**Niaz Mahmud Zafri, Tanzila Tabassum, Md. Rakibul Hasan Himal, Rashada Sultana, Anindya Kishore Debnath.** *Effect of pedestrian characteristics and their road crossing behaviors on driver yielding behavior at controlled intersections*. Pages 1-8.

**Introduction:** Globally, pedestrians are one of the most vulnerable road-user groups. Their vulnerability increases while crossing the road at controlled intersections during the "don't walk" phase. Previous literature shows that driver yielding behavior has an association with pedestrian safety at intersections. Though several studies have explored driver yielding behavior towards pedestrians at conflict points, evidence on how pedestrian actions influence driver yielding behavior at intersections is yet to be investigated. **Method:** To pursue this end, a binary logistic regression model was developed using the collected data to explore the effect of non-compliant pedestrian characteristics and their road crossing behavior on driver yielding behavior towards pedestrians at six controlled intersections of Dhaka, Bangladesh. The data were collected through videography survey. **Results:** Results showed that drivers were more likely to yield to pedestrians who were female, crossing in a group, carrying baggage, not using a mobile, making some hand gesture to the driver, or crossing by rolling gap strategy. **Practical Applications:** These findings add new insights for transportation planners into the complex interaction between vehicles and pedestrians at busy controlled intersections, and thus would help to make a pedestrian friendly street.

- ▪ **Keywords:** Pedestrian safety; Driver yielding behavior; Pedestrian road crossing behavior; Binary logistic regression model; Non-compliance behavior

**Anik Das, Mohamed M. Ahmed.** *Adjustment of key lane change parameters to develop microsimulation models for representative assessment of safety and operational impacts of adverse weather using SHRP2 naturalistic driving data*. Pages 9-20.

**Introduction:** Adverse weather has a considerable negative impact on safety and mobility of transportation networks. Microsimulation models are one of the potential tools that could be used to evaluate the safety and operational impacts of adverse weather. The development of a realistic microsimulation model requires the adjustment of driving behavior parameters with disaggregate trajectory-level data. This study presented a

novel approach to update and adjust lane change model parameters for the development of realistic microsimulation models in different weather conditions by leveraging the trajectory-level data from SHRP2 Naturalistic Driving Study (NDS). **Method:** Representative key lane change parameters in various weather conditions were extracted from an automatic identification algorithm. These lane change parameters were used to develop microsimulation models in VISSIM in an attempt to assess the safety and operational impacts of adverse weather on a freeway weaving segment. **Results:** The evaluation of safety impacts of adverse weather with regard to three Surrogate Measures of Safety (SMoS) namely Time-to-Collision (TTC), Post Encroachment Time (PET), and Deceleration Rate to Avoid Collision (DRAC) suggested that extreme adverse weather (including heavy rain, heavy snow, and heavy fog) produced a higher total number of simulated conflicts compared to clear weather. The operational analysis results revealed that adjusted parameters in most of the adverse weather produced lower average speeds with higher total travel times and total delays than clear weather. **Conclusions:** The outcomes of safety and operational assessments for the adjusted parameters showed that the development of microsimulation models should be based on weather-specific, rather than default parameters. **Practical Applications:** The methodology presented in this study could be adopted by transportation agencies to develop weather-specific microsimulation models. Moreover, the demonstrated approach could be used to evaluate different Connected Vehicle (CV) applications related to lane change in terms of safety and operations in microsimulation platforms.

- ▪ **Keywords:** Adverse weather; Microsimulation model; Lane change behavior; Naturalistic Driving Study; VISSIM

## Aryan Hosseinzadeh, Abolfazl Karimpour, Robert Kluger, Raymond Orthober. *Data linkage for crash outcome assessment: Linking police-reported crashes, emergency response data, and trauma registry records*. Pages 21-35.

**Introduction:** Traffic crash reports lack detailed information about emergency medical service (EMS) responses, the injuries, and the associated treatments, limiting the ability of safety analysts to account for that information. Integrating data from other sources can enable a better understanding of characteristics of serious crashes and further explain variance in injury outcomes. In this research, an approach is proposed and implemented to link crash data to EMS run data, patient care reports, and trauma registry data. **Method:** A heuristic framework is developed to match EMS run reports to crashes through time, location, and other indicators present in both datasets. Types of matches between EMS and crashes were classified. To investigate the fidelity of the match approach, a manual review of a sample of data was conducted. A comparative bias analysis was implemented on several key variables. **Results:** 72.2% of EMS run reports matched to a crash record and 69.3% of trauma registry records matched with a crash record. Females, individuals between 11 and 20 years old, and individuals involved in single vehicle or head on crashes were more likely to be present in linked data sets. Using the linked data sets, relationships between EMS response time and reported injury in the crash report, and between police-reported injury and injury severity score were examined. **Conclusion:** Linking data from other sources can greatly enhance the information available to address road safety issues, data quality issues, and more. Linking data has the potential to result in biases that must be investigated as they relate to the use-case for the data. **Practical implications:** This research resulted in a transferable heuristic approach that can be used to link data sets that are commonly collected by agencies across the world. It also provides guidance on how to check the linked data for biases and errors.

- ▪ **Keywords:** Data linkage; Emergency medical services; Trauma registry; Crash outcomes; Linkage bias; Selectivity bias

**Verity Truelove, Natalie Watson-Brown, Laura Mills, James Freeman, Jeremy Davey.** *It's not a hard and fast rule: A qualitative investigation into factors influencing speeding among young drivers*. Pages 36-44.

**Introduction:** Research demonstrates that young drivers exceed the posted speed limit more frequently than older drivers, and this demographic is also subsequently overrepresented in road crash statistics. This behavior remains a worldwide problem despite legal enforcement efforts that have proven to have limited efficiency and/or produce counterintuitive results. **Method:** Consequently, this study undertook a qualitative analysis in order to understand the factors that are perceived to both prevent and promote speeding behavior among young drivers, guided by self-determination theory (SDT). Focus groups were conducted with a total of 60 young drivers aged 17–25 years. An inductive thematic analysis approach was taken to analyze the data. **Results:** Findings revealed the following factors influence the prevention of speeding: (1) legal consequences were perceived to deter low-level speeding, (2) fear of injury was believed to prevent high-level speeding, and (3) speed awareness monitors were considered to be an effective countermeasure. Meanwhile, factors perceived to contribute to violating speed restrictions included: (1) perceiving it is safe to do so, (2) a perceived norm to speed, (3) emotions, and (4) unintentional speeding. According to SDT, the factors that were perceived to prevent speeding promote externalized self-regulatory processes and are therefore limited by short-term behavior change. **Practical Applications:** The findings have important implications for designing countermeasures aimed at young drivers, not least illuminating the need to have education and media campaigns that target and build drivers' perceived competence, autonomy, and relatedness in relation to speeding in order to promote longer term compliance.

