AAAM 67th Annual Conference Poster Abstracts

TITLE: Visual Function and Driving Performance of Drivers Aged 65 or Older in Three Lighting Conditions

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OBJECTIVES

Drivers aged 65 or older are at high risk for fatal nighttime crashes.[1] Age-related vision change is a significant contributing factor to greater risk of fatal crashes at night than during the day.[2,3] However, how age-related changes in visual function are modified by lighting condition and subsequently impact driving performance remains unclear. This pilot study examined the effects of visual function on driving performance (assessed by a high-fidelity driving simulator) during daytime vs. nighttime with and without glare among drivers aged 65 or older.

DATA AND METHOD

Active drivers ages 65 or older with a valid driver's license, driving at least once per week and not using any visual aids for driving were enrolled. Each participant completed a battery of visual tasks with their habitual correction for daily driving. Three basic visual functions, visual acuity (VA), contrast sensitivity function (CSF) and visual field map (VFM), were measured under photopic and mesopic conditions using the qVA, qCSF and qVFM procedures. VA and CSF were also obtained in the presence of glare in the mesopic condition. In addition, each participant completed a 30-minute driving performance assessment on a high-fidelity driving simulator under the three experimental conditions: photopic, mesopic and mesopic with glare condition. Their standard deviation of lateral position (SDLP) and reaction times in detecting targets on the roadside were measured. Linear mixed effects models were used to assess the effects of visual function on driving performance across the three lighting conditions.

RESULTS

Twenty drivers participated, with 55% being male, an average age of 70.3 years, 79% having a bachelor's degree or higher, and 64% having household income of $75,000 or higher. Visual acuity had a significant positive effect on SDLP ($\beta = 0.01$, $p< 0.01$) and reaction time ($\beta = 0.09$, $p< 0.01$). The area under log CSF (AULCSF) had a significant negative effect on SDLP ($\beta = -0.01$, $p< 0.01$) and reaction times ($\beta = -0.08$, $p< 0.01$), and the volume under the surface of the VFM (VUSVFM) had a significant positive effect on SDLP ($\beta = 0.01$, $p=0.02$) but negative effect on reaction times ($\beta = -0.01$, $p< 0.01$). Analyses of the relationships between visual function and driving performance in each lighting condition showed that visual acuity positively affected SDLP ($\beta = 0.041$, $p< 0.05$) in the photopic condition, AULCSF negatively affected SDLP ($\beta = -0.056$, $p< 0.05$) in the mesopic with glare condition, and VUSVFM negatively affected reaction time ($\beta = -0,562$, $p< 0.05$) in the mesopic without glare condition. No other significant associations were observed between visual function and driving performance.

CONCLUSIONS

This pilot study provides preliminary data on how visual function may differentially affect driving performance in different lighting conditions among older drivers. The findings suggest that age-related changes in visual function may have stronger impacts on driving during nighttime, especially in the presence of glare. Additional research with larger sample sizes is needed to confirm these results. Our findings may inform the development of guidelines on visual function standards for safe driving among older drivers.

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TITLE: Perceived Cognitive Load in Young Drivers Acutely Post Mild Traumatic Brain Injury

OBJECTIVES

The overall objective of this work was to examine the impact of mild traumatic brain injury (mTBI) on driving in teens and young adults. Due to both continued brain development and less driving experience, young drivers may be particularly at risk for driving safety decrements following mTBI. Additionally, these driving impairments may be particularly influenced under driving situations imposing higher cognitive loads. The work aimed to compare perceived cognitive load in a simulated driving scenario between young drivers acutely post mTBI and healthy matched controls.

DATA AND METHOD

Twelve licensed drivers between the ages of 16 and 24 years who experienced a mTBI and confirmed by a physician completed 4 driving scenarios in a high-fidelity driving scenario within 96 hours of injury. Twelve age- and gender-matched controls were recruited and completed the same driving scenarios. Each scenario contained a cognitive load condition (Load vs. No Load) and critical event condition (Event vs. No Event) in a 2x2 design. The Load condition presented a visual go/no-go task requiring drivers to press a specified button when target stimuli were briefly presented in the scenario's driving environment while an auditory task presented alternating math problems with short-term memory recall problems. Event conditions included driving-relevant critical events that required participants to react (e.g., brake) to avoid colliding with an object in the driving environment (e.g., car, tipped over trash can). Scenarios were presented in the same order for matched cases and controls. Immediately after each scenario, participants completed the NASA Task Load Index (TLX) reporting their perceived cognitive load during the driving scenario. The NASA TLX was a summed rating of six items: Mental, physical, and temporal demands, perceived performance, effort, and frustration each on a 0-100 scale. General estimating equations (GEE) assessed differences in NASA TLX between the 12 case-control pairs.

RESULTS

There were significant differences between cases and control in total NASA TLX in the No Load/No Event scenario, such that cases indicated significantly greater perceived cognitive load (b = 100.5, $p = .002$). Cases also indicated significantly greater total NASA TLX in the Load/Event scenario (b = 78.53, $p = .033$). Examining mental demands specifically indicated cases rated significantly greater perceived mental demands in the No Load/No Event scenario (b = 19.58, $p = .007$). There was marginal evidence suggesting cases had significantly greater mental demands in the No Load/Event scenario (b = 22.80, $p = .053$).

