Wei Yan, S.C. Wong, Becky P.Y. Loo, Connor Y.H. Wu, Helai Huang, Xin Pei, Fanyu Meng. *An assessment of the effect of green signal countdown timers on drivers' behavior and on road safety at intersections, based on driving simulator experiments and naturalistic observation studies*. Pages 1-12.

Introduction: Motor-vehicle crashes at signalized intersections are a significant traffic safety problem. To address this problem, many Asian cities have installed signal countdown displays at signalized intersections, aiming to assist drivers to make correct decisions in response to traffic signals. **Method:** In this study, we assessed the short-term and long-term effects of green signal countdown timers (GSCTs) on road safety, using a combination of driving simulator experiments and naturalistic observations. **Results:** In our driving simulator experiments, 80 participants drove at 50 km/h in scenarios in which a car either approached a signalized intersection alone or following another car. In naturalistic observations, short-term (1-week) and long-term (1-year) intersection safety in the presence and absence of GSCTs were compared. These observations revealed that GSCTs reduced the number of red-light-running violations over the short term, but not over the long term. In fact, GSCTs appeared to lead to an overall increase in rear-end crash risk at intersections, as their presence resulted in drivers exhibiting more sudden acceleration and braking, and altered intersection-crossing speeds and patterns. **Conclusions:** The results suggest that GSCTs worsen safety at signalized intersections, and thus their removal should be considered.

- ▪ **Keywords:** Signalized intersection safety; Green signal countdown timer (GSCT); Driving behavior

Ziqi Li, Xiaolong Wang, Shiji Gong, Ninghao Sun, Ruipeng Tong. *Risk assessment of unsafe behavior in university laboratories using the HFACS-UL and a fuzzy Bayesian network*. Pages 13-27.

Introduction: Risk assessment for unsafe behavior is an important task in the management of university laboratories. Yet related research activities are still in the early stages. This paper attempts to deepen the insight and provide a basis for further research. **Method:** As traditional methods are inadequate in terms of quantitative assessment and uncertainty handling, this paper proposes a method to assess the risk of

unsafe behavior in university laboratories using the human factor analysis and classification system for university laboratories (HFACS-UL)-fuzzy Bayesian network (BN) approach. A BN structure was established using the HFACS-UL model for the identification of factors influencing unsafe behavior. Using a fuzzy BN approach, parameters are learned based on prior knowledge and expert experience. The model is then applied for inference analysis to identify the main risk factors. The key agents were also analyzed along with meta-networks to determine further preventive and control measures. **Results:** Taking chemistry laboratories of a university as an example, the results show that the probability of unacceptable unsafe behavior in chemical laboratories is 86%, indicating that commitment and cooperation from different agents are required. Of the 24 risk factors, poor organizational climate, with a sensitivity value of 24.1%, has the greatest impact on unsafe behavior. The most fundamental factor contributing to the occurrence of unsafe behavior is inadequate legislation, which in turn results in unacceptable external factors and inadequate supervision, thus forming the most likely causal chain. The functional department, lab center director, and secondary faculty leadership team are the most critical agents. **Conclusions:** Results from the chemistry laboratories demonstrate the credibility of the model. **Practical applications:** This study may help provide technical support for risk management in university laboratories.

- **Keywords:** University laboratory safety; Risk assessment; Fuzzy Bayesian network; University laboratories human factor analysis and classification system; Unsafe behavior

Tuula Räsänen, Arto Reiman, Kai Puolamäki, Rafael Savvides, Emilia Oikarinen, Eero Lantto. *Finding statistically significant high accident counts in exploration of occupational accident data*. Pages 28-37.

Introduction: Finnish companies are legally required to insure their employees against occupational accidents. Insurance companies are then required to submit information about occupational accidents to the Finnish Workers' Compensation Center (TVK), which then publishes occupational accident statistics in Finland together with Statistics Finland. Our objective is to detect silent signals, by which we mean patterns in the data such as increased occupational accident frequencies for which there is initially only weak evidence, making their detection challenging. Detecting such patterns as early as possible is important, since there is often a cost associated with both reacting and not reacting: not reacting when an increased accident frequency is noted may lead to further accidents that could have been prevented. **Method:** In this work we use methods that allow us to detect silent signals in data sets and apply these methods in the analysis of real-world data sets related to important societal questions such as occupational accidents (using the national occupational accidents database). **Results:** The traditional approach to determining whether an effect is random is statistical significance testing. Here we formulate the described exploration workflow of contingency tables into a principled statistical testing framework that allows the user to query the significance of high accident frequencies. **Conclusions:** Our results show that we can use our iterative workflow to explore contingency tables and provide statistical guarantees for the observed frequencies. **Practical Applications:** Our method is useful in finding useful information from contingency tables constructed from accident databases, with statistical guarantees, even when we do not have a clear a priori hypothesis to test.

- **Keywords:** Occupational accident; Silent signals; Workplace; Prevention

Steve Granger, Nick Turner. *Adapting, adopting, and advancing change: A framework for future research in the psychology of occupational safety*. Pages 38-47.

Introduction: While there are numerous reviews of the research on the psychology of occupational safety, these studies provide weak guidance on where the research should

go next. Accordingly, we introduce a simple framework for thinking about future research in this area: the adapting, adopting, and advancing change framework. This framework summarizes how external, technological, and theoretical developments have driven research in the psychology of occupational safety and uses these observations as evidence to imagine ways in which they may continue to do so. **Method:** We critically reviewed seminal research in the psychology of occupational safety using the adapting, adopting, and advancing change framework. Adapting to change means considering external changes such as the fluctuating nature of work and the labor market. Adopting change refers to incorporating the latest technological and technical advances to facilitate more robust research methods and analyses. Finally, advancing change refers to theoretical advances and how they will push psychology of occupational safety research forward. **Results:** We highlight several avenues for future research that emerge at the convergence of the framework's three themes, including developing the safety skill construct, assessing variation in demand appraisals on safety outcomes, distinguishing safety climate from related constructs, and examining safety constructs that are usually considered as outcomes (e.g., injuries) as predictors instead. **Conclusions:** In doing so, we provide a clear structure to help researchers better identify the most effective directions for future research on the psychology of occupational safety.

Mario Alberto Trógolo, Rubén Ledesma, Leonardo Adrián Medrano, Sergio Dominguez-Lara. *Peer pressure and risky driving: Development of a new scale*. Pages 48-56.

Introduction: Peer pressure is a main factor influencing risky driving behavior in young people. Most empirical studies have focused either on direct or indirect peer pressure, and comprehensive measures assessing both are currently lacking. The present study aimed at developing and validating a scale to examine the influence of different types of peer pressure on risky driving in young drivers: the Peer Pressure on Risky Driving Scale (PPRDS). **Method:** Scale construction and assessment of its psychometric properties involved four phases: item development, assessment of content validity by expert reviewers, pre-testing of the scale and evaluation of psychometric properties of the final version in a sample of 773 young drivers aged 18–29. **Results:** Confirmatory factor analysis supported a three-factor structure that reflected the multifaceted definition of peer pressure on risky driving in the immediate driving context: risk-encouraging direct peer pressure; risk-discouraging direct peer pressure, and indirect pressure. The three factor scales showed good internal consistency and construct reliability, and correlated as expected with self-reported risky driving. Younger drivers (18–24) reported more direct and indirect peer pressure to engage in risky driving. Males indicated more direct peer pressure towards risky driving. Finally, interaction effects between age and sex were observed. Young male drivers reported the greatest direct peer pressure and adult female drivers the lowest direct peer pressure. **Conclusions:** The 23-item PPRDS scale has good psychometric properties and provides a useful tool for assessing different forms of peer pressure on risky driving. **Practical Applications:** The PPRDS can be used for evaluating the impact of peer-based education and road safety programs. The scale also provides valuable information for the design of evidence-based intervention.

Garry Claxton, Peter Hosie, Piyush Sharma. *Toward an effective occupational health and safety culture: A multiple stakeholder perspective*. **Pages 57-67.**

Introduction: This paper uses an extensive review of the safety culture literature to identify three key themes (a) role of new employees, (b) absence of a pro-active approach, and (c) need for a 'No-blame' culture, and explores their impact on the occupational health and safety culture (OHS). **Method:** We use a qualitative study with a constructivist phenomenological approach consisting of 55 in-depth interviews with a diverse range of participants, including business owners, line managers and supervisors, OHS advisors, workers, and union representatives in Western Australia. A workplace vignette was used to elicit cultural norms derived from the participants' attitudes and beliefs, which were analyzed using NVivo software to conduct a thematic analysis to classify the interview text into specific concepts and phrases. **Results:** Findings confirm the three themes identified from our literature review and provide useful insights into the challenges faced by the participants in the implementation of safety policies. **Practical Applications:** Besides extending the occupational health and safety literature, these findings have important managerial implications in view of the evolving nature of work and workplaces.

- **Keywords:** Culture; Occupational health and safety; Proactive; Stakeholders

Anders Jonsson, Marcus Runefors, Johanna Gustavsson, Finn Nilson. *Residential fire fatality typologies in Sweden: Results after 20 years of high-quality data*. **Pages 68-84.**

Introduction: Despite a positive long-term trend in fire mortality rates, more knowledge is required concerning the causes and typologies of fatal residential fires in order to improve preventative efforts and further decrease fatality rates. A previous study suggested that fatal residential fires can be grouped into six categories, however, the analyses were performed on a limited dataset that is now more than a decade old. As such, there are some uncertainties regarding the current situation. Also, in the previous study, no subgroups were analyzed separately, despite fatal fires being renowned for being strongly age-dependent. **Method:** This study re-analyzes the typologies for fatal residential fires in Sweden using cluster analysis, based on data for a period of 20 years with a particular focus on older adults. **Results:** The results suggest that the original cluster analyses were relatively robust for both the total population and for the elderly population, thereby indicating that fatal fires seem to be consistently grouped into certain types. **Conclusions:** The results suggest that preventative efforts can be directed toward these types of events involving identified individuals. The results also suggest that the number of fatal residential fires with unknown causes has increased in relation to other fires during the 20-year study period. **Practical Implications:** Fatal residential fires with unknown causes are more often large night-time fires occurring in houses in rural locations. In order to prevent these, both prevention and reactive strategies need to be re-evaluated.

