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Marzieh Hadavi, Zohreh Ghomian, Farhad Mohammadi, Ali sahebi. ***Workplace violence against health care workers during the COVID-19 Pandemic: A systematic review and meta-analysis*****. Pages 1-7.**

Introduction: During the COVID-19 pandemic, Health Care Workers (HCWs) have been at the frontline against the disease and have direct contact with patients and their companions, so they are exposed to all sorts of Workplace Violence (WPV). The aim of this study was to investigate the prevalence of WPV against HCWs during the COVID-19 pandemic. **Method:** This study was conducted according to the PRISMA guideline, and its protocol was registered at the PROSPERO under the code of CRD42021285558. Articles were obtained from data resources such as Scopus, PubMed, Web of Science, Science Direct, Google Scholar, and Embase. A literature search was conducted from the beginning of 2020 to the end of December 2021. Meta-analysis was conducted using the Random effects model, and the I2 index was used to check the heterogeneity. **Results:** In this study, 1,054 articles were initially obtained during the primary search, of which 13 were finally entered in the meta-analysis. According to the results of the meta-analysis, the prevalence of physical and verbal WPV were 10.75% (95% CI: 8.20–13.30, I2 = 97.8%, P = 0 < 001) and 45.87% (95% CI: 36.8–54.93, I2 = 99.6%, P = 0 < 001), respectively. The overall prevalence of WPV was obtained, 45.80% (95% CI: 34.65–56.94, I2 = 99.8%, P = 0 < 001) were reported. Conclusion: The results of the present study showed that the prevalence of WPV against HCWs was relatively high during the COVID-19 pandemic; nevertheless, it was lower compared to the area prior to the pandemic. Therefore, HCWs need essential training to reduce stress and increase resilience. Also, considering organizational interventions (including policies to ensure that HCWs report WPV to their supervisors, increasing staffing per patient, and installing systems for HCWs to call for immediate assistance) can increase the resilience HCWs.

- **Keywords:** Workplace Violence; Aggression; Violence; COVID-19Pandemic; Healthcare Worker; Healthcare Provider

Huarong Wang, Fen Su, David C. Schwebel. *Mobile phone use while cycling among e-bikers in China: Reasoned or social reactive?* Pages 8-14.

Introduction: China has the largest number of e-bikers in the world, and e-bike crashes cause thousands of fatalities and tens of thousands of serious injuries annually. Mobile phone use while e-biking is a violation of Chinese law and associated with increased crash risk. The current study investigated mobile phone use behavior while cycling among Chinese e-bikers and the psychological factors surrounding why individuals might choose to engage in this risk-taking behavior. **Method:** In particular, this study investigates whether the decision to use a mobile phone while cycling is explained through reasoned decision making or is a social reactive decision, or both, as defined by the prototype willingness model (PWM). Questionnaire data were collected from 784 Chinese adults with e-bike experience. **Results:** Results showed that 40.2 % of the participants reported mobile phone use while cycling e-bikes in the past month. Both behavioral intention and behavioral willingness were predictors of mobile phone while using e-bikes, and they were approximately equal in their magnitude of predictive power ($\beta BI = 0.25$; $\beta BW = 0.26$). E-bikers' attitudes, perceived behavioral control, and perception of prototype similarity and favorability were strong predictors of intention, willingness, and self-reported behavior to use mobile phones while e-biking. **Conclusions:** Both social reactive decision-making and reasoned decision-making contribute to decisions to use a mobile phone while riding an e-bike. **Practical Applications:** Results have implications for guiding development of interventions to prevent and reduce mobile phone use when e-bike cycling.

- **Keywords:** Prototype willingness model; E-bike; Mobile phone use; Reasoned decision-making; Social reactive decision-making

Numan Ahmad, Ramin Arvin, Asad J. Khattak. *How is the duration of distraction related to safety–critical events? Harnessing naturalistic driving data to explore the role of driving instability*. Pages 15-30.

Introduction: Due to a variety of secondary tasks performed by drivers, distracted driving has become a critical concern. At 50 mph, sending/reading a text for 5 seconds is equivalent to driving the length of a football field (360 ft) with eyes closed. A fundamental understanding of how distractions lead to crashes is needed to develop appropriate countermeasure strategies. A key question is whether distraction increases driving instability, which then further contributes to safety–critical events (SCEs). **Methods:** By harnessing newly available microscopic driving data and using the safe systems approach, a subsample of naturalistic driving study data were analyzed, collected through the second strategic highway research program. Rigorous path analysis (including Tobit and Ordered Probit regressions) is used to jointly model the instability in driving (using coefficient of variation of speed) and event outcomes (including baseline, near-crash, and crash). The marginal effects from the two models are used to compute direct, indirect, and total effects of distraction duration on SCEs. **Results:** Results indicate that a longer duration of distraction was positively but non-linearly associated with higher driving instability and higher chances of SCEs. Where, the chance of a crash and near-crash was higher by 34% and 40%, respectively, with a unit increase in driving instability. Based on the results, the chance of both SCEs significantly increases non-linearly with an increase in distraction duration beyond 3 seconds. For instance, the chance of a crash is 16% for a driver distracted for 3 seconds, which increases to 29% if a driver is distracted for 10 seconds. **Conclusions and Practical Applications:** Using path analysis, the total effects of distraction duration on SCEs are even higher when its indirect effects on SCEs through driving instability are considered. Potential practical implications including traditional countermeasures (changes in roadway environments) and vehicle technologies are discussed in the paper.

- **Keywords:** Crash risk; Driving instability; Distraction duration; Safe system approach; Path analysis; Joint estimation

Dawei Wang, Zhenzhen Sun, Zhaobiao Zong, Wenxu Mao, Li Wang, Yuchen Sun, Jun Zhang, Phil Maguire, Yixin Hu. *The effect of benevolent leadership on safety behavior: A moderated mediation model*. Pages 31-41.

Introduction: While high quality leadership is of great importance for enhancing safety behavior in the workplace, there has been a lack of research on how benevolent leadership influences such behavior. Subordinates' moqi (i.e., their unspoken understanding of the work expectations, intentions, and requirements of their superiors) and safety climate were introduced to examine this relationship. **Method:** Based on implicit followership theory, this study explores the relationship between benevolent (well meaning, kindly) leadership and employees' safety behavior, as well as the mediating role of subordinates' moqi and the moderating role of safety climate. 608 employees of a petroleum company in China were randomly selected as participants, and the data were collected in two stages. **Results:** The results showed that: (1) Benevolent leadership is positively correlated with employees' safety behavior. (2) Subordinates' moqi mediates between benevolent leadership and employees' safety behavior. (3) Safety climate moderates the mediating role of subordinates' moqi between benevolent leadership and employees' safety behavior. (4) The positive effect of subordinates' moqi on employees' safety behavior is enhanced under a positive safety climate. **Conclusions:** Benevolent leadership is an effective leadership style that enhances employees' safety behaviors by promoting a moqi state between supervisors and subordinates. The invisible environmental climate, in particular, the safety climate, should be a key focus in the promotion of safety behaviors. **Practical Applications:** This study further broadens the research perspective of employee safety behavior from the perspective of implicit followership theory. It also provides practical guidance for improving employee safety behavior, namely selecting and cultivating benevolent leaders, enhancing subordinates' moqi, and actively fostering a positive organizational safety climate.

- **Keywords:** Employee behavior; Subordinates' moqi; Safety climate; Implicit followership theory; Implicit leadership theory

Kyle Schofield, Bridie Kean, Florin Oprescu, Terri Downer, Margaret Hardy. *A systematic review and meta-synthesis of the complex and interconnected factors that influence planning for driving retirement*. Pages 42-51.

Introduction: With an aging population there are more older drivers than ever before. To reduce unnecessary road accidents and assist older drivers to successfully transition to non-driving, a better understanding of the factors that influence planning for driving retirement is required. This review explores documented factors that may influence older adults in planning for driving retirement, thus providing new understandings that can inform future preventative road safety measures, interventions, and policies. **Method:** A systematic search was performed using four databases to locate qualitative studies on the factors that influenced older drivers to plan for driving retirement. To identify factors influencing planning for driving retirement, a thematic synthesis approach was utilized. Identified themes were categorized in relation to elements of the Social Ecological Model theoretical framework. **Results:** The systematic search resulted in 12 included studies from 4 countries. Four major themes and 11 subthemes were identified regarding planning driver retirement. Each subtheme denotes a factor that may facilitate and/or impede older drivers planning for driving retirement. Conclusion: These results indicate that it is vitally important to encourage older drivers to plan for driving retirement as early as possible. Stakeholders involved in the safety of older drivers (including family,

clinicians, road authorities, and policy makers) should work together on interventions and policies that empower older drivers to successfully plan for driving retirement in order to improve road safety and quality of life. **Practical Applications:** Introducing conversations about driving retirement via medical appointments, family, media, and peer-support groups could facilitate planning for driving retirement. Community-based ride-sharing systems and subsidized private transport options are needed to ensure continued mobility of older adults, especially in rural and regional areas that lack alternate transport services. When devising urban and rural planning, transport, license renewal, and medical testing rules, policy makers should consider older drivers' safety, mobility, and quality of life after driving retirement.

- **Keywords:** Driving retirement; Driving cessation; Road safety; Older drivers; Meta-synthesis

Ahmed Hossain, Xiaoduan Sun, Shahrin Islam, Shah Alam, Md. Mahmud Hossain. *Identifying roadway departure crash patterns on rural two-lane highways under different lighting conditions: Association knowledge using data mining approach*. Pages 52-65.

