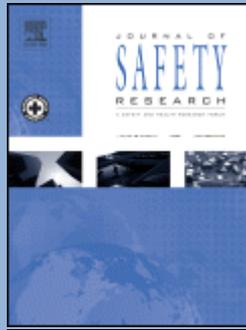


## **Journal of Safety Research – rok 2019, Volume 68**

**February 2019**



**Peng Chen, Qing Shen. *Identifying high-risk built environments for severe bicycling injuries*. Pages 1-7.**

**Introduction:** This study is aimed at filling part of the knowledge gap on bicycling safety in the built environment by addressing two questions. First, are built environment features and bicyclist injury severity correlated; and if so, what built environment factors most significantly relate to severe bicyclist injuries? Second, are the identified associations varied substantially among cities with different levels of bicycling and different built environments? **Methods:** The generalized ordered logit model is employed to examine the relationship between built environment features and bicyclist injury severity. **Results:** Bicyclist injury severity is coded into four types, including no injury (NI), possible injury (PI), evident injury (EI), and severe injury and fatality (SIF). The findings include: (a) higher percentages of residential land and green space, and office or mixed use land are correlated with lower probabilities of EI and SIF; (b) land use mixture is negatively correlated with EI and SIF; (c) steep slopes are positively associated with bicyclist injury severity; (d) in areas with more transit routes, bicyclist injury is less likely to be severe; (e) a higher speed limit is more likely to correlate with SIF; and (f) wearing a helmet is negatively associated with SIF, but positively related to PI and EI. **Practical applications:** To improve bicycle safety, urban planners and policymakers should encourage mixed land use, promote dense street networks, place new bike lanes in residential neighborhoods and green spaces, and office districts, while avoiding steep slopes. To promote bicycling, a process of evaluating the risk of bicyclists involving severe injuries in the local environment should be implemented before encouraging bicycle activities.

- **Keywords:** Bicyclist injury severity; Built environments; Generalized ordered logit model; US cities

**Mohammad Tanvi Newaz, Peter Davis, Marcus Jefferies, Manikam Pillay. *Using a psychological contract of safety to predict safety climate on construction sites*. Pages 9-19.**

**Introduction:** The fact that safety climate impacts safety behavior and delivers better safety outcomes is well established in construction. However, the way workers safety perception is inclined and developed is still unclear. **Method:** In this research, the influence of supervisors' developing safety climate and its impact on workers' safety behavior and their conceptualization of safety is explored through the lens of the 'Psychological Contract' (PC). More specifically, it is argued that 'Psychological Contract of

Safety' (PCS) is a vital factor in explaining how workers attach meaning to a supervisor behavior. Extant research suggests: (a) safety climate is based on the perception of workers regarding safety; and (b) PCS is based on perceived mutual obligations between workers and supervisors. As a result, this research argues that if PCS or mutual obligations between workers and supervisors are fulfilled, then safety climate of the workers will be positively influenced. A model is presented depicting PCS as an alternative intervention in understanding how safety climate could be influenced and predicted by the level of fulfillment of mutual safety obligations. Using Structural Equation Modeling (SEM) the model of the PCS is validated with data collected from a mega-construction project in Australia. **Results:** The results suggest that to have a positive and strong safety climate, top-level managers must ensure that mutual safety obligations between supervisor and workers are fulfilled. This enables the PCS to be introduced as a new 'predictor' of safety climate. **Practical applications:** The novel outcome of the research could be considered as a management intervention to modify supervisors' behavior to produce better safety outcomes.

- **Keywords:** Construction safety; Psychological contract; Safety climate; Supervisor; Worker

**David L. Hard, Suzanne M. Marsh, Timothy R. Merinar, Matt E. Bowyer, Stephen T. Miles, Murrey E. Loflin, Paul H. Moore. *Summary of recommendations from the National Institute for Occupational Safety and Health Fire Fighter Fatality Investigation and Prevention Program, 2006–2014. Pages 21-25.***

**Introduction:** The NIOSH Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) conducts independent investigations of selected fire fighter line-of-duty deaths (LODD) and offers recommendations to prevent similar deaths. The purpose of the current study was to provide information on more recent FFFIPP recommendations and to determine if recommendations have changed over time. **Methods:** Fatality investigations completed from 2006 to 2014 were selected for this study with recommendations being assigned into twelve major categories when possible. The most frequently occurring recommendations were then rank ordered overall and then by medical and traumatic fire fighter LODD. **Results:** There were 1,067 total recommendations made in the published fire fighter investigative reports for both medical and trauma-related fire fighter fatalities for the period 2006–2014. Of these, 784 (73%) could be placed within one of the 12 categories noted previously. The top 10 recommendation categories overall were: 1. Medical screening, 2. Fitness and wellness program, 3. Training, 4. Medical clearance, 5. Standard Operating Procedures/Standard Operating Guidelines (SOPs/SOGs), 6. Incident command, 7. Strategy and tactics, 8. Communications, 9. Personal protective equipment and 10. Staffing. **Conclusions:** The leading recommendations from the NIOSH FFFIPP medical investigations between 2006 and 2014 did not change compared to those made between 1998 and 2005, with the exception of the addition of "medical clearance for duty". There were changes for the traumatic injury leading recommendations for 2006–2014, with the major change being "training", which was the leading FFFIPP recommendation for traumatic injuries for this time period. **Practical applications:** The intent of the FFFIPP is to influence fire departments and fire fighters to critically assess and evaluate situations/circumstances similar to those identified by NIOSH investigations and implement the recommendations offered to prevent additional fire fighter fatalities.

