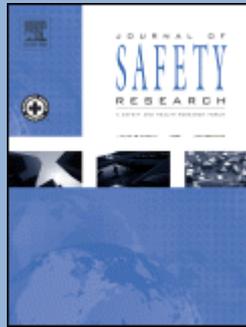


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Jose I. Castillo-Manzano, Mercedes Castro-Nuño, Xavier Fageda. *Analyzing the safety impact of longer and heavier vehicles circulating in the European market.* Pages 1-12.

Introduction: The European Union (EU) has developed different strategies to internalize the costs of excessive motor traffic in the road freight transport sector. One of these is a relaxation of restrictions on the size and load capacity of trucks that circulate between member States and a proposal has been made for Longer and Heavier Vehicles (LHVs) to be allowed to circulate across borders. LHVs are the so-called “megatrucks” (i.e., trucks with a length of 25 meters and a weight of 60 tonnes). Megatrucks have allowed to circulate for decades in some European countries such as Norway, Finland, and Sweden, world leaders in traffic accident prevention, although the impact that cross-border traffic would have on road safety is still unknown. **Methods:** This article provides an econometric analysis of the potential impact on road safety of allowing the circulation of “megatrucks” throughout the EU. **Results:** The findings show that countries that currently allow megatrucks to circulate present lower traffic accident and fatality levels, on average. **Conclusions:** The circulation of this type of vehicle is only advisable in countries where there is a certain degree of maturity and demonstrated achievements in the field of road safety. **Practical applications:** European countries that have allowed megatruck circulation obtaining better road safety outcomes in terms of accidents, although the accident lethality rate seems to be higher. Consequently, introducing megatruck circulation requires a prior proper preparation and examination.

- **Keywords:** Road accidents; Road fatalities; Freight transport; Longer and heavier vehicles; Megatrucks; Europe; Panel data

Carla L. MacLean, Itiel E. Dror. *The effect of contextual information on professional judgment: Reliability and biasability of expert workplace safety inspectors.* Pages 13-22.

Introduction: A critical aspect of occupational safety is workplace inspections by experts, in which hazards are identified. Scientific research demonstrates that expectation generated by context (i.e., prior knowledge and experience) can bias the judgments of professionals and that individuals are largely unaware when their judgments are affected by bias. **Method:** The current research tested the reliability and biasability of expert safety inspectors’ judgments. We used a two-study design (Study 1, N=83; Study 2, N=70) to explore the potential of contextual, task-irrelevant, information to bias professionals’ judgments. We examined three main issues: (1) the

effect that biasing background information (safe and unsafe company history) had on professional regulatory safety inspectors' judgments of a worksite; (2) the reliability of those judgments amongst safety inspectors and (3) inspectors' awareness of bias in their judgments and confidence in their performance. **Results:** Our findings establish that: (i) inspectors' judgments were biased by historical contextual information, (ii) they were not only biased, but the impact was implicit: they reported being unaware that it affected their judgments, and (iii) independent of our manipulations, inspectors were inconsistent with one another and the variations were not a product of experience. **Conclusion:** Our results are a replication of findings from a host of other professional domains, where honest, hardworking professionals underappreciate the biasing effect of context on their decision making. The current paper situates these findings within the relevant research on safety inspection, cognitive bias and decision making, as well as provides suggestions for bias mitigation in workplace safety inspection. **Practical Application:** Our results have implications for occupational health and safety given that inspection is an integral aspect of an effective safety system. In addition to our findings, this study contributes to the literature by providing recommendations regarding how to mitigate the effect of bias in inspection.

- **Keywords:** Bias; Safety inspection; Prevention inspection; Contextual effects; Workplace investigation

Donald L. Green. *A comparison of motorcycle instructor candidate selection practices in the United States. Pages 23-29.*

Introduction: An essential aspect of motorcycle rider education is how the instructor selection process impacts student learning, sometimes referred to as the human element, as it is a significant factor influencing curriculum success. Student and program achievements are partially contingent on instructors who understand the curriculum and facilitate student learning during instruction. Previous research on motorcycle rider education has emphasized a need for the examination of instructor selection and development, stating that quality education is reliant on instructors who are competent and qualified. **Method:** By applying an exploratory study method, state and military Motorcycle Safety Education Program Managers and Instructor Trainers were examined and compared through telephonic interviews to develop a greater understanding of instructor candidate selection criteria and vetting processes. **Results:** The results suggest that changes in instructor candidate selection systems may improve decisions about a candidate's job and organizational fit. **Conclusions:** Study conclusions indicate that use of multiple and thorough assessments to determine a candidate's motivation, social disposition, and emotional intelligence before preparation courses may better identify candidates and align potential job and organization fit within the discipline. **Practical Application:** Applications of the findings would include a standardized selection process with improved interviews and pre-course auditing, and candidate expectation management before the selection to attend preparation or certification courses. The efforts potentially decrease long-term costs and deficiencies when candidates have an inconsistent job or organizational fit, departing from organizations after short periods or by not providing consistent quality instruction to students. The study recommendations, when implemented, can improve most educational disciplines where instructors are selected for technical instructional positions where students risk injury or harm.

- **Keywords:** Rider; Education; Coaching; Safety; Transportation; Emotional intelligence; Human resources

Oluwaseun John Adeyemi. *Mobile phone use while driving: Development and validation of knowledge, attitude, and practice survey instruments.* Pages 30-39.

Introduction: Instruments that assess the knowledge, attitude, and practice (KAP) of mobile phone use serve as a primary assessment tool on which mobile phone distracted driving interventions can be designed. The objective of this study is to develop and validate KAP-modeled survey instruments that measure the knowledge of mobile phone hazards while driving (KMPHD), the attitude of drivers towards mobile phone use while driving (AMPUD), and the practice of mobile phone use while driving (PMPUD). **Method:** This study was a cross-sectional analytical survey conducted in Ibadan, Nigeria. Three instruments were designed to measure KMPHD, AMPUD, and PMPUD. Content validity, item analysis, exploratory factor analysis were conducted, and items were excluded based on the collective results of the analysis. The domains of the constructs and the reliability of the instruments are reported. A confirmatory factor analysis was used to assess the regression weights of each item and the model fit. **Results:** From an original list of 13, 12, and 10 items in the KMPHD, AMPUD, and PMPUD instruments, a final list of 7, 5, and 7 items were generated in each survey instrument, respectively. Two domains of the knowledge of hazards and practice of mobile phone use were obtained, and attitude to phone use while driving was a single domain. The reliabilities (Cronbach alpha) of the KMPHD (0.881), AMPUD (0.954), and PMPUD (0.920) were sufficiently high. Also, all items in the three instruments had moderate-to-high regression coefficients, and the model fits of the instruments were good. **Conclusions:** This study provides KAP-modeled survey instruments that can be used to assess a population-based knowledge, attitude, and practice of mobile phone use while driving. **Practical Applications:** This survey instrument can be used in assessing baseline knowledge, attitude, and practice of phone use while driving and determine the focus and effectiveness of mobile phone-induced distracted driving interventions.

- **Keywords:** Distracted driving; Road crashes; Mobile phone; Knowledge, attitude, and practice; Nigeria

John P.K. Bernstein, Tonya Rich, Stefanie McKnight, Julie Mehr, John Ferguson, Adriana Hughes. *On-road driving test performance in veterans: Effects of age, clinical diagnosis and cognitive measures.* Pages 40-45.