Introduction: More than half of all fatalities on U.S. highways occur due to roadway departure (RwD) each year. Previous research has explored various risk factors that contribute to RwD crashes, however, a comprehensive investigation considering the effect of lighting conditions has been insufficiently addressed. Data: Using the Louisiana Department of Transportation and Development crash database, fatal and injury RwD crashes occurring on rural two-lane (R2L) highways between 2008-2017 were analyzed based on daylight and dark (with and without streetlight). **Method:** This research employed a safe system approach to explore meaningful complex interactions among multidimensional crash risk factors. To accomplish this, an unsupervised data mining algorithm association rules mining (ARM) was utilized. Results and **conclusions:** Based on the generated rules, the findings reveal several interesting crash patterns in the daylight, dark-with-streetlight, and dark-no-streetlight, emphasizing the importance of investigating RwD crash patterns depending on the lighting conditions. In daylight condition, fatal RwD crashes are associated with cloudy weather conditions, distracted drivers, standing water on the roadway, no seat belt use, and construction zones. In dark lighting condition (with and without streetlight), the majority of the RwD crashes are associated with alcohol/drug involvement, young drivers (15–24 years), driver condition (e.g., inattentive, distracted, illness/fatigued/asleep), and colliding with animal(s). **Practical Applications:** The findings also reveal how certain driver behavior patterns are connected to RwD crashes, such as a strong association between alcohol/drug intoxication and no seat belt usage in the dark-no-streetlight condition. Based on the identified crash patterns and behavioral characteristics under different lighting conditions, the findings could aid researchers and safety specialists in developing the most effective RwD crash mitigation strategies.

- **Keywords:** Lighting conditions; Daylight; Dark; Construction zones; No seat belt use

Laura Mills, Verity Truelove, James Freeman. *Facebook and drug driving: Does online sharing work against road safety countermeasures?* Pages 86-94.

Introduction: Enhancements to technology have transformed several aspects of road safety, communication, and connectivity. At the intersection of these, scholars have begun to speculate whether certain aspects of technology may provide motorists ways to engage in illegal and dangerous driving behaviors without consequences. Police traffic operations such as Roadside Drug Testing are intended to occur "anywhere, anytime" to

communicate to motorists that they should not risk offending. A potential challenge for road safety is the emergence of Facebook police location pages and groups, where users can share the locations of police operations. **Method:** In this study, the authors examined two Facebook police location groups and three pages from Queensland (Australia) and conducted a content analysis of posts related to Roadside Drug Testing operations and a thematic analysis of comments on these posts. A total of 282 posts related to Roadside Drug Testing were identified between February and April 2021, with 1,823 comments made. **Results:** The findings suggest that some users: (a) had lived experiences of avoiding punishment for drug driving; (b) remain unaware of how long to wait between drug consumption and driving; (c) perceived Roadside Drug Testing operations to be for the purpose of revenue raising; and (d) changed their driving behavior upon seeing an operation. **Conclusions:** These findings suggest consideration is needed regarding the responsibility of both Facebook, and the government, in allowing groups and pages to exist that undermine law enforcement. **Practical Applications:** Regarding practice, the comments suggest that greater education is needed regarding "safe" times to drive after drug taking.

- **Keywords:** Drug driving; Facebook; Police locations

Angelo D'Elia, Stuart Newstead. *Evaluation of the effectiveness of daytime running lights (DRLs)*. Pages 95-100.

Introduction: Many studies have found that daytime running lights (DRLS) are effective in reducing daytime multi-vehicle crashes. From an Australian perspective, while studies exist using data from other jurisdictions, there has been uncertainty about how effective DRLs would be under Australian environmental conditions, which can differ from other parts of the world. In addition, in recent years DRLs have become a standard feature of many new vehicles. The objective of this work was to utilize Australian crash data to estimate the impact of DRLs on casualty crash risk reflecting the Australian crash population and local conditions. It also aimed to broadly examine the real-world crash-based effectiveness of DRLs currently present in the light vehicle fleet. **Method:** The study utilized police reported casualty crash data for crashes that occurred during 2010–2017. The analysis used induced exposure methods, which offers the potential to assess the relationship between crash risk and DRL fitment by intrinsically controlling for confounding factors. **Results:** It was found that DRL fitment can reduce the overall risk of being involved in a non-nighttime multi-vehicle crash where vehicle visibility may be a factor in crash causation by a statistically significant 8.8%. Estimated crash reductions were higher at dawn or dusk and in higher speed zones. Conclusion: Results provide clear evidence that mandating DRLs on all new vehicles would likely lead to reductions in the overall crash risk of the fleet through accelerating fitment through the fleet. Practical Application: DRL fitment can reduce the overall risk of being involved in a non-night-time multi-vehicle crash where vehicle visibility may be a factor in crash causation. Governments should consider a DRL mandate on all new vehicle models, including all variants to accelerate the process of fitment through the fleet. This would likely lead to reductions in the overall crash risk of the fleet.

- **Keywords:** Crash risk; LED technology; Government mandate; Statistical evaluation; Real-world crash evaluation

Marissa H. Swanson, Casie H. Morgan, Anna Johnston, David C. Schwebel. *Caregiver accounts of unintentional childhood injury events in rural Uganda*. Pages 101-113.

Objective: Complex environmental, social, and individual factors contribute to unintentional childhood injury events. Understanding context-specific antecedents and caregiver attributions of childhood injury events can inform the development of locally-targeted interventions to reduce injury risk in rural Uganda. **Methods:** Fifty-six Ugandan

caregivers were recruited through primary schools and completed qualitative interviews regarding 86 unintentional childhood injury events. Descriptive statistics summarized injury characteristics, child location and activity, and supervision at time of injury. Qualitative analyses informed by grounded theory identified caregiver attributions of injury causes and caregiver actions to reduce injury risk. **Results:** Cuts, falls, and burns were the most common injuries reported. At the time of injury, the most common child activities were farming and playing and the most common child locations were the farm and kitchen. Most children were unsupervised. In cases where supervision was provided, the supervisor was typically distracted. Caregivers most often attributed injuries to child risk-taking but also identified social, environmental, and chance factors. Caregivers most often made efforts to reduce injury risk by teaching children safety rules, but also reported efforts to improve supervision, remove hazards, and implement environmental safeguards. Conclusion: Unintentional childhood injuries have a significant impact on injured children and their families, and caregivers are motivated to reduce child injury risk. Caregivers frequently perceive child decision-making a primary factor in injury events and respond by teaching children safety rules. Rural communities in Uganda and elsewhere may face unique hazards associated with agricultural labor, contributing to a high risk of cuts. Interventions to support caregiver efforts to reduce child injury risk are warranted.

- **Keywords:** Unintentional childhood injury; Injury prevention; Caregiver supervision; Qualitative assessment; Grounded theory

Akinloluwa Babalola, Patrick Manu, Clara Cheung, Akilu Yunusa-Kaltungo, Paulo Bartolo. *A systematic review of the application of immersive technologies for safety and health management in the construction sector*. Pages 66-85.

Introduction: The construction industry employs about 7% of global manpower and contributes about 6% to the global economy. However, statistics have depicted that the construction industry contributes significantly to workplace fatalities and injuries despite multiple interventions (including technological applications) implemented by governments and construction companies. Recently, immersive technologies as part of a suite of industry 4.0 technologies, have also strongly emerged as a viable pathway to help address poor construction occupational safety and health (OSH) performance. **Method:** With the aim of gaining a broad view of different construction OSH issues addressed using immersive technologies, a review on the application of immersive technologies for construction OSH management is conducted using the preferred reporting items for systematic reviews and meta-analysis (PRISMA) approach and bibliometric analysis of literature. This resulted in the evaluation of 117 relevant papers collected from three online databases (Scopus, Web of Science, and Engineering Village). **Results:** The review revealed that literature have focused on the application of various immersive technologies for hazard identification and visualization, safety training, design for safety, risk perception, and assessment in various construction works. The review identified several limitations regarding the use of immersive technologies, which include the low level of adoption of the developed immersive technologies for OSH management by the construction industry, very limited research on the application of immersive technologies for health hazards, and limited focus on the comparison of the effectiveness of various immersive technologies for construction OSH management. **Conclusions and Practical Applications:** For future research, it is recommended to identify possible reasons for the low transition level from research to industry practice and proffer solutions to the identified issues. Another recommendation is the study of the effectiveness of the use of immersive technologies for addressing health hazards in comparison to the conventional methods.

- **Keywords:** Augmented reality; Health and safety; Mixed reality; Immersive technologies; Virtual reality

Nick Turner, Connie Deng, Steve Granger, Paul M. Dueck. *How does subjective invulnerability impact young workers' safety voice?* Pages 129-139.

Introduction: Young workers are at risk of workplace injuries for numerous reasons. One contentious yet untested theory is that subjective invulnerability to danger—a sense of indestructability in the face of physical hazards—can affect some young workers' reactions to workplace hazards. This study contends that subjective invulnerability can affect these reactions in two ways: (a) perceptions of physical hazards at work generate less fear of injury among those who perceive themselves as more invulnerable and/or; (b) fear of injury does not motivate speaking up about safety concerns (safety voice) among those who perceive themselves as more invulnerable. **Method:** This paper tests a moderated mediation model in which higher perceptions of physical hazards at work are related to higher safety voice intentions via higher fear of injury, but that subjective invulnerability reduces the extent to which: (a) perceptions of physical hazards at work are associated with fear of injury and/or; (b) fear of injury is associated with safety voice. This model is tested in two studies of young workers (Study 1 on-line experiment: $N = 114$, M age $= 20.67$, $SD = 1.79$; range $= 18–24$ years; Study 2 field study using three waves of data collected at monthly intervals: $N = 80$, M age $= 17.13$, $SD = 1.08$, range $= 15–20$ years). **Results:** Contrary to expectations, the results showed that young workers who feel more invulnerable to danger are more likely to speak up about safety when experiencing higher fear of injury, and that perceptions of physical hazards–safety voice relationship is mediated by fear of injury for those who perceive themselves to be more invulnerable to danger. Conclusions/**Practical Applications:** Rather than subjective invulnerability silencing safety voice as predicted, the current data suggest that subjective invulnerability may serve to accelerate how fear of injury motivates safety voice.