CONCLUSIONS

These findings suggest young drivers acutely post-mTBI report increased perceived cognitive load. Compared to controls, these increases are indicated at both the least demanding simulated driving scenario (No Load/No Event) and most demanding (Load/Event). This work supports validity of the driving scenarios designed to impose demand on drivers with mTBI using Load and Event condition paradigms. Future work should examine if these perceived increased cognitive demands while driving translate to simulated driving decrements, such as poorer lateral or longitudinal vehicle control.

TITLE: Characteristics of young drivers who failed to complete a simulated driving assessment acutely after traumatic brain injury.

OBJECTIVES

Resuming driving after a mild traumatic brain injury (mTBI) is often an immediate goal for returning to daily activities (Preece et al., 2013). A mTBI can lead to significant cognitive and functional impairments that can impact driving ability (Baker et al., 2015; Preece et al., 2010). When teen and young adult drivers can resume driving is of particular concern because they have the highest rate of mTBI and the highest crash rate of all age groups (Centers for Disease Control and Prevention, 2015; McKinlay et al., 2008). However, evidence-based guidance is lacking on when it is safe to return to driving after a mTBI. The overall objective of this work-in-progress was to compare demographic and injury characteristics between teen and young adult drivers with mTBI who completed (i.e., completers) and who failed to complete (i.e., non-completers) a driving assessment acutely within 96 hours of injury due to physical and/or mental discomfort/distress.

DATA AND METHODS

Injured young drivers, ages 16 to 24 years, with physician-confirmed mTBI were enrolled at two study sites (The University of Alabama at Birmingham and The Ohio State University) to complete an assessment in a high-fidelity driving simulator within 96 hours of injury. Participants who completed the prescribed 30-minute, 4-scenario, simulated drives were defined as completers. Participants who failed to complete the driving assessment, including those who stopped the assessment halfway or requested additional break(s) between scenarios, were defined as non-completers. Participants' demographics (e.g., sex, age, race, athlete status) and injury (e.g., symptom scores at injury and enrollment, as measured by the Post-Concussion Symptom Scale or PCSS) characteristics were described and compared between completers and non-completers.

RESULTS

Of the 29 mTBI young drivers included, 6 (20.7%) were non-completers, with 4 stopping halfway and 2 requesting additional break(s). A total of 13 (44.8%) female participants were included. Of these, 5 (38.5%) females were non-completers. The average ages were 20.2 years and 19.4 years for non-completers and completers, respectively. For non-completers, the PCSS scores were 48.7 and 38.7 at time of injury and enrollment, respectively, which was higher than the completers (36.0 at injury and 23.7 at enrollment). The average time from injury to this initial assessment was 3.3 days and 4.1 days for non-completers and completers, respectively.

CONCLUSIONS

This study is the first to assess simulated driving performance among young drivers with mTBI acutely within 96 hours post-injury. The findings indicated that not all participating drivers were able to complete the driving assessment acutely within 96 hours of injury. A higher PCSS score is a potential contributing factor in the failure to complete the simulated assessment. Additional work assessing driving performance over time during the recovery from mTBI is warranted to inform clinical practice and guidelines on when it is safe for young drivers to return to driving after mTBI.

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TITLE: Comparison of characteristics of road traffic injuries by types of road users among children and adolescents in South Korea, 2011-2021

OBJECTIVES

Road traffic injuries (RTIs) are the leading cause of mortality among children and adolescents. According to the World Health Organization (WHO), RTIs are the leading cause of death and disability among individuals aged 5 to 29. Every day, over 500 children under the age of 18 die in road accidents worldwide, and thousands suffer injuries This study aimed to compare the clinical characteristics and identify the factors associated with severe RTIs by type of road user among children and adolescents with RTIs.

DATA AND METHODS

This cross-sectional study utilized data from the Emergency Department-based Injury In-depth Surveillance registry (EDIIS) in South Korea from January 2011 to December 2021. EDIIS plays a vital role in gathering comprehensive patient information throughout their emergency department visit. This encompasses various details, such as demographic information, injury-related data, diagnostic evaluations, medical treatments, and clinical outcomes. The information is sourced from both electronic medical records and emergency medical service records. The study population included 78,021 participants below 19 years of age who sought treatment in emergency departments due to RTIs. Participants were categorized into four groups: passengers (n=20,140), pedestrians (n=19,302), motorcyclists (n=9,199), and bicyclists (n=29,380). Demographic and injury-related data were analyzed, and a multivariate logistic regression model was employed to determine factors associated with severe RTIs, defined as Excess Mortality Ratio-based Injury Severity Score ≥16. Prevalence rates of traumatic brain injuries (TBI), hospitalizations, ICU admissions, and severe RTIs were compared among road user types.

