak, A., Hamilton, H. A., Adlaf, E. M., & Mann, R. E. (2013). *Drug use among Ontario students, 1977-2013: Detailed OSDUHS findings* (Vol. CAMH Resea). Toronto, ON: Centre for Addiction and Mental Health.

Callaghan, R. C., Gatley, J. M., Sanches, M., & Asbridge, M. (2014). Impacts of the minimum legal drinking age on motor vehicle collisions in Québec, 2000-2012. *American Journal of Preventive Medicine*, *47*(6), 788–795.

Callaghan, R. C., Gatley, J. M., Sanches, M., Asbridge, M., & Stockwell, T. (2016). Impacts of drinking-age legislation on alcohol-impaired driving crimes among young people in Canada, 2009-13. *Addiction*, *111*(6), 994–1003.

Callaghan, R. C., Sanches, M., & Gatley, J. M. (2013). Impacts of the minimum legal drinking age legislation on in-patient morbidity in Canada, 1997-2007: A regression-discontinuity approach. *Addiction*, *108*(9), 1590–1600.

Callaghan, R. C., Sanches, M., Gatley, J. M., & Cunningham, J. K. (2013). Effects of the minimum legal drinking age on alcohol-related health service use in hospital settings in Ontario: a regression-discontinuity approach. *American Journal of Public Health*, *103*(12), 2284–2291.

Callaghan, R. C., Sanches, M., Gatley, J. M., & Stockwell, T. (2014). Impacts of drinking-age laws on mortality in Canada, 1980-2009. *Drug and Alcohol Dependence*, *138*(1), 137–145.

Calonico, S., Cattaneo, M. D., & Titiunik, R. (2014a). rdrobust: Robust data-driven statistical inference in Regression-Discontinuity designs (R package version 0.6). *The Stata Journal*, *14*(4), 909–946.

Calonico, S., Cattaneo, M. D., & Titiunik, R. (2014b). Robust nonparametric confidence intervals for regression-discontinuity designs. *Econometrica*, *82*(6), 2295–2326.

Canadian Institute for Health Information. (2014). *National Trauma Registry Comprehensive Data Set—data quality summary for external users*. Ottawa, ON: Canadian Institute for Health Information.

Canadian Institute for Health Information. (2016). National Trauma Registry (NTR) metadata. Retrieved from https://www.cihi.ca/en/types-of-care/specialized-services/trauma-and-injuries/national-trauma-registry-ntr-metadata

Canadian Public Health Association. (2011). *Canadian Public Health Association Position Paper: Too High a Cost: A Public Health Approach to Alcohol Policy in Canada*. Ottawa, ON: Canadian Public Health Association.

Carpenter, C., & Dobkin, C. (2009). The effect of alcohol consumption on mortality: regression discontinuity evidence from the minimum drinking age. *American Economic Journal: Applied Economics*, *1*(1), 162–184.

Carpenter, C., & Dobkin, C. (2017). The effects of minimum legal drinking age on morbidity in the United States. *Review of Economics and Statistics*, *99*(1), 95-104

Centers for Disease Control and Prevention. (n.d.). Alcohol and Public Health: Alcohol-related Disease Impact (ARDI). Retrieved from https://nccd.cdc.gov/DPH_ARDI/Info/ICDCodes.aspx.

Dee, T. S., Grabowski, D. C., & Morrisey, M. A. (2005). Graduated driver licensing and teen traffic fatalities. *Journal of Health Economics*, *24*(3), 571–589.

Gelman, A., & Imbens, G. (2014). *Why higher-order polynomials should not be used in regression discontinuity designs*. *Unpublished* (Vol. 20405). Cambridge, MA: National Bureau of Economic Research. Retrieved from http://www.stat.columbia.edu/~gelman/research/unpublished/regression_discontinuity_2.pdf

Gore, F. M., Bloem, P. J., Patton, G. C., Ferguson, J., Joseph, V., Coffey, C., … Mathers, C. D. (2011). Global burden of disease in young people aged 10-24 years: a systematic analysis. *The Lancet*, *377*(9783), 2093–2102.

Harré, N., Brandt, T., & Dawe, M. (2000). The development of risky driving in adolescence. *Journal of Safety Research*, *31*(4), 185–194.

Health Canada. (2014). Canadian Alcohol and Drug Use Monitoring Survey: Summary of Results for 2012. Retrieved from http://www.hc-sc.gc.ca/hc-ps/drugs-drogues/stat/_2012/summary-sommaire-eng.php

The Institute for Health Metrics and Evaluation. (2013). Global Burden of Disease Compare: Data Visualizations. Retrieved from http://www.healthmetricsandevaluation.org/tools/data-visualizations

Kahane, C. J. (2004). *Lives Saved by the Federal Motor Vehicle Safety Standards and Other Vehicle Safety Technologies, 1960-2002--Passenger Cars and Light Trucks--With a Review of 19 FMVSS and their Effectiveness in Reducing Fatalities, Injuries and Crashes* (Vol. DOT HS 809). Washington, DC: Evaluation Division; National Center for Statistics and Analysis National Highway Traffic Safety Administration.

Kypri, K., Voas, R. B., Langley, J. D., Stephenson, S. C., Begg, D. J., Tippetts, A. S., & Davie, G. S. (2006). Minimum purchasing age for alcohol and traffic crash injuries among 15- to 19-year-olds in New Zealand. *American Journal of Public Health*, *96*(1), 126–131.

Lee, D. S., & Lemieux, T. (2009). Regression Discontinuity Designs in Economics. *NBER Working Papers*, *48*(2), 281–355.

Lim, S. S., Vos, T., Flaxman, A. D., Danaei, G., Shibuya, K., Adair-Rohani, H., … Ezzati, M. (2012). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*, *380*(9859), 2224–2260.

The Management of Substance Abuse Team (MSB) in the Department of Mental Health and Substance Abuse (MSD) of the World Health Organization. (2011). *Global Status Report on Alcohol and Health*. Geneva, Switzerland: World Health Organization (WHO).

Mann, R. E., Macdonald, S, P., Stoduto, G., Bondy, S., Jonah, B., & Shaikh, A. (2001). The effects of introducing or lowering legal per se blood alcohol limits for driving: an international review. *Accident Analysis and Prevention*, *33*(5), 569–583.

Masten, S. V, Foss, R. D., & Marshall, S. W. (2011). Graduated driver licensing and fatal crashes involving 16- to 19-year-old drivers. *JAMA: The Journal of the American Medical Association*, *306*(10), 1098–1103.

Mayhew, D. R., Simpson, H. M., & Singhal, D. (2005). *Best Practices for Graduated Driver Licensing in Canada*. Ottawa, ON: Traffic Injury Research Foundation.

McCartt, A. T., Hellinga, L. A., & Kirley, B. B. (2010). The effects of minimum legal drinking age 21 laws on alcohol-related driving in the United States. *Journal of Safety Research*, *41*(2), 173–181.

McCartt, A. T., Teoh, E. R., Fields, M., Braitman, K. A., & Hellinga, L. A. (2010). Graduated Licensing Laws and Fatal Crashes of Teenage Drivers: A National Study. *Traffic Injury Prevention*, *11*(3), 240–248.

Palmer, C. (2007). Major Trauma and the Injury Severity Score - Where Should We Set the Bar? *Annual Proceedings of the Association for the Advancement of Automotive Medicine*, *51*, 13–29.

R Development Core Team. (2014). R: A language and environment for statistical computing. *R Foundation for Statistical Computing*. Vienna, AU. Retrieved from http://www.r-project.org/

Rhodes, N., & Pivik, K. (2011). Age and gender differences in risky driving: The roles of positive affect and risk perception. *Accident Analysis and Prevention*, *43*(3), 923–931.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. *Journal of the American Statistical Association* (Vol. 100). Boston, NY: Houghton Miflin Company.

Stockwell, T., Wettlaufer, A., Vallance, K., Chow, C., Giesbrecht, N., April, N., Asbridge, M., Callaghan, R.C., Cukier, S., Davis-Macnevin, P., Dube, M., Hynes, G., Mann, R., Solomon, R., Thomas, G., Thompson, K. (2019). Strategies to Reduce Alcohol-Related Harms and Costs in Canada: A Review of Provincial and Territorial Policies. Victoria, BC: Canadian Institute for Substance Use Research, University of Victoria.

Thistlethwaite, D. L., & Campbell, D. T. (1960). Regression-discontinuity analysis: An alternative to the ex post facto experiment. *Journal of Educational Psychology*, *51*(6), 309–317.

Vingilis, E., Blefgen, H., Lei, H., Sykora, K., & Mann, R. (1988). An evaluation of the deterrent impact of Ontario's 12-hour licence suspension law. *Accident Analysis and Prevention*, *20*(1), 9–17.

Wagenaar, A. C., & Toomey, T. L. (2002). Effects of minimum drinking age laws: review and analyses of the literature from 1960 to 2000. *Journal of Studies on Alcohol. Supplement*, *14*, 206–225.

Waller, P. F. (2002). Challenges in motor vehicle safety. *Annual Review of Public Health*, *23*, 93–113.

World Health Organization (WHO). (2015). *Global status report on road safety 2015*. Geneva, Switzerland: World Health Organization.

Evaluation of a physician communication tool to educate patients on driving risks when prescribing pain medication

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Background. Some studies have assessed risk communication related to driving impairing medications between Health Care Practitioners (HCPs) and patients. However, further research is needed to support the development of an evidence-based educational resource to inform HCPs about effective ways to communicate to patients the risks associated with prescription pain medication use and driving.

Objectives. The objective of this study was to develop and evaluate an educational resource for HCPs to effectively communicate with their patients about driving risks when prescribing pain medications.

Methods. A literature review and focus groups with HCPs (N=27) at the Washington University medical campus in St. Louis, Missouri (MO) and patients (N=16) at the Rehabilitation Institute of St. Louis (TRISL) in MO were conducted in July 2017 to develop the educational resource which was a customized Smartphone App for HCPs. The beta version was pilot-tested with HCPs (N=9) in August 2018. An experimental design with patients exposed to the intervention with the App (N=23) and patients not exposed to the intervention (N=12) was used to evaluate the impact, and to assess: (1) if patients in the experimental group were better informed about impairing risks of their medication after the intervention; and (2) if patients in the experimental group planned to adapt their behaviour in accordance with increased knowledge.

Results. Patients in the experimental group reported being more informed than those in the control group after the intervention (OR: 1.14 p=.91) and being less inclined to drive within two hours of taking prescribed pain medication (OR: 0.39 p=.42). These results were not significant.

Discussion. Preliminary results are promising but not significant. More data are being collected to determine whether results are significant.

Key-words. Prescription medication, risk communication, impaired driving.

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Introduction

While the issue of drug-impaired driving may have garnered increased attention in recent years, a greater focus has been placed on the issue of illegal drugs as compared to medicinal drugs. However, numerous medications have been identified as having the potential to impair driving including benzodiazepines, antidepressants, antihistamines and prescription pain medications (Emich, van dijk, & Monteiro, 2014; Smyth, Sheehan, Siskind, Mercier-Guyon, & Mallaret, 2013). Some work has focused on drug classification and labelling systems (Schulze, Schumacher, Urmeew, & Auerbach, 2012) or the use of pictorial aids in medication instructions (Katz, Kripalani, & Weiss, 2006; Emich et al., 2014) to help identify effective strategies to address driving risks associated with the use of prescription drugs. Nevertheless, few studies have been conducted to identify evidence-based strategies for Health Care Practitioners (HCPs) to effectively communicate with their patients about the effects of prescribed medications on driving abilities, notably in North America.

To overcome this gap, the objectives of this study were to develop an educational resource for HCPs to help them communicate effectively with their patients about the risks associated with the use of prescription pain medication when driving. The resource also included related materials for use with patients to encourage patients to adopt protective behaviors with the ultimate goal to improve road safety and protect the public.

This paper describes the methods adopted to develop and evaluate the educational resource as well as initial evaluation results.

Methods

Two focus groups with prescribing HCPs (N=27) at the Washington University medical campus in St. Louis, Missouri (MO) and two focus groups with pain medication patients (N=16) at the Rehabilitation Institute of St. Louis (TRISL) in MO were conducted in July 2017 to develop the educational resource. Participants in both groups were recruited using snowball sampling from a pool of subjects that served as a captive audience. Saturation was reached. The resource that was built using results from the focus groups consisted of a Smartphone App for HCPs, called the DiDRxChecker (i.e., Drug Impaired Driving Rx – or, medical prescription

– Checker). The beta version was pilot-tested with HCPs (N=9) in August 2018 to obtain process evaluation information. The focus groups and pilot test were organized and delivered according to Knowledge Translation (KT) theory to ensure necessary data would be obtained to inform the development of the App as to facilitate the efficient communication between HCPs and their patients. In particular, TIRF's KT model served as a guiding paradigm for this purpose (Robertson, 2013).

An experimental design with patients exposed to the intervention with the App (N=23) and patients not exposed to the intervention (N=12) was used to evaluate the impact, and to assess: (1) if patients in the experimental group were better informed about impairing risks of their medication after the intervention; and (2) if patients in the experimental group planned to adapt their behaviour in accordance with increased knowledge. Logistic regression analysis was used to analyze the data obtained with an in-person questionnaire and produce interim results. Different techniques were then used to assess the sample size needed to find significant effects given the preliminary results, including power analysis for two sample proportions test; power analysis for a Cochran-Mantel-Haenszel test; and, power analysis for matched case-control studies (StataCorp., 2015). In each power analysis the alpha was set at 0.05 for the significance level and power at 0.80.

Results

Focus groups

Focus groups with HCPs revealed that established operational practices for patient care did not facilitate discussion of the impairing effects of medication on driving. Notably, there was a considerable knowledge gap that impeded the ability of HCPs to determine the impairing effects of medication on the driving skills of individual patients. This gap reduced confidence among HCPs in identifying which patients required a conversation about this topic, key messages to include in the conversation, and strategies to conduct the conversation. Also, the main strategy followed by HCPs was to assist their patients to achieve the best outcomes and a return to baseline if possible, or to help them achieve a reasonable quality of life. In this regard, preventing them from driving or impeding their ability to drive was not perceived to be a realistic solution to manage health issues except in the most extreme circumstances.

Focus groups with patients revealed that patients appeared to be most receptive to verbal information provided by physicians as well as other HCPs, and they were less likely to review written materials that exceed a page. The ability to personalize information was determined to be an essential requirement to increase usage of information by HCPs and patients. Further, results of the focus groups suggested that although HCPs may have explained some general impairing side effects related to prescription pain medication, rarely were the implications for driving skills explicitly highlighted. This was primarily due to the fact that HCPs assumed that patients are able to extrapolate general information about impairing effects to a wide range of activities, notably driving, when in fact they are not. It may also be an indication that HCPs are less familiar with skills needed for driving, and the way that these medications can contribute to unsafe driving. It could also be possible that HCPs assume this content will be covered by the pharmacist.

Pilot-test

Based on the literature review and results from the focus groups, an online Application was built that HCPs can use to guide their conversation with their patients about the impairing risks of prescription pain medication. It was pilot-tested with HCPs and further fine-tuned based on their feedback.

The App, called the DiDRxChecker, can be downloaded from the Apple App Store or Google Play Store (currently not publicly available but only upon invitation for the remainder of the study). It consists of a user-friendly interface enabling the HCP to answer a few key questions about the patient to determine applicability of further discussion about impairing effects (e.g., types of medication prescribed; driving needs of patients; new medications; other prescribed medications; patient characteristics). Based on the answers an indication of the level of risk and associated need for a conversation about impairing risks is provided (low need, moderate need, high need; see Figure 1 for an overview of the algorithm used by the App and Figure 2 for a screen caption of the App). Along with this indication a series of resources are provided that can easily be forwarded to the patient or printed if hard copies are preferred. Resources consist of a series of short, one-page documents that provide information about the impairing effects of prescription medications, the impact on driving skills, and guidelines for effective communication (resources not included in this paper but available upon request).

Figure 1: Graphical depiction of DiDRxChecker algorithm
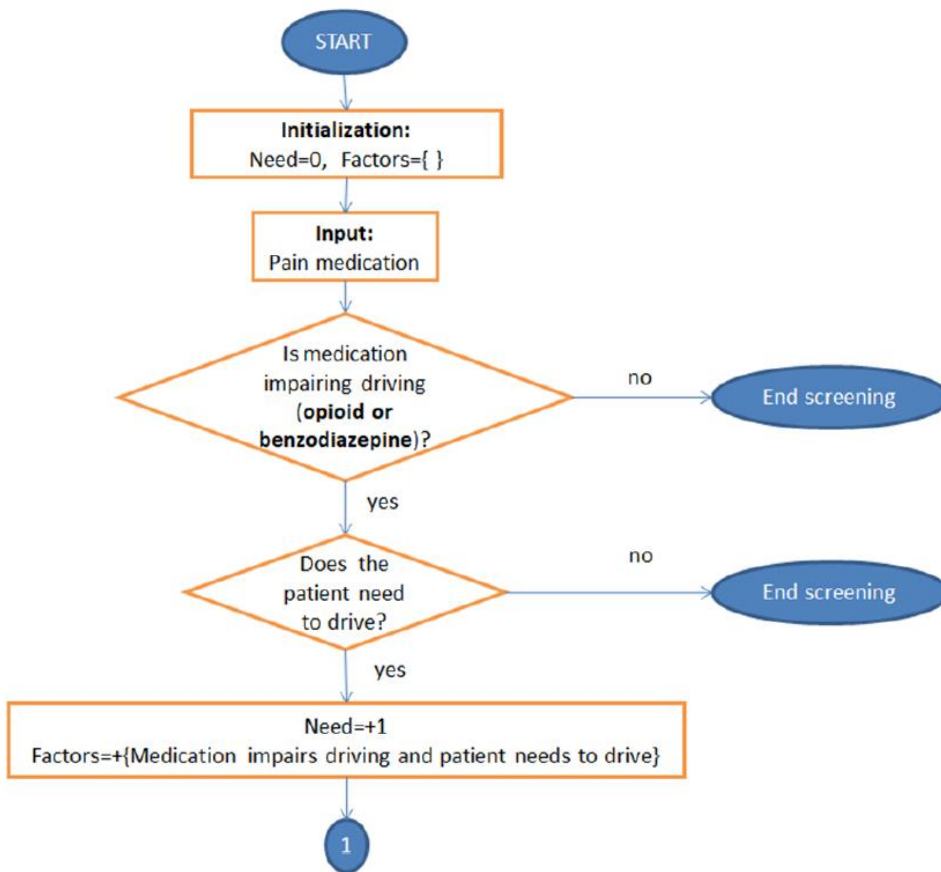
Figure 2: Screen caption of the DiDRxChecker App
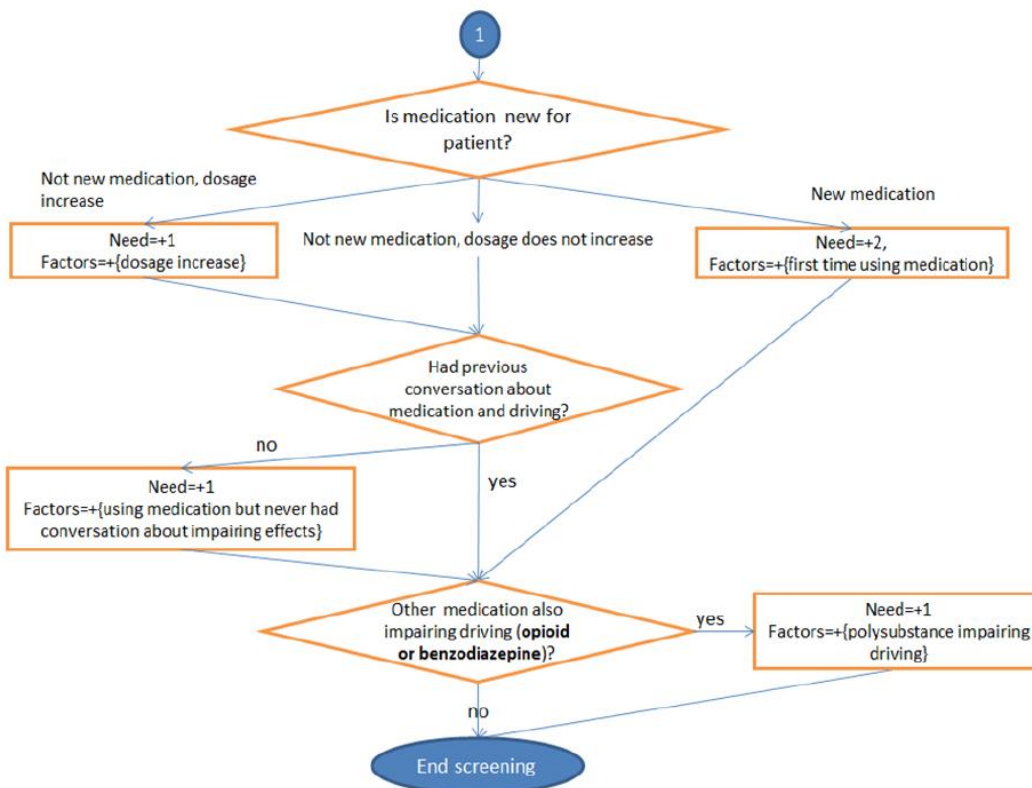
Outcome evaluation

In examining the variable "How informed do you think you are on the side effects of your prescribed pain medication that may impact your driving abilities?", an increase was observed from baseline to post-measurement in the frequency of experimental group participants who stated they were informed (36.36 % to 38.46 %). A small decrease from baseline to post-measurement was observed in the frequency of control group participants (45.45 % to 44.44 %). A logistic regression analysis examining the interaction effect of group by

time demonstrated that the odds of reporting that patients were more informed after receiving the intervention in the experimental group was 14% greater than participants in the control group (OR: 1.14 p=.91).

In examining the variable "I will drive within two hours of taking my prescribed pain medication", a decrease from baseline to post-measurement in the frequency of experimental group participants who stated they would drive within two hours of taking their prescribed pain medication was observed. At baseline, 43.48% of experimental group participants stated that it was likely that they would perform this behaviour. Post-intervention, 23.08% of experimental group participants stated this. No change in frequency of this reported behaviour was observed in the control group (33.33% both at baseline and post-intervention). A logistic regression analysis that examined the interaction effect of group by time demonstrated that the odds of driving within two hours of taking prescribed pain medication decreased by 61% for participants in the experimental group when compared to those in the control group (OR: .39 p=.42).

Power analysis

Overall, there were positive results from the focus groups with patients and HCPs who liked the DiDRxChecker App and the information contained within it. Furthermore, the outcome evaluation findings suggest that there were positive effects of the DiDRxChecker intervention when comparing patients who were exposed to the resource versus a control group of patients who were not. However, these effects were statistically non-significant. Given the small sample size used in the outcome evaluation (N=35), and the possibility to extend the study, a power analysis was conducted to estimate the sample size needed to find significant effects given the distribution of the preliminary results. The different analyses combined revealed that the sample size should be N>105.

Conclusions

In conclusion, the focus groups and questionnaire data demonstrated there is a need among HCPs and patients to be better informed about the impairing effects of prescription medication on driving. It also demonstrated HCPs and patients were receptive to using supporting tools to help them guide their conversation with patients about this issue to positively influence patient care. Based on the literature and input from HCPs and patients such an educational tool was developed, and pilot-tested. The tool is called the DiDRxChecker and is available as an App. It is easy to use and supports HCPs to have a meaningful conversation with patients who take potentially impairing medications and are driving. It also provides easy access to short documents (available electronically or for printing) that can be shared with patients to better inform them. Preliminary results from an outcome evaluation are promising and suggest that patients exposed to the resource feel better informed and are more inclined to adopt protective behaviors compared to patients not exposed to the App. However, these results were not significant, perhaps due to the small sample size. A power analysis was conducted to estimate the required sample size to find significant results. Based on these findings, additional data are being collected in 2019 for a more robust evaluation.

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References

Emich, B., van Dijk, L., & Monteiro, S. P. (2014). A study comparing the effectiveness of three warning labels on the package of driving-impairing medicines. *International Journal of Clinical Pharmacology*, 36: 1152-1159.

Katz, M.G., Kripalani, S., & Weiss, B.D. (2006). Use of pictorial aids in medication instructions: A review of the literature. *American Journal of Health-System Pharmacy*, 63: 2391-2397.

Robertson, R. (2013). Developing knowledge transfer and mobilization strategies. Presented at the 7th Fit-to-Drive Conference, Berlin, Germany, April 25th-26th, 2013.

Schulze, H., Schumacher, M., Urmeew, R., & Auerbach, K. (2012). Final report: Work performed, main results and recommendations. DRUID (Driving under the Influence of Drugs, Alcohol and Medicines) Deliverable 0.1.8.

Smyth, T., Sheehan, M., Siskind, V., Mercier-Guyon, C., & Mallaret, M. (2013a). Consumer perceptions of medication warnings about driving: A comparison of French and Australian Labels. *Traffic Injury Prevention*, 14: 557-564.

StataCorp. (2015). Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.

High-Risk Behavior Among Rural Female Impaired Drivers

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Abstract

Recent research has highlighted the increasing number of females who are arrested for driving under the influence (Schwartz & Beltz, 2018) and involved in impaired driving crashes (Vaca et al., 2014), but little is known about rural women who drive under the influence and their other risk behaviors. The present study compares the past year risk behaviors of rural female impaired drivers to other rural female offenders. As part of a larger study on drug use and risk behaviour among rural women, 400 women from three rural jails were randomly selected, screened, and consented. During a baseline face-to-face interview, participants completed the NM-ASSIST and also provided information about impaired driving, drug, and sex risk behaviors. Participants reporting past year impaired driving (n=260) were compared to those who did not (n=131). Past year impaired drivers had significantly (p < .05) higher substance use involvement scores for cannabis, sedatives, and prescription opioids. Past year impaired drivers were also significantly more likely to have been the passenger of an impaired driver (78.1% vs. 53.4%), been an injection drug user (69.6% vs. 42.0%), and traded sex for drugs or money (31.2% vs. 15.3%) in the past year. Results highlight the high rates of concomitant risk behaviors among rural female impaired drivers, exceeding those of other high-risk offenders. These findings indicate the need for thorough clinical assessment of impaired drivers as well as the opportunity to intervene to reduce multiple risk behaviors.

Introduction

Driving under the influence (DUI) remains a significant public health problem and threat to public safety. Recent research has highlighted gender-specific DUI trends, including an increasing number of females who are arrested for DUI (Schwartz & Beltz, 2018) and involved in impaired driving crashes (Vaca et al., 2014), yet relatively little is known about women's experiences with impaired driving. Although the observed increase in driving fatalities among women over time may be due, in part, to higher risk exposure as women's use of personal vehicles has increased, other research suggests that risky driving behaviors have also become more common in certain female groups (including younger women; Romano et al, 2008).

As demographic trends in DUI shift over time, it becomes increasingly important to examine populations at growing risk. For example, although national data show that arrest rates for DUI are higher in nonmetropolitan than metropolitan areas (FBI, 2018), few studies have examined differences between rural and urban impaired drivers (Malek-Ahmasi & Degiorgio 2015; Webster et al, 2010), and only one has examined these differences among female DUI offenders (Webster et al., 2009). This study found that rural female DUI offenders were more likely to be underage, have multiple DUIs, screen positive for drug problems, meet DSM-IV substance dependence and abuse criteria, and fail to meet requirements of their intervention referral compared to urban female DUI offenders (Webster et al., 2009); however, these analyses were based on DUI assessment data that were limited in breadth, generally containing only information directly related to the DUI offense. No studies have examined other characteristics and behaviors of rural female impaired drivers.

One area for further study is the association between DUI and other risky behaviors. In adolescent populations, for example, impaired driving is associated with experiences of riding with intoxicated drivers (Li et al., 2014), as well as engaging in secondary tasks while driving (e.g., texting) and other risky driving behaviors (Li et al., 2013). Although such results may be attributed to social learning and normalization of risky or impaired driving, DUI also may be indicative of a broader construct of risk-taking, related to underlying traits such as impulsivity and low risk perception (Ryb et al., 2006). One study, for example, found that current methamphetamine users (compared to controls) scored higher on measures of impulsivity and antisocial personality disorder symptomology, and worse on measures of safe driving, even when controlling for acute intoxication or withdrawal symptoms, demographics, and driving experience (Bosanquet et al., 2013).

In light of these findings, it is possible that DUI may serve as a marker for other risky behaviors. The link between substance use and risky sexual behaviors, for example, although likely moderated by response inhibition or other factors (Nydegger et al., 2014), has been well-established (Ritchwood et al., 2015). Similarly, substance use related risk behaviors, such as injection drug use, have been associated with risky sexual practices (including use of drugs before sex, having more lifetime sexual partners, and having a main sexual partner who also injects drugs; Staton et al., 2017). Considering impaired driving as a risky decision related to alcohol or drug use, it would seem that exploring possible relationships between DUI and other high-risk behaviors may offer insight into important areas for assessment and intervention.

Given the limited knowledge on rural female impaired drivers and the relationship between their impaired driving and other risk behaviors, the present study examines risk behavior in a sample of rural female drug-involved offenders, comparing risk behaviors of women who have driven impaired in the past year to the those who have not.

Methods

Participants

As part of a study on drug use and high-risk behavior among rural women, 400 women from three rural jails were randomly selected, consented, and screened. Eligibility criteria included: (1) moderate risk of substance abuse based on the NIDA-modified Alcohol, Smoking and Substance Involvement Screening Test (NM-ASSIST) score of 4+ for any drug (NIDA, 2009); (2) self-reported sexual risk behaviors in the three months before arrest, based on five questions from the risk behavioral assessment (Wechsberg, 1998); (3) residing in a designated Appalachian county before incarceration; (4) anticipated release date between two weeks and three months from screening; (5) and willingness to participate. For detailed descriptions of the sampling and screening approach, see Staton et al. (2017; 2018).

Procedure

Individuals who provided consent and met screening criteria were scheduled for a baseline interview. Interviews were conducted face-to-face by a trained female interviewer in a private room at the jail; no jail staff were present for interviews. Participants responded to questions about their drug use and other risk behaviors prior to entering jail. Responses were recorded using Computer Assisted Personal Interview (CAPI) software. Participants were paid $25 for their time. All study screening and data collection procedures were approved by the university IRB and protected under a federal Certificate of Confidentiality.

Measures

Demographics. Demographic information collected from participants included their age, race, marital status, years of education, and employment status in the 6 months prior to incarceration. Given that the sample was recruited from jails, length of the current incarceration was also collected.

Drug Use. The NM-ASSIST was used to measure participants' drug use problem severity and level of risk (NIDA, 2009). At screening, participants were asked six questions related to intensity and frequency of use of cannabis, cocaine, prescription stimulants, methamphetamine, inhalants, hallucinogens, sedatives, street opioids, and prescription opioids. A risk score was computed using standard scoring procedures for each substance, which ranged from 0 to 39. Participants also completed the Substance Problem Scale (SPS) of the Global Appraisal of Individual Needs (GAIN-I version 5; Dennis, 1998). The SPS is a 16-item measure of problematic alcohol and drug use based on DSM-IV-TR criteria. Higher SPS scores indicate more severe substance use problems. For the current study, participants specifically responded to the SPS based on the year prior to incarceration. Injection Practices. Participants were also asked about their injection practices in the year prior to incarceration: whether they injected drugs, used dirty needles/works, and the number of people with whom they shared dirty needles.

Sex Risk Behaviors. Participants provided information on their sex risk behaviors in the year prior to incarceration. Specifically, participants reported their number of sexual partners and casual sexual partners as well as whether they traded sex for money/drugs/food. Impaired Driving. Finally, participants were asked whether they had driven under the influence of drugs or alcohol in the year prior to incarceration. They also reported whether they were the passenger of an impaired driver during this time period.

Data Analysis

Nine participants from the original sample were removed due to missing data. Then,

participants reporting past year impaired driving (n=260) were compared to those who did not (n=131) on demographic characteristics using a series of t-test and chi-square analyses. The two groups were compared on their risk behaviors, controlling for demographic differences, using analysis of covariance and logistic regression analysis. Risk behavior differences were considered statistically significant at $p < 0.05$. All analyses were conducted using SPSS 24 (IBM Corp., 2016).

Results

Demographics

The majority of the sample was white (99.0%) with an average age of 32.7 and less than a high school education (11.1 years). Less than a quarter (23.0%) of participants were employed at least part time prior to incarceration and 37.3% of participants were married or living as married. As shown in Table 1, age was the only significant demographic difference between impaired drivers and other drug-using offenders, with impaired drivers being significantly younger (31.9 vs. 34.4; $t(226.6) = 2.734$, $p = .007$).

Drug Use

Participants' past year substance use severity varied across group (see Table 2). When controlling for age, impaired drivers reported significantly higher scores ($F(16,363) = 4.90$, $p = .000$) on the SPS compared to other drug-using offenders. Additionally, substance-impaired drivers had higher substance involvement scores on the NM-ASSIST for cannabis ($F(36,353) = 1.64$, $p = .014$), sedatives ($F(38,351) = 1.85$, $p = .002$), and prescription opioids ($F(36,353) = 1.88$, $p = .002$).

Other Risk Behaviors

Substance-impaired drivers were also more likely to report a number of additional past year risk behaviors compared to other drug-using offenders. Specifically, substance-impaired drivers were significantly more likely to report having injected drugs (AOR = 2.90; 95% Confidence Interval [CI] = 1.86, 4.55, $p = .000$) in the past year, having used a dirty needle and/or works (AOR = 3.05; 95% CI = 1.95, 4.77, $p = .000$) in the past year, and reported sharing dirty needles with significantly more people ($F(15,374) = 1.93$, $p = .019$). Compared to other drug-involved offenders, they were also more likely to report trading sex for drugs and/or money (AOR = 2.36; 95% CI = 1.37, 4.09, $p = .002$) in the past year and were more likely to report having been the passenger of an impaired driver (AOR = 2.85; 95% CI = 1.80, 4.52, $p = .000$).