- **Keywords:** Fire mortality; Cluster analysis; Elderly

Jennifer L. Hanna, Michelle F. Wright, Sandra T. Azar. *Use of a serious game simulation to build early childhood staff capacity for reducing unintentional childhood injuries*. **Pages 85-92.**

Introduction: Unintentional home injuries are common and costly, with over 1.6 million occurring among U.S. children ages 0–4 in 2018. Home visitors and other early childhood professionals can provide valuable prevention education and intervention to reduce unintentional injury risk for children. This proof-of-concept study aimed to test the

feasibility of the first phase of Home Safety Hero, a software-based serious game simulation that trains users in identification of home safety risks, as a capacity building tool for early childhood professionals. **Methods:** The game simulation's potential for knowledge promotion and engagement in a sample of home visitors was explored based on play of the first phase. Repeated measures ANOVAs were used to assess learning via reaction time, and engagement was measured via the User Engagement Scale (UES). **Results:** Reaction time (i.e., average time to identify hazards) improved from the first to last levels in both single and mixed category levels in this trial. Participant indicated agreement with four subscales of engagement measured by the UES, and neutral to agree on a fifth subscale, focused attention. **Conclusions:** We propose that this game simulation can meet the unique training needs of early childhood professionals while promoting home safety knowledge that can improve prevention work with families. Participant feedback was largely positive, and results suggest that the game simulation is engaging and contributes to knowledge. **Practical Applications:** The Home Safety Hero serious game simulation is a flexible training option that appeared to be feasible for reducing time to hazard identification among home visitors in this proof-of-concept study. The design of the game simulation has utility in meeting the specialized training needs of early childhood professionals and potential to build their capacity to provide direct intervention around home safety, reducing risk for unintentional injury among children.

- ▪ **Keywords:** Injury prevention; Staff training; Workforce capacity building; Early childhood professional development; Serious game simulation

Kwaku F. Boakye. *Are out-of-state drivers more seatbelt compliant than in-state drivers in the United States?* Pages 93-101.

Introduction: This study explored the seatbelt use among in-state and out-of-state drivers in relation to their personal (age, gender, license status, etc.) and crash characteristics (time, location, roadway factors, etc.) using crash data over a 10-year period (2010–2019) from the Fatality Analysis Reporting System (FARS). **Method:** Comparison of seatbelt use between the two groups (in-state vs. out-of-state drivers) were conducted using Z-test statistics. Logistic regression models were developed to examine the probability of seatbelt use among each group. **Results:** New findings in this study showed that out-of-state drivers were 5% more likely than in-state drivers to use seatbelts. Regardless of the driver's age, gender, license status, vehicle type, and injury severity, seatbelt use was significantly higher among out-of-state drivers. Moreover, irrespective of the location (rural or urban), the season (time, day, or month), road type (arterial, local streets, etc.), and jurisdictional seatbelt law (primary or secondary), out-of-state drivers were more seatbelt compliant than in-state drivers. Finally, out-of-state drivers traveling from states with secondary/no seatbelt laws exhibited higher seatbelt compliance rate in primary seatbelt law states than in states with less strict laws (i.e., secondary/no law). **Practical Applications:** The findings in this study are critical to addressing a myriad of policy questions related to seatbelt laws and seatbelt use. Future research should focus on the disparity in seatbelt use between the two groups and determine intervention strategies that are effective at promoting seatbelt use across the United States. Additionally, given the significant differences in driver seatbelt use behavior based on the type of seatbelt law, if states with less strict laws upgrade to primary seatbelt laws, there likely will be increases in seatbelt compliance in those states.

- ▪ **Keywords:** Seatbelt use; Seatbelt laws; Fatal crash; Driver; Z-test; Logistic regression

James C. Fell, Traci Toomey, Angela H. Eichelberger, Julie Kubelka, Daniel Schriemer, Darin Erickson. *What is the likelihood that underage youth can obtain marijuana from licensed recreational marijuana outlets in California, a state where recreational marijuana is legal?* **Pages 102–111.**

Objective: Since 2012, 19 states and the District of Columbia have legalized the recreational use of marijuana for adults ages 21 and older. Marijuana use at any level can impair driving performance. Prior research on enforcement of the minimum legal marijuana use age of 21 (MLMU-21) laws is limited. The objective of the current study was to assess the ease of access to marijuana by underage patrons at recreational marijuana outlets in California, where recreational marijuana was legalized in 2016. **Method:** Pseudo-underage patrons were sent to 50 randomly selected licensed recreational marijuana outlets in the state to see if they could enter the outlet without showing a valid identification of their age. **Results:** Pseudo-underage patrons were required to show age identification to enter in 100% of the licensed recreational marijuana outlets visited. **Conclusions:** It appears that licensed California recreational marijuana outlets avoid selling marijuana to underage customers. One reason could be a strong incentive for recreational marijuana outlet owners and managers to avoid being shut down for an illegal activity. Practical Application: Underage youth are not obtaining marijuana at licensed recreational outlets. Future studies and cannabis enforcement agencies should investigate whether underage patrons attempt to use fake IDs at licensed marijuana outlets and whether youth are obtaining marijuana from illicit dispensaries or from social sources.

Tyler S. Love, Kenneth R. Roy, Melvin Gill, Mark Harrell. *Examining the influence that safety training format has on educators' perceptions of safer practices in makerspaces and integrated STEM labs*. **Pages 112–123.**

Introduction: The rising popularity of makerspaces and integrated science, technology, engineering, and mathematics (STEM) education labs has increased the safety/health hazards and resulting potential risks that schools, libraries, community centers, and educators must be prepared to address. Previous studies have demonstrated that adequate safety training can enhance educators' safety perceptions and reduce accident rates. **Method:** Safety training was conducted in three different U.S. states for 48 educators working in K-12 STEM areas. Differences in the mode of delivery, length of the training, and types of hands-on activities instituted at each training site were examined in relation to the level of influence these factors had on educators' safety perceptions. A modified version of the Science Teaching Efficacy Belief Instrument (STEBI) was used, which had previously been adapted for similar safety studies and showed strong reliability measures. **Results:** The pre- and post-survey responses revealed that educators at the fully online and shortest training session did not experience significant changes in their safety perceptions. However, participants at the two face-to-face sites demonstrated significant gains in their safety perceptions. Most notably, the site that offered the longest training and integrated the most hands-on lab activities recorded the greatest gains. Additionally, correlational analyses corroborated that as the amount of hands-on activities and length of the trainings increased, there was a positive significant association with changes in educators' safety perceptions. **Conclusions:** This research helps bridge the gap between industry and K-12 STEM education research regarding better safety training practices. The findings from this study can help promote safer teaching and learning environments, while also reducing liability and the chance of a serious accident. **Practical Applications:** State departments, higher education

institutions, teacher education programs, school districts, and others providing STEM safety training to K-12 educators should utilize this research to reexamine their safety training policies and practices.

Beatrice Albanesi, Michela Piredda, Marco Bravi, Federica Bressi, Raffaella Gualandi, Anna Marchetti, Gabriella Facchinetti, Andrea Ianni, Francesca Cordella, Loredana Zollo, Maria Grazia De Marinis. *Interventions to prevent and reduce work-related musculoskeletal injuries and pain among healthcare professionals. A comprehensive systematic review of the literature*. **Pages 124-143.**

Introduction: Work-related musculoskeletal disorders (WMSDs) are among the main causes of injury and pain in healthcare professionals. Previous reviews provided a fragmented view of the interventions available for WMSDs. This review aims to provide a comprehensive description of interventions for preventing and reducing work-related musculoskeletal injuries and/or pain among healthcare professionals, and to assess the methodological quality of studies. **Methods:** A systematic literature review was performed, based on the Effective Public Health Practice Project process. A comprehensive search was conducted on six peer-reviewed databases and manually. The methodological quality of the studies included was rated as weak, moderate, or strong. The studies were organized based on the 2019 classification of the interventions by Oakman and colleagues. **Results:** Twenty-seven articles were included reporting individual (n = 4), task-specific (n = 4), work organization and job design (n = 2), work environment (n = 1), and multifactorial (n = 16) interventions. Overall quality rating was strong for 6 studies, moderate for 16, and weak for 5. Individual interventions such as neuromuscular and physical exercise were effective in reducing pain. Task-specific and work organization interventions could prevent certain injuries. Significant reduction of both injuries and pain resulted from multifactorial interventions, which were reported by the majority of strong (n = 5) and moderate (n = 10) quality articles. **Conclusions:** This review provides healthcare professionals with evidence-based information to plan interventions targeted towards reducing WMSDs. In particular, more efforts are needed to implement and extend effective multifactorial interventions. Moreover, studies about each professional healthcare target group are needed. Practical Application: Our results can guide policy-makers, healthcare managers and professionals to choose the best strategies to prevent and reduce WMSDs and to shape continuous education programs. This study prompts clinicians to develop inter-professional collaborations and to practice physical activities in order to reduce WMSDs.

Jeremy M. Gernand. *The occupational safety implications of the California residential rooftop solar photovoltaic systems mandate*. **Pages 144-150.**

Introduction: A 2018 change to the California building code mandates that new residential construction in the state include rooftop solar photovoltaic power systems beginning in 2020. As residential construction (especially work on rooftops) is among the more dangerous occupations in the United States, this paper seeks to quantify the increased risks to workers as a result of this mandate. **Method:** An analysis of the trends by occupation of nonfatal safety incident rates in the United States combined with a Monte Carlo simulation provide an estimate of the uncertain impact of this new mandate. **Results:** Recordable safety incidents are anticipated to increase by a total of 16.6

incidents (standard deviation = 1.0 incidents) over the 2020–2029 time period as a result of this policy change. However, lessons from Germany and other industries offer potential avenues to reduce the negative social impact of this mandate. **Conclusions:** While it is not possible to increase employment in any sector without increasing the expected number of occupational injuries to some degree, these results indicate that risks could be considerably reduced by making solar PV system design decisions that increase worker productivity and reduce roof exposure time. **Practical Applications:** Changes such as eliminating work on roofs could decrease the expected number of recordable injuries over the 10-year period by 0.30 incidents per year (a reduction of 18%).