Introduction: Veterans are at heightened risk of being in a motor-vehicle crash and many fail on-road driving evaluations, particularly as they age. This may be due in part to the high prevalence of age-associated conditions impacting cognition in this population, including neurodegenerative diseases (e.g., Alzheimer's Disease) and acquired neurological conditions (e.g., cerebrovascular accident). However, understanding of the impact of referral diagnosis, age and cognition on Veterans' on-road driving performance is limited. **Methods:** 109 Veterans were referred for a driving evaluation (mean age = 72.0, SD = 11.5) at a driving assessment clinic at the Minneapolis Veterans Affairs Healthcare System. Of the 109 Veterans enrolled, 44 were referred due to a neurodegenerative disease, 37 due to an acquired neurological condition, and 28 due to a non-neurological condition (e.g., vision loss). Veterans completed collection of health history information and administration of cognitive tests assessing visual attention, processing speed, and executive functioning, as well as a standardized, on-road driving evaluation. **Results:** A total of 17.9% of Veterans failed the on-road evaluation. Clinical diagnostic group was not associated with failure rate. Age was not associated with failure rates in the full sample or within diagnostic groups. After controlling for age, poorer processing speed and selective/divided attention were associated with higher failure rates in the full sample. No cognitive tests were associated with failure rates within diagnostic groups. **Conclusion:** Referral diagnosis and age alone are not reliable predictors of

Veterans' driving performance. Cognitive performance, specifically speed of processing and attention, may be helpful in screening Veterans' driving safety. **Practical Applications:** Clinicians tasked with assessing Veterans' driving safety should take into account cognitive performance, particularly processing speed and attention, when making decisions regarding driving safety. Age and referral diagnosis, while helpful information, are insufficient to predict outcomes on driving evaluations.

- **Keywords:** Driving; Older adults; Cognition; Processing speed; Attention

Yunshuo Liu, Long Ye, Ming Guo. *Does formal mentoring impact safety performance? A study on Chinese high-speed rail operators.* Pages 46-55.

The importance of mentoring as a developmental resource in organizational settings is well documented. However, the mechanism underlying the association between formal mentoring and safety performance is not well defined. Based on the self-expansion theory, this study examines the relationship between formal mentoring and individual safety performance in the high-speed railway operation. We postulate that formal mentoring enhances individual safety performance through the sequential mediation of self-expansion and self-efficacy. We also argue that the relationship between formal mentoring and individuals' self-expansion is weaker when individuals possess high power distance orientation. Using paired data from 421 protégés and 102 mentors operating high-speed railways of China, we tested the proposed model. This study contributes to the understanding of formal mentoring by; i. establishing that formal mentoring positively relates to protégés' safety performance, ii. empirically validating the sequential mechanisms by which formal mentoring promotes positive outcomes for the organization and the employees, and iii. revealing the moderating effect of power distance orientation on the relationship between formal mentoring and self-expansion. The findings of this research provide practical implications for managers to understand the positive effects of formal mentoring and make rational use of it in safety-critical organizations.

- **Keywords:** Formal mentoring; Self-expansion; Self-efficacy; Safety performance; Power distance orientation

Jen Calver, Robert Balogh, David Rudoler. *Incidence of injury in children and adolescents with intellectual and developmental disability.* Pages 56-60.

Introduction: Children and adolescents living with intellectual and developmental disability (IDD) have a higher risk of experiencing morbidities and premature death when compared to children and adolescents living without IDD. Childhood injuries are a leading cause of morbidity and death, yet there are limited studies that explore the prevalence of childhood injuries for individuals living with IDD. The purpose of this study was to analyze Ontario health administrative data to identify and compare rates of injury resulting in hospitalization in children and adolescents living with and without IDD.

Methods: This is a cross-sectional study of all Ontarians aged 0–19 years with and without IDD. The outcome of interest was the rate of injury resulting in hospitalization.

Results: This study found that children and adolescents with IDD had 1.79 (CI 1.66, 1.92) times higher rates of both intentional and unintentional injuries that resulted in hospitalization when compared to children and adolescents without IDD. Hospitalizations for self-harm related injuries were 3.16 (CI 3.09, 3.23) times higher in the IDD group.

Conclusion: Children and adolescents with IDD have a higher risk of sustaining serious injuries, particularly injuries resulting from self-harm. **Practical Applications:** This study provides evidence of increased injury related hospitalizations for children and adolescents with IDD when compared to their peers without IDD.

- **Keywords:** Hospitalizations; Injury; Accidents; Fractures; Wounds; Disability

Nick Turner, Steve Granger, Sean Tucker, Connie Deng, E. Kevin Kelloway. *Parents' work injuries and children's mental health: The moderating role of children's work centrality. Pages 61-66.*

Introduction: The purpose of this study is to explore the relationship between parents' work-related injuries and their children's mental health, and whether children's work centrality – the extent to which a child believes work will play an important part in their life – exacerbates or buffers this relationship. **Method:** We argue that high work centrality can exacerbate the relationship between parental work injuries and children's mental health, with parental work injuries acting as identity-threatening stressors; in contrast, high work centrality may buffer this relationship, with parental work injuries acting as identity-confirming stressors. We test this relationship with a sample of Canadian children (N = 4,884, 46.2% female, M age = 13.67 years). **Results:** Children whose parents had experienced more frequent lost-time work-related injuries reported worse mental health with high work centrality buffering this negative relationship. **Conclusions:** Our study highlights the vicarious effects of work injuries on salient others, specifically parental work injuries on children's mental health, as well as the role of work centrality in shaping children's sense-making and expectations about the consequences of work.

- **Keywords:** Injuries; Mental health; Parents; Work centrality; Young workers

Eva Michelaraki, Christos Katrakazas, George Yannis, Ashleigh Filtness, Rachel Talbot, Graham Hancox, Fran Pilkington-Cheney, Kris Brijs, Veerle Ross, Hélène Dirix, An Neven, Roeland Paul, Tom Brijs, Petros Fortsakis, Eleni Konstantina Frantzola, Rodrigo Taveira. *Post-trip safety interventions: State-of-the-art, challenges, and practical implications. Pages 67-85.*

Introduction: Currently, risky driving behaviour is a major contributor to road crashes and as a result, wide array of tools have been developed in order to record and improve driving behaviour. Within that group of tools, interventions have been indicated to significantly enhance driving behaviour and road safety. This study critically reviews monitoring technologies that provide post-trip interventions, such as retrospective visual feedback, gamification, rewards or penalties, in order to inform an appropriate driver mentoring strategy delivered after each trip. **Method:** The work presented here is part of the European Commission H2020 i-DREAMS project. The reviewed platform characteristics were obtained through commercially available solutions as well as a comprehensive literature search in popular scientific databases, such as Scopus and Google Scholar. Focus was given on state-of-the-art-technologies for post-trip interventions utilized in four different transport modes (i.e. car, truck, bus and rail) associated with risk prevention and mitigation. **Results:** The synthesized results revealed that smartphone applications and web-based platforms are the most accepted, frequently and easiest to use tools in cars, buses and trucks across all papers considered, while limited evidence of post-trip interventions in -rail was found. The majority of smartphone applications detected mobile phone use and harsh events and provided individual performance scores, while in-vehicle systems provided delayed visual reports through a web-based platform. **Conclusions:** Gamification and appropriate rewards appeared to be effective solutions, as it was found that they keep drivers motivated in improving their driving skills, but it was clear that these cannot be performed in isolation and a combination with other strategies (i.e. driver coaching and support) might be beneficial. Nevertheless, as there is no holistic and cross-modal post-trip intervention solution developed in real-world environments, challenges associated with post-trip feedback provision and suggestions on practical implementation are also provided.