- **Keywords:** Fire fighter; Fire fighter fatality prevention; Fire fighter medical deaths; Fire fighter trauma deaths; FFFIPP recommendations

**Su Jin Kim, Eun Kyoung Chung. *The effect of organizational justice as perceived by occupational drivers on traffic accidents: Mediating effects of job satisfaction.* Pages 27-32.**

**Introduction:** Considerable research supports a positive association between the safety climate (which is a direct organizational factor) and safety performance (such as safe driving). However, indirect organizational variables that influence safe driving have gone largely unexplored. This study contributes to safety research by examining the relationship between organizational justice, which is a distal organizational factor, and traffic accidents and the mediating role of job satisfaction. **Method:** 233 occupational drivers employed by taxi and bus companies in South Korea participated in the study. Regression analysis was conducted using police records on participants' on-the-job traffic accidents. **Results:** The analysis shows that the mediation model is statistically significant. That is, drivers with a lower level of perceived organizational justice showed a higher frequency of traffic accidents, and the mediating effect of job satisfaction was also significant. Based on the results, implications and limitations are discussed. **Practical applications:** The findings demonstrate that in order to decrease traffic accidents, transportation companies would benefit by examining distal factors such as organizational justice. This approach suggests that the conventional framework for safety management should be broadened to include aspects of the entire organization.

- **Keywords:** Traffic accidents; Occupational drivers; Organizational justice; Job satisfaction

**Iñaki Heras-Saizarbitoria, Olivier Boiral, German Arana, Erlantz Allur. *OHSAS 18001 certification and work accidents: Shedding light on the connection.* Pages 33-40.**

**Introduction:** The implications of OHSAS 18001 for substantive Occupational Health and Safety outcomes such, as a reduction in work accidents, have been under-researched in the scholarly literature. The impact of this standard on other aspects of performance, such as profitability and productivity, has attracted more attention. **Method:** This article aims to fill this gap by shedding light on the relationship between OHSAS 18001 certification and the rates of minor, serious, and fatal accidents per employee at work experienced in certified and non-certified companies. **Results:** Based on an analysis of a sample of 5,147 Spanish firms, the findings show that OHSAS 18001 certification is only loosely related with better occupational health and safety performance measured in terms of rate of accidents at work. A propensity for OHSAS 18001 certification to be found in economic sectors of activity with worse occupational health and safety outcomes in terms of rate of work-related accidents is identified. There is evidence of a negative selection-effect of the main international management standard for occupational health and safety. Potential distortions and biases that may be related to these and other findings in the scholarly literature are analyzed. Managerial implications of the main findings, implications for policy makers, and avenues for future research are discussed.

- **Keywords:** Occupational health and safety; Management systems; OHSAS 18001; Performance; Work accidents

**Jessica B. Cicchino. *Real-world effects of rear automatic braking and other backing assistance systems.* Pages 41-47.**

**Objective:** To evaluate the effects of rearview cameras, rear parking sensors, and rear automatic braking systems on backing crashes. **Method:** Negative binomial regression was used to compare police-reported backing crash involvements per insured vehicle year in 23 US states during 2012–2015 among General Motors vehicles with Rear Vision Camera alone; Rear Parking Assist alone (rear parking sensors); Rear Vision Camera and

Rear Parking Assist; or the Rear Vision Camera, Rear Parking Assist, and Rear Automatic Braking to vehicles with none of these systems. Modeling controlled for other backing assistance systems on vehicles and factors that may affect crash risk. **Results:** The combination of Rear Vision Camera and Rear Parking Assist reduced backing crash involvement rates by 42%. When Rear Automatic Braking was added to the Rear Vision Camera and Rear Parking Assist, vehicles with all three systems had backing crash involvement rates that were 78% lower than vehicles with none of the systems. On vehicles with Rear Parking Assist alone or Rear Vision Camera alone, backing crash involvement rates were reduced 28% and 5%, respectively, but these reductions were not statistically significant. **Conclusions:** Rearview cameras and rear parking sensors are preventing some backing crashes, but their effectiveness may be constrained in part by drivers not using or responding to the systems appropriately. Rear automatic braking adds to the effectiveness of these systems because it does not rely entirely on appropriate driver response. **Practical applications:** Rear parking sensors and rearview cameras are available on most new vehicles, but availability of rear automatic braking is limited. If more vehicles were equipped with rear automatic braking that performed like the system evaluated in the current study, many backing crashes that still occur among vehicles with rearview cameras and rear parking sensors could be prevented.

- **Keywords:** Active safety system; Automatic braking; Backing technology; Backup camera; Crash avoidance technology; Park Assist

**Piotr Olszewski, Piotr Szagała, Daniel Rabczenko, Anna Zielińska.**  
***Investigating safety of vulnerable road users in selected EU countries.***  
**Pages 49-57.**

**Problem:** Vulnerable road users comprise over half of all road accident victims in the EU and their safety situation is not improving as fast as for motorists. The paper examines factors affecting fatality risk of pedestrians, cyclists, motorcyclists, and moped riders in seven EU countries using data from CARE database. **Method:** Comparing accident severity indicators between countries is problematic because of data quality issues, different degree of underreporting, and different exposure levels. To avoid bias arising from these issues, fatality risk is modeled with binary logistic regression. Risk factors considered include accident location by area type, junction type, and traffic control, as well as lighting condition. Results are presented as odds ratios of fatal accident outcome in different countries under specific circumstances compared to reference conditions. It is shown that the error in OR values due to underreporting is small. **Results and discussion:** Wide confidence intervals of the odds ratios in some countries confirm problems with accident data quality. Fatality risk is always higher for non-urban versus urban area and for darkness versus daylight conditions, but the odds ratios are different for different countries. Inconsistent results are obtained for accident location with respect to junction and its control type. Possible reasons for these differences are suggested and discussed. **Practical applications:** The proposed method avoids the data quality bias of accident severity indicators, thus, it can be used in international comparisons of vulnerable road user accidents. The article findings also support the concept of changes in legislation, such as reducing the speed limit in urban areas in Poland at night. Generally, the experience of countries with low VRU fatality risk identified in the article can be transferred to those with a higher risk.