Discussion

The present study compared the risk behaviors of drug-involved female offenders who self-reported impaired driving in the past year to those who did not. Overall, impaired drivers reported engaging in more drug use and other risk behaviors than non-impaired drivers. These findings add to the impaired driving literature in three important ways.

First, this study is among the first to document drug use in rural female impaired drivers. Although the sample consisted entirely of drug-involved offenders, impaired drivers had higher SPS scores and significantly higher NM-ASSIST substance involvement scores for cannabis, sedatives, and prescription opioids. While this study did not examine the drugs involved in impaired driving, this finding is consistent with research showing that cannabis is the most frequently involved drug in impaired driving with prescription medications among the next most prevalent (NIDA, 2016). Furthermore, the drug use profiles are consistent with another study of rural convicted DUI offenders which reported cannabis, sedatives, and prescription opioids as the drugs most frequently involved in self-reported driving episodes (Webster et al., 2018).

Second, the study adds to our understanding of other risk behaviors in which rural female impaired drivers engage. This included higher rates of drug injection and risky injection practices, higher rates of trading sex, and of riding with an impaired driver. The higher prevalence of riding with an impaired driver is consistent with previous research on adolescents (Li et al. 2014). However, to our knowledge, the association between impaired driving and

injection drug use and risky sex behavior found in the present study is a new finding, and one that future research should more carefully explore. Each of these risk behaviors have clear health implications for these women and point to the importance of comprehensive assessment of impaired drivers to identify and appropriately target intervention efforts.

Finally, and more generally, these findings contribute to the small but growing literature on rural impaired drivers. A disproportionate number of DUI arrests and impaired driving fatalities occur in rural areas (FBI, 2018; National Center for Statistics and Analysis, 2017), yet rural impaired drivers remain largely unstudied (Webster et al., 2018). Future studies should continue to examine this population to gain a better understanding of how best to prevent future harm to themselves and others through targeted intervention.

Limitations

Study limitations should be considered when interpreting results. First, participants were recruited from three rural jails and were selected because they engaged in risky behaviors; therefore, findings may not generalize to other rural female impaired drivers. Second, only past year impaired driving and other risk behaviors were examined; as a result, the relationship between long-term patterns of risk behavior and impaired driving among rural females is unknown. Finally, data were self-reported and may be subject to recall bias.

Conclusions

Despite these limitations, the current study provides new information about rural female impaired drivers and their high rates of concomitant risk behaviors, which exceed those of other high-risk, drug-involved offenders. This consistent pattern may suggest an underlying cause, which future research could target. Furthermore, these findings indicate the need for thorough clinical assessment of impaired drivers so that appropriate interventions may target multiple risk behaviors.

References

Bosanquet, D., MacDougall, H. G., Rogers, S. J., Starmer, G. A., McKetin, R., Blaszczynski, A., & McGregor, I. S. (2013). Driving on ice: Impaired driving skills in current methamphetamine users. *Psychopharmacology, 225,* 161-172.

Dennis, M. L. (1998). Global Appraisal of Individual Needs (GAIN). Bloomington, IL: Chestnut Health Systems.

[FBI] Federal Bureau of Investigation. (2018). *Crime in the United States, 2017.* Retrieved from https://ucr.fbi.gov/crime-in-the-u.s/2017/crime-in-the-u.s.-2017/tables/table-31 IBM Corp. (2016). IBM SPSS Statistics for Macintosh. Ver 24.0. Armonk, NY: IBM

Li, K., Simons-Morton, B. G., & Hingson, R. (2013). Impaired-driving prevalence among US high school students: Associations with substance use and risky driving behaviors. *American Journal of Public Health, 103*(11), e71-e77.

Li, K., Simons-Morton, B. G., Vaca, F. E., & Hingson, R. (2014). Association between riding with an impaired driver and driving while impaired. *Pediatrics, 133*(4), 620-626.

Malek-Ahmadi M., Degiorgio, L. (2015). Risk of alcohol abuse in urban versus rural DUI offenders. *American Journal of Drug and Alcohol Abuse, 41,* 353–357.

National Center for Statistics and Analysis. (2017). Rural/Urban comparison of traffic fatalities: 2015 Data. Washington, DC: NHTSA. Report No. DOT HS 812 393.

[NIDA] National Institute on Drug Abuse. (2009). NIDA Modified-ASSIST. Retrieved February 20, 2018 from http://www.drugabuse.gov/nidamed/screening/

Nydegger, L. A., Ames, S. L., Stacy, A. W., & Grenard, J. L. (2014). Response inhibition moderates the association between drug use and risky sexual behavior. *Substance Use & Misuse, 49,* 1457-1464.

Ritchwood, T. D., Ford, H., DeCoster, J., Sutton, M., & Lochman, J. E. (2015). Risky sexual behavior and substance use among adolescents: A meta-analysis. *Children and Youth Services Review, 52,* 74-88.

Romano, E., Kelley-Baker, T., & Voas, R. B. (2008). Female involvement in fatal crashes: Increasingly riskier or increasingly exposed? *Accident Analysis and Prevention, 40,* 1781-1788.

Ryb, G. E., Dischinger, P. C., Kufera, J. A., & Read, K. M. (2006). Risk perception and impulsivity: Association with risky behaviors and substance use disorders. *Accident Analysis and Prevention, 38,* 567-573.

Schwartz, J., & Beltz, L. (2018). Trends in female and male drunken driving prevalence over thirty years: Triangulating diverse sources of evidence. *Addictive Behaviors, 84,* 7-12.

Staton, M., Ciciurkaite, G., Havens, J., Tillson, M., Leukefeld, C., Webster, M., Oser, C., & Peteet, B. (2017). Correlates of injection drug use among rural Appalachian women. *Journal of Rural Health, 34,* 31-41.

Staton, M., Ciciurkaite, G., Oser, C., Tillson, M., Leukefeld, C., Webster, J. M., & Havens, J. R. (2018). Drug use and incarceration among rural Appalachian women: Findings from a jail sample. *Substance Use and Misuse, 53*(6), 931-941.

Vaca, F. E., Romano, E., & Fell, J. C. (2014). Female drivers increasingly involved in impaired driving crashes: Actions to ameliorate the risk. *Academic Emergency Medicine, 21,* 1485-1492.

Webster, J. M., Dickson, M. F., Duvall, J. L., & Clark, D. B. (2010). Rural and urban differences in Kentucky DUI offenders. *Journal of Addictions Medicine, 4*(3), 186-190.

Webster, J. M., Dickson, M. F., & Staton, M. (2018). A descriptive analysis of drugged driving among rural DUI offenders. *Traffic Injury Prevention, 19*(5), 462-467.

Webster, J. M., Pimentel, J. H., Harp, K. L. H., Clark, D. B., & Staton-Tindall, M. (2009). Substance abuse problem severity among rural and urban female DUI offenders. *The American Journal of Drug and Alcohol Abuse, 35*(1), 24-27.

Wechsberg, W. M. (1998). *The revised risk behavior assessment*. Research Triangle Park, NC: Research Triangle Institute.

Traumatic Experience and DWI Offenders; PTSD, Substance Use, Alcohol, and Risk.

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Abstract

Background: Although there has been an abundance of work looking at the impact of traumatic events and substance use and problems, there is little to none that have examined the impact of traumatic experiences in the DWI population.

Aim: The current study considers convicted DWI offenders who indicated they had experienced at least one of the criteria listed in Criterion A of the DSM diagnosis for PTSD. Comparisons are made between three groups: no trauma, less than 33 on the PTSD symptom assessment, and then 33 or more on the PTSD symptom assessment.

Method: This effort is part of a larger study of convicted DWI offenders who have been mandated to install an Interlock in their vehicle. Recruitment of offenders occurred in impaired driving programs, at the places where interlocks were installed, and from STOPDWI In Erie County. For the current report, the measures used included measures of substance use, risk, alcohol problems, PTSD Symptoms, and mental health problems.

Results: Comparisons showed that relative to the no-trauma and low PTSD symptom groups, the group with high PTSD symptoms were more likely have had prior treatment, prior criminal history, to use a bicycle and public transportation, and to have been injured in a crash. The high symptom group also showed higher means for drug use in the last year, number of total DSM 5 current alcohol use disorder criteria, problem risk, readiness to change, and all subscales on the Brief Symptom Inventory.

Conclusions: Experiencing a traumatic event has an impact on convicted DWI offenders in terms of risk factors. However, the experience alone is not sufficient, there needs to high levels of symptoms for that influence to be evident. This has implications for assessment of DWI offenders when they show up for treatment.

Background

Exposure to traumatic experiences and events is a known risk factor for negative outcomes for individuals and is a public health issue impacting families and communities (SAMHSA, 2014). Research indicates that upwards of 70% of the general population worldwide has experienced a traumatic event in their lifetime, and the average number of traumas that a person has been exposed to is 3 (Kessler, et al., 2017). Exposure to trauma does not automatically cause post-traumatic stress disorder (PTSD), anxiety, depression or other mental health issues, although repeated or prolonged exposure to trauma increases the risk of long term issues (Atwoli, Stein, Koenen, & McLaughlin, 2015).

There is no single act, action or activity that in and of itself constitutes trauma. Many things can be experienced as trauma by an individual, whether physical or psychological, and although trauma has been operationalized in the Diagnostic and Statistical Manual (DSM), there is not one exclusive list of events or experiences that define trauma or traumatic experiences (SAMHSA, 2014). In addition, the experience of or exposure to a potentially traumatic event does not automatically create a long lasting negative impact on an individual, individuals interpret experiences uniquely.

Diagnosis of PTSD in the DSM-V requires exposure to a traumatic event that includes actual or threatened death, serious injury or sexual violence (American Psychiatric Association, 2013). An individual can be exposed to the trauma either directly through experience, or indirectly through witnessing something happen to another person, or learning about a trauma occurring to someone they are close to, or being exposed to details of traumatic events repeatedly (therapists and first responders). PTSD symptoms include repeated and

intrusive memories of the trauma that cannot be controlled or avoided; emotional numbness and avoidance of places, people and activities; and increased arousal.

Considering that PTSD is an accepted diagnosis and listed in both the DSM-V and International Classification of Diseases-10 (ICD-10; Centers for Medicare & Medicaid Services, 2019), it is important to remember that mental health is a topic that continues to carry significant stigma in the United States (Corrigan & Watson, 2002). Stigma or the anticipation of stigma can prevent an individual or family from accessing mental health services (Fox, Smith, & Vogt, 2018). In place of proper services and support, research finds that self-medication with alcohol or other substances for mental health issues, such as PTSD, happens in around 20% of the population and self-medication leads to a higher risk of suicidality, and decreased mental health (Leeies, Pagura, Sareen, & Bolton, 2010). Self-medication for mental health issues is common and is seen as more prevalent among younger, single, white men; self-medication for mental health issues can lead to a substance use disorder (Turner, Mota, Bolton, & Sareen, 2018).

Although exposure to trauma has some clear associations with alcohol and other substance use, little research has been done on the experiences of trauma in the alcohol impaired driving offender. Some research has shown that for repeat alcohol impaired driving offenders, who are in treatment, those with PTSD experience a higher rate of alcohol impaired driving recidivism than those offenders without PTSD (Peller, Najavits, Nelson, LaBrie, & Shaffer, 2010). This link between trauma, alcohol and impaired driving requires further examination.

Methods

Participants

Participants were 276 Driving While Intoxicated (DWI)/Driving While Ability Impaired (DWAI) offenders from western New York state. They were in the post sentencing period and were serving license suspension or received a conditional driver's license or hardship license at the time of recruitment. Sentences for impaired driving may include fines, jail time, participation in a drinking driver program/impaired driver program (DDP/IDP), participation in a victim impact panel, license revocation or suspension, and for DWI offenders who violated Leandra's Law, installation of the Ignition Interlock Device (IID) in their vehicles.

Inclusion criterion for this study was having a recent DWI/DWAI conviction in Erie County, NY where the study interviews took place, and being over the age of 18. Recruitment for this longitudinal study began in 2015 and final interviews will take place in 2020. In this sample, the majority of participants were White, non-Hispanic (78%), single (75.3%), male (62%), with at least some college (77.5%) and almost a third of participants hold a bachelor's degree or higher (32.3%).

Procedures

This research is part of the Managing Heavy Drinking (MHD) research study, a study of IID users and DWI offenders. Participants were recruited using fliers and presentations specifically targeting locations where DWI offenders may frequent. These fliers were distributed in person at impaired driving classes by research assistants, and by community partners at victim impact panels, ignition interlock installation centers, substance abuse treatment facilities and health centers. In addition, we created a website and a Google phone number for information and directions to the study location, and to accept calls, emails and text messages for questions and scheduling purposes.

Participation in this longitudinal study included three interviews over the course of 12-18 months and consisted of a computer survey, biological sample collection (hair, blood/saliva) and a Timeline Follow-Back interview at each of the three time points. Interviews were conducted by trained research assistants at a research center or in a mobile office at a location convenient to the participant. Participants received cash payment at each of the three interview time-points for a total of $300-$375. A $25 per appointment incentive was offered for participants to provide a blood sample in lieu of a saliva sample. In addition, each participant who arrived for their first appointment as scheduled received their selection of an additional gift card. These gift cards varied throughout the study and ranged in value from $20-$30.

Due to the fact that all participants were currently or recently court involved, we applied for and received a certificate of confidentiality to ensure that our data were protected from forced disclosure. This was done so that our participants could be sure that their answers were private and could not be used against them in

continuing court procedures. Even though the court process was finished for most participants, those who have IID devices are still connected to the courts, as their performance on the IID is actively monitored through STOP DWI, and positive tests are reported to court.

Measures

Data regarding trauma exposure and experience were collected during the computer survey. As a screening question, participants were asked to identify if they had ever witnessed or experienced an extremely traumatic event that included actual or threatened death or serious injury to themselves or someone else. Examples given with this question included rape, assault, someone dying in an accident, natural disasters, combat or any other upsetting event (MINI_Screen; Sheehan & Lecrubier, 2006). If a participant said yes, they were directed to a list of 19 traumatic events from the DSM-IV definition of trauma. Along with the pre-filled list, participants were able to indicate if their trauma experience was not covered by one of the items in the list. All participants, regardless of endorsing trauma exposure or not, completed the PCL-C, which is the civilian version of the PTSD Checklist (PCL).

In addition, all participants completed the RIASI, AUDIT, BSI, AUDADIS (abuse and dependence subscales) and a six-month Timeline Follow-back regarding drinking, driving and drug use behavior.

Data were analyzed utilizing IBM SPSS Statistics 25. We looked at frequencies, cross-tabs and t-tests to identify response patterns among participants.

Results

Of the 276 participants, fifteen selected the option "Prefer not to respond" to the trauma screening question. From the remaining 261, forty-nine percent (n=127) endorsed the trauma screening question and fifty-one percent (n=134) did not endorse the trauma screening question.

The mean number of specific traumas identified by participants was 2.3, with a range of 0-14. Five of the traumas on the list were combat specific and were endorsed by 8 or fewer participants (<6%). The most frequently endorsed trauma was the unexpected, sudden death of a close friend or relative (77%, n=97), followed by learning that one of the traumas in the list happened to someone close to you when you were not there (68%, n=86). Serious injuries and accidents were reported by 49-52% of the respondents respectively.

When looking at the PTSD Checklist (PCL-C), 256 participants responded to the questions about PTSD symptoms and severity. Of these respondents, fifty-four percent (n=140) met the DSM-V criteria for PTSD based on their responses to this measure, which is 13 more participants than endorsed the trauma screening question. Over half of these participants (n=77) scored above 38 on the PCL-C, which is the cutoff score for probable PTSD in veterans (there is no consensus as to the cutoff score for civilians, but it is hypothesized to be lower than this score).

We were interested in potential differences between those who experienced trauma and those who did not report experiencing trauma. The groups were relatively similar in several areas as there was no difference for BAC at arrest, number of days drinking in a typical week, number of drinks on a typical drinking day, frequency of binge drinking (5 or more drinks (male) or 4 or more drinks (female) on a given drinking occasion). There was also no difference in the rate of IID installation between groups, and no gender, race, education or marital status differences were found.

A significant difference in income over $40,000 was identified between the trauma group and non-trauma group, (42.1 vs 55.9, p=.039), and unemployment was significantly higher in the trauma group (23.6%) vs the non-trauma group (13%, p=.027). Those in the trauma group were more likely to have been injured in a crash (26.0 vs 11.9, p=.004), and more likely to have been in prior treatment for substance use (60.0 vs 48.5, p=.037) although there were no differences in prior DWI or prior suspension.

We asked participants about additional substance use on both the computer survey as well as during the TLFB interview. Participants in the trauma group reported using significantly more types of drugs in the past year than the non-trauma group (5.09 (3.66) vs 3.84 (2.56), p=.004). The trauma group also scored higher on overall risk (RIASI) (21.31 (5.90) vs 18.53 (5.60), p<.001).

Not surprisingly, there were significant differences on both the total score for the BSI (92.28 (43.32) vs. 70.37 (25.49), p<.001), as well as on all of the individual subscales on the BSI.

Discussion

Systemically, the stigma associated with being a DWI offender carries both social and financial consequences. Unemployment and poverty are two risk factors for mental health issues as well as alcohol and substance use, and these were seen significantly more frequently in the trauma group. A DWI conviction carries financial cost that includes fines, fees (for IID, IDP, DMV etc), increased car insurance rates, legal fees and more. In this study, participants are reporting total costs of their DWI at between $8,000-$15,000. For those making $40,000/year, this represents 20-38% of their annual income before taxes. If paying for the DWI puts a financial burden on an individual who is already experiencing financial issues, it may be unlikely that they engage fully with the interventions that are put in place, such as treatment (pay per session), IDP (pay per program) or the IID device (pay for install, per-month fee, reset fee for positive test, uninstall fee).

For a person who is self-medicating for mental health issues prior to a DWI, the stigma of the conviction, coupled with the financial strain, may not set the stage for change. A trauma-informed framework that includes acknowledging and addressing the presence of trauma in DWI offenders may change the outcomes for offenders in court and in the sanction phase, when they are interacting with psycho-educational, interventional and treatment components. A new perspective of being treated as someone who needs assistance, rather than someone who is just a criminal may reduce stigma, improve outcomes throughout the process, potentially mitigating the increased risk for alcohol and substance abuse that is associated with trauma, and in turn improving public health and traffic safety.

Further research is needed to integrate trauma-informed perspectives into court and sanctions for DWI offenders. Reducing the stigma of mental health can start here.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th ed).* Arlington, VA: American Psychiatric Publishing.

Atwoli, L., Stein, D. J., Koenen, K. C., & McLaughlin, K. A. (2015, July). Epidemiology of posttraumatic stress disorder: Prevalence, correlates and consequences. *Current Opinion of Psychiatry, 28*(4), 307-311. doi:doi: 10.1097/YCO.0000000000000167

Centers for Medicare & Medicaid Services. (2019). *CMS.gov*. Retrieved from https://www.cms.gov

Corrigan, P. W., & Watson, A. C. (2002). The paradox of self-stigma and mental illness. *Clinical Psychology: Science and Practice, 9*(1), 35-53.

Fox, A. B., Smith, B. N., & Vogt, D. (2018). How and when does mental illness stigma impact treatment seeking? Longitudinal examination of relationships between anticipated nad internalized stigma, symptom severity, and mental health service use. *Psychiatry Research, 268*, 15-20. doi:https://doi.org/10.1016/j.psychres.2018.06.036

Kessler, R. C., Aguilar-Gaxiola, A., Alonso, J., Benjet, C., Bromet, E. J., Cardoso, G., . . . Koenen, K. C. (2017). Trauma and PTSD in the WHO World Mental Health Surveys. *European Journal of Psychotraumatology, 8*(sup5). doi:DOI: 10.1080/20008198.2017.1353383

Leeies, M., Pagura, J., Sareen, J., & Bolton, J. M. (2010). The use of alcohol and drugs to self-medicate symptoms of posttraumatic stress disorder. *Depression and Anxiety, 27*, 731-736.

Peller, A. J., Najavits, L. M., Nelson, S. E., LaBrie, R. A., & Shaffer, H. J. (2010). PTSD among a treatment sample of repeat DUI offenders. *Journal of Traumatic Stress, 23*(4), 468-473.

SAMHSA. (2014). *SAMHSA's Concept of trauma and guidance for a trauma-informed approach. Hhs Publication No. (SMA) 14-4884.* Rockville: Substance Abuse and Mental Health Services Administration.

Sheehan, D., & Lecrubier, Y. (2006). *M.I.N.I. Screen 5.0.0.* Tampa: University of South Florida.

Turner, S., Mota, N., Bolton, J., & Sareen, J. (2018). Self-medication with alcohol or drugs for mood and anxiety disorders: A narrative review of the epidemiological literature. *Depression and Anxiety, 35*(9), 851-860. doi: https://doi.org/10.1002/da.22771

In-Person Versus Distance Delivery of the Back on Track Remedial Program: A Pilot Study Comparison

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Abstract

Background: Back on Track (BOT) is a remedial program for impaired driving offenders. Currently, BOT is offered at 30 sites across Ontario. Although efforts have been made to enable equitable access, impaired driving offenders in more remote areas may face challenges in accessing the program. In light of recent evidence suggesting that internet-based psychotherapeutic interventions may be effective, distance participation in BOT is being considered.

Objective: This pilot study was designed to provide a preliminary comparison of in-person versus distance delivery of the BOT program.

Methods: Nine participants were randomly assigned to the in-person condition and ten participants to the distance condition. Distance participants watched live feed of the in-person group, presented via the Ontario Telehealth Network (OTN), with two-way audio and visual feed between groups. All participants completed pre- and post-workshop assessments of knowledge and attitudes relevant to impaired driving, as well as assessments of satisfaction, engagement, and presentation clarity. Facilitators completed a feedback questionnaire.

Results: Only one difference in outcome between the two program delivery methods was identified; the in-person group appeared to experience an improvement in knowledge about impaired driving, whereas the simulated distance group appeared to experience a decrease in knowledge ($F(1,14)=8.40$, $p=0.012$). Client Satisfaction ($t(17)=-4.89$, $p<.001$) and Participant Engagement ($t(15)=-2.05$, $p=.058$) were higher among in-person than simulated distance participants. In-person participants found the workshop to be more clearly presented than did simulated distance participants ($t(12.44)=-2.79$, $p=.016$). Facilitator feedback cited challenges with the technology and identified the need for trained clinical staff at the distance learning site to deal with any client issues.

Discussion, Conclusions and Implications: Recognizing sample size limitations, the current study found few differences in outcomes between groups, although both participant and facilitator data suggest concerns about the experience of distance participants. Results support further refinement and evaluation of distance delivery of BOT.

Introduction

Back on Track (BOT) is a remedial program for drivers convicted of a Criminal Code impaired driving offence or drivers with two or more administrative driving suspensions; full reinstatement of driving privileges is contingent, in part, on successful program completion. Based on an initial assessment, program clients are assigned to either an 8-hour education or a 16-hour treatment intervention/workshop. Follow-up interviews are conducted six months following workshop completion. Developed and operated by the Centre for Addiction and Mental Health (CAMH), the program is currently offered at 30 sites across the province. Program content and procedures are manualized to safeguard consistency and quality of program delivery. The BOT program has received high participant satisfaction ratings (Smart et al., 2012), and been associated with reductions in alcohol and drug use and related problems following program participation (Stoduto et al., 2014; Wickens, Flam-Zalcman et al., 2013).

Although efforts have been made to enable equitable access to BOT across Ontario, impaired driving offenders in more remote areas of the province face challenges in accessing the program. In order to increase accessibility, distance participation through web-based and related technologies has been considered.

Available research of distance therapy suggests that it can have beneficial effects for some participants. A meta-analysis of internet-based psychotherapeutic interventions showed a medium effect size for these interventions, and concluded that they were as effective as traditional face-to-face therapies (Barak et al, 2008). However, distance therapy faces several challenges such as an absence of visual cues and spontaneous clarifications potentially impairing communication (Rochlen et al., 2004) or the need for technological literacy in order to manage the medium (Stofle, 2001). Other concerns in BOT's regulatory context include verifying the identity of participants, determining if they are under the influence of alcohol or drugs, and determining that the participant has remained engaged during the program.

Offering distance participation in BOT is an attractive option in that it may increase accessibility of the program, but it is important to understand how distance participation might affect the demonstrated beneficial impact of the program for in-person participants. Therefore, the purpose of this pilot study was to compare in-person with simulated distance BOT participants in changes in knowledge and attitudes about impaired driving and their levels of client satisfaction, program engagement, and perception of presentation clarity.

Methods

Study Design and Sample
This pilot evaluation adopted a mixed between-within (pre-post) design. Recruitment began in April, 2017 and continued until the sample of 20 participants was obtained. A total of 22 participants provided voluntary informed consent; 19 completed the study (17 males; 2 females).

Participant Inclusion/Exclusion
Individuals assigned to the Education workshop based on completion of the initial assessment were eligible to participate in the pilot study if they were: (a) 18 years of age or older; (b) planning to attend BOT at the Toronto site; (c) able to participate in the program without assistance (e.g., does not require an interpreter); (d) able to understand written English (as determined by self-report and the ability to read the informed consent form), and; (e) willing to provide informed consent to participate in either the control or distance participation conditions.

Measures
Impaired Driving Knowledge and Attitudes. Pre- and Post-Workshop Questionnaires were identical and consisted of 13 items that assessed Affect (4 items), Attitudes toward Drink-Driving (3 items), Behavioural Intentions (3 items), Self-Efficacy (2 items), and Knowledge (1 item). With one exception, all items were rated on a 4-point Likert-type scale with the labels "1-Strongly Disagree", "2-Somewhat Disagree", "3-Somewhat Agree", and "4-Strongly Agree". The item assessing Knowledge asked: "The number of drinks an average person can have in two hours and still drive safely is:" with response options ranging from 0 to 8+. Previous research has identified a significant improvement for 12 of the 13 items following workshop completion (Wickens et al., 2019).
Client Satisfaction. The Satisfaction Questionnaire consists of 15 items that assess satisfaction with the service and facilitators. All items are rated on a 5-point scale with labels "1=Disagree" to "5=Agree". Overall Satisfaction was calculated for each client based on their average score across all 15 items. Negatively worded items were reverse-coded; thus, high scores denoted greater overall satisfaction.
Participant Engagement Scale. Adapted for the current study from a measure of student engagement and disaffection with learning (Skinner et al., 2009), the 27-item Participant Engagement Scale included items targeting behavioural and emotional engagement and disaffection. Items were rated on a 5-point scale with labels "1-Strongly Disagree", "2-Somewhat Disagree", "3-Neither Agree nor disagree", "4-Somewhat Agree", and "5-Strongly Agree". Negatively worded items were reverse-coded, and all items averaged to create an Overall Engagement score.

Workshop Evaluation. The Workshop Evaluation divides the BOT program into 22 distinct curriculum components and asks participants to rate how clearly presented each component was using a 5-point Likert-type scale ranging from "1 = not at all" to "5 = very". Ratings were averaged across all 22 components.

Facilitator Feedback. Facilitators were asked to provide written responses to open-ended questions assessing their experience with the simulated distance delivery of the program.

Procedure

When a BOT client was assigned to the Education workshop (at the Toronto site) based on the initial assessment, the staff member completing the assessment provided the client with a brief description of the study. Those individuals interested in participating were scheduled to attend the program on the day of the pilot evaluation. Upon arrival at the workshop location, potential participants were shown the Study Information and Informed Consent form. Those who voluntarily agreed to participate in the evaluation were randomly assigned, on a 1-to-1 basis, to participate in either the in-person (control, n=9) or simulated distance (experimental, n=10) delivery of the workshop. Clients in the in-person (control) condition experienced the BOT program as usual. Clients in the simulated distance (experimental) condition participated via interactive video technology, utilizing Ontario Telehealth Network (OTN) facilities. After ensuring valid and informed consent, participants in the experimental group were guided to a conference room where OTN equipment was located. The participants were able to view and interact audio-visually with the program facilitators and in-person participants. Prior to beginning the workshop, all participants completed a brief personal information form that requested some basic demographic information and the Pre-Workshop Questionnaire which took a baseline measure of knowledge and attitudes relevant to impaired driving. Upon completion of the workshop, participants completed the Post-Workshop Questionnaire, Client Satisfaction Questionnaire, Participant Engagement Scale, and Workshop Evaluation. At the end of the workshop, participants were provided with a Tim Horton's gift card, worth $20, to thank them for participating in the study.

Planned Statistical Analyses

Initially, characteristics of the data, including normality and presence of outliers, were assessed. Subsequently, simple descriptive analyses were carried out (e.g., means, standard deviations, proportions). Finally, bivariate tests were conducted to compare the in-person and simulated distance groups on measures of change in knowledge and attitudes with program participation, client satisfaction, evaluation of program components, and self-rated program engagement (*t*-test, one-way ANOVAs). Missing values were treated listwise.

Results

Sample Characteristics

Table 1 presents the characteristics of the in-person (control) and simulated distance (experimental) groups. Across the sample, there were 17 males and 2 females with ages ranging from 18 to 59 years (mean = 35.0, SD = 12.0). A series of independent-sample t-tests and chi-square analyses revealed no statistically significant differences between groups in age, sex, type of offence, or knowledge and attitudes about impaired driving before workshop participation.

Change in Program Outcomes and Experiences

Table 2 presents the means, standard deviations, and measures of internal consistency for each of the output variables. Based on ANOVA tests of program outcomes, a change in Knowledge about impaired driving from pre- to post-workshop differed across groups, with the in-person group increasing in knowledge but the simulated distance group decreasing in knowledge ($F(1,14)=8.40$, $p=0.012$). No significant interactions with Affect, Attitude, Behavioural Intent, or Self-Efficacy were found. Self-Efficacy remained constant pre- and post-session for both groups. There was a main effect pre- to post-workshop for Attitude ($F(1,17)=6.96$, $p=.017$), indicating that both groups demonstrated improved Attitude toward impaired driving following program participation.

Table 1: Sample characteristics

Variable	α / r	In-Person (n=9)	Distance (n=10)	t / χ²	p
Age (mean in years, SD)	-	33.33, 11.16	36.50, 13.09	0.564	.580
Sex					
Male	-	9	8	2.012	.156
Female	-	0	2		
Type of Offence					
Criminal Code	-	8	9	0.006	.937
Highway Traffic Act	-	1	1		
Pre-Workshop Questionnaire (mean, SD)					
Knowledge	-	0.78, 0.67	0.90, 0.74	0.377	.711
Affect	.54	1.22, 0.34	1.50, 0.60	1.22	.239
Attitude	- [a]	3.78, 0.24	3.73, 0.34	-0.324	.750
Behavioural Intent	.55	1.78, 0.67	1.53, 0.45	-0.946	.357
Self-Efficacy	- [a]	4.00, 0.00	4.00, 0.00	-	-

[a] At least one of the component variables has zero variance.

Table 2: Means, standard deviations, and measures of internal consistency by program type

Variable	α / r	In-Person (n=9) Mean	SD	Distance (n=10) Mean	SD
Post-Workshop Questionnaire					
Knowledge [b]	-	1.13	0.35	0.75	0.71
Affect	.93	1.39	0.99	1.53	0.79
Attitude	- [a]	3.93	0.15	3.93	0.21
Behavioural Intent	- [a]	1.67	0.44	1.43	0.32
Self-Efficacy	- [a]	4.00	0.00	4.00	0.00
Client Satisfaction	.82	4.61	0.32	3.67	0.49
Participant Engagement [c]	.96	4.82	0.20	4.23	0.74
Workshop Evaluation	.93	4.81	0.27	4.20	0.62

[a] At least one of the component variables has zero variance.

[b] Due to listwise deletion of missing data, the reported means and standard deviations for both the in-person and simulated distance groups are each based on n=8.

[c] Due to listwise deletion of missing data, the reported means and standard deviations for the in-person group is based on n=7.

Independent-samples t-tests were performed to assess differences in how participants experienced the program. Client Satisfaction ($t(17)=-4.89$, $p<.001$) and Participant Engagement ($t(15)=-2.05$, $p=.058$) were significantly higher among in-person than simulated distance participants, although the latter effect only approached statistical significance. Participants in the in-person group found the workshop to be more clearly presented than those in the simulated distance group ($t(12.44)=-2.79$, $p=.016$).

Facilitator feedback cited challenges with the technology used to implement distance delivery of the program and identified the need for trained clinical staff to be present at the distance learning site to deal with any client issues such as use of substances in contravention of BOT policy or emotional responses to the program content.

Discussion

Only one difference in outcome between the two program delivery methods was identified. Specifically, clients in the in-person group appeared to experience an improvement in knowledge about impaired driving, whereas the simulated distance group appeared to experience a decrease in knowledge. Despite the few differences in program outcomes, there was some indication that participants in the distance group experienced the program differently. Participants in the simulated distance group reported both lower engagement and satisfaction with the program and described the curriculum as less clearly presented than

did the in-person participants. The distance group was watching the workshop through a camera focused on the facilitator and the screen. Challenges included the sound and video quality, which had to be adjusted when a video was switched on. Similarly, when curriculum relevant to impaired driving knowledge was presented, the distance participants had an informal group discussion which may have affected their uptake of the information and contributed to the divergent scores on the Knowledge component of the Post-Workshop Questionnaire; however, the statistical difference is minimal and should not be extrapolated too broadly.