- ▪ **Keywords:** Self-determination theory; Deterrence; Speed; Young drivers; Novice driver; Self-regulation

**Michalis Mavroulidis, Panagiotis Vouros, Stefanos Fotiadis, Foteini Konstantakopoulou, Georgios Fountoulakis, Ioannis Nikolaou, Konstantinos Evangelinos.** *Occupational health and safety of multinational construction companies through evaluation of corporate social responsibility reports*. Pages 45-54.

**Introduction:** The aim of this paper is to examine Occupational Health and Safety (OHS) behavior in the construction industry through the assessment of Corporate Social Responsibility reports. The level of accident rates in the construction industry place OHS issues at the heart of their strategic management. **Method:** The assessment of OHS issues was made by drawing appropriate data from the Corporate Social Responsibility reports of 19 multinational construction companies published on a voluntary basis. **Results:** The findings show a low response rate by the companies sampled to the requirements of stakeholders for responsible organizational behavior and accountability for their consequences. Most of the companies sampled have only focused on a small number of OHS issues to assure the transparency of the information published such as OHS governance, accident and illness rates, training hours, third party assurance, and membership of externally developed OHS charters. Similarly, other important OHS issues seem to be less covered by the companies sampled such as the representation of total workforce in OHS committees, the percentage of high risk occupations, and OHS practices in the supply chain.

- ▪ **Keywords:** Corporate responsibility; Sustainability reporting; Sustainable development; Voluntary disclosure; Construction industry; Evaluation of CSR reports; Evaluation systems

**ZhenYu Xie, Aya Kojima, Hisashi Kubota. *A study on the effect of sports on elderly traffic injury prevention*. Pages 55-66.**

**Introduction:** In recent years, the percentage of elderly fatalities in traffic crashes in Japan has been increasing and has exceeded 50% since 2010. The fatality rate is high for the elderly due to the deterioration of physical functions. **Method:** The purpose of this study was to reduce the high fatality rate of elderly people at the time of the crash and to find out the effective exercise elements for maintaining physical functions, and to deter traffic crashes and reduce the fatality rate of the elderly people. **Results:** The effect of exercise on improving and maintaining physical fitness was remarkable, and even when encountering a near miss injuries or crashes, the percentage of the group that was able to respond in some way to a near miss or crashes was higher in the group that regularly exercised. The elderly who do not exercise tend to take longer to start crossing and tend to check both sides of the road less often while crossing. In addition, when they were about to encounter a car, they tended to continue walking, which tended to lead to dangerous crossing. **Conclusion:** As a result of the questionnaire survey, the possibility of preventing traffic crashes by participating in sports was confirmed. As a result of running experiments using a crossing simulator, it was found that elderly people who do not exercise have a gap between their usual awareness of crossing and their actual behavior. **Practical implications:** Through the discovering elements of exercise that are useful in reducing injuries will make it possible to provide accurate guidance and training to elderly people with reduced physical functions, and it is expected that pedestrians will be able to avoid traffic injuries with their own abilities.

- ▪ **Keywords:** Traffic safety; Injury; The aged; Exercise

**Marco Dozza, Alessio Violin, Alexander Rasch. *A data-driven framework for the safe integration of micro-mobility into the transport system: Comparing bicycles and e-scooters in field trials*. Pages 67-77.**

**Introduction:** Recent advances in technology create new opportunities for micro-mobility solutions even as they pose new challenges to transport safety. For instance, in the last few years, e-scooters have become increasingly popular in several cities worldwide; however, in many cases, the municipalities were simply unprepared for the new competition for urban space between traditional road users and e-scooters, so that bans became a necessary, albeit drastic, solution. In many countries, traditional vehicles (such as bicycles) may not be intrinsically safer than e-scooters but are considered less of a safety threat, possibly because—for cyclists—social norms, traffic regulations, and access to infrastructure are established, reducing the number of negative stakeholders. Understanding e-scooter kinematics and e-scooterist behavior may help resolve conflicts among road users, by favoring a data-driven integration of these new e-vehicles into the transport system. In fact, regulations and solutions supported by data are more likely to be acceptable and effective for all stakeholders. As new personal-mobility solutions enter the market, e-scooters may just be the beginning of a micro-mobility revolution. **Method:** This paper introduces a framework (including planning, execution, analysis, and modeling) for a data-driven evaluation of micro-mobility vehicles. The framework leverages our experience assessing bicycle dynamics in real traffic to make objective and subjective comparisons across different micro-mobility solutions. In this paper, we use the framework to compare bicycles and e-scooters in field tests. **Results:** The preliminary results show that e-scooters may be more maneuverable and comfortable than bicycles, although the former require longer braking distances. **Practical Applications:** Data collected from e-scooters may, in the short term, facilitate policy making, geo-fencing solutions, and education; in the long run, the same data will promote the integration of e-scooters into a cooperative transport system in which connected automated vehicles share the urban space with micro-mobility vehicles. Finally, the framework and the models presented in this paper may serve as a reference for the future assessment of new micro-mobility vehicles and their users' behavior

(although advances in technology and novel micro-mobility solutions will inevitably require some adjustments).

**Mehrdad Nasri, Kayvan Aghabayk, Arsalan Esmaili, Nirajan Shiwakoti.** *Using ordered and unordered logistic regressions to investigate risk factors associated with pedestrian crash injury severity in Victoria, Australia*. Pages 78-90.

**Introduction:** The safety of pedestrians is a major concern in Victoria, Australia. Despite the considerable number of pedestrian fatalities and injuries in traffic crashes, a limited number of studies focused on pedestrian crash severity in Victoria. **Methods:** This study investigates and identifies the influential factors determining the severity of pedestrian injuries in traffic crashes in Victoria by using crash data from 2010 to 2019. An unordered multinomial logit model and an ordered logit model are developed for this purpose. **Results:** The results indicate that pedestrian crashes on weekends, in the period of 10 a.m. to 10 p.m., on dark streets, at intersections, in areas with a speed limit above 50 km/h, and on medians or footpaths are associated with a higher probability of severe and fatal injuries. Male pedestrians, children, and older adults (>59) were more likely to sustain a higher level of injury in crashes. Concerning the driver characteristics, no significant relationship was found between pedestrian injury severity and driver gender and license status, but older drivers were more likely to cause severe and fatal injuries. Pedestrian collisions with motorcycles, heavy vehicles, light commercial vehicles, bus/minibus/coach, and trams increase the probability of more severe injuries compared to cars. Moreover, older vehicles are associated with a higher probability of severe pedestrian injuries. Comparison of the model results illustrated that the MNL model was slightly better fitted on the data than the ordered logit model, but the conclusions inferred from these two models were generally similar. Practical Application: To reduce the injuries of pedestrian crashes, we recommend improving lighting conditions and sidewalk design, implementing speed reduction strategies at high pedestrian activity areas, introducing more pedestrian crossings at midblock, installing warning signs to drivers, and discouraging the use of vehicles that are more than 20 years old.

**Manman Zhu, Haojie Li, N.N. Sze, Gang Ren.** *Exploring the impacts of street layout on the frequency of pedestrian crashes: A micro-level study*. Pages 91-100.