- **Keywords:** Road safety; Vulnerable road users; Accident data; Fatality risk; Logistic regression

**Hassan Iqbal, Bushra Waheed, Husnain Haider, Solomon Tesfamariam, Rehan Sadiq. *Mapping safety culture attributes with integrity management program to achieve assessment goals: A framework for oil and gas pipelines industry.* Pages 59-69.**

**Introduction:** The safety of oil and gas pipelines is an increasing concern for the public, government regulators, and the industry. A safety management system cannot be efficient without having an effective integrity management program (IMP) and a strong safety culture. IMP is a formal document (policies, planning, scheduling, and technical processes) while safety culture is a measure of views, beliefs, and traditions about safety. For regulatory authorities and O&G companies, assessing the effectiveness of both the IMP and safety culture through regulatory audits is a daunting task with indistinct findings. **Method:** An integrated framework based on regulatory audits is developed to assess the maturity of safety culture based on IMP efficacy through risk-based approach by using failure mode and effect analysis (FMEA). The framework focuses on three distinct aspects, the probability of failure occurrence in case of the non-compliance of regulatory and program requirements, severity of non-compliance, and effectiveness of the corrective actions. **Results:** Program requirements and performance indicators are translated into assessment questions which are grouped into 18 IMP components. Subsequently, these components are linked with four safety culture attributes. Sensitivity analysis revealed that four IMP components, i.e., organizational roles and responsibilities, policy and commitment, risk assessment, and training and competency, significantly affect the safety culture maturity level. **Conclusions:** Individual assessment of IMP and safety culture in O&G sector consumes extensive time and efforts in the auditing process. The framework facilitates the process by pursuing common criteria between IMP and safety culture. The O&G companies and regulator can prioritize the improvement plans and guidelines using the framework's findings. **Practical applications:** The integrated framework developed in this research will improve the existing assessment mechanism in O&G companies. The framework has been effectively implemented on a case of 17 upstream O&G pipeline-operating companies in the province of British Columbia, Canada.

- **Keywords:** Integrity management program; Safety culture; Oil and gas pipelines; Failure-mode-effect-analysis; Safety management system

**Anik Das, Ali Ghasemzadeh, Mohamed M. Ahmed. *Analyzing the effect of fog weather conditions on driver lane-keeping performance using the SHRP2 naturalistic driving study data.* Pages 71-80.**

**Introduction:** Driving in foggy weather conditions has been recognized as a major safety concern for many years. Driver behavior and performance can be negatively affected by foggy weather conditions due to the low visibility in fog. A number of previous studies focused on driver performance and behavior in simulated environments. However, very few studies have examined the impact of foggy weather conditions on specific driver behavior in naturalistic settings. **Method:** This study utilized the second Strategic Highway Research Program (SHRP2) Naturalistic Driving Study (NDS) dataset to evaluate driver lane-keeping behavior in clear and foggy weather conditions. Preliminary descriptive analysis was conducted and a lane-keeping model was developed using the ordered logistic regression approach to achieve the study goals. **Results:** This study found that individual variables such as visibility, traffic conditions, lane change, driver marital status, and geometric characteristics, as well as some interaction terms (i.e., weather and gender, surface condition and driving experience, speed limit and mileage last year) significantly affect lane-keeping ability. An important finding of this study illustrated that affected visibility caused by foggy weather conditions decreases lane-keeping ability significantly. More specifically, drivers in affected visibility conditions showed 1.37 times higher Standard Deviation of Lane Position (SDLP) in comparison with

drivers who were driving in unaffected visibility conditions. **Conclusions:** These results provide a better understanding of driver lane-keeping behavior and driver perception of foggy weather conditions. Moreover, the results might be used to improve Lane Departure Warning (LDW) systems algorithm by allowing them to account for the effects of fog on visibility. **Practical Applications:** These results provide a better understanding of driver lane-keeping behavior and driver perception of foggy weather conditions. Moreover, the results might be used to improve Lane Departure Warning (LDW) systems algorithm by allowing them to account for the effects of fog on visibility.