The facilitators had concerns about the need for a trained individual at the distant site in case of any triggered reaction, acting-out behaviour, or alcohol intoxication/withdrawal among participants. They also requested training for managing technological aspects of the workshop.

Limitations

This pilot comparison was conducted with a small group of 19 participants. Results may not be representative of a larger population. In real life settings, the number of participants in the distant group might be as low as 1 to as high as 10 or more. Also, the settings might not be as controlled, e.g. the distant participant might do the workshop from home, from a community health centre, or a hospital. We excluded participants who would need interpreters, which might not be possible in real life settings. Also, these results are not transferable to more intense treatment workshops which are designed for more vulnerable drivers.

Conclusion

This pilot comparison of in-person versus distance participation in BOT showed that on many measures of program impact the two groups were similar. However, those in the simulated distance group did not show an increase in knowledge about impaired driving following the workshop similar to that demonstrated by participants in the in-person group. Client satisfaction, engagement, evaluation of the program's clarity of presentation, and feedback from facilitators suggested areas where the experience of those in the distance group was not as positive as those who participated in-person. Results suggest that an expanded evaluation of distance participation that successfully addresses the concerns identified here is necessary before this option could be recommended for implementation.

References

Barak, A., Hen, L., Boniel-Nissim, M., & Shapira, N. (2008). A comprehensive review and a meta-analysis of the effectiveness of internet-based psychotherapeutic interventions. *Journal of Technology in Human Services, 26*(2/4), 109-160.

Rochlen, A., Zack, J., & Speyer, C. (2004). Online therapy: Review of relevant definitions, debates, and current empirical support. *Journal of Clinical Psychology, 60*(3), 269-283.

Skinner, E. A., Kindermann, T. A., & Furrer, C. J. (2009). A motivational perspective on engagement and disaffection: Conceptualization and assessment of children's behavioral and emotional participation in academic activities in the classroom. *Educational and Psychological Measurement, 69*, 493-525.

Smart, R. G., Flam-Zalcman, R., Docherty, C., Chan, V., Simpson, S., Stoduto, G., & Mann, R. E. (2012). *Back on Track report no. 10. Analysis of client satisfaction data 2008-2010.* Toronto: Centre for Addiction and Mental Health.

Stoduto, G., Mann, R. E., Flam-Zalcman, R., Sharpley, J., Brands, B., Butters, J., Smart, R. G., Wickens, C. M., Ilie, G., & Thomas, R. K. (2014). Impact of Ontario's remedial program for drivers convicted of drinking and driving on substance use and problems. *Canadian Journal of Criminology and Criminal Justice, 56*(2), 201-217.

Stofle, G. S. (2001). *Choosing an online therapist.* Harrisburg, PA: White Hat Communications.

Wickens, C. M., Flam-Zalcman, R., Docherty, C., Stoduto, G., Smart, R. G., Thomas, R. K., Apostolidis, S., Wardell, J. D., & Mann, R. E. (2019). *Development and initial validation of a measure of within-session change for impaired drivers participating in remedial programs.* Paper presented at the 22nd International Council on Alcohol, Drugs and Traffic Safety Conference, Edmonton, Alberta, Canada.

Wickens, C. M., Flam-Zalcman, R., Stoduto, G., Docherty, C., Watson, T. M., van der Maas, M., Brands, B., Ilie, G., Matheson, J., Mann, R. E., & Thomas, R. K. (2018). The impact of remedial program participation on convicted drinking drivers' alcohol and other drug use six months following program completion. *International Journal of Mental Health and Addiction, 16*, 598–616.

Intensified Drink Driving Enforcement in a Swedish Region – An Evaluation of a Pilot Study

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Abstract

A new way of organizing drink driving enforcement was tested in a pilot study in a Swedish police region. One of the goals of the pilot study was to increase the perceived risk of being stopped by the police to conduct a breath test. This paper shows preliminary results of the evaluation based on a questionnaire answered by respondents recruited from the police's Facebook pages. A preliminary conclusion is that one (out of four) of the districts included in the pilot study showed an increased proportion of respondents who had been stopped by the police. The respondents had also noticed an increase of posts about drink driving controls on social media. However, no actual improvement in perceived risk of being stopped by the police could be detected. The results of the entire evaluation must be awaited before any final conclusions can be drawn.

Keywords: Enforcement, drink driving, perceived risk, questionnaire

Disclosure: No conflict of interest.

Introduction

Drink driving is one of the major road safety problems in Sweden. In recent years, police enforcement in terms of the number of breath tests conducted has declined. Between 2010 and 2015, the number of tests were reduced by 53% (ETSC, 2016). This decline has led to great concern in the traffic safety community. In 2016, the police published a new strategy for traffic enforcement. One of the goals of this strategy is to increase the visibility of the police and thus increase the perceived risk of being stopped in a police control. The strategy also supports the use of rather short controls (around 20 minutes) based on the work by Koper (1995).

As a result of the new strategy, a new way of organizing the drink driving enforcement was tested in a pilot study in one of the police regions in Sweden. The pilot was conducted during a 6 month period and included 20-minute controls spread out over different times of the day and over different geographical locations. In addition, information about the controls was published on the police's Facebook pages.

The aim of the study presented in this paper was to evaluate the pilot study with respect to perceived risk of being stopped by the police. The evaluation also includes experiences from the police. However, because data collection is still underway, only a part of the evaluation is presented here. More results will be presented at ICADTS 2019 when the evaluation is finalized.

Method

The pilot study was conducted in four different districts:

- Uppsala: a city with 150 000 inhabitants covering an area of 44 km^2
- Västerås: a city with 120 000 inhabitants covering an area of 48 km^2
- Enköping/Håbo: This district consists of two cities (about 13 000 and 23 000 inhabitants, respectively) and several smaller urban areas that in total covers an area of 35 km^2
- Heby: a rural district including several smaller urban areas (the police controls were conducted in or near the urban areas).

The number of police controls per week and control locations in each district were calculated based on three criteria:

- 20 h of random breath test (RBT) controls per 100 km^2 per week (based on Cameron, 2013)
- each control should last about 20 min
- the number of control locations should be twice the number of controls per week

This resulted in 27 controls per week in Uppsala, 30 controls in Västerås and 21 controls in Enköping/Håbo. In Heby, the prerequisites were different since it is a rural area with rather long distances from the police station. Therefore, the number was set to 7 controls per week which was assessed as a reasonable workload for the police.

The control locations were selected by the police, but also checked by the authors of this paper. Some small corrections were suggested to spread out the controls over the entire districts.

Posts were published on the Police's Facebook pages in order to increase the public's attention to the controls. These posts were published irregularly and typically included information of where the control was conducted and the result, for example if any driver was caught drink driving.

The pilot started in September 2018 (different starting dates in different areas) and was concluded on February 28, 2019. The controls (location, time of day, number of breath tests) were documented in a web-based form.

The central part of the evaluation was a questionnaire answered by a web-panel before and after the pilot study. This questionnaire was distributed both to residents in the pilot area and to residents in a control area. The questions most relevant for the evaluation concerned perceived risks, if the respondents had been stopped by the police to conduct a breath test or not and if they had noticed posts about drink driving controls on social media. As a complement to the web-panel, drivers were also asked to answer a short version of the questionnaire through a post on the police's Facebook pages. This was also done before and after the pilot study, but only in the pilot area, not in the control area. In addition, each police district was asked to write a story of their experiences of the pilot study, which should contain both positive and negative experiences, as well as suggestions for improvement.

This paper shows preliminary results of the evaluation based only on the Facebook-questionnaire. Results from the web-based questionnaire will be presented at ICADTS 2019.

Results and Discussion

According to initial feedback from the police, the new way of organizing police controls worked well, and they became more motivated to conduct drink driving enforcement. The police also plan to continue working according to this model, at least in the urban districts. However, they also reported difficulties to keep up with the prescribed number of controls per week during periods with high workload and adverse weather conditions. This initial feedback will be followed up with interviews and the police's own stories regarding the experience.

Information about the performed police controls during the pilot was received from the web-based form. None of the police districts reached the number of prescribed controls (Figure 1). In Uppsala, the police had some problems at the beginning of the period, but this improved over time. In Heby, which is rural district, the large distances became a problem and the method with 20-minute controls are probably not optimal. Overall (from October and onwards), Enköping/Håbo had the highest number of actual controls relative to the prescribed number (89%), followed by Västerås (71%) and Uppsala (69%).
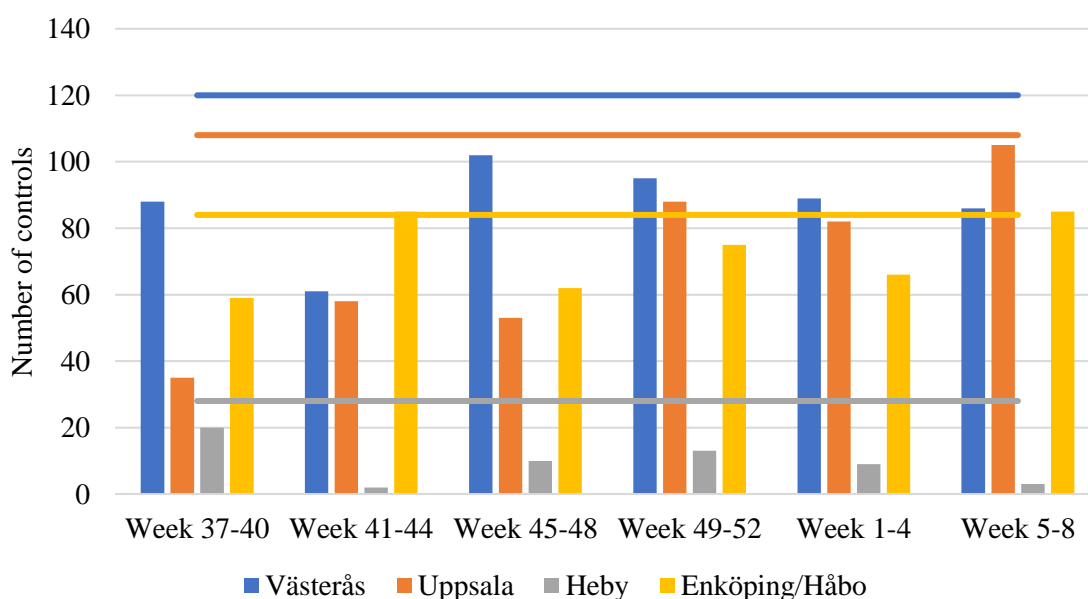

Figure 1 *Number of controls per four-week period and district. The horizontal lines show the prescribed number of controls per district based on the area.*

The respondents of the Facebook-questionnaire were assigned to the police district where they lived, and the number of respondents varied between districts, as well as before and after the pilot study. In Uppsala 265 responses were recorded before the pilot study and 356 after. In Västerås the numbers were 164 before and 405 after, in Enköping/Håbo 62 before and 96 after, and in Heby 22 before and 30 after. Results from Heby are not shown separately because of the small number of responses.

In Enköping/Håbo, the proportion that reported that they had been stopped by the police to conduct a breath test during the last six months increased during the pilot study (significant difference on the 5% level), see Figure 2. No other statistically significant differences were found. This result is plausible since Enköping/Håbo was the district that conducted most police controls in relation to the prescribed number of controls.
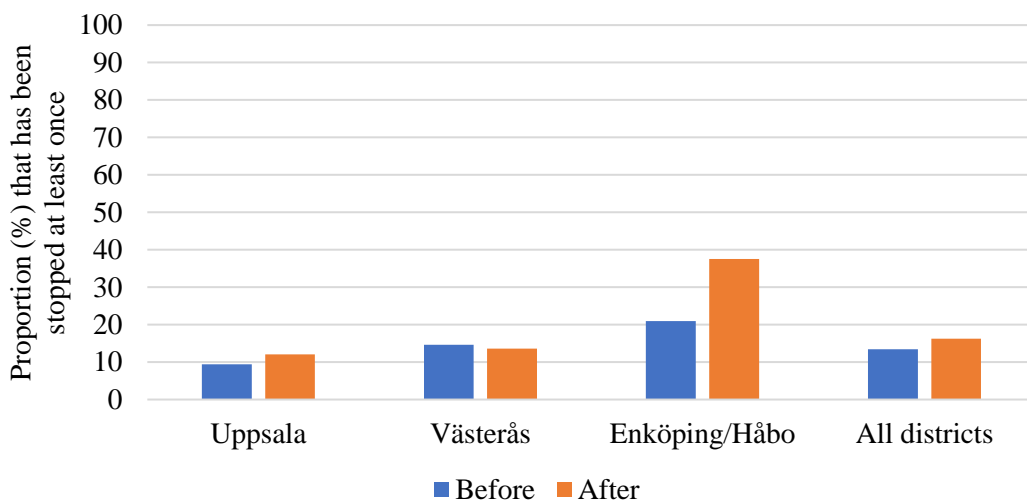
Figure 2 *Proportion of questionnaire respondents who have been stopped at least once during the last six months. Based on the question: During the last six months, how many times have you been stopped by the police to conduct a breath test?*

Figure 3 shows the proportion of respondents who have noticed posts about drink driving enforcement on social media a few times a month or more often, before and after the pilot study. The proportion has increased in all districts (significant difference on the 5% level). This result is expected since respondents were recruited from the police's Facebook pages and the police deliberately increased their number of posts as part of the pilot study. The result confirms that people visiting the police's Facebook page also have noticed this increase.
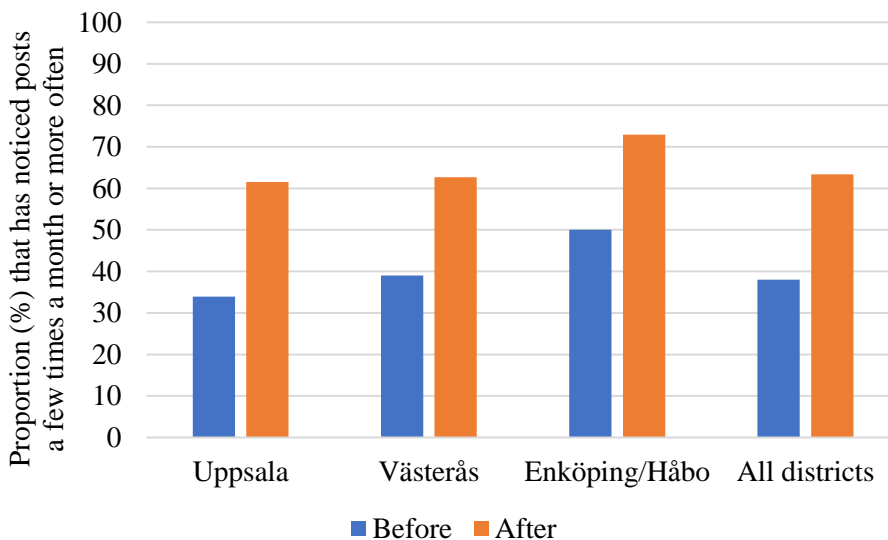
Figure 3 *Proportion of respondents who have noticed posts on social media a few times a month or more often. Based on the question: How often have you, during the last six months, seen articles and/or posts about drink driving enforcement in newspapers or other media (answers for social media).*

An important aim of the pilot study was to increase the perceived risk of being stopped by the police and asked to conduct a breath test. However, this result could not be seen in the responses to the Facebook-questionnaire. Even after the pilot, a majority of the respondents found it very unlikely that they would be stopped by the police (Figure 4). Combining the data from all districts, this proportion increased marginally from 73.1% to 74.9%. The perceived likelihood of being stopped differs somewhat between the districts but no clear changes seems to have taken place during the pilot study.
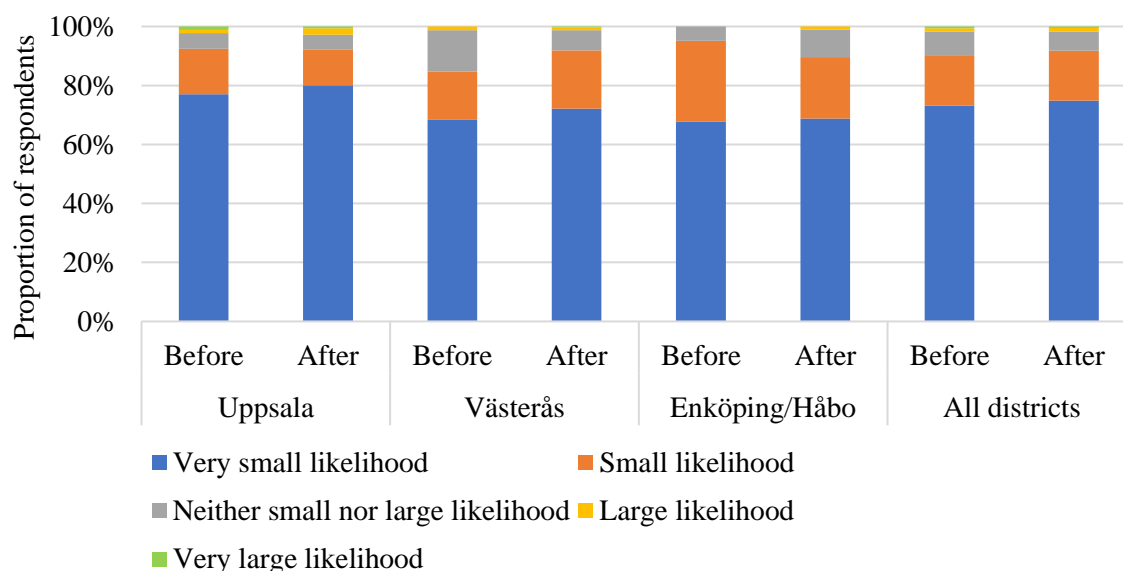
Figure 4 *The respondents' perceived risk of being stopped by the police. Based on the question: On a typical journey, how likely is it that you (as a driver) get stopped by the police to conduct a breath test?*

Preliminary conclusions

Only preliminary conclusions can be drawn since the evaluation is not yet finalized. The conclusions are mainly drawn based on responses from persons recruited from the police's Facebook-pages. The results may therefore not be representative for the population living in the pilot area in general. However, comparisons between responses from the Facebook-questionnaire and responses from the web-panel in the before period showed consistent results.

The preliminary conclusions are:

- None of the districts in the pilot study reached the prescribed number of controls per week. Enköping/Håbo was closest with a rate of 87%.

- The proportion reported to have been stopped by the police increased during the pilot study in Enköping/Håbo. In the other districts, the proportion was about the same before and after the pilot study.

- The respondents in all districts noticed an increase in posts about drink driving controls on social media. This result was expected since respondents were recruited from the police's Facebook pages and the police deliberately increased their number of posts as part of the pilot study.

- No actual improvement in perceived risk of being stopped by the police could be detected. However, the results of the entire evaluation must be awaited before a final conclusion can be reached.

References

Cameron, M. (2013) Best practice in random breath testing and cost-effective intensity levels. Available [2019-03-27]: https://pdfs.semanticscholar.org/5174/7ad80b3535abaf1e1442632eb8e0ac0d29f4.pdf.

ETSC. (2016) How traffic law enforcement can contribute to safer roads. PIN Flash Report 31. European Transport Safety Council, Brussels. Available [2019–03–27]: http://etsc.eu/how-traffic-law-enforcement-can-contribute-to-safer-roads-pin-flash-31/.

Koper, C. (1995) Just enough police presence: Reducing crime and disorderly behavior by optimizing patrol time in crime hotspots. *Justice Quarterly*, *12(4)*, 649-672.

Involvement of Alcohol and Drugs in Fatal Traffic Crashes: A Report from Autopsy and Police Data 2013-2017 in Chiba, Japan

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Abstract

Background: Alcohol-impaired driving decreased dramatically in Japan during the early 2000s. However, little research has been conducted on the involvement of drugs other than alcohol in traffic crashes. Systematic drug testing is not an integral part of the crash investigation by traffic police and empirical data on drug use are missing in police crash records. Autopsies are conducted on a handful of fatally injured road users upon request from the police, and results of drug testing are compiled in the database.

Purpose: To describe the characteristics of autopsy data including prevalence of drugs detected in fatally injured road users and to compare this with police data.

Method: A retrospective data analysis using the two databases from Chiba Prefecture between 2013 and 2017: autopsy data of Chiba University and the police crash data. Study protocol was approved by the ethics committees of participating institutions.

Results: There were ca. 730 fatal injury crashes (deaths within 24 hours). Of 152 autopsied cases (25% women, mean age 62), 36% were pedestrians, followed by pedal cyclists (26%) and drivers of four-wheeled vehicle (20%). Medicinal drugs were detected from 54% of the cases after deleting medicinal drugs likely to be given for treatment. Most frequently detected agents included cough suppressants, antianxiety/sleeping pills, antihypertensives, antihistamines, antipsychotics, antidiabetics, and so on. Poly-medication was identified in 60% of the cases where medicinal drugs were detected. No illicit drugs were detected. Alcohol involvement was documented in 33% of police investigations, and alcohol was detected in 41% of the autopsied bodies. Socioeconomic and health factors surrounding the deceased will also be reported.

Introduction

Alcohol-impaired driving decreased dramatically in Japan in the early 2000s. Traffic crash statistics show that alcohol is involved in 6% of at-fault motor vehicle drivers involved in fatal crashes (National Police Agency [NPA], 2018). Little is known, however, about alcohol involvement of pedestrians and pedal cyclists, because alcohol involvement of drivers tends to be the focus of enforcement and of police investigation of crash-responsibility. Pedestrians and pedal cyclists account for 50% of fatally injured road users in Japan. Nearly 60% of all fatally injured road users in Japan, —including drivers, passengers, bicyclists, and pedestrians, —are 65 years and over (NPA, 2018). Given the high proportion of vulnerable road user fatalities, alcohol involvement of pedestrians and cyclists merits investigation.

Furthermore, little research has been conducted on the involvement of drugs other than alcohol in traffic crashes. Systematic drug testing is not a routine part of the crash investigation and empirical data on involvement of licit and/or illicit drugs among injured road users are almost non-existent in Japan. The prevalence of illicit drug use in the general Japanese population is lower than in western countries (Wada, Funada, & Matsumoto, 2013), while the prevalence of use of licit psychotropic medication appears to be similar to that in European countries (Nakagawa, 2011).

It is shown that Canadian police rarely identify drivers who had used impairing drugs or medications during course of crash investigation (Brubacher et al., 2018). This may be true for Japanese police, in which case crash statistics do not capture most drug-related crashes. Against this background, we investigated fatal

crashes where the deceased were autopsied and drug-tested. Autopsies are conducted on fatally injured road users upon request from police. In the early 1990s, 5-6% of fatally injured road users in Japan were autopsied (Fujita, 2009). The current figure may be higher and varies from region to region within Japan. Police request autopsies when they need to clarify cause of death or suspect involvement of more than one striking vehicle in a crash (e.g., suspected hit-and-run). This judgment is made by specially trained police officers.

In the absence of epidemiological data regarding road user impairment due to drugs, the aim of this paper was to describe the characteristics of autopsy data of fatally injured road users and to compare this with police crash data.

Materials and Methods

We conducted a retrospective data analysis using information from the Chiba Prefecture (population 6.3 million), situated east of Tokyo. Most autopsies are conducted in Chiba University. Two data sources were used: (1) autopsy data of Chiba University (April 2013 and March 2017), and (2) corresponding police crash data. Police data were retrieved from the National Research Institute of Police Science database. The study protocol was approved by the ethics committees of participating institutions.

The extracted autopsy data (N = 152) included all types of road users who were fatally injured or found dead on the road or roadside. These 152 cases were autopsied and had toxicology testing using broad spectrum drug testing that screened for 273 substances. The toxicology panel included methamphetamine/amphetamine (the most abused illicit drugs in Japan), cannabis, and 10 other illicit drugs as well as various medicinal drugs. All detected drugs were confirmed and quantified in preserved blood (femoral and heart) and urine by mass spectrometric techniques (LC-MS/MS). We classified detected substances as inert or active depending on whether they were known to have psychotropic effects on humans. Active drugs were classified into the seven categories of the Drug Evaluation and Classification (DEC) system (Canadian Centre on Substance Use and Addiction, 2018). We also categorized drugs according to the Japanese drug warning system for consumers: 'driving prohibition', 'drive with due care', or no warning (Okamura, Fujita, Kihira, & Kosuge, 2018).

From police crash data, we extracted 725 fatal crashes (death within 24 hours) and 76,464 "serious or slight injury" crashes. The latter included crashes resulting in death more than 24 hours after crash occurrence. The two databases were linked using date/time of crash, police jurisdiction, and age/sex of the deceased as key parameters (see Fig. 1).

Alcohol > 0.1 mg/ml detected either in blood or urine was interpreted as cases where the deceased had consumed alcohol (Suzuki & Yashiki, 2002). The threshold of 0.1 mg/ml was set to eliminate potential post-mortem alcohol production due to decomposition. Drugs likely given for post-crash resuscitation were also deleted (lidocaine, atropine, midazolam, pentazocine, and ketamine) after inspecting autopsy reports for record of hospitalization and treatment.

Uni- or bivariate statistics were presented using t, chi-square or Fisher's exact test to describe the data. Statistical significance was determined at $p < .05$ throughout this paper.
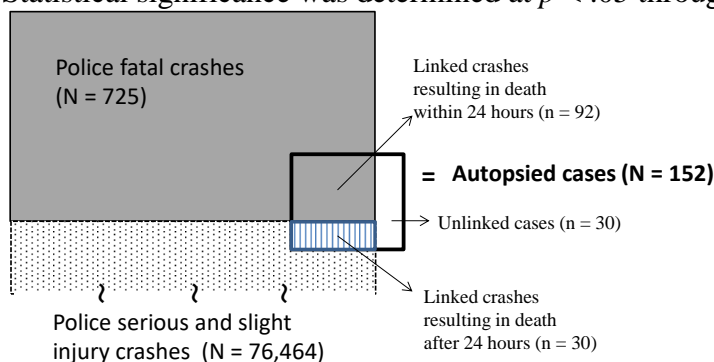

Fig. 1. Schematic diagram of the data used in this study

Results

Autopsy data: general characteristics

Mean age of autopsied cases was 61.7 (standard deviation [SD]: 19.5, range: 18—99). Women accounted for 25% of cases. Thirty-eight percent were pedestrians, 27% pedal cyclists, 19% car/truck drivers, 2% car passengers, and 15% moped/motorcycle drivers. Thirty percent were deemed to be the most at-fault party, 68% were partially at fault (Police assign relative responsibility—the most at-fault and the second at-fault—to drivers, cyclists, and pedestrian). Typically, between one and several days had passed after death before autopsies were conducted. This may have affected drug detection. Various post-mortem factors may lead to reduction or increase in the drug concentration (Leikin & Watson, 2003; Skopp, 2009). The longer it took before the autopsy was conducted, the greater the change in drug concentration and this could result in false negative results (failure to detect drugs that were actually present before death).

Sociodemographic information about the deceased was provided by investigating police. It was documented that 5% had criminal record(s) and 4% had a past traffic-related incident (imprisonment, crash involvement or citation). Some were known to have health problems such as one or more medical condition other than hypertension (27%), hypertension (15%), mental disorder other than dementia (11%), dementia (7%), walking difficulties (7%), history of falling (7%), and alcohol-related problems (6%).

Autopsy data: involvement of alcohol and drugs

Alcohol was detected in 32% of the autopsied cases (the mean femoral blood alcohol concentration [BAC]: 1.3 mg/ml, SD: 0.8, range: 0.1—3.0), while police suspected that 27% of the deceased had consumed alcohol (BAC not provided). No illicit drugs were detected, although police documented detection of methamphetamine in one surviving at-fault striking driver but not from the deceased driver.

Medicinal drugs were detected in 53% of the autopsied cases. Poly-medication was identified in 62% of drug-positive cases. Of these drug-positive cases, the mean number of active drugs per body was 1.7 (SD: 2.2, range: 0—12); the mean number of drugs with driving-related warning per body was 2.6 (SD: 2.1, rage: 0-12). Of detected 231 substances, 103 (45%) were central nervous system (CNS) depressants, followed by inert drugs (38%), CNS stimulants (14%), and narcotic analgesics (4%) under the DEC category system. Under the Japanese drug warning system, 73% of the detected drugs were classified as "driving prohibition" and 20% "drive-with-due-care" class, meaning that 92% of detected drugs had a driving-related warning. Examples of frequently detected drugs were antihypertensives, benzodiazepines or hypnotics of a similar type (e.g., zopiclone), antipsychotics, antihistamines, antitussives, antipyretic analgesics, and antidiabetics. Under the Japanese drug warning system, almost all hypnotics, antipsychotics, antidepressants, antihistamines and antitussives were labeled as "driving prohibition", while antihypertensives and antidiabetics were labeled as "driving-with-due-care". The latter class was classified into inert under the DEC category system.

Involvement of alcohol and drugs were compared between types of road user. However, there was no statistically significant difference in percentage of alcohol and drug involvement, meaning that alcohol and drug involvement in pedestrians and cyclists did not differ from drivers of motorized vehicles.

Next, age and sex were compared by involvement of alcohol and drugs. A significantly higher percentage of men had alcohol than women (38% vs 18%), but no significant difference was found as to age. There were some significant differences by involvement of drugs. First, significantly more women than men had used drugs with a driving-related warning (68% vs 42%). Also, those who had taken these drugs were older than those who did not (mean age 68.1 vs 55.1).

Linkage to police crash data

Of 152 autopsied cases, 122 (80%) could be linked to police crash data. Seventy-five percent of these had been registered as fatal crashes, 16% as serious injury crashes, and 8% as slight injury crashes in police data.

Causes of death for the 30 unlinked cases were: pathological/sudden deaths (47%), drowning (13%), physical trauma (10%), suicide (10%), and undetermined (10%).

There were some statistically significant group differences between linked and unlinked cases. Fewer unlinked cases than linked cases were brought to hospital (62% vs 82%), suggesting that the deceased had been dead for some time. A significantly higher proportion of unlinked cases took active drugs compared with linked cases (52% vs 31%). Conversely, the mean BAC of unlinked cases was lower than linked cases (0.25 mg/ml vs 1.06 mg/ml) where detected, which could be due to longer time till drug testing.

Involvement of alcohol and drugs within the linked autopsy data

Among the linked cases, there was a statistically significant association between alcohol involvement and severity of crashes as registered by police. Alcohol was detected in 42% of the deceased bodies in crashes resulting in death within 24 hours, this figure was much lower (7%) in crashes that resulted in death after 24 hours. This may represent alcohol metabolism following the crash or less frequent alcohol-testing. Second, there was a statistically significant association between alcohol involvement and type of crash. Alcohol was detected in 40% of deceased who were involved in single-vehicle crashes, but in fewer people who died in a pedestrian-vehicle crash (21%) or multiple-vehicle crash (11%).

In contrast, we found no significant association between drug involvement and the severity or type of crashes.

Comparison of autopsied and non-autopsied fatal crashes

We studied crashes resulting in death within 24 hours (from police data) and compared autopsied cases (n = 85) with police non-autopsied cases (n = 640).

There were statistically significant differences in environmental conditions between autopsied and non-autopsied fatal crashes. A higher proportion of autopsied crashes versus non-autopsied crashes occurred between 22:00-3:00 (40% vs 12%). Conversely, a significantly higher proportion of non-autopsied crashes occurred during daytime. A higher percentage of autopsied crashes occurred in the rain (18% vs 10%), whereas a higher percentage of non-autopsied fatal crashes occurred in good weather. Also, autopsied cases were more likely to occur between intersections and on narrower or undivided roads.

There were also statistically significant differences in type of collision between autopsied and non-autopsied crashes. While 40% of non-autopsied crashes were multiple-vehicle collisions (e.g., angle/turning collision at intersection), 53% of autopsied crashes were pedestrian-vehicle collisions. While 29% of non-autopsied cases were collisions with a pedestrian who were crossing the road, 28% of autopsied crashes were collision with a pedestrian who were lying on the road, suggesting alcohol involvement or walking difficulties. Hit-and-run and multiple-collisions in one crash were more prevalent in autopsied crashes.

Age and sex of the deceased were comparable between autopsied and non-autopsied crashes. However, more autopsied crashes involved people of non-Japanese nationality compared with non-autopsied crashes (4% vs 1%). The proportion of alcohol involvement was significantly higher among autopsied than in non-autopsied crashes (48% vs 14%). Involvement of drugs was not recorded at all in the police fatal crash data.

Conclusion

The autopsy data reported in this paper provided insight into general trends in Japanese fatal crashes, but some distinct characteristics were found in autopsied cases such as higher alcohol involvement not only in drivers but also in pedestrians and cyclists. Involvement of impairing medications was more prevalent than alcohol and particularly high in older or female road users. Unfavorable health or socioeconomic conditions could potentially be related to involvement in fatal crashes, but understanding these factors requires more accurate data and larger samples. Much more information is needed to understand the causal effects of alcohol and drug involvement on crash occurrence.

References

Brubacher, J., Chan, H., Erderlyi, S., Asbridge, M., Mann, R.E., Purssell, R.A., & Solomon, R. (2018). Police documentation of drug use in injured drivers: Implications for monitoring and preventing drug-impaired driving. *Accident Analysis and Prevention*, 118, 200-206.

Canadian Centre on Substance Use and Addiction (2018, May). Drug evaluation and classification program. Policy brief. Retrieved from http://www.ccdus.ca/Resource%20Library/CCSA-Drug-Evaluation-Classification-Program-Policy-Brief-2018-en.pdf

Fujita, M. (2009). Forensic autopsy of traffic deaths in Japan. *Journal of the Japanese Council of Traffic Science*, 9, 3-9 (in Japanese).