- **Keywords:** Post-trip interventions; State-of-the-art technologies; Smartphone applications; Monitoring platform; Transport modes

Paul Sârbescu, Andrei Rusu. *Personality predictors of speeding: Anger-Aggression and Impulsive-Sensation Seeking: a systematic review and meta-analysis. Pages 86-98.*

Introduction: The purpose of this review was to identify the most influential personality predictors of speeding. **Method:** Thus, this study analyzed the associations of Anger-Aggression and Impulsive-Sensation Seeking with Speeding. Research studies included in online databases and papers identified in previous reviews were considered for inclusion. **Results:** Using a random effects model, we found a small but significant effect for the relation between Anger-Aggression and Speeding ($r = 0.12$ [0.06–0.18], $Z = 3.85$, $p < 0.001$). We identified a significantly stronger effect for the relation between Impulsive-Sensation Seeking and Speeding, but still of low magnitude ($r = 0.23$ [0.16–0.29], $Z = 6.54$, $p < 0.001$). Moderator analysis revealed only one significant moderator: driver type. Namely, for professional drivers, the relation with Speeding was non-significant for both predictors ($r = -0.004$, $p = 0.958$ for Impulsive-Sensation Seeking and $r = 0.02$, $p = 0.720$ for Anger-Aggression, respectively) and significantly smaller than the associations for general population and young drivers. **Conclusions:** Overall, our results confirm Speeding's associations with both hypothesized most important predictors, but at a low magnitude.

- **Keywords:** Speeding; Systematic review; Anger-Aggression; Impulsive-Sensation Seeking; Meta-analysis

Julius Tikka, Philippe Lunetta. *Land-traffic crash leading to passenger vehicle submersion, drowning and other fatal injuries: A 44-year study based on records from the Finnish Crash Data Institute. Pages 99-104.*

Background: Land motor traffic crash (LMTc) -related drownings are an overlooked and preventable cause of injury death. The aim of this study was to analyze the profile of water-related LMTcs involving passenger cars and leading to drowning and fatal injuries in Finland, 1972 through 2015. **Materials and methods:** The database of the Finnish Crash Data Institute (FCDI) that gathers detailed information on fatal traffic accidents provided records on all LMTcs leading to drowning during the study period and, from 2002 to 2015, on all water-related LMTcs, regardless of the cause of death. For each crash, we considered variables on circumstances, vehicle, and fatality profiles. **Results:** During the study period, the FCDI investigated 225 water-related LMTcs resulting in 285 fatalities. The majority of crashes involved passenger cars (124), and the cause of death was mostly drowning (167). Only 61 (36.5%) fatalities suffered some—generally mild—injuries. The crashes frequently occurred during fall or summer (63.7%), in a river or ditch (60.5%), and resulted in complete vehicle's submersion (53.7 %). Half of the crashes occurred in adverse weather conditions and in over 40% of the cases, the driver had exceeded the speed limit. Among drivers, 77 (68.8%) tested positive for alcohol (mean BAC 1.8%). **Conclusion:** Multidisciplinary investigations of LMTcs have a much higher potential than do exclusive police and medico-legal investigations. The risk factors of water-related LMTcs are similar to those of other traffic crashes. However, generally the fatal event in water-related LMTc is not the crash itself, but drowning. The paucity of severe physical injuries suggests that victims' functional capacity is usually preserved during vehicle submersion. **Practical Applications:** In water-related LMTcs, expansion of safety measures is warranted from general traffic-injury prevention to prevention of drowning, including development of safety features for submerged vehicles and simple self-rescue protocols to escape from a sinking vehicle.

- **Keywords:** Road safety; Traffic accident; Prevention; Water; Immersion

Zichu Zhou, Fanyu Meng, Cancan Song, N.N. Sze, Zhongyin Guo, Nan Ouyang. *Investigating the uniqueness of crash injury severity in freeway tunnels: A comparative study in Guizhou, China. Pages 105-113.*

Introduction: With the rapid development of transportation infrastructures in precipitous areas, the mileage of freeway tunnels in China has been mounting during the past decade. Provided the semi-constrained space and the monotonous driving environment of freeway tunnels, safety concerns still remain. This study aims to investigate the uniqueness of the relationships between crash severity in freeway tunnels and various contributory factors. **Method:** The information of 10,081 crashes in the entire freeway network of Guizhou Province, China in 2018 is adopted, from which a subset of 591 crashes in tunnels is extracted. To address spatial variations across various road segments, a two-level binary logistic approach is applied to model crash severity in freeway tunnels. A similar model is also established for crash severity on general freeways as a benchmark. **Results:** The uniqueness of crash severity in tunnels mainly includes three aspects: (a) the road-segment-level effects are quantifiable with the environmental factors for crash severity in tunnels, but only exist in the random effects for general freeways; (b) tunnel has a significantly higher propensity to cause severe injury in a crash than other locations of a freeway; and (c) different influential factors and levels of contributions are found to crash severity in tunnels compared with on general freeways. Factors including speed limit, tunnel length, truck involvement, rear-end crash, rainy and foggy weather and sequential crash have positive contributions to crash severity in freeway tunnels. **Practical applications:** Policy implications for traffic control and management are advised to improve traffic safety level in freeway tunnels.

- **Keywords:** Crash injury severity; Freeway tunnel; Multilevel model; Unobserved heterogeneity; Road safety

Mehdi Hosseinpour, Tanja Kidholm Osmann Madsen, Anne Vingaard Olesen, Harry Lahrmann. *An in-depth analysis of self-reported cycling injuries in single and multiparty bicycle crashes in Denmark. Pages 114-124.*

Introduction: Cycling is one of the main forms of transportation in Denmark. However, while the number of traffic crash fatalities in the country has decreased over the past decade, the frequency of cyclists killed or seriously injured has increased. The high rate of serious injuries and fatalities associated with cycling emphasizes the increasing need for mitigating the severity of such crashes. **Method:** This study conducted an in-depth analysis of cyclist injury severity resulting from single and multiparty bicycle-involved crashes. Detailed information was collected using self-reporting data undertaken in Denmark for a 12-month period between 1 November 2012 and 31 October 2013. Separate multilevel logistic (MLL) regression models were applied to estimate cyclist injury severity for single and multiparty crashes. The goodness-of-fit measures favored the MLL models over the standard logistic models, capturing the intercorrelation among bicycle crashes that occurred in the same geographical area. **Results:** The results also showed that single bicycle-involved crashes resulted in more serious outcomes when compared to multiparty crashes. For both single and multiparty bicycle crash categories, non-urban areas were associated with more serious injury outcomes. For the single crashes, wet surface condition, autumn and summer seasons, evening and night periods, non-adverse weather conditions, cyclists aged between 45 and 64 years, male sex, riding for the purpose of work or educational activities, and bicycles with light turned-off were associated with severe injuries. For the multiparty crashes, intersections, bicycle paths, non-winter season, not being employed or retired, lower personal car ownership, and race bicycles were directly related to severe injury consequences. **Practical Applications:** The findings of this study demonstrated that the best way to promote

cycling safety is the combination of improving the design and maintenance of cycling facilities, encouraging safe cycling behavior, and intensifying enforcement efforts.