Tristan W. Casey, Xiaowen Hu, Lisette Kanse, Angelica Varhammar. *A tale of six climates: Reflections and learnings after the development of six industry-specific safety climate scales*. Pages 151-158.

Introduction: Researchers are finding merits in utilizing industry-specific safety climate scales that capture the nuances of context, and tend to show stronger associations with safety behavior and outcomes like incidents. Yet, to date, guidance around the practicalities of developing and validating such industry-specific scales is lacking in the safety science literature. **Method:** In this paper we outline our experiences developing six industry-specific safety climate scales and highlight strengths and limitations of our approach. We also briefly review the industry-specific safety climate literature and offer highlights for consideration when developing such scales. Our method to develop industry-specific safety climate scales followed an established best practice structure: literature review of existing published industry scales, collation and review of existing scale items, consultation interviews with industry experts, item drafting, exploratory and confirmatory statistical analyses, and finally, a real-world ecological validity test. **Results:** Our research highlighted the diversity of safety climate dimensions (both the conceptual and content domains of each dimension) when it is considered at an industry level. Also, the literature reviews revealed a dearth of industry-specific safety climate scales in the areas we engaged with, so our project filled a glaring gap in research and practice. Best practice safety climate scale development methods are provided to stimulate further research. **Conclusions:** We conclude with reflections on the nature of safety climate within and across industries, and offer suggestions for future lines of research across other contexts (e.g., national culture, geography, and regulatory settings). We suggest that industry-specific safety climate scales have a specific use case, such as identifying specific areas to improve and evaluating the impact of safety interventions. **Practical Applications:** This article provides applications for both applied researchers (to improve capabilities in safety climate scale development) and practitioners who wish to measure organisational safety climate and design effective interventions. Engaging with regulators to build safety climate scales is powerful because their personnel have rich experiences to share across multiple workplaces. Organisational researchers can engage with survey panels to build robust scales. Finally, industry-specific nuances can lead to richer insights into an organisation's safety climate.

Jin Wang, Jessica B. Cicchino. *Safety effects of roundabout conversions in Carmel, Indiana, the Roundabout City*. Pages 159-165.

Introduction: Roundabouts are a proven safety countermeasure for intersection safety. This study examined the safety effects of roundabout conversions in Carmel, Indiana, also known as the "Roundabout City." Doing so is of particular interest because Carmel has a high density of roundabouts and its drivers understand their effectiveness and are familiar with navigating them. This study also adds to the current state of knowledge

about innovative double-teardrop roundabouts (i.e., linked roundabouts with teardrop-shaped central islands). **Method:** Negative binomial models accounting for correlation within site pairs were applied to evaluate the safety effects of converting conventional intersections to roundabouts on total crashes, injury crashes, and property-damage-only (PDO) crashes between study sites and control sites for different roundabout types (single-lane, multi-lane, and double-teardrop). We compared crash data from a 2-year period before the installation of the roundabouts with the 2-year period after the conversions. **Results:** Injury crashes were 47% lower than what would have been expected without the roundabout conversions. The effects were strongest at the double-teardrop roundabouts, where injury crashes were significantly reduced by 84% and total crashes by 63%. Single-lane roundabouts experienced significant decreases of 51% in total crashes and 50% in PDO crashes (and a nonsignificant decrease of 50% in injury crashes). Multi-lane roundabouts were associated with increases in total and PDO crashes but a 15% decrease in injury crashes, though all were nonsignificant. **Conclusions:** Overall, the City of Carmel's roundabout program is associated with reductions in injury crashes, which indicates improvements to safety. Single-lane and double-teardrop roundabouts are associated with improvements in the occurrence and severity of crashes. **Practical Applications:** Double-teardrop roundabouts should be considered for installation at interchange terminals to improve highway safety.

- **Keywords:** Single-lane roundabouts; Multi-lane roundabouts; Double-teardrop roundabouts; Crashes; Injuries

Keyao Li, Mark A. Griffin. *Safety behaviors and job satisfaction during the pandemic: The mediating roles of uncertainty and managerial commitment*. Pages 166-175.

Introduction: As the Covid-19 pandemic affects the world, disruptions to work routines impose a psychological burden on people, and thus can affect their job performance and well-being. We conducted an empirical study to explore the links between the experience of Covid-19 and workers' safety behaviors and well-being outcome of job satisfaction. **Method:** Structural equation modelling (SEM) with a sample of 515 safety workers was conducted to simultaneously test the links among these constructs. **Results:** Experience of Covid-19 was associated with lower employee job satisfaction, explained by higher psychological uncertainty and decreased perception of managerial commitment to safety. Notably, contrasting pathways from experience of Covid-19 to safety behaviors were found. On the one hand, higher psychological uncertainty caused by the pandemic was associated with lower perceptions of managerial safety commitment; and lower perceived managerial safety commitment was linked to reduced safety compliance and safety participation. On the other hand, experience of Covid-19 in this study showed unexpected positive direct links with safety behaviors, which might be explained by workers' enhanced safety knowledge, motivation, and status of mindfulness due to Covid-19 related safety instructions and communications. **Conclusions:** This exploratory study helps to deepen the understanding of workplace safety and well-being in the context of pandemic and in times of uncertainty. **Practical Applications:** The practical insights are useful for applying appropriate strategies for managing the Covid-19 crisis, coping with uncertainties, and building a healthier and safer workplace in the long run.

- **Keywords:** Covid-19 pandemic; Psychological uncertainty; Safety compliance; Managerial safety commitment; Safety participation; Job satisfaction

Richard A. Dunn, Nathan W. Tefft, Eduardo Romano. *The prevalence and excess mortality risk of driving with children*. Pages 176-183.

Introduction: The presence of passengers can affect the driving behavior of motor-vehicle operators. Child passengers present unique motivations to drive more safely, as well as opportunities to distract drivers. Because motor-vehicle crashes are an important

cause of premature childhood mortality, this study assesses whether adult drivers with child passengers are more or less likely to cause a fatal crash. **Method:** Data include fatal crashes involving one or two vehicles from 2007 to 2017 in the U.S. Fatality Analysis Reporting System. We apply methods developed by Levitt and Porter (2001) and Dunn and Tefft (2020) -the LPDT approach- to estimate the risk that adult drivers (21 years or older) with at least one child passenger (15 year or younger) cause a fatal crash relative to adults without child passengers. **Results:** Childhood crash exposure when traveling with an adult driver is low: 0.78% of vehicle miles traveled by adults included a child passenger. Nevertheless, adult drivers with child passengers were significantly more likely to cause a fatal crash than adult drivers without child passengers. The estimated risk of causing a single-vehicle crash was 6.2 times higher among the full sample of adults, 7.2 times higher among female drivers, and 5.0 times higher among drivers 25–44 years old. **Conclusions:** Despite their relatively low crash exposure, child passengers are associated with much greater risk of causing a fatal crash. **Practical Applications:** This study not only informs about the need to develop interventions to remind parents and adult drivers of the risks associated with driving children, but also reminds researchers about the enormous potential of the LPDT approach when applied to traffic safety issues.

- **Keywords:** Child passenger; LPDT approach; Crash risk; Protective and risk factors

Colin Glesner, Robbe Geysmans, Catrinel Turcanu. *Two sides of the same coin? Exploring the relation between safety and security in high-risk organizations*. Pages 184-193.

Introduction: While safety in high-risk organizations has been high on the agenda for multiple decades, these organizations are now increasingly concerned about security threats. In light of this, academics and institutions have set forth the vision of a synergistic integration of safety and security, warranted by their common goal to protect people and the environment. However, it is not always clear how this vision should be enacted on the work floor. While safety and security policies share some elements, recent studies point out that their practical enactments may diverge and lead to potential tensions. **Methods:** Using an empirically grounded inquiry within a nuclear research center, this paper analyzes how safety and security practices interact. Our analysis reveals that, while they contain similar management frameworks and practical means, safety and security interactions are also characterized by various tensions. Mobilizing paradox theory, we highlight how these tensions are (to a large extent) rooted in three underlying paradoxes: distrust vs trust; transparency vs confidentiality; and movement enablement vs movement restriction. **Practical Applications:** We discuss the practical implications of these findings and, based on these, we argue that an integrated approach to safety and security should, rather than sideline tensions, promote the creation of 'tension venues.' Such tension venues offer spaces for reflection, and as such would enable the co-creation of innovative measures to articulate safety and security.

- **Keywords:** Safety; Security; Relations; Tensions; Paradoxes

Byungjoo Choi, SangHyun Lee. *The psychological mechanism of construction workers' safety participation: The social identity theory perspective*. Pages 194-206.

Introduction: Safety participation has gained increasing attention as an important dimension of workers' safety behaviors. Although previous studies attempted to identify factors affecting workers' safety participation, only a few studies paid attention to the psychological mechanisms behind it. Therefore, this study aimed to develop and test a research model that explains how management factors are implicated in workers' safety participation. Specifically, this study focused on project-based organizations (e.g.,

construction projects) because employee psychological mechanisms may have a unique nature in such transient employment. **Method:** The hypotheses in the research model of the psychological mechanism of construction workers' safety participation are tested using survey data from 261 construction workers. **Results:** The results indicated that construction workers' safety participation is influenced by project identification after controlling the shared variance of safety compliance. Project identification also mediates the effects of transformational leadership and communication climate on safety participation. **Practical Applications:** This study offers researchers and practitioners an explanation of how management factors influence construction workers' safety behaviors and clarifies the role of project identification play in explaining the effects of management factors on safety compliance and safety participation.

- ▪ **Keywords:** Construction safety; Safety participation; Project identification; Transformational leadership; Communication climate; Psychological mechanism

Luke Strasiotto, Annabel Ellis, Shane Daw, Jasmin C. Lawes. *The role of alcohol and drug intoxication in fatal drowning and other deaths that occur on the Australian coast*. Pages 207-220.

