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TITLE: Exploring Disparities in Cannabis-Impaired Driving: A Sociodemographic and Behavioural Analysis Based on the Canadian Automobile Association (CAA) Surveys in Ontario, 2021-2023

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OBJECTIVES

To evaluate the difference between various behavioural and sociodemographic factors on the prevalence of driving under the influence of cannabis (DUIC), both in their lifetime and in the past 12-months. Additionally, we aim to identify and quantify how some modifiable factors contribute to differences in the prevalence of DUIC across different demographic categories, including age, gender, and educational background.

DATA AND METHODS

Utilizing data from the 2021, 2022, and 2023 'Drug Impaired Driving' conducted by the Canadian Automobile Association (CAA), the study focuses on English-speaking Ontario residents aged 19-75 years, who are cannabis users with a valid driver's licence and have access to a vehicle. We calculated standardized prevalence of DUIC across various sociodemographic characteristics, standardized by age and gender. Additionally, we calculated the standardized prevalence of attitudes and behaviours associated with DUIC. This process included the calculation of standardized marginal differences to highlight variations in these prevalence rates. To further our understanding of why certain social groups, demonstrate higher levels of DUIC prevalence, we employed causal decomposition analyses. By doing so, we not only estimate inequalities but also aid in explaining them, thereby offering insights into potential strategies to mitigate these health disparities.

RESULTS

The lifetime DUIC prevalence of 27.3%, with annual rates of 13.1% in 2021, 12.6% in 2022, and 18.0% in 2023 among the 1,897 participants. Higher DUIC prevalences were noted among men, individuals under 35, those with secondary education or less, widowed persons, those with an income under $49,999, and daily cannabis users. A marked difference in DUIC prevalence was observed across age groups, with younger individuals (less than 34 years) showing higher lifetime and past 12-month DUIC prevalences compared to older individuals (more than 55 years) (Table 1).

The study also examined behavioural and perceptual characteristics, finding that those less concerned about cannabis-impaired driving had a higher past 12-month DUIC prevalence. Notably, individuals believing that cannabis-impaired driving had no worse effect or was better than non-impaired driving had a significantly higher DUIC prevalence. These patterns persisted over the survey years (Table 1).

The application of causal decomposition showed that the belief in the relative safety or superiority of cannabis-impaired driving contributes to the observed disparities in DUIC prevalence by gender, education, and age. These perceptions factors accounted for a substantial portion (from 40% to 60%) of the existing prevalence differences, highlighting the importance of addressing these beliefs in interventions (Figure 1).

CONCLUSIONS

The demographic analysis points to specific groups with higher DUIC prevalences, suggesting targeted areas of intervention and policy development. The findings emphasize that while sociodemographic factors are crucial, the belief about the effects of cannabis on driving ability is a key contributor to disparities in DUIC prevalence. The results suggest the need for comprehensive strategies that address cannabis-impaired driving, including targeted educational campaigns, policies addressing socio-economic disparities, and interventions tailored to specific groups and perceptions of DUIC. The study underscores the importance of ongoing research and data collection for continuously refining these strategies to effectively reduce cannabis-impaired driving and enhance road safety.

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TITLE: Motor Vehicle Crash Occupants with Tibial Fracture Have Different Outcomes Based on Patient Zip Code

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OBJECTIVES

Tibial shaft fractures are the most common long bone fracture overall; therefore, our institution has a large retrospective dataset on this injury. Additionally, prior studies have shown that patients with these fractures and a low socioeconomic status have worse long term functional outcomes when compared to patients with a higher socioeconomic status (Pandya et al. 2018, Elsoe et al. 2018). This difference can be a function of a patient's access to resources, including healthcare (Mundy et al. 2022. There is an existing measure of socioeconomic indicators that are linked to a person's zip code called the Area Deprivation Index (ADI, Kind et al. 2018). Higher ADI scores indicate a more disadvantaged group. The hypothesis for this study was that in Motor Vehicle Crash (MVC) occupants with a tibial shaft fracture the patients with higher ADI scores would have worse outcomes.