- **Keywords:** Bicycle crashes; Injury severity; Self-reported crashes; Crash type; Multilevel logistic model

Mouyid Islam. *The effect of motorcyclists' age on injury severities in single-motorcycle crashes with unobserved heterogeneity.* Pages 125-138.

Introduction: Due to the myriad of unique characteristics associated with motorcycle operation, motorcycle safety is a public health concern as complex as it is serious. National crash data suggest motorcyclists are 28 times more likely to be killed when compared to passenger car occupants. In the state of Florida, motorcycle crashes are 1.5 times more likely to result in the death of the rider, placing Florida among the top deadliest states for motorcyclists in the nation. Using police-reported data from 2016, this study addresses the complex and interconnected nature of the many characteristics associated with motorcycle operation by investigating the effect of age on motorcyclists' riding behavior as it relates to injury severity for single-motorcycle crashes in the state of Florida. **Method:** To account for unobserved heterogeneity in the crash data, mixed logit models with heterogeneity in means and variances were estimated to model three injury severity outcomes (non-visible, severe, and fatal) for three age groups (under 30, 30–49, and 50 and above). **Results:** Model results indicate that age affects motorcyclists' safety perception and ability to assess risks, thereby influencing their involvement in risky behaviors. Characteristics unique to motorcycle operation—spatial characteristics, speed, motorcycle type, time of day, helmet usage, alcohol consumption, ejection from motorcycle, passenger presence, endorsement status, and lighting—are further complicated by their dependency on the characteristics of the individual motorcyclist. Age of motorcyclist indicates a relationship between motorcyclists' behavior and perceived safety. **Conclusion:** The model results indicated that statistically significant parameters constituted different models and they were not equal across the age groups of motorcyclists: aged under 30, aged 30–49, and aged 50 and above. Through advanced econometric modeling, this study fills a gap in the existing literature and assists the safety professionals, motorcycle trainers, policymakers, law enforcement agencies, and roadway designers in developing countermeasures.

- **Keywords:** Motorcycle safety; Age groups; Injury severity; Mixed logit with heterogeneity in means and variances

Manal Tagod, A. Q. Adeleke, Taofeeq D. Moshood. *Coercive pressure as a moderator of organizational structure and risk management: Empirical evidence from Malaysian construction industry.* Pages 139-150.

Introduction: The construction industry in Malaysia has been bedevilled by myriads of risk issues that have hampered its smooth operations in recent times. This paper is an empirical assessment that aims to examine the effect of coercive pressure on the relationship between organizational structure and construction risk management among construction industry in Malaysia. **Method:** Based on the proposed model, a quantitative method was employed to obtain data from G7 construction industry operating within the peninsular Malaysia. Out of the 180 copies of questionnaire, 165 copies were properly filled, returned, and used for the analysis. PLS-SEM was used to analyze the obtained data. **Results:** The findings of the study affirmed that specialization, centralization, and management of risk by the construction industry had positive correlation. **Conclusions:** As anticipated, coercive pressure had positive moderating correlation with both formalization and the management of risk by the construction industry. Similarly, it was also found that in the course of carrying out construction activities, coercive pressure made significant interactive influence on formalization, specialization, and centralization.

Practical Applications: Coercive pressure reduced the frequency of accidents among workers in the process of carrying out construction works.

- **Keywords:** Coercive Pressure; Organizational Structure; Construction Risk Management; PLS-SEM; Partial Least Square; Malaysia

Aryan Hosseinzadeh, Amin Moeinaddini, Ali Ghasemzadeh. *Investigating factors affecting severity of large truck-involved crashes: Comparison of the SVM and random parameter logit model. Pages 151-160.*

Introduction: Reducing the severity of crashes is a top priority for safety researchers due to its impact on saving human lives. Because of safety concerns posed by large trucks and the high rate of fatal large truck-involved crashes, an exploration into large truck-involved crashes could help determine factors that are influential in crash severity. The current study focuses on large truck-involved crashes to predict influencing factors on crash injury severity. **Method:** Two techniques have been utilized: Random Parameter Binary Logit (RPBL) and Support Vector Machine (SVM). Models have been developed to estimate: (1) multivehicle (MV) truck-involved crashes, in which large truck drivers are at fault, (2) MV track-involved crashes, in which large truck drivers are not at fault and (3) and single-vehicle (SV) large truck crashes. **Results:** Fatigue and deviation to the left were found as the most important contributing factors that lead to fatal crashes when the large truck-driver is at fault. Outcomes show that there are differences among significant factors between RPBL and SVM. For instance, unsafe lane-changing was significant in all three categories in RPBL, but only SV large truck crashes in SVM. **Conclusions:** The outcomes showed the importance of the complementary approaches to incorporate both parametric RPBL and non-parametric SVM to identify the main contributing factors affecting the severity of large truck-involved crashes. Also, the results highlighted the importance of categorization based on the at-fault party. **Practical Applications:** Unrealistic schedules and expectations of trucking companies can cause excessive stress for the large truck drivers, which could leads to further neglect of their fatigue. Enacting and enforcing comprehensive regulations regarding large truck drivers' working schedules and direct and constant surveillance by authorities would significantly decrease large truck-involved crashes.

- **Keywords:** Crash injury severity; Large truck crashes; Support Vector Machine; Random parameter logit model; At-fault party; Unobserved heterogeneity

Carlos Roque, Mohammad Jalayer, Ahmed Sajid Hasan. *Investigation of injury severities in single-vehicle crashes in North Carolina using mixed logit models. Pages 161-169.*

Introduction: Roadway departure (RwD) crashes, comprising run-off-road (ROR) and cross-median/centerline head-on collisions, are one of the most lethal crash types. According to the FHWA, between 2015 and 2017, an average of 52 percent of motor vehicle traffic fatalities occurred each year due to roadway departure crashes. An avoidance maneuver, inattention or fatigue, or traveling too fast with respect to weather or geometric road conditions are among the most common reasons a driver leaves the travel lane. Roadway and roadside geometric design features such as clear zones play a significant role in whether human error results in a crash. **Method:** In this paper, we used mixed-logit models to investigate the contributing factors on injury severity of single-vehicle ROR crashes. To that end, we obtained five years' (2010–2014) of crash data related to roadway departures (i.e., overturn and fixed-object crashes) from the Federal Highway Administration's Highway Safety Information System Database. **Results:** The results indicate that factors such as driver conditions (e.g., age), environmental conditions (e.g., weather conditions), roadway geometric design features (e.g., shoulder width), and vehicle conditions significantly contributed to the severity of ROR crashes. **Conclusions:** Our results provide valuable information for traffic design

and management agencies to improve roadside design policies and implementing appropriately forgiving roadsides for errant vehicles. **Practical applications:** Our results show that increasing shoulder width and keeping fences at the road can reduce ROR crash severity significantly. Also, increasing road friction by innovative materials and raising awareness campaigns for careful driving at daylight can decrease the ROR crash severity.