RESULTS

Among a total of 78,021 patients, bicyclists accounted for the highest proportion of patients with RTI at 37.7% (n=29,380), followed by passengers at 25.8% (n=20,140), pedestrians at 24.7% (n=19,302), and motorcyclists at 11.8% (n=9,199). Among all road users (48.7%), head injuries were the most prevalent, except for pedestrians, who suffered the greatest number of lower extremity injuries (45.0%). The motorcyclist group exhibited the highest proportions of TBI (8.3%), total admissions (28.8%), ICU admissions (8.2%), severe RTIs (41.0%), and mortality (2.0%). Safety devices were found to be protective against severe RTIs in passengers and motorcyclists, with adjusted odds ratios (OR) of 0.83 (95% Confidence Interval: 0.76–0.90) and 0.75 (95% CI: 0.68–0.83), respectively (Table 1). In the outcome analyses, pedestrians and motorcyclists had higher ORs than passengers.

CONCLUSIONS

The findings of this study demonstrate that the clinical characteristics and factors associated with severe RTIs vary among different types of road users in children and adolescents. Motorcyclists were found to be particularly vulnerable, experiencing the highest rates of severe RTIs and mortality. Interventions to reduce RTIs in this population should be tailored to the specific needs of each road user group. Safety devices showed promise in mitigating severe RTIs among passengers and motorcyclists. These results highlight the importance of targeted interventions to address the unique risks faced by each group.

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TABLES AND FIGURES:

Table 1. Comparison of injured body parts and clinical outcomes by road traffic injury among children and adolescents by road users (2011–2021)

Variable*	Total (N = 78,021)	Passenger (N = 20,140)	Pedestrian (N = 19,302)	Motorcyclist (N = 9,199)	Bicyclist (N = 29,380)
	n (%)	n (%)	n (%)	n (%)	n (%)
Head	38,617 (48.7)	11,139 (55.3)*	7,726 (40.0)	4,296 (46.7)*	14,707 (50.1)*
TBI	2,441 (3.1)	380 (1.9)	765 (4.0)*	759 (8.3)*	504 (1.7)
Neck	4,561 (5.8)	2,975 (14.8)*	526 (2.7)	499 (5.4)*	535 (1.8)
Chest	3,602 (4.5)	1,226 (6.1)	941 (4.9)	684 (7.4)*	726 (2.5)
Abdomen	6,729 (8.5)	1,916 (9.5)	1,899 (9.8)	1,030 (11.2)*	1819 (6.2)
Upper extremity	15,911 (20.1)	1,801 (8.9)	3,062 (15.9)	2,356 (25.6)*	8,351 (28.4)*
Lower extremity	21,534 (27.2)	2,204 (10.9)	8,680 (45.0)*	3,790 (41.2)*	6,625 (22.6)*
EMR-ISS (≥16)	16,704 (21.1)	2,622 (13.0)	4,375 (22.7)*	3,773 (41.0)*	5,652 (19.2)*
ED disposition					
Discharge	66,492 (83.9)	18,200 (90.4)	15,001 (77.7)	5,885 (64.0)	26,310 (89.6)
Transfer to other hospital	1,943 (2.5)	394 (2.0)	622 (3.2)	578 (6.3)	334 (1.1)
Admission, total	10,562 (13.3)	1,484 (7.4)	3,574 (18.5)	2,649 (28.8)	2,717 (9.3)
Death	275 (0.4)	62 (0.3)	105 (0.5)	87 (1.0)	19 (0.1)
ICU	2,217 (2.8)	335 (1.7)	742 (3.8)*	750 (8.2)*	367 (1.3)
Operation	4,147 (5.2)	535 (2.7)	1,179 (6.1)	1,160 (12.6)*	1,194 (4.1)
Death within 30 days	480 (0.6)	101 (0.5)	170 (0.9)	178 (2.0)	26 (0.1)

ED: emergency department; LOS: length of stay; EMR-ISS: excess mortality ratio-adjusted injury severity score; ICU: intensive care unit

*Variables among age groups were compared using the Pearson $\chi 2$ test, except ED LOS**.

** Values presented are the median (interquartile range) and were analyzed using analysis of variance.

The p-values of all variables (head, neck, chest, abdomen, upper extremity, lower extremity, ED LOS, EMR-ISS, ED disposition, ICU admission, operation, and death within 30 days) were less than 0.01.