Leikin, J.B. & Watson, W.A. (2003). Post-mortem toxicology: what the dead can and cannot tell us. *Journal of Toxicology: Clinical Toxicology*, 41, 47-56.

Nakagawa, A. (2011). *International comparison of psychotropic medication prescription patterns*. Health Labour Research Grant Special Research (in Japanese).

National Police Agency (2018, February). Annual report on traffic accidents and enforcement. Retrieved from https://www.e-stat.go.jp/stat-search/files?page=1&layout=datalist&toukei=00130002&tstat=000001027458&cycle=7&year=20170&month=0

Okamura, K., Fujita, G., Kihira, M., & Kosuge, R. (2018). Patterns of use, knowledge, perceived effects of sedating medication on driving: A questionnaire survey of Japanese drivers who use sedating medications. *Transportation Research Part F: Traffic Psychology and Behaviour*, 54, 276-289.

Skopp, G. (2009). Postmortem toxicology. *Forensic Science, Medicine, and Pathology*, 6, 314-425.

Suzuki, O. & Yashiki, M. (2002). *Handbook of practical analysis of drugs and poisons in human specimens—chromatographic methods*. Tokyo: Jiho (in Japanese).

Wada, K., Funada, M., & Matsumoto, T. (2013). Current status of substance abuse and HIV infection in Japan. *Journal of Food and Drug Analysis*, 21, S33-S36.

Kava Influence on Driving Skills: A Case Study

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Abstract

Context: Kava is not defined as a "drug" in traffic legislation in NSW Australia. Increasing use of kava by various community groups has resulted in more traffic offences. This presentation relates to two serious motor vehicle collisions, caused by the same driver being under the influence of kava.

Objectives: This presentation alerts the public and law enforcement agencies to concerns surrounding traffic safety, after high dose kava ingestion.

Key Outcomes: It is highly recommended that a high dose of kava ingestion should be avoided if driving or operating heavy machinery.

Discussion: Mr A had two serious vehicle collisions in an 8-month period in the early hours of the morning, involving two parked vehicles and a road barrier, respectively. Based on witnesses' observations after the collisions, he appeared to be seriously affected by alcohol and / or illicit substances. Roadside breath tests returned a negative reading for alcohol, and his initial blood / urine tests returned negative results for any drugs and alcohol. A witness stated that Mr A had consumed an unknown amount of kava shortly prior to the first collision. After the second collision Mr A's blood sample was analysed again at a later date, and approximately 3 mg/L of kavain was detected in his blood. Mr A stated he had consumed 12 cups of kava in the hours prior to this collision. Mr A had consumed approximately 60 times more than the medicinal dose of kavain in addition to an unknown amount of another five major kavalactones, shortly prior to the second collision. The signs and behaviours he displayed after both collisions were consistent with the effects of kava and it is concluded that he was under the influence of kava at the time of both collisions.

Keywords: Kava, driving-skills.

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Content

Kava (Piper methysticum) is a plant indigenous to the Pacific Islands. It is a psychotropic plant that has been used both recreationally and medicinally for centuries among Pacific Island populations (Lindstrom, 2004). People from the major Pacific Islands have developed kava as a beverage and it is commonly consumed much like alcohol in Western cultures (Steiner, 2001). In countries, such as Fiji, Samoa, Vanuatu and Australia, kava is popular for recreational usage amongst some communities (Clough, 2003; Mathews et al., 1988).

In recent years, motor vehicle collisions following kava ingestion have raised the concern of many scientists. Several studies have been performed to investigate the relationship between motor vehicle collisions and kava intake (Wainiqolo et al., 2012, 2015 and 2016; Sarris et al., 2011). These studies suggested that drinking kava in the six hours prior to driving was a major contributing factor in some motor vehicle collisions. The cases we report on, were two motor vehicle collisions caused by one regular kava drinker. The driver consumed 12 cups of kava drink, finishing one hour before the second collision occurred. The cases are the typical examples of motor vehicle collisions caused by kava ingestion in New South Wales, Australia and are consistent with the conclusions of the abovementioned studies.

Objectives

This article reports on two serious motor vehicle collisions, which were caused by one driver under the influence of kava. This case study demonstrates concern relating to traffic safety after high dose kava ingestion. The study also demonstrates the emergence of new problematic drug abuse in relation to traffic situations and recommends broadening the spectrum of drug analysis.

Key Outcomes

In New South Wales, Australia, drivers suspected of driving whilst under the influence (DUI) are required to provide blood and urine samples for analysis. The range of drugs included in the analytical spectrum is defined by legislation. The result of the case studies presented, provided support for recommendations to broaden the drug analysis spectrum of blood samples taken from drivers suspected of DUI. Considering the increasing recreational use of kava by various communities in Australia, we highly recommend that high dose of kava ingestion should be avoided if driving or operating heavy machinery.

Case Brief

A middle-aged male, Mr A, had two serious motor vehicle collisions in an 8-month period, both of which occurred in the early hours of the morning.

Case 1: The first incident happened at about 2.30 am, in a residential area of NSW, Australia. The vehicle being driven by Mr A collided with a parked vehicle, then continued to be driven a short distance where it collided with another parked vehicle. After the collisions, Mr A refused to exchange details with the owners of the parked vehicles and drove away. Witnesses reported to police that they believed that Mr A was significantly affected by alcohol or drugs due to his manner of driving and stated that he was "staring blankly ahead while he was driving his car and going nowhere". Police stated that after being removed from his vehicle, Mr A appeared to be extremely affected by alcohol or a drug. He was unable to speak in sentences, slurred his words and was unable to stand unassisted.

Mr A's roadside alcohol breath test returned a negative result, and he was conveyed to a hospital for mandatory blood and urine sample collection. The analysis of his blood and urine samples returned negative results for any drug or alcohol. At that time, there was no analysis for kavalactones (kava's major constituents) performed on the samples at NSW Forensic and Analytical Science Service Laboratory. At a later date, one of Mr A's family members stated to police that Mr A had consumed a lot of kava drinks shortly prior to the collisions.

Case 2: Approximately 8 months after the first incident, Mr A had a single vehicle collision on a New South Wales highway at about 4.35 am. The vehicle driven by Mr A collided with a safety barrier and finally stopped in dense grassland after sliding about 100 meters from the point of impact. Based on the signs Mr A displayed after the collision, witnesses formed the opinion that he appeared to be seriously affected by alcohol and / or an illicit substance. He was unable to stand, continually fell over on the grass, appeared very sleepy and mumbled when he spoke. His eyes were bloodshot, and he had trouble maintaining any conversation with police. Mr A was assisted by police to walk from the grassland as he was unable to walk unassisted. He was subjected to a roadside breath test which returned a negative reading for alcohol.

Mr A was conveyed to hospital for medical assessment and a blood sample was collected. Mr A stated to police that he had consumed 12 cups of kava drink approximately one hour prior to the collision and he did not consume alcohol, a drug or any other substance, nor was he suffering any medical condition.

Mr A's blood sample was analysed at a later date and reported approximately 3 mg/L of kavain (one of the six major kavalactones) was detected in his blood. There were no other common psychoactive substances found in his blood.

Discussion

Kava is the name of a beverage produced from the dried roots of the Piper methysticum shrub. Kava has mild psychoactive effects, similar to the effects of alcohol. Kava was first brought to northern Australia in the 1980s by Pacific Islanders who had settled in the country. They used the herb as an alternative to alcohol, because of its similar effects for promoting relaxation, relieving muscle tension and inducing social interaction (Clough, 2003; Mathews et al., 1988). Kava herb extracts are available as a dietary supplement in U.S.A. In Europe, purified extracts or synthetic kavain can be prescribed as an antidepressant and muscle relaxant (Baselt, 2017). The Australian Therapeutic Goods Administration (TGA) has recommended that no more than 250 mg of kavalactones should be taken in a 24-hour period (Kava Fact Sheet, TGA).

The primary bioactive compounds in kava are kavalactones (KLT). Eighteen KLTs have been identified; six major KLTs constitute about 96% of the lipid extract of dried roots and rhizomes.

These are kavain, dihydrokavain desmethoxyyangonin, yangonin, methysticin, and dihydromethysticin (Fu et al., 2009). A single oral 400 mg dose of kavain given to healthy subjects resulted in average peak plasma concentration of 0.05 mg/L at 1.5 hours (Baselt, 2017). In a fatal kava overdose case, the deceased post mortem femoral blood kavalactones' concentrations were detected as: kavain 1.4 mg/L; 7,8-dihydrokavain 2.7 mg/L; methysticin 0.46 mg/L; 7,8-dihydromethysticin 1.6 mg/L and desmethoxyyangonin 0.13 mg/L (Ketola et al., 2015). In the case we are reporting, Mr A's blood kavain concentration was approximately 3.0 mg/L, which is 60 times more than the TGA recommended dose and about double the kavain concentration in the reported fatal intoxication case.

Scientific studies demonstrated that the physical effects of kava include muscle relaxation and analgesia. The psychoactive effects of kava include euphoria, anxiolytic, sedation or stimulation, and a tendency toward being very talkative or introspective (Baselt, 2017). The similar effects of kava to alcohol and benzodiazepines have raised the concern over the possibility that kava could adversely influence driving performance and increase the risk of road collisions (Wainiqolo et al., 2015).

A study examining the saccade (a rapid movement of eyes) and cognitive impairment associated with kava intoxication, concluded that intoxicated kava drinkers (who had each consumed 205 grams of kava powder) displayed specific abnormalities of movement coordination and visual attention, but normal performance of complex cognitive functions (Cairney et al., 2003).

A study carried out by Wainiqolo et al in Fiji showed that in motor vehicle collision incidents 23% of drivers reported having consumed kava 12 hours prior to the incidents. In contrast, 4% of drivers reported having consumed kava 12 hours prior to non-crashed vehicles. Also, nearly twice the number of drivers of crashed vehicles reported drinking kava several times a week to daily in the preceding 12 months as compared to non-crashed vehicles. This study concluded that driving following the use of kava was associated with a significant risk of being involved in a serious motor vehicle collision. It suggested that drinking kava in the six hours prior to driving was a major contributing factor to being involved in a serious injury motor vehicle collision in Fiji. The study also suggested that road safety strategies should explicitly recommend avoiding driving following kava ingestion (Wainiqolo et al., 2012 and 2016).

Limitations

In New South Wales, Australia, while there is mandatory blood and urine testing of drivers suspected of DUI, the drugs included in the spectrum of the analysis is limited to a defined list of illicit and medicinal drugs for which there is scientific evidence of psychomotor effects. Some new medications and recreational drugs are not currently in the spectrum of the analysis. Kava was not included in the analytical spectrum of drugs at the time of the incidents reported in these case reports. Confirmation of kava use in case 2 was on the basis of targeted drug analysis due to information provided at the time of the incident.

Conclusions

According to the nature of the reported collisions, the admission of high dose ingestion of kava hours prior to the collisions, the significant amount of kavain detected (Case 2) and no detection of alcohol and other drug in Mr A's blood / urine samples, as well as the physical and behavioural signs displayed by Mr A which are consistent with the effects of kava, we conclude that Mr A was under the influence of kava and had impaired driving ability at the time of the collisions. Such cases have identified emerging new recreational drugs, a changing pattern of drug usage by drivers, such as kava use and new medications with potentially impairing effects.

We highly recommend:

avoidance of recreational high doses of kava ingestion if driving or operating heavy machinery, and inclusion of kavalactone in mandatory blood testing of suspected impaired drivers in Australia.

Note: Submissions to traffic policy authorities resulted in an amendment to legislation in New South Wales in December 2018 to include a much broader analytical spectrum of drugs.

Next Steps: Currently only kavian, one of the six major KLTs, is targeted in the blood sample analysis. The six major KLTs are going to be targeted analysis for a more accurate and broad range evaluation of the suspected drivers' impairment in future studies.

References

Baselt, R.C. Disposition of Toxic Drugs and Chemicals in Man, 11th Edition, 2017, page 11381139.

Cairney S, Clough AR, Maruff P, Collie A, Currie BJ, Currie J. Saccade and cognitive function in chronic kava users. Neuropsychopharmacology. 2003 Feb;28(2):389-96.

Fu S, Tattam BN, Duke CC, Ramzan I. High-performance liquid chromatography assays for desmethoxyyangonin, methysticin, kavain and their microsomal metabolites. Biomed Chromatogr. 2009 Jan;23(1):81-91.

Ketola RA, Viinamäki J, Rasanen I, Pelander A, Goebeler S. Fatal kavalactone intoxication by suicidal intravenous injection. Forensic Science International. 2015 Apr; 249:e7-11.

Lindstrom L. History, Folklore, Traditional and Current Uses of Kava. In: Singh YN. editor. Kava from Ethnology to Pharmacology. CRC Press, Boca Raton; 2004. p.11 – 28.

Mathews JD, Riley MD, Fejo L, Munoz E, Milns NR, Gardner ID, Powers JR, Ganygulpa E, Gununuwawuy BJ. Effects of the heavy usage of kava on physical health: summary of a pilot survey in an aboriginal community. Med J Aust 1988; 148(11):548-55.

Sarris J, LaPorte E, Schweitzer I. Kava: a comprehensive review of efficacy, safety, and psychopharmacology. The Australian and New Zealand Journal of Psychiatry. 2011 Jan;45(1):27-35.

Steiner, G.G. Kava as an anticraving agent: preliminary data. Pacific Health Dialog. 2001; 8: 335-9.

TGA, Kava Fact Sheet .https://www.tga.gov.au/community-qa/kava-fact-sheet , accessed on 24 Feb 2019.

Wainiqolo I, Kafoa B, Kool B, Robinson E, Herman J, McCaig E, Ameratunga S. Driving following Kava Use and Road Traffic Injuries: A Population-Based Case-Control Study in Fiji (TRIP 14). PLoS One. 2016 Mar 1;11(3).

Wainiqolo I, Kool B, Nosa V, Ameratunga S. Is driving under the influence of kava associated with motor vehicle crashes? A systematic review of the epidemiological literature. Australian and New Zealand Journal of Public Health. 2015 Oct;39(5):495-9.

Wainiqolo I, Kool B, Robinson E, Kafoa B, McCaig E, Herman A and Ameratunga S. Kava use and risk of car crash injury: a population –based case control study in Fiji. Australiasian Road Safety Research, Policing and Education Conference 2012, October 4-6.

Medication and Driving: A Comparison Between Canada, United States, and Europe

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Abstract

Keywords. medication, impaired driving, self-report, survey

Background. Drug-impaired driving is a prominent road safety concern and research surrounding this issue is being conducted at an unprecedented pace. However much less is known about driving under the influence of medication, and how to manage this road safety issue, especially in light of an aging population. Further research to support the development of tailored enforcement strategies and educational campaigns that address the risks associated with medication use and driving is needed.

Objectives. The objective of this study was to compare the rates of drivers in Canada, the United States, and Europe who self-declare driving after taking medication with a warning that it may influence driving ability to determine what quantitative differences exist between these three regions. The effects of demographics and personal beliefs on this self-reported behaviour were also examined.

Methods. Self-reported use of medication with a warning that it may influence driving ability, and personal acceptability of this behaviour were measured as part of the E-Survey of Road Users' Attitudes (ESRA 2; www.esranet.eu). ESRA 2 is a joint international initiative of 26 research centres and road safety institutes; the project has surveyed road users in 38 countries on 5 continents. The descriptive analysis compared rates of this self-reported behaviour and opinions regarding personal acceptability by region. A multivariate model predicting driver's self-reported use of medication with a warning that it may influence driving ability was estimated.

Results. At the time of submission of this abstract, data collection for the cross-sectional online survey is ongoing. Data collection will begin in December 2018; final analysis results will be available in February, 2019.

Discussion. To be completed when the survey data is available and analyses are finalized.

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Introduction

Driving under the influence of medications, both prescription and over-the-counter (OTC) drugs, is a growing road safety concern. Certain medications can impair cognitive and psychomotor performance, and their effect on driving ability have been documented in both experimental and epidemiological studies (Verstraete et al., 2014; Strand, Gjerde, & Mørland, 2016; Rudisill et al. 2016; Gjerde, Strand, & Mørland, 2015). Some of the drug classes with the potential to impair driving include stimulants, opioids, benzodiazepines and other central nervous system (CNS) depressants, antihistamines, antiemetics, and cold and flu medications (Smith, Turturici & Camden, 2018).

Studies examining the prevalence of prescription and OTC medications in various populations offer valuable insight into the magnitude of the issue. In Canada, the Traffic Injury Research Foundation (TIRF) produces the Road Safety Monitor (RSM) which is based upon an online survey of drivers' attitudes and

behaviours. The RSM measured the self-reported behaviour of driving within 2 hours of taking a medication that may affect driving ability within the last 12 months. Results showed that 15.4% of drivers in Canada reported driving within two hours of using OTC medications for allergies, hay fever, cold, flu, cough or insomnia. In addition, 3.1% of drivers reported driving within two hours of taking prescription drugs carrying a warning that it may affect their driving (Robertson, Hing, Woods-Fry & Vanlaar, 2018).

In the United States, the 2013-2014 National Roadside Survey (NRS) measured the prevalence of prescription and OTC medications at the roadside. Results showed that 10.7% of daytime drivers and 7.4% of nighttime drivers tested positive for prescription and OTC medications (Berning, Compton, & Wochinger, 2015). Furthermore, data from the FARS database demonstrate an increasing prevalence of prescription drugs in fatally injured drivers from 1999 to 2010 (Rudisill et al., 2014).

In Europe, results from the first edition of the European Survey of Road users' safety Attitudes (ESRA1, now called 'E-Survey of Road users' Attitudes) measured the self-reported behaviour of medication use and driving. Drivers across Europe were asked if they had driven while taking a medication that carries a warning about its potential to influence driving ability. Results showed that 22% of drivers reported to have done so within the last 12 months (Achermann, 2016). In addition, the average prevalence of medications in fatally injured drivers across European countries was 1.4%, with benzodiazepines being the second most frequently detected substance in fatally injured drivers after alcohol (Schulze, Schumacher, Urmeew, & Auerbach, 2012).

Although various individual studies have measured the prevalence of medication use and driving in Canada, the U.S. and Europe, research comparing this issue across these regions has not, to the best of our knowledge, been conducted. The objective of this paper is to determine what differences exist between these three regions by comparing the rates of drivers in Canada, the U.S., and Europe, who self-report driving after taking medications that have a warning that it may influence driving ability, and the personal acceptability of this behaviour.

Methods

ESRA 2 survey

The ESRA project (E-Survey of Road users' Attitudes) is a joint initiative of road safety institutes, research organisations, public services, and private sponsors, aiming at collecting comparable international and national data on road users' opinions, attitudes and behaviour with respect to road traffic risks. The project is funded by the partners' own resources and covers countries all over the world.

ESRA is an extensive online panel survey, using a representative sample (at least N=1,000) of the national adult populations in each participating country. A common questionnaire was developed and translated into national language versions. The themes covered are e.g. 'self-declared behaviour', 'attitudes and opinions on unsafe traffic behaviour', 'enforcement experiences', and 'support for policy measures'. The survey addresses different road safety topics (e.g. DUI of alcohol, drugs and medicines, speeding, distraction) and targets all types of road users (car drivers, moped drivers and motorcyclists, cyclists, pedestrians). The first edition of the ESRA survey (ESRA1) was carried out in three waves between 2015-2017. Data were gathered from almost 40,000 road users in 38 countries across 5 continents (Meesmann, Torfs, Nguyen, Van den Berghe, 2018).

The present paper is based on the second edition of this global survey (ESRA2_2018). It was conducted in 32 countries in 2018. In total, this survey collected data from more than 35,000 road users (Meesmann, & Torfs, 2019).

Data analysis

Descriptive analyses were conducted to compare the self-reported behaviour of driving after taking a medication carrying a warning that it may influence driving ability, and the attitudes surrounding the acceptability of drivers who drive after taking medications that may affect driving ability. Proportions were compared across all three regions (Canada, United States, and Europe) to determine if there were significant differences between them. Note that a weighting of the data was applied to the descriptive analyses. This weighting took into account small corrections with respect to national representativeness of the sample based

on gender and six age groups: 18-24y, 25-34y, 35-44y, 45-54y, 55-64y, 65y+; based on population statistics from United Nations data (United Nations Statistics Division, 2019). For Europe, the weighting also took into account the population size of each country in the total set of 20 countries (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, The Netherlands and United Kingdom). SPSS 25.0 was used for all analyses (IMB corp, 2017).

Results

As part of the ESRA2_2018 questionnaire, respondents in each region were asked questions about medications and driving. Results are grouped into two sections: self-reported behaviour of driving after taking a medication carrying a warning that it may influence driving ability, and the personal acceptability of this behaviour. More results from the ESRA2_2018 survey on driving under influence of alcohol, drugs and medication can be found in Achermann, Stürmer & Meesmann (2019).

Self-reported behaviour

Rates of the self-reported behaviour of driving after taking medication carrying a warning that it may influence driving ability within the last 30 days are reported by region in Table 1. Self-reported behaviour was measured on a five-point rating scale ranging from never to (almost) always. For the purpose of the analysis, the value of 1 was coded as never, and values 2 to 5 were coded as at least once.

Table 1: Proportions of self-reported behaviour for all three regions.

Over the last 30 days, how often did you as a CAR DRIVER drive after taking medication that carries a warning that it may influence your driving ability?		Canada	United States	Europe
	Never	83,3%$_a$	85,0%$_a$	84,9%$_a$
	At least once	16,7%$_a$	15,0%$_a$	15,1%$_a$

Note. (1) When the superscript letter is different, then the row proportions are significantly different from each other at the 0.05 level.

Regional differences in the proportion of drivers who drove at least once in the past 30 days after taking a medication that carries a warning that it may influence driving ability were not found to be significant (chi-squared = 1.50; df = 2; p-value= 0.471).

Personal acceptability

The proportions of personal acceptability of drivers who drive after taking medication that may influence ability to drive are reported by region in Table 2. Personal acceptability was measured on a five-point rating scale ranging from unacceptable to acceptable. For the purpose of the analysis, values 1 to 3 were coded as unacceptable/neutral, and values 4 and 5 were coded as acceptable

Table 2: Proportions of personal acceptability for all three regions.

How acceptable do you, personally, feel it is for a CAR DRIVER to drive after taking a medication that may influence the ability to drive?		Canada	United States	Europe
	Unacceptable/neutral	96,2%$_a$	99,4%$_b$	97,6%$_c$
	Acceptable	3,8%$_a$	0,6%$_b$	2,4%$_c$

Note. (1) When the superscript letter is different, then the row proportions are significantly different from each other at the 0.05 level.

When asked whether respondents felt it to be personally acceptable for a driver to drive after taking medications that may influence ability to drive, the proportions of those that found it acceptable were significantly different between regions (3.8% for Canada, 0.6% for U.S., and 2.4% for Europe) (chi-squared = 18.54; df = 2; p-value =0.000).

Conclusions

Taking medications and driving is not always perceived as dangerous. However, there are a number of medications, both prescribed and over-the-counter, that significantly impair driving. Across the three regions, we found that 15% or more of respondents candidly responded they had taken these medications

and driven, yet no more than 3.8% indicated that it was an acceptable behaviour. The discordance between beliefs and behaviour is concerning. Although motorists may recognize using these potentially impairing medications as unacceptable, they may also feel there is little option (i.e., some medications are life saving) and that the risk is minimal. For example, in a recent study conducted in the U.S., only 42.5% of drivers reported that people driving after using prescription drugs was a very serious threat to their personal safety on the roadway (AAA Foundation for Traffic Safety, 2018).

These results speak to the need to develop and revaluate our current practices for educating the public about using medications and driving. Drivers may not always distinguish between impairing and non-impairing medications, nor understand potential interactive effects among medications. As such, health professionals are instrumental in better identifying and informing drivers about the potential dangers through counseling and improved prescription labeling (i.e., warnings). More specifically, pharmacists, doctors and other healthcare practitioners require evidence-based tools and training that facilitates their ability to screen and effectively communicate to patients the impact that certain medications may have on driving ability. A study by Hill, Rybar and Styer (2013), demonstrated that the implementation of a training curriculum for healthcare professionals resulted in increased knowledge about medications and driving impairment, as well as increased confidence in screening patients about their medication use and driving. Medication labeling is also important. Although all three of the study regions have policies on prescription warning labels, not all clearly communicate the potential driving risk. Improvements may include warnings presented in larger font, brighter in color, or displaying a signal word (i.e., "danger"). Pictorial aids can also enhance understanding (Katz, Kripalani, & Weiss, 2006). In the European research project DRUID (Driving under the Influence of Drugs, Alcohol and Medicines) a warning label using a rating pictogram on medicines and driving (ranging for risk categories from green, yellow, orange to red), proved to be effective in risk communication (Meesmann et al., 2011).

Finally, although still low, it is interesting to note that acceptability of driving after using a potentially impairing medication is significantly lower in the United States than Europe and Canada (Canada having the highest acceptable reports). This warrants further examination as it suggests differences in how drivers perceive risks, both crash and injury, as well as enforcement and apprehension for driving and using potentially impairing medications. These differences may relate to how information is relayed to drivers, and what might be the most effective educational delivery mechanisms.

References

AAA Foundation for Traffic Safety (2018). 2017 Traffic Safety Culture Index. *AAA Foundation for Traffic Safety, Washington, D.C.*

Achermann Stürmer, Y. (2016). Driving under the influence of alcohol and drugs. ESRA thematic report no. 2. ESRA project (European Survey of Road users' safety Attitude). Bern, Switzerland: Swiss Council for Accident Prevention.

Achermann Stürmer, Y., & Meesmann, U. (2019) Driving under the influence of alcohol and drugs. ESRA2 Thematic report Nr. 2. ESRA project (E-Survey of Road users' Attitudes). Bern, Switzerland: Swiss Council for Accident Prevention.

Berning, A., Compton, R., & Wochinger, K. (2015). Results of the 2013-2014 national roadside survey of alcohol and drug use by drivers. Journal of Drug Addiction, Education, and Eradication, 11(1), 47.

Gjerde, H., Strand, M. C., & Mørland, J. (2015). Driving under the influence of non-alcohol drugs–an update. Part I: epidemiological studies.

Hill, L. L., Rybar, J., & Styer, T. (2013). Evaluation of curriculum to improve health professionals' ability to manage age-related driving impairments. Accident Analysis & Prevention, 61, 222-232.

IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

Katz, M. G., Kripalani, S., & Weiss, B. D. (2006). Use of pictorial aids in medication instructions: a review of the literature. American Journal of Health-System Pharmacy, 63(23), 2391-2397.

Robertson, R. D., Mainegra Hing, M., Woods-Fry, H., & Vanlaar, W. G. (2018). Road Safety Monitor 2017, Drugs & Driving in Canada.

Rudisill, T. M., Zhao, S., Abate, M. A., Coben, J. H., & Zhu, M. (2014). Trends in drug use among drivers killed in US traffic crashes, 1999–2010. Accident Analysis & Prevention, 70, 178-187.

Meesmann U., Boets S., De Gier J.J., Monteiro S., Álvarez F.J., & Fierro I. (2011). Main DRUID results to be communicated to different target groups. DRUID (Driving under the Influence of Drugs, Alcohol and Medicines). 6th Framework programme. Deliverable 7.3.2.

Meesmann, U., & Torfs. K. (2019). ESRA2 methodology report. ESRA project (E-Survey of Road users' Attitudes). Brussels, Belgium: Vias institute.

Meesmann, U., Torfs, K., Nguyen, H., & Van den Berghe, W. (2018). Do we care about road safety? Key findings from the ESRA1 project in 38 countries. ESRA project (European Survey of Road users' safety Attitudes). Brussels, Belgium: Vias institute.

Schulze, H., Schumacher, M., Urmeew, R., & Auerbach, K. (2012). DRUID final report: work performed, main results and recommendations. *Bergisch Gladbach (Germany): Federal Highway Research Institute*.

Smith, R.C., Turturici, M. & Camden, M.C. (2018). Countermeasures Against Prescription and Over-the-Counter Drug-Impaired Driving. AAA Foundation for Traffic Safety.

Strand, M. C., Gjerde, H., & Mørland, J. (2016). Driving under the influence of non-alcohol drugs—an update. Part II: Experimental studies. Forensic Sci Rev, 28(2), 79-101.

UNdata, United Nations Statistics Division, 2019.

Verstraete, A. G., Legrand, S. A., Vandam, L., Hughes, B., & Griffiths, P. (2014). Drug use, impaired driving and traffic accidents (Vol. 16). Publications Office of the European Union.

Perceptions of Those Who Drive After Cannabis Use: Exploring Concepts from the Social Cognition Literature

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Abstract

Background: Theoretical concepts from the social cognition literature have proven valuable in understanding and developing countermeasures for driving under the influence of alcohol. Yet, these concepts have rarely been applied to inform understanding of driving under the influence of cannabis (DUIC).

Objectives: This study aimed to expand knowledge of perceived collision risk and social influences associated with DUIC and driving after other substance use.

Methods: Semi-structured interviews were conducted with 20 participants of a remedial program for impaired drivers. Two independent coders initiated thematic analysis. Early discussion of emergent themes led to the identification of applicable social cognition concepts, resulting in selective coding and interpretation.

Results: Many participants identified DUIC as less risky than driving under the influence of alcohol or other drugs. Mixed perceptions regarding the dangerousness of DUIC were expressed, with some participants denying increased collision risk except among novice cannabis users. Comparative optimism bias was also expressed by participants who perceived themselves as less likely than others to be involved in a collision when DUIC. In view of normative influence, participants perceived friends to be more accepting of DUIC than family, and there were indications that fellow users' opinions were viewed as more credible than those who did not use cannabis.

Discussion, Conclusions and Implications: Comparative optimism bias and normative influence may contribute to perceived risks associated with DUIC and may, therefore, be useful concepts to employ to increase the effectiveness of intervention initiatives. Important implications for public health and road safety campaigns including the source and focus of the message are discussed.

Introduction

According to international roadside survey studies, cannabis is often the illicit drug most commonly used prior to driving (Beirness & Beasley, 2010; Berning et al., 2015; Davey et al., 2007; Verstraete & Legrand, 2014) and, after alcohol, the substance most frequently detected in seriously and fatally injured drivers (Drummer et al., 2004; Verstraete & Legrant, 2014; Woodall et al., 2015). The magnitude of collision risk associated with cannabis-related impairment is difficult to measure and varies between studies (Asbridge et al., 2012; Elvik, 2013; Li et al., 2012; Rogeberg & Elvik, 2016). While legal and other efforts to reduce impaired driving have predominantly focused on driving under the influence of alcohol (DUIA), now efforts to reduce drug-driving, especially driving under the influence of cannabis (DUIC), are garnering substantial policy and research attention (Watson & Mann, 2016).

Studies on DUIA provide insights helpful for advancing understanding of DUIC (Asbridge et al., 2016; Watson & Mann, 2016). Key topic areas of DUIA research have included driver attitudes, perceived risks, and normative influence such as the role of perceived peer disapproval (Baum, 2000; Davey et al., 2005; McCarthy et al., 2007). Earlier research identified a widespread lack of recognition of DUIA as a high-risk behaviour; personal judgments of responsibility and appropriate sanctions for DUIA, for example, were highly sensitive to situational context and minimal in the absence of adverse consequences such as serious injury or property damage (DeJoy, 1989; DeJoy & Klippel, 1984; Pliner & Cappell, 1977). However,

knowledge and beliefs regarding DUIA have changed over time and the behaviour is now widely regarded as a major collision risk factor and met with strong social disapproval (Berger & Marelich, 1997; Danton et al., 2003; Greenberg et al., 2005), a shift accompanied by significantly reduced DUIA prevalence (Berger & Marelich, 1997; Elder et al., 2004; Fell & Voas, 2014; Mann et al., 2001; Wickens et al., 2013; Yanovitzky & Bennett, 1999).

Evidence shows that engaging in DUIA is influenced, in part, by safety-related perceptions, with lower likelihood of DUIA among those who perceive the behaviour to increase collision risk (Greenfield & Rogers, 1999; Harbeck & Glendon, 2013; Harbeck et al., 2017). Drink-drivers also demonstrate a comparative optimism bias that leads individuals to estimate their own risk of a negative event as lower than that of someone else (Shepperd et al., 2002). Drink-drivers tend to perceive themselves as less likely than the average driver to have a collision when DUIA; and this bias represents a means to self-justify engaging in DUIA (Albery & Guppy, 1996).

Understanding DUIC has rarely been informed by relevant concepts from social cognition literature, such as comparative optimism bias and normative influence (see Aston et al., 2016; Barrie et al., 2011; Danton et al., 2003; Greene, 2018). We used qualitative interviews to assess perceived collision risk and social influences associated with DUIC.

Methods

We extracted from the transcribed dataset responses to questions about perceptions related to: the effects of cannabis use on collision risk (i.e., increases risk, decreases risk, or has no effect); driving skills most affected by cannabis use; and beliefs of friends and family regarding whether and how cannabis use affects collision risk.

The data were co-coded by the interviewer and first author. Thematic analysis began with independent coding of all extracted transcript text for emergent themes without preconceived hypotheses (Glaser, 2004) and we followed coding steps found in standard qualitative research guides (Coffey & Atkinson, 1996; Corbin & Strauss, 2008; Denzin & Lincoln, 1994; Rubin & Rubin, 2005). While openly coding data, the first author observed applicable concepts from the social cognition literature. We re-read the data multiple times and prepared a table containing narrower themes of interest with illustrative quotations. We then discussed any outstanding discrepancies and how to present our findings, including how to address any uncommon examples we observed. Thus, while our coding began inductively, observation of and mutual interest in applicable social cognition concepts led to selective coding and interpretation, moving us away from grounded theory techniques (Glaser, 2004).