- **Keywords:** Lane-keeping; Naturalistic driving study; Standard deviation of lane position; Ordered logistic regression; Foggy weather conditions

**Laurie F. Beck, Marcie-jo Kresnow, Gwen Bergen. *Belief about seat belt use and seat belt wearing behavior among front and rear seat passengers in the United States. Pages 81-88.***

**Introduction:** Unrestrained drivers and passengers represent almost half of all passenger vehicle occupant deaths in the United States. The current study assessed the relationship between the belief about importance of seat belt use and the behavior of always wearing a seat belt. **Method:** Data from 2012 ConsumerStyles were analyzed separately for front and rear passenger seating positions. Multivariable regression models were constructed to identify the association between seat belt belief and behavior (i.e., always wears seat belt) among adults. Models controlled for type of state seat belt law (primary, secondary, or none). **Results:** Seat belt use was higher in front passenger seats (86.1%) than in rear passenger seats (61.6%). Similarly, belief that seat belt use was very important was higher in reference to the front passenger seat (84.2%) versus the rear passenger seat (70.5%). For the front passenger seat, belief was significantly associated with seat belt use in states with both primary enforcement laws (adjPR 1.64) and secondary enforcement laws (adjPR 2.77). For the rear passenger seat, belief was also significantly associated with seat belt use, and two 2-way interactions were observed (belief by sex, belief by region). **Conclusions:** Despite overall high rates of seat belt use in the United States, certain groups are less likely to buckle up than others. The study findings suggest that efforts to increase seat belt use among high-risk populations, such as those who live in states with secondary or no seat belt laws and those who ride in rear seats (which include people who utilize taxis or ride-hailing vehicles) could benefit from interventions designed to strengthen beliefs related to the benefits of seat belt use. **Practical applications:** Future research that uses a theoretical framework to better understand the relationship between beliefs and behavior may inform interventions to improve seat belt use.

- **Keywords:** Passenger vehicle occupant; Restraint use; Motor vehicle; Injury prevention; Health behavior

**Bronwyn Hemsley, Joanne Steel, Linda Worrall, Sophie Hill, Lucy Bryant, Leanne Johnston, Andrew Georgiou, Susan Balandin. *A systematic review of falls in hospital for patients with communication disability: Highlighting an invisible population. Pages 89-105.***

**Background:** Patients with communication disability, associated with impairments of speech, language, or voice, have a three-fold increased risk of adverse events in hospital. However, little research yet examines the causal relationship between communication disability and risk for specific adverse events in hospital. **Objective:** To examine the impact of a patient's communication disability on their falls risk in hospital. **Methods:** This systematic review examined 61 studies on falls of adult hospital patients with communication disability, and patients at high risk of communication disability, to determine whether or not communication disability increased risk for falls, and the nature

of and reasons for any increased risk. **Results:** In total, 46 of the included studies (75%) reported on participants with communication disability, and the remainder included patients with health conditions placing them at high risk for communication disability. Two thirds of the studies examining falls risk identified communication disability as contributing to falls. Commonly, patients with communication disability were actively excluded from participation; measures of communication or cognition were not reported; and reasons for any increased risk of falls were not discussed. **Conclusions:** There is some evidence that communication disability is associated with increased risk of falls. However, the role of communication disability in falls is under-researched, and reasons for the increased risk remain unclear. **Practical applications:** Including patients with communication disability in falls research is necessary to determine reasons for their increased risk of adverse events in hospital. Their inclusion might be helped by the involvement of speech-language pathologists in falls research teams.

- **Keywords:** Falls; Hospital; Communication disability; Patient safety incidents; Risk

**Mahdi Rezapour, Milhan Moomen, Khaled Ksaibati. *Ordered logistic models of influencing factors on crash injury severity of single and multiple-vehicle downgrade crashes: A case study in Wyoming. Pages 107-118.***

**Introduction:** The state of Wyoming, like other western United States, is characterized by mountainous terrain. Such terrain is well noted for its severe downgrades and difficult geometry. Given the specific challenges of driving in such difficult terrain, crashes with severe injuries are bound to occur. The literature is replete with research about factors that influence crash injury severity under different conditions. Differences in geometric characteristics of downgrades and mechanics of vehicle operations on such sections mean different factors may be at play in impacting crash severity in contrast to straight, level roadway sections. However, the impact of downgrades on injury severity has not been fully explored in the literature. This study is thus an attempt to fill this research gap. In this paper, an investigation was carried out to determine the influencing factors of crash injury severities of downgrade crashes. **Method:** Due to the ordered nature of the response variable, the ordered logit model was chosen to investigate the influencing factors of crash injury severities of downgrade crashes. The model was calibrated separately for single and multiple-vehicle crashes to ensure the different factors influencing both types of crashes were captured. **Results:** The parameter estimates were as expected and mostly had signs consistent with engineering intuition. The results of the ordered model for single-vehicle crashes indicated that alcohol, gender, road condition, vehicle type, point of impact, vehicle maneuver, safety equipment use, driver action, and annual average daily traffic (AADT) per lane all impacted the injury severity of downgrade crashes. Safety equipment use, lighting conditions, posted speed limit, and lane width were also found to be significant factors influencing multiple-vehicle downgrade crashes. Injury severity probability plots were included as part of the study to provide a pictorial representation of how some of the variables change in response to each level of crash injury severity. **Conclusion:** Overall, this study provides insights into contributory factors of downgrade crashes. The literature review indicated that there are substantial differences between single- and multiple vehicle crashes. This was confirmed by the analysis which showed that mostly, separate factors impacted the crash injury severity of the two crash types. **Practical applications:** The results of this study could be used by policy makers, in other locations, to reduce downgrade crashes in mountainous areas.