- **Keywords:** Roadway departure; Run-off-road; Mixed logit model; Crash severity model

Grégoire S. Larue, Christopher N. Watling, Alexander Black, Joanne M. Wood. *Improving the safety of distracted pedestrians with in-ground flashing lights. A railway crossing field study. Pages 170-181.*

Introduction: Current signage at intersections is designed for attentive pedestrians who are looking ahead. Such signage may not be sufficient when distracted by smartphones. Illuminated in-ground LED lights at crossings are an innovative solution to alert distracted pedestrians. **Method:** We conducted a field study at a railway crossing equipped with in-ground lights to assess whether distracted pedestrians (N = 34, Mean age 33.6 ± 8.6 years) could detect these lights and how this impacted on their visual scanning and crossing behaviour. This involved a 2×3 repeated measures design exploring the impact of the presence (treatment) or absence (control) of in-ground lights (treatment) at a crossing, and a distractor task presented through a mobile device (none, visual, and audio) on eye movements recorded using an eye tracker, and verbal reporting of when participants detected the lights. **Results:** Participants engaged in the distraction tasks as evidenced by their accuracy and reaction times in all conditions. With both the audio and visual distraction tasks, participants looked at the in-ground LEDs and detected their activation as accurately as when not distracted (95%). While most participants detected the lights at their activation, visual distraction resulted in 10% of the detections occurring as participants entered the rail corridor, suggesting effectiveness in gaining pedestrians' attention. Further, participants were significantly less likely to check for trains when visually distracted (70%), a 10% reduction compared to the no or audio distractor conditions (80% and 78% respectively). The introduction of the in-ground lights resulted in appropriate scanning of the rail tracks (77% and 78% for the visual and auditory distractor tasks respectively) similar to that of non-distracted participants for the crossing without lights (80%). **Conclusions:** Our findings indicate that illuminated in-ground lights could be useful in attracting the attention of distracted pedestrians at railway level crossings, and possibly at other road intersections. **Practical Applications:** Illuminated in-ground lights can be installed at rail and road intersections with known pedestrian distraction as a countermeasure. Further research is necessary to understand their long-term effects.

- **Keywords:** Distraction; Vulnerable road user; Mobile device; Road intervention; Crossing

Kari Kjestveit, Oddfrid Aas, Kari Anne Holte. *Occupational injury rates among Norwegian farmers: A sociotechnical perspective. Pages 182-195.*

Introduction: This study addressed relative injury risk among Norwegian farmers, who are mostly self-employed and run small farm enterprises. The aim was to explore the relative importance of individual, enterprise, and work environment risks for occupational injury and to discuss the latent conditions for injuries using sociotechnical system theory. **Method:** Injury report and risk factors were collected through a survey among Norwegian farm owners in November 2012. The response rate was 40% (n = 2,967). Annual work hours were used to calculate injury rates within groups. Poisson regression using the log of hours worked as the offset variable allowed for the modeling of adjusted rate ratios for variables predictive of injury risk. Finally, safety climate measures were

introduced to assess potential moderating effects on risk. **Results:** Results showed that the most important risk factors for injuries were the design of the workplace, type of production, and off-farm work hours. The main results remained unchanged when adding safety climate measures, but the measures moderated the injury risk for categories of predominant production and increased the risk for farmers working with family members and/or employees. An overall finding is how the risk factors were interrelated. **Conclusions:** The study identified large structural diversities within and between groups of farmers. The study drew attention to operating conditions rather than individual characteristics. The farmer's role (managerial responsibility) versus regulation and safety climate is important for discussions of injury risk. **Practical Applications:** We need to study sub-groups to understand how regulation and structural changes affect work conditions and management within different work systems, conditioned by production. It is important to encourage actors in the political-economic system to become involved in issues that were found to affect the safety of farmers.

- **Keywords:** Agriculture; Injury risk; Sociotechnical system theory; Small enterprises; Safety; Climate

Alex A. Black, Vu Bui, Emily Henry, Khuong Ho, Diana Pham, Tuyen Tran, Joanne M. Wood. *Using retro-reflective cloth to enhance drivers' judgment of pedestrian walking direction at night-time.* Pages 196-201.

Purpose: Fatal pedestrian collisions are over-represented at night and poor conspicuity is believed to be a leading causative factor. Retro-reflective clothing enhances pedestrian conspicuity, particularly when placed in a biological motion or "biomotion" configuration. In this study, we explored how various retro-reflective clothing configurations affected the ability to judge the direction of a pedestrian walking across the road, which has important implications for collision avoidance. **Methods:** Participants included 21 young drivers (mean age 21.6 ± 2.0 years) with normal vision. A closed-road circuit was used to assess the accuracy of drivers' judgement of the direction of walking of a pedestrian at night-time wearing one of five different clothing configurations: four with retro-reflective materials placed in different locations (Biomotion, Legs + Torso, Torso Only, Legs Only), and a control wearing only black clothing (Street). Participants were seated in a stationary vehicle with low beam headlamps, 135m from a pedestrian, who walked across the road from both sides, in different directions (towards the car, straight across the road, or away from the car). Outcome measures included drivers' response accuracy and confidence ratings for judging pedestrian walking direction. **Results:** Accuracy in judging pedestrian walking direction differed significantly across the clothing configurations ($p < 0.001$). Response accuracy was significantly higher for the Biomotion configuration (80% correct), compared to the other retro-reflective (Legs + Torso 64%; Torso Only 53%; Legs Only 50%) and Street configurations (33%). Similar trends were noted for confidence ratings across the clothing conditions, yet the relationship between confidence ratings and response accuracy within each clothing configurations was poor. **Conclusions:** The use of retro-reflective clothing in a biomotion configuration facilitated the highest accuracy and confidence in drivers' judgment of pedestrian walking direction, compared to other configurations. These findings highlight the importance of using biomotion clothing for pedestrians at night, to not only facilitate drivers' earlier recognition of pedestrians, but also increase their accuracy in determining the walking direction of pedestrians as they cross the road. **Practical applications:** The use of clothing incorporating retro-reflective material in a biomotion configuration for pedestrians crossing roads at night provides enhanced cues for drivers regarding the presence and walking direction of pedestrians.

- **Keywords:** Pedestrian safety; Night-time visibility; Biological motion; Retro-reflective material

Lucas Tito Pereira Sobreira, Flávio Cunto. *Disaggregated traffic conditions and road crashes in urban signalized intersections. Pages 202-211.*

Introduction: Road safety studies in signalized intersections have been performed extensively using annually aggregated traffic variables and crash frequencies. However, this type of aggregation reduces the strength of the results if variables that oscillate over the course of the day are considered (speed, traffic flow, signal cycle length) because average indicators are not able to describe the traffic conditions preceding the crash occurrence. This study aims to explore the relationship between traffic conditions aggregated in 15-min intervals and road crashes in urban signalized intersections.

Method: First, an investigation of the reported crash times in the database was conducted to obtain the association between crashes and their precursor conditions. Then, 4.1 M traffic condition intervals were consolidated and grouped using a hierarchical clustering technique. Finally, charts of the frequency of crashes per cluster were explored. **Results:** The main findings suggest that high vehicular demand conditions are related to an increase in property damage only (PDO) crashes, and an increase in the number of lanes is linked to more PDO and injury crashes. Injury crashes occurred in a wide range of traffic conditions, indicating that a portion of these crashes were due to speeding, while the other fraction was associated with the vulnerability of road users. Traffic conditions with: (a) low vehicular demand and a long cycle length and (b) high vehicular demand and a short cycle length were critical in terms of PDO and injury crashes. **Practical Applications:** The use of disaggregated data allowed for a stronger evaluation of the relationship between road crashes and variables that oscillate over the course of the day. This approach also permits the development of real-time risk management strategies to mitigate the frequency of critical traffic conditions and reduce the likelihood of crashes.