**Introduction:** Pedestrian safety has become a critical issue since walking is increasingly promoted as a sustainable transport mode. However, pedestrians are vulnerable to severe injury and mortality in road crashes. Therefore, it is important to understand the factors that affect the safety of pedestrians. This paper investigates the impacts of street layout on the frequency of pedestrian crashes by examining the interactive pattern of built environment, crossing facilities, and road characteristics. **Method:** A surrogate exposure variable of pedestrian crashes at the road-segment level is proposed by considering the locations of crossing facilities, distribution of points of interest (POIs), road characteristics, and pedestrian activities. A network-based kernel density technique is used to identify the pedestrian crash risk at the road segment level. Bayesian spatial models based on different exposure variables are employed and compared. **Results:** The results suggest that models using the surrogate exposure of pedestrian crashes provide better model fit than the ones simply using the density of pedestrians. It is also found that the presence of POIs is related to a higher risk of pedestrian-vehicle crash. In

addition, a significantly higher number of pedestrian crashes are found to occur on segments with more bus stops and metro stations. Results also show that the longer the distance between the crossing facilities and road segments, the more pedestrian crashes are observed. **Conclusions:** The proposed aggregated indicator can provide more efficient exposure and higher prediction accuracy than the density of pedestrians. Besides, the POIs, crossing facilities, and road types were all significantly related to pedestrian crashes. **Practical Applications:** Our results suggest that the locations of POIs and transport facilities should be planned in a way that can decrease the number of road crossed or guide pedestrians to take safe crossing path.

- **Keywords:** Road safety; Pedestrian crashes; Road segment; Street layout

**Tingting Zhang, Xiao Zhou, Pei Wang, Ching-Yao Chan. *An efficient framework of developing video-based driving simulation for traffic sign Evaluation*. Pages 101-109.**

**Introduction:** The driving simulator is a widely adopted experimental platform for investigating human-factors questions related to traffic signs and other traffic control devices in a safe environment. This paper presents a methodological framework for developing a video-based simulation program for traffic-sign evaluation. **Method:** We firstly collected video data and vehicle movement data from on-road driving. Secondly, the signs on the collected video footage were detected and tracked automatically using image processing techniques. Images of newly designed signs were integrated onto the video footage and placed onto the real-world sign locations. The inserted image properties were fused to fit into the video background to yield a natural visual effect. Thirdly, the vehicle-movement data collected during the drive-through were incorporated into the video sequence as well as the motion of the driving simulator. Using throttle and brake pedals of the driving simulator, participants drove through the video sequence with control over the video's playback speed and the simulator's movement to achieve a comparable visualization and motion experience as real-world driving. Results **Conclusions:** This framework was used to investigate drivers' visual attention and understanding of various newly proposed changeable message signs (CMSs). The results prove that this framework effectively engaged drivers in the driving task in the realistic traffic scene and successfully evaluated drivers' perception and understanding of the traffic signs. **Practical Applications:** With this methodological framework, a driving simulation program based on real-world video data from specified road environment and vehicle-movement information can be quickly established and used for testing a variety of traffic control devices, especially traffic signs, in the study of human–machine interaction.

- **Keywords:** Methodological framework; Driving simulation program; Vehicle motion; Traffic sign evaluation; Changeable message signs; Image processing

**Mette Møller, Thomas C. Jensen. *Sociodemographic characteristics of youth licensing at age 17 in the context of supervised driving in Denmark*. Pages 110-115.**

**Introduction:** Allowing young drivers to gain experience while being supervised by an experienced driver is a widely used measure to try to reduce crash risk. On 1 January 2017, the Danish licensing system was updated to allow licensing at age 17 with post-license supervised driving until solo driving at age 18. **Method:** Based on data from the Danish Driving License register and Statistics Denmark, including the entire population, the purpose of this study is to determine if sociodemographic characteristics and a history of violations and crash involvement among youth predict licensing at age 17. A second purpose is to estimate the time period from licensing until the driver turns 18 and to explore changes in license demand in the context of Denmark's updated licensing system. **Results:** An increasing proportion choose to license at the age of 17, but the

proportion below 19 with a driver's license is unchanged. On average, the license is obtained 5.3 months before turning 18. Living in rural areas, with both parents, and in a family with several cars and higher income increases the likelihood of licensing at age 17. Young people with a history of involvement in non-traffic-related accidents or violations are more likely to license at age 17. **Conclusion:** Lowering the license age to allow supervised driving increases early licensing. The average time period from licensing until the driver turns 18 is less than six months. Sociodemographic characteristics predict early licensing. **Practical implications:** Minimum requirements for the time period from licensing until the driver turns 18 are needed to support a safety benefit. Follow-up studies mapping supervised driving, crash involvement, and possible changes in crash risk associated with the change in the Danish licensing system are needed to specify the requirements.

- **Keywords:** Supervised driving; Young drivers; Road safety; Sociodemographic characteristics; Licensing age

## Laura Mills, James Freeman, Jeremy Davey. *A study into the nature and extent of drug driving recidivism in Queensland (Australia)*. Pages 116-122.

**Introduction:** While research has reported on overall prevalence rates of drug driving, the extent of recidivist offending has yet to be explored. The objective of this research was to examine recidivistic behaviors detected through Roadside Drug Testing (RDT) in Queensland (between December 2007 and June 2020), with a focus on: Delta-9-tetrahydrocannabinol (THC), 3,4-Methylenedioxymethylamphetamine (MDMA), and methamphetamine (MA). **Method:** Data were provided by the Queensland Police Service, and contained information on positive drug detections that were confirmed via laboratory analysis. **Results:** The analyses revealed 50,442 unique offenders with a total of 67,727 offenses, as 25% (N = 12,490) of all offenders had been apprehended more than once (ranging from 2 to 11 offences). MA use was more common among recidivist offenders, whereas THC was more common for those with one offense. On average, the days between offenses decreased with increases in offense number. **Conclusions:** The findings provide evidence for the extent of drug driving recidivism on Queensland roads. **Practical applications:** To deter recidivists and the greater motorist population from drug driving, there is need for greater resources dedicated to RDT to increase both the perceived and real likelihood of detection.

- **Keywords:** Roadside drug testing; Recidivism; Queensland; Drug driving

## Amy Irwin, Jana Mihulkova, Stephanie Berkeley, linca-Ruxandra Tone. *'No-one else wears one:' Exploring farmer attitudes towards All-Terrain Vehicle helmets using the COM-B model*. Pages 123-133.