- **Keywords:** Injury severity; Mountain passes; Hazardous downgrades; Ordinal logistic regression

**Gregory E. Prussia, Geoffrey P. Willis, Madhu Rao. *Influences on safety consciousness in a utility company: A sequential mediation model.* Pages 119-129.**

**Introduction:** The purpose of this research was to determine whether the influence of supervisory support for safety on safety consciousness is direct or indirect. Based in part on predictions from the Theory of Reasoned Action (TRA) and Social Cognitive Theory (SCT), we examined the extent to which belief (safety self-efficacy) and attitude (cavalier safety attitude) mediate the impact of supervisory support for safety on employee safety consciousness. **Method:** A survey of 995 employees was distributed across 24 work groups in an electric utility company, and sequential mediation modeling was used to determine indirect effects on safety consciousness. **Results:** We found that the effect of supervisory support on safety consciousness was indirect, fully mediated through both efficacy and attitude in a sequential mediation model. **Practical applications:** Supervisors should be aware of and emphasize supportive behaviors and create welcoming conditions for employees to raise safety concerns. Furthermore, organizational programs pertaining to safety improvement need to consider how to develop positive beliefs regarding safety activity and attitudes and reduce negative ones.

- **Keywords:** Theory of reasoned action; Social cognitive theory; Utility industry; Sequential mediation modeling

**David G. Kidd, Neil K. Chaudhary. *Changes in the sources of distracted driving among Northern Virginia drivers in 2014 and 2018: A comparison of results from two roadside observation surveys.* Pages 131-138.**

**Introduction:** An increase in distracted driving has been suggested as a factor contributing to the 15% increase in fatal crashes from 2014 to 2016, but objective information about the prevalence of distracted driving in recent years is incomplete or lacking. The current study replicated a 2014 observation study conducted in Northern Virginia to examine whether the prevalence of distracted driving overall and of individual secondary behaviors has changed. **Method:** Drivers of moving or stopped vehicles were observed at 12 locations across 4 Northern Virginia communities during the daytime. The presence of 12 different secondary behaviors was recorded. **Results:** In 2018, about 23% of drivers were engaged in at least one secondary behavior, which was not significantly different from 2014. Overall phone use was not significantly different between 2014 and 2018. However, the likelihood of holding a cellphone significantly decreased while the likelihood of manipulating a cellphone significantly increased in 2018 relative to 2014. About 14% of drivers were engaged in noncellphone secondary behaviors in 2014 and 2018, which exceeded the proportion using phones in both years. **Conclusions:** There was no evidence that distracted driving has become more common in recent years, but the prevalence of some secondary behaviors has changed. Most concerning was the 57% increase in the likelihood of cellphone manipulation in 2018 relative to 2014, a behavior that has been consistently linked to increased crash risk; however, because the behavior is uncommon overall, the increased prevalence would be expected to only slightly increase crash rates. **Practical applications:** Although cellphone use was frequently observed in 2014 and 2018, collectively, other noncellphone secondary behaviors were more prevalent. Practitioners and policymakers should continue targeting cellphone use, but also must target other common secondary behaviors to fully address distracted driving.

- **Keywords:** Cellphone; Distracted driving; Distraction; Observation survey; Texting

**Carla L. MacLean, J. Don Read. *An illusion of objectivity in workplace investigation: The cause analysis chart and consistency, accuracy, and bias in judgments.* Pages 139-148.**

**Introduction:** Investigation tools used in occupational health and safety events need to support evidence-based judgments, especially when employed within biasing contexts, yet these tools are rarely empirically vetted. A common workplace investigation tool, dubbed for this study the "Cause Analysis (CA) Chart," is a checklist on which investigators select substandard actions and conditions that apparently contributed to a workplace event. This research tests whether the CA Chart supports quality investigative judgments. **Method:** Professional and undergraduate participants engaged in a simulated industrial investigation exercise after receiving a file with information indicating that either a worker had an unsafe history, equipment had an unsafe history, or neither had a history of unsafe behavior (control). Participants then navigated an evidence database and used either the CA Chart or an open-ended form to make judgments about event cause. **Results:** The use of the CA Chart negatively affected participants' information seeking and judgments. Participants using the CA Chart were less accurate in identifying the causes of the incident and were biased to report that the worker was more causal for the event. Professionals who used the CA Chart explored fewer pieces of evidence than those in the open-ended condition. Moreover, neither the open-ended form nor the structured CA Chart mitigated the biasing effects of historical information about safety on participants' judgments. **Conclusion:** Use of the CA Chart resulted in judgments about event cause that were less accurate and also biased towards worker responsibility. The CA Chart was not an effective debiasing tool. **Practical application:** Our results have implications for occupational health and safety given the popular nature of checklist tools like the CA Chart in workplace investigation. This study contributes to the literature stating that we need to be scientific in the development of investigative tools and methods.

- **Keywords:** Cognitive bias; Workplace incident investigation; Context effects; Checklist; Incident report form

**Rafael Vicente Lozano-Díez, Oscar López-Zaldívar, Sofía Herrero del Cura, Amparo Verdú-Vázquez. *Analysis of the impact of health and safety coordinator on construction site accidents: The case of Spain.* Pages 149-156.**

The figure of the Health and Safety Coordinator (HSC), as a necessary and competent engineer in the construction sector, emerged in Spain on December 25, 1997 as a result of the implementation of European Directive 92/57/EEC. The coming of age of this figure is a sufficient period of time for determining its implementation and impact within the construction sector. The research carried out in this article arose from the analysis of statistical data obtained through Public Authorities and Professional Bodies. The quantitative study of the data extracted is complemented by the creation of specific benchmark indicators which connect four fundamental variables in the construction industry: the number of accidents, volume of workers employed, building units, and health and safety coordination posts. Furthermore, the legislation governing the HSC engineer in each of the 28 Member States of the European Union is studied. The results show a high implementation rate for the figure of the HSC, as well as a positive impact in relation to the reduced accident rate in the construction sector. Likewise, an update to the procedures of the various authorities is considered to be necessary in order to make the data concerning the actual work of the health and safety coordinators public. Finally, a review of the Spanish legislation concerning the HSC Coordinator is considered to be inevitable, in order to bring it up to the levels of professional skill and competence defined by the majority of European Union Member States.