Table 2. Results from the logistic regression analysis of road user-stratified severe outcomes of road traffic injury (Excess Mortality Ratio-based Injury Severity Score ≥16)

	Passenger (N = 20,140)		Pedestrian (N = 19,302)		Motorcyclist (N = 9,199)		Bicyclist (N = 29,380)	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Age								
0-6	Reference		Reference		Reference		Reference	
7-12	1.55*	1.39-1.74	0.88*	0.81-0.96	1.10	0.58-2.07	0.96	0.88-1.05
13-18	2.11*	1.90-2.34	0.83*	0.76-0.92	1.26	0.79-2.02	0.95	0.87-1.05
Time of injury								
00-06	1.70*	1.47-1.96	1.45*	1.19-1.78	1.48*	1.33-1.65	1.03	0.87-1.21
06-12	0.88*	0.77-0.99	1.08	0.97-1.21	1.28*	1.08-1.51	1.05	0.95-1.16
12-18	0.97	0.87-1.08	0.93	0.86-1.01	0.94	0.84-1.06	0.96	0.89-1.02
18-00	Reference		Reference		Reference		Reference	
Road type								
Expressway	Reference		Reference		Reference		Reference	
National Highway	0.89	0.78-1.03	0.87	0.67-1.12	0.94	0.74-1.21	1.20	0.90-1.60
Alleyway	0.74	0.47-1.17	0.61*	0.47-0.80	0.64*	0.44-0.93	0.96	0.72-1.29
Other/Unknown	0.83*	0.71-0.96	0.63*	0.49-0.82	0.73*	0.56-0.94	0.87	0.66-1.16
Safety Device								
Yes	0.83*	0.76-0.90			0.75*	0.68-0.83	1.01	0.89-1.14
EMS Use								
Yes	4.18*	3.82-4.57	5.34*	4.95-5.76	3.97*	3.54-4.45	2.80*	2.63-2.98

Abbreviations: OR=odds ratio; CI=confidence interval; EMS=emergency medical services

* Adjusted for sex, age, time of injury, season, activity, road type, safety device, EMS use.

TITLE: Hospital Length of Stay Prediction for Children Involved in Road Traffic Crashes

OBJECTIVES

Road traffic accidents (RTA) are the main cause of mortality, morbidity, and disability for children globally [1]. These accidents mostly result to hospital admissions with the attendant medical and cost implications [2]. Several studies have attempted to predict hospital length of stay (LOS) for various patient groups [3]. However, to the best of our knowledge, no study exists in the literature focused on LOS prediction for children involved in RTA. The aim of this study is to predict the LOS for children admitted to hospital due to RTA by means of machine learning (ML) algorithms as well as to identify the most important factors associated with LOS for children involved in RTA based on the SHapley Additive exPlanations (SHAP) algorithm.

DATA AND METHODS

The dataset used for this study consists of 297 records of children involved in RTA admitted to Al Ain hospital in the United Arab Emirates (UAE) containing 29 features including text data. Six ML classifiers were used to assess the performance of the LOS prediction model. Additionally, the SHAP feature attribution method was used to identify the most important variables associated with LOS for children involved in RTA. Finally, individual case studies were performed based on the Local Interpretable Model-agnostic Explanations (LIME) and SHAP. The experiments were performed with and without the detailed unstructured injury text data.

RESULTS

The results of the experiments indicates that five out of the six ML models achieved comparable prediction performance (Area Under Curve (AUC) values between 0.791-0.747) while the SVM model had a very poor performance (AUC = 0.445) in the experiments without injury text data. The experiments with injury text data resulted in slight improvements on the performance of some ML models (between 2% to 6.8%) whereas some of the models recorded a slight decrease in prediction performance (between 1.1% to 2.2%). The New Injury Severity Score (NISS), pulse rate, crash time, week of crash, and child weight were identified as the main predictors of LOS in both the experiments with and without the injury text data. Injury type, body temperature, Unassisted Respiratory Rate (URR), Revised Trauma Score (RTS), and hospital admission unit (AU) were identified as the most significant factors affecting LOS in the experiment without injury text data while scalp injuries, injuries resulting in hematoma, facial injuries, contusion injuries, and laceration injuries were identified as the most important contributors to hospital LOS for children involved in RTA in the experiment with injury text data.

CONCLUSIONS

This study presents a model for hospital LOS prediction for children involved in RTA. The model presented in this study can be easily adopted in clinical settings for LOS prediction for children admitted to hospitals due to RTA. The analysis of the factors affecting LOS can help hospitals and clinicians in the general and individual assessment of LOS for children involved in RTA thereby providing optimum care and reducing the costs associated with prolonged hospital stay.