- **Keywords:** Road safety; Condition based; Clustering; Signal cycle length; SCOOT

Sivana Barron, Carolyne Falank, Julianne Ontengco, Bruce Chung, Damien W. Carter. *Severity and patterns of injury in helmeted vs. non-helmeted motorcyclists in a rural state. Pages 212-216.*

Introduction: Under current law in our rural state, there is no universal requirement for motorcyclists to wear helmets. Roughly 500 motorcycle crashes are reported by the state each year and only a fraction of those riders wear helmets. We sought to determine the difference in injury patterns and severity in helmeted versus non-helmeted riders.

Methods: Retrospective review (2014–2018) of a single level 1 trauma center's registry was done for subjects admitted after a motorcycle collision. Demographic, injury and patient outcome data were collected. Patients were stratified by helmet use (n = 81), no helmet use (n = 144), and unknown helmet use (n = 194). Statistical analysis used Student's t-test or Pearson's χ^2 p-value ≤ 0.05 as significant. State Department of Transportation data registry for state level mortality and collision incidence over the same time period was also obtained. **Results:** Of the 2,022 state-reported motorcycle collisions, 419 individuals admitted to our trauma center were analyzed (21% capture). State-reported field fatality rate regardless of helmet use was 4%. Our inpatient mortality rate was 2% with no differences between helmet uses. Helmeted riders were found to have significantly fewer head and face injuries, higher GCS, lower face, neck, thorax and abdomen AIS, fewer required mechanical ventilation, shorter ICU length of stay, and had a greater number of upper extremity injuries and higher upper extremity AIS. **Conclusions:** Helmeted motorcyclists have fewer head, face, and cervical spine injuries, and lower injury severities: GCS and face, neck, thorax, abdomen AIS. Helmeted riders had significantly less mechanical ventilation requirement and shorter ICU stays. Non-helmeted riders sustained worse injuries. **Practical Applications:** Helmets provide safety and motorcycle riders have a 34-fold higher risk of death following a

crash. Evaluating injury severities and patterns in motorcycle crash victims in a rural state with no helmet laws may provide insight into changing current legislation.

- **Keywords:** Motorcycle; Helmet; Protection; Injury; Safety

Nitesh R. Shah, Sameer Aryal, Yi Wen, Christopher R. Cherry. *Comparison of motor vehicle-involved e-scooter and bicycle crashes using standardized crash typology. Pages 217-228.*

Introduction: The market share of e-scooters in the United States has proliferated in cities: 86 million trips were made on shared e-scooters in 2019, a more than 100% increase compared to 2018. However, the interaction of e-scooters with other road users and infrastructure remains uncertain. **Method:** This study scrutinized 52 e-scooter and 79 bicycle police-reported crashes in Nashville, Tennessee, from April 2018 to April 2020 from the Tennessee Integrated Traffic Analysis Network (TITAN) database. We used descriptive analysis and a recent prototype version of the Pedestrian and Bicycle Crash Analysis Tool (PBCAT) to classify crashes based on the locations of the crashes relative to roadway segments or intersections, as well as the maneuver of the motor vehicle and e-scooter/bicycle relative to the motor vehicle. **Results:** Two crash typologies can explain the majority of e-scooter crashes, while bicycle crashes are distributed over several crash typologies. Additionally, 1 in 10 e-scooter- and bicycle-motor vehicle crashes leads to the injury or fatality of the e-scooter rider or bicyclist. Furthermore, we noted statistically significant differences in spatial and temporal distribution, demographics, lighting conditions, and crash distance from home for e-scooter and bicycle crashes. **Conclusions:** The police crash report provides a comprehensive picture of e-scooter safety complementing existing literature. We found that e-scooter crash characteristics do not fully overlap with features of bicycle crashes. Practical Implications: A generalized engineering, education, and enforcement treatment to reduce and prevent e-scooter and bicycle crashes, injuries, and fatalities might not result in equal outcomes for each mode. More rigorous enforcement could be implemented to deter e-scooters riders under the age of 18 years and e-scooter safety campaigns could target female riders.

- **Keywords:** e-scooter; Bicycle; PBCAT crash typology; Micromobility; Safety

Jun Liu, Steven Jones, Emmanuel Kofi Adanu, Xiaobing Li. *Behavioral pathways in bicycle-motor vehicle crashes: From contributing factors, pre-crash actions, to injury severities. Pages 229-240.*

Introduction: This study performed a path analysis to uncover the behavioral pathways (from contributing factors, pre-crash actions to injury severities) in bicycle-motor vehicle crashes. **Method:** The analysis investigated more than 7,000 bicycle-motor vehicle crashes in North Carolina between 2007 and 2014. Pre-crash actions discussed in this study are actions of cyclists and motorists prior to the event of a crash, including "bicyclist failed to yield," "motorist failed to yield," "bicyclist overtaking motorist," and "motorist overtaking bicyclist." **Results:** Model results show significant correlates of pre-crash actions and bicyclist injury severity. For example, young bicyclists (18 years old or younger) are 23.5% more likely to fail to yield to motor traffic prior to the event of a crash than elder bicyclists. The "bicyclist failed to yield" action is associated with increased bicyclist injury severity than other actions, as this behavior is associated with an increase of 5.88 percentage points in probability of a bicyclist being at least evidently injured. The path analysis can highlight contributing factors related to risky pre-crash actions that lead to severe injuries. For example, bicyclists traveling on regular vehicle travel lanes are found to be more likely to involve the "bicyclist failed to yield" action, which resulted in a total 44.38% (7.04% direct effect + 37.34% indirect effect) higher likelihood of evident or severe injuries. The path analysis can also identify factors (e.g., intersection) that are not directly but indirectly correlated with injury severity through pre-crash actions. **Practical Applications:** This study offers a methodological framework

to quantify the behavioral pathways in bicycle-motor vehicle crashes. The findings are useful for cycling safety improvements from the perspective of bicyclist behavior, such as the educational program for cyclists.

- **Keywords:** Bicycle-motor vehicle crash; Behavioral pathway; Pre-crash action; Path analysis; Marginal effects

Liu Yang, Adam Branscum, Viktor Bovbjerg, Curtis Cude, Crystal Weston, Laurel Kincl. *Assessing disabling and non-disabling injuries and illnesses using accepted workers compensation claims data to prioritize industries of high risk for Oregon young workers. Pages 241-254.*

Introduction: Young workers are especially vulnerable to occupational injuries and illnesses. There is a continued need to investigate injury burden among young workers across demographics and industry to inform targeted interventions. Workers compensation (WC) claims are important for quantifying work-related injuries and illnesses, however published studies have focused on disabling claims. This study extended previous research on Oregon young workers by including the most recent WC claims data to identify patterns of injury and high risk industries. **Methods:** We obtained all accepted disabling claims (N=13,360) and a significant portion of non-disabling claims (N=24,660) on workers aged 24 years and under from 2013 to 2018. Claim count, rate and cost were calculated by year, age, gender, industry, and injury type. A prevention index (PI) method was used to rank industries in order to inform prevention efforts. **Results:** Average annual disabling and non-disabling claim rates were 111.6 and 401.3 per 10,000 young workers. Workers aged 19–21 (disabling: 119.0 per 10,000 and non-disabling: 429.3) and 22–24 years (115.7 and 396.4) and male workers (145.3 and 509.0) had higher claim rates than workers aged 14–18 (80.6 and 297.0) and female workers (79.8 and 282.9). The most frequent injury types were “struck by/against” (35.6%) and “work-related musculoskeletal disorders (WMSDs)” (19.5%). High risk industries included agriculture, construction, and manufacturing for both genders combined. For female young workers, the highest risk industry was healthcare. **Conclusions:** This study demonstrated the added value of non-disabling WC claims data. Using both disabling and non-disabling data and PI method, agriculture, construction, manufacturing and healthcare industries were identified as priority workplaces to prevent common and costly injuries among Oregon young workers. **Practical Applications:** While the industries identified are considered hazardous for all workers, findings in this study can guide targeted research and prevention efforts specific to young workers.