- **Keywords:** Health and Safety Coordinator; Safety at work; Building; Standardization

**Dana Waltzman, Kelly Sarmiento. *What the research says about concussion risk factors and prevention strategies for youth sports: A scoping review of six commonly played sports. Pages 157-172.***

**Introduction:** Given the growing research on potential adverse outcomes related to concussion and other serious brain injuries and the increased susceptibility for concussion among youth athletes, primary prevention is vital to protect the health and safety of this population. The purpose of this study is to summarize the current research on risk factors and primary concussion prevention strategies focused on specific youth sports, and to identify research gaps. **Methods:** A literature search was conducted using six electronic databases. A scoping review method was used to identify studies that addressed risk factors or primary concussion prevention strategies focused on youth athletes (ages 5–18 years) in six sports (football, ice hockey, soccer, lacrosse, basketball, and wrestling). **Results:** Of the 18 publications identified, the publications focused on risk factors (N = 11), policy (N = 1), rule changes (N = 3), education (N = 2), equipment (N = 2), and playing technique (N = 0). Some articles had information related to multiple topics. **Conclusions:** Current research on concussion prevention has primarily been focused on risk factors. There are a dearth of studies that examine primary concussion prevention in sports. When studies do exist, most focus on football and ice hockey. Only a small number of studies focus solely on risk factors or primary prevention in soccer, lacrosse, basketball, and wrestling—all sports in which concussions are common. **Practical applications:** This scoping review summarizes current research on concussion risk factors and primary prevention strategies in specific sports focused on youth athletes and identifies research gaps to help inform future efforts.

- **Keywords:** Concussion; Traumatic brain injury; Prevention; Youth; Sport

**Caitlin N. Pope, Jessica H. Mirman, Despina Stavrinou. *Adolescents' perspectives on distracted driving legislation. Pages 173-179.***

**Purpose:** Distracted driving is a growing global epidemic, with adolescent drivers reporting frequent engagement in distracted driving behaviors. Public health initiatives and legislative efforts designed to decrease the prevalence of these unwanted driving behaviors have demonstrated small, but significant reductions in crash risk. Non-compliance is a known problem among drivers of all ages, but may be especially problematic for novice, adolescent drivers. Using a construct from the Health Belief Model, the relations between demographic factors, perceived threat to safety, and peer influences were investigated with adolescents' support for three types of distracted driving legislation regarding: (a) reading or sending text messages/emails while driving; (b) hand-held cell phone use while driving; and (c) using non-driving-related-in-vehicle (NDIV) technology while driving. Investigating adolescents' perceptions provides an opportunity to understand distracted driving enforcement and legislation. **Methods:** Three hundred and seventy-nine adolescents aged 15–19 (M = 16.12, SD = 0.56) were recruited from public high schools. Demographics, perceptions, and support regarding distracted driving were assessed using self-report surveys. Statistical analyses included bivariate correlations and adjusted odds ratios to investigate influences of adolescent support for distracted driving legislation. **Results:** Female adolescents were at 2 times greater odds of supporting a law against texting/emailing while driving compared to male adolescents. Greater perceived threat to safety was associated with all three types of distracted driving legislation (aOR = 1.10, 1.33). Minimal association was found with peer influences. **Conclusions:** Perceived threat to safety and gender were associated with legislative support in adolescents. **Practical application:** Interventions and public health campaigns that incorporate elements related to perceived threat may be more successful with female adolescent drivers than male adolescents. Future experimental research will

help to determine what factors affect adolescents' perspectives on distracted driving to promote compliance with related legislation.

- **Keywords:** Distracted driving; Adolescent; Teen; Perceived threat to safety; Legislative support

**Ward G.M. Vanlaar, Hannah Barrett, Marisela Mainegra Hing, Steve W. Brown, Robyn D. Robertson. *Canadian wildlife-vehicle collisions: An examination of knowledge and behavior for collision prevention. Pages 181-186.***

**Objectives:** This study examines drivers' responses to wildlife on Canadian roads. The objective of this paper is to demonstrate that knowledge of what to do when encountering wildlife on the road does not always translate into the appropriate behavior to avoid a collision. **Methods:** Data from the Traffic Injury Research Foundation's (TIRF) 2016 Road Safety Monitor (RSM) and data from TIRF's National Fatality Database from 2000 to 2014 were analyzed to test hypotheses based on the theory of planned behavior. Logistic regression and piecewise linear regression were used. **Results:** Analyses of the data showed that the prevalence of fatal WVCs has remained relatively consistent, and that the majority of persons killed in WVCs died in crashes that involved large mammals. The majority of fatalities occurred in the summer (182 or 38.4%) and fall (163 or 34.4%). The RSM data revealed that 60.9% [50.5, 70.4] of respondents who previously hit an animal indicated that drivers should slow down and steer straight when confronted with wildlife, while 47.3% [37.1, 57.6] of respondents indicated this was the action they took when they hit wildlife. Comparatively, 59.5% [56.6, 62.4] of respondent who have not hit an animal indicated this was an appropriate response. Additionally, 33.2% [24, 44] of respondents who previously hit an animal indicated that drivers should swerve to avoid a collision with wildlife, while 37.5% [28.2, 47.8] of respondents indicated this was the action they took when they hit wildlife. **Conclusions:** Many drivers are unaware of what the safest method of WVC prevention is. Further, while a subgroup of drivers may have the knowledge and intention to slow down and steer straight even if the animal is directly in the path, i.e., the safest possible behavior, they are not necessarily adopting this behavior. **Practical applications:** Recommendations are formulated to address this discrepancy, as well as practical applications.