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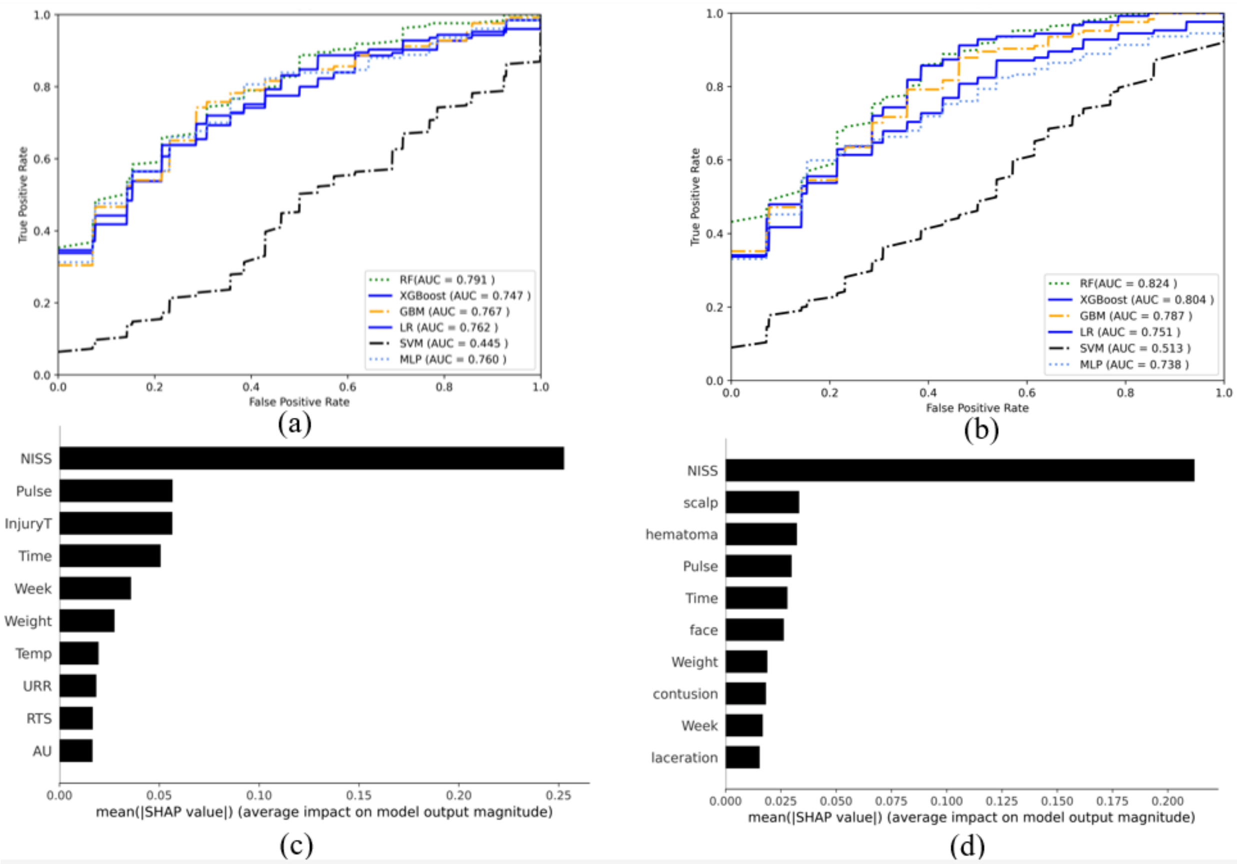

Figure 1: Experimental Results for Hospital LOS Prediction (a) Comparison of Area under the Receiver Operating Characteristic (AUC - ROC) for Multiple ML Models without Text Data (b) Comparison of AUC - ROC for Multiple ML Models with Text Data (c) SHAP Feature Importance Plot without Text Data (d) SHAP Feature Importance Plot with Text Data

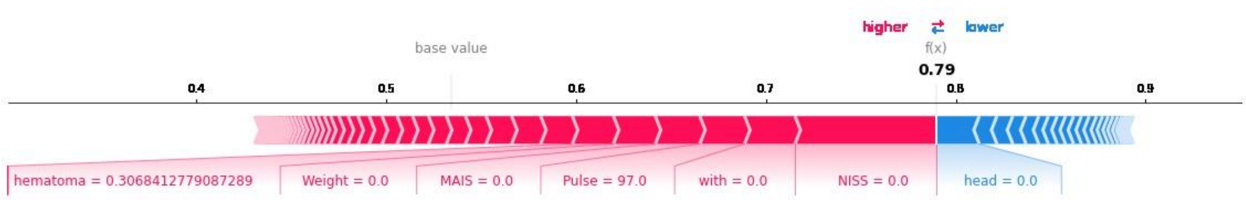

Figure 2: Individual Hospital LOS Prediction for a Child RTA Victim; variables in red color results in prolonged hospital LOS while variables in blue color results in decreased hospital LOS.

TITLE: An Anthropometric Evaluation of Child Occupant Safety Policy in the United Arab Emirates

OBJECTIVES

The United Arab Emirates (UAE) has one of the highest child occupant traffic mortalities and morbidities worldwide [1]. Vehicle safety legislations mandate the use of restraint systems to provide protection for children in vehicles. These legislations are based on the body dimensions of the target child occupants [2]. The World Health Organization (WHO) best practice requirement for child occupant safety recommends the use of child safety seats up to the age of 10 years or height of 135 cm [3]. On the other hand, the child occupant safety law in the UAE requires the use of child restraint systems only for children aged ≤4 years and prohibits children of <10 years or with a height of <145 cm from riding in the front seat of vehicles [4]. This is inconsistent with the WHO best practice recommendation for child occupant protection in vehicles because there is a coverage gap in the law for children aged 5–9 years.

DATA AND METHODS

This study proposes some recommendations that can be used to improve the current child occupant safety legislation to be reflective of UAE child passenger anthropometry. A representative anthropometric study involving 713 UAE children aged 0-12 years old was conducted for proposing child passenger safety legislation that is in tune with the reality of child passenger anthropometry in the country.