- **Keywords:** Injuries; Invulnerability; Safety voice; Young workers

Maxwell Fordjour Antwi-Afari, Heng Li, Alan Hoi Shou Chan, JoonOh Seo, Shahnawaz Anwer, Hao-Yang Mi, Zezhou Wu, Arnold Yu Lok Wong. *A science mapping-based review of work-related musculoskeletal disorders among construction workers*. Pages 114-128.

Introduction: Work-related musculoskeletal disorders (WMSDs) are recognized as a leading cause of nonfatal injuries in construction, but no review of existing studies has systematically analyzed and visualized the trends of WMSDs among construction workers. The current science mapping-based review summarized research published between 2000 and 2021 related to WMSDs among construction workers through co-word, co-author, and citation analysis. **Method:** A total of 63 bibliographic records retrieved from the Scopus database were analyzed. **Results:** The results identified influential authors with high impacts in this research domain. Moreover, the results indicated that MSDs, ergonomics, and construction not only had the highest occurrence of been studied, but also the highest impact in terms of total link strength. In addition, the most significant contributions to research relating to WMSDs among construction workers have originated primarily from the United States, Hong Kong, and Canada. Furthermore, a follow-up in-depth qualitative discussion was conducted to focus on summarizing mainstream research topics, identifying existing research gaps, and proposing directions for future studies. **Conclusions:** This review provides an in-depth understanding of related research on WMSDs among construction workers and proposes the emerging trends in this research field.

- **Keywords:** Construction workers; Literature review; Science mapping; Scientometric analysis; Work-related musculoskeletal disorders

Emma B. Sartin, Leah R. Lombardi, Kristina B. Metzger, Rachel K. Myers, Melissa R. Pfeiffer, Allison E. Curry. *Variation in drivers' seat belt use by indicators of community-level vulnerability*. Pages 140-146.

Introduction: Examining crash reports with linked community-level indicators may optimize efforts aimed at improving traffic safety behaviors, like seat belt use. To examine this, quasi-induced exposure (QIE) methods and linked data were used to (a) estimate trip-level seat belt non-use of New Jersey (NJ) drivers and (b) determine the degree to which seat belt non-use is associated with community-level indicators of vulnerability. **Method:** Driver-specific characteristics were identified from crash reports (age, sex, number of passengers, vehicle type) and licensing data (license status at the time of the crash). Geocoded residential addresses were leveraged within the NJ Safety and Health Outcomes warehouse to create quintiles of community-level vulnerability. QIE methods were applied to estimate trip-level prevalence of seat belt non-use in non-responsible, crash-involved drivers between 2010–2017 (n = 986,837). Generalized linear mixed models were then conducted to calculate adjusted prevalence ratios and 95 % confidence intervals for being unbelted for driver-specific variables and community-level indicators of vulnerability. **Results:** Drivers were unbelted during 1.2 % of trips. Males, those with suspended licenses, and those without passengers had higher rates of being unbelted than their counterparts. An increase was observed in traveling unbelted with increasing quintiles of vulnerability, such that drivers in the most vulnerable communities were 121 % more likely to be unbelted than those in the least vulnerable communities. **Conclusions:** Prevalence of driver seat belt non-use may be lower than previously estimated. Additionally, communities with the highest amount of the population living with three or more indicators of vulnerability have higher rates of seat belt non-use; this may be a particularly useful metric to inform future translational efforts improving seat belt use. **Practical Applications:** As evidenced by the findings that risk of being unbelted increased as drivers' community vulnerability increased, novel communication efforts tailored to drivers from vulnerable neighborhoods may optimize efforts.

- **Keywords:** Health behaviors; Motor vehicles; Traffic injury; Risk factors; Community Resilience Estimates

Tyler D. Quinn, Suzanne M. Marsh, Kierstyn Oldham, Steven J. Wurzelbacher, Steven J. Naber. *Workers' compensation injury claims among firefighters in Ohio, 2001–2017*. Pages 147-156.

Background: Firefighters are at high risk for nonfatal and fatal occupational injuries. While some past research has quantified firefighter injuries using various data sources, Ohio workers' compensation injury claims data largely have not been used. **Methods:** Public and private firefighter claims, including volunteer and career firefighters, from Ohio's workers' compensation data for 2001–2017 were identified based on occupational classification codes and manual review of the occupation title and injury description. The task during injury (firefighting, patient care, training, other/unknown, etc.) was manually coded based on the injury description. Injury claim counts and proportions were described across claim type (medical-only or lost-time), worker demographics, task during injury, injury events, and principal diagnoses. **Results:** 33,069 firefighter claims were identified and included. Most claims were medical-only (66.28%, <8 days away from work) and involved males (93.81%) aged 25-54 years (86.54%). While the task during injury could not be categorized for many narratives (45.96%), the largest percentage that could be categorized occurred during firefighting (20.48%) and patient care (17.60%). The most common injury events were overexertion involving outside sources (31.33%) and struck by objects or equipment (12.68%). The most frequent principal diagnoses were back, lower extremity, and upper extremity sprains (16.02%, 14.46%, and 11.98%, respectively). **Conclusions:** This study provides a preliminary basis for the development of focused firefighter injury prevention programming and training. Obtaining denominator data, enabling rate calculation, would strengthen the risk

characterization. Based on the current data, prevention efforts focusing on the most frequent injury events and diagnoses may be warranted.

- **Keywords:** Firefighter; First responder; Occupational injuries; Surveillance; Workers' compensation

Zhenggan Cai, Xiaoyan Wu. *Modeling spatiotemporal interactions in single-vehicle crash severity by road types*. Pages 157-171.

Introduction: Spatiotemporal correlations have been widely recognized in single-vehicle (SV) crash severity analysis. However, the interactions between them are rarely explored. The current research proposed a spatiotemporal interaction logit (STI-logit) model to regression SV crash severity using observations in Shandong, China. **Method:** Two representative regression patterns-mixture component and Gaussian conditional autoregression (CAR)-were employed separately to characterize the spatiotemporal interactions. Two existing statistical techniques-spatiotemporal logit and random parameters logit-were also calibrated and compared with the proposed approach with the aim of highlighting the best one. In addition, three road types-arterial road, secondary road, and branch road-were modeled separately to clarify the variable influence of contributors on crash severity. **Results:** The calibration results indicate that the STI-logit model outperforms other crash models, highlighting that comprehensively accommodating spatiotemporal correlations and their interactions is a recommended crash modeling approach. Additionally, the STI-logit using mixture component fits crash observations better than that using Gaussian CAR and this finding remains stable across road types, suggesting that simultaneously accommodating stable and unstable spatiotemporal risk patterns can further strengthen model fit. According to the significance of risk factors, there is a significant positive correlation between distracted diving, drunk driving, motorcycle, dark (without street lighting), and collision with fixed object and serious SV crashes. Truck and collision with pedestrian significantly mitigate the likelihood of serious SV crashes. Interestingly, the coefficient of roadside hard barrier is significant and positive in branch road model, but it is not significant in arterial road model and secondary road model. **Practical Applications:** These findings provide a superior modeling framework and various significant contributors, which are beneficial for mitigating the risk of serious crashes.

- **Keywords:** Traffic safety; Single-vehicle crashes; Bayesian model; Spatiotemporal interactions

Adefemi Aka, Bankole Awuzie, Fidelis Emuze, Abdullateef Adewale Shittu. *Evaluating the effectiveness of strategies for implementation of health and safety programs on construction sites in Nigeria: A mixed-method study*. Pages 172-181.

Introduction: Empirical and anecdotal evidence show that construction projects are delivered on work sites where unsafe acts and conditions abound. Researchers have investigated the strategies that can be adopted to effectively implement health and safety (H&S) in projects so as to reduce the high rates of accidents, injuries and fatalities. However, the effectiveness of these strategies have not been marginally established. Therefore, this study established the effectiveness of H&S implementation strategies on accidents, injuries, and fatalities reduction in Nigerian construction projects. **Method:** A mixed-method research design was adopted for data collection in the study. Physical observations, interviews, and a questionnaire were the instruments used for data collection in the mixed-method research design. **Results:** The resultant data identified six appropriate strategies for enabling the desired levels of H&S program implementation on construction sites. Setting up statutory bodies such as the Health and Safety Executive to promote awareness, good practices, and standardization was adjudged pertinent as one of the effective H&S implementation programs that can be

used to reduce accidents, incidents, and fatalities in projects. It is expected that the adoption of these strategies would culminate in effective H&S program implementation and subsequently a reduction in the prevalence of accidents, injuries, and fatalities in projects.

- **Keywords:** Accidents; Construction; Health and safety; Projects; Nigeria

Elizabeth White, Feng Guo, Shu Han, Mike Mollenhauer, Andrea Broaddus, Ted Sweeney, Sarah Robinson, Adam Novotny, Ralph Buehler. *What factors contribute to e-scooter crashes: A first look using a naturalistic riding approach*. Pages 182-191.

Introduction: Shared dockless electric scooters (e-scooters) are a popular shared mobility service providing an accessible last-mile transportation option in urban and campus environments. However, city and campus stakeholders may hesitate to introduce these scooters due to safety concerns. While prior e-scooter safety studies have collected injury data from hospitals or riding data under controlled or naturalistic conditions, these datasets are limited and did not identify risk factors associated with e-scooter riding safety. To address this gap in e-scooter safety research, this study collected the largest naturalistic e-scooter dataset to date and quantified the safety risks associated with behavioral, infrastructure, and environmental factors. **Method:** A fleet of 200 e-scooters was deployed on Virginia Tech's campus in Blacksburg, VA for a 6-month period. Fifty were equipped with a unique onboard data acquisition system, using sensors and video to capture e-scooter trips in their entirety. The resulting dataset consisted of 3,500 hours of data spanning over 8,500 trips. Algorithms were developed to identify safety critical events (SCEs) in the dataset and analyses were conducted to determine the prevalence of various SCE risk factors and associated odds ratios. **Results:** Results from this study indicate that infrastructure-related factors, behavior of e-scooter riders and other actors, and environmental factors all contributed to the SCE risk for e-scooter riders in Virginia Tech's pedestrian-dense campus environment. **Conclusions:** To help mitigate unsafe rider behavior, educational outreach programs should quantify the significant risks associated with infrastructure, behavioral, and environmental risk factors and provide clear recommendations to riders. Improved infrastructure maintenance and design may also improve safety for e-scooter riders. **Practical Applications:** The infrastructure, behavioral, and environmental risk factors quantified in this study can be applied by e-scooter service providers, municipalities, and campus administrators to develop mitigation strategies to reduce the safety risks associated with e-scooter deployments in the future.