Results

Sample characteristics

Participant ages ranged from 21 to 53 years (mean = 32). Self-reported length of time with a driver's license ranged from five to 31 years. Table 1 presents other sample characteristics, including past-year DUIC frequency and substance use. All participants who reported daily past-year occurrences of DUIC also reported daily cannabis use. A majority (65%) reported having driven in the past year after drinking, while 15% reported driving after use of other drugs. All participants indicated that the impaired driving offence that brought them to BOT was related to alcohol; only one reported being charged for DUIC at the same time as their alcohol-related charge.

Only 15% of participants reported having been involved in a collision as a driver after using cannabis; in one case, alcohol was also reported to be involved. Two participants reported ever having been in a collision as a passenger with a driver who had used cannabis, and again one noted that alcohol was also involved.

Perceived effects of cannabis use on collision risk and driving skill

While some participants believed that cannabis use impairs driving and increases collision risk, this was often qualified by statements regarding the amount consumed or level of personal experience with the drug.

[I]t's not a good idea for people who haven't smoked weed[...]it would endanger others because I feel like if you're doing it first, like for your first couple of times, it'll boost your anxiety up, then probably create a car crash on the road. (participant 12)

Table 1. Sample characteristics

	% reporting [n]
Gender	
Male	90 [18]
Female	10 [2]
BOT workshop type in which participant was enrolled	
Education workshop	65 [13]
Treatment workshop	35 [7]
Past-year DUIC [within hour of cannabis use]	
Daily	20 [4]
Weekly	25 [5]
Monthly	15 [3]
Less than monthly	40 [8]
Past-year cannabis use	
Daily	55 [11]
Weekly	15 [3]
Monthly	20 [4]
Less than monthly	10 [2]
Past-year alcohol use	
Daily	5 [1]
Weekly	70 [14]
Monthly	20 [4]
Less than monthly	5 [1]
Past-year other drug use [not cannabis or alcohol]	
Monthly use	25 [5]
Less than monthly use	20 [4]
No use	55 [11]

Commonly drawing on personal experiences, participants identified varied skills related to driving that could be negatively impacted by cannabis use including judgement (e.g., misjudging speed or distance between vehicles), reaction time, and peripheral vision. Paranoia and anxiety or panic induced by cannabis use were mentioned as feeling states that could disrupt driving. Many reported varied attention-related effects that could impair driving such as distracted concentration, focusing on other details (e.g., "tunnel vision", "hyper-focusing"), and decreased alertness or being too "relaxed".

Despite acknowledging driving-related abilities that could be negatively affected, some participants did not believe that cannabis use increases collision risk. Several participants who reported experiencing effects on concentration, alertness, and paranoia considered these effects as having a positive impact.

My attention span is there. I'm not driving anything dangerous. I'm driving very, like, cautiously[...]I'm checking, I'm aware. I'm like, in fact, I'm extremely alert. So there's really nothing that's going to happen that I'm going to do on the road. (participant 13)

A few participants believed that cannabis use improves their overall driving ability: e.g., "I drive perfectly fine. It made me drive better, to be honest with you." (participant 4)

Comparative optimism bias

Many participants demonstrated a comparative optimism bias, expressed as lower estimates of personal risk for a negative outcome (i.e., collision) compared to others' risk. These participants often believed that while cannabis use did not affect or no longer affected (e.g., due to drug tolerance) their own driving, it likely could or does affect someone else's driving, especially in reference to novice or less frequent cannabis users.

> I've really been smoking for years now and I'm always driving. It's never affected me, like not even the slightest. But I've heard people tell me that, 'Oh, I've smoked, I can't drive', 'Oh, I get paranoid' and stuff like that. (participant 2)

These participants identified effects of cannabis use that they themselves do not experience as the primary cause of possible driving-related impairment, allowing them to perceive themselves as different from drivers who experience a collision after cannabis use.

Several participants compared their DUIC to DUIA while identifying the latter behaviour as far riskier.

> Honestly, I think it's [DUIC] better than drinking[…]when you drink, like, you don't even remember the things that you do the next day, but when you smoke you actually, like, you focus. You focus on the road, even if you're driving, you focus. (participant 7)

Again, this type of cognitive bias allows drivers to rationalize and legitimize their choice to engage in DUIC.

Normative influences

Normative influences may also impact DUIC risk perceptions. When asked about what their friends or family think regarding the effects of cannabis use on collision risk, many recalled having conversations about the issue. Overall, friends were seen as more accepting of DUIC compared to family members.

> My parents definitely think that it would increase it [collision risk], but my friends, no. My friends, they smoke often, as often as I do, and they drive as often as I do and they don't feel it impairs their driving. (participant 2)

Participant responses revealed that some may regard as more credible the opinions of fellow cannabis users than the opinions of non-users regardless of whether they were friends or family.

Some participants expressed a sense that DUIC is socially accepted or generally "not frowned upon" and connected this sense to viewing cannabis use and DUIC as commonplace, and to beliefs that DUIC is relatively benign in terms of collision risk.

> I think my friends are of the same mind[…]I don't think that any one of them would argue that it's [cannabis use is] not a hindrance. But I'm sure there would be a couple that would be like, 'Whatever, it's no big deal', you know. I think there's[…]been a long underground belief that marijuana's not a big deal and that it's not really a drug and all that sort of stuff. So I think people my age, like between twenty-five and thirty-five or twenty-five and forty, they've just kinda been working through that[…]the government's actions and their willingness to look at legalisation and stuff is kind of representative of that. (participant 19)

This participant and several others, based on their own and others' anecdotal experiences, suggested that many Canadians now view cannabis use as low risk for driving-related and other harms. In these instances, impending cannabis legalisation was viewed as confirmation that cannabis use poses minimal health and safety risks (statements that can be contrasted with growing evidence (Fischer et al., 2017)).

Discussion

Our study has several limitations. Interviews generate self-reported data that may be subject to recall issues and social desirability bias. The latter is perhaps a larger concern because participants were recruited from a program they must complete to have their driving licenses reinstated. That said, participants were assured that study participation was confidential and would not impact their program status. Most spoke comfortably during their interviews. As we consulted a group of known at-risk drivers, it is unclear to what extent our findings may transfer to the broader population, including medical and non-medical cannabis users. Additionally, as most who volunteered to participate in our study identified as male, our findings may have limited transferability to female drivers.

Consideration of how comparative optimism bias and normative influence may contribute to perceived risks associated with DUIC may well inform future intervention efforts. The wide spectrum of beliefs about the dangerousness of DUIC poses a significant challenge to the delivery of effective prevention messaging to a diverse driving public. Our results lead to recommendations for developing new public health and road safety campaigns: 1) consistently base messaging on up-to-date evidence of the impairing effects of cannabis use on driving (Brands et al., submitted; Downey et al., 2013; Hartman et al., 2015); 2) provide information on the limited utility of personal efforts to compensate for cannabis-related impairment while driving [e.g., slowing driving speed (Brands et al., submitted; Young & Regan, 2007); and 3) aim for a wide audience in an effort to decrease the perceived social acceptability of DUIC. Finally, our findings also suggest considering the perceived credibility of the source of prevention messaging. If individuals who engage in DUIC are more influenced by fellow cannabis users than others, it may be important that public campaigns are endorsed or delivered by those with relevant lived experience.

References

Albery, I. P., & Guppy, A. (1996). Drivers' biased perceptions of the adverse consequences of drink-driving. *Drug and Alcohol Review, 15*(1), 39-45.

Asbridge, M., Wickens, C. M., Mann, R. E., & Cartwright, J. (2016). Alcohol, cannabis and new drivers. In D. L. Fisher, J. K. Caird, W. J. Horrey & L. Trick (Eds.), *Handbook of teen and novice drivers* (pp. 191-210). Boca Raton: CRC Press.

Asbridge, M., Hayden, J. A., & Cartwright, J. L. (Mar 2012). Acute cannabis consumption and motor vehicle collision risk: Systematic review of observational studies and meta-analysis. *BMJ: British Medical Journal, 344*(7846), 1-9.

Aston, E. R., Merrill, J. E., McCarthy, D. M., & Metrik, J. (2016). Risk factors for driving after and during marijuana use. *Journal of Studies on Alcohol and Drugs, 77*(2), 309-316. doi:10.15288/jsad.2016.77.309

Barrie, L. R., Jones, S. C., & Wiese, E. (Feb 2011). "At least I'm not drink-driving": Formative research for a social marketing campaign to reduce drug-driving among young drivers. *Australasian Marketing Journal (AMJ), 19*(1), 71-75.

Baum, S. (2000). Drink driving as a social problem: Comparing the attitudes and knowledge of drink driving offenders and the general community. *Accident Analysis and Prevention, 32*, 689-694.

Beirness, D. J., & Beasley, E. E. (2010). A roadside survey of alcohol and drug use among drivers in british columbia. *Traffic Injury Prevention, 11*(3), 215-221. doi:10.1080/15389581003735626

Berger, D. E., & Marelich, W. D. (1997). Legal and social control of alcohol-impaired driving in california: 1983-1994. *Journal of Studies on Alcohol, 58*(5), 518-523.

Berning, A., Compton, R., & Wochinger, K. (2015). *Results of the 2013–2014 national roadside survey of alcohol and drug use by drivers (traffic safety facts research note).* (No. DOT HS 812 118). Washington, DC: National Highway Traffic and Safety Administration.

Brands, B., Mann, R., Wickens, C., Sproule, B., Stoduto, G., Sayer, G., . . . Le Foll, B. (submitted). *Acute and residual effects of cannabis on driving simulator performance of young drivers: Randomized clinical trial.*

Coffey, A., & Atkinson, P. (1996). *Making sense of qualitative data. complementary research strategies.* Thousand Oaks: Sage.

Corbin, J., & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (3rd ed.). Thousand Oaks: Sage.

Danton, K., Misselke, L., Bacon, R., & Done, J. (2003). Attitudes of young people toward driving after smoking cannabis or after drinking alcohol. *Health Education Journal, 62*(1), 50-60. doi:- http://dx.doi.org/10.1177/001789690306200106

Davey, J., Leal, N., & Freeman, J. (May 2007). Screening for drugs in oral fluid: Illicit drug use and drug driving in a sample of Queensland motorists. *Drug and Alcohol Review, 26*(3), 301-307.

Davey, J. D., Davey, T., & Obst, P. L. (2005). Drug and drink driving by university students: An exploration of the influence of attitudes. *Traffic Injury Prevention, 6*(1), 44-52.

DeJoy, D. M. (1989). An attribution theory perspective on alcohol-impaired driving. *Health Education Quarterly, 16*(3), 359-372.

DeJoy, D. M., & Klippel, J. A. (1984). Attribution responsibility for alcohol-related near-miss accidents. *Journal of Safety Research, 15*(3), 107-115.

Denzin, N. K., & Lincoln, Y. S. (Eds.). (1994). *Handbook of qualitative research*. Thousand Oaks: Sage.

Downey, L. A., King, R., Papafotiou, K., Swann, P., Ogden, E., Boorman, M., & Stough, C. (2013). The effects of cannabis and alcohol on simulated driving: Influences of dose and experience. *Accident Analysis and Prevention, 50*, 879-886.

Drummer, O. H., Gerostamoulos, J., Batziris, H., Chu, M., Caplehorn, J., Robertson, M. D., & Swann, P. (2004). The involvement of drugs in drivers of motor vehicles killed in Australian road traffic crashes. *Accident Analysis and Prevention, 36*(2), 239-248. doi:10.1016/S0001-4575(02)00153-7

Elder, R. W., Shults, R. A., Sleet, D. A., Nichols, J. L., Thompson, R. S., Rajab, W., & Task Force on Community Preventive Services. (2004). Effectiveness of mass media campaigns for reducing drinking and driving and alcohol-involved crashes: A systematic review. *American Journal of Preventive Medicine, 27*(1), 57-65.

Elvik, R. (2013). Risk of road accident associated with the use of drugs: A systematic review and meta-analysis of evidence from epidemiological studies. *Accident Analysis and Prevention, 60 No*, 254-267.

Fell, J. C., & Voas, R. B. (2014). The effectiveness of a 0.05 blood alcohol concentration (BAC) limit for driving in the united states. *Addiction, 109*, 869-874.

Fischer, B., Russell, C., Sabioni, P., van den Brink, W., Le Foll, B., Hall, W., . . . Room, R. (2017). Lower-risk cannabis use guidelines: A comprehensive update of evidence and recommendations. *American Journal of Public Health, 107*(8), e1-e12.

Glaser, B. G. (2004). Remodeling grounded theory. *Forum: Qualitative Social Research, 5*(2), 4.

Greenberg, M. D., Morral, A. R., & Jain, A. K. (2005). Drink-driving and DUI recidivists' attitudes and beliefs: A longitudinal analysis. *Journal of Studies on Alcohol, 66*(5), 640-647.

Greene, K. M. (2018). Perceptions of driving after marijuana use compared to alcohol use among rural American young adults. *Drug and Alcohol Review,*

Greenfield, T. K., & Rogers, J. D. (1999). Alcoholic beverage choice, risk perception and self-reported drunk driving: Effects of measurement on risk analysis. *Addiction, 94*(11), 1735-1743.

Harbeck, E. L., & Glendon, A. I. (2013). How reinforcement sensitivity and perceived risk influence young drivers' reported engagement in risky driving behaviors. *Accident Analysis and Prevention, 54*, 73-80.

Harbeck, E. L., Glendon, A. I., & Fine, T. J. (2017). Reward versus punishment: Reinforcement sensitivity theory, young novice drivers' perceived risk, and risky driving. transportation research part F, 47, 13-22. *Transportation Research Part F: Traffic Psychology and Behaviour, 47*, 13-22.

Hartman, R. L., Brown, T. L., Milavetz, G., Spurgin, A., Pierce, R. S., Gorelick, D. A., . . . Huestis, M. A. (2015). Cannabis effects on driving lateral control with and without alcohol. *Drug & Alcohol Dependence, 154*, 25-37. doi:http://dx.doi.org/10.1016/j.drugalcdep.2015.06.015

Li, M., Brady, J. E., DiMaggio, C. J., Lusardi, A. R., Tzong, K. Y., & Li, G. (2012). Marijuana use and motor vehicle crashes. *Epidemiologic Reviews, 34*, 65-72. doi:http://dx.doi.org/10.1093/epirev/mxr017

Mann, R. E., Macdonald, S., Stoduto, G., Bondy, S., Jonah, B., & Shaikh, A. (2001). The effects of introducing or lowering legal per se blood alcohol limits for driving: An international review. *Accident Analysis and Prevention, 33*, 569-583.

McCarthy, D. M., Lynch, A. M., & Pederson, S. L. (2007). Driving after use of alcohol and marijuana in college students. *Psychology of Addictive Behaviors, 21*(3), 425-430.

Pliner, P., & Cappell, H. (1977). Drinking, driving, and the attribution of responsibility. *Journal of Studies on Alcohol, 38*(3), 593-602.

Rogeberg, O., & Elvik, R. (2016). The effects of cannabis intoxication on motor vehicle collision revisited and revised. *Addiction, 111*(8), 1348-1359.

Rubin, H. J., & Rubin, I. (2005). *Qualitative interviewing: The art of hearing data* (2nd ed.). Thousand Oaks: Sage.

Shepperd, J. A., Carroll, P., Grace, J., & Terry, M. (2002). Exploring the causes of comparative optimism. *Psychologica Belgica, 42*(1-2), 65-98.

Verstraete, V. G., & Legrand, S. (2014). *Drug use, impaired driving and traffic accidents* (2nd ed.). Lisbon: European Monitoring Centre for Drugs and Drug Addiction.

Watson, T. M., & Mann, R. E. (2016). International approaches to driving under the influence of cannabis: A review of evidence on impact. *Drug and Alcohol Dependence, 169*, 148-155.

Watson, T. M., Mann, R. E., Wickens, C. M., & Brands, B. (in press). Deterring driving under the influence of cannabis: Knowledge and beliefs of drivers in a remedial program. *Canadian Journal of Criminology and Criminal Justice*.

Wickens, C. M., Mann, R. E., Stoduto, G., Flam Zalcman, R., & Butters, J. (2013). Alcohol control measures and traffic safety. In P. Boyle, P. Boffetta, A. B. Lowenfels, H. Burns, O. Brawley, W. Zatonski & J. Rehm (Eds.), *Alcohol: Science, policy and public health* (pp. 378-388). Oxford: Oxford University Press.

Woodall, K. L., Chow, B. L., Lauwers, A., & Cass, D. (2015). Toxicological findings in fatal motor vehicle collisions in Ontario, Canada: A one-year study. *Journal of Forensic Sciences, 60*(3), 669-674.

Yanovitzky, I., & Bennett, C. (1999). Media attention, institutional response, and health behavior change. the case of drunk driving. *Communication Research, 26*(4), 429-453.

Young, K., & Regan, M. (2007). Driver distraction: A review of the literature. In I. J. Faulks, M. Regan, M. Stevenson, J. Brown, A. Porter & J. D. Irwin (Eds.), *Distracted driving* (pp. 379-405). Sydney, NSW: Australasian College of Road Safety.

Prevalence and Trends of Drugged Driving in Canada

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Abstract

Background: While alcohol-impaired driving has declined for more than a decade in Canada, drugged driving seems to be rising, at least among fatally injured drivers (Brown et al. 2017). Objectives: To describe the state of drugged driving in Canada.

Methods: Data from the Road Safety Monitor (RSMs 2002-2018) and the National Fatality Database (2000-2015) maintained by the Traffic Injury Research Foundation (TIRF) were used. Data from 2016 will be included by the time of paper submission. Two sample tests of proportions, logistic regression analysis and piece-wise linear regression were used to analyze the data.

Results: There have been some changes in the prevalence of some drug types among drivers. There was a 106% increase from the 1.6% of drivers reporting driving within two hours of using marijuana in 2013 to 3.3% in 2018. There were also increases in the percentage of fatally injured drivers testing positive for all drugs (see table 3.13, page 44 for data up to 2014). Results showed varying characteristics based upon gender and age among self-reported and fatally injured drugged drivers.

Discussion, Conclusions and Implications: Drugged driving behaviours remain prevalent among Canadian drivers and drugs were in over one-third of tested fatally injured drivers. Of concern are the increasing trends of this risky behaviour on the road. These findings highlight the need for increased public awareness about the risks associated with drugs and driving.

Keywords: drugged driving; trends; impaired-driving

Introduction

In Canada, the prevalence of drugs found in drivers has been shown to rival that of alcohol (Jonah, 2013; Robertson et al. 2017). In fact, while alcohol-impaired driving has declined for more than a decade in Canada, drugged driving seems to be increasing (Brown et al. 2017).

Our understanding of how drugs affect driving behaviours is limited compared to what we know about alcohol. Cannabis, one of the most common substances found in drivers, has been shown to increase the risk of collision (Asbridge et al., 2012). However, tolerance to cannabis can also result in less impairment in drivers (Wolff et al., 2013), reaffirming that setting standardized per se limits for drugs in drivers is more complicated than limits for alcohol. Other illicit psychoactive drugs and prescription drugs have been shown to cause side-effects which could impair driving abilities (Stoduto et al., 2012; Wolff et al., 2013).

Self-report studies are useful in ascertaining the prevalence of specific driving behaviours and attitudes among drugged drivers. As drug testing of fatally injured drivers increases, the percentage of fatally injured drivers positive for drugs becomes a relatively reliable measure of the drugged driving problem (Brown et al., 2017).

The objectives of this paper are to identify the state of drugged driving in Canada, compare recent data with those from previous years to determine possible changes, and characterize drugged drivers with respect to gender and age.

Methods

Data **Sources**

Data on drugged driving behaviours and attitudes have been collected as part of the Traffic Injury Research Foundation (TIRF) series of Road Safety Monitors (RSM) since 2002, specifically in the years 2002, 2004, 2005, and from 2010 onward. The survey is administered annually to a sample of Canadian drivers who had driven in the past 30 days and held a valid driver's licence (see Table 1 for the sample sizes).

Table 1: Number of participants (N) in the RSM, 2002-2018

Year	N
2002	1,212
2004	1,221
2005	1,218
2010	1,195
2011	1,208
2012	903
2013	1,201
2014	1,031
2015	1,204
2016	2,009
2017	2,018
2018	1,203

Data from TIRF's National Fatality Database were also used to identify the percentage of fatally injured drivers in Canada who tested positive for drugs between 2000 and 2015. The TIRF National Fatality Database includes data from coroners and medical examiners on fatally injured motor vehicle collision victims in all Canadian jurisdictions. In this study we included the 19,654 drivers of highway vehicles who died within 30 days in crashes on public roads. The data in this study exclude British Columbia whose data have not been available since 2011. The drug types are broadly classified into seven groups according to the Drug Evaluation and Classification categories (i.e., cannabis, depressants, stimulants, narcotic analgesics, hallucinogens, dissociative anesthetics, and inhalants) (Jonah, 2012).

Further details about RSM data and the TIRF National Fatality Database can be found in Robertson et al. (2017).

Data Analysis

All analyses were conducted using Stata 14.2 (StataCorp., 2015). The data from the RSM were analyzed, considering the stratified and weighted sampling design to avoid bias. Two-sample tests of proportions, piecewise linear regression and logistic regression analyses were conducted to evaluate statistical significance of results and possible trends while also controlling for gender and age differences within the population.

Results

Self-reported Drugged Driving in Canada

Figure 1 shows the prevalence of self-reported drugged driving in Canada since 2002, for all years in which related items were included in the survey.
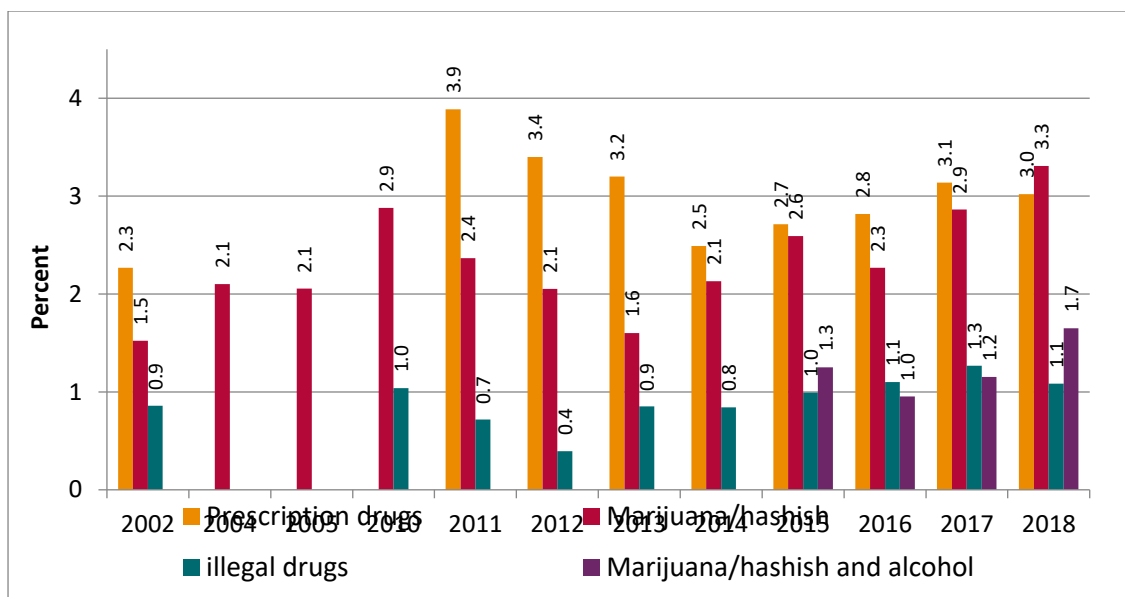
Figure 5. Percentage who drove within two hours of taking drugs in the past 12 months: 2002-2018.

Prescription drugs have been the most prevalent drug type compared to marijuana/hashish and other illegal drugs. Although there was a decreasing trend (coef.=-0.44, p<0.001) from the 3.9% of drivers reporting they drove within two hours of using prescription drugs in 2011, to the 2.5% in 2014, this was followed by an increasing trend (coef.=0.17, p<0.001) up to 3.0% in 2018.

A smaller percentage of drivers have consistently reported to driving under the influence of marijuana or hashish compared to prescription drugs, except in 2018 when 3.3% reported doing so. A piecewise regression model for the use of marijuana or hashish before driving revealed an increasing trend (coef.=0.15, p=0.001) between 2002 and 2010, followed by a decreasing trend (coef.=-0.38, p=0.001) until 2013, and increasing again (coef.=0.30, p<0.001) between 2013 and 2018.

An even smaller percentage of drivers reported driving while under the influence of other illegal drugs. In 2002, 0.9% of Canadian drivers admitted to driving within two hours of taking an illegal drug at least once in the previous 12 months. In 2012, a low of 0.4% was reported, however, a piecewise regression model revealed a small but significant increasing trend from 2012 to 1.1% in 2018 (coef.=0.09, p=0.02).

Only six years of data were collected from the RSM with respect to the prevalence of marijuana or hashish combined with alcohol while driving. The percentage of drivers who indicated they drove within two hours of taking marijuana or hashish combined with alcohol did not change significantly from 1.3% in 2015 to 1.7% in 2018.

Analyses of RSM data from 2002 to 2018 revealed significant sex and age differences in the prevalence of drugged driving (see Table 2).

Table 2: Percentage and odds ratios (OR) for drivers reporting driving within two hours of taking drugs in the past 12 months: 2002-2018 by sex and age. *p-value<0.05

|	Sex		Age			
	Female	Male	16- 24	25-44	45-64	65 or older
Illegal drugs	0.5* (1.0)	1.5* (2.7*)	2.2* (7.8*)	1.4* (5.3*)	0.6* (2.5)	0.2* (1.0)
Marijuana/hashish	1.5* (1.0)	3.3* (2.1*)	6.4* (24.7*)	3.2* (12.6*)	1.2* (5.1*)	0.2* (1.0)
Prescription drugs	2.7 (1.0)	3.3 (1.2)	3.8* (1.6)	3.6* (1.6*)	2.5* (1.1)	2.2* (1.0)
Marijuana/hashish /alcohol	0.8* (1.0)	1.6* (2.2*)	1.7*(5.3*)	2.0* (7.1*)	0.8* (2.8)	0.2* (1.0)

Overall, 1.5% of male drivers versus 0.5% of female drivers reported driving within two hours of taking an illegal drug at least once in the previous 12 months. Regarding marijuana use, 3.3% of male drivers versus 1.5% of female drivers reported driving within two hours of using this substance. No significant sex differences were found with respect to the prevalence of prescription drugs. Male drivers were also more likely than female drivers to drive after consuming marijuana combined with alcohol (1.6% vs. 0.8%).

Drivers aged 16 to 24 years, were more likely to report driving within two hours of taking an illegal drug (2.2%) or marijuana (6.4%), or prescription drugs (3.8%) in comparison to older age groups. Furthermore, the prevalence of use of these drugs before driving decreased with age. Drivers aged 25 to 44 years were more likely (2.0%) to report driving after consuming marijuana combined with alcohol than drivers in other age groups.

Logistic regression models controlling for sex and age confirmed the above results.

Drug use among fatally injured drivers

Figure 2 shows the percentage of fatally injured drivers who were tested for drugs in Canada (except British Columbia) from 2000 to 2015, and the total percentage of drug-positive drivers among those who were tested.
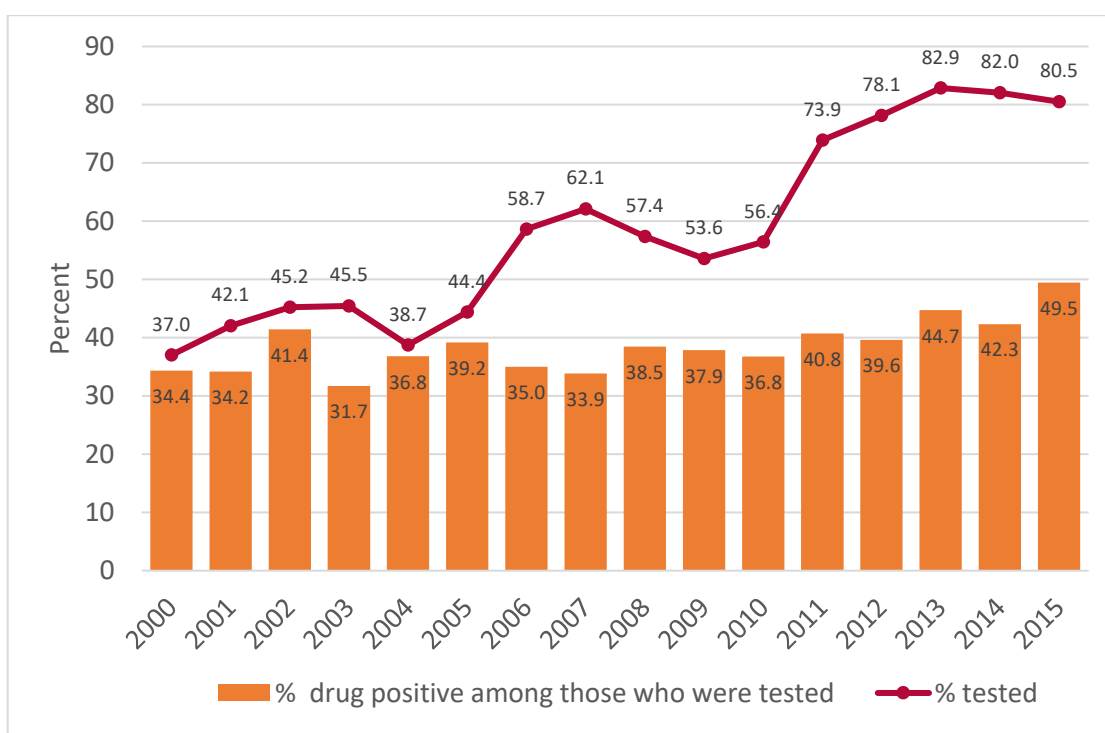
Figure 6: Percentage of fatally injured drivers tested for drugs, and the percentage of fatally injured drivers testing positive for any substance: 2000-2015.

The testing rates among fatally injured drivers have significantly increased by 117.5% from 37.0% in 2000 to 80.5% in 2015 (z=-21.3; trend: coef.=3.2, p<0.001). The percentage of drug-positive drivers has significantly increased by 43.9% from 34.4% of drivers in 2000 to 49.5% in 2015 (z=-7.5; trend: coef.=0.69, p=0.002).

Figure 3 depicts the percentage of fatally injured drivers from 2000 to 2015 that were drug positive for four drug categories. Overall, between 2000 and 2015, 17.1% of fatally injured drivers who were tested for drugs were positive for cannabis, 14.2% for depressants, 8.9% for stimulants and 7.8% for narcotic analgesics. Since the percentages of drivers testing positive for hallucinogens, dissociative anesthetics, or inhalants were below 1%, they are not included in this figure.
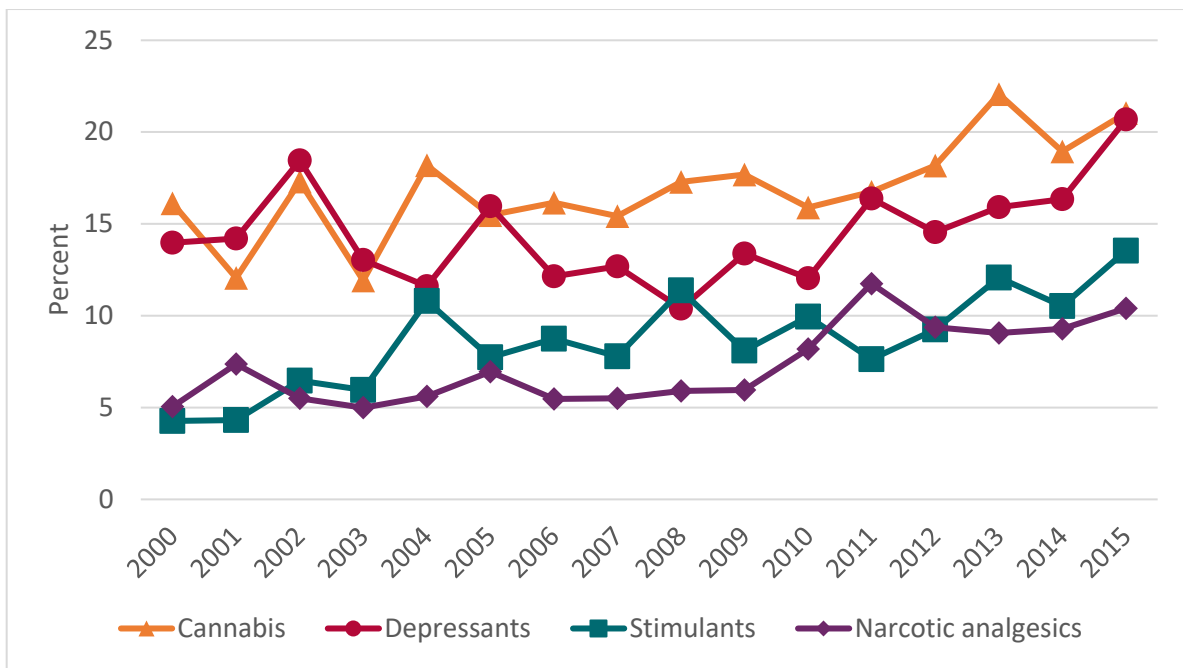
Figure 7: Percentage of fatally injured drivers who were positive for drugs: 2000-2015.