RESULTS

The following changes are proposed to be considered for implementation to the child occupant legislation in the UAE based on the data obtained: Children in the UAE should be restrained in rear-facing child restraint systems from birth and should only transition to forward-facing child safety seats after the age of 2 years, at which point they would have completely outgrown the weight limits of rear-facing child restraint systems (13 kg). Additionally, children in the UAE should not travel unrestrained or transition to seatbelts at the age of 4 years; rather, they should be restrained in forward-facing child safety seats until they completely outgrow those seats, which would be after the age of 5 years (18 kg). Furthermore, children in the UAE should be restrained in booster seats from the age of 6 years and should only transition to seatbelt/ride in front seats of vehicles when they completely outgrow the weight limits of booster seats (36 kg) and satisfy the minimum thresholds for weight of 37 kg, height of 148 cm, and seated height of 74 cm for seatbelt fit at the age of >11 years. These proposals are based on the relevant anthropometry of UAE children (weight, height, seated height, and shoulder breadth) as well as the best practice recommendations for protecting children in vehicles.

CONCLUSIONS

The proposed changes to the child occupant policy aims to reduce child occupant injuries and fatalities by ensuring that children in the country are using the most appropriate form of safety restraint. This will help in ensuring the optimal protection of child passengers in vehicles, thereby reducing the severity of crash injuries sustained by them and significantly enhancing their survivability from those crashes.

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TABLES AND FIGURES:

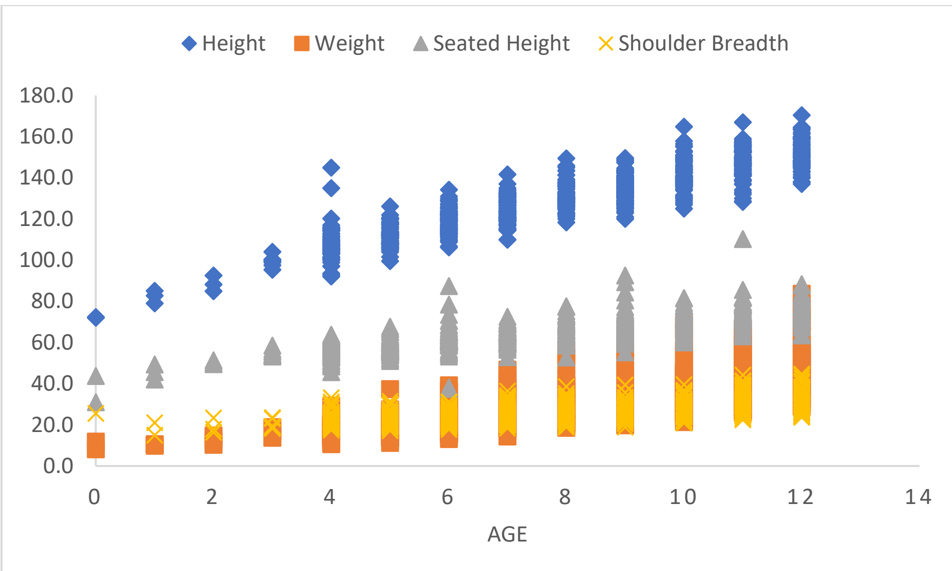
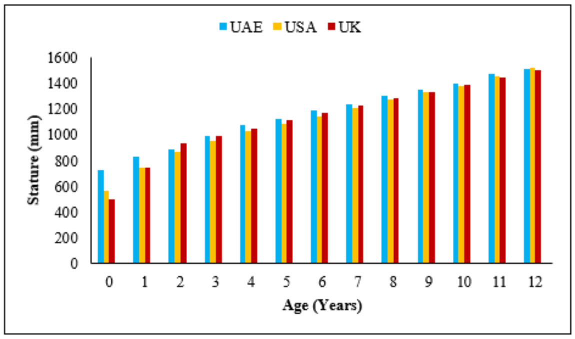
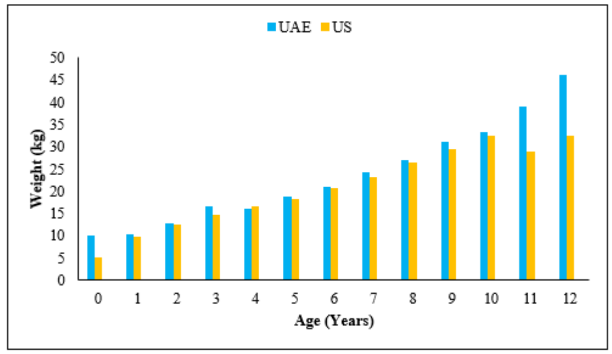


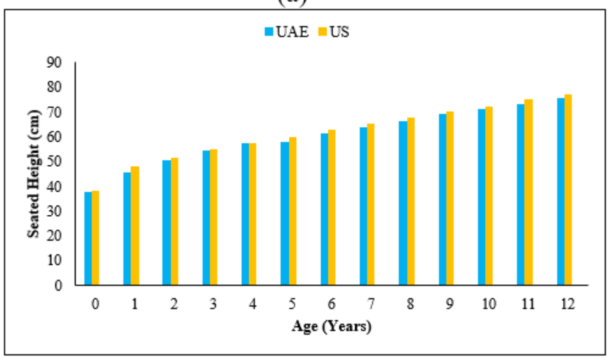
Figure 1: Distribution of Anthropometric Data for UAE Children