- **Keywords:** Safety; Last-mile transportation; Mobility as a service; Crash severity; Crash risk

Wangxin Xiao, Peixia Cheng, Junjie Hua, David C. Schwebel, Guoqing Hu. *Product-related injury morbidity among Americans aged 0–19 years, 2001–2020*. Pages 192-199.

Introduction: This study examined changes in product-related injury morbidity among under-20 Americans between 2001 and 2020. **Method:** Product-related injury morbidity data came from the National Electronic Injury Surveillance System (NEISS). Using age-standardized morbidity rates, the authors performed Joinpoint regression models to identify time periods with significant changes between 2001 and 2020 and quantified the annual magnitude of morbidity changes with annual percent changes (APCs) in rates and 95 % confidence intervals (CIs). **Results:** Age-standardized product-related injury morbidity declined consistently among under-20 Americans from 2001 to 2020 (from 7449.3 to 4023.5 per 100,000 persons; APC = -1.5 %, 95 % CI: −2.3 %, −0.7 %), with

the most striking morbidity drop in 2019–2020 (-1576.8 per 100,000 persons). Sports and recreation equipment and home were the most common product and location, respectively, for nonfatal pediatric product-related injuries. Large morbidity differences and varying spectrum by product and by occurring location existed across sex and age groups. **Conclusions:** Product-related injury morbidity declined significantly among under-20 Americans between 2001 and 2020, but large variations remained across sex and age groups. **Practical Applications:** Further research is recommended to understand causal factors contributing to the observed decrease in product-related injury morbidity over the past 20 years and to understand product-related injury morbidity disparities across sex and age groups. Understanding of causal factors could lead to implementation of additional interventions to reduce product-related injury among children and adolescents.

- **Keywords:** Product-related injury; Morbidity; Children; Adolescent; United States

Aimee E. Cox, Alexandra S. Mueller, Jessica B. Cicchino. *Safety potential of crash avoidance features, improved headlights, and V2V-enhanced technologies for older drivers*. Pages 200-209.

Introduction: Age-related changes and frailty are among the reasons that older drivers are overrepresented in certain crash types. Vehicle safety features that address these crash types may therefore deliver greater safety benefits for older drivers than for other age groups even though they are designed for the general population. **Methods:** U.S. crash data from 2016–2019 were used to estimate the proportion of crash involvements and fatal and nonfatal driver injuries for older (70 years old and above) and middle-aged (35–54 years old) drivers from crash scenarios to which current crash avoidance features, improved headlights, and forthcoming vehicle-to-vehicle (V2V)-connected intersection-assistance features could be relevant. Risk ratios were then calculated to determine the relative benefits of each technology for older drivers compared with middle-aged drivers. **Results:** Combined, these technologies were potentially relevant to 65 % of older driver and 72 % of middle-aged driver fatalities during the study period. Intersection assistance features showed the most promise for older drivers. Such features were potentially relevant to 32 % of older driver crash involvements, 38 % of older driver injuries, and 31 % of older driver fatalities. Intersection assistance features were significantly more likely to be relevant to older driver deaths than middle-aged driver fatalities (RR, 3.52; 95 % CI, 3.33–3.71). **Conclusions:** Vehicle technologies have the potential to substantially reduce or mitigate crashes and the injuries that they cause for everyone, but the potential safety impact of each technology varies by driver age because different age groups are over- or underrepresented in specific crash scenarios. **Practical applications:** With the older driver population growing, these findings underscore the need to bring intersection assistance technologies to the consumer market. At the same time, everyone stands to benefit from currently available crash avoidance features and improved headlights, so their use should be promoted among all drivers.

- **Keywords:** Older drivers; ADAS; Safety benefits; Intersections; Vehicle technology

Abbas Sheykhfard, Farshidreza Haghighi, Grigorios Fountas, Subasish Das, Ali Khanpour. *How do driving behavior and attitudes toward road safety vary between developed and developing countries? Evidence from Iran and the Netherlands*. Pages 210-221.

Introduction: The rates of road traffic injuries and fatalities in developing countries are significantly higher than in developed countries. This study examines the differences in driving behavior, road safety attitudes, and driving habits between a developed country (the Netherlands) and a developing country (Iran), which bear major differences in terms

of crash involvement per population. **Method:** In this context, this study assesses the statistical association of crash involvement with errors, lapses, aggressive driving incidents, and non-compliance with traffic rules, attitudes, and habits. Structural equation modeling was used to evaluate data obtained from 1,440 questionnaires (720 samples for each group). **Results:** The results revealed that more insecure attitudes toward traffic-regulation observance, negative driving habits, and risky behaviors, such as traffic rule violations act as influential factors of crash involvement. Iranian participants showed a greater likelihood to get involved in violations and driving habits with a higher level of risk. In addition, lower levels of safety attitudes toward traffic-regulation observance were observed. On the other hand, Dutch drivers were more likely to report lapses and errors. Dutch drivers also reported safer behavior in terms of unwillingness to engage in risky behaviors such as violations (speeding and no-overtaking). The structural equation models for crash involvement based on behaviors, attitudes, and driving habits were also evaluated for their accuracy and statistical fit using relevant indicators. **Practical Applications:** Finally, the findings of the present study point out the need for extensive research in some areas to foster policies that can effectively enhance safer driving.

- **Keywords:** Driving behaviors; Driving habits; Driving attitudes; SEM; Survey

Jingyu Li, Weihua Zhang, Dianchen Zhu, Zhongxiang Feng, Zhengbing He, Quansheng Yue, Zhipeng Huang. *Evaluation of driver demand for in-vehicle information: An integrated method combining clustering and multivariate ordered probit model*. Pages 222-233.

Introduction: The proper execution of driving tasks requires information support. While new technologies have increased the convenience of information access, they have also increased the risk of driver distraction and information overload. Meeting drivers' demands and providing them with adequate information are crucial to driving safety. **Methods:** Based on a sample of 1,060 questionnaires, research on driving information demands is conducted from the perspective of drivers. A principal component analysis and the entropy method are integrated to quantify the driving information demands and preferences of drivers. The K-means classification algorithm is selected to classify the different types of driving information demands, including dynamic traffic information demands (DTIDs), static traffic information demands (STIDs), automotive driving status information demands (ATIDs), and total driving information demands (TDIDs). Fisher's least significant difference (LSD) is used to compare the differences in the numbers of self-reported crashes among different driving information demand levels. A multivariate ordered probit model is established to explore the potential factors that influence the different types of driving information demand levels. **Results:** The DTID is the driver's most in-demand information type, and accordingly, gender, driving experience, average driving mileage, driving skills, and driving style significantly affect the driving information demand levels. Moreover, the number of self-reported crashes decreased as the DTID, ATID, and TDID levels decreased. Conclusion: Driving information demands are affected by a variety of factors. This study also provides evidence that drivers who have higher driving information demands are more likely to drive more carefully and safely than their counterparts who do not exhibit high driving information demands. Practical implications: The results are indicative of the driver-oriented design of in-vehicle information systems and the development of dynamic information services as a way to avoid negative impacts on driving.

- **Keywords:** Driving safety; Information demand; In-vehicle information systems; Driving style; Driving skills

Judd H. Michael, Serap Gorucu. *Severe injuries from product movement in the U.S. food supply chain*. Pages 234-241.

Introduction: The modern food supply chain presents unique hazards to employees that result in higher morbidity and mortality rates versus other industries. Employees in food manufacturing, wholesaling, and even retailing experience relatively high numbers of occupational injuries and fatalities. One reason for the high hazard rates may be the reliance on a synergistic packaging system designed to load and transport food products within and between manufacturers, wholesalers, and retailers. Packaged food products are often aggregated using palletizers before they can be transported by forklifts and pallet jacks. Materials handling within facilities is critical to the efficient functioning of all members of the food-related supply chain, but product movement can be a source of occupational injuries. No previous research has examined the cause and result of such hazards. **Method:** This paper aims to examine severe injuries related to the packaging and movement of food products in segments of the food and beverage supply chain from manufacturing to retailing. An OSHA database was used to investigate all severe injuries in the six years from 2015 to 2020. The focus was on the food supply chain for the period since OSHA began mandating new reporting procedures for severe injuries. **Results:** Results show there were 1,084 severe injuries and 47 fatalities during the six-year period. Fractures of the lower extremities were most prevalent, with the most frequent event type being transportation-related such as pedestrian-vehicle incidents. Significant differences were seen in the three parts of the food supply chain. **Practical Applications:** Implications are drawn for key sectors of the food-related supply chain to reduce packaging- and product movement-related hazards.

- **Keywords:** Food; Forklift; OSHA; Packaging; Pallet

Ahmed Jalil Al-Bayati, Andrew T. Rener, Michael P. Listello, Mamdouh Mohamed. *PPE non-compliance among construction workers: An assessment of contributing factors utilizing fuzzy theory*. Pages 242-253.