DATA AND METHODS

Retrospective data from a single institution was compiled following Institutional Review Board approval. Patients that received tibial shaft fracture operative fixation by a fellowship-trained Orthopaedic Trauma Surgeon between 2012 and 2022 composed the initial dataset. That dataset was further narrowed to patients injured during a MVC with at least 1 year follow-up, demographic data, outcome data, zip code, and comorbidities (as measured by the Charlson comorbidity index). The specific outcome data assessed were 90-day readmission rates, no-show to follow-up healthcare appointment rates, and post-operative complication rate. The ADI score was obtained from a University of Wisconsin School of Medicine and Public Health public dataset (https://www.neighborhoodatlas.medicine.wisc.edu/mapping) and assigned based on the patient's home zip code. The patients were grouped into quartiles based on their ADI score. Using R software, regression analysis measured the association between the ADI quartile and the outcome measure of interest. Additional regression analyses also assessed the relationship between the outcome variables of interest and race, age, sex, and comorbidities.

RESULTS

Patients with higher ADI scores were significantly more likely to miss their follow-up appointments. They did not have higher rates of re-admission or post-operative complications. When patient demographics were considered, patients that were white, older, sicker (more comorbidities), and male were more likely to make their post-operative visits.

CONCLUSIONS

These preliminary data suggest that the ADI score might be used to determine a patient's ability to access care. Follow-up visits for patients following a MVC injury are important to optimize patient care and outcomes. Because these patients are not returning for care, it is also difficult to determine if their long term outcomes are worse when compared to patients that receive care. Given these findings, future studies can identify specific interventions for patients with a higher ADI to optimize their care.

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TITLE: Risk factor for serious injury of far-side occupants in motor vehicle side crashes using the KIDAS(Korean In-Depth Accident Study) data

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OBJECTIVES
This study aims to identify the risk factors associated with serious injuries sustained by far-side occupants in motor vehicle side-impact collisions.

DATA AND METHODS
This is a retrospective observational study utilizing data from the Korean In-Depth Accident Study (KIDAS), covering accidents from 2011 to June 2023. Of the 589 total side-impact collisions reported in KIDAS, 252 involved far-side occupants. After excluding accidents involving buses or large trucks and passengers under the age of 15, 222 individuals were included in the final analysis. Serious injuries were defined as those with the Maximum Abbreviated Injury Scale (MAIS) score was 3 or higher. Variables analyzed included the occurrence of a perpendicular collision (at 9 or 3 o'clock), whether the collision affected the passenger compartment, whether the impact reached the height of the windows, and the extent of vehicle damage (Extent 1-2 or 3 or more). The study stratified participants into groups with serious and non-serious injuries to evaluate the risk factors for serious injuries among far-side passengers, taking into account human, vehicle, and safety variables. A logistic regression analysis was conducted to determine the impact of these risk factors, employing backward elimination (Wald) for model selection.

RESULTS
Of those studied, 51 individuals (23%) sustained serious injuries, while 171 (77%) did not. The final model retained age, the type of colliding object, and the extent of vehicle damage as significant predictors. An increase in age was associated with a slight increase in risk, with an Odds Ratio (OR) of 1.022 (95% Confidence Interval (CI) 0.999-1.045). Relative to passenger vehicles, the OR for collisions with light trucks was 2.150 (0.745-6.207), with medium-to-large trucks 2.144 (0.851-5.404), with narrow fixed objects 13.513 (2.896-63.056), and with wide fixed objects 7.521 (1.1926-29.370). The OR for vehicles with extensive damage (Extent 3 or more) compared to minor damage (Extent 1-2) was 2.583 (1.193-5.593).

CONCLUSIONS
The findings suggest that serious injuries to far-side occupants in side-impact collisions are predominantly associated with collisions involving fixed objects, particularly narrow ones, and significant damage to the vehicle's passenger compartment.

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Table 1. Comparison of variables between serious (MAIS 3+) and non-serious (MAIS 1-2) groups