**Introduction:** All-Terrain Vehicles (ATV) are a popular piece of farming machinery but are linked to many fatalities and injuries every year. Despite evidence that ATV helmets reduce the risk of serious or fatal injury, research suggests that few farmers wear them. The aim of this study was to explore farmer attitudes toward ATV helmets, using the COM-B model as a framework to identify key barriers and enablers of helmet use and suggest potential interventions to increase helmet use in agriculture. **Methods:** A mixed-methods online survey featuring quantitative and qualitative questions was used to explore key attitudinal factors relevant to farmer helmet wearing. A total of 211 UK and Irish farmers were recruited, including farm owners, managers, workers, and contractors. **Results:** Personal exemption from risk, emotional benefits, cognitive barriers, and guideline prompts were all found to be significant predictors of farmer helmet wearing. Key categories within the qualitative data indicated that helmet properties, risk perception, farming culture, and the farming environment could all function as barriers to helmet wearing. Suggested enablers of helmet use included increasing helmet availability

and enhancing awareness of the consequences of ATV accidents. **Conclusions:** The key barriers and enablers presented within this paper highlight the relevance of capability (helmet design, time pressure), opportunity (social norms), and motivation (perceived control of risk) when considering farmer helmet wearing behaviors. In order to encourage farmers to wear helmets it will be necessary to design specific interventions using the behavior change wheel. **Practical applications:** Key interventions to prompt helmet use include the inclusion of more cues to prompt helmet wearing (e.g., stickers on the ATV), enhanced training and education, and modelling (e.g., key farming figures shown to wear helmets in the media).

- **Keywords:** Safety; ATV; Farming; COM-B; Helmet wearing; Interventions

## Femke Cathelyn, Pieter Van Dessel, Jan De Houwer. *Predicting drunk driving using a variant of the implicit association test*. Pages 134-142.

**Introduction:** Drunk driving is one of the primary causes of road traffic injuries and fatalities. A possible approach to reduce drunk driving rates is to identify which individuals are at risk of such behavior and establish targeted prevention. Simply asking individuals about drunk driving in real-world contexts would be problematic because of potential deception. The use of implicit measures such as the Implicit Association Test (IAT) could overcome this problem because they are less controllable than self-reports and thus less susceptible to deception. However, previous studies have shown poor predictive utility of implicit measures for drunk driving behavior. The current studies aimed to test the predictive utility of a variant of the IAT designed to assess beliefs about past driving under the influence (the P-DUI-IAT). **Method:** Study 1 (N = 216) tested whether the P-DUI-IAT could predict self-reported prior drunk driving and future likelihood of drunk driving. We also examined incremental predictive validity of the P-DUI-IAT for these outcomes. Study 2 (N = 159) examined whether results from Study 1 were reproducible. **Results:** In both studies, results showed that the P-DUI-IAT discriminated well between participants who had engaged in drunk driving and participants who had not. The P-DUI-IAT also showed independent and incremental predictive validity for past drunk driving and future likelihood of drunk driving. **Conclusions:** These studies provided initial evidence for the predictive utility of the P-DUI-IAT for drunk driving. Practical Applications: The P-DUI-IAT is a promising tool for identifying which individuals are at risk of drunk driving. The application of this measure could especially be valuable for identifying young novice drivers at risk for drunk driving-related accidents.

- **Keywords:** Implicit measures; Drunk driving; Prediction; Past behavior

## Benjamin Davey, Alexander Parkes, James Freeman, Laura Mills, Jeremy Davey. *Versatile, but not focused, traffic offenders are more likely to be at fault for a fatal crash*. Pages 143-152.

**Introduction:** The aim of this study was to determine whether drivers who had received more traffic infringements were more likely to be at fault for the crash in which they were killed. **Method:** The current dataset was derived from the crash and traffic history records provided by the Queensland Department of Transport and Main Roads and Coroner's Court for every driver, with available records, who was killed in a crash in Queensland, Australia, between 2011 and 2019 (N = 1,136). The most common traffic offenses in the current sample were speeding, disobeying road rules, driving under the influence of drugs and alcohol, and unlicensed driving. Logistic regression models were used to compute odds ratios for the number of overall offenses, the number of specific offense types, and for specific offending profiles that were derived from the literature. Age, gender, and crash type were each controlled for by entering them into the initial blocks of the regression models. **Results:** After accounting for the variance associated with age, gender, and crash type, only the overall number of offenses and the number of

unlicensed driving offenses predicted a significant change in a drivers' likelihood of being at fault for the crash that killed them. Furthermore, drivers who were identified as having versatile (i.e., multiple offenses from different categories) or criminal-type offense profiles (i.e., offenses that were considered to approximate criminal offenses) were each significantly more likely to be at fault for a fatal crash. **Practical Applications:** This study provided an important contribution by demonstrating how a more nuanced approach to understanding how a driver's traffic history might be used to identify drivers who are more at risk of being involved in a crash (i.e., for which they were at fault). The implications of these findings are discussed with recommendations and consideration for future research.

- **Keywords:** Versatile; Traffic offence; Crash risk; Fatal crash; Dangerous driving

## Khabat Amin, Marie Skyving, Carl Bonander, Maria Krafft, Finn Nilson. *Fall- and collision-related injuries among pedestrians in road traffic environment: a Swedish national register-based study*. Pages 153-165.

**Objective:** To investigate the burden of pedestrian injuries, including pedestrian fall injuries (PFI), compared to other transport-related injuries in Sweden and document their characteristics in terms of demographics, causes, type of injuries, and severity level with a focus on long-term consequences. **Methods:** Data were retrieved from the national Swedish Traffic Accident Data Acquisition register. A total of 361,531 fatalities and injuries were reported by emergency hospitals during 2010–2019, of which 127,804 were pedestrians (35%). We assessed the magnitude of PFIs and conducted comparative analyses to assess differences compared to other types of road users regarding sex, age, severity level, injury circumstances, hospital care, causes of accidents, and type of injuries. **Results:** Pedestrians were the second largest group of traffic-related deaths in Sweden after car occupants and accounted for just over a quarter of all fatal accidents in the road traffic environment. Of the total number of pedestrian fatalities, three out of four have been in collision accidents and the others in fall-related accidents. In terms of injuries, pedestrians were the largest group among all road users, regardless of the type of accident. PFIs accounted for a third of all injuries in the road traffic environment and nearly half of all injuries resulting in permanent medical impairment (i.e., 2.2 times more long-term consequences among PFIs compared to injured car occupants). Females (particularly middle-aged and older) and older adults were overrepresented, and most PFIs occurred on urban and municipal roads. The causes were often related to maintenance (e.g., slippery surfaces such as ice, snow, leaves or gravel together with uneven pavements and roads are the cause three out of four of PFIs). Among collision injuries, the representation was almost equal for sex and age. **Conclusions:** Injuries and fatalities among pedestrians are a considerable issue in the road traffic environment in Sweden. Contrary to other traffic groups, the incidence has not decreased over time, meaning that this issue must be met with specific measures and address the specific risk factors they are associated with. Practical Application: Including fall accidents in the definition of traffic accidents increases the chances of getting better information about the accidents and taking preventive measures.

- **Keywords:** Pedestrian; Traffic injuries; Fall injuries; Permanent medical impairment; Maximum Abbreviated Injury Scale; MAIS

## Ahmed Sajid Hasan, Muntahith Mehadil Orvin, Mohammad Jalayer, Eric Heitmann, Joseph Weiss. *Analysis of distracted driving crashes in New Jersey using mixed logit model*. Pages 166-174.