Introduction: Alcohol and drug (illicit or prescription) intoxication impairs motor skills, coordination, decision making abilities, hazard perception, and is known to increase the risk of death in coastal environments. Prior coastal safety research has focused largely on the impact of alcohol on drowning, with less research on the influence of drugs and leaving a significant number of other non-drowning fatalities largely excluded, despite being preventable with mitigation of injuries or medical factors. **Method:** This retrospective cross-sectional study explored the impact of alcohol and drugs on unintentional Australian drowning deaths and other coastal fatalities over a 16-year period to identify higher-risk populations and coastal activity groups for which alcohol/drug use is increased. **Results:** It was found that alcohol, benzodiazepines/sedatives, and amphetamine usage was prevalent in coastal deaths. Of the 2,884 coastal deaths, 80.6% of decedents had known toxicological data. Alcohol and/or drug intoxication contributed to 23% of coastal drowning deaths and 19% of fatalities. For drowning and other fatalities combined, 8.7% were due to alcohol, 8.7% due to drugs, and 4.1% due to both alcohol and drugs. Australian-born decedents were more likely to involve alcohol (RR = 1.7, 95%CI = 1.26–2.3, p < 0.001), drugs (RR = 2.62, 95%CI = 1.85–3.7, p < 0.001), or both alcohol and drugs (RR = 4.43, 95%CI = 2.51–7.82, p < 0.001) with an increased risk identified in Indigenous Australian populations (RR = 2.17, 95%CI = 1.12–4.24, p = 0.04). The impact of alcohol and drug intoxication varied by activity, with Personal Watercraft users more likely to die due to alcohol intoxication (RR = 2.67, 95%CI = 1.23–5.78, p = 0.035), while scuba divers (RR = 0, p < 0.001), snorkelers (RR = 0.14, 95%CI = 0.036–0.57, p < 0.001), and rock fishers (RR = 0.46, 95%CI = 0.22–0.96, p = 0.03) were less likely. Recreational jumping and fall-related coastal deaths were more likely to involve alcohol and alcohol/drugs combined. **Practical Applications:** This study identifies factors to further investigate or target with prevention strategies to decrease the holistic burden of mortality due to alcohol and/or drug usage on the Australian coast.

- ▪ **Keywords:** Injury prevention; Drowning; Alcohol; Drugs; Coastal environment

Bahar Dadashova, Eun Sug Park, Seyedeh Maryam Mousavi, Boya Dai, Rebecca Sanders. *Assessment of inequity in bicyclist crashes using bivariate Bayesian copulas*. Pages 221-232.

Introduction: Physical activity associated with active transport modes such as bicycling has major health benefits and can help to reduce health concerns related to sedentary lifestyles, such as cardiovascular disease, Type II diabetes, and obesity, as well as risks of colon and breast cancer, high blood pressure, lipid disorders, osteoporosis, depression,

and anxiety. However, as a vulnerable user group, bicyclists experience negative health impacts of transportation policies and infrastructure, such as traffic crashes and exposure to air and noise pollution that is disproportionately distributed within low-income and underserved areas. **Method:** This study used aggregated (block-group) bicyclist crash data from Harris County, Texas, to analyze how various equity measures are associated with both fatal and injury (FI) and no injury (property damage only) bicyclist crashes that occurred from 2010 to 2017. We used Bayesian bivariate copula-based random effects regression analysis to evaluate these associations. In contrast to more traditional univariate analysis, this novel methodology can consider the effects of factors of interest across different severity levels or crash types to fully understand their effects and how they may differ across categories. **Results:** The analysis results indicate that the bicyclist exposure, vehicle exposure, population demographics, population density, the percentage of African-Americans, and households below the poverty level are associated with both FI and PDO bicyclist crashes. **Conclusions:** Although more location and context-specific analyses are required, this study's overall results once again conform with the findings and assumptions in bicycling safety literature that the low-income and racially diverse communities are prone to experience more bicyclist crashes. **Practical Applications:** The findings of this study may have implications for future transportation and planning policies. These findings can be used to guide the policies and strategies targeting the elimination of inequity in transportation-related health concerns.

- **Keywords:** Active transport; Bicyclist crashes; Bivariate Bayesian copulas; Equity

Ou Stella Liang, Christopher C. Yang. *Mental health conditions and unsafe driving behaviors: A naturalistic driving study on ADHD and depression*. Pages 233-240.

Introduction: Road injuries remain a persistent public health concern across the world. The task of driving is complicated by mental health conditions, which may affect drivers' executive functioning and cognitive resource allocation. This study examines whether attention-deficit/hyperactivity disorder (ADHD) and depression are associated with unsafe driving behaviors. **Method:** Generalized linear mixed models were employed to estimate the association of self-reported ADHD and depression with 18 unsafe driving behavior types found prior to at-fault crashes and near-crashes using a large-scale naturalistic driving dataset. Driver demographics, cognitive traits, environmental factors, and driver random effects were included to reduce confounding and biases. **Results:** Controlling for other covariates, people with self-reported ADHD were more likely to have performed improper braking or stopping (OR = 4.89, 95% CI 1.82–13.17) prior to an at-fault crash or near-crash, while those with self-reported depression did not have a significant association with any unsafe driving behavior. **Conclusions:** After accounting for demographic, cognitive, and environmental covariates, individuals with ADHD and depression were not prone to purposefully aggressive or reckless driving. Instead, drivers with self-reported ADHD may unintentionally execute unsafe driving behaviors in particular driving scenarios that require a high level of cognitive judgment. **Practical Applications:** These findings can inform the curriculum design of driver's education programs that help learners with mental health conditions gain practice in certain road scenarios, for example, more practice on preemptively reducing speed instead of making sudden brakes and smooth turning on curved roads for students with ADHD. Furthermore, specific advanced driver assistance systems may prove particularly helpful for drivers with ADHD, such as detection of leading objects and curve speed warning.

- **Keywords:** ADHD; Depression; Mental health; Unsafe driving behaviors; Road safety

Xiaomeng Li, Liu Yang, Xuedong Yan. *An exploratory study of drivers' EEG response during emergent collision avoidance*. Pages 241-250.

Introduction: EEG (electroencephalogram) has been applied as a valuable measure to estimate drivers' mental status and cognitive workload during driving tasks. However, most previous studies have focused on the EEG features at particular driver status, such as fatigue or distraction, with less attention paid to EEG response in emergent and safety–critical situations. This study aims to investigate the underlying patterns of different EEG components during an emergent collision avoidance process. **Method:** A driving simulator experiment was conducted with 38 participants (19 females and 19 males). The scenario included a roadside pedestrian who suddenly crossed the road when the driver approached. The participants' EEG data were collected during the pedestrian-collision avoidance process. The log-transformed power and power ratio of four typical EEG components (i.e., delta, theta, alpha and beta) were extracted from four collision avoidance stages: Stage 1-normal driving stage, Stage 2-hazard perception stage, Stage 3-evasive action stage, and Stage 4-post-hazard stage. **Results:** The activities of all four EEG bands changed consistently during the collision avoidance process, with the power increased significantly from Stage 1 to Stage 4. Drivers who collided with the pedestrian and drivers who avoided the collision successfully did not show a significant difference in EEG activity across the stages. Male drivers had a higher delta power ratio and lower alpha power ratio than females in both hazard perception and evasive action stages. **Conclusions:** Enhanced activities of different EEG bands could be concurrent at emergent and safety–critical situations. Female drivers were more mentally aroused than male drivers during the collision avoidance process. **Practical Applications:** The study generates more understanding of drivers' neurophysiological response in an emergent and safety–critical collision avoidance event. Driver state monitoring and warning systems that aim to assist drivers in impending collisions may utilize the patterns of EEG activity identified in the collision avoidance process.

▪ **Keywords:** EEG; Collision avoidance; Driving simulator; Driver gender; Driver profession

Renée M. St. Louis, Sjaan Koppel, Lisa J. Molnar, Marilyn Di Stefano, Peteris Darzins, Michelle M. Porter, Michel Bédard, Nadia Mullen, Anita Myers, Shawn Marshall, Judith L. Charlton. *Examining the contribution of psychological resilience on self-reported and naturalistic driving behavior of older adults*. Pages 251-260.

Introduction: This study examined the contribution of psychological resilience on self-reported driving comfort, abilities, and restrictions, and on naturalistic driving (ND) behavior of older adults at two time points, five years apart (N = 111; Male: 65.8%, Mean age = 86.1 years). **Method:** Participants from the Ozcandrive older driver cohort study completed a demographic questionnaire, functional assessments, psychosocial driving questionnaires, and a resilience scale. Participants' vehicles were equipped with a recording device to monitor driving behavior throughout the study. Over 1.7 million kilometers of ND data were analyzed. **Results:** There was a significant increase in resilience over time, and both self-reported and ND measures revealed reduced driving across five years. Hierarchical regression analyses using age, sex, driving exposure, functional measures, and resilience showed that adding resilience into the models at the final step resulted in statistically significant increases in the amount of variance explained for driving comfort during the day and night, perceived driving abilities, number of trips, trip distance, and proportion of night trips. **Conclusions:** This research leveraged the longitudinal nature of the Ozcandrive study to provide the first insights into the role of resilience and ND. The observed patterns of reduced driving, captured by both subjective and objective measures, are suggestive of increased levels of self-regulation. As resilience is associated with adaptive coping skills, older adults with higher resilience may

be able to more effectively engage in appropriate coping behaviors with regard to driving behavior, safety, and mobility. **Practical Applications:** Effective methods of increasing resilience in the context of driving is worthy of future research as it will provide valuable information about how older drivers navigate the process of aging as it relates to driving and may assist stakeholders in developing suitable measures to support older driver safety.

▪ **Keywords:** Psychosocial factors; Real-world driving; Older drivers; Road safety; Mobility

Huimin Ge, Yunyu Bo, Hui Sun, Mingqiang Zheng, Ying Lu. *A review of research on driving distraction based on bibliometrics and co-occurrence: Focus on driving distraction recognition methods*. Pages 261-274.