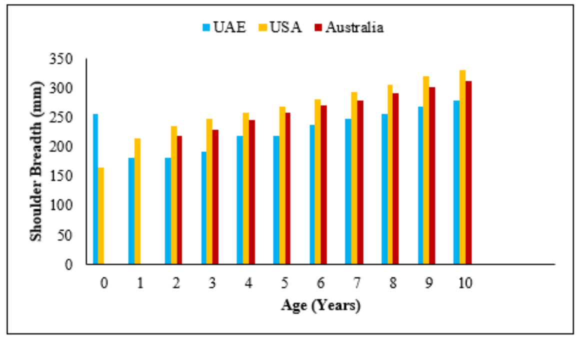
(a)



(b)



(c)



(d)

Figure 2: Anthropometric Data Comparison Between UAE and Other Countries (a) Stature (b) Weight (c) Seated Height (d) Shoulder Breadth
USA data obtained from [5], UK data culled from [6], and Australian data obtained from [7].

TITLE: Design and usability evaluation of Risk-ATTEND - an updated version of a computer-based risk anticipation training program

OBJECTIVES

Teen driver crash risk is highest at the start of independent driving (Foss et al, 2011). This is due in part to the lack of risk anticipation skills, or the ability to identify scenes or events which precede crash hazards. According to prior research, teens who learn these skills can improve their safety. While training programs such as Risk Awareness and Perception Training - RAPT (Pradhan et al, 2006) have been developed, there has been no recent update to the content/platform for the training. The goal of this study was to create a new training program and evaluate its usability. This evaluation included a heuristic evaluation based on Nielsen's Heuristics (Nielsen & Molich, 1990). Following the training program, we assessed participants' NASA Task Load Index (NASA-TLX) and System Usability Scale (SUS) scores (Brooke, 1996; Hart, 2006).

DATA AND METHODS

The Risk-ATTEND (Risk Anticipation Training to Enhance Novice Driving) program was created to provide risk anticipation training by using various crash and hazard types in a variety of driving environments as exemplar scenarios. The Axure application (Axure Software Solutions, 2020) was used to create a prototype of a final training program. Scenarios created in a Unity environment were captured by creating panoramic snapshots from the driver's perspective; each scenario could be represented by 4-5 images. Each image was shown for 5 seconds before automatically switching to the next one. The program included one practice and thirteen training scenarios. Users were instructed to click (tap) on areas of the image that were relevant to any risk; with a maximum of ten clicks on each image. A set of scoring rules were developed to evaluate the accuracy of risk identification in each scenario. Scenarios were bookended by an introduction and instruction screen at the start, followed by a feedback and solution screen at the end. The user testing evaluation included two rounds, the first with 28 participants and the second with 25 participants. Participants completed the training program, heuristic evaluation followed by surveys SUS and NASA-TLX.

RESULTS

A heuristic evaluation of the training in the first round of evaluation identified some of the recurring issues and ranked them individually by severity based on frequency, impact, and persistence of the problem as shown in Table 1. The first evaluation of testing yielded a SUS of 5.65. (SD 2.61) and the average NASA-TLX score was 4.22. The recorded average SUS was considered low, indicating a lack of program clarity and intuitiveness. After the recommendations were implemented, the second evaluation resulted in a 3.4% increase in the SUS and a 5.68% decrease in the NASA-TLX scores.

CONCLUSIONS

The user feedback informed the designers of changes to the overall interface of the training program. The changes made to the program in response to the initial evaluation feedback improved usability while decreasing workload. This training will be used for simulator evaluation in future research. Further evaluation of the program, including summative assessment of the study could assess if the training programs can help teens improve their risk-anticipation skills.

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TABLES AND FIGURES:

Table 1. Severity Ratings

Average ratings	Problems
4	Instructions are inconsistent and unclear
2	Color scheme is inconsistent
2	Font (size, style, and color)
2.75	Review page is redundant and unnecessary
3.25	Context for each scenario is scarce - In terms of what is happening
4	User feedback is unclear
3	Point of view of scenarios need improvement/clarification
2.5	Lacking user freedom and flexibility
4	Lack of information slides (cognitive overload)

Figure 1: Practice Scenario Image

OBJECTIVE

Traffic accidents provoke around 1.24 million deaths per year (World Health Organization; WHO, 2013). Cognitive processes (e.g., Working Memory overload or Attention) have been extendedly pointed as essential factors in determining those accidents (e.g., Young & Stanton, 2002). In this sense, different cognitive processes are interrelated (such as motor processes; see Vilchez, 2013, for a review) and they deserve an in-depth analysis for the improvement of traffic safety. For all of this, theoretical cognitive models have been proposed (e.g., Vilchez, 2013) that explain the relationship between the meaning of attentional cues had in a specific context and the effects produced in subjects` path movement (such as driving) found in the literature (e.g., Vilchez, 2022a, 2022b, 2021, 2020a, 2020b, 2019a, 2019b, 2019c, 2019d, 2018a, 2018b, 2017a, 2017b, 2015; Vilchez & Tornay, 2012). Given the consequences of the mental representation of traffic signs, the present study aims to compare the Response Times (RTs) to Warning signs (cf. Vilchez, 2019c) and Informative signs in that mental representation with participants from Ecuador.