- **Keywords:** Wildlife; Wildlife-vehicle collisions; Collision prevention; Trends; Theory of planned behavior

**Jiangshi Zhang, Wenyue Zhang, Peihui Xu, Na Chen. *Applicability of accident analysis methods to Chinese construction accidents. Pages 187-196.***

**Introduction:** It is necessary to clearly understand construction accidents for preventing a rise in Chinese construction accidents and deaths. Better analysis methods are required for Chinese construction sector accidents. **Methods:** Choosing and analyzing a typical construction accident based on four popular contemporary accident causation models: STAMP, AcciMap, HFACS, and the 2-4 Model. Then we evaluated the models' applicability to construction accidents, including their usability, reliability, and validity. **Results:** STAMP addressed how complexity within the accident system influenced the accident development, and its output makes the responsibilities clearer for the accident. AcciMap described the entire system's failure, the entire accident's trajectory, and the relationship between them. AcciMap showed that the accident was a dynamic developing process, and this method has a high usability. The taxonomic nature of HFACS is an important feature that provides it with a high reliability. In the accident reviewed here, we found that poor management was a critical factor rather than the individual factor in the accident. The 2-4 Model provided detailed causes of the accident and established the relationship among

the accident causes, the safety management system, and the safety culture. It also avoided capturing all of the complexity in the large sociotechnical system and revealed a dynamic analysis and developing process. We confirmed that it has a high usability and validity. Therefore, the 2-4Model is recommended for future Chinese construction accident analysis efforts. **Practical Applications:** The study provides a useful, reliable, and effective analysis method for Chinese construction accidents.

- **Keywords:** Chinese construction accidents; Accident causation models; Accident analysis; Applicability

**Barbara A. Morrongiello, Mackenzie Seasons, Katherine McAuley, Stephanie Koutsoulanos. *Child pedestrian behaviors: Influence of peer social norms and correspondence between self-reports and crossing behaviors.* Pages 197-201.**

**Objective:** The aims of this study were to determine if children's perception of peers' behavioral norms for crossing streets relates to their personal norms for doing so and if children's self-reports about crossing relates to their actual crossing in a virtual traffic situation. **Method:** Children (8–10 years, N = 86) completed questionnaires about peer's norms and their personal norms about crossing streets, and also reported on their recent crossing behaviors. These self-reports about crossing were then related to children's actual crossing behaviors measured using a fully immersive virtual reality (VR) system. **Results:** Children's perception of peers' behavioral norms for crossing related to their personal norms for doing so, and their norms related to their reports of how they have crossed in the past few weeks. When crossing virtual streets, children with higher scores on self-reports about risky crossing behaviors selected smaller (riskier) inter-vehicle gap sizes to cross into, showed less start delay (less time appraising traffic before starting), and experienced more hits. **Conclusion and practical applications:** Children's perception of peers' behavioral norms for crossing are relevant to their crossing behaviors and may be one way that peers elevate children's risk of pedestrian injury. Children's self-reports about crossing risk may be useful for identifying at-risk youth and strategically targeting interventions to these children.

- **Keywords:** Children; Pedestrian injury; Peers; Behavioral norms

**Laura S. Fruhen, Mark A. Griffin, Daniela M. Andrei. *What does safety commitment mean to leaders? A multi-method investigation.* Pages 203-214.**

**Introduction:** Perceived management safety commitment as an aspect of safety climate or culture is a key influence on safety outcomes in organizations. What is unclear is how perceptions of management commitment are created by leaders. **Method:** To address this gap in the literature, we position safety commitment as a leadership construct viewed from the perspectives of the leaders who experience and demonstrate it. In this paper, an established multidimensional commitment framework is applied to leaders' safety commitment (consisting of affective, normative, and calculative commitment). Via an exploratory sequential mixed methods design combining interviews (n = 40) and surveys (n = 89), we investigate the applicability of this theoretical conceptualization to safety commitment. **Results:** The results indicate the multiple dimensions captured leaders' safety commitment well, safety commitment can be demonstrated via a range of behaviors, and the dimensions' association with behavioral demonstrations aligned with those of other types of commitment reported in the literature. Only affective safety commitment was consistently associated with demonstrations of safety commitment. The link between high levels of affective and normative safety commitment and demonstrations was more pronounced when participants perceived their company's safety climate more positively. **Conclusions:** Adopting a focus on leaders' experience of

safety commitment offers opportunities for new research into the way in which safety commitment perceptions are shaped by leaders. **Practical application:** The findings can support leaders' reflection about their personal mindset around safety and support them in fostering strong safety climates and cultures. It further encourages organizations in creating work environments that in particular foster affective and normative safety commitments in leaders.