Introduction: The existing selection of driving distraction recognition methods is based on a specific research perspective and does not provide comprehensive information on the entire field of view. **Method:** We conducted a systematic review of previous studies, aiming to come up with appropriate research methods to identify the driver's distraction state. First, this article selects four sets of search keywords related to driving distraction discrimination from five databases (Web of Science, ScienceDirect, Springer Link, IEEE, and TRID) and identifies 1,620 peer-reviewed documents from 2000 to 2020; these 1,620 documents underwent bibliographic analysis and co-occurrence network analysis. The co-occurrence coupling relationship is analyzed from the aspects of time, country, publication, author and keywords. Second, 37 papers published were screened, and the driving distraction recognition methods proposed by these 37 papers were summarized and analyzed. **Results:** The results show that this field has been prevalent since 2013; countries such as the United States, Britain, Germany, Australia, China, and Canada are in the forefront of research in this field, and the cooperation between related countries is relatively close. The cooperation between authors is characterized by aggregation, and the mobile phone as the main keyword is almost connected to other keyword nodes; the recognition model of deep learning algorithm based on video surveillance data sources has become the mainstream hot spot distraction recognition method. The recognition model of machine learning algorithm based on vehicle dynamics data, driver physiology, and eye movement data sources has specific advantages and disadvantages. **Practical Applications:** The results can help people to understand the current situation of driving distraction comprehensively and systematically, provide better theoretical support for researchers to choose the subsequent driving distraction recognition model, and provide research direction for driving distraction recognition in the future.

▪ **Keywords:** Driving behavior; Driving distraction recognition; Bibliometric analysis; Co-occurrence analysis

Mickey Edwards, Daniel Leonard. *Effects of large vehicles on pedestrian and pedalcyclist injury severity*. Pages 275-282.

Introduction: Fatal pedestrian and pedalcyclist crashes have been on the rise in the United States since 2009. This rise in fatalities coincides with the rise of large vehicles on American roadways, continuing a trend that began years earlier. **Method:** Through rare access to both crash and hospital records, this report investigates the relationship between striking vehicle type and medical outcomes of pedestrian and pedalcyclist cases. **Results:** Results suggest that children are eight times more likely to die when struck by a SUV compared to those struck by a passenger car. Passenger cars were the striking vehicle in most fatal pedestrian and pedalcyclist crashes, though they were underrepresented relative to the proportion of all crashes in which they were involved. Though pickup trucks were the striking vehicle in just 5.6% of pedestrian and pedalcyclist crashes, they were involved in 12.6% of fatalities. SUVs were similarly

overrepresented in fatalities relative to the proportion of their involvement in all crashes. SUVs struck 14.7% of the pedestrians and pedalcyclists investigated here, but were involved in 25.4% of the fatalities. Head and thorax injury severities are examined by vehicle type and age. Hospital charges of pedestrian and pedalcycle crash victims are also analyzed by striking vehicle type and victim age. **Practical applications:** Findings suggest larger vehicles are involved in pedestrian and pedalcyclist crashes with more severe injuries that result in higher hospital charges. By race, Blacks are also found to be overrepresented as pedestrian and pedalcyclist crash victims.

- **Keywords:** Pedestrian; Cycling; Crash; Large vehicles; Fatalities

Jeetendra Yadav, Denny John, Geetha R. Menon, Richard C. Franklin, Amy E. Peden. *Nonfatal drowning-related hospitalizations and associated healthcare expenditure in India: An analysis of nationally representative survey data*. Pages 283-292.

Background: Drowning is a global public health challenge, with significant burden in low- and middle-income countries. There are few studies exploring nonfatal drowning, including the economic and social impacts. This study aimed to quantify unintentional drowning-related hospitalization in India and associated healthcare expenditure. **Method:** Unit level data on unintentional drowning-related hospitalization were obtained from the 75th rounds of the National Sample Survey of Indian households conducted in 2018. The outcome variables were indices of health care cost such as out of pocket expenditure (OOPE), health care burden (HCB), catastrophic health expenditure (CHE), impoverishment, and hardship financing. Descriptive statistics and multivariate analysis were conducted after adjusting for inflation using the pharmaceutical price index for December 2020. The association of socio-demographic characteristics with the outcome variable was reported as relative risk with 95% CI and expenditure reported in Indian Rupees (INR) and United States dollars (USD). **Results:** 174 respondents reported drowning-related hospitalization (a crude rate of 15.91–31.34 hospitalizations per 100,000 population). Proportionately, more males (63.4%), persons aged 21–50 years (44.9%) and rural dwelling respondents (69.9%) were hospitalized. Drowning-related hospitalization costs on average INR25,421 ($345.11USD) per person per drowning incident. Costs were higher among older respondents, females, urban respondents, and longer lengths of hospital stays. About 14.4% of respondents reported hardship financing as a result of treatment costs and 9.0% of households reported pushed below the poverty line when reporting drowning-related hospitalization. **Conclusions:** Drowning can be an economically catastrophic injury, especially for those already impacted by poverty. Drowning is a significant public health problem in India. Investment in drowning prevention program will reduce hospitalization and economic burden. **Practical Applications:** This study provides support for investment in drowning prevention in India, including a need to ensure drowning prevention interventions address the determinants of health across the lifespan.

- **Keywords:** Drowning; Economics; Emergency medical systems; Injury; Public health

Yidan Dong, Ping Jiang, Xu Jin, Nazhakaiti Maimaiti, Shijuan Wang, Liyun Yang, Mikael Forsman, Lihua He. *Derived patterns of musculoskeletal symptoms and their relationships with ergonomic factors among electronic assembly workers: A latent class analysis*. Pages 293-300.

Introduction: Multi-site musculoskeletal symptoms (MSS) are considered to be more common and have more serious consequences than single-site MSS. This study aimed to determine whether derived patterns of MSS may be identified in electronic assembly workers and if extracted MSS classes are associated with personal and work-related

factors. **Method:** A cross-sectional questionnaire study was performed with 700 participating electronic assembly workers. The questionnaire included individual factors, psychosocial and physical exposures, and MSS. The derived patterns of MSS and their relationships with ergonomic factors were analyzed using latent class analysis (LCA) and multinomial logistic regression models (MLRM). **Results:** The 1-year prevalence of MSS affecting only one body site or two or more body sites was 14.9% and 32.7%, respectively. The results of LCA showed three distinct classes of MSS patterns, which were labelled 'MSS in most sites' (5.0%), 'MSS in neck and shoulder' (27.0%), and 'MSS in one or no site' (68.0%). The results of MLRM showed that the 'MSS in neck and shoulder' was associated with job tenure (OR 5.579, 95% CI 2.488–12.511), excessive dynamic and static loads (OR 3.868, 95% CI 1.702–8.793 and OR 5.270, 95% CI 2.020–13.747, respectively); while the 'MSS in most sites' was associated with high job demands (OR 4.528, 95% CI 1.647–12.445) and excessive dynamic loads (OR 111.554, 95% CI 4.996–2490.793). **Conclusions:** The results showed unique patterns of MSS among electronic assembly workers that were associated with personal and work-related factors. **Practical applications:** The findings highlight that the high prevalence of multi-site MSS in this group should be a focus. It also provides further evidence that LCA considering the number and location of anatomical sites involving MSS can be used to determine distinct classes of MSS patterns, which is of great significance for the epidemiological study and management of MSS in the future.

- **Keywords:** Musculoskeletal symptoms; Latent class analysis; Electronic assembly workers; Pain patterns; Risk factors

Chia-Wen Liao, Tsung-Lung Chiang. *Occupational injuries among non-standard workers in the Taiwan construction industry*. Pages 301-313.

Introduction: Global changes in the labor force have led to an increase in non-standard employment (NSE) workers, particularly apparent in the construction industry. These workers have a higher risk of occupational injury and negative health-related outcomes. **Method:** In this study, relevant literature and the database for construction accidents are examined to identify the classification of NSE in the Taiwan construction industry. Accident reports from 2000 to 2018 are extracted from case reports of the Northern Occupational Safety and Health Center of Taiwan. Pearson's chi-squared test are then employed to analyze a total of 1,612 occupational fatality cases in the construction industry to explore the differences in occupational injuries between NSE and standard employment (SE). Further, characteristics of occupational injuries for different types of NSE in the construction industry are analyzed. **Results:** The NSE occupational injury rate for older workers over 60 years old is higher, especially for self-employed workers taking on technical work. NSE workers are more expected to suffer occupational fatalities in the small-scale, non-public, and repair projects. Occupational injuries involving self-employed and temporary agency workers are clearly regionally concentrated. Temporary agency workers involved in occupational injuries are most engaged in non-technical work and movement for worker motion with their unfamiliarity with the worksite. Most enterprises did not perform safety management on construction sites for occupational injuries involving NSE workers, especially for self-employed workers. **Conclusions:** The results show that the hazard characteristics of NSE workers are clearly different from SE workers. NSE workers face inferior job security and protection, especially for self-employed workers. **Practical Applications:** The results can be used to establish effective occupational safety management policies and programs more efficiently.

- **Keywords:** Non-standard worker; Occupational fatality; Construction safety; Pearson's chi-squared test

Sara A. Harper, Samantha Corbridge, Christopher Long, Tyson S. Barrett, Alex Braeger, Brevin J. Zollinger, Amy E. Hale, Chayston B. Brown, Kenneth Harrison, Shandon L. Poulsen, Travis Boman, Christopher J. Dakin. *Safe stairway negotiation: Role of distractions and handrail use*. Pages 314–322.

Introduction: This study sought to examine stairway safety by identifying associations between fall-related events on stairways, distractions, gait speed, drifting, as well as handrail use and proximity. **Method:** Video recordings captured 11,137 observations of stair users in two public stairways and recorded distractions (e.g., looking at a mobile device, talking on a mobile device, using earbuds or headphones, holding a mobile device, or talking with a peer), gait speed (m/s), drifting (change of direction), as well as handrail use and proximity to a handrail. **Results:** In our sample, consisting of primarily young adults (observed 18–40 years old), we found that when a distraction was present, gait speed was reduced (p <.001), drifting increased (p <.001), and handrail use negatively impacted (p <.001) compared to stair users who were not distracted. **Conclusions:** These results indicate that distractions, such as mobile devices, used during stair negotiation can reduce handrail use and increase behaviors associated with fall-related events. **Practical Applications:** Mobile device use during stairway negotiation increases the likelihood of distraction-induced events. Stair users should be encouraged to limit or avoid mobile device use in public stairway environments. Mobile manufacturers and mobile app developers could aim to develop strategies or mobile app alerts to reduce the impact of distractions (e.g., mobile device use) during stair negotiation to lessen the health and financial burden associated with fall-related events on stairways.