Introduction: Construction practitioners are at a disproportionately higher risk of fatal and nonfatal injuries compared to practitioners from other industries. The absence of and inappropriate use of personal protective equipment (PPE), hereinafter referred to as PPE non-compliance, are major causes of fatal and nonfatal injuries at construction workplaces. **Method:** Accordingly, a robust 4-step research methodology was employed to investigate and assess factors that contribute to PPE non-compliance. As a result, 16 factors were identified utilizing literature review and ranked utilizing fuzzy set theory and K-means clustering. Top among them: inadequate safety supervision, poor risk perception, lack of climate adaptation, lack of safety training, and lack of management support. **Results:** Managing construction safety in a proactive manner is vital to eliminate or minimize construction hazards and improve overall site safety. Thus, proactive measures to address these 16 factors were identified utilizing a focus group methodology. The validation of the statistical findings with that of the focus groups of industry professionals provides validation of the findings as both practical and actionable. **Practical Applications:** This study significantly contributes to construction safety knowledge and practice which, in turn, aids academic researchers and construction practitioners in their continuous efforts to reduce fatal and nonfatal injuries among construction workers.

- **Keywords:** Personal Protective Equipment; Construction Safety Culture; Construction Safety; Climate; Safety management

Mariusz Ptak, Johannes Wilhelm, Marek Sawicki, Mateusz Dymek, Fábio A.O. Fernandes, Helmuth Kristen, Emma Garatea. *Assessment of child*

***safety on bicycles in baby carriers – The importance of evaluating both head and neck injuries*. Pages 254-265.**

Introduction: The paper addresses an important accident type that involves children in bicycle seats – the bicycle fall over. It is a significant and common accident type and many parents have been reported to experience this type of "close call." The fall over occurs at low velocities and even while a bicycle is standing still, and may result from a split-second lack of attention on behalf of the accompanying adult (e.g. while loading groceries, i.e. while not being exposed to traffic per se). Moreover, irrespective of the low velocities involved, the trauma that may result to the head of the child is considerable and may be life-threatening, as shown in the study. **Method:** The paper presents two methods to address this accident scenario in a quantitative way: in-situ accelerometer-based measurement and numerical modeling approaches. It is shown that the methods produce consistent results under the prerequisites of the study. They are therefore promising methods to be used in the study of this type of accident. **Results:** The importanance of the protective role of a child helmet is without discussion in everyday traffic.However, this study draws attention to one particular effect observed in this accident type: that the geometry of the helmet may at times expose the child's head to considerably larger forces, by having contact with the ground. The study also highlights the importance of neck bending injuries during bicycle fall over, which are often neglected in the safety assessment – not only for children in bicycle seats. The study concludes that considering only head acceleration may lead to biased conclusions about using helmets as protective devices.

- **Keywords:** Accident reconstruction; Bicycle child seat; Head and neck injuries; Helmet; Cyclist; Traffic safety

Md Tawhidur Rahman, Kakan Dey, V. Dimitra Pyrialakou, Subasish Das. *Factors influencing safety perceptions of sharing roadways with autonomous vehicles among vulnerable roadway users*. Pages 266-277.

Introduction: The operation of autonomous vehicles (AVs) on public roadways affects the safety of vulnerable roadway users, such as pedestrians and bicyclists. This research contributes to the literature by investigating vulnerable roadway users' safety perceptions on road sharing with AVs. **Method:** This study analyzed the survey responses of pedestrians and bicyclists in Pittsburgh, Pennsylvania, collected by Bike Pittsburgh (Bike PGH) in 2017 and 2019. First, this study investigates how pedestrians and bicyclists perceive safety regarding road sharing with AVs. Second, the study examines how the safety perceptions of pedestrians and bicyclists regarding AVs might be changing over time. Non-parametric tests were applied to compare the safety perceptions of pedestrians and bicyclists across different characteristics, experiences, and attitudes, considering the ordinal nature of the AV safety perception data. An ordered probit model was estimated to better understand the factors influencing safety perceptions regarding road sharing with AVs. **Results:** The study findings suggest that higher exposures to AVs are associated with improved safety perceptions. In addition, respondents with a stricter attitude toward AV regulations perceive road sharing with AVs as less safe. Respondents whose opinion regarding AVs did not worsen due to the pedestrian/bicyclist involved AV accident in Arizona have higher safety perceptions. **Practical Applications:** Policymakers can use the findings of this study in developing guidelines to ensure safe road sharing and develop strategies to sustain active transportation usage in the future AV era.

- **Keywords:** Autonomous vehicles; Vulnerable roadway users; Safety; Regulations

Wen Hu, Jessica B. Cicchino. *Effects of a rural speed management pilot program in Bishopville, Maryland, on public opinion and vehicle speeds*. Pages 278-286.

Introduction: In summer 2021, a speed management pilot program was conducted on a rural two-lane road (MD 367) in Bishopville, Maryland, that combined countermeasures from engineering, enforcement, and communications. The study evaluated public awareness of the program and its effects on speeds. **Method:** Telephone surveys of drivers in Bishopville and neighboring communities, and of drivers in control communities across the state that had no program, were conducted before and after the program started. Vehicle speeds were collected at treatment sites on MD 367 and at control sites before, during, and after the program. Log-linear regression models estimated changes in speeds associated with the program; separate logistic regression models estimated changes in odds of vehicles exceeding the speed limit and exceeding the speed limit by more than 10 mph during and after the program. **Results:** The percentage of interviewed drivers in Bishopville and neighboring communities who thought speeding was a major problem on MD 367 declined from 31.0% (before) to 6.7% (after). The program was associated with a 9.3% reduction in mean speeds, a 78.3% reduction in odds of exceeding the speed limit by any amount, and a 79.6% reduction in odds of exceeding the speed limit by more than 10 mph. After the program ended, the mean speeds at the MD 367 sites were 1.5% lower than expected had the program not occurred, odds of exceeding the speed limit by any amount was 37.2% lower, and odds of exceeding the speed limit by more than 10 mph was 11.7% higher. **Conclusions:** The program was well publicized and reduced speeding, but the effect did not last after the program ended for those traveling at higher-end speeds. **Practical applications:** Comprehensive speed management programs that leverage multiple proven strategies, similar to the program in Bishopville, are recommended in other communities to reduce speeding.

- **Keywords:** Speed management program; Rural road; Public awareness; Speeds; Speeding

Michael A. Gebers, Bayliss J. Camp. *Traffic violator school masked convictions: California finally got it right*. Pages 287-295.

Introduction: The negative traffic safety impact of California's prior traffic violator school (TVS) citation dismissal policy is well documented in past California TVS evaluations. **Method:** Using advanced inferential statistical techniques, the current study evaluated the substantive changes to California's traffic violator school program as required by California Assembly Bill (AB) 2499. The program changes implemented by AB 2499 appear to be associated with a specific deterrent effect as evidenced by a reliable and statistically significant reduction in subsequent traffic crashes of those receiving a masked TVS conviction as opposed to a countable conviction. **Results:** The results suggest that this relationship exists primarily among TVS drivers with less elevated prior records. The change in status from a TVS citation dismissal to a TVS masked conviction has reduced the negative traffic safety impact of the TVS citation dismissal policy in effect prior to the implementation of AB 2499. Several recommendations are offered to enhance the positive traffic safety impact of the TVS program by further combining its educational elements with the state's post license control program by way of the Negligent Operator Treatment System. **Practical Applications:** The findings and recommendations have implications to all states and jurisdictions utilizing pre-conviction diversion programs and/or demerit point systems associated with traffic violations.

- **Keywords:** Motor vehicle crashes; Crash prevention; Evaluation; Traffic law violators; Driver improvement schools; Point system

Faan Chen, Jingyang Lyu, Tianye Wang, N.N. Sze. *Exploring the association between quantified road safety target attributes and their success: An empirical analysis from OECD countries using panel data*. Pages 296-307.

Introduction: Setting quantified road safety targets has been recognized as a best practice to eliminate road fatalities by international organizations such as the Organisation for Economic Co-operation and Development (OECD). Previous studies have examined the relationship between setting quantified road safety targets and road fatality reduction. However, little attention has been paid to the association between the targets' characteristics and their successes under certain socioeconomic conditions. **Method:** This study aims to fill this gap by identifying the quantified road safety targets that are the most achievable. Specifically, using panel data on the OECD countries' quantified road safety targets, this study develops a fixed effects model to determine the specific characteristics (i.e., target duration and level of ambition) of an optimal target to make it as achievable as possible for OECD countries. **Results:** The study finds that a significant association exists between target duration, level of ambition, and target achievement, with targets that have lower levels of ambition having higher achievements. Moreover, different groups of OECD countries carry different characteristics (e.g., target duration) that concern their most achievable targets. **Conclusions:** The findings suggest that, in terms of duration and level of ambition, OECD countries' target setting should establish their own socioeconomic development conditions. This provides government officials, policymakers, and practitioners with useful references for the future quantified road safety target settings that are the most likely to be achieved.

- **Keywords:** Quantified targets; Road fatality; Achievement status; Level of ambition; Target duration

Colin Pilbeam, Nektarios Karanikas. *Safety training in context: technical, cultural and political factors affecting its design, delivery and transfer*. Pages 308-320.

Introduction: Safety training is integral to modern safety management systems. However, what is trained in the classroom is not always adopted and applied in the workplace, creating the training transfer problem. Taking an alternative ontological stance, the aims of this study were to conceptualize this problem as one of 'fit' between what is trained and the contextual factors in the work environment of the adopting organization. **Method:** Twelve semi-structured interviews were conducted with experienced health andsafety trainers having diverse backgrounds and experience. Data were thematically coded 'bottom-up' to capture reasons for safety training and where consideration of context occurs in the design and delivery of training. Then, the codes were thematically grouped against a pre-existing framework to categorize contextual factors that affect 'fit' into technical, cultural, and political factors each operating at different levels of analysis. **Results:** Safety training occurs to satisfy external stakeholder expectations and meet internal perceptions of need. Consideration of contextual factors can occur both in the design and delivery of training. A range of technical, cultural, and political factors were identified, which can operate at individual, organizational, or supra-organizational levels to influence safety training transfer. **Conclusions:** The study draws particular attention to the influence of political factors and the impact of supra-organizational factors on the successful transfer of training, areas not consistently considered in safety training design and delivery. Practical Application: The application of the framework adopted in this study provides a useful tool for discriminating between different contextual factors and the level at which they operate. This could enable more effective management of these factors to improve the potential for transfer of safety training from the classroom to the workplace.