**Introduction:** Distracted driving is a concern for traffic safety in the 21st century, and can be held responsible for the increasing propensity and severity of traffic crashes. With the advent of mobile technologies, distractions involving the use of cellphones while driving have emerged, and young drivers in particular are getting more and more

engaged in these distractions. Texting or receiving phone calls while driving are offenses in most states, and they are punished with fiscal penalties. Awareness campaigns have also been arranged over recent decades across the United States in order to minimize crashes due to distracted driving. The severity of such crashes depends on driver behavior, which can also be affected by various factors like the geometric design of the roadway, lighting and environmental conditions, and temporal variables. **Method:** In this study, we analyzed data on five years (2015–2019) of crashes involving cellphone use in New Jersey using a mixed logit model. As estimated model parameters can vary randomly across roadway segments in this approach, this allowed us to account for unobserved heterogeneities relating to roadway characteristics, environmental factors, and driver behavior. A pseudo-elasticity analysis was further employed to observe the sensitivity of the significant explanatory variables to crash severity. **Results:** We found that higher speed limits and a larger total number of vehicles involved both increased crash severity, while higher annual average daily traffic (AADT) levels and the presence of an urban road setting reduced it. **Practical Applications:** These findings will help decision-makers to comprehend what the significant contributing factors associated with crash injury severity due to distracted driving are, and how to implement necessary interventions to reduce this severity.

- **Keywords:** Distracted driving; Cellphone distractions; New Jersey; Mixed Logit Model; Pseudo-elasticity

## Mohammed H.U. Bhuiyan, Mohamad Fard, Stephen R. Robinson. *Effects of whole-body vibration on driver drowsiness: A review*. Pages 175-189.

**Introduction:** Whole-body vibration has direct impacts on driver vigilance by increasing physical and cognitive stress on the driver, which leads to drowsiness, fatigue and road traffic accidents. Although sleep deprivation, sleep apnoea and alcohol consumption can also lead to driver drowsiness, exposure to steady vibration is the factor most readily controlled by changes to vehicle design, yet it has received comparatively less attention. **Methods:** This review investigated interrelationships between the various components of whole-body vibration and the physiological and cognitive parameters that lead to driver drowsiness, as well as the effects of vibration parameters (frequency, amplitude, waveform and duration). Vibrations transmitted to the driver body from the vehicle floor and/or seat have been considered for this review, whereas hand-arm vibration, shocks, acute or transient vibration were excluded from consideration. **Results:** Drowsiness is affected by interactions between the frequency, amplitude, waveform and duration of the vibration. Under optimal conditions, whole-body vibration can induce significant drowsiness within 30 min. Low frequency whole-body vibrations, particularly vibrations of 4–10 Hz, are most effective at inducing drowsiness. This review notes some limitations of current studies and suggests directions for future research. **Conclusions:** This review demonstrated a strong causal link exists between whole-body vibration and driver drowsiness. Since driver drowsiness has been established to be a significant contributor to motor vehicle accidents, research is needed to identify ways to minimise the components of whole-body vibration that contribute to drowsiness, as well as devising more effective ways to counteract drowsiness. **Practical Applications:** By raising awareness of the vibrational factors that contribute to drowsiness, manufacturers will be prompted to design vehicles that reduce the influence of these factors.

- **Keywords:** Driver drowsiness; Fatigue; Whole-body vibration (WBV); Human factors; Cognitive performances

**Chenhui Liu, Wei Zhang.** *Exploring the stop sign running at all-way stop-controlled intersections with the SHRP2 naturalistic driving data*. Pages 190-196.

**Introduction:** All-way stop control (AWSC) has been widely used at unsignalized intersections in the United States for its safety effects. However, many drivers do not make a complete stop before stop signs in practice (i.e., stop sign running), which presents safety concerns. **Method:** This study explores driver behaviors at AWSC intersections with the SHRP2 naturalistic driving data. **Results:** First, it is found that the full-stop rate is only 20.2% at AWSC intersections. Then, the study quantitatively analyzes what factors might influence the stop sign running decisions at AWSC intersections, where driver, vehicle, intersection geometry, maneuver, and environmental features are taken into account. In addition, considering the possible unobserved heterogeneities across drivers and intersections, a logistic regression model with both driver and intersection random effects is adopted. The results show that young and older drivers are less likely to fully stop, but there is no gender difference found. SUVs and vans are less likely to fully stop, drivers are less likely to fully stop at 3-leg intersections, and drivers are more likely to fully stop in daytime and weekdays. In terms of maneuvers, left-turn traversals are more likely to make a complete stop. In addition, both the driver and intersection random effects are found to be significant, vary greatly by individuals, and can be used to identify the few but critical high-risk drivers/intersections. **Practical applications:** The findings are expected to provide new insights for transportation agencies to formulate effective measures to deter stop sign running.

- **Keywords:** All-way stop control; Stop sign running; Random effects logistic regression; Naturalistic driving; SHRP2

**Salaheddine Bendak, Rene Jouaret, Hamad Rashid.** *Effects of high ambient temperature on construction workers performance: a longitudinal empirical study*. Pages 197-202.

**Introduction:** The construction industry is known to be of high-risk when compared to other industries. Ambient temperature can also exacerbate this risk, where hot weather conditions can lead to increased physical and mental fatigue, reduced performance, slower reactions and more human errors. Yet this issue is rarely researched objectively. This paper describes a longitudinal empirical study that aimed to assess how high ambient temperatures affect construction workers performance. **Method:** A sample of 120 randomly selected workers (age range 22–35 years) from a large construction company in Dubai participated in this study. Since construction workers performance cannot be directly measured due to the nature of work involved, performance of 60 participants was measured on a task battery involving single reaction time and choice reaction time in summer months before starting work and 5.5 h after starting work. Then the same procedure was repeated on 60 workers in winter months. Accident reports for one full year within the same company were also collected and analyzed. **Results:** Results show that performance on both tasks before starting work was significantly lower in summer than in winter months possibly due to accumulated fatigue resulting from the high ambient temperature in summer. Results also show that performance on both tasks significantly deteriorated during the first 5.5 h of work to a greater extent in summer months than in winter months. Results also indicate that accidents showed an increasing trend in summer months. **Conclusions:** Accumulated fatigue due to high ambient temperature in Summer is thought to cause this drop in performance and increase in accidents. **Practical implications:** Based on the findings, recommendations to enhance construction workers performance and reduce accidents are given.