- **Keywords:** Mobile device; Gait speed; Drifting; Falls; Stairs

Alex de Voogt, Hilary Kalagher, Brianna Santiago, Jonas W. B. Lang. *Go-around accidents and general aviation safety*. Pages 323-328.

Introduction: Changes in General Aviation (GA) accident rates, specifically in the go-around phase, are examined by comparing the number of accidents, the proportion of fatal accidents, and the proportion of certain causes of accidents over time. **Methods:** Two sets of accidents from 2000 to 2004 and from 2013 to 2017 were extracted from the National Transportation Safety Board (NTSB) online database. **Results:** Although the total number of GA accidents per landing significantly decreased over time, the proportion of fatal accidents in the go-around phase increased. Fatalities most often occurred in instrument meteorological conditions. Conclusion: Advances in technology and training show improvements in GA accident rates, but not for accidents in the go-around phase. **Practical Applications:** Scenario-based learning is recommended to include specific instruction concerning the timing of go-around procedures in unstable flights.

- **Keywords:** General Aviation; Fixed-wing aircraft; Landing; Go-around; Aviation training

Sergio A. Useche, Francisco J. Llamazares. *The guilty, the unlucky, or the unaware? Assessing self-reported behavioral contributors and attributions on pedestrian crashes through structural equation modeling and mixed methods*. Pages 329-341.

Introduction: Recent literature suggests that the causation of pedestrians' crashes and the contribution of safety-related behaviors within them may substantially differ compared to other road users. This study aimed to test the effect of individual factors and safety-related road behaviors on the self-reported walking crashes suffered by

pedestrians and, complementarily, to analyze the causes that pedestrians attributed to the crashes they suffered as pedestrians during the previous five years. **Method:** For this cross-sectional research performed in Spain, data from a nationwide sample of 2,499 pedestrians from the 17 regions of the country were collected. Participants had a mean age of 31 years. They responded to a questionnaire on demographics, safety-related walking behaviors, and self-reported pedestrian crashes and the causes attributed to them. **Results:** Utilizing Structural Equation Models (SEM), it was found that self-reported walking crashes can be predicted through unintentional risky behaviors (errors). However, violations and positive behaviors remain non-significant predictors, allowing to hypothesize that they might, rather, play a key role in the pedestrian's involvement in pre-crash scenarios (critical situations preceding crashes). Also, categorical analyses allowed to determine that the causes that pedestrians attributed to the walking crashes they had suffered were principally their own errors (44.6%), rather than their own traffic violations (8.5%). Nevertheless, this trend is inverse when they believe the responsibility of the crash weighs on the driver. That is to say, they usually attribute the crash to their traffic violations rather than errors. However, many biases could help explain these attributional findings. **Practical Applications:** The results of this study highlight key differences in behavioral features and crash predictors among pedestrians, with potentially relevant applications in the study and improvement of walking safety from behavioral-based approaches.

- ▪ **Keywords:** Pedestrians; Risky behaviors; Errors; Traffic violations; Positive behaviors; Self-reported walking crashes

Sherrie-Anne Kaye, David Rodwell, Natalie Watson-Brown, Chae Rose, Lisa Buckley. *Road users' engagement in prosocial and altruistic behaviors: A systematic review*. Pages 342-351.

Introduction: Engagement in prosocial and altruistic on-road behaviors is a new area of research with potential safety benefits for road users. This paper systematically reviewed studies on road users' engagement in prosocial and altruistic behaviors to provide guidance regarding the next steps in this area of research, particularly to inform targeted interventions. The objective was to identify the types of on-road prosocial and altruistic behaviors that have been studied, and the factors associated with these behaviors. Road users were defined as drivers, passengers, or vulnerable road users (e.g., pedestrian, motorcyclists, and bicyclists). **Method:** The database search was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRIMSA) guidelines and was conducted in June 2021. A total of 23,090 articles were identified in four databases including APA PsycINFO, Embase, Web of Science, and the Transportation Research Information Database. Eleven articles (13 studies) published between 2004 and 2021 met the inclusion criteria and were included in the review. **Results:** Six studies focused on intervening behaviors, specifically relating to passengers' willingness or intentions to speak up to a driver engaging in unsafe driving behaviors, four studies focused on drivers' yielding behaviors at crosswalks, and one study each focused on altruistic driving behaviors, prosocial driving behavior at long-wait stops, and prosocial behavior towards cyclists. Studies typically examined characteristics of the prosocial road user, including self-esteem, efficacy, and subjective norms, as well as contextual factors, such as other road users' behaviors and on-road messaging. **Conclusions:** This review highlights specific factors that may predict road users' engagement in prosocial and altruistic on-road behaviors. **Practical Applications:** The outcomes from this review may be used to guide the development of future road safety public education messages designed to encourage greater participation in prosocial and altruistic on-road behaviors that act to benefit all road users.

- ▪ **Keywords:** Prosocial; Altruism; Positive social influence; Speaking up; Passengers; Driver behavior

Ashan Senel Asmone, Yang Miang Goh, Michelle S.H. Lim. _Prioritization of industry level interventions to improve implementation of design for safety regulations_. Pages 352-366.

Introduction: Many countries introduced mandatory Design for Safety (DfS) or Prevention through Design (PtD) requirements to reduce construction accident rates. However, there is a knowledge gap on the relative importance of industry level interventions to improve the implementation of DfS regulations. Thus, this study aims to identify and prioritize a set of industry level interventions to help regulators and industry associations understand the industry's perceptions and improve the implementation of mandatory DfS. **Method:** A mixed method approach consisting of 59 semi-structured interviews, four focus group discussions, and an online poll was implemented. **Results:** Key challenges faced during DfS implementations were identified (lack of guidelines, lack of commitment towards DfS, the inadequate capability of DfS team, and limited effectiveness of DfS Professionals (DfSPs)). The study elicited eight industry level interventions to overcome these challenges and ranked them based on effectiveness and ease of implementation. The ranked industry level interventions in descending order are continuing training for DfSPs, samples and guidelines, DfS training for non-DfSPs, Building Information Modelling (BIM) for DfS review, strengthening DfSP as a profession, DfS awards for developers, third party audits for DfS reviews, and submission of DfS Risk Register to regulator. **Conclusions:** Identified interventions were classified into four intervention categories: (a) improving competency/ knowledge; (b) technological tools; (c) checks/ audits; and (d) recognitions/ certifications. The key contributions of this study are the identification and prioritization of industry level interventions for DfS, and the classification of safety interventions available to industry associations and regulators. **Practical applications:** Findings from this study help regulators and industry associations prioritize their resources to improve the implementation of mandatory DfS. Moreover, regulators and industry associations can also use the generic framework of industry level interventions to identify possible interventions to improve other mandatory WSH processes.

- **Keywords:** Construction safety; Building design; Safety interventions; Industry-level interventions

Briana L. Moreland, Elizabeth R. Burns, Yara K. Haddad. _Differences in fall-related emergency departments visits with and without an Injury, 2018_. Pages 367-370.

Background: Falls, with or without an injury, often affect the health of older adults (65+). **Methods:** We used the 2018 Healthcare Cost and Utilization Project to describe older adults' fall-related ED visits. We defined fall-related ED visits as those with a fall external cause of morbidity code and fall-injury related ED visits as those with an injury diagnosis code and a fall external cause of morbidity code. Percentages of fall-related and fall-injury related ED visits were analyzed by select characteristics. **Results:** Over 86% of fall-related ED visits were fall-injury related. A higher percentage of females (87%) and rural (88%) older adults' fall-related ED visits were fall-injury related compared to males (85%) and urban older adults (86%). A higher percentage of fall-related ED visits without a coded injury (33%) were hospitalized compared to those with a coded injury (29%). Conclusion: The majority of fall-related ED visits included an injury diagnosis. **Practical applications:** Researchers can consider which method of measuring ED visits related to falls is most appropriate for their study. Limiting fall-related ED visits to only those where an injury diagnosis is also present may underestimate the number of fall-related ED visits but may be appropriate for researchers specifically interested in fall injuries.

- **Keywords:** Elderly; Fall injuries; Falls; ICD-10-CM; Older adults

Arthur H. Goodwin, Yudan Chen Wang, Robert D. Foss, Bevan Kirley. *The role of inexperience in motorcycle crashes among novice and returning motorcycle riders*. **Pages 371-375.**

Objectives: To examine the crash trends of younger novice and older novice/returning motorcycle riders. **Methods:** We used a linked database of North Carolina crash and licensing data from 1991 through 2018 that included 103,142 younger novice and 98,540 older novice/returning motorcycle riders. We examined the percent of riders who crashed each month after obtaining a motorcycle license. **Results:** Crash rates peak for both younger novice and older novice/returning motorcycle riders immediately after licensure. Crash rates decline rapidly, and the rate of decrease resembles a power function. The improvement rate (IR) for younger novice riders is 0.42; that is, the crash rate for younger novices declines by approximately 42% as experience doubles. Conclusion: The crash curve for novice motorcyclists is similar to that of novice car drivers and is consistent with a learning process. **Practical Applications:** The crash trends of novice motorcycle riders indicate that current training, licensing, and educational efforts are not adequately preparing new riders. Additional efforts to develop more effective training, and research to inform a well-calibrated graduated licensing process for new riders are needed.