- **Keywords:** Safety training; Training transfer problem; Safety interventions; Contextual factors

Amy E. Peden, Patricia Cullen, Buna Bhandari, Luke Testa, Amy Wang, Tracey Ma, Holger Möller, Margie Peden, Susan M Sawyer, Rebecca Ivers. *A systematic review of the evidence for effectiveness of interventions to address transport and other unintentional injuries among adolescents*. Pages 321-338.

Introduction: Globally, injuries are a leading cause of mortality and morbidity for adolescents, which disproportionately affect the disadvantaged. To build an investment case for adolescent injury prevention, evidence is needed as to effective interventions. **Methods:** A systematic review of peer-reviewed original research published between 2010–2022 was conducted. CINAHL, Cochrane Central, Embase, Medline and PsycINFO databases were searched for studies reporting the effectiveness of unintentional injury prevention interventions for adolescents (10–24 years), with assessment of study quality and equity (e.g., age, gender, ethnicity, socio-economic status). **Results:** Sixty-two studies were included; 59 (95.2%) from high-income countries (HIC). Thirty-eight studies (61.3%) reported no aspect of equity. Thirty-six studies (58.1%) reported prevention of sports injuries (commonly neuromuscular training often focused on soccer-related injuries, rule changes and protective equipment). Twenty-one studies (33.9%) reported prevention of road traffic injury, with legislative approaches, commonly graduated driver licensing schemes, found to be effective in reducing fatal and nonfatal road traffic injury. Seven studies reported interventions for other unintentional injuries (e.g., falls). Discussion: Interventions were strongly biased towards HIC, which does not reflect the global distribution of adolescent injury burden. Low consideration of equity in included studies indicates current evidence largely excludes adolescent populations at increased risk of injury. A large proportion of studies evaluated interventions to prevent sports injury, a prevalent yet low severity injury mechanism. Findings highlight the importance of education and enforcement alongside legislative approaches for preventing adolescent transport injuries. Despite drowning being a leading cause of injury-related harm among adolescents, no interventions were identified. Conclusion: This review provides evidence to support investment in effective adolescent injury prevention interventions. Further evidence of effectiveness is needed, especially for low- and middle-income countries, populations at increased risk of injury who would benefit from greater consideration of equity and for high lethality injury mechanisms like drowning.

- **Keywords:** Injury; Adolescence; Cost-benefit; Risk; Mortality; Morbidity; Evaluation

Keni Song, Ming Guo, Fulei Chu, Songlin Yang, Kaibiao Xiang. *The influence of perceived Human Resource strength on safety performance among high-speed railway drivers: The role of organizational identification and psychological capital*. Pages 339-347.

Introduction: Under the Chinese railway system reform background, high-speed railway drivers face continuous organizational change. As a communication channel between organizations and employees, the implementation of Human Resource Management (HRM) requires urgent attention. The present study explored the impacts of perceived Human Resource (HR) strength on safety outcomes premised on social identity theory. The relationships among perceived HR strength, organizational identification, psychological capital, and safety performance were investigated. **Method:** This study gathered 470 sets of paired data from Chinese high-speed railway drivers and their direct supervisors. **Results:** The results indicated that perceived HR strength positively affects safety performance via organizational identification, directly and indirectly. The findings also revealed that psychological capital promotes the direct effect of perceived HR

strength on drivers' safety performance. **Practical Applications:** Railway organizations were suggested to not only focus on the HR content but also consider the HR process, especially in an organizational change context.

- **Keywords:** Railway safety; Human Resource Process; Organizational identity; Positive psychology; Organizational change

Hoang Nam Le, Tu Anh Trinh, Ariane Cuenen, Davy Janssens, Geert Wets, Kris Brijs. *Identification of beliefs determining wrong lane riding intentions among Vietnamese adolescent two-wheeled riders: An Expectancy-Value approach*. Pages 348-360.

Introduction: In Vietnam, road traffic crashes are one of the leading causes of death and serious injury in adolescents, especially in the 15–19-year age group. Wrong lane riding (WLR) is seen as the most common risky behavior of adolescent two-wheeled riders. This study (a) tested the expectancy-value model held to underpin the key determinants of behavioral intention (i.e., attitude, subjective norm, perceived behavioral control) as proposed by the Theory of Planned Behavior, and (b) identified appropriate targets for road safety interventions. **Method:** A cluster random sample of 200 adolescent two-wheeled riders in Ho Chi Minh City participated in a cross-sectional study designed to measure the variables of interest (i.e., behavioral beliefs, normative beliefs, control beliefs, and intention towards wrong lane riding). **Results:** The results of hierarchical multiple regression lend clear support for the expectancy-value theory as an approach to model the different belief components behind the key determinants of behavioral intention. Conclusion: Road safety interventions aimed at reducing WLR among Vietnamese adolescent two-wheeled riders would best target both the cognitive and the affective components of attitude, subjective norm, and perceived behavioral control. Interestingly, the sample investigated in this study is rather negatively predisposed toward WLR. **Practical Applications:** It is recommended to further strengthen and stabilize these safety-oriented beliefs, and to develop the required implementation intentions to guarantee that the appropriate goal intentions in terms of WLR are translated into action. More research is needed to see whether the commission of WLR can also be explained in function of a reactive pathway, or is exclusively under volitional control.

- **Keywords:** Wrong lane riding; Adolescents; Two-wheeled riders; Vietnam; Theory of Planned Behavior; Expectancy-Value approach

Leslie M. Carson, Suzanne M. Marsh, Margaret M. Brown, Katherine L. Elkins, Hope M. Tiesman. *An analysis of suicides among first responders — Findings from the National Violent Death Reporting System, 2015–2017*. Pages 361-370.

Introduction: First responders, including law enforcement officers (LEOs), firefighters, emergency medical services (EMS) clinicians, and public safety telecommunicators, face unique occupational stressors and may be at elevated risk for suicide. This study characterized suicides among first responders and identifies potential opportunities for additional data collection. **Methods:** Using suicides identified from the three most recent years of National Violent Death Reporting System data with industry and occupation codes from the NIOSH Industry and Occupation Computerized Coding System (2015–2017), decedents were categorized as first responders or non-first responders based on usual occupation. Chi-square tests were used to evaluate differences in sociodemographic and suicide circumstances between first and non-first responders. **Results:** First responder decedents made up 1% of all suicides. Over half of first responders (58%) were LEOs, 21% were firefighters, 18% were EMS clinicians, and 2% were public safety telecommunicators. Compared to non-first responder decedents, more

first responders served in the military (23% vs. 11%) and used a firearm as the method of injury (69% vs. 44%). Among first responder decedents for whom circumstances were known, intimate partner problems, job problems, and physical health problems were most frequent. Some common risk factors for suicide (history of suicidal thoughts, previous suicide attempt, alcohol/substance abuse problem) were significantly lower among first responders. Selected sociodemographics and characteristics were compared across first responder occupations. Compared to firefighters and EMS clinicians, LEO decedents had slightly lower percentages of depressed mood, mental health problems, history of suicidal thoughts, and history of suicide attempts. **Conclusions:** While this analysis provides a small glimpse into some of these stressors, more detailed research may help inform future suicide prevention efforts and interventions. Practical application: Understanding stressors and their relation to suicide and suicidal behaviors can facilitate suicide prevention among this critical workforce.

- **Keywords:** Suicide prevention; Emergency medical services; Public safety telecommunicator; Surveillance; Firefighter; Law enforcement

Carlton Washburn, Clair Kueny, Susan Murray. *Establishing links between safety culture, climate, behaviors, and outcomes of long-haul truck drivers*. Pages 371-379.

Introduction: This paper examines the safety relationships between safety culture, safety influences, safety climate, and safety outcomes for long-haul truck drivers. The relationships focus on the intersection of the electronic logging device (ELD) technology, regulations, and truck drivers that fall into the lone-worker category. **Results:** Through research questions, links between safety culture and safety climate were established with links between the layers. **Conclusions:** The implementation of the ELD system was associated with safety outcomes.

- **Keywords:** Safety; Culture; Climate; Lone-workers; Truck drivers

Elif Deniz Oguz Erkal, Matthew R. Hallowell, Siddharth Bhandari. *Formal evaluation of construction safety performance metrics and a case for a balanced approach*. Pages 380-390.

Introduction: Measuring safety performance is crucial to making informed decisions that improve construction safety management. Traditional approaches to construction safety performance measurement primarily focus on injury and fatality rates, but researchers have recently proposed and tested alternative metrics such as safety leading indicators and safety climate assessments. Although researchers tend to extol the benefits of alternative metrics, they are studied in isolation and the potential weaknesses are rarely discussed, leaving a critical gap in knowledge. **Method:** To address this limitation, this study aimed to evaluate existing safety performance against a set of pre-determined criteria and explore how multiple metrics may be used together to optimize strengths and offset weaknesses. For a well-rounded evaluation, the study included three evidence-based assessment criteria (i.e., the extent to which the metric is predictive, objective, and valid) and three subjective criteria (i.e., the extent to which each metric is clear, functional, and important). The evidence-based criteria were evaluated using a structured review of existing empirical evidence in literature, while the subjective criteria were evaluated using expert opinion solicited through the Delphi method. **Results:** The results revealed that no construction safety performance measurement metric is strong in all evaluation criteria, but many weaknesses may be addressed through research and development. It was also demonstrated that combining multiple complementary metrics may result in a more complete evaluation of the safety systems because multiple metrics offset respective strengths and weaknesses. **Practical Applications:** The study provides a holistic understanding of construction safety measurement that may guide safety

professionals in their selection of metrics and assist researchers who seek more reliable dependent variables for intervention testing and safety performance trending.

- **Keywords:** Safety performance; Safety metrics; Performance metrics; Lagging indicators; Metric evaluation

Mark W. Wiggins, David Lim, Meredith Porte, Piers Bayl-Smith. *Cue utilization and pool lifeguarding*. Pages 391-397.