		MAIS 3+		MAIS 1-2		Total		p-value
		N	%	N	%	N	%	
Number		51		171		222		
Sex	Male	32	62.75	91	53.22	123	55.41	0.230
	Female	19	37.25	80	46.78	99	44.59	
Age	Mean ± Standard deviation	49.29	±9.29	47.36	±7.36	47.81	±7.81	0.469
Age group	15-64	42	82.35	146	85.38	188	84.68	0.600
	65+	9	17.65	25	14.62	34	15.32	
Seating Position	Driver	30	58.82	116	67.84	146	65.77	0.053
	1st row Right	17	33.33	28	16.37	45	20.27	
	2nd row left	1	1.96	13	7.6	14	6.31	
	2nd row Right	3	5.88	14	8.19	17	7.66	
Vehicle Type	Sedan	29	56.86	109	63.74	138	62.16	0.280
	SUV	7	13.73	31	18.13	38	17.12	
	Light Truck	9	17.65	15	8.77	24	10.81	
	Van	6	11.76	16	9.36	22	9.91	
Counterpart	Passenger Car	16	31.37	110	64.33	126	56.76	<0.05
	Light Truck	7	13.73	19	11.11	26	11.71	
	Heavy Truck	11	21.57	27	15.79	38	17.12	
	Fix object <Non-wide>	6	11.76	3	1.75	9	4.05	
	Fix object <Wide>	6	11.76	6	3.51	12	5.41	
Force direction	3 or 9 o' clock	30	58.82	69	40.35	99	44.59	<0.05
	02/04 or 08/10 o' clock	21	41.18	102	59.65	123	55.41	
Side damage Location	P*	22	43.14	53	30.99	75	33.78	<0.05
	Y/Z/D***	24	47.06	75	43.86	99	44.59	
	F/B**	5	9.8	43	25.15	48	21.62	
Extent of damage	Extent 1-2	14	27.45	99	57.89	113	50.9	<0.001
	Extent 3+	37	72.55	72	42.11	109	49.1	
Seatbelt	Fasten	16	31.37	46	26.9	62	27.93	0.726
	Unfasten	35	68.63	115	67.25	150	67.57	
Frontal Airbag	Non-deployment	42	82.35	134	78.36	176	79.28	0.694
	Deployment	9	17.65	35	20.47	44	19.82	
Seat Side Airbag	Non-deployment	50	98.04	155	90.64	205	92.34	0.122
	Deployment	0	0	9	5.26	9	4.05	
Curtain Airbag	Non-deployment	51	100	156	91.23	207	93.24	0.122
	Deployment	0	0	10	5.85	10	4.5	
Passengers	No	25	49	88	51.5	113	50.9	0.760
	Yes	26	51	83	48.5	109	49.1	
Passengers - seatbelt status	No passenger	25	49	88	51.5	113	50.9	0.460
	Passenger -unfastening seatbelt	5	9.8	26	15.2	31	14	
	Passenger -fastening seatbelt	21	41.2	57	33.3	78	35.1	

* P: Side Center section(Left or right); Passenger compartment

**F:Side Front(Left or Right), B: Side Rear(Left or Right)

***Y:F+P, Z:B+P, D:F+B+P

Table 2. Result of logistic regression (Last step of backward method)

		95% Confidence Interval	
	Odds ratio	Lower	Upper
Constants	0.033		
Age	1.022	0.999	1.045
Passenger Car	Ref		
Light Truck	2.15	0.745	6.207
Heavy Truck (5T +)	2.144	0.851	5.404
Fixed Object (Narrow)	13.513	2.896	63.056
Fixed Object (Wide)	7.521	1.926	29.37
Crush Extent 3+	2.583	1.193	5.593

TITLE: Inflammatory protein elicitation in response to whole-body vibration exposure

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OBJECTIVES

The International Organization for Standardization has established whole-body vibration (WBV) exposure threshold values for injury to the lumbar spine and its connected nervous tissue (ISO, 1997). While there has been thorough research on the risk of spinal injury, little is known about how WBV exposure affects the brain. The body's biodynamic response amplifies vibrations at the seat, leading to up to twice the exposure at the head compared to the seat (Paddan & Griffin, 1998). Research conducted on mice has shown that WBV exposure can cause pathophysiological effects similar to brain injury (Abbate et al., 2004). Inflammatory-response protein concentrations are a commonly used benchmark for brain injury and could provide a link between WBV exposure and brain injury (Papa et al., 2014). This study aims to assess the effects of WBV on the brain through changes in blood protein concentrations, seat and head accelerations, and symptomatology over time.