- **Keywords:** Novice Motorcyclists; Crash curve; Rider Training; Returning riders; Rider experience

Hope Tiesman, Suzanne Marsh, Srinivas Konda, Suzanne Tomasi, Douglas Wiegand, Thomas Hales, Sydney Webb. *Workplace violence during the COVID-19 pandemic: March–October, 2020, United States*. **Pages 376-384.**

Problem: COVID-19 has impacted United States workers and workplaces in multiple ways including workplace violence events (WVEs). This analysis scanned online media sources to identify and describe the characteristics of WVEs related to COVID-19 occurring in the United States during the early phases of the pandemic. **Method:** Publicly available online media reports were searched for COVID-19-related WVEs during March 1–October 31, 2020. A list of 41 keywords was used to scan four search engines using Natural Language Processing (NLP). Authors manually reviewed media reports for inclusion using the study definition and to code variables of interest. Descriptive statistics were calculated across three types of violence: non-physical, physical, and events with both physical and non-physical violence. **Results:** The search of media reports found 400 WVEs related to COVID-19 during March 1–October 31, 2020. Of the WVEs, 27% (n = 108) involved non-physical violence, 27% (n = 109) physical violence, and 41% (n = 164) both physical and non-physical violence. Nineteen WVEs could not be assigned to a specific type of violence (5%). Most occurred in retail and dining establishments (n = 192, 48%; n = 74, 19%, respectively). Most WVEs related to COVID-19 were perpetrated by a customer or client (n = 298, 75%), but some were perpetrated by a worker (n = 61, 15%). Most perpetrators were males (n = 234, 59%) and acted alone (n = 313, 79%). The majority of WVEs were related to mask disputes (n = 286, 72%). In 22% of the WVEs, the perpetrator coughed or spit on a worker while threatening infection from SARS-CoV-2, the virus that causes COVID-19. Discussion: This analysis demonstrated that media scraping may be useful for workplace violence surveillance. The pandemic resulted in unique violent events, including those perpetrated by workers. Typical workplace violence prevention strategies may not be effective in reducing COVID-19-related violence. More research on workplace training for workers during public health crises is needed.

- **Keywords:** Nonfatal injuries; Workplace violence; Occupational safety and health; COVID-19; Workplace mask policies

Feng Guo, Danni Lu. *How many crashes does cellphone use contribute to? Population attributable risk of cellphone use while driving*. Pages 385-391.

Background: Cellphone distraction is a major contributing factor for traffic crashes, a leading cause of death worldwide. The novel naturalistic driving study (NDS) study with continuously collected in situ driving videos provides an opportunity to accurately estimate the safety impact of cellphone distraction. **Methods:** We apply a case-cohort study design to the Second Strategic Highway Research Program NDS, the largest NDS up-to-date with more than 3400 participants. The data include with 842 level 1–3 crashes and 19,338 randomly selected control driving segments. We propose a partial Population Attributable Risk (PAR) estimator that provides consistent and stable estimation over time and across different driving behaviors. **Results:** The US population-adjusted PAR show that 8% of crashes (PAR = 0.08, 95 %CI: [0.06, 0.19]) can be reduced if cellphone distraction were switched to sober, alert, and attentive driving behavior. Young adults (age 20–29 years) and middle-aged drivers (age 30–64 years) each contribute 39% of the population level PAR. Within each age group, the PARs vary substantially from 18% for young adult drivers to 5% for middle-aged drivers. The contribution of cellphone visual-manual tasks to crashes is more than 4 times larger than cellphone talking and accounts for 87.5% of cellphone-related crashes (PAR = 0.07). **Conclusions:** Cellphone distraction contributes to a considerable part of crashes. Young drivers are more susceptible to the influence of cellphone distraction and visual-manual distraction accounts for the majority of cellphone-related crashes.

▪ **Keywords:** Population attributable risk; Naturalistic driving study; Case-cohort study; Distracted driving; Cellphone distraction

Wen Hu, Jessica B. Cicchino. *Relationship of pedestrian crash types and passenger vehicle types*. Pages 392-401.

Introduction: This is the first known study that examines the association between common pedestrian crash types and passenger vehicle types. **Method:** The analysis included single-vehicle, single-pedestrian crashes from two data sets: North Carolina state crash data and the Fatality Analysis Reporting System (FARS). We performed separate multinomial logistic regression analyses of major pedestrian crash types occurring at or near intersections and at nonintersections. **Results:** At or near intersections, minivans, large vans, pickups, and SUVs (collectively known as light truck vehicles, or LTVs) were more likely than cars to be involved in crossing-roadway–vehicle-turning-left crashes versus crossing-roadway–vehicle-not-turning crashes. LTVs were also more likely involved in fatal crossing-roadway–vehicle-turning-right crashes at or near intersections versus crossing-roadway–vehicle-not-turning crashes when compared with cars. At nonintersections, LTVs were associated with increased odds of walking-along-roadway crashes relative to crossing-roadway–vehicle-not-turning crashes when compared with cars. **Conclusions:** LTVs were more likely to be involved in certain pedestrian crash types, implying a potentially problematic visibility of pedestrians near the front corners of these vehicles. **Practical applications:** More research is needed to examine A-pillar blind zones by vehicle type. If it is found that LTVs have larger blind zones, automakers should consider ways to design the A-pillars of these vehicles to minimize blind zones while maintaining pillar strength. Doing this could improve pedestrian safety around these increasingly popular larger vehicles.

▪ **Keywords:** Pedestrian crash types; Light truck vehicles; A-pillar blind zones

Rachel Shichrur, Navah Z. Ratzon. *Convergent validity of vision based technology (VBT) among professional bus drivers*. Pages 402-408.

Introduction: Due to the relative rarity of crashes, researchers use traffic offenses, police records, public complaints, and In-Vehicle Data Recorder (IVDR) data as proxies for assessing crash risk. In this study, a unique IVDR system, called Vision-Based Technology [(VBT), (Mobileye Inc.)] was used to monitor perilous naturalistic driving events, such as insufficient distance from other vehicles and pedestrian or bicycle rider near-misses. The study aimed to test the convergent validity of VBT as an indicator of crash involvement risk. **Methods:** Data from 61 professional drivers working for a large bus company were analyzed (16 of 77 in the original data cohort were excluded for insufficient VBT data). Data included: recorded VBT data, objective data collected from official records (crash records provided by the bus company, and public complaints of reckless driving), self-report data regarding crash involvement, and police tickets. The correlation between VBT, objective and self-reported data was analyzed. Binary-logistic regression modeling (BLM) was used to calculate the odds ratio (OR) for participants involved in a car crash. **Results:** Correlations were found between the total VBT risk score and official crash records, public complaints, and self-reports of crash involvement. The BLM correctly classified 90% of those who were involved in a crash (sensitivity) and 60% of those who were "crash-free" (specificity). The VBT total risk score was the only significant contributing factor to crash risk, and for each point of increase, the odds of being involved in a crash increased by a factor of 1.55. **Conclusions:** It is the first study to provide empirical evidence validating the VBT as an indicator of crash involvement and driver safety among professional bus drivers. **Practical Applications:** VBT technology can provide researchers and clinicians a better understanding of bus drivers' risky driving behaviors- a valuable contribution to road safety interventions for this target group.

Cammie Chaumont Menéndez, Richard Munoz, Timothy J. Walker, Benjamin C. Amick. *Assessing the Australian occupational driver behavior questionnaire in U. S. taxi drivers: Different country, different occupation and different worker population*. Pages 409-416.

Background: Promoting safe driver behaviors is an important aspect of road safety. To better understand road safety behaviors, there is a role for practical instruments that can validly measure typical road safety behaviors among occupational drivers. The Occupational Driver Behavior Questionnaire (ODBQ) was developed to assess road safety behaviors among home health nurses in Australia. **Methods:** We administered a cross-sectional survey to a sample of taxi drivers in two U.S. metropolitan areas. The survey included Newnam's ODBQ-12 and a study-specific 15-item version (ODBQ-15) assessing 4 different road safety behaviors with 3 more items added and motor-vehicle crashes in the past year. Logistic regression analyses examined the association of the road safety behaviors with motor vehicle crashes. A series of confirmatory factor analysis (CFA) models assessed the construct validity of the ODBQ-12 and ODBQ-15. **Results:** We pooled survey data from 497 Houston drivers and 500 Los Angeles drivers to assess study aims. CFA models examining the 12-item and the 15-item ODBQ versions had good model fit (Comparative Fit Index > 0.95, Tucker Lewis Index ≥ 0.95, root mean square error of approximation < 0.06, standardized root mean square residual ≤ 0.05). The ODBQ's road safety behaviors were significantly associated ($p < 0.001$) with crashes while working (ORs 0.51–0.75) and not working (ORs 0.57–0.84). **Conclusions:** The ODBQ-12 and ODBQ-15 were both significantly associated with motor vehicle crashes among taxicab drivers in two large U.S. metropolitan areas. Researchers studying occupational drivers who transport passengers may want to consider using the ODBQ-15. The 3 additional items are meaningful to this workforce and are priority areas for international road safety efforts.

Guangnan Zhang, Qiaoting Zhong, Ying Tan, Qingxuan Yang. *Risky behavior analysis for cross-border drivers: A logit model and qualitative comparative analysis of odds of fault and injury vulnerability in Guangdong, Hong Kong and Macau.* **Pages 417-429.**

Introduction: Due to globalization and the acceleration of cross-border exchanges, cross-border risk behaviors have received widespread attention. Previous research has concluded that foreign cross-border drivers engage in relatively more risk-taking behavior patterns and are likely to experience a higher crash rate or be more inclined to cause severe crashes. However, there is little evidence on the comparison of drivers who belong to the same ethnic group driving across within-country borders. **Method:** Based on the cross-border motor-vehicle crash reports in 2006–2010 from the Road Traffic Accident Database of the China Ministry of Public Security, this paper examines the risk factors of being at fault and getting killed or seriously injured in cross-border traffic crashes and casual paths toward crash liability and injury severity for Hong Kong and Macao drivers driving in the Chinese mainland. **Results:** There are extremely complex factors behind drivers from Hong Kong and Macao causing at-fault crashes or sustaining fatal and serious injuries in the Chinese mainland. Factors such as gender, age, illumination, and weather conditions do not individually affect the risk of driver at-fault crashes or severe casualties in the crashes among Hong Kong and Macao drivers driving in the Chinese mainland. Nonetheless, collectively, these factors influence them along with different vehicle types, roads, and environmental factors. **Conclusions:** This paper provides more theoretical findings for understanding the compound effect of multiple risk factors involving cross-border at-fault crashes or serious casualties. The conclusions of this research are valuable as representative references for cross-border risk management policies. **Practical applications:** To reduce the effects of different factors on cross-border risky driving behaviors and/or injurious crashes, various measures should be focused on, including specialized driver training, enhancement of the roads/environment, development of effective road safety campaigns, and directives facilitating cross-border cooperation in the field of road safety.