Introduction: Amongst pool lifeguards, the capacity to identify drowning swimmers quickly and accurately depends on the interpretation of critical cues. However, assessing the capacity for cue utilization amongst lifeguards at present is costly, time-consuming, and largely subjective. The aim of this study was to test the relationship between cue utilization and the detection of drowning swimmers in a series of virtual public swimming pool scenarios. **Method:** Eighty-seven participants with or without lifeguarding experience engaged in three virtual scenarios, two of which were target scenarios where drowning events occurred within a 13 minute or 23 minute period of watch. Cue utilization was assessed using the pool lifeguarding edition of the EXPERTise 2.0 software following which 23 participants were classified with higher cue utilization, while the remaining participants were classified with lower cue utilization. **Results:** The results revealed that participants with higher cue utilization were more likely to have acquired experience as a lifeguard, were more likely to detect the drowning swimmer within a three minute period, and, in the case of the 13 minute scenario, recorded a greater dwell time on the drowning victim prior to the drowning event. Conclusion: The results suggest that cue utilization is associated with drowning detection performance in a simulated environment and could be employed as a basis for assessments of performance amongst lifeguards in the future. Practical Implications: Measures of cue utilization are associated with the timely detection of drowning victims in virtual pool lifeguarding scenarios. Employers and trainers of lifeguards can potentially augment existing lifeguarding assessment programs to quickly and cost-effectively identify the capabilities of lifeguards. This is especially useful for new lifeguards or where pool lifeguarding is a seasonal activity that might be associated with skill decay.

- **Keywords:** Cues; Drowning; Situation Assessment; Virtual Reality; Simulation

Yusuke Hayashi, Jonathan E. Friedel, Anne M. Foreman, Oliver Wirth. *A hierarchical cluster analysis of young drivers based on their perceived risk and frequency of texting while driving*. Pages 398-404.

Introduction: The present study attempted to provide a proof-of-concept of usefulness of cluster analysis for identifying distinct and practically meaningful subgroups of drivers who differed in their perceived risk and frequency of texting while driving (TWD). **Method:** Using a hierarchical cluster analysis, which involves sequential steps in which individual cases are merged together one at a time based on their similarities, the study first attempted to identify distinct subgroups of drivers who differed in their perceived risk and frequency of TWD. To further evaluate the meaningfulness of the subgroups identified, the subgroups were compared in terms of levels of trait impulsivity and impulsive decision making for each gender. **Results:** The study identified the following three distinct subgroups: (a) drivers who perceive TWD as risky but frequently engage in TWD; (b) drivers who perceive TWD as risky and infrequently engage in TWD; and (c) drivers who perceive TWD as not so risky and frequently engage in TWD. The subgroup of male, but not female, drivers who perceive TWD as risky but frequently engage in TWD showed significantly higher levels of trait impulsivity, but not impulsive decision making, than the other two subgroups. Discussion: This is the first demonstration that drivers who frequently engage in TWD can be categorized into two distinct subgroups that differ in terms of the perceived risk of TWD. **Practical applications:** For drivers

who perceived TWD as risky yet frequently engage in TWD, the present study suggests that different intervention strategies may be needed for each gender.

- **Keywords:** Texting while driving; Perceived risk; Impulsivity; Cluster analysis; College students

Nethmin Malshani Pilanawithana, Yingbin Feng, Kerry London, Peng Zhang. *Framework for measuring resilience of safety management systems in Australian building repair and maintenance companies*. Pages 405-418.

Introduction: The complex and dynamic nature of building repair and maintenance (R&M) work tends to create safety risks for workers. Resilience engineering approach is identified as a complementary to conventional safety management techniques. Resilience of safety management systems is characterized by the capabilities to recover from, respond during, and prepare for unexpected situations. This research aims to conceptualize resilience of safety management systems in the building repair and maintenance context by introducing resilience engineering principles into the safety management system concept. **Method:** Data were collected from 145 professionals in building repair and maintenance companies in Australia. The structural equation modeling technique was utilized to analyze the collected data. **Results:** The results confirmed three dimensions (i.e., people resilience, place resilience, and system resilience) with 32 measurement items for assessing resilience of safety management systems. The results revealed that safety performance of building R&M companies was significantly affected by the interactions between people resilience and place resilience and the interactions between place resilience and system resilience. **Conclusions:** Theoretically, this study contributes to the safety management knowledge by theoretically and empirically supporting the development of concept, definition, and purpose of resilience for safety management systems. **Practical Applications:** Practically, this research proposes a framework for assessing the level of resilience of safety management systems that is characterized by employees' capabilities, supportiveness of workplace, and supportiveness of management to recover from safety incidents, react during unexpected situations, and prepare for preventative actions before occurrence of undesirable events.

- **Keywords:** Building repair and maintenance; Dimension; Resilience; Safety management system; Structural equation modeling

Samantha Islam, Akhter B. Hossain, Mohamed Shaban. *Older driver at-fault crashes at unsignalized intersections in Alabama: Injury severity analysis with supporting evidence from a deep learning based approach*. Pages 419-428.

Introduction: The research described in this paper explored the factors contributing to the injury severity resulting from the male and female older driver (65 years and older) at-fault crashes at unsignalized intersections in Alabama. **Method:** Random parameter logit models of injury severity were estimated. The estimated models identified a variety of statistically significant factors influencing the injury severities resulting from older driver at-fault crashes. **Results:** According to these models, some variables were found to be significant only in one model (male or female) but not in the other one. For example, variables such as driver under the influence of alcohol/drugs, horizontal curve, and stop sign were found significant only in the male model. On the other hand, variables such as intersection approaches on tangents with flat grade, and driver older than 75 years were found significant only in the female model. In addition, variables such as making turning maneuver, freeway-ramp junction, high speed approach, and so forth were found significant in both models. Estimation findings showed that two parameters in

the male model and another two parameters in the female model could be modeled as random parameters, indicating their varying influences on the injury severity due to unobserved effects. In addition to the random parameter logit approach, a deep learning approach based on Artificial Neural Networks was introduced to predict the outcome of the crashes based on 164 variables that are listed in the crash database. The artificial intelligence (AI)-based method achieved an accuracy of 76% indicating the role of the variables in deciding the final outcome. **Practical Applications:** Future plans are set to study the use of AI on large sized datasets to achieve a relatively high-performance, and hence to be able to identify which variables contribute the most to the final outcome.

- **Keywords:** Injury severity; Older driver; Random parameters; Unsignalized intersection; Deep learning

Kim A. Vuong, Ioni Lewis, Kirsten Vallmuur, Angela Watson. *Identifying foci for safety messages targeting child injury from driving quad bikes: A critical beliefs analysis of parental beliefs in Australia*. Pages 429-435.

Introduction: In Australia, between 2017–2021, 16% of quad bike fatalities involved children. Trauma statistics highlight that public awareness of the risks associated with children driving quads is required. Consistent with the Step approach to Message Design and Testing (SatMDT) and, in particular, Steps 1 and 2, this study sought to identify critical beliefs influencing parental intentions to allow their children to drive a quad bike and develop message content. The critical beliefs analysis was based on eliciting the Theory of Planned Behavior's (TPB) behavioral, normative, and control beliefs. **Methods:** An online survey was distributed via parenting blogs, social media posts, and snowballing of the researchers' network list. Parents who participated (N = 71; 53F, 18 M), were aged between 25–57 years (M = 40.96, SD = 6.98), had at least one child aged between 3 to 16 years, and currently resided in Australia. **Results:** The critical beliefs analysis identified four critical beliefs that significantly predicted parental intentions to allow their child to drive a quad bike. These beliefs included a behavioral belief (the perceived advantage that allowing their child to drive a quad bike would enable tasks to be completed), two normative beliefs (the perception that one's parents and partner would likely approve of allowing their child to drive a quad bike), and one control belief (a perceived barrier to allowing one's child to drive a quad that was associated with being aware of an increasing cultural concern around the safety of quad bikes). **Conclusions:** Findings contribute to insights regarding parental beliefs underpinning their intention to allow their child to drive a quad bike, an area previously lacking in research evidence. **Practical applications:** With child-use posing a high-risk activity for children, this study provides an important contribution that may help to inform future safety messaging targeting children's use of quad bikes.

- **Keywords:** Quad bikes; Children; Parents; Theory of Planned Behavior; Step approach to Message Design and Testing framework

Mathilde Duflos, Hebah Hussaina, Lise Olsen, Takuro Ishikawa, Mariana Brussoni. *Is parental propensity to risk associated with their child's medically-attended injuries? A cross-sectional study*. Pages 436-441.

Background: Societal expectations about safety influence parents' risk perceptions and children's risky play opportunities. This study examined parents' propensity to take risks themselves and their propensity to accept risks for their child, sex-related differences in parents' propensity to accept risks for their child, and the association between parents' propensity to accept risks for their child and that child's medically-attended injury history. **Methods:** A total of 467 parents attending a pediatric hospital with their 6–12-year-old child completed a questionnaire about their risk propensity for themselves and for their child and reported their child's injury history. **Results:** Parents' risk propensity for themselves was significantly higher than for their child, and fathers' risk propensity

for themselves was higher than mothers'. Linear regressions showed that fathers reported significantly more propensity to accept risks for their child than mothers, but parents did not differentiate between their sons and daughters. A binary logistic regression showed that parents' propensity to accept risks for their child was a significant predictor of pediatric medically-attended injury. **Conclusions:** Parents were more comfortable in taking risks for themselves than for their child. While fathers were more comfortable with their children engaging in risks than mothers, child's sex was not related to parents' propensity to accept risks for their child. Pediatric injury was predicted by parents' propensity to accept risks for their child. Further research investigating injury type and severity related parent risk propensity is needed to determine how parents' attitudes toward risk might relate to severe injury.

- **Keywords:** Risk perception; Attitudes; Public health; Child; Parenting

Yang Ding, Xiaohua Zhao, Yiping Wu, Chenxi He, Shuo Liu, Rupeng Tian. *Optimization method to reduce the risky driving behaviors of ride-hailing drivers*. Pages 442-456.