The figure shows an overall increase in the percent of fatally injured drivers that were positive for cannabis, depressants, stimulants and narcotic analgesics from 2000 to 2015 (cannabis: 16.1% to 21.0%, depressants: 14.0% to 20.7%, stimulants: 4.3% to 13.5% and narcotic analgesics: 5.1% to 10.4%). A test of proportions revealed that these increases (cannabis: 30.5%, depressants: 47.9%, stimulants: 217.1%, narcotic analgesics: 105.9%) were statistically significant ($p<0.05$). Regression analyses confirmed that there were statistically significant increasing trends from 2000 to 2015 in the percent of fatally injured drivers that were positive for cannabis (coef.=0.4, $p=0.002$), stimulants (coef.=0.44, $p<0.001$) and narcotic analgesics (coef.=0.44, $p<0.001$). In the case of depressants, there was a decreasing trend from 2000 to 2008 (coef.=-0.5, $p=0.04$) followed by an increasing trend from 2008 to 2015 (coef.=1.02, $p=0.001$).

Sex differences among all drug-positive fatally injured drivers correspond with the RSM data which showed differences between males and females. Between 2000 and 2015, 39.7% of fatally injured male drivers were positive for any type of drug, slightly but significantly larger than the 36% of females (z=-3.2, $p=0.001$). Among those drivers tested, fatally injured males were more likely to test positive for cannabis (18.8% versus 10.3%, OR=2.1) and stimulants (9.7% versus 5.7, OR=1.8) than females (see Table 3). Conversely, fatally injured female drivers were more likely to test positive for depressants (18.8% versus 10.3%, OR=2.1) and narcotic analgesics (18.8% versus 10.3%, OR=2.1) than males.

Table 3: Percentage and odds ratios (OR) testing positive for drugs among fatally injured drivers who were tested: 2000-2015. All p-values<0.05

	Sex		Age			
	Female	**Male**	**14-24***	**25-44**	**45-64**	**65 or older**
Cannabis	10.3 (1)	18.8 (2.1)	27.5 (63)	21.3 (43.6)	10.4 (17.9)	0.6 (1)
Depressants	19.6 (1)	13.4 (0.6)	5.4 (0.2)	13.6 (0.5)	19.8 (0.8)	23.7 (1)
Stimulants	5.7 (1)	9.7 (1.8)	9.0 (7.8)	14.5 (13.1)	5.3 (4.1)	1.4 (1)
Narcotic analgesics	8.8 (1)	7.2 (0.8)	3.3 (0.3)	6.9 (0.6)	10.1 (0.9)	11.5 (1)
*Drivers aged 14 and 15 years represented 0.23% of all fatally injured drivers tested for drugs						

Regarding the influence of age on the drug use of fatally injured drivers, a larger percentage (27.5%) of drivers aged 14 to 24 years tested positive for cannabis than any other age group, and the prevalence for this drug decreased with the increase in age (see Table 3). In the case of stimulants, drivers aged 25 to 44 had the largest prevalence (14.5%), followed by drivers under 25 years (9.0%). The oldest drivers (65 and older) had the larger prevalence of depressants (23.7%) and narcotic analgesics (11.5%). For these two drug categories, prevalence increased with age. Logistic regression models controlling for sex, age and victim's year of death confirmed the above results (see odds ratios in Table 3).

Conclusions

Analyses of the RSM data and the National Fatality Database showed that drugged driving continues to be a prevalent issue among Canadians. Of concern are the increasing trends in the percentages of drivers that report driving within two hours of using prescription drugs, marijuana or hashish and other illegal drugs over the past four years. Furthermore, the percentage of fatally injured drivers testing positive for any drug type has also significantly increased. By comparison, other studies have shown decreases in the percentage of fatally injured drivers testing positive for alcohol (Brown et al., 2017).

When combining the RSM data from 2002 to 2018, young (aged 16 to 24 years) and male drivers were more likely to admit to driving within two hours after using illegal drugs including marijuana or hashish. Male drivers were also more likely to report driving when combining alcohol and marijuana and drivers aged 25 to 44 years were more likely to report this behaviour.

Among fatally injured drivers who were tested for drugs, male and young drivers were also more likely to test positive for cannabis and stimulants while female and older drivers were more likely to test positive for depressants and narcotic analgesics.

These findings highlight the need for increased public awareness about the risks associated with drugs and driving.

References

Asbridge, M., Hayden, J. A., Cartwright, J. L. (2012). Acute Cannabis Consumption and Motor Vehicle Collision Risk: Systemic Review of Observational Studies and Meta-Analysis. British Medical Journal. BMJ 2012;344:e536

Brown, S.W., Vanlaar, W.G.M., Robertson, R.D. (2017). The Alcohol and Drug-Crash problem in Canada 2014 Report. CCMTA Road Safety Research Report Series. Prepared by Traffic Injury Research Foundation of Canada. Ottawa: Canadian Council of Motor Transport Administrators.

Jonah, B. (2012). Drugs and Driving Framework, Ottawa: Canadian Council of Motor Transport Administrators.

Jonah, B. (2013). CCMTA Public Opinion Survey of Drugs and Driving in Canada: Summary Report. Canadian Council of Motor Transport Administrators.

Robertson, R.D., Mainegra Hing, M., Pashley, C.R., Brown, S.W., Vanlaar, W.G.M. (2017) Prevalence and trends of drugged driving in Canada. Accident Analysis and Prevention, 99, pp. 236-241.

StataCorp. (2015). Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.

Stoduto, G., Mann, R. E., Ialomiteanu, A., Wickens, C. M., Brands, B. (2012). Examining the link between collision involvement and cocaine use. Drug and Alcohol Dependence, 123(1): 260-263.

Wolff, K. Brimblecombe, R., Forfar, J. C., Forrest, A. R., Gilvarry E., Johnston, A., Morgan, J., Osselton, M. D., Read, L., Taylor, D. (2013). Driving Under the Influence of Drugs: Report from the Expert Panel of Drug Driving. London, UK: Department for Transport.

Reviewing a Decade of Changes in Swiss Traffic Medicine – Repercussions/Ramifications on Future Challenges

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Abstract

Traffic Medicine is one of the Swiss legal entities that contribute to minimizing traffic casualties. But has pertaining Swiss legislation adequately incorporated developments in medicine, science, society and politics to attain this goal? Moreover, is the field in general sufficiently prepared and agile to react timely to heralding mega-trends such as legalization and medical use of cannabis, automation and overaging of drivers?

Our objective is to reflect roughly a decade of measures affecting Swiss traffic medicine. With a focus on medically relevant measures, we review origin, implementation and – wherever already ascertainable – resulting effects, both from the practical and scientific perspective of a traffic medicine expert.

After parliamentary debate since 2008, the Swiss parliament passed the project "Via sicura" in 2012 comprising 22 measures. Since 2013, 19 of these were put into law. We will discuss five measures, the latter not being part of Via sicura: 1.) quality measures for traffic medicine experts (Stufensystem), 2.) compulsory exams after DUI above 1.6 ‰ alcohol, 3.) Evidential detection of alcohol levels via blood vs. breath 4.) factual no-alcohol-rule (<0.1 ‰) for learning drivers and chauffeurs, 5.) raising the age for regular compulsory exams from 70 to 75.

Despite ever increasing traffic, the number of traffic deaths has dropped from 544 in 2001 to 216 in 2016. Particularly in the light of the WHO decade of action, his gratifying reduction is partly due to "Via sicura". However, we find some of the measures (3 and 5) to be justified on a weak and rather political basis, ultimately even conflicting hard evidence (3).

Particularly in the light of the above mentioned challenges we call for more fully integrated clinical research in traffic medicine: collected evidence, evaluated by interdisciplinary expert teams, should form the basis for creative and pragmatic future bills.

Switzerland registered a close to record low number of street-traffic casualties in 2017 (230 (BFS, 2019)) and will most likely report even lower numbers for 2018 (first 6 months: 100 (ASTRA, 2019)). According to the European Transport safety Council's (ETSC) 11th Road Safety Performance Index (PIN) Report (council, 2017), this equals to 26 casualties per million inhabitants in 2016. As compared to the reference years 2010 and 2001, this reflects a reduction of 19% or 60% reduction in road casualties, respectively. Surpassed only by the Baltic and Scandinavian states, this corresponds to a yearly reduction of 5.9% (2007-2016). Also in relation to bmd (billion miles driven, 3.7 casualties/bmd), Switzerland is only surpassed by Norway, Sweden and the UK with each 3.0, 3.3 and 3.5 casualties/bmd, respectively.

A very illustrative differentiation by kind of accident can be found in (Helfenberger, 2018): roughly 50 % of traffic casualties stem from accidents which involve no other party. Casualties originating from car-accidents involving other cars, bicycles, pedestrians or motorized 2-wheelers sum up to about 40 % of casualties, while the predominant number of all accidents (also w/o casualties) are still caused by young and senior drivers. Further detailed reference may be found in the Annual Road Safety Report, Sinus 2018 (Unfallverhütung, 2018).

This development can be seen as an overall success and Sitzerland's leading role resulted in ETCS's Road Safety PIN Award in 2017. But what are the reasons for this success and on what basis can the numbers be even more reduced or prevented from rising again?

The fundamental European safety attitude to put precautionary principle first (exquisitely elaborated in (Fisher, 2011), Section 3) results in ambitious joint visions and EU Frameworks which have consistently been worked on in the last decades. With the overall long-term "Vision zero" to avoid any traffic deaths by 2050, the EU's intermediate pragmatic framework goals from 2000/2001 and the subsequent 2011 "Transport White Paper" aim at a 50% reduction of traffic casualties within a decade.

In 2002, Switzerland adopted and extended this EU Framework and between 2005 and 2012 a set of 60 individual actions was formulated and most of which, grouped in 22 legislative measures, have been put into law by 2016. This concerted federal effort - labeled "Via sicura", for "safe ways" - involved all institutions with responsibilities in traffic regulation and safety: the federal ASTRA (road safety), the cantonal STVAs (Road traffic offices), the BFU and BFS (Federal Office for Accident Prevention and Federal Bureau for Statistics), the law enforcement and, finally, Traffic Medicine (TM) as the subject field that services the medical and forensic expertise forming the basis for legal repressions, fines and regulation for offenders or applicants for driving licenses by the STVAs.

In short, traffic medicine ensures the medically defined short- and long-term fitness to drive, based on comprehensive medical exams and closed-mesh follow-up examinations after any DUI involving drugs or alcohol.

Assuming a self-critical perspective, we here want to review TM-related developments and their effects within the project "Via sicura" throughout roughly the last decade. Within the context of a strategic repositioning of our own institution – but maybe also Swiss Traffic Medicine in general - , we want the put these developments in context and in perspective to imminent societal and scientific developments.

Outcomes – Origin, implementation and effects of TM-related measures of Via sicura

Measure 1 – Quality Management of Traffic medicine

The first and most important development for Traffic Medicine was the federation-wide harmonization and structuring of traffic medicine as an organizational and professional body. This originated in part in pre-"Via sicura"-efforts to establish a professionalized medical title specific for higher level exams within the section of traffic medicine of the Swiss society for Legal Medicine (SSLM) starting in the late 2000s, finally agreed upon in 2011 and anchored in the law by 2013. Concomitant with an increasingly apparent need to re-evaluate and update medical examination standards stemming mainly form the 1970, a concerted restructuring and alignment of the professional regulations and responsibilities with the law were at hand: fragmented cantonal responsibilities and well-executed but informally performed appointments and educational programs were harmonized into a federation-wide graduated system of qualification (Stufensystem). As a result, traffic medical exams are open to any qualified person and there is no separation between a general practitioner and a medical officer (e.g. cantonally appointed). Four levels of qualification are matched with the graduated categories of driving licenses and complexity of medical conditions in question: for example, the basic criteria for drivers of individual vehicles above and age of – until the end of 2018 - 70 years (see below) can be confirmed by an (self-)educated general practitioner (level 1, Module 1-3 or confirmed self-study of the contents thereof). Examining the criteria to obtain or keep higher category driving licenses (including trucks, taxis and coaches) requires a 1 day qualification (level 2, Module 4-5). Level 3 professionals are qualified by an additional one-day course (module 6) to exam - for example – applicants who are disabled, aged >65a, or after serious injury or illness. Level 4 requires the above mentioned professional title "Verkehrsmediziner, SSLM" and enables for exams clarifying the long term fitness to drive (Chronic diseases, behavioral problems). In doubt, level 1 and 2 can escalate to level 3 or 4 in order to obtain a clarifying second opinion.

The harmonization of qualification has led to improved quality management and much improved clarity in relation to STVAs and jurisdiction. Also, detaching the qualification from (previously in part obligatory cantonal) institutions has allowed for a market diversification and a better coverage and more focused choice for the patients, reducing the overall time needed for obtaining examination results

Measures 2-4 – Alcohol related measures:

The following three measures deal with the "evergreen" of traffic medicine, alcohol.

The first measure lowers limits at which a full traffic medicine exam becomes compulsory from 2.5 ‰ to 1.6 ‰ (1.25 mg/l to 0.8 mg/l). In line with internal findings and reports form our own and other groups in Switzerland, the SSLM as a whole argued that the likelihood of alcohol related subsequent offenses and problems is similarly elevated at DUIs at <2.5 ‰ and DUIs at 1.6 ‰ -2.5‰, with a distinct increase from DUIs below 1.6 ‰. To prevent serious events, a compulsory full exam after a DUI above 1.6 ‰ should encompass a strong focus on determining the likelihood of alcohol abuse and dependencies with stricter abstinence obligations (Baumann, 2014; Höhn, 2015a, 2015b). The effect of this measure, which was put into law in July 2014, is currently analyzed in two separate retrospective analyses. A first tendency shows that postulated positive effects began to show (manuscripts in preparation).

A second adjustment strengthened total alcohol abstinence (<0.1‰) while driving for professional drivers (trucks, coach, taxi) and novice drives (preliminary license). This call for total abstinence while driving was put into law in January 2014 and also covers driving teachers, learning drivers and persons accompanying novice drivers holding a preliminary license. The law stems predominantly from the above mentioned maximizing of precautionary principles for passengers (coach, taxi), massive impact potential (trucks), and the particularly error prone novice drivers. According to a statistical overview of administrative measures by way of the ASTRA, this measure is the cause for a 16.5% reduction in license-suspensions on the basis of DUIs in 2017 (N =617) as compared to 2016 (739). However, this measure might have accelerated the continuously decreasing yearly numbers of license suspensions since 2012-2015 (N= 891, 849, 806, 742) and the effect of the law might thus have shown with a delay (ASTRA, 2018).

In October 2016, the last alcohol-related measure within Via sicura established that blood alcohol levels could be determined evidentiary on site by using breath alcohol measurements (evBrAC) using validated instrumentation (predominantly Dräger7110 Evidential). First established as an aiding initial road-side test in the 1960s in the US, the current evidentiary measurement systems use two independent measures to determine BAC within approx. 1 minute and promise to be mouth-alcohol insensitive. Concomitantly, the unit description was harmonized to mg/l. In line with the "rule of thumb" mg/l = ½ ‰ and the conversion factor used in Switzerland from evBrAC to BAC was fixed to 2000 l/mg. With whole blood based BAC being the only evidentiary accepted method previously, evBrAC promised to accelerate determination at the point-of-care (POC) and provide a timed value not requiring any back-calculation: previously, and initial qualitative detection of alcohol needed to be confirmed in a hospital by qualified personnel, often resulting in delays and dispute, never mind substantial costs. Thus it was argued that evBrAC would streamline securing proof for the benefit of all parties, also avoiding the taking of blood as a medical intervention. Here it needs to be stated, that – on the one hand – the suspected offender can demand an additional BAC for confirmation, and – on the other hand – law enforcement might require taking a blood sample if they observe sings for additional substance abuse.

Measure 5 – Increasing the age limit

In contrast to the four measures describe previously, a last change in legislation was not part of Via sicura: with effect Jan 1st 2019, the age for compulsory and regular traffic medicine exams at level 1 or higher) for the elderly drivers of lower categories was raised from 70 to 75 years of age. Also the qualified doctor's maximal age was raised from 70 to 75 years of age. While a politically motivated argument that senior drivers are in general in much better overall health nowadays as compared to 30 years ago might be factual, this loosening of established and proven procedure was not supported by the representative bodies of Traffic Medicine and represents a surprising breach with a long term-proven principle of maximal precautionary principles in Switzerland. This method will not be discussed in further detail in the following section, as there is no data are present as of now.

Discussion

The establishments of a federally harmonized quality management for Traffic Medicine – including the level-system and education as well as the continuous harmonized updating of standard to scientific

knowledge – have to be welcomed in total from our perspective. Above all, the positive effects of this professionalization effort for the patient/customer show in faster results and improved communication between TM, STVAs and TM and customer. Together with the SSLM as the professional body of expertise, this "leap" also releases capacities for much better reactivity to incumbent fundamental challenges in traffic medicine with respect to automated driving and such.

The three alcohol-related measures of Via sicura exemplify the possibilities and restrictions of fact based decisions in Traffic medicine regulation in total, especially the relation between measure 2 and 4 show conflict potential and added rather than reduced certainty and control: while compulsory TM-exams after a DUI <1.6‰ were well reasoned for ahead of the legislation and positive effects began to show, the introduction of evBrAC seems to partially thwarts the potential long-term positive effects or at least makes it difficult to observe these consistently: BrAC and evBrAC are and were criticized and contested for two reasons. First, it is argued that the determination of BAC vs evBrAC relies of a plethora of individual physiological factors and might over or underestimate the BAC within a wide range (partition, lung volume, metabolism; (Iten & Wüst, 2009; Wüst, 2009)). The standard BAC blood sample determination allowed for a additional screening for substance abuse, allowed reanalysis of samples if results were in doubt and provided clearer back-calculation to the time of offense. More systematic studies display in part largely diverging comparative values with an underestimation of on average 0.3 mg/l or 0.18 mg/ml (Roiu et al., 2013; Weinmann, Disch, Längin, Nussbaumer, & Jackowski, 2016). Still, evBrAC is reality in most European states (Jones, 2016).

In relation to measure 2, it needs to be discussed and evaluated if the introduction of evBrAC does not lead to a factual erosion and masking of the positive security effects resulting from measure 2: for example (Weinmann et al., 2016) does argue that based on a comparison of 1059 cases 48% less drivers reached the critical 0.8 mg/ml (i.e. 1.6 ‰) based on evBrAC, strongly favoring the driver. In only 12% of the cases a disadvantage for the driver could be deduced. In fact we, do see a reduction of >1.6 cases in our institution albeit this might be also the result of measure 1. In total, variability , dependence and use of BrAC and/or of fixed and dose-dependent conversion factors between evBrAC and BAC has been discussed repeatedly and at length (e.g. (Hartung et al., 2016; Iten & Wüst, 2009; Jones, 2016; Roiu et al., 2013; Wilske, Eisenmenger, & Liebhardt, 1991; Wüst, 2009)) on the scientific level.

We see independent and additional real-life problems which thwart the best intentions: a large fraction of offenders do demand a traditional test. Law enforcement does order very often additional blood sample for drug testing based on behavioral cues (Zürich, 2014). Despite the legal claim to have broad coverage, most law enforcement vehicles do not allow housing the instrumentation, so that the real on-road coverage of this method is factually very low and tests are performed at the police station without reliable back-calculation. To our view, this approach – while *per se* advantageous and beneficial – faces expected and predicted real-life challenges that do serve neither scientific robustness nor economic criteria. It needs to be evaluated in the coming years, whether case data allow for consistent trends.

Albeit there has been a 25-year-"promise" from the fields of microfluidics and biomedical engineering concepts for hand-held POC-blood testing devices with strong or even fully evidentiary character, have not yet been proven to be robust. With venous blood seems still the best analyte reporting both substance and concentration, it would however be highly desirable to have such POC-devices for standard finger blood testing at hand (Aymerich et al., 2018).

Conclusion – Repercautions for future challenges

Overall, the discussed measures show organizational, scientific and political origins with postulated and or reported effects ranging from – to our view – very positive (Measure 1 and 2) to conflicting or at least questionable (measure 4 and 5). We observe a tendency to (unwillingly) revert positive and evidence based measures due to political and/or seemingly economic reasons (economy and police).
Moreover, three of the five discussed measures deal with changes in alcohol legislation. This strong and continued fixation combined with partially crab-like developments (see above) is surprising in so far, as to Swiss Traffic Medicine *per se* and – to the best of our knowledge - also other related institutions - have no

foresighted work-program in place (or in discussion) to prepare and address incumbent societal and scientific changes such as, for example, more widespread Cannabis-use and aging drivers.

With the incoming remarks about the success in the reduction of traffic casualties, we see an urgent need to address these challenges ahead of time to – above all - maintain these record low numbers of casualties. While Switzerland is a small country with particular challenges to topography and traffic composition (high density , public transport, developing cyclists movement, high and powerful motorization), we call for a more integrated effort within Swiss traffic medicine to define and advertise for systematic clinical studies of the holistic system "man" in the context of the system "machine". We find, it would be negligent for Swiss Traffic Medicine to either just rely on other country's research-efforts and -findings and/or not to take advantage of being mostly part of a striving academic setting.

References

ASTRA. (2018). ADMAS - Statistik 2012 bis 2017 - Schweiz.

ASTRA. (2019). Accidentdata of Switzerland - Unfalldaten der Schweiz
https://www.astra.admin.ch/astra/de/home/dokumentation/unfalldaten.html

Aymerich, J., Márquez, A., Terés, L., Muñoz-Berbel, X., Jiménez, C., Domínguez, C., . . . Dei, M. (2018). Cost-effective smartphone-based reconfigurable electrochemical instrument for alcohol determination in whole blood samples. *Biosensors and Bioelectronics, 117*, 736-742. doi:https://doi.org/10.1016/j.bios.2018.06.044

Baumann, V. C. (2014). *Die Fahreignungsabklärung bei Verdacht auf eine Alkoholproblematik am IRM-UZH: eine Standortbestimmung* (MD MD), UZH, Zürich Retrieved from http://www.zora.uzh.ch/id/eprint/120333/ (ohne Volltext)

BFS, B. f. S.-. (2019). Transport accidents in Switzerland. https://www.bfs.admin.ch/bfs/de/home/statistiken/mobilitaet-verkehr/unfaelle-umweltauswirkungen/verkehrsunfaelle.assetdetail.5808718.html

council, E.-E. t. s. (2017). 11th Annual Road Safety Performance Index (PIN) Report. from ETSC - European transportation security council https://etsc.eu/11th-annual-road-safety-performance-index-pin-report-2/

Fisher, D. E., Rizzo, M. (Ed.), Caird, J. (Ed.), Lee, J. (Ed.). (2011). *Handbook of Driving Simulation for Engineering, Medicine, and Psychology*. Boca Raton: CRC Press.

Hartung, B., Schwender, H., Pawlik, E., Ritz-Timme, S., Mindiashvili, N., & Daldrup, T. (2016). Comparison of venous blood alcohol concentrations and breath alcohol

Driving Risk Behaviors of Brazilian Drivers According to Sociodemographic Characteristics

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Abstract

Background: Exposure to traffic risk behaviors differs according to sociodemographic characteristics. However, little is known about the profile of risky drivers in Brazil, which could help develop effective measures in terms of traffic safety.

Objective: To investigate different driving risk behaviors according to gender, level of education and age groups among Brazilian drivers.

Methods: 9,724 drivers from five Brazilian capitals were interviewed through a KAP survey on traffic behavior. Variables analyzed were: drinking and driving, speeding tickets and seat belt use. The association between the variables was verified using the Chi-Square test.

Results: The sample comprised mostly men (67.2%), between 30 and 59 years old (62.1%), with a college degree (38.8%). Men were more involved in risky behaviors, with less seat belt use (81.60% vs. 89.11% p < 0 .001), more speeding tickets (19% vs 11%, p < 0 .001), and more driving under the influence of alcohol (56% vs 33%, p < 0 .001). Individuals with higher education and a degree had more speeding tickets than the overall sample (18% and 23% vs. 16%, p < 0 .001). 43.9% and 38.3% of those who were fined for non-use of seatbelts had high schooling and college degrees. Acollege degree was associated with higher prevalence of driving under the influence of alcohol. Drivers between 18 and 29 years had a high prevalence of drinking and driving (57%).

Conclusions: Male drivers are more exposed to risky situations. Higher educational levels may be a vulnerability to risky driving behavior. Our data also indicate that younger drivers are more prone to the influence of alcohol when compared to other age groups. Our results are in line with international data, suggesting that adapting measures that are being used - and already known to be effective - in other locations for drivers who engage in traffic risky situations in Brazil is appropriate.

Introduction

Brazilian data indicates that around 47 thousand people die annually due to traffic crashes (Ministério da Saúde – MS, 2017). In terms of public health, traffic injuries generate health expenses, since emergency treatments have a high cost, in addition to the infrastructure damage caused by these events (Word Health Organization – WHO, 2018).

The leading cause of traffic crashes is human behavior to include drunk driving and speeding (Word Health Organization – WHO, 2005). Recent findings indicate that the profile of traffic offenders is heterogeneous and that aspects such as sociodemographic characteristics influence driver behavior (Brown et al., 2016; 2015; Dedovic et al., 2016; Zhao et al., 2017). International studies indicate that engaging in risk behavior can be associated with certain gender and age profiles (Rhodes & Pivik, 2011). Therefore, it appears that there is a driver profile with a more risk-oriented behavioral repertoire.

Despite the regulations, inspections and preventive measures in Brazilian traffic, the exposure to these risk behaviors is still significant. Data indicates that the number of people who driver under the influence of alcohol increases each year (MS, 2017) and this results in physical, psychological and economic dame to both the

victims and the perpetrator (WHO, 2005). This scenario shows that drivers of higher risk may not be benefiting from the preventive interventions implemented in Brazil.

International data on driver profiles is more consolidated; however, there is a gap in the literature in terms of a broader understanding of driver profiles in Brazil. Comprehending this scenario could help in the development of effective traffic safety measures, since Brazilian intervention actions are not directed to specific driver profiles and seem to be ineffective in terms of reducing traffic injury.

Objective

To investigate different driving risk behaviors according to gender, level of education and age groups among Brazilian drivers.

Method

A cross-sectional study recruited drivers from five Brazilian cities, that were chosen by the road safety program "Vida no Trânsito" [Life in Traffic] based on convenience. The chosen cities were initially divided into regions along the existing municipal divisions. The choice of these regions was based on the assumption that the distribution of drivers at that location was equal to that of the driver population throughout the city and the number of regions sampled varied according to the size of the intervention city. In each region, data collection teams identified locations that were easily accessible and where they could safely approach drivers, such as supermarkets, gas stations, shopping malls and public parks.

Data was collected from August 2011 to July 2013 by researchers from the Federal University of Rio Grande do Sul in collaboration with the Johns Hopkins International Injury Research Unit. Individuals who had reported not driving in the past 12 months and under the age of 18 were excluded from the study, totaling 9.724 drivers in our sample. The selected drivers were interviewed through a KAP *(knowledge, attitudes and practices)* survey on issues pertinent to high risk behavior ("In the last year, have you been fined for speeding?", "In the last year, did you drive within an hour of consuming alcohol?", "In the last year, have you been fined for not wearing a belt while driving?"). The World Health Organization indicates that the previously listed behaviors were the main traffic risk behaviors in Brazil (WHO, 2015). Sociodemographic information was also collected from participants, such as gender, age and level of education.

Data analysis was performed through the SPSS program and the association between risk behavior and sociodemographic variables was verified using the Chi-Square test.

Results

Table 1 shows the sociodemographic data of the analyzed sample. The majority of drivers interviewed were men (67.2%), between 30 and 59 years old (62.1%), with a college degree (38.8%).

Table 1. Sociodemographic data

	Total n = 9724 (100%)	Male n = 6532 (67,2%)	Female n = 3192 (32,8%)	p-value
Age (years) [1]	38 [29;65]	38 [30;66]	36 [28;66]	**<0,005**
Education [2]				
Elementary school	1114 (11.5)	999 (15.3)	115 (3.6)	
High school	3735 (38.4)	2758 (42.2)	977 (30.6)	
College degree	3772 (38.8)	2179 (33.4)	1593 (49.9)	**<0,005**
Post-graduation	929 (9.6)	484 (7.4)	445 (13.9)	
Income [1]	2200 [1300;10000]	2400 [1500;10000]	2000 [1100;8000]	**<0,005**

[1] Values expressed by median [Interquartile range], Mann Whitney test;

[2] Values expressed by n (%), Chi-Square test.

When analyzing the association between traffic risk behaviors and socio-demographic characteristics of drivers (Table 2), considering gender, it was verified that men are more involved in traffic risk behaviors compared to women, evidenced by the higher prevalence of tickets for not seat belt use (77% vs. 23% p <0.001), higher prevalence of speeding tickets (19% vs 11%, p <0.001), and higher occurrence of driving under the influence of alcohol (56% vs 33%, p <0.001). Regarding level of education, individuals with higher education and post-graduation had a higher prevalence of speeding tickets than the general prevalence of the sample (18% and 23% vs. 16%, p <0.001). Regarding the history of tickets for not wearing seat belts, 43.9% of those who were fined had higher education. College degrees were associated with a higher prevalence of driving under the influence of alcohol. Drivers between 18 and 29 years old had higher prevalence of drinking and driving (57%); while drivers older than 60 years had a lower prevalence (31%) when compared to the general mean of the sample (50%, p <0.001).

Table 2. Traffic risk behaviors and sociodemographic characteristics

	Tickets for not wearing seat belts	Tickets for speeding	Driving under the influence of alcohol
Gender			
Male	5029 (77%)*	1245 (19%)*	2308 (56%)*
Female	734 (23%)	353 (11%)	486 (33%)
Age (years)			
18 - 29	144 (5.7%)*	382 (15%)	927 (57%)*
30 - 59	241 (3.9%)	1015 (17%)	1712 (49%)
≥ 60	39 (3.3%)	201 (17%)	155 (31%)
Education			
Elementary school	89 (8%)	156 (14%)	479 (43%)
High school	1643 (43.9%)*	523 (14%)	1942 (52%)
College degree	1433 (38.3%)	679 (18%)*	1923 (51%)
Post-graduation	74 (8%)	213 (23%)*	455 (49%)

Values expressed by absolute frequency (%) Chi-Square test
Prevalence of variable in the columns within the categories in the rows
* Significant at p<0,001 level.

Discussion and Conclusion

The results show that men and women have different behaviors in traffic, with male drivers tending to engage more in risk taking behaviors. Specifically, drinking and driving behavior seems to be associated with young male drivers (between 18 and 29 years old) and college or advanced degrees, unlike the profile of drivers who do not use seat belts, for example, which tend to have less education. In this sense, our results corroborate what the characteristics of drivers that drink and drive reported in international studies, showing heterogeneity of the profile of drivers linked to different risk behaviors.

Regarding gender, previous studies corroborate our results, which show that men tend to drive in a more dangerous way compared to women (Oltedal & Rundmo, 2006; Whissell & Bigelow, 2003). Likewise, research has found that male drivers have a higher tendency to drive under the influence of alcohol and exceed the speed limit (Pechansky et. al., 2009; Rhodes & Pivik, 2011), which may reflect the high mortality rates of men, consistently higher than women (WHO, 2005). These results seem to demonstrate that sex-related factors may play an important role in the behavior of drivers in traffic, which suggests that prevention measures in Brazil should target this riskier group. Another interesting point of our findings is that, although women presented lower rates of drinking and driving behavior when compared to men, the prevalence of this

risk behavior was still significant. Few studies have been carried out exclusively with female drivers, most of them are predominantly male or compared between genders (Lapham et. al 2000; Welsh & Lenard, 2001). Therefore, little is known about the characteristics of women who drink and drive, which in the Brazilian context seems to be relevant in terms of traffic injury prevention.

Our results indicated that the prevalence of driving under the influence of alcohol was higher among young drivers compared to other age groups. Studies conducted with young drivers associate factors related to age to the increased risk of traffic injury, such as lack of driving practice and their ability to recognize hazards (Borowsky, Shinar, & Oron-Gilad, 2010; McKnight & McKnight, 2003). In addition, other factors are associated with this age group, like higher levels of impulsivity and sensations seeking (Brown et al., 2017; Clarke & Robertson, 2005), which may lead to an increase in risk behavior in traffic, such as drinking and driving. Therefore, the need for interventions directed to this age group is significant, since traffic accidents are cited as the primary cause of death among men in the youngest age group (WHO, 2018).

Another variable associated with risk behavior in traffic is the level of education of drivers - our results showed that drivers with high levels of education tend to engage in risky traffic behaviors: drinking and driving and speeding. On the other hand, less educated drivers had a higher prevalence of non-use of seat belts, which seems to indicate that drivers with lower levels of education present more passive risk behaviors when compared to more aggressive traffic behaviors such as drinking and driving and excess of speed, which were more prevalent in higher education levels.

It is suggested that adapting measures, which are currently in place - and already known to be effective - in other locations for drivers who engage in traffic risky situations in Brazil is appropriate. A systematic review pointed out that interventions such as ignition interlock systems, implementing compulsory blood-alcohol content testing in traffic injury cases, alcohol safety education, and use of designated driver and safe ride programs are effective in reducing alcohol-related accidents/ or associated fatal and nonfatal injuries (Shults et al., 2001). In addition to sociodemographic characteristics, studies indicate that other factors seem to influence the engagement of risk behaviors in traffic, such as cognitive and personality aspects (Beanland, Sellbom, & Johnson, 2014; Lev, Hershkovitz, & Yechiam, 2008; Ulleberg & Rundmo, 2003). Therefore, it is recommended that other variables be analyzed for a better understanding of the profile of the high risk drivers in Brazilian traffic.