DATA AND METHODS

Thirty-two subjects recruited from Virginia Tech and the surrounding area were randomly assigned to control, short-term (1 hour), and long-term exposure (8 hours) groups. Subjects' venous blood was sampled before, immediately after, and 24 hours after testing. A Lansmont Model 1000 Vibration Test System® (Lansmont Model 1000 Vibration Test System, Monterey, CA) was used to administer vertical axis vibration exposure to subjects. Seat and head accelerations were measured using Vicon Blue Trident® (Vicon Blue Trident, Version 2, Denver, CO) inertial measurement units. Localized subject discomfort was gauged hourly. Subjects were given modified Rivermead Post-Concussion Symptoms Questionnaires (RPQ) following testing. Glial fibrillary acidic protein (GFAP) and S100B measurements were determined from plasma samples. The average and maximum resultant head acceleration, weighted root-mean-square acceleration (A_{ws}), total vibration dose value (VDV), and seat-to-head transmissibility (STHT) were calculated for triaxial accelerations. Changes in physical discomfort were assessed with paired t-tests, and changes in blood protein concentrations and vibration measures were assessed using mixed ANOVAs.

RESULTS

Physical discomfort increased by 111% from baseline to 8 hours of exposure ($H(2) = 4.201$, $p = 0.04$). Fatigue was the only RPQ measure that differed between exposure groups ($t(15) = 2.13$, $p = 0.049$). Glial fibrillary acidic protein and S100B concentrations were similar between the short- and long-term exposure groups ($F_{2,59} = 0.237$, $p = 0.79$; $F_{2,62} = 0.028$, $p = 0.972$). Total VDV and A_{ws} were similar between the beginning and end of exposure ($F_{1,19} = 1.301$, $p = 0.268$; $F_{1,19} = 2.644$, $p = 0.120$), as well as between short- and long-term exposure groups ($F_{1,19} = 0.041$, $p = 0.843$; $F_{1,19} = 0.341$, $p = 0.566$). The average resultant STHT was similar across time ($F_{2,57} = 0.16$, $p = 0.852$).

CONCLUSIONS

Individual bouts of WBV exposure likely do not cause neurological injury based on the biomarker response. However, repetitive bouts of WBV exposure could lead to neurophysiological adaptations (Yan et al., 2015). Reported increases in WBV-related fatigue and discomfort support prior findings that indicate WBV exposure affects driver attention, potentially increasing the risk of traffic accidents (Azizan et al., 2018).

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TABLES AND FIGURES:

Table 1. Whole-Body Vibration Exposure Measures

	Average Resultant Head Acceleration	Maximum Resultant Head Acceleration	Weighted R.M.S acceleration (A_{ws})	Total Vibration Dose Value (VDV)	Seat-to-Head Transmissibility (STHT)
Beginning	9.809 m/s^2	14.665 m/s^2	1.509 m/s^2	8.396 $m/s^{1.75}$	2.03
End	9.862 m/s^2	14.679 m/s^2	1.573 m/s^2	8.729 $m/s^{1.75}$	
1-hour	9.827 m/s^2	14.576 m/s^2	1.558 m/s^2	8.531 $m/s^{1.75}$	2.41
8-hour	9.844 m/s^2	14.768 m/s^2	1.525 m/s^2	8.593 $m/s^{1.75}$	2.50

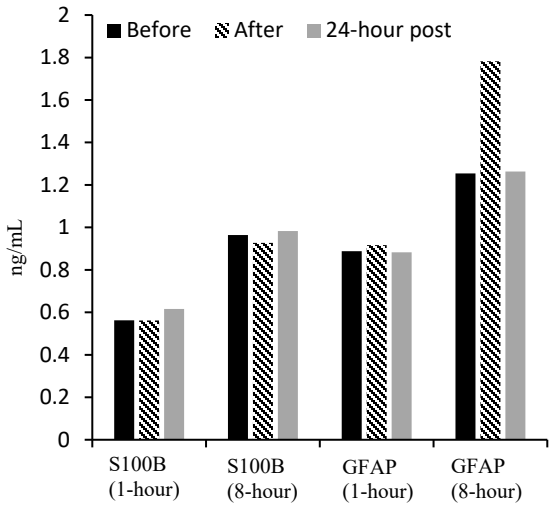

Figure 1. Biomarker concentrations for short-term and long-term exposure groups

TITLE: Efficacy and Feasibility of a Breath Sensor for Detecting Driver Fatigue and Drowsiness

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OBJECTIVES

Drowsiness has been shown to impair reaction times, decision-making abilities, and awareness of hazards critical to driving in a manner similar to the effects of driving under the influence of alcohol.[1] Drowsy driving has been estimated to cause thousands of fatal crashes per year and has resulted in billions of dollars in lost revenue.[2] However, while breathalyzers and ignition interlock devices can be used to mitigate the risk of drunk driving, no such devices are commercially available for roadside or behind-the-wheel diagnostics for drowsiness. To address this gap, the objective of this study was to demonstrate the efficacy and feasibility of a breath sensor to detect fatigue and drowsiness in a simulated driving environment.