Azin Ghamari, Nazila Rezaei, Mohammad-Reza Malekpour, Sina Azadnajafabad, Ayyoob Jafari, Naser Ahmadi, Kavi Bhalla, Saeid Shahraz, Dipan Bose, Farshad Farzadfar. *The effect of non-punitive peer comparison and performance feedback on drivers' behavior using the telematics: The first randomized trial in Iran.* **Pages 430-437.**

Background: Aggressive driving is the leading behavior resulting in fatal or nonfatal disabling injuries. Therefore, programs with the main focus on driving behavior could reduce the risk of traffic injuries remarkably. We aimed to investigate the role of non-punitive performance feedback on drivers' behavior and evaluate the persistence of the altered behavior by using in-vehicle telematics. **Methods:** This study was done as a randomized controlled trial by repeated-measures design to evaluate the non-punitive behavioral intervention's efficacy on the behavioral transition to safer driving for 1,289 bus and 104 taxi drivers. All participants were studied during 17 weeks through three stages: stage 0 (five weeks for collecting the baseline characteristics of the participants), stage 1 (nine weeks for randomizing the participants into intervention group or control group and sending the intervention group feedback via short message service), and stage 2 (three weeks for following-up the participants without sending feedback). The intervention group drivers received weekly text messages about the driving score and

drivers' rank within their peer group.The study's primary outcome was the driver score changing pattern throughout the study calculated by a neuro-fuzzy scoring system composed of four factors: speed violation, harsh acceleration, harsh braking, and harsh turning. **Results:** Among the bus drivers, a significant positive effect of the intervention was found in stage 1 (P<0.0001) and in stage 2 (P<0.0001) regarding the calculated scoring system. Among the taxi drivers, a significant positive effect of the intervention was found in stage 1 (P<0.0001), but the effect was not significant in stage 2 (P=0.15). Conclusion: The results of this study were in favor of using telematics and its positive effect on driving performance. The reformed behavior persisted even after the intervention ceased. Practical Application: Behavioral interventions could be considered a promising strategy to enhance and promote safe driving performance.

- **Keywords:** Road traffic injuries; Telematics; Driving performance; Behavioral intervention; Public health

Amanda N. Stephens, Sharon Newnam, Kristie L. Young. *Preliminary evidence of the efficacy of the Reducing Aggressive Driving (RAD) program*. Pages 438-449.

Introduction: Aggressive driving contributes to crashes, which often result in serious or fatal injuries. Efforts to reduce road trauma need to include strategies to reduce emotional and aggressive driving. Thus far, solutions have not comprehensively addressed the reasons why drivers become aggressive. This study provides preliminary evidence of the effectiveness of the Reduce Aggressive driving (RAD) program in improving driver behavior. The RAD is based on group discussion, feedback, and goal setting to encourage more positive responses to triggers for aggressive driving. The aim of this study was to evaluate the delivery of the RAD and its impact on driver anger and aggression. **Method:** A total of 94 drivers, ranging in age from 18 to 74 years (Mean = 38; SD = 15; 56% males) attended one two-hour online RAD session during which they identified triggers for their aggression and developed individual strategies to avoid aggressive driving. Most (87%) participants agreed that the RAD helped them generate realistic strategies to avoid aggressive driving. A subset of 67 participants provided self-reported anger and aggressive driving tendencies one month, and four months after the RAD. **Results:** When these were compared to baseline measures taken before participation in the RAD, decreases across all measures were observed. Thus, anger and aggressive driving significantly decreased one month after the RAD, and these decreases were maintained at the four month follow up; providing evidence of the effectiveness of the RAD in reducing these dangerous behaviors. Further research is needed to objectively measure changes in behavior to and support broader roll-out of the RAD program.

- **Keywords:** Aggressive driving; Behavior modification; Road safety

Tracey O'Connor, Jim Kinsella, Denis O'Hora, John McNamara, David Meredith. *Safer tomorrow: Irish dairy farmers' self-perception of their farm safety practices*. Pages 450-458.

Introduction: Encouraging safe work practices (SWPs) is challenging in agriculture. Group-based social learning has effectively promoted SWPs and health behaviors in other occupations, and could be applied in agriculture (e.g., through farmer discussion groups (DGs)). In Ireland, dairy DG members are more likely to adopt novel technologies and practices, a relationship that might extend to SWPs. The extent of SWP adoption among Irish dairy farmers is unknown. This paper evaluates a 2018 baseline study of SWP implementation, conducted as part of a dairy DG-based intervention study. **Method:** A paper-based survey of SWP implementation and safety self-perception was distributed to 1,220 farmers from 84 dairy DGs. For eight SWPs, associated with high-risk farm hazards (livestock, slurry, machinery, or tractors), farmers were asked how frequently they

implemented these practices in the previous year, and how frequently they intended to do so next year (0: never, 1: rarely, 2: sometimes, 3: most of the time, 4: all of the time). **Results:** Surveys were completed by 460 farmers. For the previous year, three SWPs, related to slurry, machinery, and tractor hazards, scored a median frequency of four. Four SWPs, related to livestock, slurry, and machinery hazards, scored a median frequency of three. The lowest median score (two) was for tractor exit behavior. Median intention scores matched or exceeded past frequency for all SWPs, while 73% intended to increase implementation of at least one SWP. Most (96%) considered themselves a "safe farmer." **Conclusions:** Farmers generally perceived themselves to be safe at work, which is reflected in their SWP implementation. Most farmers intended to increase SWP implementation, suggesting awareness of safety shortcomings and a desire to farm more safely. **Practical applications:** This study can inform farm safety promotion initiatives. The disconnect between farmers' safety self-perception and SWP implementation merits further research.

- ▪ **Keywords:** Agriculture; Behavior; Occupational safety; Social learning

Briana Moreland, Neil Ortmann, Tessa Clemens. *Increased unintentional drowning deaths in 2020 by age, race/ethnicity, sex, and location, United States*. Pages 463-468.

Introduction: During the COVID-19 pandemic, one study in Australia showed an increase in drowning deaths in certain settings, while a study in China showed a decrease in drowning deaths. The impact of the COVID-19 pandemic on drowning deaths in the United States is unknown. **Objective:** To report on unintentional drowning deaths among U.S. persons aged ≤29 years by demographic characteristics and compare 2020 fatal drowning rates with rates from 2010 to 2019. **Methods:** Data from CDC WONDER were analyzed to calculate unintentional drowning death rates among persons aged ≤29 years by age group, sex, race/ethnicity, and location of drowning. These rates were compared to drowning death rates for the previous 10 years (2010–2019). **Results:** In 2020, 1.26 per 100,000 persons aged ≤29 years died from unintentional drowning, a 16.79% increase from 2019. Drowning death rates decreased 1.81% per year on average (95% CI: −3.02%, −0.59%) from 2010 to 2019. The largest increases in unintentional drowning deaths from 2019 to 2020 occurred among young adults aged 20 to 24 years (44.12%), Black or African American persons (23.73%), and males (19.55%). The location with the largest increase in drowning was natural water (26.44%). Conclusion: Drowning death rates among persons aged ≤29 years significantly increased from 2019 to 2020. Further research is needed to understand the impacts of the COVID-19 pandemic on drowning and identify how drowning prevention strategies can be adapted and strengthened. **Practical applications:** Drowning remains a leading cause of injury death among persons aged ≤29 years. However, drowning is preventable. Interventions such as learning basic swimming and water safety skills, and consistent use of lifejackets on boats and among weaker swimmers in natural water, have the potential to reduce drowning deaths. Developing strategies that ensure equitable access to these interventions may prevent future drowning.

- ▪ **Keywords:** Drowning; Disparities; COVID-19; Children; Young adults

Natalie H. Lennon, Andrea E. Carmichael, Judith R. Qualters. *Health equity guiding frameworks and indices in injury: A review of the literature*. Pages 469-481.

Background: In early 2021, CDC released the CORE Health Equity Strategy, which resolves to integrate a comprehensive health equity approach to the work of the Agency. One priority of the Injury Center's Division of Injury Prevention is to move health equity research in injury forward. The purpose of this research is to perform an initial exploration of health equity guiding frameworks and indices to better understand which

of these has been applied to injury research topics. **Methods:** A PubMed and CINAHL search of meta-analysis and systematic review articles was conducted from January 1998 through April 2022. Articles of any type and additional frameworks/indices were also identified from staff knowledge of the literature. Books were also considered, where accessible. The following areas were reviewed for each resource: population addressed, guiding framework/index, other health equity variables, gaps identified, and whether the articles addressed an injury topic. Findings: The PubMed/CINAHL search produced 230 articles, and an additional 29 articles and 8 books were added from previous knowledge of the literature, resulting in a total of 267 resources for review. There were 60 frameworks/indices compiled that were relevant to health equity. Out of all the resources, three reported on an injury topic and used the PROGRESS-Plus framework, the WHO Social Determinants of Health Conceptual Framework, and a social-ecological framework. **Conclusions:** This study found there were many frameworks/indices for measuring health equity; however, there were few injury-related meta-analysis and systematic review articles. Some frameworks/indices may be more appropriate than others for measuring health equity in injury topic areas, depending on which social determinants of health (SDOHs) they address. **Practical Applications:** Measuring health equity in injury and other public health research areas can help build a foundation of evidence. Moving forward, injury researchers can consider the frameworks/indices identified through this study in their health equity injury research.

▪ **Keywords:** Injury; Framework; Index; Health equity; Social determinants of health