It is important to highlight some limitations of the study: our data cannot be generalized, because the sample was collected for convenience, despite the attempt to randomly select the drivers for the interview. Another point is the fact that the interviews had the presence of an interviewer which may have generated a bias of social desirability, which may have influenced the responses. In addition, the approaches were performed in public places, which may have hampered the accuracy of the individuals' responses, due to external factors such as lack of time, for example. Finally, our analyzes were not controlled by kilometers driven by the participants, which could interfere in the found findings. However, despite the limitations, our study is the first study to analyze the profile of Brazilian drivers according to sociodemographic characteristics using a significant sample size.

References

Beanland, V., Sellbom, M., & Johnson, A. K. (2014). Personality domains and traits that predict self-reported aberrant driving behaviours in a southeastern US university sample. *Accident Analysis & Prevention*, *72*, 184–192. https://doi.org/10.1016/j.aap.2014.06.023

Borowsky, A., Shinar, D., & Oron-Gilad, T. (2010). Age, skill, and hazard perception in driving. *Accident Analysis & Prevention*, *42*(4), 1240–1249. https://doi.org/10.1016/j.aap.2010.02.001

Brown, T. G., Ouimet, M. C., Eldeb, M., Tremblay, J., Vingilis, E., Nadeau, L., … Bechara, A. (2016). Personality, executive control, and neurobiological characteristics associated with different forms of risky driving. *PLoS ONE*, *11*(2), e0150227. https://doi.org/10.1371/journal.pone.0150227

Brown, T. G., Ouimet, M. C., Eldeb, M., Tremblay, J., Vingilis, E., Nadeau, L., … Bechara, A. (2017). The effect of age on the personality and cognitive characteristics of three distinct risky driving offender groups. *Personality and Individual Differences*, *113*, 48–56. https://doi.org/10.1016/J.PAID.2017.03.007

Brown, T. G., Ouimet, M. C., Nadeau, L., Tremblay, J., & Pruessner, J. (2015). Sex Differences in the Personality and Cognitive Characteristics of First-Time DWI Offenders. *Journal of Studies on Alcohol and Drugs*, *76*(6), 928–934. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/26562601

Clarke, S., & Robertson, I. (2005). A meta-analytic review of the Big Five personality factors and accident involvement in occupational and non-occupational settings. *Journal of Occupational and Organizational Psychology*, *78*(3), 355–376. https://doi.org/10.1348/096317905X26183

Dedovic, K., Pruessner, J., Tremblay, J., Nadeau, L., Ouimet, M. C., Lepage, M., & Brown, T. G. (2016). Examining cortical thickness in male and female DWI offenders. *Neuroscience Letters*, *619*, 189–195. https://doi.org/10.1016/j.neulet.2016.03.034

Lapham, S. C., Skipper, B. J., Hunt, W. C., & Chang, I. (2000). Do Risk Factors for Re-Arrest Differ for Female and Male Drunk-Driving Offenders? *Alcoholism: Clinical and Experimental Research*, *24*(11), 1647–1655. https://doi.org/10.1111/j.1530-0277.2000.tb01966.x

Lev, D., Hershkovitz, E., & Yechiam, E. (2008). Decision making and personality in traffic offenders: A study of Israeli drivers. *Accident Analysis & Prevention*, *40*(1), 223–230. https://doi.org/10.1016/j.aap.2007.05.009

McKnight, A. J., & McKnight, A. S. (2003). Young novice drivers: careless or clueless? *Accident; Analysis and Prevention*, *35*(6), 921–925. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12971927

Ministério da Saúde (2017) Base de dados DATASUS, Informações sobre as vítimas de acidentes de trânsito. Brasília. Disponível em: <http://www.vias-seguras.com/layout/set/print/os_acidentes/estatisticas/estatisticas_nacionais/estatisticas_do_ministerio_da_saude>

Oltedal, S., & Rundmo, T. (2006). The effects of personality and gender on risky driving behaviour and accident involvement. *Safety Science*, *44*(7), 621–628. https://doi.org/10.1016/j.ssci.2005.12.003

Pechansky, F., De Boni, R., Diemen, L. Von, Bumaguin, D., Pinsky, I., Zaleski, M., … Laranjeira, R. (2009). Highly reported prevalence of drinking and driving in Brazil: data from the first representative household study. *Revista Brasileira de Psiquiatria*, *31*(2), 125–130. https://doi.org/10.1590/S1516-44462009000200008

Rhodes, N., & Pivik, K. (2011). Age and gender differences in risky driving: The roles of positive affect and risk perception. *Accident Analysis & Prevention*, *43*(3), 923–931. https://doi.org/10.1016/j.aap.2010.11.015

Shults, R. A., Elder, R. W., Sleet, D. A., Nichols, J. L., Alao, M. O., Carande-Kulis, V. G., … Thompson, R. S. (2001). *Reviews of Evidence Regarding Interventions to Reduce Alcohol-Impaired Driving*. *Am J Prev Med* (Vol. 21). Retrieved from http://theathenaforum.org/sites/default/files/Evidence Regarding Interventions to Reduce Impaired Driving_0.pdf

Ulleberg, P., & Rundmo, T. (2003). Personality, attitudes and risk perception as predictors of risky driving behaviour among young drivers. *Safety Science*, *41*(5), 427–443. https://doi.org/10.1016/S0925-7535(01)00077-7

Welsh, R., & Lenard, J. (2001). Male and female car drivers - difference in collision and injury risks. Retrieved from https://dspace.lboro.ac.uk/dspace-jspui/handle/2134/1079

Whissell, R. W., & Bigelow, B. J. (2003). The speeding attitude scale and the role of sensation seeking in profiling young drivers at risk. *Risk Analysis : An Official Publication of the Society for Risk Analysis*, *23*(4), 811–820. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12926573

World Health Organization. (2018). Global status report on road safety 2018

Zhao, R.-J., Sun, W., Zhang, L.-L., Bao, Y.-P., Huang, L., Dong, P., … Sun, H.-Q. (2017). Psychopathology and personality traits associated with driving while intoxicated in Beijing, China: Implications for interventions. *The American Journal on Addictions*, *26*(4), 374–378. https://doi.org/10.1111/ajad.12536

State of Texas Ignition Interlock Laws

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Abstract

Current Texas statutes mandate Driving While Intoxicated (DWI) offenders install an ignition interlock device (IID) as a condition of bond and/or probation. To fully understand how Texas' IID statutes may be improved, it is critical to examine the statutes for strengths, weaknesses, and opportunities for enhancement. This paper undertakes a comparative analysis between the IID programs of Texas and other states to identify strengths, weaknesses, and opportunities for improvement to the Texas' ignition interlock program.

Introduction

According to the National Highway Traffic Safety Administration (NHTSA), IIDs designed to detect breath alcohol and prevent motor vehicle use while under the influence of alcohol, are effective in reducing recidivism among impaired driving offenders (Goodwin et. al, 2015). Currently, all 50 states have laws that require IID installation for impaired driving offenders. Further, 37 states have made IIDs mandatory or highly incentivized for all impaired driving offenders, including requiring IIDs even for first-time offenders (Dong et al., 2016).

To reduce impaired driving on Texas roadways, legislative statutes mandate that DWI offenders install an IID as a condition of bond and/or probation if they meet certain criteria. Each biennium, when the Texas legislature meets, stakeholders work to strengthen Texas' ignition interlock policies. To better understand ways in which Texas' ignition interlock statutes may be improved, the researchers conducted a multifaceted evaluation and examined the current statutes for strengths, weaknesses, and opportunities for improvement.

Methodology

Researchers first reviewed Texas' ignition interlock statutes to provide a foundation for analysis. Next, researchers reviewed the ignition interlock statutes of three comparison states, and conducted a comparative analysis that identified similarities and differences in relation to Texas' IID program. The selection of comparison states was based on NHTSA's Evaluation of State Ignition Interlock Programs: Interlock Use Analyses from 28 States, 2006-2011. This document evaluates and rates the quality of interlock program in 28 states on eight categories (Casanova-Powell et. al, 2015). Researchers averaged and ranked the ratings, and selected three states with the strongest IID programs: Colorado, New Mexico, and Washington.

Comparative Analysis of Ignition Interlock Laws Between Texas and Comparison States

Texas' ignition interlock laws are found in the Penal Code (PC), Code of Criminal Procedure (CCP), as well as the Transportation Code (TC), and work together to form a comprehensive IID program. As part of the comparative analysis Texas' IID program was compared with the IID programs of Colorado, New Mexico, and Washington, the three comparison states identified by researchers. The applicable ignition interlock statutes of all four states are summarized in Table 1 (see pg. 3).

Texas law requires an IID to be ordered as a condition of bond for all second and subsequent offenders. Additionally, Texas law mandates an IID be installed as a condition of probation first offenders with a blood alcohol concentration (BAC) ≥ 0.15 or under the age of 21, and all second or subsequent offenders. In 2015, Texas also passed a law allowing offenders with a suspended license to receive an unrestricted occupational driver's license if they show proof of IID installation. Currently, Texas does not utilize compliance-based removal, which requires offenders to be violation-free for a period prior to removal of the IID.

Due to the nature of its IID statutes and program size, Texas utilizes a decentralized system that allows each jurisdiction discretion on ordering and supervising IIDs. Additionally, the policies and procedures related to IIDs depend on county size, and whether it is being ordered as a condition of bond or probation. On the regulatory side, the Texas ignition interlock industry is overseen by the Texas Department of Public Safety

(TxDPS). TxDPS issues and maintains standards for IID manufacturers, and undertakes approvals, maintenance, and calibration of IIDs.

From the comparative analysis, the key characteristics that contribute to the overall strength of the comparison states' IID programs are:

Employ centralized administration of the IID program in the state: All three comparison states employ a centralized agency to administer IID programs in their state, ensuring consistent application of state statutes and reducing tendency of offenders to avoid their IID requirement. In all comparison states, the same departments that are responsible for administrative oversight are also responsible for issuing state standards for ignition interlock manufacturers and the approval of all devices (see Table 1, pg. 3). However, the courts maintain the authority to order offenders to install an IID as part of their disposition.

Require IID installation for all convicted offenders: Studies show that the average first offender drives impaired 87 times before getting caught (Advocates for Highway & Auto Safety, 2010). In New Mexico and Washington, a first DWI conviction results in license revocation and an IID installation requirement for one year. Subsequent DWI convictions result in additional time of license revocation and IID installation requirement. Mandatory IID for first offenders have been found to be effective in lowering recidivism rates (Marques et al., 2010) and lowering the number of alcohol-related fatalities (Ullman, 2016; McGinty et al., 2017). For example, New Mexico saw a 25 percent drop in alcohol-related fatalities the first year that it enacted this mandatory law (Marutollo, 2009)

Table 1 also summarizes the key attributes of the IID programs in Texas, Colorado, New Mexico and Washington (see pg 3).

Table 1. States Ignition Interlock Program Applicable Statute and Attributes

State	Date Law Came in Effect	Agency Responsible for Monitoring and Regulation	IID Required	IID Installation Time Requirement (Months)	Compliance Based Removal
Texas[1,2,3]	September 1, 2015	County Level Agencies (Monitoring) Texas Department of Public Safety (Regulation)	• Sometimes for 1st Offenders • 2nd Offenders • 3rd Offenders	• Half of Probation Period	No
Colorado[4]	January 1, 2009	Colorado Department of Revenue, Division of Motor Vehicles	• All Offenders	• 1st Offense – 8 • 2nd Offense – 24	Yes
New Mexico[5]	June 17, 2005	New Mexico Department of Transportation, Traffic Safety Bureau, DWI / Compliance Unit	• All Offenders	• 1st Offense – 12 • 2nd Offense – 24 • 3rd Offense – 36 • 4th Offense – Rest of Life	Yes
Washington[6]	January 1, 2009	Washington State Patrol, Forensic Laboratory Service Bureau, Impaired Driving Section	• All Offenders	• 1st Offense – 12 • 2nd Offense – 60 • 3rd Offense – 120	Yes

[1] Texas Penal Code (PC), Source: https://statutes.capitol.texas.gov, Applicable Code: §49.09(h)

[2] Texas Code of Criminal Procedures (CCP), Source: https://statutes.capitol.texas.gov/Docs/SDocs/CODEOFCRIMINALPROCEDURE.pdf, Applicable Code: §17.441, §42A.408

[3] Texas Transportation Code (TC), Source: https://statutes.capitol.texas.gov/Docs/SDocs/TRANSPORTATIONCODE.pdf, Applicable Code: §521.242, §521.246, §521.2465, §521.247, §521.2475, §521.2476, §521.342(b)

[4] Colorado Revised Statutes (CRS), Source: https://leg.colorado.gov/colorado-revised-statutes, Applicable Code: §42-2-126, §42-2-132.5

[5] New Mexico Statutes. Source: https://www.nmlegis.gov/sessions/13%20Regular/bills/house/HB0349JCS.HTML, Applicable Code: §66-5-33.1, §66-5-35, §66-5-501, §66-5-502, §66-5-503, §66-5-504, §66-8-102

[6] Revised Code of Washington (RCW), Source: https://apps.leg.wa.gov/rcw/, Applicable Code: §46.20.720, §46.20.740, §46.20.385

Incentivize IID installation: Colorado and Washington incentivize IID installation that enable offenders to legally get back on the road sooner. Colorado allows offenders access to an Ignition Interlock Restricted License during the period of their license suspension, after a one to two month waiting period. In Washington, an offender is eligible for early removal of their IID through day-for-day credit, if the IID is installed prior to conviction.

Utilize compliance-based removal: All comparison states employ compliance-based removal, whose key features require offenders to complete a mandated period on the IID without alcohol violations, and

tampering or circumvention of the IID. Compliance-based removal is favored due to its effectiveness in encouraging behavior change and decreasing recidivism (Marques et al. 2010; Bailey et al. 2013). In both Colorado and Washington, failure to meet the IID program conditions are subject to additional penalty.

Penalize those who tamper with or circumvent their IID or fail to install IIDs when required: All three comparison states have enhanced penalties for offenders who drive without installing a required IID or attempt to tamper with or circumvent their IID which ensures offenders successfully fulfill their IID requirement and to generate compliance from them.

Recommendations and Conclusion

For ways to improve its current IID program, Texas should look to comparison states with strong ignition interlock programs, as well as consider recommendations from NHTSA and Mothers Against Drunk Driving (MADD). Moreover, MADD advocates 12 model ignition interlock law provisions that could provide strong incentives for interlock use and compliance by impaired driving offenders (MADD, 2018); Texas should consider incorporating these provisions. Researchers recommend the following changes to improve Texas' ignition interlock program:

Simplify the Transportation Code and other laws related to IIDs: IID statutes of comparison states are streamlined and located in one place, making them easier to implement.

Implement IID mandate for first offenders. NHTSA's model guidelines encourage all states to adopt IID provisions for first offenders (NHTSA, 2013) which all comparison states have.

Penalize those who tamper with or circumvent their IID or operate a motor vehicle without an IID when ordered: Also recommended by MADD (2018) in their model provisions, the comparison states have specific penalty for tampering with or circumventing IIDs which all comparison states have.

Apply ignition interlock statutes across the state consistently: Comparison states with strong ignition interlock programs have one centralized agency which oversees their IID programs. Additionally, MADD (2018) makes a similar recommendation in their model provisions. Consistent application of IID statutes allow for improved supervision of offenders.

Move to a compliance-based removal system: Compliance-based removal system is utilized by all comparison states and is also recommended by MADD (2018).

Limitations

One limitation to the described methodology is that the comparison states' selection was based on 28 states evaluated in the NHTSA document (Casanova-Powell et. al, 2015). Had this document considered all 50 states, the comparison states would have potentially been different.

Despite, this limitation, the incorporation of the recommended changes will strengthen Texas' current ignition interlock statutes, simplify implementation, reduce alcohol impaired driving, and ultimately make Texas' roadways safer.

References

Advocates for Highway & Auto Safety. (2010). The 2010 Roadmap to State Highway Safety Laws.

Bailey, T. J., Lindsay, V. L., & Royals, J. (2013). Best Practice in Alcohol Ignition Interlock Schemes. Paper presented at the 2013 Australasian College of Road Safety Conference – "A Safe System: The Road Safety Discussion", Adelaide.

Casanova-Powell, T., Hedlund, J., Leaf, W., & Tison, J. (2015). Evaluation of State Ignition Interlock Programs: Interlock Use Analyses From 28 States, 2006–2011. (DOT HS 812 145). Washington, DC: National Highway Traffic Safety Administration.

Dong, C., Nambisan, S. S., Xie, K., Clarke, D. B., & Yan, X. (2016). Analyzing the effectiveness of implemented highway safety laws for traffic safety across U.S. states. Transportmetrica A: Transport Science, 13(2), 91-107. doi:10.1080/23249935.2016.1212290

Goodwin, A., Thomas, L., Kirley, B., Hall, W., O'Brien, N., & Hill, K. (2015, November). Countermeasures that work: A highway safety countermeasure guide for State highway safety offices, 8th Edition. (Report No. DOT HS 812 202). Washington, DC: National Highway Traffic Safety Administration.

Mothers Against Drunk Driving. (2018). Ignition Interlocks: Every State, For Every Apprehended Drunk Driver.

Marques, P., Voas, R., Roth, R., & Tippetts, A. (2010). Evaluation of the New Mexico Ignition Interlock Program. (Report No. DOT HS 811 410). Washington, DC: National Highway Traffic Safety Administration.

Marutollo, J. (2009). No Second Chances: Leandra's Law and Mandatory Alcohol Ignition Interlocks for First-Time Drunk Driving Offenders. Pace L. Rev., 30, 1090.

McGinty, E. E., Tung, G., Shulman-Laniel, J., Hardy, R., Rutkow, L., Frattaroli, S., & Vernick, J. S. (2017). Ignition Interlock Laws: Effects on Fatal Motor Vehicle Crashes, 1982–2013. American Journal of Preventive Medicine, 52(4), 417-423. doi:https://doi.org/10.1016/j.amepre.2016.10.043

National Highway Traffic Safety Administration. (2013, December). *Model Guideline for State Ignition Interlock Programs.* (Report No. DOT HS 811 859). Washington, DC: Author

Ullman, D. F. (2016). Locked and not loaded: First time offenders and state ignition interlock programs. International Review of Law and Economics, 45, 1-13.

Synthetic Cannabinoid's Acute Effect on Psychomotor, Cognitive and Subjective Experience in Intoxicated Participants

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Abstract

Background: Synthetic cannabinoid (SC) mixtures have become very popular over the last years but can cause serious intoxications, resulting in impaired driving performance. In 2 controlled experimental studies we previously demonstrated that low doses of the SC JWH-018 impair cognitive and psychomotor functioning. Strikingly however, half of the participants did not feel intoxicated after administration, which hampers the interpretation of the results.

Objective: In the current study, we are looking at the effects on driving related skills of JWH-018 after acute administration, in participants who feel intoxicated.

Methods: 24 healthy cannabis-experienced participants take part in this placebo controlled, cross-over study. Participants inhale the smoke of 75µg JWH-018/kg bodyweight, and are given a booster dose if needed to induce feelings of subjective high. They are subsequently monitored for 4 hours, during which psychomotor and cognitive performance, vital signs and subjective experience are measured. In addition, blood samples are taken regularly to determine JWH-018 levels.

Results: Previously we demonstrated that subjective high scores showed a large variability in the subjective intoxication experienced by the participants. Serum concentrations of JWH-018 were found to be significantly higher in responders (participants who showed subjective intoxication). JWH-018 significantly impaired critical tracking performance in all participants. Responders had slower reaction times in the stop signal task and impaired performance in the spatial memory task after JWH-018 administration. Drug effects were also found on several subjective measures. Data collection of the new study is expected to end soon, and the results will be incorporated in the presentation.

Conclusion: In our previous two studies we demonstrated psychomotor, cognitive and subjective effects of low doses of JWH-018 even though not all participants reported feelings of intoxication. We expect to see stronger effects in participants in whom we first confirmed subjective intoxication. Keywords: Synthetic cannabinoid, psychomotor performance, inhibition, tracking performance, attention

Introduction

Synthetic cannabinoid (SC) mixtures were originally portrayed as natural and harmless and were easily accessible, which made them a very popular alternative for cannabis. Nevertheless, SCs can have severe side effects such as tachycardia, aggression and psychosis, and an increasing number of users end up in hospital (Auwärter et al., 2009; WHO, 2014). Controlled studies on the effects of SCs on human performance are scarce. We therefore assessed the safety pharmacology of the SC JWH-018 after acute administration in 2 controlled experimental studies (E. L. Theunissen et al., In press; Eef L Theunissen et al., 2018). Participants inhaled the vapor of JWH-018 (doses between 2 and 6,2 mg) using a crack pipe. Vital signs, cognitive performance and subjective experience were monitored for 12 hours. Subjective high scores showed that there is a large variability in the subjective experience of participants, with half of the participants not feeling intoxicated after administration. The group that experienced intoxication (i.e. subjective high score > 2), hence 'responders', showed significantly higher serum concentrations of JWH-018. Responders also performed more poorly in tests measuring reaction time and showed increased levels of confusion, amnesia, dissociation, derealisation and depersonalisation and increased drug liking after JWH-018. In both responder and non-

responder groups, JWH-018 increased heart rate within the first hour, and significantly impaired critical tracking and memory performance. From these studies it was concluded that fluctuations in drug delivery probably contributed to the variation in drug response as JWH-018's impairing effects on cognition and subjective measures were mainly demonstrated in participants who experienced a subjective intoxication of the drug. In addition, a higher dose of JWH-018 or better administration procedure would be needed to achieve a behavioral impairment profile that is similar to a typical cannabis dose. Interpretation of the results of our studies with JWH-018 is challenging as half of the participants did not feel intoxicated after administration. Therefore, in a follow-up study, we used an improved method for drug administration to reliably induce JWH-018 induced intoxication.

Methods

Twenty-four healthy cannabis-experienced participants took part in this placebo controlled, cross-over study. Participants inhaled the smoke of 75µg JWH-018/kg bodyweight. JWH-018 powder was heated via a vaporizer pen, which reaches temperatures of approximately 380°C. Participants inhaled the vapor in 5 intakes, according to a strict inhalation regimen. In case participants did not show a subjective response within 15 minutes after administration (i.e. a subjective high score <3), a booster dose of 50µg /kg bodyweight was administered. This was repeated a second time if needed. Participants were subsequently monitored for 4 hours, during which driving related skills, subjective experience and vital signs are measured. Driving related skills included measures of eye-hand coordination (Critical Tracking Task (CTT), processing speed (Digit Symbol Substitution Task), divided attention, response inhibition (Stop Signal Task and Matching Familiar Figures test), spatial memory and executive functioning (Tower of London). In addition, blood samples are taken regularly to determine JWH-018 levels.

Preliminary Results

Twenty one participants completed the study at the moment of writing this working paper. On 6 occasions it was needed to give the participant a booster dose. Preliminary data of this dataset show that the maximum subjective high is reached 15 minutes after administration of JWH-018 (average 5.98 cm) (fig.1). Eye-hand coordination performance (CTT) also shows a one-sided significant difference between the two treatments (p=.032), at 15 minutes after administration (fig. 2).
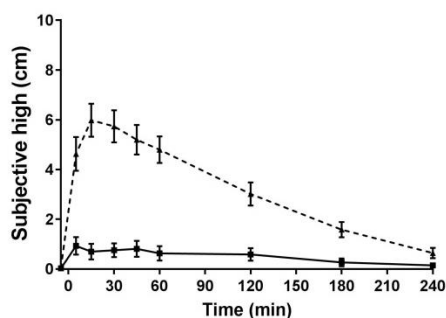

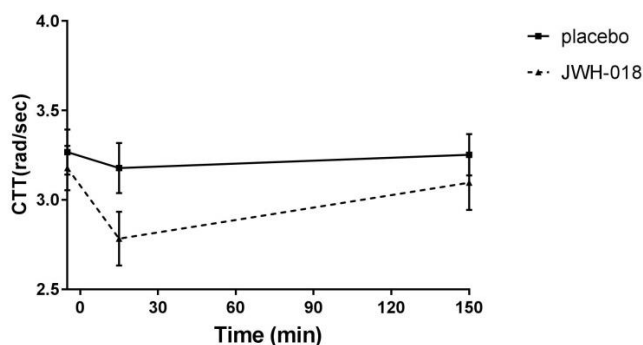Figure 1. Average (SE) subjective high score for placebo and JWH-018 over time (min)

Figure 2. Average (SE) CTT score for placebo and JWH-018 over time (min)

Conclusion

Data collection of the present study is currently still ongoing. In our previous two studies we demonstrated psychomotor, cognitive and subjective effects of low doses of JWH-018 even though not all participants reported feelings of intoxication (E. L. Theunissen et al., In press; Eef L Theunissen et al., 2018). Based on the preliminary data we expect to see more and stronger effects of JWH-018 on driving related skills in the current study, which should be more representative for users of SCs in real life settings.

References

Auwärter, V., Dresen, S., Weinmann, W., Müller, M., Pütz, M., & Ferreirós, N. (2009). 'Spice' and other herbal blends: harmless incense or cannabinoid designer drugs? *Journal of Mass Spectrometry, 44*(5), 832-837.

Theunissen, E. L., Hutten, N. R., Mason, N. L., Toennes, S. W., Kuypers, K. P., & Ramaekers, J. G. (In press). Neurocognition and subjective experience following acute doses of the synthetic cannabinoid JWH-018: Responders versus non-responders. *Cannabis and Cannabinoid Research*.

Theunissen, E. L., Hutten, N. R., Mason, N. L., Toennes, S. W., Kuypers, K. P., Sousa Fernandes Perna, E. B., & Ramaekers, J. G. (2018). Neurocognition and subjective experience following acute doses of the synthetic cannabinoid JWH-018: a phase 1, placebo-controlled, pilot study. *British Journal of Pharmacology, 175*(1), 18-28.

WHO. (2014). *World Health Organization. JWH-018 Critical Review Report*. Retrieved from WHO website: https://www.who.int/medicines/areas/quality_safety/4_5_review.pdf

The Criminal Justice System of Pakistan: Deterrent Impacts for Drug and Alcohol Use Among Road Drivers

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Abstract

Pakistan is a Muslim majority country and the use of drugs or alcohol is legally prohibited. However, both have seen a considerable increase in use across various social strata in the past decade. In the case of illicit drug use, the Ministry of Narcotics Control Pakistan has reported that every year at least 50,000 new people become addicted to different kinds of illegal drugs in Pakistan, adding to the 6.9 million already addicted. Pakistan is more susceptible to drug use as it has the world's main transit corridors for opiates and cannabis from Afghanistan, the world's top producer of such substances. Though direct evidence-based information about the utilisation of drugs or alcohol among Pakistani drivers is scarce, indirect evidence suggests that a large number of drivers use alcohol or drugs while driving. This study explores the involvement of alcohol and drugs in road crashes across Pakistan in road crashes reported by police and subsequent judicial enforcement of criminal laws. Five years' of crash and court data (2013- 2017) was obtained manually from different government departments across Pakistan. A total of 41,789 reported road crashes (involving deaths or/and injuries) are examined. Not a single driver in the five year period has been imprisoned in relation to their involvement in road crashes as a result of alcohol or drug consumption. The data indicate little judicial action of any kind. The mechanism of criminal justice system in Pakistan exhibits significant shortcomings in administering penalties and is therefore unlikely to contribute to deterrence of alcohol and drug use by road users. Road safety policy leaders in Pakistan need to think strategically to introduce interventions in the legal and enforcement systems to enhance the detection and conviction of such drivers. This study helps to address shortcomings in Pakistan's road safety enforcement and legal system.

Introduction

Pakistan is strategically located, lying astride the world's busiest drug trafficking corridors, largely due to the cultivation of opium poppy and cannabis in neighbouring Afghanistan, one of the world's largest producers of such illicit drugs. The Narcotics Control Strategy Report, 2016 released by the Bureau for International Narcotics and Law Enforcement Affairs International (INCSR) of United States Department of State identified Pakistan as one of major illicit drug producing and/or drug-transit countries (INCSR, 2016).

Pakistan is a Muslim country and despite being legally prohibited, alcohol and illicit drugs remain widely available and abuse has become a significant social problem. Illiteracy/low education level, peer pressure, age, social and family stress are influencing and contributing factors to high illegal drug use, while drug distribution routes provide an ease of access to drugs at very low prices (Aslam, Kamal & Ahmed, 2011; Aslam, 2015; Jabeen et al., 2017). UNODC's 2013 nationwide drug user survey indicated that 6.7 million Pakistanis aged 15 to 64 – about 6 percent of the population – used drugs illegally. Cannabis and opioids were the most prevalent drugs consumed, with four million and 2.7 million users, respectively. Around 860,000 people used heroin regularly, approximately 19,000 people reported they had used methamphetamine. Overall, the survey indicated that 4.25 million drug users aged 15 to 64 were suffering from substance use disorders. The trend of drug use is continuing to rise (every year, almost 50,000 more drug addicted people are added to the existing numbers), whereas the capacity of Pakistan to align its resources to treat those with substance use disorders and educate its people about the dangers of illicit drugs has been questioned (UNODC, 2013; INCSR, 2016).

In Pakistan, the road safety problem has registered a very sharp increase during recent years and more than 27,000 people die in road crashes annually (WHO, 2018). Among many factors responsible for the increasing trend of road crashes worldwide, driving under the influence of drugs or alcohol poses a significant threat to road safety by increasing the risk of a crash that results in death or serious injuries (WHO, 2018). Drug and alcohol use in the field of road safety has attracted little attention in Pakistan. Information on common drugs used among drivers (mostly professional) is available through media, police, and government/non-government

organisation reports and studies in other fields and general population drug use (i.e. Khawaja et. al., 1997; Ahmed et. al., 2003; Haque et. al., 2004; Aslam, Kamal & Ahmed, 2011; Aslam, 2015; Kayani, King & Fleiter, 2013, Jabeen et al., 2017). Only a few studies (i.e. Mir et al., 2012, Kayani, King & Fleiter, 2013) provide information on the widespread use of drugs by professional drivers. Notably, no study has yet been conducted to investigate illegal drink and drug driving among general drivers. A study in Rawalpindi and Islamabad by Mir et al. (2012) on a sample of 857 commercial bus and truck drivers reported that alcohol was used by almost 10% of drivers while driving, whereas 30% of drivers used marijuana. The use of both substances was reported by 4.6% of the sample. A qualitative study in Lahore, Rawalpindi and Islamabad (Kayani, King & Fleiter, 2013) found accounts of widespread use of illicit drugs among bus, truck and taxi drivers for recreational purposes and to combat fatigue. It also revealed that police are well aware of widespread drug use among drivers, however lack the resources and legal framework to conduct formal drink/drug driver testing. A case study in Lahore (Batool, Carsten & Jopson, 2011) noted the use of drugs and alcohol predominantly among and public transport drivers as contributing to the exacerbation of aberrant behaviours.

The constitution of Pakistan is one of the only constitutions of the world which prohibits its citizens the use of injurious drugs and consumption of alcohol under Article 37 (g) and (h). An exemption is provided for the consumption of alcoholic liquor for medical and, in the case of non-Muslims, religious purposes. The Pakistan penal code, under the Prohibition (Enforcement of Had) Order of 1979, awards punishment to those convicted of consuming prohibited intoxicants such as alcohol and drugs. However, this law is not applicable to non-Muslims who have a permit issued to them by the government for the use of alcohol under prescribed conditions. The "Control of Narcotic Substances Act, 1997" is a special law which the legislature had enacted mainly for awarding deterrent punishment to the persons involved in the cultivation, possession, trafficking, and trade of narcotics in any manner. Under this law, any such act is punishable by imprisonment up to two years to death or imprisonment to life.

Aims

- Examine and develop an understanding of the overall legal framework, situation and nature of drug and alcohol related registered (reported) road crashes;
- Understand the overall situation of road crashes across Pakistan in terms of each road crash registered (reported) by police, casualties in each registered case, numbers and characteristics of those subsequently subject to judicial procedures, trends in recent years and legal consequences of such registered road crashes after police investigations and court trial;
- Understand the mechanisms underpinning crash reporting, investigation and court proceedings.

Methods

This study was undertaken via secondary source analysis of de-identified data from 2013-2017 obtained all over Pakistan (including all provinces and districts) including government organisations – provincial police (district police, traffic police), National Highways and Motorways Police, National Police Bureau, Statistics Bureau of Pakistan, provincial Home, Prison and Prosecution departments, and Emergency Services 1122. Ethics approval for this study was granted by the Queensland University of Technology Human Research Ethics Committee (QUT UHREC). Different crash datasets are examined to understand the characteristics of the problem. For example, the mechanisms of reporting, investigation and court proceedings; collection and analysis of the road crash data reported to police and emergency departments; the cases transferred to courts and legal outcomes of trials in courts in particular of those that involved a death or injury. About 55,000 fatal (involving death) and non-fatal (involving injury) reported cases were examined in this study.

A verbal and written request was made to the different organisations to collect the data. Different data collection formats were developed through a prescribed pro forma as per data needs and the organisation's scope of work. An extensive exercise was launched for the manual collection of required information from all over Pakistan by disseminating the prescribed pro formas in police stations (a primary unit of policing in a specified local area). After collection of manual information on papers, Excel spreadsheets were created to digitalise the data. Different crash datasets were examined to understand the characteristics of problem. For example the mechanisms of reporting, investigation and court proceedings: collection and analysis of the road crash data reported to police and transferred to courts. Descriptive analysis was used to understand the characteristics of registered road crashes. Data variables include: police station, case registration number, fatal or

non- fatal, number of casualties involved, cases registered under sections of Pakistan Penal Code (classification in each section), cause of road crash, type of vehicle (s) involved, driving with/ without a license, and outcome of cases after a court trial (i.e. completed, under court trial, under police investigations, conviction (imprisonment/ fine/ or both)).