Introduction: To promote the safety level of ride-hailing services, this study develops the Targeted and Differentiated Optimization Method of Risky Driving Behavior Education and Training (TDOM-RDBET) founded on driver type classification of high-risk drivers. **Method:** Based on value and goal orientations, 689 drivers were classified into four driver types and were assigned to three groups, including an experimental group, a blank control group, and a general control group. This research preliminarily analyzes the effectiveness of the TDOM-RDBET to reduce mobile phone use while driving by assessing the main effects of the group and test session on the risk value ranking of mobile phone use while driving (AR), the frequency per 100 km of mobile phone use while driving (AF), and the frequency per 100 km of risky driving behaviors (AFR), as well as the interactive effects of the two factors on AR, AF, and AFR, based on a two-way analysis of variance (two-way ANOVA). **Results:** The results demonstrate an overall significant reduction in AR ($F = 8.653$, $p = 0.003$), AF ($F = 11.027$, $p = 0.001$), and AFR ($F = 8.072$, $p = 0.005$) for the experimental group after training. Moreover, significant interactive effects of the driver group × test session on AR ($F = 7.481$, $p = 0.001$) and AF ($F = 15.217$, $p < 0.001$) were found. AR was significantly lower for the experimental group than for the blank control group ($p < 0.05$) in the post-training condition. Moreover, AF was also significantly lower for the experimental group than for the blank control group ($p < 0.05$) and general control group ($p < 0.05$) in the post-training condition. **Practical Applications:** On the whole, it was preliminarily verified that the TDOM-RDBET is more effective than the general training method at modifying the risky driving behavior.

- **Keywords:** Driver education and training; Ride-hailing drivers; Mobile phone use while driving; Driver type classification; Two-way ANOVA

Zhitian Zhang, Tian Xiang, Hongling Guo, Ling Ma, Zhongyao Guan, Yihai Fang. *Impact of physical and mental fatigue on construction workers' unsafe behavior based on physiological measurement*. Pages 457-468.

Introduction: Construction worker fatigue is an important factor leading to unsafe behavior, a major cause of construction accidents. Uncovering the impact mechanism of fatigue on workers' unsafe behavior can prevent construction accidents. However, it is difficult to effectively measure workers' fatigue onsite and analyze the impact of worker fatigue on their unsafe behavior. **Method:** This research analyzes the relationship between the physical and mental fatigue of construction workers and their unsafe behavior via physiological measurement based on a simulated experiment on handling tasks. **Results:** It is found that: (a) both physical fatigue and mental fatigue have negative effects on workers' cognitive ability and motion ability, and the negative effects are more serious under the combination of the two types of fatigue; (b) mental fatigue

can easily change workers' risk propensity, making them more willing to face risks, and in a state of the two types of fatigue, they are more likely to make choices with less pay and higher risk; (c) the number of signal identification errors is positively correlated with LF (low frequency)/HF (high frequency), and negatively correlated with the standard deviation of normal-to-normal intervals (SDNN), while the number of footstep control errors is negatively correlated with the time elapsed between two successive R waves (RR interval) and skin temperature (SKT). **Practical Applications:** These findings can enrich construction safety management theory from a perspective of quantified fatigue and facilitate safety management practices on construction sites, thus contributing to the body of knowledge and practices of construction safety management.

- **Keywords:** Construction workers; Physical and mental fatigue; Unsafe behavior; Fatigue measurement; Safety management

Aya Bayramova, David J. Edwards, Chris Roberts, Iain Rillie. *Constructs of leading indicators: A synthesis of safety literature*. Pages 469-484.

Introduction: Leading indicators represent an invaluable tool that offer organizations the capability to: track health and safety performance, not just failures and accidents; measure effectiveness of safety efforts adopted; and focus on undesired precursors, rather than undesired occurred events. Despite these palpable advantages associated with their adoption, leading indicator's definition, application, and function are mostly ambiguous and inconsistent within literature. Therefore, this study systematically reviews pertinent literature to identify the constructs of leading indicators and generates guidance for leading indicator implementation (as a conceptual model). **Method:** The overarching epistemological design adopted interpretivism and critical realism philosophical stances together with inductive reasoning to analyze 80 articles retrieved from the Scopus database, plus 13 more publications supplemented by the snowballing technique. Analysis of the safety discourse within literature (as secondary data) was undertaken in two stages, namely: (1) a cross-componential analysis identified the main features of leading indicators in comparison to lagging indicators; and (2) content analysis revealed prominent constructs of leading indicators. Results and conclusion: Analysis results identify that the definition, types, and development methods represent the main constructs for understanding the concept of leading indicators. The study identifies that ambiguity around the definition and function of leading indicators is due to the lack of differentiation of its types, namely passive leading indicators and active leading indicators. Practical application: As a practical contribution, the conceptual model, which introduces continuous learning through a perpetual loop of development and application of leading indicators, will help adopters create a knowledge repository of leading indicators and to continuously learn and improve their safety and safety performance. Specifically, the work clarifies their difference in terms of the timeframe passive leading indicators and active leading indicators take to measure different safety aspects, the functions they serve, the target they measure and their stage of development.

- **Keywords:** Leading indicators; Lagging indicators; Safety management; Safety-I; Safety-II

José M. Carretero-Gómez, Francisco J. Forteza, Bàrbara Estudillo. *Linking occupational accidents and construction firm survival*. Pages 485-491.

Introduction: This paper examines the relationships between the reported accidents of workers in construction firms and the probability of those firms' survival. **Method:** Between 2004 and 2010, a sample of 344 Spanish construction firms from Majorca were selected. The study built panel data with the reported official accidents from the Labor Authority records and the firm survival or mortality from the Bureau van Dijḱs Iberian Balance Sheet Analysis System database. The hypothesis is that a higher number of

accidents directly affects the probability of the company surviving in the sector. By using a probit regression model with panel data, the relationship between these two variables were explored to test the hypothesis. **Results:** The study found evidence that an increment in accidents decreases the probability of the company continuing to operate, or worse, going bankrupt. The results can be useful to highlight the importance of defining policies to control those accidents effectively, since this may be a key factor in the sustainability, competitiveness, and growth of the construction sector for the economy of a region.

- **Keywords:** Occupational injuries; Economic performance; Competitiveness; Sustainability; Insolvency and Bankruptcy

Abderrahim Zermane, Mohd Zahirasri Mohd Tohir, Mohd Rafee Baharudin, Hamdan Mohamed Yusoff. *Investigating patterns of workplace fatal fall injuries: Case study of Malaysia*. Pages 492-506.

Introduction: Falling from heights can be a serious and potentially life-threatening hazard. In Malaysia, falls from heights are one of the leading causes of workplace accidents and fatalities. The Malaysian Department of Occupational Safety and Health (DOSH) reported that the year 2021 recorded an alarmingly high number of fatalities, of which the majority of the injuries were due to falls from heights. Objective: The purpose of this study is to understand the relationship between the different variables associated with fatal falls from heights, which will help identify potential areas to work on to prevent these types of injuries. **Methods:** The study analyzed 3,321 fatal falls from height accidents from 2010 to 2020 DOSH data. Data were cleaned and normalized to extract relevant information for analysis, with agreement on variables and reliability achieved through independent sampling. **Results:** This study found that general workers were the most vulnerable category to fatal falls, with a 32% yearly average, whereas supervisors were the least vulnerable, with 4%. Roofers recorded a yearly fatal falls average of 15.5%, followed by electricians with 12%. Cramer's V results ranged from negligible, weak, and strong correlations; strong to moderate correlation between the dates of injuries and the factors used in this study, whereas the direct and root causes recorded a weak to negligible correlation with the rest of the variables. **Conclusions:** This study provided a better understanding of the working conditions of the Malaysian construction industry. By analyzing fall injury patterns and uncovering the factors, direct and root causes relationship with other variables, it was clear how severe the Malaysian workplace conditions were. **Practical Applications:** This study will help better understand fatal fall injuries in the Malaysian construction industry and help develop prevention measures based on the uncovered patterns and associations.

- **Keywords:** Fatal falls from heights; Cramer's V; Statistical analysis; Fatalities prevention

Jill Daugherty, Kelly Sarmiento, Dana Waltzman, Julianne Schmidt. *Special Report from the CDC Healthcare provider influence on driving behavior after a mild traumatic brain injury: Findings from the 2021 SummerStyles survey*. Pages 507-512.

Introduction: Research shows that a mild traumatic brain injury (mTBI) impairs a person's ability to identify driving hazards 24 h post injury and increases the risk for motor vehicle crash. This study examined the percentage of people who reported driving after their most serious mTBI and whether healthcare provider education influenced this behavior. **Methods:** Self-reported data were collected from 4,082 adult respondents in the summer wave of Porter Novelli's 2021 ConsumerStyles survey. Respondents with a driver's license were asked whether they drove right after their most serious mTBI, how safe they felt driving, and whether a doctor or nurse talked to them about when it was ok

to drive after their injury. **Results:** About one in five (18.8 %) respondents reported sustaining an mTBI in their lifetime. Twenty-two percent (22.3 %) of those with a driver's license at the time of their most serious mTBI drove within 24 h, and 20 % felt very or somewhat unsafe doing so. About 19 % of drivers reported that a doctor or nurse talked to them about when it was safe to return to driving. Those who had a healthcare provider talk to them about driving were 66 % less likely to drive a car within 24 h of their most serious mTBI (APR = 0.34, 95 % CI: 0.20, 0.60) compared to those who did not speak to a healthcare provider about driving. **Conclusions:** Increasing the number of healthcare providers who discuss safe driving practices after a mTBI may reduce acute post-mTBI driving. **Practical Applications:** Inclusion of information in patient discharge instructions and prompts for healthcare providers in electronic medical records may help encourage conversations about post-mTBI driving.

- **Keywords:** Traumatic brain injury; Injury prevention; Driving; Public health; Survey research