- **Keywords:** Safety commitment; Leadership; Management; Exploratory sequential mixed methods design; Organizational safety

**Celestin Missikpode, Corinne Peek-Asa, Daniel V. McGehee, Robert Wallace. *Classifying and predicting risky driving among novice drivers: A group-based trajectory approach. Pages 215-222.***

**Introduction:** Classifying risky driving among new teenage drivers is important for efficiently targeting driving interventions. We thoroughly investigated whether novice drivers can be clustered by their driving outcome profiles over time. **Methods:** A sample of 51 newly licensed teen drivers was recruited and followed over a period of 20 weeks. An in-vehicle video recording system was used to gather data on dangerous driving events referred to as DDEs (elevated g-force, near-crash, and crash events), risky driving behaviors referred to as RDBs (e.g., running stop signs, cell phone use while driving), and miles traveled. The DDE and RDB weekly rates were determined by dividing the number of DDEs and RDBs in a week by the number of miles traveled in that week, respectively. Group-based trajectory modeling was used to map the clustering of DDE rate and RDB rate patterns over time and their associated covariates. **Results:** Two distinct DDE rate patterns were found. The first group (69.1% of the study population) had a lower DDE rate which was consistent over time. The second had a higher DDE rate pattern (30.9%) and characterized by a rising trend in DDE rate followed by a steady decrease (inverted U-shaped pattern). Two RDB rate patterns were also identified: a lower RDB rate pattern (83.4% of the study population) and a higher RDB rate pattern (16.6%). RDB and DDE rate patterns were positively related, and therefore, co-occurred. The results also showed that males were more likely than females to be in the higher DDE and RDB rate patterns. **Conclusion:** The groups identified by trajectory models may be useful for targeting driving interventions to teens that would mostly benefit as the different trajectories may represent different crash risk levels. **Practical applications:** Parents using feedback devices to monitor the driving performance of their teens can use the initial weeks of independent driving to classify their teens as low or high-risk drivers. Teens making a very few DDEs during their early weeks of independent driving are likely to remain in the lower risk group over time and can be spared from monitoring and interventions. However, teens making many DDEs during their initial weeks of unsupervised driving are likely to continue to make even more DDEs and would require careful monitoring and targeted interventions.

- **Keywords:** Novice drivers; Dangerous driving events; Risky driving behaviors; Group-based trajectory modeling; And dual trajectory modeling

**Kelly Sarmiento, Zoe Donnell, Elizabeth Bell, Rosanne Hoffman. *From the CDC: A qualitative study of middle and high school professionals' experiences and views on concussion: Identifying opportunities to support the return to school process. Pages 223-229.***

**Introduction:** Current research recommends that students returning to school after a concussion should receive a return to school plan that is tailored to their individual symptoms. School professionals play important roles in designing and implementing the supports outlined in return to school plans. **Methods:** This qualitative study explored middle and high school professionals' experiences with concussion, particularly their

knowledge and perceptions of the injury and their experience with supporting students with concussion. Six focus groups were conducted with two to four school professionals per group, including two groups of teachers, two groups of school psychologists and counselors, and two groups of school nurses. Findings were coded into four categories: (a) challenges with identifying a concussion; (b) strategies for communicating with students about concussion; (c) barriers to implementing return to learn plans; and (d) establishing a collaborative school support team. **Results:** School professionals who participated in the focus groups were knowledgeable about concussion and the importance of helping their student recover. Participants also understood the importance of recognizing the signs and symptoms of concussion and communicating with students and parents about this injury. However, the study participants reported various challenges related to concussion identification and management, including the perceived validity of concussion symptom reporting by students. A team-based approach was mentioned across all groups as the preferred method for school-based concussion management for students. **Conclusion:** School professionals in this study were eager to address concussion in their schools, but desire guidance on how to overcome social norms around concussion identification and reporting. In addition, there is a need for consistent use of written instructions from healthcare providers to help guide return to learn (RTL) accommodations. **Practical applications:** The findings from this study can help inform the integration of concussion, and other health, management plans in schools.

- **Keywords:** Concussion; Traumatic brain injury; Children; School; Nurse

**Amber Robinson, Aleta Christensen, Sarah Bacon. *From the CDC: The Prevention for States program: Preventing opioid overdose through evidence-based intervention and innovation. Pages 231-237.***

**Introduction:** Since 1999, overdose deaths involving opioids have substantially increased. In 2016, 42,249 opioid-related deaths occurred—a 27.7% increase from the previous year (Hedegaard et al., 2017). As the nation's public health agency, the Centers for Disease Control and Prevention (CDC) has been actively involved in efforts to prevent opioid misuse, opioid use disorder, and opioid overdose since 2014. One of CDC's three principal opioid overdose prevention programs, the Prevention for States (PfS) program, began funding 16 state partners in August 2015 and then expanded to fund a total of 29 states in March 2016. The PfS program aims to prevent opioid morbidity and mortality by implementing evidence-based strategies such as enhancing and maximizing prescription drug monitoring programs (PDMPs) and implementing community or health systems interventions. **Methods:** In this article, we will describe the origins of the PfS program, provide an overview of program strategies, and locate PfS strategies in the larger landscape of nation-wide opioid overdose prevention efforts advanced by other partners and stakeholders. To describe the implementation of PfS, we offer an iterative model of using information to inform strategy selection, implementation, and evaluation. This model is a product of our observations of program implementation over time and has emerged, post hoc, as a helpful framework for organizing our insights and reflections on the work. **Results:** For each step of the model, we provide examples of how CDC has supported funded state partners in these efforts. Lastly, we describe innovative facets of the program and implications for both ongoing and future programs. **Practical applications:** Opioid overdose morbidity and mortality continues to increase across the United States. Adoption of the strategies and the program implementation paradigm described in this article when implementing prevention activities could improve the ability of public health programs to reverse this trend.

- **Keywords:** Opioids; Overdose; PDMP; Communities; Health systems