The details of provincial population, total districts in provinces and total number of police stations covered in the study are given in Table below.

Details of provincial population, total districts in provinces and total number of police stations

Province	Population	Total Districts	Total Police Stations
Punjab	110,012,442	36	705
Sindh	47,886,051	27	562
KPK	30,523,371	25	273
Baluchistan	12,344,408	26	120
Jammu & Kashmir	4,045,366	10	47
Gilgit Baltistan	922,745	10	66
Federal Capital Area, Islamabad.	2,006,572	1	22
Total		135	1795

Results

The analysis of data exposed many inaccuracies, shortcomings and inconsistencies in the reporting of road crash cases, police investigations, court proceedings and legislation. Manifestly, driving under the influence of drug or alcohol has not been identified as specific driving behaviours or as cause of a road crash in all reported cases during the period of study. The legal procedure for collecting evidence of drug and drink driving is very lengthy and complicated and requires that the driver be taken to a doctor and a medical laboratory. Moreover, police investigations are not scientific and do not specify drug and alcohol use as a behaviour, attributing almost all the road crashes to general causes, such as negligent driving, speeding, careless driving, etc. Such general findings in police investigations are almost impossible to prove in the court proceedings. For that reason, the analysis revealed that in all reported road crashes (during 2013- 2017), not a single driver has been reported and convicted in relation to their involvement in road crashes in connection with alcohol or drug driving. Enforcement and investigation is considered necessary to evaluate the deterrent impact of in practice countermeasures; however it seems no mechanism of targeted and intelligence-led enforcement methods on road or fatally injured driver's alcohol and drug testing system.

Discussion and Conclusions

Analyses indicates that the performance of criminal justice system is not at its optimal level in Pakistan in detection and conviction of drivers who use illicit drugs or alcohol during driving, which has serious repercussions in undermining the deterrent effect of road safety laws and regulations. The inefficient reporting, investigations and penalties or deterrent mechanism provided in the existing enforcement and legal system appear manifestly negligible if intended to instil any considerable change in driver's illicit drink or drug driving behaviour. Effective legislation, enforcement and the judicial system play an important role and are a prerequisite for deterrence of road user behaviour through the establishment and detection of offences, and imposition of penalties and sanctions. However the impact of legal sanctions is weakened if they are not

applied automatically and consistently. The analysis shows that there is no investigation initiated by police to investigate the factors associated with road crashes. Inadequate investigations from police that fail to identify the responsibility, grounds and circumstances of road crashes, coupled with a lack of knowledge and awareness among road users, can give rise to misunderstandings about crash causation and may lead people to attribute crashes to other factors such as fate or predestined (Kayani et al,. 2012, 2013, 2014).

This study provides comprehensive information on the existing road safety enforcement and legal system situation in Pakistan, and suggests that the structure of the road safety enforcement and legal system in Pakistan requires reform to address the inadequacies and to improve the system of accountability to make it more responsive to illegal driving behaviours including illicit drug use or drinking. Inadequacies and inefficiencies in Pakistan's complex criminal justice structure are embedded in interconnected systems and interventions may include all spheres of improvements: the police reforms in improvement of reporting and investigative procedures, strengthening prosecution and judiciary, alignment of legislative and regulatory frameworks.

The police reports analysed provided very little information regarding examination of the presence of different human conditions and states (i.e. drug or alcohol use). Police road crash reports are perhaps the most important source of road crash databases and analysis. There is a need to develop a comprehensive reporting and investigation system and to monitor the quality of police-reported road crash data. WHO and number of other road safety experts have repeatedly emphasised that inaccurate crash data is a significant problem faced by all developing countries such as Pakistan, most importantly when assessment of full-scale and nature, and priorities for attention and funding are made (Kayani et al., 2014). WHO (2018) has asserted that "without the ability to assess progress and the effectiveness of efforts to reduce fatalities and injuries, countries will not be able to identify gaps in the system and deliver tailored improvements. As a result of the differences in definitions, reporting, and coding practices adopted by health, police, and insurance, the individual sources of data often provide an incomplete view of the actual situation" (page 79). Quality data and appropriate investigation are critical in reducing the road toll that is rapidly growing to pandemic proportions in much of the developing world, including Pakistan. Many factors may contribute to inaccurate reporting and investigations of road crashes. There is need to investigate such factors to identify the shortcomings and achievement of future targets.

References

Ahmed, M. A., Zafar, T., Brahmbhatt, H., Imam, G., Hassan, S. U., Bareta, J. C., & Strathdee, S. A. (2003). HIV/AIDS risk behaviors and correlates of injection drug use among drug users in Pakistan. *Journal of Urban Health*, Volume 80, Issue 2, pp 321-329.

Batool, Z., Carsten, O. & Jopson, A. (2011). "Road safety issues in Pakistan: a case study of Lahore." *Transportation Planning and Technology* 35(1): 31-48.

Aslam, N., Kamal, A. and Ahmed, I. (2011). Demographic profile and etiological factors of starting drugs among patients with drug addiction. *Journal of College of Physicians and Surgeons Pakistan*, 21: 125-126.

Aslam, N. (2015). Horrendous situation of substance abuse in Pakistan: A bird's eye view on socio-demographics. *Journal of Alcoholism and Drug Dependence*, 3: 201. http://dx.doi. org/10.4172/2329-6488.1000201.

Haque, N., Zafar, T., Brahmbhatt, H., Imam, G., Ul Hassan, S., & Strathdee, S. A. (2004). High-risk sexual behaviours among drug users in Pakistan: implications for prevention of STDs and HIV/AIDS. *International Journal of STD AIDS*, 15:601—607.

International Narcotics and Law Enforcement Affairs International (INCSR), United States Department of State (2016). The Narcotics Control Strategy Report, 2016. https://www.state.gov/documents/organization/253655.pdf

Jabeen, S., Raja, M. S., Sadia Saeed, S., Zafar, M. M., Ghani, R. A., Mahmood, A., Fiaz, M., Shiaq, P. A., Baig, S. M.., Naqvi, S., and Raja, G. K. (2017). Factors Influencing Vulnerability Towards Heroin Addiction in a Pakistani Cohort. *Pakistan journal of zoology*, vol. 49(1), pp 95-99, 2017. DOI: http://dx.doi.org/10.17582/journal.pjz/2017.49.1.95.99

Kayani, A., King, M.J. & Fleiter, J.J. (2012). Fatalism and its implications for risky road use and receptiveness to safety messages: a qualitative investigation in Pakistan. *Health Education Research, 27*(6), 1043-1054.

Kayani, A., King, M.J. & Fleiter, J. (2013). "A qualitative investigation of drug use among Pakistani road users". In 20th International Council on Alcohol, Drugs and Traffic Safety Conference Brisbane, Australia.

Kayani, A., Fleiter, J.J., & King, M.J. (2014). Under-reporting of road crashes in Pakistan and the role of fate. Traffic Injury Prevention. *Traffic Injury Prevention, 15*(1), 34-39.

Khawaja, Z. A., Gibney, L., Ahmed, A. J., & Vermund, S. H. (1997). HIV/AIDS and its risk factors in Pakistan. *AIDS*, 11:843–848.

Mir, M.U., Khan. I, Bilal Ahmed, B., & Razzak, J. A. (2012). Alcohol and marijuana use while driving--an unexpected crash risk in Pakistani commercial drivers: a cross-sectional survey. *BMC Public Health*, 12:145.

United Nations Office on Drugs and Crime. (2013). Drug Use in Pakistan 2013: Technical Summary Report. http://www.unodc.org/documents/pakistan/2013.03.01ab_Summary_Report_Drug_Use_in_pakistan_ SvdV_v1.pdf

United Nations Office on Drugs and Crime. (2018). World Drug Report 2018. https://www.unodc.org/wdr2017/field/Booklet_1_EXSUM.pdf

United Nations Office on Drugs and Crime. (2018). World Drug Report 2018. https://www.unodc.org/wdr2018/prelaunch/WDR18_Booklet_1_EXSUM.pdf

WHO (2015). Global Status Report on Road Safety. Geneva: World Health Organization http://apps.who.int/iris/handle/10665/189242

WHO. (2018). WHO Global Status Report on Road Safety 2018. https://www.who.int/violence_injury_prevention/road_safety_status/2018/English- Summary- GSRRS2018.pdf

The Effects of Recent Drug Driving Legislation in Great Britain

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Abstract

Statuary drug driving limits were introduced in England and Wales in March 2015, whereby it became an offence to drive above specific limits for 17 proscribed drugs in blood. Eight of these drugs were nominally illicit and 8 nominally medicinal, plus amphetamine. At the same time roadside screening devices based on saliva samples were introduced. These however only test for THC and Cocaine.

Despite this limitation, within the first year of legislation prosecutions for drug driving offences increased by a factor of eight over pre legislation numbers. Subsequent to this, prosecutions for drug driving offences have continued to rise steeply. There are now in excess of 25,000 per year compared with around 1000 pre legislation. Only two devices are currently approved for roadside screening. A DrugWipe device produced by Securetec and one produced by Drager. The vast majority of tests are conducted using the DrugWipe device.

Approximately two thirds of drivers who are roadside screened are positive and then only 50% are eventually confirmed positive in blood with successful prosecutions, due to procedural issues. This paper will present the latest figures for drug driving prosecutions and also address how the very successful legislation can be further improved. In particular possible extension to screening for Methamphetamines, principally MDMA, the next most commonly used and impairing illicit drug, and importantly, creation of legislation allowing the option for the collection of evidential saliva samples at the roadside. The latter procedure would not only most likely significantly reduce the cost and time for sample analysis, but also likely increase in the number of successful prosecutions for drug driving offences.

Keywords: Drug driving, Illicit, Great Britain

Background

In 1985 the Department for Transport (DfT) commissioned the then Transport Research Laboratory (TRL) to undertake a study of the incidence of drugs in driver fatalities. The results of this research were published in 1989 (Everest et al,, 1989) and showed that 6% of fatally injured drivers had traces of medicinal drugs and 3% had traces of illicit drugs.

The topic then remained relatively dormant until 1995 when increasing evidence of illicit drug use in the community, mainly cannabis, was giving rise to concern. The DfT then undertook its own repeat study of drugs in road user fatalities between 1995 and 2000. The results of this work showed a massive 6 fold increase in illicit use in drivers, 3% to 18%, but virtually no change in medicinal use at 6%, (Tunbridge et al, 2001).

These results prompted the Government to fund a large programme of work into the issue of drug driving including experimental studies on the effect of cannabis on driving (Sexton et al, 2000) and how best to detect drug impaired drivers at the roadside (Tunbridge et al, 2000).

The evidence for an increased drug driving problem resulted in the Government bringing in new legislation under the Railways and Transport Safety Act 2003 (RATS). This allowed police to conduct roadside screening tests with 'Type Approved' devices testing for drugs in saliva or sweat. However, 11 years on, no such devices had received government approval. The RATS Act also allowed police to conduct, so called, Field Impairment Tests (FIT) under Section 4 of the Road Traffic Act 1988, to assess whether a driver might be impaired through drugs. Such tests, however, can only give a subjective indication of impairment, but not prove impairment. The latter is extremely complex. In practice these tests have been used spasmodically.

During the mid-2000's more research was carried out on the increase of recreational drug use in the community and associated likely increase in illicit drug use amongst drivers. The British Crime Survey (BCS) of admitted

drug use, published annually, consistently shows around 20% of 16 -25 year olds, the key road safety group, admitting to taking illicit drugs in the previous year. In addition, the most popular Clubbing magazine, Mixmag, showed that of regular clubbers around 75% admitted cannabis and ecstasy (MDMA) use in the past year. By 2010, the general population was consuming cocaine in proportions heading towards those of Cannabis consumption.

The IMMORTAL Project (2005; www.immortal.org.at) showed that of over 1300 drivers in Glasgow, who had been stopped at random and had a saliva sample taken, 10% were positive for illicit drugs; mainly cannabis and ecstasy (MDMA).

In addition, other non government funded studies showed around 20% of young drivers admitting to DUID. Following this research the then-Government announced a Review of Drink and Drug Driving Policy to be carried out by Sir Peter North, (North, 2010). North and a House of Commons Transport Select Committee concluded that drug screening of drivers should be introduced as soon as practically possible. In early 2012 an 'expert' panel was be set up to consider the technical aspects of introducing an offence of driving after taking illegal drugs and the possibility of identifying impairing levels for these drugs. The expert panel reported in March 2013 and recommended limits based on road accident 'Risk'. The vast majority of the panel's evidence was based on a re-reading of the Pan European study DRUID (DRiving Under the Influence of Drugs, alcohol and medicines) www.druid-project.eu.

Soon after, a new law was introduced as the Crime and Courts Act 2013. Under this new law the basic offence became: 'Driving or being in charge of a motor vehicle with a concentration of a specified drug above a specified limit'

The law applies only to controlled drugs i.e. those controlled under the Misuse of Drugs Act 1971.These basically comprise the most commonly taken illicit drugs plus some CNS active prescription-only drugs.

The illicit drugs covered are cannabis, cocaine, benzoylecgonine, heroin metabolite (6MAM), ketamine, LSD, methamphetamine and ecstasy. The main medicinal drugs are primarily six benzodiazepine tranquillizers and hypnotics, plus methadone and morphine. Amphetamine is also included and can be seen as either a medicinal or illicit drug depending on use.

Drug driving limits or levels in blood for the drugs outlined above where finally set in law in March 2015. At the same time devices detecting 2 of the 17 drugs proscribed in the Act (Cannabis and Cocaine) received 'Type Approval' for use in roadside drug screening. The proscribed drug levels in blood are available at www.gov.uk/government/collections/drug-driving#table-of-drugs-and-limits.

Aims

This paper aims to review the background to the drug driving situation in Great Britain over the past 30 plus years, the results of research and the consequent anti drug driving legislation and its effects. The current paper updates the presentation given to T 2016 with developments over the past 3 years.

Method

This is a review paper on drug driving in GB covering background, research undertaken, development of government policy subsequent change in drug driving legislation and the results of this. This paper is an update of the one delivered at T2016 with the latest developments in GB drug driving policy since then and up to date drug driving prosecution statistics.

Results

The Crime and Courts Act 2013 has been a major step forward; for the first time setting in law drug drive limits for specific drugs.

Since the law was enacted in March 2015, there has been a massive increase in the enforcement of drug driving, with convictions increasing, in the police forces of England and Wales, by up to a factor of 8 in the first year subsequent to the act, from around 1000 to nearly 8000.

In subsequent years the availability of roadside screening devices for the two most commonly used illicit drugs in Great Britain, Cannabis (THC) and Cocaine has lead to a massive increase in drug drive prosecutions under the new act. Over the past 3 years with the availability of drug screening devices for THC and cocaine prosecutions are estimated to be approaching 33,000 per annum and still growing!

Latest results (December 2018) suggest that around 65% of screening tests performed on drivers at the roadside are positive for drugs. But only 50% are successfully prosecuted following confirmation in blood. Of the 20% that aren't, the loss is principally due to the failure to get an evidential blood sample (Needle phobia issues are significant and constricted veins post Cocaine consumption are also important) or the time delay in getting to a Doctor or Health Care Professional to take a sample.

One force, North Wales, shows an average level of drug driver prosecution before the new law of 30 drivers, where as their current 2018 results indicate nearly 800 drug driver prosecutions per year, a 25 fold increase.

The England and Wales drug driving legislation allows arrest under the 1988 Road Traffic Act 1988 under two Sections. Section 4 which requires the demonstration of Impairment at the point of the driving offence; or Section 5a which requires provision of a roadside screening sample for one of the two currently proscribed drugs, Cannabis (THC) or Cocaine. At present around 95% of prosecutions in England and Wales are under Section 5a.

The devices currently approved for roadside screening are illustrated below.

 DrugWipe 3S Cannabis and Cocaine Keyboard.   Drager DDT 5000 with printer and keyboard.

Discussion / Conclusions

Following on from the initial results presented at T2016, it is clear that drug driving prosecutions have increased massively, estimated at over 25 fold, due to clear legislation and the availability of a simple to use, portable and reliable roadside saliva screening device. The issue is clearly a major road safety problem in Great Britain as many forces are now reporting more prosecutions for drug drive than drink driving.

After more than 20 years of campaigning we have at long last seen a major success in this important area of road safety!

To take this road safety improvement to the next and readily achievable level, it is recommended to take several relatively simple steps. In particular, the screening for MDMA, the next most commonly used illicit drug, and legislation for the option to collect evidential saliva samples at the roadside.

Epidemiological evidence on drug use in the general population suggests that MDMA (Ecstasy) use is the next most common illicit drug to cocaine and as a first step, roadside screening devices need approval for testing of Methamphetamines principally MDMA along with Cannabis and Cocaine.

The procedure to introduce evidential saliva collection at the roadside would not only reduce the cost and time of sample analysis but also increase successful drug drive prosecutions. Best estimates from current drug analysis practice in GB suggest that evidential saliva test results could be made available in one or two days compared to 3 to 4 weeks for evidential blood samples!

Furthermore, the cost of individual analyses could be reduced from around £400 - 500 GB to around £ 50 GB per saliva analysis! A great saving in time, effort and cost and likely increase in drug driving enforcement building the necessary deterrent to save lives and reduce injury.

The latter procedure has already had successful application in France and other European countries as well as Australia.

To counter this very significant road safety issue, the Department for Transport needs to improve and extend its anti-drug drive campaign, but this must come with more focus from the Home Office in assisting with legislative changes and to maintain, at least, the current number of specialist Road Traffic Police.

References

Everest, JT, Tunbridge, RJ and Widdop, B (1989). The Incidence of drugs and alcohol in road accident fatalities. TRL Report 202.

Tunbridge, RJ, Keigan, M and James, F (2000). Recognizing drug use & drug related impairment in drivers at the roadside. TRL Report 464.

Sexton, BF, Tunbridge, RJ, Brook-Carter, N, Jackson PJ, Wright, K, Stark MM and Englehart, K (2000). The Influence of Cannabis on Driving. TRL Report 477.

Tunbridge, RJ, Keigan, M and James, F (2001). The Incidence of drugs and alcohol in road accident fatalities. TRL Report 495.

North P.; *Report of the Review of Drink and Drug Driving Law* London; DfT Publications, 2010

The *One for the Road* Group Intervention for Repeat Impaired Drivers- Evaluation and Developments.

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Abstract

Context: Drink driving is a serious problem in New Zealand (NZ). Over the years 2014–2016, alcohol/drugs were a factor in 29 percent of fatal crashes (Ministry of Transport 2017). From 2009-2012, 47 percent of detected drink drivers were repeat or recidivist offenders who had at least one previous historical drink driving conviction (Waters, 2013).

Objectives: One for the Road *(OFTR)* is a New Zealand based group intervention targeting behaviour change in repeat drink/ drugged drivers. This programme has been active since 2008 and has been developed to achieve both best- practice and achieve a unique approach appropriate to a New Zealand context. Group therapy is the key, seeking exploration of deeper underlying issues and using a relational approach to engage with Maori and Pacific Islander people who make up 45% of participants. Attendees are mixture of those referred prior to sentencing, as part of a court ordered sentencing programme, or towards the end of an 'indefinite' licence disqualification period.

Key Outcomes: A recent independent evaluation by RIDNZ (Waters, 2019) has supported programme effectiveness for the longer version of the programme (20 hours), with an overall 7.5% re-offending rate, and a 20.2% reduction in reoffending over 3 years, when compared to a well matched control group. However the earlier 10 hour version of *OFTR* (last implemented in 2013) was not supported for effectiveness.

Discussion and Conclusions The evaluation by RIDNZ has been an opportunity for reflective practice, and valuable in highlighting the effectiveness, strengths and limitations of *OFTR*. Harmony Trust have gained validation for programme integrity, and the developments in lengthening and updating *OFTR* to it's current version. Subsequent to this study there have been some further changes to the style, structure, and length of the programme in order to achieve best practice.

Introduction- *Background to drink driving in NZ- why focus on repeat drink drivers?*

Drinking and driving behaviour has long been of concern in NZ, with reports indicating 31% of road deaths being alcohol-related (Ministry of Transport, 2009). Dawe (2010) has found that 36% of drink drivers were reconvicted over the 10 year period 1999 to 2008 in New Zealand, which appears to be high compared to overseas examples, and Waters (2013) has reported that from 2009-2012, 47 percent of detected drink drivers were repeat or recidivist offenders who had at least one previous historical drink driving conviction. It is generally acknowledged that preventing recidivists from re-offending is likely to have the greatest impact on alcohol-related crashes (Campbell, 2000; Joyce, 2000; Roadsafe Auckland, 2001).

Methods of social change to reduce drink driving have been attempted such as increased police presence and breath testing, tougher sentencing, media shock tactics, and lowering the drink-driving limit from .08 (80mgs per 100 mls of blood) to .05 (50mgs). However there remains a concern about the high number and cost of people receiving a custodial sentence for traffic and vehicle related offences making up 19% of the total number of custodial sentences passed in 2009 (Statistics New Zealand, 2010). There appear to be persistent drink-drivers who appear immune to these interventions and who appear to feel their behaviour is justified as 'normal' as 'thousands do it'. The *OFTR* programme focuses on group work with repeat offenders, using engagement, empathy, challenging to world views, eliciting commitment to change, and promoting a zero drink/drugged driving limit.

The One for the Road Programme- *Background and Development:*

The *OFTR* programme was first implemented by Harmony Trust in 2008 as a pilot initiative to test whether a 'brief intervention' model would show any effectiveness with repeat drink/drugged drivers. Initial funding was from The New Zealand Transport Agency via The Auckland Council/Auckland Transport. To date

some 250 individual groups have been completed across the Auckland region and the Central North Island of NZ, with in excess of 2000 people completing. During these 10 years there has been a continuous process of experimentation, trial and error, reflection, review and development.

OFTR Version 1: From 2008-2013 OFTR consisted of a 10 hour programme run over 2 days workshop style (6 hours and 4 hours). This was typically on a Friday and Sunday afternoon to 'capture' the weekend binge drinking times and give a chance to practice group challenge in situ. This version which could be described as condensed, was based on the assertion of Bill Miller that 'there is much that can be done in even a single session to initiate change in alcohol use' (Miller and Rollnick, 2002), and was adopted to facilitate engagement (attendance and completion rates) in what is often a resistant and pre-contemplative population referred through the justice system. To this end also meal catering and end of group gifts were provided (a OFTR key ring and fridge magnet). The group was also designed to reduce barriers and resistance to change, have an emotional impact, create cognitive dissonance, and develop a discomfort (aversion) for drink-driving. The process was based on a central victim empathy session, sensitive and careful use of guilt and shame, peer group feedback and accountability, emotional insight and moral development, and planning for change.

OFTR Version 2: From 2013-2018 (with additional national funding from the Ministry of Health) a 20 hour programme was developed which included the original 2 day workshop plus 5x 2 hour weekly sessions. The additional 10 hours run over 6 weeks offered a greater change for group participants to demonstrate change and commitment through practice with a group action challenge set each week focusing on behaviour change, completion of an AOD log to monitor use during the week including triggers and coping skills, an increased opportunity for process therapy, peer feedback, development in communication styles, awareness of cognitions and consequential thinking, and relapse prevention. In this time Harmony Trust had also produced a brief video 'Be Back Soon', which was used in group to promote awareness of impact of behaviour on others.

OFTR Version 3: With preliminary information gained from the evaluation by Waters (2019) an opportunity for reflection and review was created. In August 2018 OFTR was extended to the current a 22 hour version run over 8 weeks. Version 3 features the same content and process of the previous version but with an extended time frame consisting of an initial 1 day (6 hour) workshop, plus 8 x 2 hr closed weekly sessions. This lengthening of the programme was an acknowledgement that, while still a brief intervention, OFTR would benefit from the extra time needed for repeat impaired drivers to consolidate learnings and demonstrate commitment to change over time. We were aware that some graduates of the earlier 10 hour programme would have been able to 'fake' change more easily or avoid a more thorough exploration of their offending.

The Typical Group Member Profile:

Referrals have generally come from defence lawyers (clients who have court cases pending), probation (as part of a court order), Alcohol and Drug Services, or via the NZTA from those applying to have a licence disqualification lifted.

The following points are based on demographic data gathered by Harmony Trust and from data received from the Ministry of Justice on 142 OFTR programmes run between July 2009 and March 2015, some 1437 particpants. This data has indicated the 'typical' One for the Road group member is: male (88%), on average is between 35-39 years old, may equally be Pakeha (NZ European) or Polynesian, has 3 plus 'excess breath alcohol' convictions, shows a tendency to binge drink and alcohol 'abuse' (moderate, rather than meet the criteria for dependency (less than 10% scoring medium or high on the LDQ), is 'pre-contemplative' (does see a need to change) and likely to have ways of justifying their behaviour, may be guarded or defensive, show stored anger and a tendency to blame other.

Repeat offenders have developed a particular 'mindset' or attitude with strong and compelling reasons for rationalising and continuing with their behaviour. These justifications assist the drink driver to 'cope' with potential feelings of guilt, shame, hurt, victimisation, alienation, and anger. One group member described having a 'book' of justifications he could draw upon at any point in order to 'feel' better about his behaviour. These are often statements (beliefs) such as: "I only had a few…I drive better when I'm drunk…I'm the least drunk so I had to drive…It's only around the corner… Where's the victim, I haven't hurt anybody…There's thousands out there that drink and drive".

Current Evaluation by RIDNZ 2019:

OFTR was subjected to a matched control group outcome comparison, with up to 3 matches per OFTR offender, undertaken by RIDNZ (Repeat Impaired Drivers New Zealand- Waters, 2019)). Findings from this study indicate:

- The OFTR 20hr programme appears to be an effective intervention for repeat and high level first time detected drink drivers. This is encouraging given the group is often delivered as a 'stand-alone' intervention. However the previous OFTR 10 hour programme (by itself) appears not to be effective intervention, with no reduction in re-offending.
- Participants who completed the full programme were 20 per cent less likely to reoffend over the 3-year period when compared with the control groups (7.5 per cent recidivism rate among 20hr programme participants compared to 9.4 for the matched control group and 10.6 per cent unmatched 'other' drink drive offenders among the controls). However an important caveat of this study is that the actual numbers involved are quite low and future research would be needed to be replicate and confirm.
- Those who re-offended were just more likely to do so in the first year post group.
- The RODD – 'Risk of Drink Driving' Screening Tool used by Harmony Trust appears to be an effective assessment of risk.
- Future evaluations should not rely on just post programme detected reoffending alone without the use of any comparison control group to indicate reduction in re-offending.

Conclusions, Findings and /or Recommendations:

Initial results for One for the Road are promising in terms of the reduction in re-offending and relatively low reconviction rates. The low reconviction rate is more impressive given the relatively high previous drink-drive convictions and low motivation to change compared to overseas programmes. The relatively inexpensive cost of the programme indicates that the programme is likely to be cost-effective relative to custodial sentences.

Key Features / Learnings for OFTR- *What we have learnt through this review process:*

1. *Brief Intervention*

OFTR has always been a brief and intensive, and this has assisted with engagement and client retention in group, as the task of attending appears more manageable to clients. This helps with retention but the evaluation has shown that there is a cost to brief intervention in terms of programme integrity and outcomes, and the learning is 'brief, but not too brief'.

2. *Motivational Enhancement*

Alcohol and other drug intervention studies support the effectiveness of a brief intervention model in motivating a client towards behaviour change (Bill Miller, 1996; Miller and Taylor, 1980).The essential process followed in group parallels the work of Bill Miller (2002) with the 'motivational interviewing process of working towards change in a) Expressing Empathy b) Rolling with Resistance c) Developing Discrepancy and d) Supporting Self Efficacy. One OFTR client remarked in end of group feedback: *"I knew I had to change, but meeting you has made me want to change".*

3. *Group Therapy*

OFTR is a true closed therapy group which can be described as experiential (action, emotion, and activity based) rather than educational. To assist with this process numbers should be capped at 14.This is more about 'being in' a situation than talking about a situation. There is a group resource booklet given to clients, and videos are shown but these are secondary to group process, where the group

members are regarded as the 'guest speakers'. One exception is the 'Be Back Soon' video created by Harmony Trust to elicit feelings for family and support people of repeat impaired drivers. Feedback from group participant: *"I have stood before the just 3 times but never felt as guilty as I do right now".*

4. The Anti-Drink Driving Peer Group

Human beings have a strong drive for affiliation and we typically live in groups, work in groups, and tend to drink alcohol in groups (ie 'social drinkers'). Drink Drivers who don't believe they have an 'alcohol' problem, are more likely to attend a group for 'drink drivers' than one for 'alcoholics'. One of the most important objectives of One for the Road is then to establish an 'anti drink driving' peer group amongst the group members, where the person who remains 'pro' drink driving and begins to feel 'abnormal'. Group feedback: *"I 'enjoyed' being confronted and challenged rather than a room full of people smiling and agreeing with me".*

5. Connecting with Maori Pacific Island People- whakawhanaungatanga

The group is designed specifically to cater for people of Maori and Pacific Islander origin (approx. 45%) and a feature of this is the focus on hospitality- a cooked kai (food) is provided to participants, use of karaka, observance of tikanga (protocol). Both Maori and Pacific cultures are reflected in group leaders, and the attendance of 'drink-driver crash survivor', Tamati Paul, Ngati Porou, and who has been through a process of rehabilitation and recovery, provides an important catalyst for change.

In conclusion, over 10 years, through trial and error, the OFTR programme has been continually reviewed and developed. The programme has evolved a distinctive NZ flavour, innovative practice, and a true therapeutic focus. With the more rigorous scrutiny offered by the recent matched control group evaluation by Waters (2019), there has been a further chance to reflective and improve. The outcomes indicate a qualified success in reducing re-offending in this 'hard to engage' and resistant population, who, without intervention, are highly likely to reoffend causing harm to themselves or others.

References

Allport, G. W. (1954). The nature of prejudice. Cambridge, MA:Addison-Wesley

Campbell, G. (2000). Auckland Region CBT results for the twelve-month period between 1.7.99 and 30.6.00. Personal communication: Auckland region Traffic Alcohol Group, Auckland Police.

Dawe, M. (2010). Repeat drink-driver rehabilitation effectiveness: Preliminary evaluation of the 'One for the Road' programme October 2010. Health and Safety Developments. Unpublished.

Health Canada. (2004). Best practices: Treatment and rehabilitation for driving while impaired offenders. Health Canada. Ottawa, Ontario. Available from: www.hc-sc.gc.ca/hc-ps/pubs/adp-apd/bp_treatment-mp_traitement/index-eng.php

Joyce, K. (2000). General information on the rehabilitation of serious traffic offenders. Personal communication: Safer People, Land Transport Safety Authority.

Law Commission. (2009). Alcohol In Our Lives: an issues paper on the reform of New Zealand's liquor laws - NZLC IP15. Law Commission, Wellington July 2009. Available from: www.lawcom.govt.nz/ProjectIssuesPaper.aspx

Miller, W. R. (1996). Motivational interviewing: Research, practice, and puzzles. Addictive Behaviors, 21, 835-842.

Miller, W. R., & Rollnick, S. (2002). Motivational interviewing: Preparing people for change. New York: Guilford Press

Miller, W. R., & Taylor, C. A. (1980). Relative effectiveness of bibliotherapy, individual and group self-control training in the treatment of problem drinkers. Addictive Behaviors, 5, 13-24.

Ministry of Transport. (2009). Yearly report 2009: Motor vehicle crashes in New Zealand 2008. Statistical statement calendar year 2008. Available from: www.transport.govt.nz/research/Documents/MOT_Motor%20vehicle%20crashes%202008_Full%20version.pdf

Ministry of Transport. (2010). Safer journeys: New Zealand's road safety strategy 2010-2020. Available from: www.transport.govt.nz/saferjourneys/Documents/SaferJourneyStrategy.pdf

Ministry of Transport (2017) Alcohol and drugs 2017.

Ministry of Transport. (2019). Annual number of road deaths historical information. Available from https://www.transport.govt.nz/mot-resources/road-safety-resources/road-deaths/annual-number-of-road-deaths-historical-information/

Roadsafe Auckland, (2001a). Preventing alcohol related crashes though community action targeting repeat drink-drivers: Background Report. Unpublished report: Auckland Regional Council.

Statistics New Zealand (2010). Criminal Conviction and Sentencing Statistics: 2009 tables. Available from: www.stats.govt.nz/tools_and_services/tools/tablebuilder/conviction-and-sentencing-tables.aspx (accessed September 2010).

Trimboli, L. & Smith, N. (2009). Drink-driving and recidivism in NSW. Crime and Justice Bulletin, 135. September 2009, NSW Bureau of Crime Statistics and Research. Available from: www.lawlink.nsw.gov.au/lawlink/bocsar/ll_bocsar.nsf/vwFiles/cjb135.pdf/$file/cjb135.pdf

Waters, G. (2013). Drink/Drug Driving Data 2009-2012 and Preliminary Report on Interlock Uptake in New Zealand. New Zealand Automobile Association, New Zealand.

Waters, G. (2019). 'One For The Road - An Outcome Evaluation of a Drink Driver Rehabilitation Programme'. RIDNZ. Unpublished.

Wells-Parker, E.; Bangert-Drowns, R.; McMillen, R.; and Williams, M. (1995) Final results from a meta-analysis of remedial interventions with drink/drive offenders. *Addiction* 90:907–*926, 1995.*

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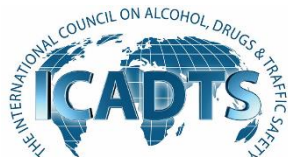 Pacific Institute for Research and Evaluation (PIRE)

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