- **Keywords:** Construction workers; Work performance; High ambient temperature; Human fatigue; Human errors

**Cassandra Madigan, Kïrsten A. Way, Kelly Johnstone, Mike Capra. *Differences between managers' and safety professionals' perceptions of upwards influence attempts within safety practice*. Pages 203-215.**

**Introduction:** The ability to influence upwards and gain management commitment has been identified as an essential capability for safety professionals, yet little is known about managers' perceptions of their subordinates use and effectiveness of influence tactics. This study utilizes intra-organizational influence theory to explore how safety professionals influence managers who are making important safety decisions. **Method:** Survey data were collected from managers (n = 145) on influence tactics used by safety professionals, perceived outcomes, and factors that promote and impede influence. Survey data from a previous study of safety professionals (n = 385) were used to compare the differences in perceptions between the two groups. **Results:** Managers perceive that the use of influence tactics provides explanation for safety professionals' effectiveness, with rational persuasion being positively associated with influencing effectiveness, and personal appeals and legitimating being negatively associated with effectiveness. Certain factors (i.e., knowledge, understanding organizational context, interpersonal skills, and experience) were more frequently perceived by managers to enable influence, while others were more frequently reported as barriers (i.e., organizational culture, safety beliefs, and leadership styles of managers). Managers and safety professionals agreed on many of these findings, although safety professionals reported a broader range of tactics as being effective than did managers. **Conclusions:** This study provides important contributions to understanding the upward influence behavior of safety professionals, and to our knowledge is the first study to report this behavior from the perspective of managers. **Practical Applications:** These findings may prompt safety professionals to reflect on current tactic usage and associated efficacy from managers' perspectives. Safety professionals should also consider the culture of the organization, safety beliefs, and the leadership style of managers prior to influencing, as these factors may negatively impact influencing outcomes. Developing knowledge and skills in both technical and non-technical domains may enhance the strategic influence of safety professionals.

- ▪ **Keywords:** Safety; Influence; Influence behaviour; Safety professionals; Professional practice

**Fangrong Chang, Helai Huang, Alan H.S. Chan, Siu Shing Man, Yaobang Gong, Hanchu Zhou. *Capturing long-memory properties in road fatality rate series by an autoregressive fractionally integrated moving average model with generalized autoregressive conditional heteroscedasticity: A case study of Florida, the United States, 1975–2018*. Pages 216-224.**

**Introduction:** Time series models play an important role in monitoring and understanding the serial dynamics of road crash exposures, risks, outcomes, and safety performance indicators. The time-series methods applied in previous studies on crash time series analysis assume that the serial dependency decays rapidly or even exponentially. However, this assumption is violated in most cases because of the existence of long-memory properties in the crash time series data. Ignoring the long-memory dependency could result in biased understanding of the dynamics of road traffic crashes. **Method:** To fill this research gap, this study proposes an autoregressive fractionally integrated moving average model with generalized autoregressive conditional heteroscedasticity (ARFIMA-GARCH) to capture and accommodate the long-memory decencies in the road fatality rate time series. To further investigate how the factors influencing the fatality risks play a role in the long-memory dependence, the effects of exogenous variables are examined in this study. The analysis is conducted based on the road crash fatality data in Florida, USA over 44 years. Results' **Conclusions:** The case analysis confirmed the existence of long-memory property in the crash fatality time

series data by both the joint tests of Augmented Dickey-Fuller and the Phillips–Perron, and the integer order of differencing (≤0.5) in the proposed models. The model results reveal that gasoline price and alcohol consumption per capita is positively associated with road fatality risks, whereas unemployment rate and rural/urban road mileage are negatively related to the road fatality risks. **Practical Applications:** The significant influential factors are also found to account for the long-memory serial correlations between road traffic fatalities to some extent.

## Juan Pineda-Jaramillo, Humberto Barrera-Jiménez, Rodrigo Mesa-Arango. *Unveiling the relevance of traffic enforcement cameras on the severity of vehicle–pedestrian collisions in an urban environment with machine learning models*. Pages 225-238.

**Purpose:** One of the leading causes of violent fatalities around the world is road traffic collisions, and pedestrians are among the most vulnerable road users with respect to such incidents. Since walking is highly promoted in urban areas to alleviate motor-vehicle externalities, it is paramount to understand the causes associated with vehicle–pedestrian collisions and their severity to provide safe environments. Although traffic enforcement cameras can address vehicle-vehicle collisions, little is known about their effectiveness with respect to vehicle–pedestrian incidents. **Methodology:** In this study, we trained a set of machine learning models to forecast if a vehicle–pedestrian collision will turn into an injury or fatality, and the most suitable model was used to investigate the contributing features associated with such events with emphasis on the impact of traffic enforcement cameras. In addition to traffic enforcement camera proximity, features associated with the collision, weather, vehicle, victim, and infrastructure are included in the model to reduce unobserved heterogeneity. **Results:** Results show that a Linear Discriminant Analysis model surpasses other machine learning models considering the evaluation metrics. Results reveal that the age and gender of the victim, the involvement of larger vehicles in the collision, and the quality of the illumination are the causes associated with pedestrian fatalities. On the other hand, involvement of motorcycles and collisions that occurred in densely populated locations are the causes associated with pedestrian injuries. **Conclusions:** This investigation demonstrates how to articulate machine learning into a vehicle–pedestrian crash analysis to understand the direction and magnitude of covariates in the corresponding severity outcome. Furthermore, it highlights the remarkable effect that traffic enforcement cameras and other features have on vehicle–pedestrian crash severity. These results provide actionable guidance for educational campaigns, enhanced traffic engineering, and infrastructure improvements that could be implemented in the analyzed region to provide safer transportation.

## Élie Vignac, Pascal Lebihain, Bastien Soulé. *Safety optimization in an accident-prone aquatic context: a qualitative study of drowning risk detection by public pool lifeguards*. Pages 239-248.

**Introduction:** Drownings occur in French public swimming pools (PCP) in spite ofconstant supervision by qualified lifeguards. This studyhypothesizesthat organizational aspects may affect the mission of pool supervision andtakes a systemic approach that views safety as an emergent property, and drowning as a multifactorial and long-term process that is not restricted to the end of an accidental sequence. **Method:** We

conducted a qualitative survey at four municipal poolsin France based on 30 semi-structured interviews. **Results:** The findings revealed that several interrelated elements influence the detection by lifeguards of bathers in distress: (a) their training, their conception of the profession, and the reasons that led them to enter this occupation; (b) their representations of the drowning risk and the evaluation of their ability to perceive such situations; (c) the question of regulation; and (d) the methods of dealing with this framework in daily operations, which involves trade-offs and appropriations at each level of the system. **Conclusions:** In order to identify the most significant influences, it seems relevant:(a) to shift the focus away from these professionals; and (b) to prioritize an analysis of the functioning of the risk management system as a whole, not just critical or post-accident periods. In order to reduce the risk to swimmers, it seems preferable to identify the source of the constraints that weigh daily on lifeguards in charge of pool supervision.The functioning of PSP's is the end result of joint regulation processes likely to influence, positively or negatively, the identified feedback loops. An analysis of the pool supervision can help to identify early warning signs of vulnerability (which can sometimes be acted upon at low cost),identify the practical implications, and makepreventive recommendations.

- **Keywords:** Public swimming pool; Pool supervision; Drowning prevention; Risk analysis; Safety management

## Md Atiquzzaman, Huaguo Zhou. *Modeling the risk of wrong-way driving at the exit ramp terminals of partial cloverleaf interchanges*. Pages 249-258.