- **Keywords:** Young workers; Workers’ compensation; Disabling claims; Non-disabling claims; Work-related injury and illness

Sungwon Kim, Daniel P. Connaughton. *Soccer, concussions, and safety: Perceptions of parents of youth soccer participants. Pages 255-262.*

Introduction: The rate of concussions in youth soccer is among the highest of all youth sports. Parents play an important role in caring for their children and making decisions regarding whether they should participate in a sport, such as soccer, where concussions are well known. This study examined parental perceptions regarding: (a) coaches’ role in concussion management, (b) heading restriction policies, and (c) overall concussion risk and participation issues. **Method:** Online surveys were completed by 419 parents of youth soccer players who participated in the largest U.S. youth soccer programs nationwide. **Results:** Findings indicated 44.5% of the respondents had considered keeping their children from playing organized soccer and 47.2% were concerned about a potential decline in youth soccer participation due to concussions. Nearly 69% of responding parents agreed that heading should be banned for participants 10 years old or younger, while 56.5% thought heading should not be limited for participants 13 or older. Only 35% of parents were very confident about their child’s coach’s ability to properly

identify concussions and remove those suspected of a concussion from play. Parents' socioeconomic status (SES), soccer coaching and playing experience, and previous history of concussion(s) were key predictors of greater perceived risk about concussions. **Conclusions:** Findings from this study shed light on parents' perceptions about concussions and related safety issues in youth soccer. Understanding what parents believe about concussions is vital to preserve youth soccer participation and can be used to strengthen education and policies that promote a safer environment for youth sport participants. **Practical Applications:** Youth soccer coaches can benefit from stronger, comprehensive educational efforts at the league/club level. Additionally, parents of youth athletes who are in the lower SES communities should be targeted to receive concussion safety information and/or interventions that would improve their knowledge, attitude, and practices regarding concussion safety.

- **Keywords:** Attitudes; Injury prevention; Youth sport; Head injury; Coaches; Heading

Rebecca A. Weast, Samuel S. Monfort. *Characteristics of vehicles driven by teens and adults killed in crashes, 2013–2017. Pages 263–267.*

Introduction: Teen drivers experience higher crash risk than their experienced adult counterparts. Legislative and community outreach methods have attempted to reduce this risk; results have been mixed. The increasing presence of vehicle safety features across the fleet has driven fatality numbers down in the past decades, but the disparity between young drivers and others remains. **Method:** We merged Fatality Analysis Reporting System (FARS) data on fatal crashes with vehicle characteristic data from the Highway Loss Data Institute (HLDI). The analysis compared the vehicle type, size, age, and the presence of select safety features in vehicles driven by teens (ages 15–17 years) and adult drivers (ages 35–50 years) who were killed in crashes from 2013 to 2017. Results were compared with a similar analysis conducted on data from 2007 to 2012. **Results:** Teen drivers were more likely than their adult counterparts to be killed while driving older, smaller vehicles that were less likely to have the option to be equipped with side airbags. **Discussion:** Teenage drivers remain more likely to be killed while driving older, smaller vehicles than adult drivers. Parents and guardians are mainly responsible for teen vehicle choice, and should keep vehicle size, weight, and safety features in mind when placing their teen in a vehicle. **Practical Application:** These findings can help guide safer vehicle choice for new teen drivers.

- **Keywords:** Vehicle characteristics; Fatality statistics; Teen drivers

Michel Héry, Marc Malenfer, Stéphanie Devel, Catherine Levert. *Evolution of working conditions under the impact of ICTs. Pages 268–276.*

Introduction: Information and communication technologies (ICTs) play a major role in the current evolution of work. They are both a great tool for emancipating human beings from the most tedious and most dangerous tasks and an effective vector for intensifying work. **Methods:** On the basis of three foresight exercises carried out in recent years and by describing concrete examples of work organizations, the authors highlight the main possible trends for the changes to come. **Conclusions:** They conclude on a few general principles that could allow the establishment of a win-win policy.

- **Keywords:** Information and communication technologies; Health and safety; Automation; Robots – Work

Juan Carlos Aldasoro, María Luisa Cantonnet. *The management of the new and emerging musculoskeletal and psychosocial risks by EU-28 enterprises. Pages 277-287.*

Introduction: Although the strategic framework of the European Union in the field of Health and Safety at Work 2014-2020 considers as one of its main challenges to improve the prevention of diseases related to NERs (New and Emerging Risks) (European Commission, 2014) there are still not many studies in the literature related to them.

Method: An exploratory study was carried out in order to get a picture of the NERs management in the UE-28 countries. The sample was extracted from the ESENER-2 datasets. ESENER-1 was carried out in 2009 and ESENER- 2 in 2014. This survey explores managers' and workers representatives' opinions on health and safety management. It surveyed over 49,000 enterprises in 36 countries. **Results:** The results obtained confirm that there are significant differences between the EU-28 countries in terms of the identification and the management of NERs. Conclusions NERs are becoming an increasingly studied phenomenon due to the changes that are taking place in the labour market: the percentage of temporary workers is increasing, the demands to the workers due to the globalization of the market are more complex and all this with an aging working force. **Practical Applications:** It would be necessary to rethink the management of OHS, so that managers are aware that the combination of musculoskeletal and psychosocial risks should have a global approach in order to reduce accident and disability rates.

- **Keywords:** New and emerging risks; Musculoskeletal; Pshychosocial

Aimee E. Cox, Jessica B. Cicchino. *Continued trends in older driver crash involvement rates in the United States: Data through 2017–2018. Pages 288-295.*

Introduction: With the growing older adult population due to the aging baby-boom cohort, there was concern that increases in fatal motor-vehicle crashes would follow. Yet, previous analyses showed this to be untrue. The purpose of this study was to examine current trends to determine if previous declines have persisted or risen with the recent increase in fatalities nationwide. **Methods:** Trends among drivers ages 70 and older were compared with drivers 35–54 for U.S. passenger vehicle fatal crash involvements per 100,000 licensed drivers from 1997 to 2018, fatal and all police-reported crash involvements per vehicle miles traveled using the 1995, 2001, 2009, and 2017 National Household Travel Surveys, and driver deaths per 1,000 crashes. **Results:** Since the mid-1990s, fatal crashes per licensed driver trended downward, with greater declines for drivers ages 70 and older than for middle-aged drivers (43% vs. 21%). Fatal crash rates per 100,000 licensed drivers and police-reported crash rates per mile traveled for drivers ages 70–79 are now less than those for drivers ages 35–54, but their fatal crash rates per mile traveled and risk of dying in a crash remain higher as they drive fewer miles. As the economy improved over the past decade, fatal crash rates increased substantially for middle-aged drivers but decreased or remained stable among older driver age groups.