METHODS

Participants. 293 participants` RTs to traffic signs were analyzed (cf. 2019c).

Tasks. By using OpenSesame (Mathôt, Schreij, & Theeuwes, 2012), the Representativity and Univocity of Ecuadorian Regulatory and Informative traffic signs were assessed. In a computer screen, definitions of signs were presented after a fixation cross, this presentation remained on screen until response (see Vilchez, 2022a, 2019d, 2018b, 2017b; for a description of the methodology in detail). The definitions matched or not with the actual sign presented afterward. Participants decided if the definition corresponded or not to the sign. The representativeness of signs was defined as the degree to which traffic signs reflected features of their parent population (Kahneman & Tversky, 1972). On the other hand, according to Temmerman (1997), univocity was defined as the absence of polysemy (more than one meaning). In this sense: (a) if the sign really represented its meaning (representative sign), before the right matched definition-sign, RTs were shorter than when the sign did not represent that meaning; (b) if the sign was not ambiguous (univocal sign), before the wrong matched definition-sign, RTs were shorter than when the sign was ambiguous.

DATA SOURCES

Stimuli. Informative and Warning traffic signs from Ecuador (see the Ecuadorian Institute of Normalization [INEN], 2011) were evaluated in their mental representation.

RESULTS

A Student`s *t* analysis showed that the differences between Informative signs (M = 1635.25 ms; SD = 520.93) and Warning signs (M = 1464.04 ms; SD = 491.13), $t(292) = 8.92$, $p < .001$, were significant for the Representativity of those kinds of sign (see Figure 1). Likewise, the differences between Informative signs (M = 1326.47 ms; SD = 371.01) and Warning signs (M =

1190.68 ms; *SD* = 331.89), *t*(292) = 12.67, *p* < .001, were also significant for the Univocity of those kinds of sign (see Figure 2).

SIGNIFICANCE OF RESULTS

In previous works, Warning signs showed themselves as faster than Regulatory signs in both their Representativity and Univocity (Vilchez, 2022b). Likewise, Informative signs showed themselves as faster than Regulatory signs (Vilchez, 2021). These studies show that traffic signs are differently represented, based on their meaning. The present works shows that the last comparison to be made confirms that Warning signs are the best understood since they also show themselves as faster than Informative signs both representing their meaning and discarding other possible meanings.

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FIGURES

Figure 1. Comparison of participants` Response Times (RTs) in the Representativity of traffic signs.

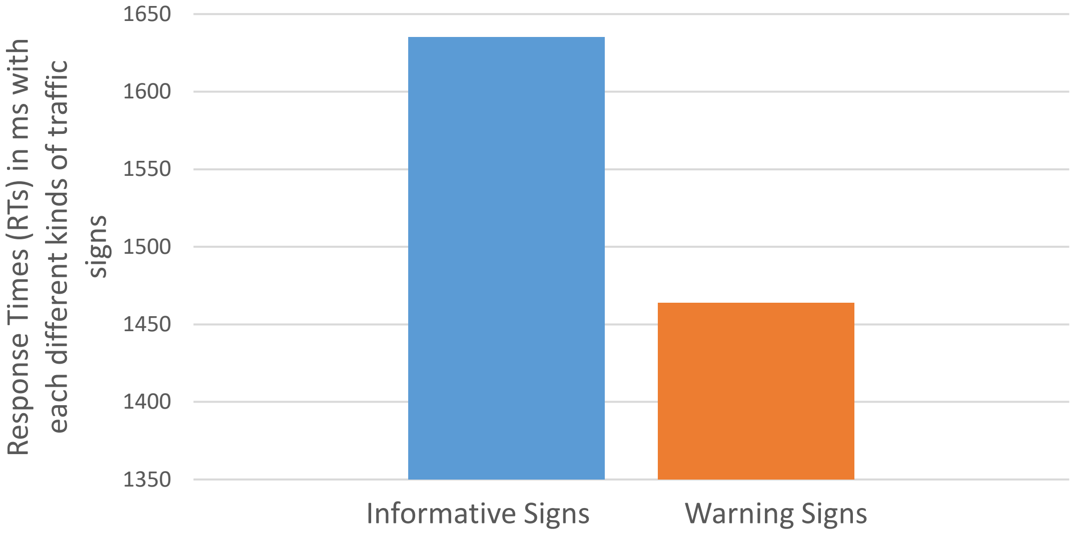

Figure 2. Comparison of participants` Response Times (RTs) in the Univocity of traffic signs.