**Introduction:** Partial cloverleaf (parclo) interchanges with closely spaced parallel entrance and exit ramps are more prone to wrong-way driving (WWD) compared to other interchange types. In this study, a logistic regression model was developed to predict the risk of WWD at the exit ramp terminals of parclo interchanges. **Method:** The logistic regression model was developed using Firth's penalized likelihood techniques based on the predictor variables such as exit ramp geometric design features, wrong-way related traffic control devices, area type, and traffic volume. **Results:** According to the model, the significant predictors of WWD at parclo exit ramp terminals include corner radius from crossroad to entrance ramp, type of median on crossroad, width of median on two-way ramp, channelizing island, distance to the nearest access point, "Keep Right" sign, wrong-way arrow, intersection signalization, and traffic volume at the exit and entrance ramps. This model was used to conduct network screening for all the exit ramp terminals of parclo interchanges in Alabama and Georgia to identify high-risk locations in these two states. Seven high-risk locations were monitored by video cameras for 48-hours to observe the occurrences of WWD incidents. Results suggest that two locations in Alabama and two locations in Georgia experienced multiple WWD incidents within 48-hours of a typical weekend. **Conclusion:** The observation of WWD incidents at high-risk locations demonstrates strong evidence that the model could identify the exit ramp terminals with high risk of WWD. **Practical Applications:** Transportation agencies can use this model to assess the risk of WWD at the exit ramp terminals within their jurisdictions and identify the high-risk locations for countermeasures implementation.

- **Keywords:** Wrong-way driving; Effect of geometric design; Partial cloverleaf interchange; Network screening; Firth's penalized-likelihood logistic regression

## Mohamed Ben-Saed, Colin Pilbeam. *The effect of an embargo, sanctions and culture on safety climate: A qualitative view from aviation maintenance in the MENA region*. Pages 259-269.

**Introduction:** Safety climate assessment is a key measure of organizational safety. A strong safety climate is integral to the high safety performance in aviation. Most survey instruments that purport to measure safety climate are derived from evidence obtained

in developed countries in the west. It is rare for these studies to examine the influence of macro-environmental factors on safety climate, and rarer still in countries found in the Middle East and North Africa (MENA) region. **Method:** The researchers conducted 28 semi-structured interviews with experienced aviation maintenance engineers from a national carrier in the region. The interview questions were derived from an extensive review of existing studies of safety climate. Data from interview transcripts were coded, creating a data structure using participant quotes for 1st order codes and arriving at three aggregate dimensions: organizational commitment to safety, organizational safety practices and social relationships and their consequences. **Results:** Commercial considerations influenced negatively organizational commitment to safety. Organizational safety practices were weak. There was a lack of safety training, a lack of resources to support safe working, poor safety communication, and a failure to report safety issues. Strong friendships were developed through working together in teams. This adversely influenced the reporting of errors and the punishment of violations. Discussion and **conclusion:** The apparently weak organizational safety climate reported here was attributed to financial constraints following the imposition of economic sanctions and embargos, and to the influence of Arabic cultural values that privilege family connections and the importance of maintaining harmony in social relationships that precludes punishment. Practical application: Financial constraints inevitably limit resources for safety and encourage prioritization of production. Arabic cultural values inhibit the development of a 'just' culture and a 'reporting' culture and challenge the universal adoption of approaches for promoting organizational safety developed in the West.

- **Keywords:** Low- and Middle-Income Countries; Middle East and North Africa region; Occupational safety; Organizational safety culture; Safety reporting; Wasta

## Francisco J. Forteza, José M. Carretero-Gómez, Albert Sesé. *Organizational factors and specific risks on construction sites*. Pages 270-282.

**Introduction:** This study develops an empirical test of two theoretical models using the approach of Structural Equation Model (SEM) to test the relationships between specific organizational factors of safety management system (SMS) and specific risk variables. **Method:** Two SEM models with two and four latent variables, respectively, and 10 observed risk variables were used to identify the strongest relationships that may lead to an accident on site. A random sample of 474 construction sites were visited and assessed in Spain from 2003 to 2010. Most of the samples were small and medium sized enterprises (SMEs), which is the predominant type of company in the Spanish construction industry. To assess the risk on sites and get the measurements of the variables included in the models, the validated method CONSRAT (Construction Sites Risk Assessment Tool) was used. After estimating the proposed models, an adequate fit was obtained for both of them. **Results:** Results provide empirical evidence that: (a) the factor "Resources on site" is more determinant in explaining influences on risk variables because of their influence on all risk variables (Model 1); (b) the factor "Site structure complexity" (which includes structure and organization, and safety resources available on site) has a stronger effect on risk variables than other factors related to intrinsic characteristics of the work, site, or companies (Model 2). **Conclusions:** These results mean that the complexity and resource factors that depend on companies are those that have the greatest impact on risks, which makes it possible for companies to undertake the appropriate risk control measures. Practical Application: These results can help construction firms obtain earlier information about which organizational elements can affect future safety conditions on site, improve those elements for preventing risks, and consequently, avoid accidents before they occur.

- **Keywords:** Risk onsite; Site complexity; Site resources; Structural Equation Modeling

**Libby L. Moore, Steven J. Wurzelbacher, I-Chen Chen, Michael P. Lampl, Steven J. Naber.** *Reliability and validity of an employer-completed safety hazard and management assessment questionnaire*. **Pages 283-296.**

**Introduction:** Managing and improving occupational safety and health requires evaluating performance. Organizations are encouraged to use both lagging indicators (such as injury rates and costs) and leading indicators (such as questionnaire-assessed safety hazards and management practices) for this purpose, but the association between types of indicators over time can be complex. Longitudinal data can assist in clarifying these associations and increasing indicator utility. **Method:** Employer data were used to evaluate the reliability and predictive validity of a safety management questionnaire. Employers' longitudinal questionnaire responses and workers' compensation (WC) claims data were analyzed using a marginal model with time-dependent covariates. Multivariable Poisson and linear regression analyses with claim rate and logarithmic cost, respectively, as dependent variables were carried out after adjusting for industry sector and size. Questionnaire data were used to evaluate questionnaire scaling properties and to assess generalizability of results. **Results:** One safety management scale was associated with a better WC outcome as predicted and two scales were unexpectedly associated with poorer WC claim outcomes. Analyses assisted in interpreting the latter results, suggesting that WC outcomes were a stimulus for change in some cases. Twelve hazards assessed on the questionnaire were associated with poorer WC claim outcomes as predicted. **Conclusions:** This study extends leading indicator research using longitudinal questionnaire and WC claims data from employers. Analyses provided insight into associations between leading and lagging indicators, emphasizing the importance of both for safety improvement. Safety management questionnaire scales were predictive of WC claim outcomes, although support for hazard assessments as leading indicators was stronger. **Practical Applications:** This study supports the use of employer-completed hazard assessment questionnaires for targeting and prioritizing improvement efforts. Employer-completed safety management scales may be useful for directing improvement efforts, although the conditions under which they are completed, including submission to insurers, require additional consideration.