DATA AND METHODS

Solid state breath sensors calibrated to previously identified breath biomarkers of fatigue and drowsiness were arrayed to determine changes in the breath profiles of subjects undergoing a full-motion driving simulation designed to elicit driver fatigue. A multi-sensor approach was used rather than relying on a single biomarker. The biomarker profile targeted compounds such as benzene derivatives (e.g., benzene, benzaldehyde, toluene, phenol), 2-butanone, and 2-ethyl-1-hexanol, among others. To address potential confounders such as eating/drinking, cigarette smoke, alcohol, and medical conditions like COPD or diabetes, the study was conducted under controlled conditions: participants refrained from eating for a couple of hours before the experiment, were non-smokers, had not consumed alcohol for the past day, and had no known medical conditions. The breath biomarker profiles were then correlated with established drowsiness metrics, specifically the PERCLOS (Percentage of Eye Closure) and the Karolinska Sleepiness Scale (KSS).

RESULTS

The breath sensor array collected breath biomarker profiles for 61 subjects. The biomarker profiles demonstrated a trend consistent with increasing PERCLOS and KSS responses (see figure). During the 60-minute driving simulation designed to elicit driver fatigue, the PERCLOS showed a steady increase in response over time, while the KSS did not show an increase in perceived sleepiness until the 60 minute mark. Similarly, the breath biomarker sensor response showed a significant increase at the 60-minute timepoint, consistent with increases in both the PERCLOS and the KSS, demonstrating evidence of increased driver fatigue and drowsiness (see Figures 1 and 2).

CONCLUSIONS

These findings suggest that integrating drowsiness breath sensor arrays into vehicle systems could significantly enhance drowsiness detection, thereby reducing crashes, injuries, and fatalities. Moreover, the scalability and non-invasiveness of the proposed system lays the groundwork for broader applications, extending beyond vehicles to fields such as aviation and healthcare.

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TABLES AND FIGURES:

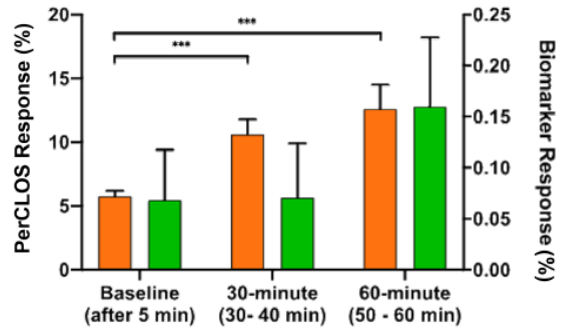

Figure 1: Responses of the PERCLOS (orange) and Breath Sensor (green) at baseline, 30 minutes, and 60 minutes during the driving simulation designed to elicit driver fatigue.

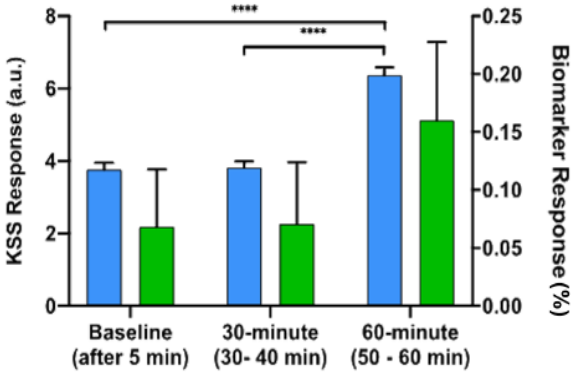

Figure 2: Responses of the KSS (blue) and Breath Sensor (green) at baseline, 30 minutes, and 60 minutes during the driving simulation designed to elicit driver fatigue.