Conclusions: Fatal crash involvements for adults ages 70 and older has recently increased, but they remain down from their 1997 peak, even as the number of licensed older drivers and the miles they drive have increased. Health improvements likely contributed to long-term reductions in fatal crash rates. As older drivers adopt vehicles with improved crashworthiness and safety features, crash survivability will improve.

Practical Application: Older adults should feel confident that their independent mobility needs pose less risk than previously expected.

- **Keywords:** Aging; Fatal crash trends; Crash survivability; Police-reported crash trends; Motor vehicle travel

Franziska Homann, Caroline Limbert, Simon Matthews, Darren Castaldi, Peter Sykes. *Identifying management practices that drive production-line workers' engagement through qualitative analysis.* Pages 296-310.

Introduction: Engagement research - most often defined by a worker's psychological state of vigor, dedication, and absorption - pays little attention to production-line workers. This study therefore explores factors that drive workers' engagement with health and safety (H&S) in a production-line context as well as their perception of managerial influence. Furthermore, the study adds to the body of research by exploring H&S engagement concepts through the use of qualitative research methods. **Method:** 38 semi-structured interviews were conducted and analyzed through template analysis to identify themes that promote and hinder engagement. **Results:** The main engagement drivers were found to be: (a) the displayed safety focus of the company in organizational and social aspects; (b) the quality of the communication approach with respect to quality, consistency and direction; and (c) the environment encompassing the relationship between workers and supervisors and peers as well as the psychological environment. Notably, a trusting relationship between supervisors and workers appeared to be the most influential driver in determining engaged H&S behavior. Discussion and impact in industry: The study highlights factors that could be adapted to improve engagement and consequently enhance H&S approaches. Originality: The study reported in this paper offers a unique insight into individual production workers' perceived drivers of H&S engagement using Qualitative Analysis. **Practical applications:** The study identified the important role that supervisors play in workers' H&S engagement levels and what skills they need to employ to enhance workers' engagement in general and in the context of H&S behavior and performance. Furthermore, the importance of psychological and sociological factors in safety approaches are highlighted and were found to be key for creating safer workplaces.

- **Keywords:** Work engagement; Safety; Promoting and hindering factors; Manufacturing; Management skills; Qualitative research

Joshua Stipancic, Paul G. St-Aubin, Bismarck Ledezma-Navarro, Aurélie Labbe, Nicolas Saunier, Luis Miranda-Moreno. *Evaluating safety-influencing factors at stop-controlled intersections using automated video analysis.* Pages 311-323.

Introduction: Although stop signs are popular in North America, they have become controversial in cities like Montreal, Canada where they are often installed to reduce vehicular speeds and improve pedestrian safety despite limited evidence demonstrating their effectiveness. The purpose of this study is to evaluate the impact of stop-control configuration (and other features) on safety using statistical models and surrogate measures of safety (SMoS), namely vehicle speed, time-to-collision (TTC), and post-encroachment time (PET), while controlling for features of traffic, geometry, and built environment. **Methods:** This project leverages high-resolution user trajectories extracted from video data collected for 100 intersections, 336 approaches, and 130,000 road users in Montreal to develop linear mixed-effects regression models to account for within-site and within-approach correlations. This research proposes the Intersection Exposure Group (IEG) indicator, an original method for classifying microscopic exposure of pedestrians and vehicles. **Results:** Stop signs were associated with an average decrease in approach speed of 17.2 km/h and 20.1 km/h, at partially and fully stop-controlled respectively. Cyclist or pedestrian presence also significantly lower vehicle speeds. The proposed IEG measure was shown to successfully distinguish various types of pedestrian-vehicle interactions, allowing for the effect of each interaction type to vary in the model. **Conclusions:** The presence of stop signs significantly reduced approach speeds compared to uncontrolled approaches. Though several covariates were significantly related to TTC and PET for vehicle pairs, the models were unable to demonstrate a

significant relationship between stop signs and vehicle–pedestrian interactions. Therefore, drawing conclusions regarding pedestrian safety is difficult. **Practical Applications:** As pedestrian safety is frequently used to justify new stop sign installations, this result has important policy implications. Policies implementing stop signs to reduce pedestrian crashes may be less effective than other interventions. Enforcement and education efforts, along with geometric design considerations, should accompany any changes in traffic control.

- **Keywords:** Traffic control; Stop signs; Computer vision; Pedestrians; Surrogate safety; Regression models

Kari Cruz, Angela Deokar, Sara J. Feldman, Holly Patrick. *Special Report from the CDC: Readiness to surge: State health departments' workforce infrastructure during the opioid crisis. Pages 324-327.*

Introduction: As part of scaling up the response to the opioid overdose epidemic, there is an opportunity to examine how state public health departments addressed workforce and other infrastructure needs to implement a large-scale opioid overdose prevention program. Understanding how this was done—and any lessons learned from the process—can inform future workforce development and capital improvement efforts. **Methods:** Administrative data from the Centers for Disease Control and Prevention (CDC) Prescription Drug Overdose Prevention for States (PfS) program were analyzed to understand how states adapted to this emerging public health priority. **Results:** Six months into the first year of funding, 6 of the 16 state health departments had filled all anticipated staffing positions. States faced challenges obtaining timely expenditure authority and hiring staff. However, states were able to overcome these challenges by strategically reassigning staff, hiring from within, and utilizing existing contract mechanisms. **Conclusion:** Our analysis revealed how planning, using existing infrastructure, and maintaining a prepared workforce are critical to ensure that public health agencies have the ability to surge to meet emerging challenges and effectively utilize resources to achieve program goals. **practical applications:** Greater attention should be directed toward strategically addressing known barriers and timelines in work plans and budgets during the application and selection process to ensure implementation readiness.

- **Keywords:** Prevention for States; Prescription drug overdose; Public health infrastructure; State health departments

Martevia Bledsoe, Alexis Captanian, Alisha Somji. *Special Report from the CDC: Strengthening social connections to prevent suicide and adverse childhood experiences (ACEs): Actions and opportunities during the COVID-19 pandemic. Pages 328-333.*

Introduction: During this time of intensified hardship and disruption due to the SARS-CoV-2 (COVID-19) pandemic, communities, practitioners, and state and local governments have had to rapidly implement and adapt strategies that support mental health and wellbeing during a global pandemic. Prior to the COVID-19 pandemic, suicide was the 10th leading cause of death in the United States, and at least half of the top 10 leading causes of death have been associated with adverse childhood experiences (ACEs). A number of established risk factors for suicide and ACEs may have been exacerbated by the pandemic, including loneliness and lack of connectedness. **Method:** This article briefly considers the effects of COVID-19 on social connection and outlines the importance of adapting and developing programming and resources that address suicide and ACEs prevention during a time of infrastructure disruption. **Practical Applications:** The COVID-19 pandemic has affected the ways that many individuals are able to safely interact and socially connect due to public health prevention strategies

implemented to slow the spread of COVID-19. Local, city, and state government, community organizations, and public health and medical practitioners should consider the adaptation and development of existing and new programming, resources, and activities that support and strengthen social connection. In addition to implementing programs, policies may help address systemic and structural barriers to social connection, such as access to parks and open space, public transportation, or digital connectivity.

- **Keywords:** Loneliness; Isolation; Connectedness; Coronavirus; Mental health; Wellbeing