- **Keywords:** Leading; Lagging metrics; Predictor; Workers' compensation

**Yang Zeyin, Sun Long, Ren Gaoxiao.** *Effects of safe driving climate among friends on prosocial and aggressive driving behaviors of young drivers: The moderating role of traffic locus of control*. **Pages 297-304.**

**Introduction:** This study focused on the impact of safe driving climate among friends on prosocial and aggressive driving behaviors for young Chinese drivers, arguing for the moderating role of traffic locus of control. **Method:** Three hundred and fifty-two young Chinese drivers aged 18 to 25 years agreed to participate in this study and completed the questionnaire, which included items related to safe driving climate among friends, traffic locus of control, and prosocial and aggressive driving behaviors. **Results:** Safe driving climate among friends and traffic locus of control had direct effects on prosocial and aggressive driving behaviors. More importantly, internal locus of control moderated the relationship between communication on prosocial driving behavior and the relationship between shared commitment to safe driving and aggressive driving behavior. External locus of control moderated the relationship between social costs and prosocial driving behavior and the relationships between shared commitment to safe driving and prosocial and aggressive driving behaviors. It can be inferred that the effects of safe driving climate on prosocial and aggressive driving behaviors varied with their levels of traffic locus of control. **Practical Applications:** This study enriches current theoretical frameworks and may be applied in the development of interventions and training for young drivers from the perspective of safe driving climate among friends and traffic locus of control.

- **Keywords:** Young driver; Safe driving climate; Traffic locus of control; Prosocial driving behavior; Aggressive driving behavior

**Alexandra S. Mueller, Jessica B. Cicchino.** *Teen driver crashes potentially preventable by crash avoidance features and teen-driver-specific safety technologies*. Pages 305-312.

**Introduction:** Vehicle technologies have the potential to help address the disproportionate crash risk that teen drivers face. While crash avoidance features benefit the general population, several address crash scenarios for which teen drivers are particularly at risk, such as rear-end and lane-drift crashes. Other emerging technologies have been designed for teen drivers by addressing certain crash or injury risk factors associated with risky driving behavior, such as speeding or not wearing a seat belt. **Methods:** Using nationwide U.S. crash data from 2016 to 2019, this study examined the maximum potential safety benefits of three currently available crash avoidance features (front crash prevention, lane departure prevention, and blind spot monitoring) and three teen-driver-specific technologies (speeding prevention, extended seatbelt reminders and interlocks, and nighttime curfew violation alerts). **Results:** Teen-driver-specific features have the largest potential for reducing teen driver injuries and fatalities, followed by lane departure prevention, front crash prevention, and blind spot monitoring; however, altogether these technologies have the potential to prevent 78% of teen driver fatalities, 47% of injured teen drivers, and 41% of crashes involving teen drivers. **Conclusions:** Crash avoidance features and teen-driver-specific vehicle technologies appear to address different risk factors and crash scenarios, which emphasizes the importance of utilizing both types of safety features to reduce the crash risk of teen drivers. **Practical applications:** Wider acceptance, accessibility, and use of these technologies are needed for their safety potential to be realized. More manufacturers should offer and advertise teen-driver-specific technology suites that integrate crash avoidance systems and safety features that address risky driving behavior. While this study shows the maximum potential safety benefits of these technologies, further research is needed to understand the behavioral implications as teens learn to drive with these features.

- **Keywords:** Adolescent drivers; Young drivers; Safety benefits; ADAS; Vehicle technologies

**Haojie Li, Haodong Hu, Ziqian Zhang, Gang Ren, Xin Liu.** *Impacts of enforcement cameras on pedestrians' risk perception and drivers' behaviors at non-signalized crosswalks*. Pages 313-325.

**Introduction:** Pedestrians are more vulnerable to traffic crashes than other road users, particularly at non-signalized crosswalks. Safety measures (such as law enforcement cameras) can be implemented to regulate road users' behavior and traffic safety. This study evaluates the effects of such cameras on pedestrian-vehicle conflicts by investigating different interaction patterns of pedestrian risk perception and driving style. **Data:** Field investigations were conducted at four non-signalized crosswalks. Video data were collected using unmanned aerial vehicles and roadside cameras. **Method:** Two-step cluster analysis and k-means cluster analysis were employed to classify the pedestrian's behavior and driving style, respectively. Surrogate safety measures were adopted to measure the pedestrian-vehicle conflicts. **Results and conclusions:** The results suggest that the implementation of cameras would decrease both the actual and perceived risks of pedestrians, while the heterogeneity between the actual and perceived risk is more obvious at camera sites. They also indicate that the cameras have a positive influence on reducing drivers' aggressiveness and conflict severity. In terms of pedestrian-vehicle interaction patterns, the most severe conflicts occur when the pedestrian perceived risk level is low and the driving style is aggressive. Such dangerous interactions are observed more frequently at camera sites. In contrast, a safer interaction pattern is associated with a moderate driving style and cautious crossing behavior, which is more frequently

observed at comparison sites. However, regardless of which interaction pattern is observed, the conflict severity is found to be lower at camera sites, indicating the effectiveness of the cameras. **Practical Applications:** Supplementary facilities, such as warning signs, flash lights, and speed control measures, should be implemented to maintain the effectiveness of the law enforcement cameras.

**Linda Foettinger, Friederike Doerwald, Andreas Kalbitz, Karin Bammann.** *Risk factors and parental risk perception of unintentional home injuries of children under 6 years in Germany: A secondary data analysis*. Pages 326-332.

**Introduction:** Unintentional home injuries are a major health risk for children. To develop and implement appropriate interventions, both theoretical guidance and empirical evidence are required. While theoretical models informing injury prevention are available, detailed information on unintentional home injuries of children and parental risk perception is still missing. The objective of this study was to identify relevant determinants of unintentional home injuries of children under 6 years of age and parental risk perception from an empirical perspective. **Method:** The secondary data analysis is based on data from two nationally representative surveys from Germany conducted in 2014–2017 (n = 4,009) and 2019 (n = 411). Both bivariate analyses and multivariate binary logistic regression models were conducted to determine the associations between various factors with unintentional home injuries and parental risk perception. **Results:** Key determinants of unintentional home injuries included the age and personality of the child, migrant status, and housing tenure. Parental risk perception was significantly associated with children's sex. The number of children living in the household and household net income were identified as determinants for both unintentional home injuries and parent's risk perception. Furthermore, a discrepancy between parent's risk perception and actual risk factors of unintentional home injuries was found. **Conclusions:** Findings from this study strengthen the evidence base by demonstrating relevant determinants of unintentional home injuries of children and parent's risk perception. Since this study provides first evidence of a distorted parental risk perception, future research should focus on parental risk perception to assess it more accurately in interventions to prevent unintentional home injuries of children. **Practical Applications:** The present findings may inform health practitioners about which points they should address when interacting with parents. For instance, they should focus on raising parent's awareness of actual risk factors and discuss concrete behavioral or environmental safety precautions.